

UNCLASSIFIED

RADAR BULLETIN NO. 8A

(RADEIGHT-A)

AIRCRAFT CONTROL MANUAL

DECLASSIFIED

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NAVY DEPARTMENT
OFFICE OF THE CHIEF OF NAVAL OPERATIONS

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NAVY DEPARTMENT,
OFFICE OF THE CHIEF OF NAVAL OPERATIONS,
Washington 25, D. C., 21 June 1950.

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Rear Admiral, U. S. Navy,
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CHAPTER ONE

INTRODUCTION TO THE CONTROL OF AIRCRAFT

- A. THE NEED FOR CONTROL.
- B. PURPOSE OF RADEIGHTABLE
- C. CONTROL OF AIRCRAFT—DEFINITION.
- D. HOW CONTROL IS EXERCISED.
- E. FUNDAMENTALS OF CONTROL.

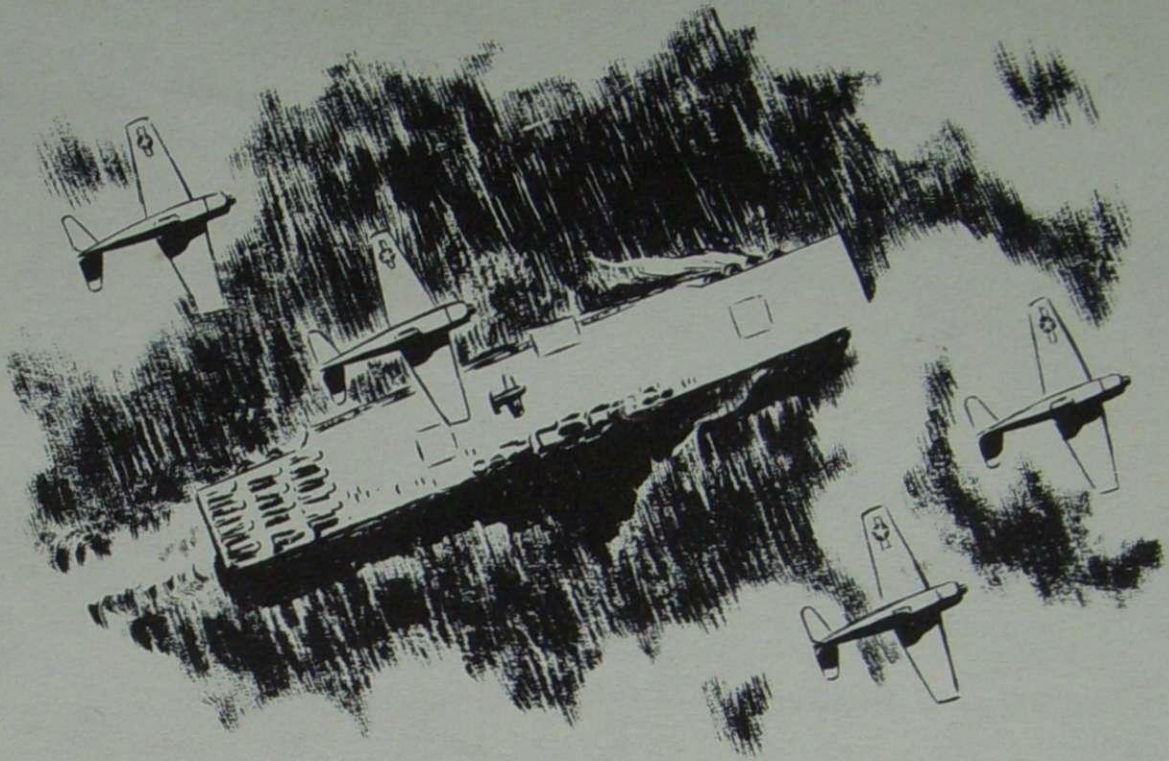


Figure 1.

CHAPTER 1

INTRODUCTION TO THE CONTROL OF AIRCRAFT

A. THE NEED FOR CONTROL

Aircraft in modern warfare have assumed a role of tremendous tactical importance. The speed, flexibility, and striking power which insured their rise to equal partnership with ground and surface forces created new requirements in planning and directing modern naval operations. The day of the pilot as a one-man fighting unit, strictly on his own, has definitely passed. Today pilots are members of highly trained tactical teams which include not

Control of aircraft is vital in present-day operations because of the number of aircraft involved, the complexity of modern, round-the-clock air tasks, and the vastly speeded-up tempo of air warfare. Briefing of pilots prior to a mission is still essential, but it can never be sufficiently comprehensive to cope with all the exigencies which arise from our newer and vastly broadened sources of tactical information.

Control of aircraft is a technique fashioned to meet these needs and made possible by rapid



Figure 2.

basic equipment used for aircraft control are air search and surface search sets. From these, regardless of conditions of weather or visibility, the presence of an object, its bearing, range, altitude, and composition can be determined with a predictably high degree of accuracy. Radar has extended many-fold our knowledge of the immediate area of operations. The second instrument essential to aircraft control is electronic communication. Through radio the flight leaders and individual pilots can keep in constant touch with their controlling base. The basis of all aircraft control is the closely integrated and skillful employment of aircraft, detection devices, and communication.

B. PURPOSE OF RADEIGHTABLE

The purpose of RADEIGHTABLE is to summarize in one nontechnical publication the principal means and methods used in the control of aircraft in current naval operations. This discussion will be general rather than specific, for changes and improvements in equipment and techniques are both constant and inevitable. However, the developments that have taken place during and since World War II have been the result of sufficient combat experience to create a firm nucleus of practice and doctrine.

C. CONTROL OF AIRCRAFT—DEFINITION

Aircraft control is defined as the direction of and/or the assistance to flights of aircraft by personnel not actually engaged in the flights themselves. It includes such aircraft control functions as Landing Traffic Control, Ground Controlled Approach, Carrier Controlled An-

are prepared to exercise whatever operational control may be desirable for the successful accomplishment of a mission. In effect, control means immediate, voice-radio effected briefing of pilots during their missions to enable them to meet any situations which may arise.

The degree of control which is required varies considerably according to the type of mission on which the aircraft are engaged. In the case of routine air searches or antisubmarine patrol control may be limited to simple communications and identification checks and landing instructions. Control of spotting planes, reconnaissance missions, and "Call Strikes" is more complex and the control of defensive night fighter patrols in the protection of own forces may be regarded as the most exacting technique of all. Visual Fighter Direction, now known as Defensive Visual Control, was the parent of all types of aircraft control depending on electronic information. Visual still remains the most highly developed technique, it must not be forgotten that air control has many other vital uses. New equipment undoubtedly lead to the development of additional functions of air control, particularly with respect to offensive missions.

D. HOW CONTROL IS EXERCISED

The cooperative nature of aircraft control calls for a high degree of mutual understanding between controllers and pilots. On board aircraft carriers it is possible and highly desirable for the controllers to become intimately acquainted with the aptitudes, personality traits, and reactions under pressure of the individual pilots and leaders. Through practice, patient and persistence coordination of effort and teamwork leads to success in action. Carriers, however, are not the only ships which control aircraft; any ship with the proper equipment and qualified personnel embarked may be called



on to control planes. It is, therefore, the responsibility of carrier air control officers to insure that their pilots are uniformly trained in standard techniques which are in accordance with the latest effective doctrine. Only if this is accomplished can the fleet depend on uniformity of results.

Combat Information Center is the main nerve center for the control of aircraft. CIC is a space wherein are located the personnel and equipment for the reception, interpretation, evaluation, and dissemination of information. Briefly, CIC furnishes a continuous accurate picture of the current tactical situation and takes positive action in controlling assigned



Figure 4.

aircraft and in protecting the force from attack. Using the authority delegated to them by higher command, CIC personnel work as a team within the force to coordinate the air activities of forces afloat and ashore.

If the force experiences enemy air attack, CIC directs the pilots out to meet the enemy. From the information available, size of raid, course, speed, altitude, location, condition of readiness and number of own defensive fighters, the Group CIC Officer decides how many defensive planes to send out to intercept the raid.

Defensive Air Control is a flexible and changing art. Interception techniques depend on whether the interception is made at night or in daylight, or from a ship, shore base, or other aircraft. Different tactical situations naturally call for different techniques but defensive air control and interception constitute only one phase of the broad field of aircraft control. Patrols, strikes, search and attack, and the other special missions must be tracked, kept accurately located, and kept in communications contact wherever possible. Information must be made available to the control centers so that they may issue landing orders and guide planes in to landings under restricted visibility conditions. It is the responsibility of CIC, as representative of the OTC to exercise, or be prepared to exercise immediate control over all aircraft assigned. It is the Force CIC Officers' responsibility to the OTC to exercise for him or be prepared to exercise, immediate control over all aircraft assigned. (See USF 15, ch. 3, fig. 1.)

E. FUNDAMENTALS OF CONTROL

Certain fundamentals in the control of aircraft must be clearly understood by all personnel who may be called upon to exercise control. A firm theoretical grasp and a practical working knowledge of the following subjects are mandatory for effective control of aircraft:

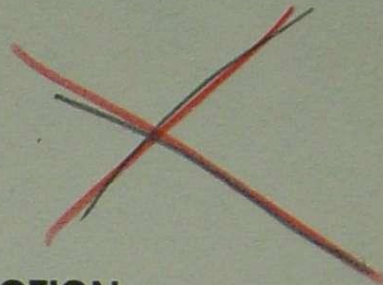
- a. relative motion at aircraft speeds (subsonic, sonic, and super-sonic).
- b. weather conditions affecting operations and combat tactics.
- c. voice radio (R/T) vocabulary and procedure.
- d. radar scope and plot interpretation.
- e. aircraft performance.
- f. control technique for all missions under all conditions.
- g. organization, functions, and responsibilities of CIC in task organizations.

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troller must bring to his task an alert mind and be capable of quick action based on sound and rapid judgment. The requisite skills can be developed only through long and arduous prac-

tice. But such skills are vital, for effective control of aircraft can mean the salvation of an operation, its misuse may mean the destruction of the fleet.

CHAPTER TWO



AERIAL NAVIGATION AND RELATIVE MOTION

- A. INTRODUCTION.
- B. WIND.
- C. RELATIVE MOTION.
- D. VECTOR DIAGRAMS.

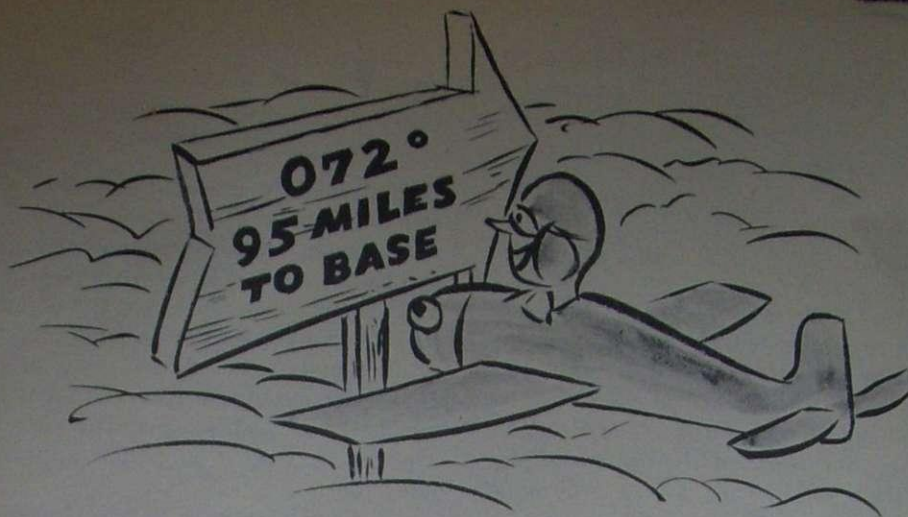


Figure 5.

CHAPTER 2

AERIAL NAVIGATION AND RELATIVE MOTION

A. INTRODUCTION

Aerial navigation is basically identical to any other type of navigation. It is the science of finding and following the most expeditious route through the air from one point to another. Applied to aircraft control, this destination may be an island, an airfield or a moving carrier base, a specific geographic or relative sector to search, or a point at which another moving plane may be intercepted.

In order to understand the movement of aircraft for purposes of exercising control, a clear conception of relative motion is essential.

Relative motion of aircraft presents a much more complex problem than the relative motion of surface vessels. For example, with your ship underway you are to give a plane near you a heading so it can join another that is passing at some distance. The motion of the wind, your ship, and certain instrument errors must be considered. Briefly, the instrument errors in the plane are caused by its altitude and the temperature. The corrections are made with certain tables and devices, such as the Mark VIII Computer, which will not be discussed here.

B. WIND

The first motion that affects the plane's actual movement from one point on the earth to another is the wind. The wind is actually a movement of the air that is supporting the plane, so it will obviously have an effect on it.

In considering the direction of wind it is important to remember that the direction given is normally the direction *from* which the wind is blowing rather than the direction in which it is blowing. This terminology differs from that used in describing other types of motion.

Example: To get from Point A on the earth to B with no wind blowing, a plane would point directly for B. This would be its *True Heading* (TH), the direction in which the plane is pointed. The speed at which the plane flies through the air would be its *True Air Speed* (TAS). Its *Indicated Air Speed* (IAS) is the speed indicated on the plane's instruments and would be somewhat less than its *True Air Speed*. A correction card in the plane shows the correction to be applied to the indicated air speed. If a wind were blowing, the plane on the same heading would be forced to the side in the

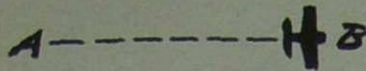


Figure 6.

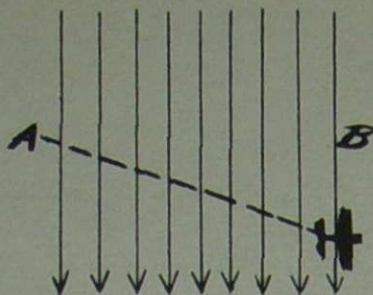


Figure 7.

direction the wind was blowing. Here its *Heading* is the same, but its motion over the earth shown by the dotted line is different. The dotted line is called the *Track* of the plane, its actual movement over the earth. The direction of the dotted line is called the *Course* of the plane and the speed of this motion is *Ground Speed* of the plane.

True Heading should be distinguished from Magnetic Heading which involves an adjustment in the Magnetic Heading of the plane to compensate for error caused by Variation in each given area of operation; this adjustment in Magnetic Heading will cause the plane to fly the desired True Heading.

C. RELATIVE MOTION

Motion consists of direction and speed.

Relative Motion is the direction and speed an object appears to move when observed from another moving object.

Example: You are on a ship moving south. You see a plane east of you at Point A at time 0800.

At 0801 you observe the plane at Point B still due east.

The plane appears to have moved from A to B. This is the relative motion of the plane with respect to the ship. The direction of the line from A to B is called *Direction of Relative Motion* (DRM). The speed of the movement from A to B is called *Speed of Relative Motion* (SRM). The distance from A to B is the *Measurement of Relative Motion* (MRM). This is

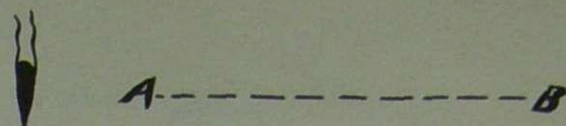


Figure 10.

the movement that would appear on your relative plot board.

However, you have been moving south during this time. At 0800 you were in position 1 on the earth's surface and observed the plane at Point A. At 0801 you were in position 2 on the earth's surface and observed the plane at Point B. Hence the dotted line from A to B is the actual movement of the plane over the earth's surface. This is the track that would appear on a DRT plot.

The third motion to be considered is that of one moving plane relative to another. V

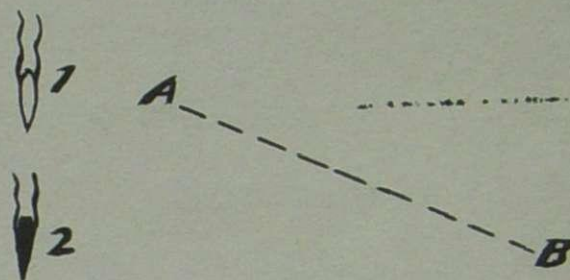


Figure 11.

and ship's motion will be omitted to simplify the example.

Example: P_2 is at Point A. P_1 is flying at a given speed.

It is clear that if P_2 were given a heading straight at P_1 the planes would not meet. P_1 would have advanced along its course.

P_2 will be given a heading to a point somewhere ahead of P_1 so that the two will meet there simultaneously.

Computing their headings as well as compensating the wind and ship's movements may be done by use of a vector diagram.

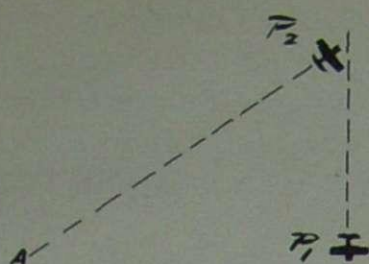


Figure 13.

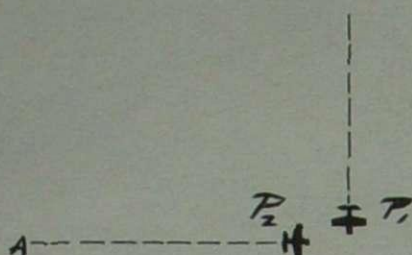


Figure 14.

D. VECTOR DIAGRAMS

As stated before, motion consists of a speed and direction. It can be represented by an arrow pointing in the direction of the motion, with the length of the arrow measuring the speed.

The vector is labeled with the object in motion at the arrow end and what the motion is relative to at the other end. Small letters are used, which are descriptive of the objects involved.

Example: The motion of a plane relative to the earth in direction 090 at a speed of 150 knots, i. e., its *True Ground Speed*, and Track.

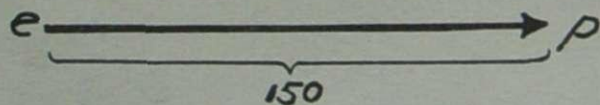


Figure 15.

The basic rule for joining vectors is that ends having common designations may be joined one on the other if their proper slope or direction is retained and if they are of the proper length based on some common scale. New vectors which may be constructed as a result of such joining have all the properties of the original vectors and may be read as describing the movement of one object in relation to another in the indicated direction at the indicated speed.

top of the page and a common scale will be used to measure length of vectors, i. e., speed of motion.

1. The motion of the air (w) over the earth (e) from a direction of 220° at a velocity of 20 knots.

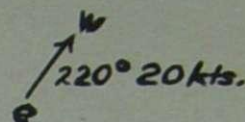


Figure 16.

2. The motion of our ship (s) over the earth (e) in a direction of 180° at a speed of 30 knots.

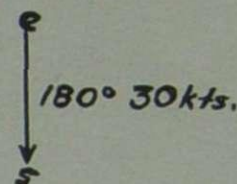


Figure 17.

3. The relative motion of a plane (P_1) which we have been plotting and determined to be a relative direction of 074° at a relative speed of 169 knots.

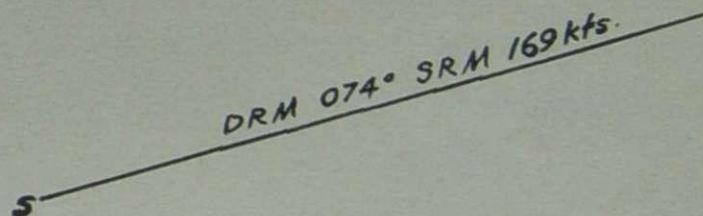


Figure 18.

Joining the ends of these having common designations.

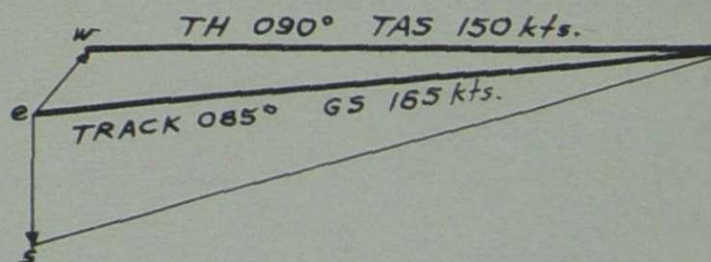


Figure 19.

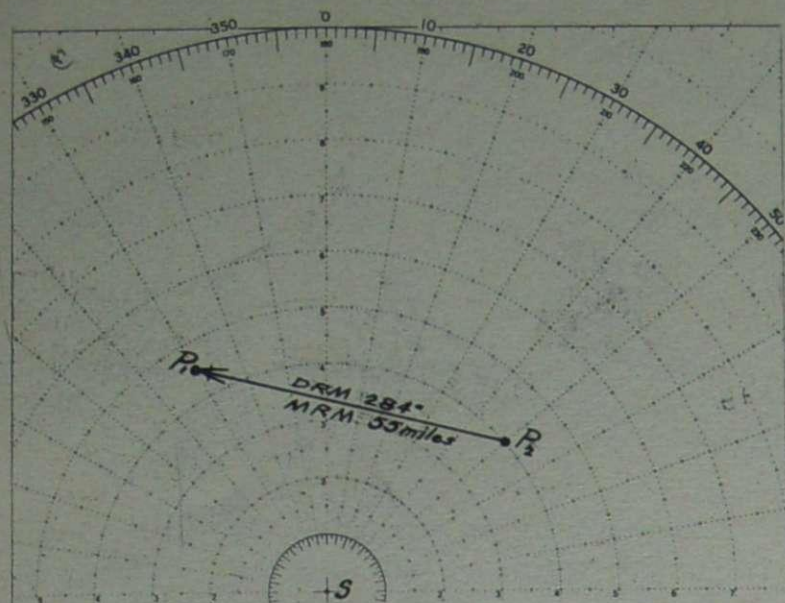


Figure 20.

Speed (TAS) of 150 knots; and ($e-p_1$) the motion of the plane relative to the earth, that is a track of 085° at a Ground Speed (GS) of 165 knots.

4. Now supposing we wanted to have a second plane (P_2), which at the time was 40 miles from us on a true bearing of 050° , join the plane that we had been tracking (P_1) which at the same moment was 45 miles from us on a true bearing of 330° . The plane (P_2) is to use a True Air Speed of 180 knots.

The relative picture of the situation at that moment would be as shown in figure 20.

It should be understood that this illustration is

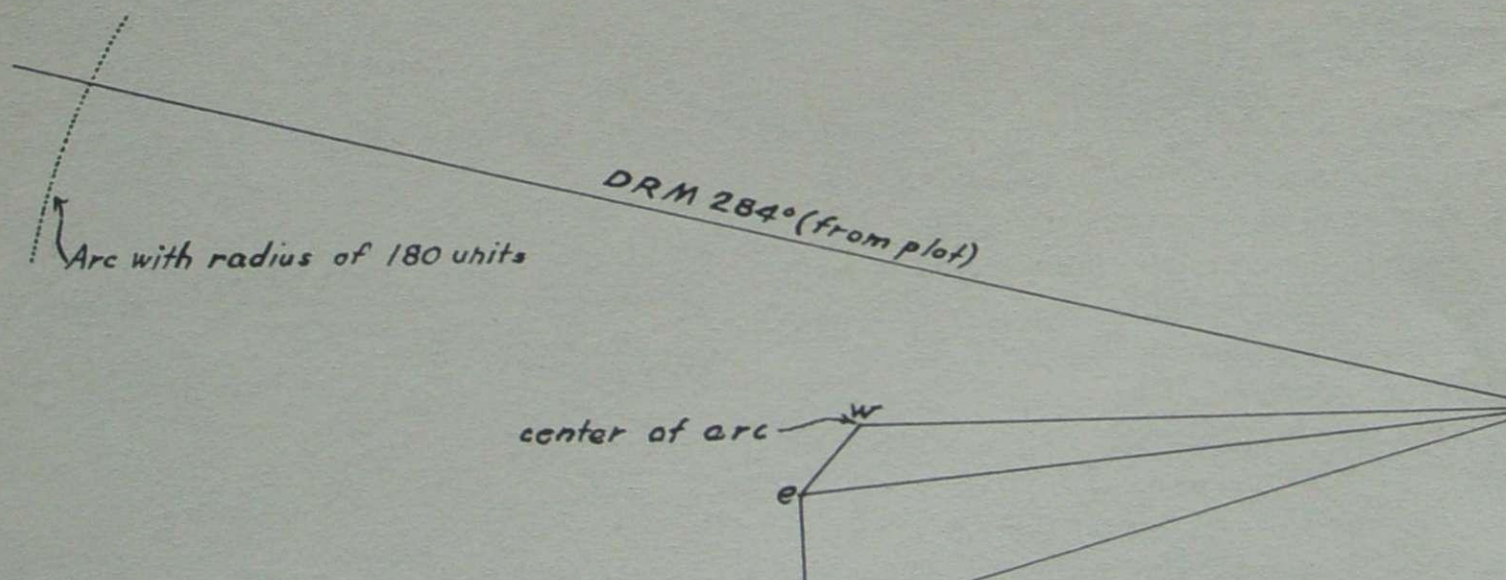
that of a relative plot and not part of our vector diagram and as such the positions are labeled by capital letters to distinguish them from points of our vector diagram. It does tell us, however, that if Plane 2 is to join with Plane 1 then it must fly so that its *Direction of Relative Motion* (DRM is 284°), and we can measure the relative distance that it has to travel (MRM 55 miles). From the information that we have we can put down our P_1-P_2 vector. Draw a line from P_1 in the direction 284° (DRM). We know that P_2 is to fly at *True Air Speed* 180 knots which gives us the length of $w-p_2$. Swing an arc of radius 180 units with w as center (figure 21).

The length of P_1-P_2 , the SRM, is determined by where it is intersected by the *True Air Speed* arc.

By measurement we find that the speed of relative motion is 322 knots. We can also see that the direction of the $w-p_2$ vector is 295° *True Heading* of the plane (figure 22).

5. By completing the various triangle in the vector diagram we obtain the following additional vectors (figure 23):

$e-p_2$ which tells us that the plane that we are directing shall move across the earth in a direction of 302° at a *Ground Speed* of 195 knots. The vector $s-p_2$ tells that his direction of relative motion to us shall be 309° and relative speed 195 knots. This is the direction



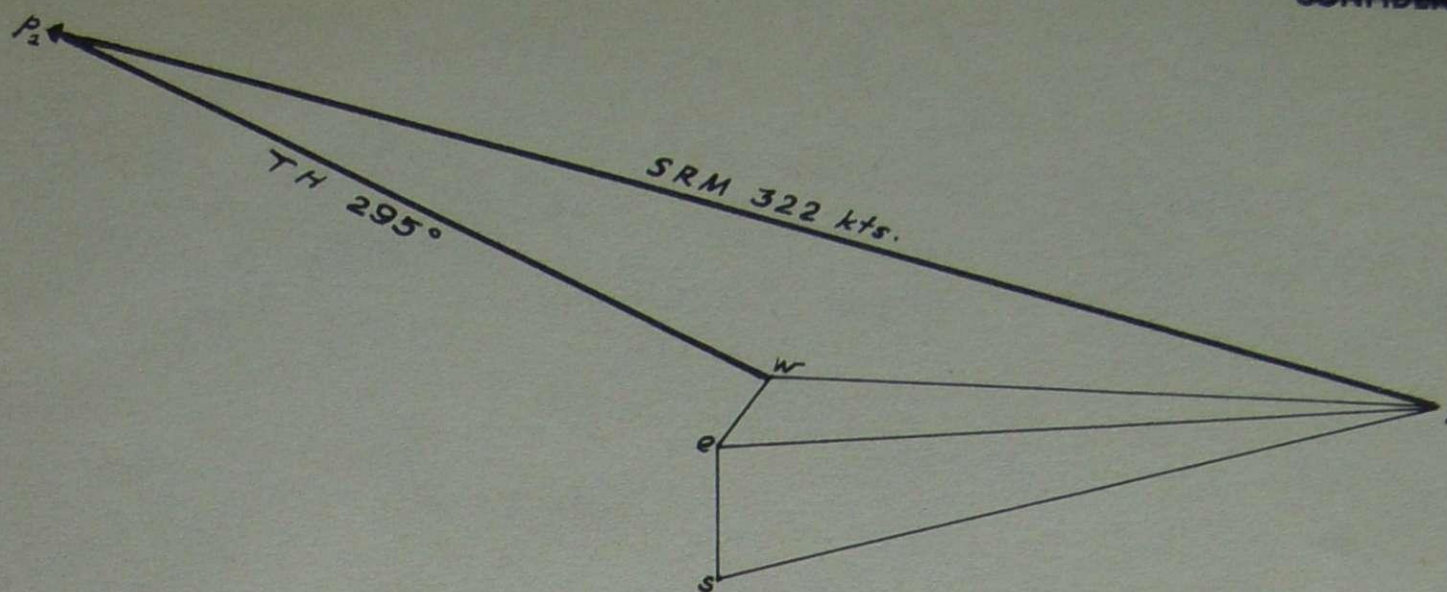


Figure 22.

and speed at which he would move across our plotting boards.

With this fundamental concept of the nature of vectors and their combination into vector diagrams we can figure out the somewhat complex problems of the relative motion of any number of moving objects to one another.

The controllers must assure themselves of a sound grasp of these basic fundamentals in

controlling aircraft. However, it should be noted that absolute accuracy in the solution of problems of relative motion in air combat is often not feasible. The exigencies of combat conditions demand split-second decisions. Hence the competent controller must rely through experience to solve these problems rapidly in his head with the aid of the "sea eye."

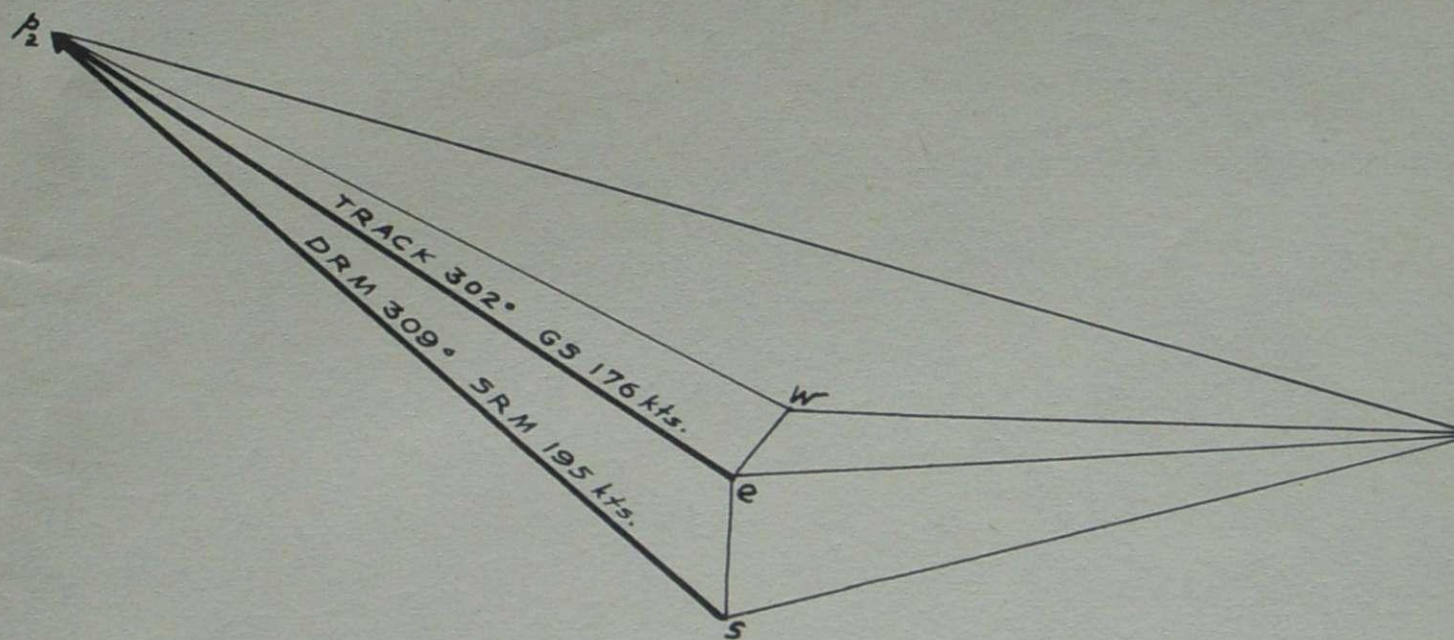


Figure 23.

CHAPTER THREE

WEATHER AND THE CONTROL OF AIRCRAFT

- A. IMPORTANCE OF WEATHER.
- B. SOURCES OF WEATHER INFORMATION.
- C. WEATHER INFORMATION FROM RADAR.
- D. WEATHER AND STATIONING THE COMBAT AIR PATROL.
- E. WEATHER AND INTERCEPTION.
- F. STACKING OF COMBAT AIR PATROLS.
- G. INTERCEPTING A SINGLE BOGEY.
- H. WEATHER AND THE CONTROLLED INTERCEPTION.
- I. WIND AND LANDING.

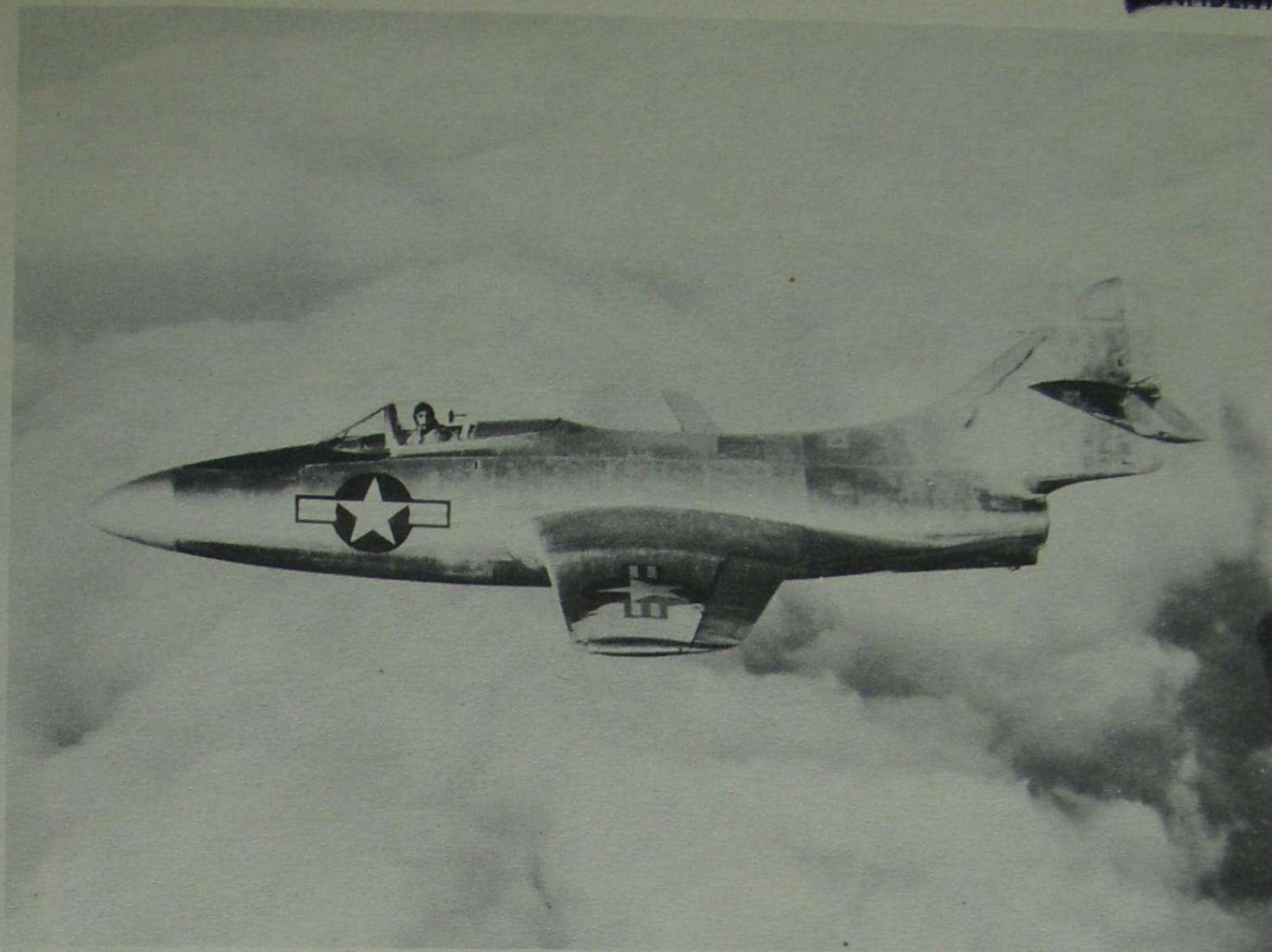


Figure 24.

CHAPTER 3

WEATHER AND CONTROL OF AIRCRAFT**A. IMPORTANCE OF WEATHER**

In conducting air operations weather directly affects the amount and type of flying as well as the effectiveness of aerial missions. In offensive operations, weather influences the type of attack, numbers and deployment, and time and direction of approach to the target area. Since the enemy may also take advantage of meteorological conditions in timing their attacks against us, weather also influences the number and positioning of our defensive aircraft.

B. SOURCES OF WEATHER INFORMATION

There are various sources of weather information

mand center on the basis of reports from flung weather stations from the Arctic to tropics.

2. Local aerological department reports
3. Ship's own radars.



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4. Special weather reconnaissance flights.
5. Spot reports by combat air patrols and other routine flights.

A combination of available weather information aids the CIC officer in stationing the CAP, making successful interceptions, homing air-

C. WEATHER INFORMATION FROM RADAR

Useful weather information can be obtained from radars, which does not replace but merely supplements the regular aerological data.

Radar operators can distinguish weather

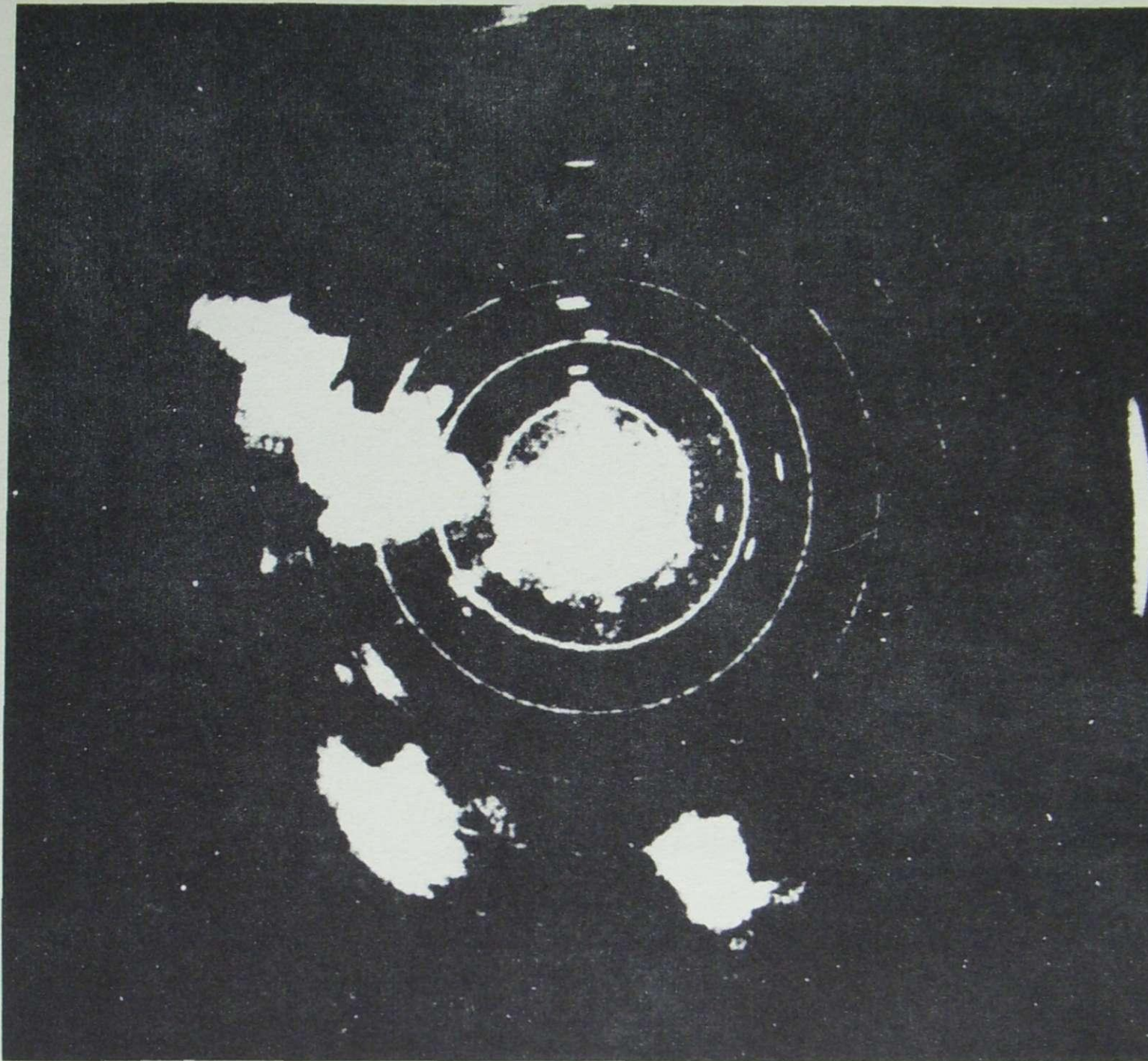


Figure 26.—Radar echo from a thunderstorm on the PPI scope (40 mile sweep with 5 mile markers). Scanning in elevation disclosed the extent of this storm to be 40,000 feet. (S-band system). Right lenticular spot at the outer edge of the circle is 0° azimuth. Irregular bright area at azimuth 190° is thunderstorm.

craft, giving navigational data to pilots, and passing on reliable information to the bridge and to the OTC. A knowledge of weather con-

dications by the saturation and the unsteadiness of the echo on the A-scope, the shape and brightness on the PPI and by the eleva-

1. A thunderstorm echo—bright, dense central area with indistinct boundaries.
2. A convective cloud echo—scattered as in a random manner, moving with direction and velocity of the general circulation.
3. An orthographic thunderstorm echo—will show little geographic movement.
4. A cold front echo—usually arranged in a line.
5. A warm front echo—hazy and usually covers very wide area.
6. A line squall echo—long, narrow, and moves rapidly.
7. A shower echo—generally less intense than thunderstorm with a hazy structure.

The lower frequency (meter wave) radars rarely are of much weather help, though they may occasionally detect heavy rain storms.

D. WEATHER AND STATIONING OF THE CAP

The altitude and disposition of CAP may depend very largely on the latest pilot report concerning "mattress," "quilt," "blanket," and "pillow." In good visibility the controller puts the CAP at normal stations, but if clouds exist, he may have to keep some planes above cloud cover and some below for a sound defense of the force.

Heavy winds aloft combined with cloud cover also affect the stationing of the CAP. Such conditions make it difficult for the planes to hold their stations. Therefore, wherever possible, the CAP should be placed where it can maintain visual contact with the base. If it is necessary to keep planes at very high altitudes or out of sight contact, the controller must constantly track his planes on a PPI to prevent them from drifting off station.

All pilots must learn the proper use of YE-YG/ZB and other homing equipment for keeping station when visibility is reduced. By careful tuning of ZB gear an experienced pilot can maintain an assigned position within a YE-YG letter sector. Alternatively he may fly a short patrol line across two or three sectors. In neither case is sight contact necessary even

E. WEATHER AND INTERCEPTION

When conducting an interception, the controller depends on his CAP for weather reports—particularly visibility and the presence of cloud layers or stacks—in the immediate vicinity. If all is clear, his primary concern is the utilization of any advantage the sun may produce. When the enemy has been discovered to be a group of planes, and if it does not complicate an otherwise simple interception, interception should be from a position up-sun with 3 to 4 thousand feet altitude advantage. When the enemy is a single plane, the altitude advantage may be lessened so as to increase the chance of making a tallyho.

On the basis of local CAP reports, the controller must keep all pilots informed of radar weather change at the base.

Cloud conditions may vary on different bearings and at different ranges and altitudes.

If the flight leader knows the bogey's height and bogey's range, he is the best judge as to how a cloud formation or weather front should be handled, reporting action taken to the controller.

F. STACKING OF COMBAT AIR PATROL

The presence of cloud layers or frontal conditions greatly complicates the controller's problems. Utilizing the best altitude estimate of approaching enemy planes and his picture of cloud and visibility conditions, he must decide whether to send his fighters above or below a cloud layer, to split them, or to control them through the clouds.

As the enemy continues to develop and to exploit his knowledge of our radar characteristics and limitations along with the advantages clouds provide him, it has been found necessary to disperse defensive fighters in altitude, bearing, and range when intercepting sizeable enemy groups. Such dispersion may be known as "staggered ladder" in which the greatest numbers are generally at the best estimated intercept altitude and most directly in line with the

1. A thunderstorm echo—bright, dense central area with indistinct boundaries.

2. A convective cloud echo—scattered as in a random manner, moving with direction and velocity of the general circulation.

3. An orthographic thunderstorm echo—will show little geographic movement.

4. A cold front echo—usually arranged in a line.

5. A warm front echo—hazy and usually covers very wide area.

6. A line squall echo—long, narrow, and moves rapidly.

7. A shower echo—generally less intense than thunderstorm with a hazy structure.

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On the basis of local CAP reports, the controller must keep all pilots informed of rapid weather change at the base.

Cloud conditions may vary on different days and at different ranges and altitudes.

If the flight leader knows the bogey's location and bogey's range, he is the best judge as to whether a cloud formation or weather front should be handled, reporting action taken to the controller.

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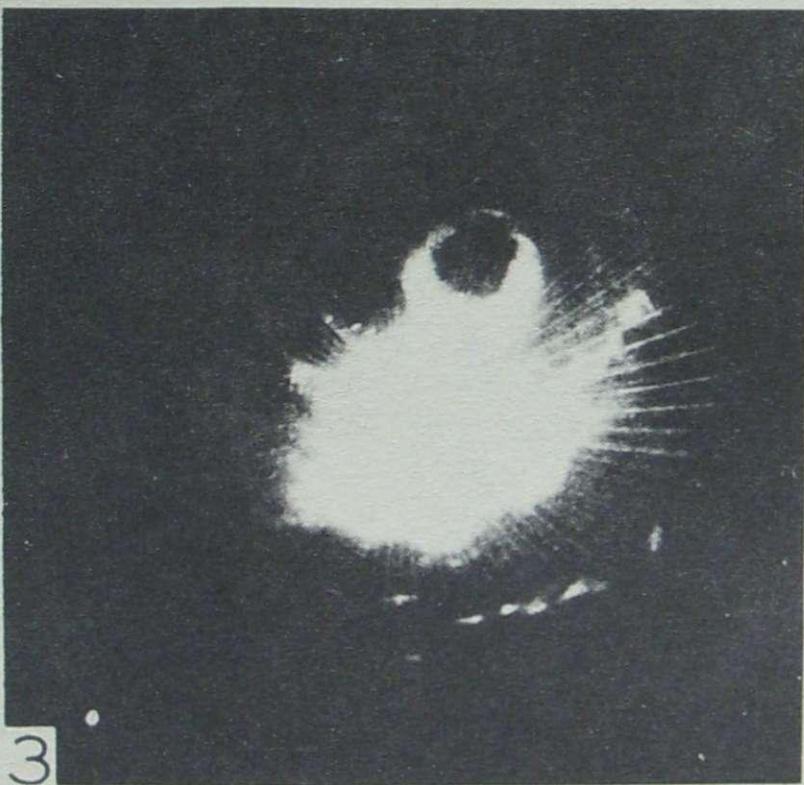
RADAR SCOPE SHOWS TYPHOON MOVEMENT OVER 4½ HOUR PERIOD



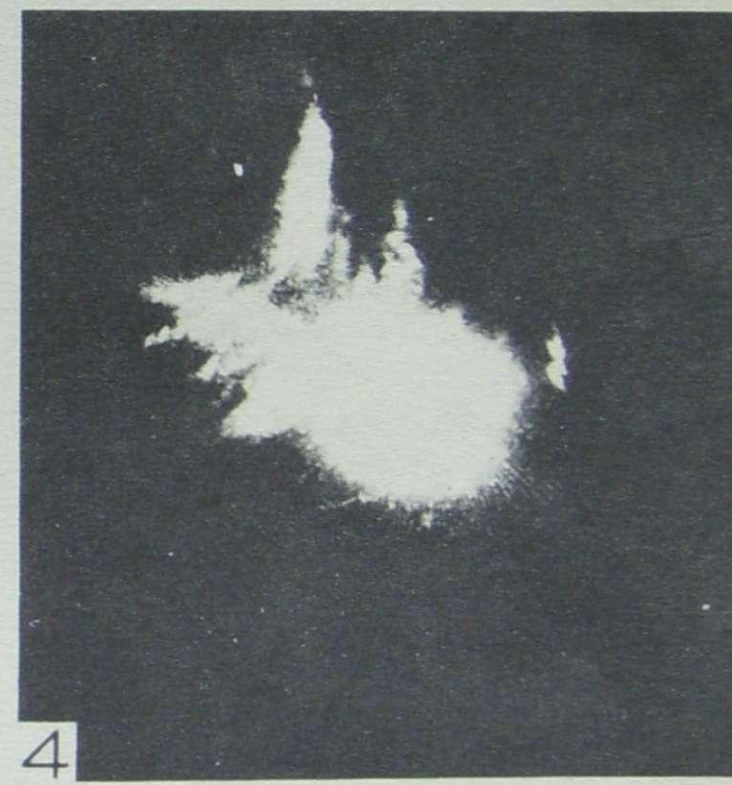
This picture was taken at 1100 at which time the center of the typhoon was 39 miles distant, bearing 077° (T). Wind was 57 knots, with gusts to 66 knots. Ceiling was less than 500 feet; visibility, 800 to 1,200 yards. The sea was very high—20 to 40 feet.



Taken at 1200, this picture shows the typhoon center 35 miles distant, bearing 055° (T). Wind in gusts exceeded 75 knots from 315° (T). Ceiling was less than 500 feet and visibility 600 to 1,000 yards. Seas were very high to mountainous—40 feet plus.



At 1300 the storm was nearest the ship which submitted this record. The center was 35 miles distant, bearing 026° (T). Wind in gusts exceeded 75 knots. Ceiling and visibility



The picture taken at 1530, shows the circular cloud and precipitation pattern of the typhoon, the center of which is now off the scope. Winds were 41 knots with gusts to 60 knots.

group and generally below any intermediate cloud layers (this group may be split to cover top and bottom of clouds). The controller uses these to strike any enemy planes which split and come down from the initial group. They may be ordered merely to assume a "back-stop" station and pick off whatever they see; or, if the radar picture is sufficiently clear, they may be controlled on interceptions.

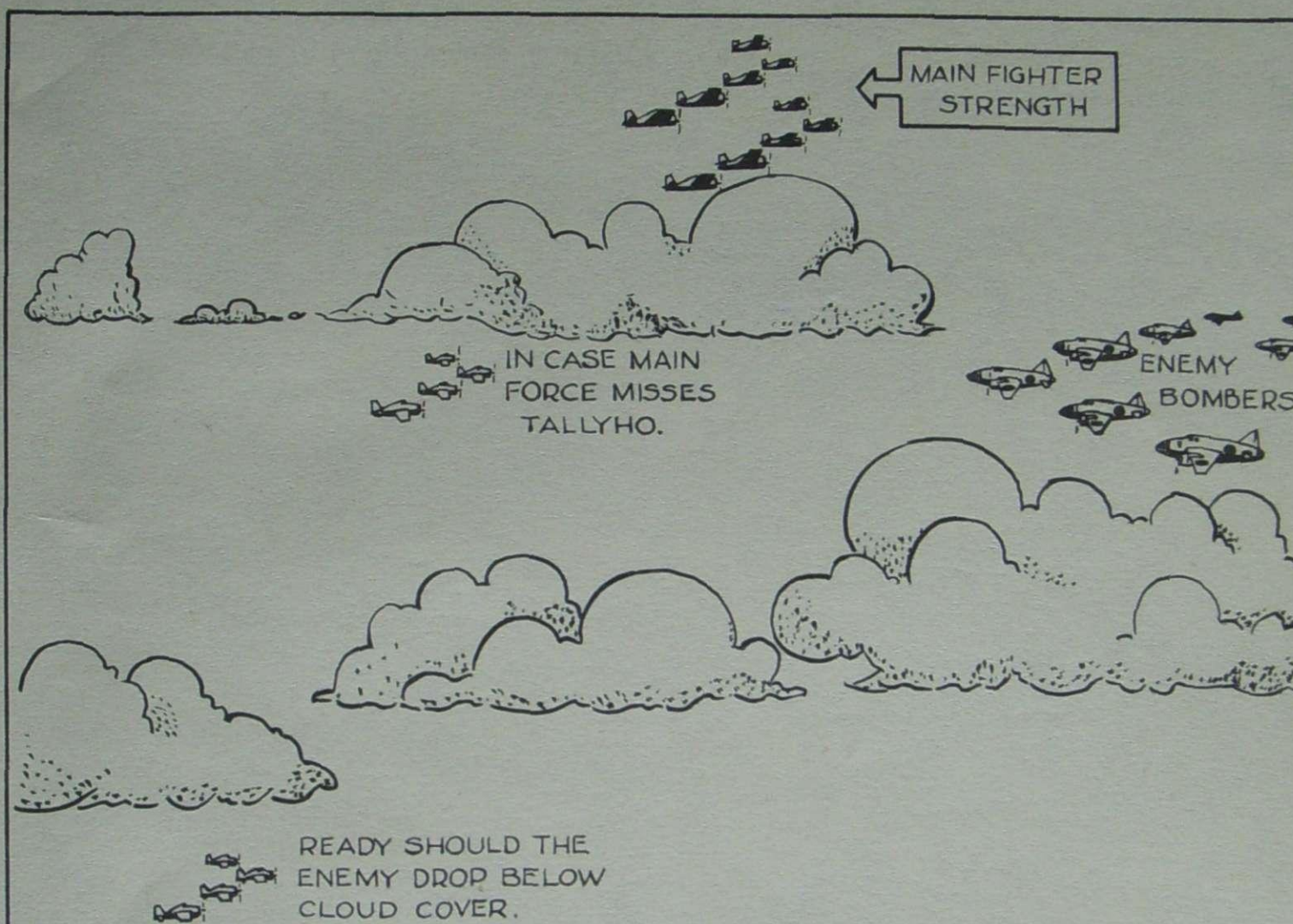
A third group of fighters (if available), generally the smallest in number, may be sent out behind the other two groups at low altitude to intercept whatever enemy planes have thus far escaped and are pressing in their attack on our forces. This group normally flies below the

lowest cloud layer or at a maximum altitude not over 3,000 feet.

This is one type of group deployment which may serve as a guide. Others may be developed to fit the needs of the particular weather and visibility conditions.

G. INTERCEPTING A SINGLE BOGEY

If a single bogey is thought to be taking advantage of scattered clouds, cloud bank layers, a division can be utilized as a search unit, or can be split in two sections and used to cover simultaneously the top and bottom of cloud formation. In such disposition the division may still be controlled as a unit or



WHEN CLOUD COVER IS HEAVY, THE "STAGGERED LADDER" MAY BE USED.

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section may be controlled separately and joined up at the completion of the interception.

H. WEATHER AND THE CONTROLLED INTERCEPTION

Working against cloud or haze conditions, the fighters may need close control. A "head-on" interception is a good visibility interception, and the chances of tactical surprise are greatly enhanced if tactical use is made of the sun, i. e., if the controller interposes his fighters between the enemy and the sun. When visibility is restricted, it may be necessary to employ a "controlled" interception in which the controller places his fighters in the most strategic position to sight and initiate attack against the enemy.

Enemy aircraft often approach through a front or through stacked clouds. If it is not

feasible to have friendly fighters go on through to complete the interception, the fighters may be orbited at the most likely position the bomber is expected to break through. As soon as the bomber does emerge, the fighters should be in a position to tallyho and attack.

I. WIND AND LANDING

Winds always affect landing and launch operations. This effect is minimized, in carrier forces by their having sufficient available speed. Other forces with less available speed (i. e. CVE's) are adversely affected by lack of wind. This is overcome by the use of the catapult when necessary. When fighters are to be landed, it is necessary to inform them of velocity and direction of wind even though the ship may be on a landing course.

CHAPTER FOUR

COMMUNICATIONS IN AIRCRAFT CONTROL

- A. INTRODUCTION.
- B. SECURITY.
- C. VERY HIGH AND ULTRA HIGH FREQUENCY RADIO—
VHF AND UHF.
- D. HIGH FREQUENCY RADIO—HF.
- E. ASSIGNMENT OF FREQUENCIES.
- F. CODES.
- G. AUTHENTICATION.
- H. RADIO DISCIPLINE.
- I. RADIO AND RADAR SILENCE.

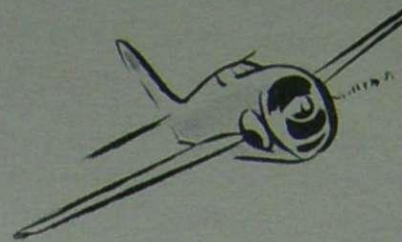


Figure 29.

CHAPTER 4

COMMUNICATIONS IN AIRCRAFT CONTROL

A. INTRODUCTION

Radio is the primary means of modern aircraft communications. Continuous-wave transmissions, electronic, and visual signals are used to a limited extent, but the great majority of all messages are transmitted by radio telephone

B. SECURITY

In using radio careful consideration must be given to the problem of security. The enemy can receive our transmissions and may gain knowledge therefrom which can be of great value to him. In addition to intercepting messages

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security measures are taken to minimize these dangers.

C. VERY HIGH AND ULTRA HIGH FREQUENCY RADIO—VHF AND UHF

Choosing the proper frequency depends primarily on the mission involved. Transmissions on frequencies of approximately 30 megacycles and above possess a characteristic not found in the lower bands. They are quasi-optical or line-of-sight transmissions. In other words these transmissions will not, except under freak conditions, follow the earth's curvature. VHF/UHF is therefore well adapted for intra-task group communications since, regardless of the power used, ships or stations below the horizon cannot normally intercept the transmissions. This condition must not permit the development of a false sense of security among users of VHF/UHF.

In working with aircraft VHF/UHF affords reliable communications out to about 100 miles and often considerably farther providing the plane has sufficient altitude to put it above the horizon. VHF/UHF is now used exclusively by all aircraft for all missions within effective range of this equipment.

D. HIGH FREQUENCY RADIO—HF

For long-range transmissions when planes are below the horizon it is necessary either to use lower frequencies or to station VHF/UHF relays every hundred miles or so. In employing HF the use of the minimum necessary power is a good security measure. Also there are bands in the lower frequencies which possess certain peculiarities such as skip distances and difficulty in D/Fing. These peculiarities are taken into consideration by communications officers when drawing up frequency plans.

The use of HF in aircraft control is much less extensive than that of VHF/UHF. HF is used principally by planes when over an enemy target or when they are well away from our units. Generally, the high frequencies used are common throughout a task force. On rare occasions it will be possible to establish HF/CW

E. ASSIGNMENT OF FREQUENCIES

In assigning radio channels for any air operation first consideration is given to the frequencies available and the type of equipment employed. Having this information at hand the channels are assigned in such a way as to permit the widest possible dissemination of information while yet avoiding congestion arising from excessive traffic on individual channels.

Assignment of frequencies for various missions listed in USF 15 and USF 70 (B) is done in accordance with USF 70 (B) and the communication plan for each individual operation.

F. CODES

Aircraft radio telephone communications are generally sent in plain language. High security codes are not well adapted to the requirements of speed and simplicity which characterize aircraft communications. Simple, frequently changed codes are necessary, however, for concealing information involving time, bearings and distances, courses and speeds, and the like, especially when they deal with operations sufficiently far in the future to permit the enemy to take effective countermeasures.

A typical example of this is the "shackle" code which substitutes letters for numbers and changes daily or in accordance with existing instructions. The shackle code is not difficult to break down, but the delay attendant in breaking it down is such that it serves the purpose for which it is intended. Unless proper procedure is used in each case, however, compromise of the daily shackle list is apt to occur.

Example:

Decipher

Examples

A-5	N-1	1. "Will attack at shackle Vi
B-7	O-2	Oboe Charlie Sugar."
C-0	P-9	
D-8	Q-6	Meaning: Will attack at 120
E-5	R-4	
F-5	S-0	2. "ETA shackle Charlie Peter Y
G-2	T-9	Zebra group composed of sha
H-8	U-3	Nan Charlie unshackle Vi

Decipher		Examples
M-Ø	Z-Ø	Meaning: Estimated time of arrival 0900. Group composed of 10 VF, 5VB, 5VT.

The "Joint Air Warning and Air Defense Code" (JANAP 142 series) is not a true code, for it offers only a slight degree of security. It was designed to expedite communications rather than to serve as a security system.

G. AUTHENTICATION

Besides intercepting our transmissions, the enemy sometimes attempts to counterfeit transmissions and gives false orders or information to our forces. A system of authenticators is used to counter this move. An addressee who is suspicious of the source of a message should demand proper authentication before taking any action. To challenge, transmit "Say again and authenticate," or "Authenticate your last transmission." In order to prevent enemy use of the authenticators they are changed daily, and CIC personnel must be cognizant of them.

H. RADIO DISCIPLINE

Strict radio discipline on aircraft circuits is essential to efficient operations. Since upward of 100 planes may be on the same channel simultaneously, unnecessary transmissions must be completely eliminated. A thorough understanding by the pilots of rendezvous procedure, lost plane procedure, R/T procedure and the use of visual methods of communication is of great importance in this connection.

I. RADIO SILENCE AND RADAR SILENCE

To assist in setting up a communications plan, various conditions of radio and radar silence are defined in fleet publications. These conditions limit the use of the different frequency bands. While en route to an objective, strict limitations may be placed on the use of radio and radars, but once the attack has commenced and our presence is known to the enemy, discipline may be relaxed. The OTC prescribes the effective conditions of radio and radar silences to conform with the tactical situation. (See USF 15 and USF 70 (B).)

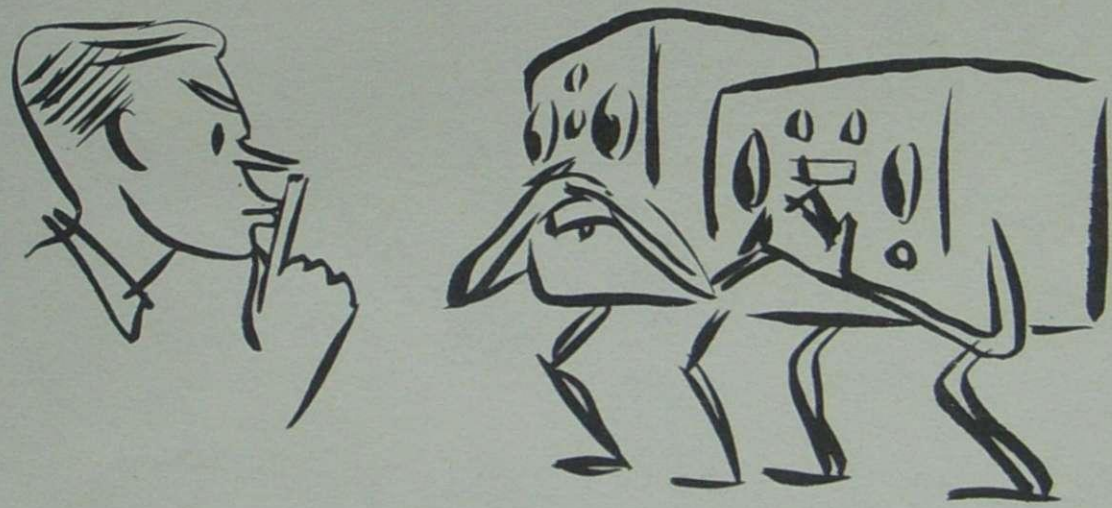


Figure 30.

CHAPTER FIVE

RADIO TELEPHONE (R/T) PROCEDURE

- A. INTRODUCTION.
- B. RULES FOR CLARITY.
- C. RADIO TELEPHONE PROCEDURE.
- D. CALLING PROCEDURE.
- E. AIR CONTROL ORDERS.
- G. IDENTIFICATION CALLS.
- H. PRONUNCIATION OF NUMBERS.
- I. AIR CONTROLLER'S GLOSSARY.

CHAPTER 5

RADIO TELEPHONE (R/T) PROCEDURE

A. INTRODUCTION

For purposes of accuracy, speed, and clarity in radio telephone communications for controlling aircraft, a vocabulary, procedure, and technique have been developed. Correct R/T is the only basis for efficient voice communications, and its importance cannot be overemphasized. All officers and men whose duties involve the use of radio-telephone must know and adhere to the standard procedure.

The CIC officers and controllers must get their messages across and at the same time instill confidence in those under their control. Clear positive transmissions are mandatory. Adherence to a few simple rules will obviate many communication problems.

B. RULES FOR CLARITY

1. *Keep your voice natural.* This not only gives the impression of calmness but is usually more readily understandable.
2. *Know what you are going to say before you speak,* then speak with authority.
3. *Once you begin a transmission, continue until you have finished it.* Fumbled transmissions denote a fumbling controller.
4. *Listen before you speak* and make sure that no one else is speaking on the net at the moment. Wait 3 or 4 seconds after a pilot being controlled by another controller has completed reading back an order. The other controller may want to correct the transmission.
5. Above everything else, *keep your transmissions to a minimum.* Brevity is the essence of R/T procedure.

been standardized as much as possible, and should be memorized and strictly adhered to in all communications between ships and aircraft. The good controller and the good CIC officer should be so familiar with the R/T code that they think in terms of R/T when controlling in the same manner that a skilled linguist thinks without hesitation in another language. Unfamiliarity with the code and carelessness usually result in slipshod control.

Component parts of any radio message in aircraft control operations will always consist of three parts—the *call*, the *text*, and the *ending*. The original call of a radio message consists of the call sign of the receiving station followed by the call sign of the transmitting station.

D. CALLING PROCEDURE

1. The Call

The following call-up procedure will be used on initial transmissions. First the call sign of the station or person called; then the phrase "this is" following by the call sign of the station of the person calling.

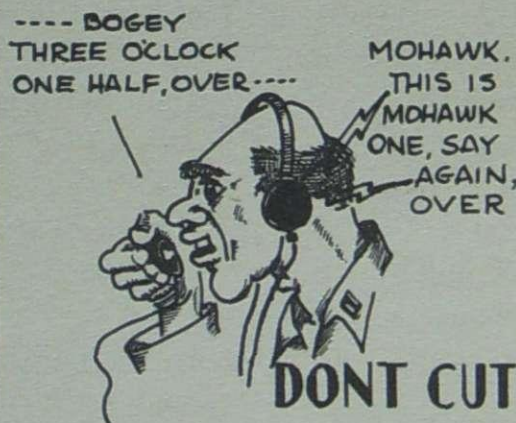
Example: Mohawk One, this is Mohawk. . . ."

The use of "Hello" preceding the call sign is optional. It has the advantage of alerting the net and helping to make sure that the call sign of the addressee is not clipped off. In a crowded net or when brevity is desired, "Hello" should not be used. *Example:* "Hello Mohawk One, this is Mohawk. . . ."

When answering a call, it is only necessary to identify oneself. (However, if channel is crowded with traffic use both call signs.

Example: "This is Mohawk One . . ."

DON'T'S IN R/T



HI JOE -
YOU GOT
MY ZOOM
BUGGIES ON
YER OUIJA
BOARD?



series) and phrased in the correct manner.

3. The Ending

The text is always followed by either the word "over" or the word "out." "Over" means "my transmission is ended and I expect a response from you." "Out" means "this transmission is ended and no response is expected." The words "over" and "out" are just as important as the rest of the transmission and must be used correctly.



Figure 32.

E. AIR CONTROL ORDERS

In an air control order, the vector, speed, and angels are given in that order.

Example: "Mohawk One, this is Mohawk. Vector three-one-zero—Buster—Angels ten. Over."

In acknowledging such transmissions the order is always read back, preceded by "wilco" and followed by "out."

Example: "This is Mohawk One, Wilco. Vector three-one-zero—Buster—Angels ten. Out."

F. R/T PHRASEOLOGY

There are certain phrases for acknowledging or clarifying transmissions which, although covered later in the R/T vocabulary, need fuller explanation.

"Roger" means "I have received your last transmission satisfactorily." It does *not* mean

message, understand it, and will comply." A proword can only be used on the authority of the Commander or authority to whom the original message is addressed.

"Say again" means "Repeat all of your transmission." If followed by identification data, it means "Repeat ——— (portion indicated)."

"That is correct" means "You have received my last transmission correctly."

"Affirmative" and "negative" are used for clarity instead of "yes" and "no."

G. IDENTIFICATION CALLS

All ships, aircraft, and shore stations are assigned radio voice calls (JANAP 119) for use in air control, tactical maneuvers, and communications. Fighter divisions on coastal air patrol assume the call of their parent carrier followed by a number designating the division. Thus the first fighter division from an aircraft carrier whose radio call is "Mohawk" would have the call "Mohawk One," the second division would be "Mohawk Two," etc. Fighter divisions are further broken down into sections or individual aircraft by adding a number of that aircraft in the division to the division's call. Thus the call for the second fighter in "Mohawk Five" would be "Mohawk Five-Two," and the fighter's call for the third plane in the fifth division would be "Mohawk Five-Three."

If "Mohawk" were calling her first fighter division, the call would be as follows:

"Mohawk One, this is Mohawk . . . (followed by message) . . . Over."

H. PRONUNCIATION OF NUMBERS

Since numbers are inclined to be indistinct on radio-telephone, and since the numbers may often be of immeasurable importance, the following aids in pronunciation will clarify their usage on the air.

Figure Spoken

1	Wun	6	Six
2	Too	7	Seven

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Figure 33.

I. AIR CONTROLLER'S GLOSSARY

The following explanation of the Joint Air Warning and Air Defense Code (JANAP 142 series) contains examples of the use of many of the words and phrases. It supplements the brief description of the meanings given in the alphabetical list and should be studied in connection therewith. Also included are words and phrases which currently are of common usage in the Fleet for newer phases of aircraft control. They are used in conjunction with the code. The terms are grouped below under heads such as IDENTIFICATION, SPEEDS, ALTITUDES, HOMING, etc. In night, high speed, and visual control, where brevity is of extreme importance, it must be borne in mind that abbreviations will be used more frequently than in normal day control, and call signs may even be dropped at times. For example, in normal day control, the transmission would be: "Mohawk One, this is Mohawk," whereas in night control this may be abbreviated to "One . . ." In visual control, if no other planes are operating on the same frequency, call signs may be dropped completely. Also in visual control, all transmissions from the air controller should usually be followed by "out" rather than "over," since compliance or noncompliance with any orders can be observed directly and no "wilco" is needed from the pilot.

SPEEDS

SAUNTER—Fly at best endurance.

LINER—Fly at speed giving maximum cruising range.

BUSTER—Fly at maximum continuous speed (power).

after burners, rockets, etc., in accordance local doctrine.)

SPEED—Given as an order to own fighter to what indicated air speed to use. *Example*: "One, speed two hundred. Over." The word "speed" should only be used in referring to the indicated air speed to be flown by a friendly fighter and should not be used in referring to a bogey's speed (compare with "bogey indicating.") Note that in referring to speed is given as "Two Hundred" or "one-eight-hundred" and NOT as "two-zero-zero" or "one-eight-zero."

BOGEY INDICATING—Bogey's indicated air speed. *Example*: "Mohawk One, bogey indicating two hundred, over." The words, "bogey indicating" are used in referring to an estimated

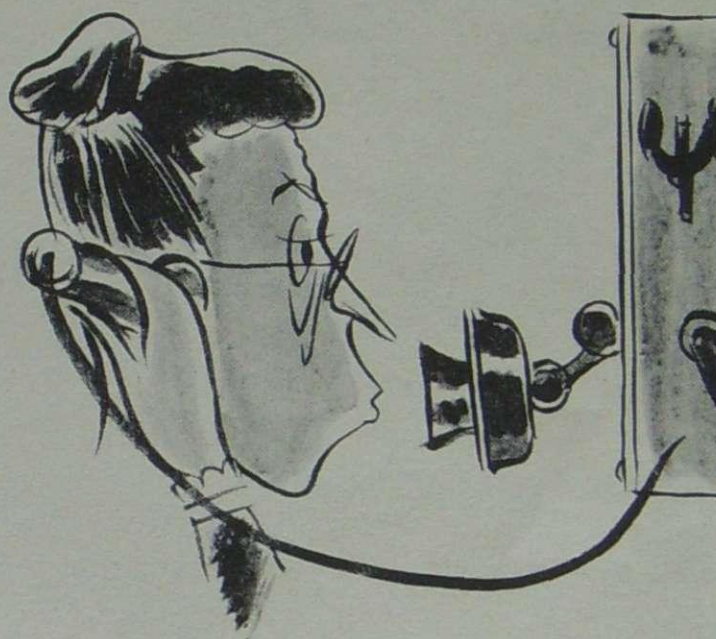


Figure 34.

of the indicated air speed flown by the enemy aircraft and NOT that of the friendly fighter which is attempting the interception.

SPEED UP—Increase speed ——— knots.

THROTTLE BACK—Decrease speed ——— knots. *Example*: "Mohawk One, speed (throttle back) ten (twenty or thirty), over." This order should not be given for an increase (decrease) in excess of thirty knots and should not be used more than once consecutively. Planes under visual control should fly at

ALTITUDES

ALTITUDE—Altitude of aircraft, in feet. This word is used primarily to give information on the altitude of the enemy plane(s) which are being intercepted. *Example:* "Mohawk One, bogey altitude seventy-five hundred. Out." The word may also be used to give information on altitude of friendly planes.

ANGELS—Altitude in thousands of feet. This word is used normally with friendly aircraft only. *Example:* "Hello, Mohawk One, this is Mohawk, Angels seven point five. Over." This constituted an order to Mohawk One to fly at 7,500 feet.

BELOW—Aircraft below you (information only).

ABOVE—Aircraft above you (information only). The above terms are intended to be used in giving information with respect to other planes and do NOT constitute orders. *Example:* "Mohawk One, bogey eleven o'clock above, twelve (miles). Over." The twelve miles in the foregoing case means twelve miles away NOT up or down twelve.

AT ANGELS—Am at and holding "Angels" ordered. The words "At Angels" are used by pilots in reporting that they have reached the altitude ("Angels") to which they were ordered. *Example:* "At angels fifteen. Out." The word "level" is used by the Controller to tell the pilot that the bogey is at the same height. *Example:* "One, bogey level. Out."

ON THE DECK—Fly at minimum altitude (may be used to indicate target is at minimum altitude or at sea level).

VECTORS

VECTOR—Alter heading to magnetic heading indicated. (Must be used with three figure group; e. g., "Vector zero-six-zero" NOT "Vector six zero" or "Vector sixty." For homing course, "STEER" is used.) Normally, a vector should contain a "PORT" or "STARBOARD" to indicate the direction of the turn. However, on an initial vector from an orbit, the direction of the turn is indicated. *Example:* "Hello



Figure 35.

mally left off a night transmission, its meaning is implied. The transmission would be "Starboard two-seven-zero. Over.")

VECTOR PORT—Alter heading to magnetic heading indicated, turning to port (left). This may be abbreviated to "Port."

VECTOR STARBOARD—Alter heading to magnetic heading indicated, turning to starboard (right). This may be abbreviated "Starboard." These orders are used when the pilot knows the heading of the fighter and wishes to control the direction of his turn. The turn is normally made at a standard rate. The use of these orders permits the pilot to start his turn immediately without having to figure out what way he should make the turn. *Example:* "Hello Mohawk One, this is Mohawk. Vector starboard three-zero-zero. Over."

VECTOR HARD PORT—Alter heading to magnetic heading indicated turning left in a tight turn.

VECTOR HARD STARBOARD—Alter heading to magnetic heading indicated, turning right in a tight turn. These orders are used when a turn of shorter radius is desired. *Example:* "Hello Mohawk One, Vector hard port two-seven-zero. Over." These orders may be abbreviated "Hard Port . . ." or "Hard Starboard . . ."

STEER—Set magnetic heading expressed in degrees to reach me. *Example:* "One, Steer

other than the controlling base. *Example:* "One, Steer one-three-five for Hotshot. Over." This order should be used only when giving planes vectors to a base or station. At all other times, the word "vector" is used instead. For example, planes are vectored to an interception, vectored back to an orbit, but are given "Steer" when returning to a base. The word "Steer" is used to answer "Request homing."

DETACH—Detach your unit(s) from the patrol or mission. This order makes specific what one or more divisions in a large flight should do. It is used by controller to make certain what is the disposition of all his units.

CHECK PORT—Alter heading—degrees to port (left) then resume original heading.

CHECK STARBOARD—Alter heading——degrees to starboard (right) then resume original heading. These orders are used to assist the night fighter in picking up a bogey on his A. I. radar. They make him turn his plane through a number of degrees and then, immediately, resume the original heading, giving his A. I. radar a chance to "sweep." It would not normally be used with a turn of more than thirty degrees. *Example:* "One, check port (starboard) thirty. Over."

CONTINUE PORT—Continue turning port (left) at present rate of turn to heading indicated.

CONTINUE STARBOARD—Continue turning starboard (right) at present rate of turn to heading indicated. These orders are used where a plane is already in a turn and it is desired to have him continue the turn farther than already indicated. *Example:* If a plane was turning port to two-seven-zero, and it was desired to have him continue his turn to two-one-zero, this would be done as follows: "Mojave One, continue port two-one-zero. Over."

HARD PORT—Alter heading to magnetic heading indicated, turning left in a tight turn. See "Vector Hard Port".

HARD STARBOARD—Alter heading to magnetic

TIGHTEN TURN—Tighten rate of turn maximum. This order is used when it is desired to have the plane turn faster than was originally intended.

EASE TURN—Ease rate of turn. This order is used when it is desired to have the plane turn slower than was originally intended.

PORT—Alter heading to magnetic heading indicated, turning left.

STARBOARD—Alter heading to magnetic heading indicated, turning right. Normally turns are made at a standard rate. These orders are used as abbreviations for "Vector Port" and "Vector Starboard". *Example:* "One, Starboard one-three-zero. Over" meaning to "vector one-three-zero, turning to starboard in a standard rate turn."

RIGHT—Alter heading to right by indicated number of degrees.

LEFT—Alter heading to left by indicated number of degrees. These orders are used when it is desired to vector the aircraft through a small relative course change. It is used primarily during the final stages of a controlled intercept. *Example:* "One, Left twenty. Over." Not more than two relative course changes should be given consecutively. These orders would not normally be used with turns of more than thirty degrees.

STEADY—Am on prescribed heading. This is used by the pilot to report when he has gone onto a new heading. *Example:* "Steady two-seven-zero. Out." It may also be used to order the pilot to straighten out immediately on his present heading.

BOGEY HEADING—Bogey's magnetic heading. This is used for information only to let the pilot know the magnetic heading on which the bogey is flying. *Example:* "One, bogey heading three-four-zero. Over."

NOTE—It should be noted that when the orders, "Vector," "Vector Port (Starboard)," "Vector Hard Port (Starboard)," "Port (Starboard)," "Hard Port (Starboard)," "Continue Port (Starboard)," or "Steer" are used they

ber which consists of two digits to indicate a change in heading relative to the magnetic heading being flown.

TYPES OF PLANES OR TARGETS

- ANYFACE—AEW Aircraft.
- BANDIT—Aircraft identified as enemy.
- BOGEY—Unidentified aircraft (implies, "Investigate with caution, may be friendly").
- BOXCARS—Heavy/very heavy bomber aircraft.
- CHICKENS—Friendly fighters.
- EAGLES—Medium bomber aircraft.
- FISHES—Torpedo aircraft.
- FRIENDLY—Friendly aircraft or ship.
- HAWKS—Dive bombers.
- JET—Jet propelled aircraft. This word is used as a prefix to further explain any standard type of aircraft. *For example:* "jet bogey", "jet rats", etc.
- MISSILE—Guided missile, including pilotless aircraft.
- MONSTERS—Cargo/transport aircraft.
- RATS—Fighter aircraft identified as enemy.
- SHADS—Shadower aircraft.
- SNOOPERS—Low shadower aircraft (below 2,000 feet).
- TRACTORS—Towing aircraft.
- WINDMILLS—Helicopter aircraft.

WEATHER

- PILLOW—Visibility in miles.
- BLANKET—Amount of cloud coverage in tenths.
- QUILT—Top of cloud layer given in thousands of feet above sea level.
- MATTRESS—Base of cloud layer given in thousands of feet above sea level. The elements of weather information are listed in the above order so as to conform to the order in which they should be reported by a pilot.
- POPEYE—Am flying in cloud or area of reduced visibility. This term is used to inform the controller that his fighters are flying in a cloud and constitutes a suggestion that their angels be changed.

hundreds of feet but add the word "dred."

O—*Over* or *top* of cloud level in thousands of feet. If unknown use the word "unknown". If there is more than one cloud layer report the upper immediately following the lower, e. g., "two, two, seventeen, twenty-five".

W—*Wind* (8 points, N, NE, E, SE, S, SW, W, NW) plus the velocity in knots. When wind is missing; omit, or use the word "unknown".

W—*Weather*—General description of weather in plain language such as clear, partly cloudy, cloudy, overcast, light rain, moderate or heavy rain, mist, haze, thunderstorm, and distant lighting. An indication of the weather should be made at the end of the report under "E".

A—*Amount* of clouds, in tenths.

V—*Visibility* in miles. Use a fraction if less than one mile.

E—*Extra* phenomena of significance such as turbulence, icing, heavy swell, and description of front. This is an elaboration of the report which includes anything of interest in plain and common language.

The standard Carrier-Weather Code is the standard form weather report, "Bowwave". Inasmuch as this report under certain conditions, may be difficult to make and may clutter up voice circuits in use, a short form weather report, "VATB", has been provided and may be used under conditions warrant. Normally, the weather report will be sent by the division leader at the test of communications as soon as aircraft are on station.

Weather information may be sent at any time by the pilot, or the controller may ask for it any time. The letters in the code word "Bowwave" are used to determine the order of reporting weather information. If any letter is omitted the word "Unknown" will be substituted. *Example:* "Mohawk, One, Re-

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WEATHER—Short form weather report, giving:

V—*Visibility* in miles (Pillow).

A—*Amount* of clouds in tenths (Blanket).

T—*Top* of cloud layer in thousands of feet (Quilt).

B—*Bottom* of cloud layer in thousands of feet (Mattress).

This weather code is used by carrier pilots and controllers when it is desired to quickly report or obtain a brief description of the weather. (See explanation of "BOWWAVE"). The reply to "Report Weather" is a series of four numbers. An unknown item is answered by "zero". *Example*: "Mohawk One, report weather. Over." "Mohawk, this is Mohawk One, ten-six-zero-thirteen. Over." When the pilot originates a short form weather report he should preface this report with the word "Weather". *Example*: "Mohawk, this is Mohawk One, Weather ten-six-eight-seven. Over." If there is more than one cloud layer, the report should so indicate. *Example*: "Mohawk. This is Mohawk One. Weather ten-six-eight-seven, also two-seventeen-fifteen. Over."

ORANGES SWEET—Weather is suitable for the mission on which the aircraft has been dispatched, in the area where the mission will be carried out or en route to that area.

ORANGES SOUR—Weather is unsuitable for the mission on which the aircraft has been dispatched in the area where the mission will be carried out or en route to that area.

INFORMATION TRANSMISSIONS

AMMO MINUS—Have less than half ammunition left. (Caliber may be specified.)

AMMO PLUS—Have more than half ammunition left. (Caliber may be specified.)

AMMO ZERO—Have no ammunition. (Caliber may be specified.)

FUEL—Amount of fuel remaining. Fuel that remains should be reported in hundreds of

Normally the controller will read back to pilot his fuel report. *Example*: "One, understand fuel twenty-one pounds. Out."

AWAY—Aircraft is flying away from trolling station or ship.

TOWARDS—Aircraft is flying towards trolling station or ship.

FREDDIE—Air control ship or station.

FREDDIE INDICATING—Am identifying myself as air control ship or station by making use of smoke and/or some other prearranged signal.

O'CLOCK—Aircraft at clock-code sector indicated. *Example*: "Mohawk One, this is Mohawk. Many bogies eleven o'clock, five Over." Clock code is used by either controller or pilot in reporting the position and range of other aircraft relative to fighter planes, twelve o'clock being dead ahead, six o'clock dead astern, etc. In the majority of cases the pilot will be concerned with clock-code primarily in making a tallyho report. Clock code is usually used when fighters are within two miles of target. "Ahead" followed by range is used at all other times.

PIGEONS—Magnetic bearing and distance from controlling unit from friendly aircraft. (Information only.) *Note*: "Pigeons" does not necessarily imply "home."

When the word "Pigeons" is followed by a call sign of some other station or point, it means the magnetic bearing and distance from that designated station or geographic point from friendly aircraft. This transmission is used when it is desired to inform the pilot of his position with relation to a point other than the controlling station. As an example of the usefulness of this transmission: a friendly pilot may be running low on fuel and receive a warning which takes him away from a picket destroyer which is controlling him, yet in the direction of a carrier on which he may land in case the pilot finds it necessary to do so prior to returning to his "FREDDIE". *Example*: "Mohawk One, pigeons BOLO, one-eight-three, eight two. Out." In this example BOLO is the call sign of a station other than the station

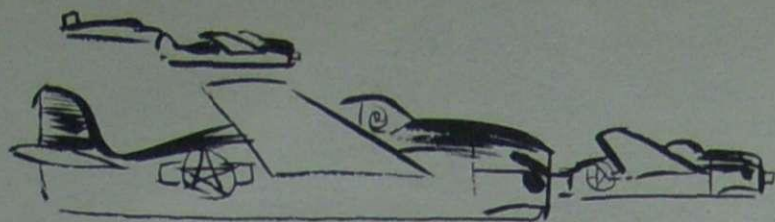


Figure 36.

SPLASHED—Enemy aircraft shot down, followed by number and type.

GRAND SLAM—All enemy aircraft originally sighted have been shot down (with a number indicates number shot down). The word "splashed" is used to report the number of enemy planes shot down. *Example:* "Mohawk, this is Mohawk One. Splashed three Hawks. Over."

The term "grand slam" should not be used unless all aircraft (enemy) originally sighted have been shot down. *Example:* "Mohawk, this is Mohawk One. Grand Slam fifteen hawks. Over."

TALLYHO—Aircraft sighted, presumably the aircraft I have been directed to intercept. (*Note:* The controller should immediately advise the pilot as to whether the aircraft sighted are the aircraft to be intercepted.) The word "Tallyho" should be followed by the call of the reporting plane, the clock-code position of the bogey, the distance of the bogey, the number of bogeys, and their height. The above information constitutes the initial Tallyho report. As soon as further information is available an amplifying report giving the identity, type of planes, and heading should be made to the controller. *Example:* "Tallyho, this is Mohawk One, four o'clock, five, three bogeys—ten thousand, over."

TOUCH—In touch on homing beacon. This transmission is used by fighter plane to indicate that he has picked up either a radio or radar homing beacon. *Example:* "Mohawk, this is Mohawk One. Touch on HAYRAKE. Over," or, "Mohawk, this is Mohawk One. Touch on MOTHER. Over."

WHAT STATE—Report fuel and ammunition

aircraft called. *Example:* "Mohawk One, is Mohawk. What state. Over." The answer is the lowest figure in the division or flight to fuel and ammunition. "Mohawk, this is Mohawk One. Fuel ninety-five, ammo-plus over." This should be repeated back by Mohawk for check.

WHAT LUCK—What has been the result of your assigned mission.

CENTER—Center of unit or indicated part of unit.

VAN—Front of unit or indicated part of unit.

REAR—Rear of unit or indicated part of unit.

STATIONING INSTRUCTIONS

ANCHOR(ED)—Orbit (Am orbiting) a specified point. The orbit point should be specified. *e. g.,* "Mohawk One, this is Mohawk, Anchor Point ABLE. Over."

BASE—Home airfield or home carrier.

ORBIT—Circle and search. Limit orbiting radius to smallest practicable for type aircraft.

ORBIT PORT—(Left) Circle and search to port (left).

ORBIT STARBOARD—(Right) Circle and search to starboard (right).

ORBIT FIGURE EIGHT—Make figure of eight and search. May be used also, "Orbit figure eight port (left)"; "Orbit figure eight starboard (right)".

OVER TO SNAP—You are to be directed to snap. Fly at sustained combat speed when directed. All turns and movements are to be as fast as possible. Acknowledgement of order is not required. When confusion cannot be avoided, call signs will not be used.

PANCAKE—Land, refuel, and rearm.

PANCAKE AMMO—Returning short of ammunition. Wish to land.

PANCAKE FUEL—Returning short of fuel. Wish to land.

PANCAKE HURT—Returning wounded or damaged. Wish to land.

RESUME—Resume last patrol ordered. *Example:* "Mohawk One. Resume. Over."

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STANDARD R/T TRANSMISSIONS

ACKNOWLEDGE—Let me know that you have received and understood this message.

AFFIRMATIVE—Yes, correct. Do not use "Roger" in answer to a question.

CORRECTION—An error has been made in this transmission (or message indicated). The correct version is ——— *Example:* If a pilot has been ordered to "vector two-seven-zero" and the controller meant to give him a vector of one-seven-zero, the transmission would be "Hello Mohawk One, this is Mohawk. Correction—vector one-seven-zero. Over."

I SAY AGAIN—I will repeat.

NEGAT—Used as an order to indicate, "Stop," "turn off," "cease" etc.

NEGATIVE—No. (Used as an answer to a question.)

ROGER—I have received all of your last transmission. (Should not be confused with affirmative.)

SAY AGAIN—Repeat your last transmission.

SPEAK SLOWER—Speak more slowly.

VERIFY—Check coding, check text (subject matter) with the originator and send correct version.

WAIT—If used by itself: "I must pause for a few seconds." If the pause is to be longer than a few seconds, "Wait—out" should be used. If "Wait" is used to prevent another station's transmitting, it must be followed by the ending "Out."

WILCO—I have received and understand your last order and "will comply."

WRONG—What you have said is incorrect. The Correct version is ———. *Example:* If a pilot has been ordered to "vector one-seven-zero" but wilco'd for a vector of two-seven-zero, the transmission would be: "Mohawk One, this is Mohawk, wrong, vector one-seven-zero. Over."

IDENTIFICATION AND HOMING

COCKEREL—IFF Mark III (cockerel "Crows" and is heard not seen).

COCKEREL GEORGE—IFF Mark III "G" Band

CROWING—Showing IFF Mark III ("crowing" is "heard" not "seen").

CROWING ONE TO CROWING SIX—Showing IFF Mark III, with code 1 to 6.

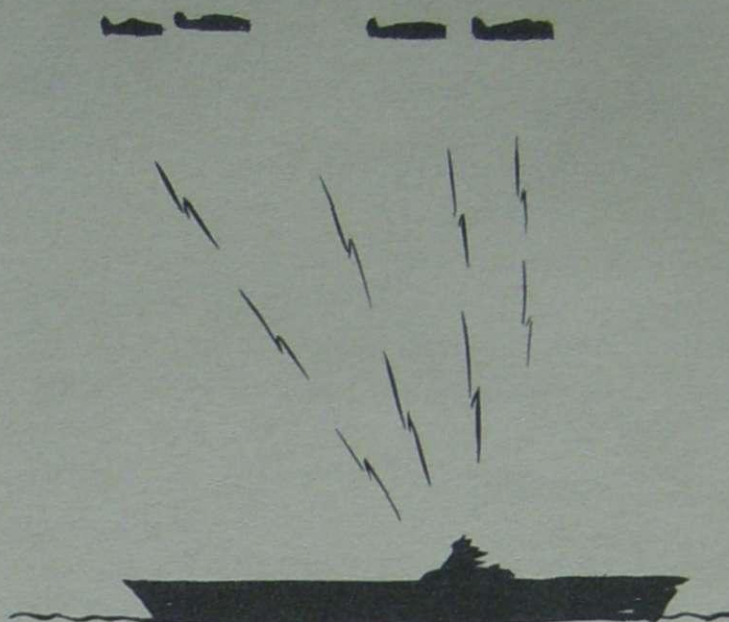


Figure 37.

CROWING MAYDAY—Showing IFF Mark I emergency code.

CHECK CONTACT—Check the designated contact for purposes of identification.

HAYRAKE—Radio Homing Beacon (YE, YG, etc.). *Examples:* (1) "Mohawk, this is Mohawk One, is Hayrake sweet. Over." Meaning "Is the radio homing beacon operating efficiently?" (2) "Hello Mohawk, this is Mohawk One, Hayrake says sugar. Over." Meaning pilot is picking up letter "S" from YG (Y).

LIGHTS—Identify yourselves now by visual means (not to be used to refer to IFF). *Example:* If a search plane were approaching your base, and he was sighted but not identified visually, he could be told: "Hello Sleepy Eight, this is Limbo, lights. Over." The search plane would then make the recognition maneuver, fire his recognition cartridges, etc. as required.

MOTHER—Radar homing beacon. *Example:* (1) "Mohawk, this is Mohawk One, is Mother sweet? Over." Meaning "Is the radar homing beacon operating efficiently?" (2) "H

EMERGENCY TRANSMISSIONS

SKIP IT—Do not attack, or cease investigation. (Should be followed by further instructions.)

EXPEDITE—As fast as possible, or "hurry up."
Example: "Mohawk One, this is Mohawk. Expedite angels twenty-two. Over."

SALVOES—Am about to open fire. Keep clear. Magnetic bearing may be indicated.

SALVOES PROXIMITY—Am about to open fire with VT fused shells. Keep clear and use especial caution. Magnetic bearing may be indicated.

HEADS UP—Enemy got through. Followed by a number to indicate how many. *Example:* "Mohawk, this is Mohawk One. Heads up—six fish. Over."

SCRAMBLE—Take off as quickly as possible. This transmission is usually followed by course and altitude instructions.

ABLE, Over." Meaning you are entering of fire of the battery designated as "Able."

EQUIPMENT

CLARA—Radar scope is clear of contacts than those known to be "friendly."

CONTACT—An indication on a radar scope have an indication on my radar scope.

CONTACT LOST—The indication on my has faded.

BENT—Equipment indicated is inoperative or unserviceable.

SOUR—Equipment indicated is operating at reduced efficiency.

SWEET—Equipment indicated is operating efficiently.

STRANGLE—Switch off equipment indicated. *Example:* "Mohawk One, Strangle Co George. Over."

MUGS—External fuel tanks carried on craft.



Figure 38.

HEY RUBE—Need support. Come to my assistance.

TALLYHO POUNCE—I see the enemy aircraft and can get him before he reaches effective AA range.

TALLYHO HEADS UP—I see the aircraft but am not able to intercept before he reaches AA range.

BURST—Am about to fire AA shells to burst at estimated altitude and direction of enemy.

WEAPON—Air-borne Intercept Radar Air-Sea Rescue Transmissions.

ARK—Air-borne lifeboat, may be followed by a number to indicate number of survivors aboard.

BIRD DOG—Rescue ship other than submarine.

DAVY JONES—Survivor in sea without life jacket.

DUMBO—Amphibious aircraft or seaplane for search and rescue.

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LIFEGUARD—Rescue Submarine.

PLUTO—Land type aircraft for search and rescue.

YELLOWJACKET—Survivor in the sea wearing life jacket.

AI RADAR TRANSMISSIONS

WEAPON—Air-borne Intercept Radar (AI)
Example: "One, switch your weapon, Out."
Meaning, "switch on your AI radar."

PUNCH—You should very soon be obtaining a "contact" on the aircraft that is being intercepted—Look sharp. "Punch" is considered to

be an order. This word should be preceded by information as to the probable position of target. *Example:* "One, Bogey twelve o'clock, four, punch. Over." This word is used with AI interceptions. Pilot acknowledges with "Punch. Out."

JUDY—Take over (or "am taking over") interceptions. This word is used only with AI interceptions.

No Joy—Cannot find raid allotted to you. This word is used primarily with AI interceptions.

CHAPTER SIX

THE USE OF THE PLAN POSITION INDICATOR
AND CIC PLOTTING FACILITIES IN THE
CONTROL OF AIRCRAFT

- A. THE PPI.
- B. GEOGRAPHIC PICTURE.
- C. THE SCOPE COVER.
- D. INFORMATION.
- E. BLIP INTERPRETATION.
- F. TRACKING ON THE SCOPE.
- G. WIND.
- H. VARIATION.
- I. SPEED OF RELATIVE MOTION WITH RESPECT TO SHIP.
- J. RANGE OF COVERAGE.
- K. FADES.
- L. IFF SIGNALS IN TRACKING.
- M. LOW-FLYING AIRCRAFT.
- N. JAMMING.
- O. CORRELATION OF PLOTTING AND THE PPI.



Figure 39.

CHAPTER 6

THE USE OF THE PLAN POSITION INDICATOR AND CIC PLOTTING FACILITIES IN THE CONTROL OF AIRCRAFT

A. THE PPI

The PPI (Plan Position Indicator) is a cathode ray tube which presents a plan view of the surrounding area. The time base extends from the center of the tube to the edge and rotates clockwise or counterclockwise about the central point as an axis. As a result, targets appear as small arcs of a circle with the inside center of each arc or blip representing the exact position of the object picked up. The length of the arc or the number of degrees of azimuth through which it extends depends upon the horizontal beam width of the transmitted pulse. The angular distance from the top of the scope also gives the bearing of the target. Ordinarily, this is a true bearing but adjustments can be made to show a picture relative to the ship's heading. The latter arrangement is seldom used in the control of aircraft.

PPI tubes are made in various sizes, including 5, 7, 9, and 12 inch diameters. The 12 inch

B. GEOGRAPHIC PICTURE

At any moment the PPI presents an instantaneous picture of the area about the radar within its effective range. It reveals the position in range and bearing from the radar of any targets within the coverage of the particular set. With each revolution of the time base around the scope in synchronization with the movement of the antenna it "paints" a new picture of each target blip; and as the target changes its position with respect to the radar, so does the position of the blip change on the scope. Consequently, over a period of time the movement of the blip across the scope will indicate the movement of the target with respect to the radar. If the radar is located in a stationary base, this movement is the track of the target over the ground; if the radar is on a ship, the movement of the blip represents the movement of the target relative to the ship.

C. THE SCOPE COVER

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ing and recording of information and to aid in control. Consisting of a thin sheet of plexiglass bent to the shape of the scope, it may be etched with either a compass rose or a grid. The compass rose is used for all normal shipboard control. The compass rose cover usually shows every 10° azimuth line and also several range circles.

The grid cover is useful for controlling support aircraft in strikes on enemy land positions, and it is designed in accordance with the controlling tactical grid being used in the particular operation. The anti-parallax plot-

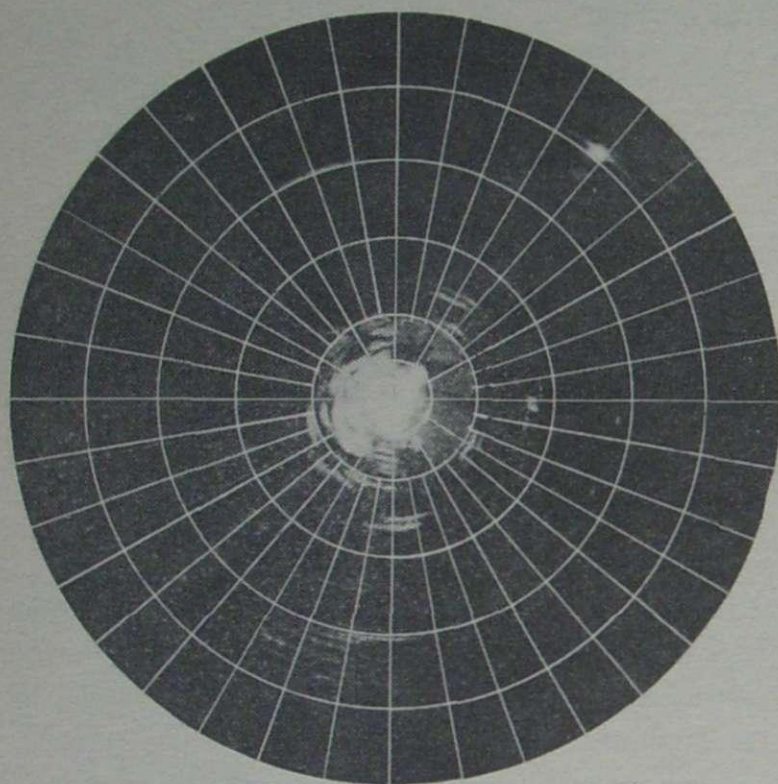


Figure 40.—Range circles and azimuth lines.

ting head (APPH), a PPI scope cover, permits accurate plotting to be done on its raised, transparent surface. It eliminates parallax, and causes the grease marks to appear as though they were plotted directly on the face of the cathode ray tube of the PPI. This allows an undistorted 12-inch relative movement plot to be kept on the face of the repeater.

D. INFORMATION

The controller obtains most of the informa-

and knows their location and disposition. The controller can follow movement of strikewarps, and searches and thus be up to date on the current air situation.

E. BLIP INTERPRETATION

When a bogey appears on the scope, the controller has an instantaneous and accurate position on it. By observing the size, shape, and form of the blip he can make an approximate estimate of the number of aircraft in the formation. (Best done on "A" scope.) A few aircraft flying a tight formation may appear the same as a single large aircraft; but if the formation is spread, or if there are a number of planes, the blip will appear thicker than normal or composed of several partially merged blips.

F. TRACKING ON THE SCOPE

Additional information about the target can be obtained by tracking it on the face of the scope. Two types of tracks can be used: the continuous line or the dot method. The continuous line method consists of placing the grease pencil or marker at the exact inside center of the blip and drawing back a short line. On each successive sweep of the time base this is repeated on the new position, always being sure to start at the new position of the target and to draw the line back to connect with the last position. If a sharp soft pencil is used, a light, narrow continuous line results, showing clearly the track of the target.

If the dot method is used, the operation is similar, except that successive positions of the target are not joined, and, as a result, the track appears as a line of dots. This method does not show course changes of the target quite so accurately as the continuous line method, but it does have the distinct advantage of revealing radical changes in the target's speed.

If information about the target's speed is desired, the dot method is used; otherwise the continuous line is preferable.

The dot method is also more useful for reckoning the movement of targets on the

case of the stationary base, the track on the scope representing the track of the target over the ground is also the heading of the target under no-wind conditions. If there is wind at the altitude at which the target is flying, his track over the earth may not be the same as his heading. In the case of the shipboard set, the track on the scope is the result not only of the effect of the wind on the target but also the effect of the movement of the ship. Both factors must be considered in determining the target's true heading. This may take the form of a rough estimate by the controller or the information can be obtained more accurately by the use of a computer and the intercept plot.

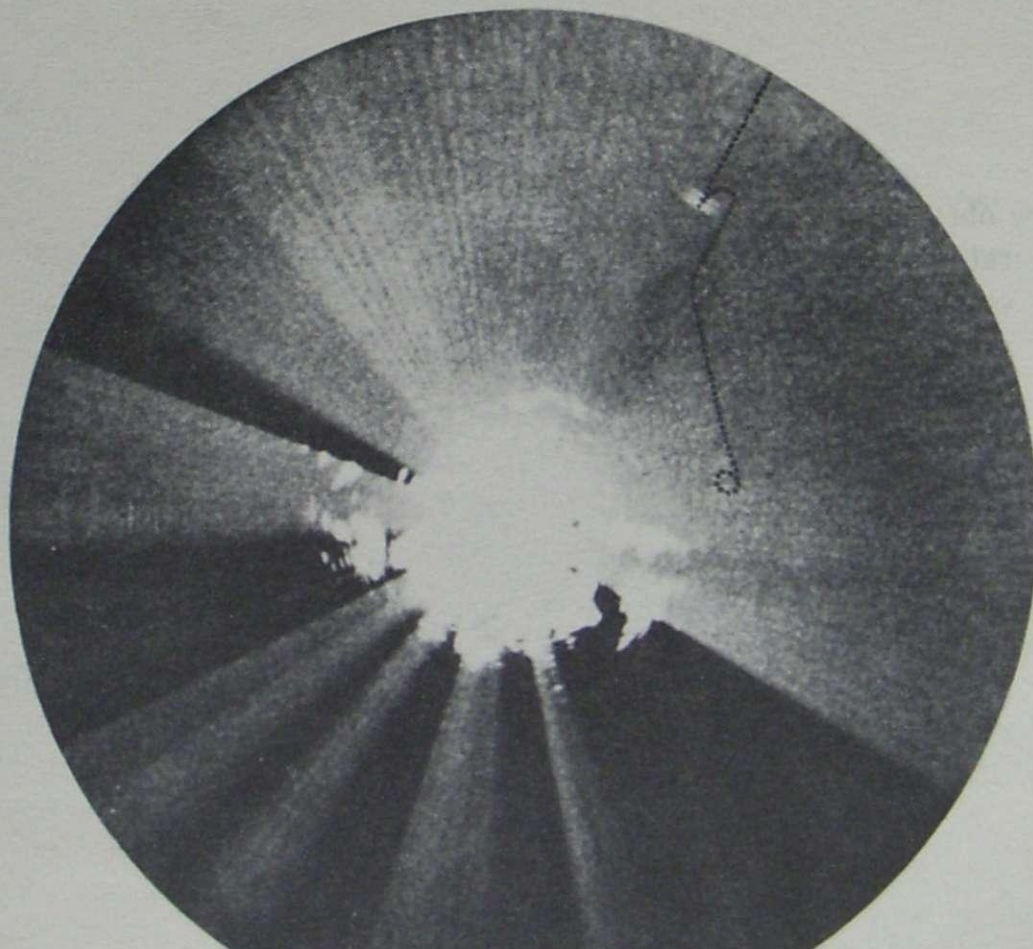
H. VARIATION

In addition to correcting for wind factors, this true heading must be converted to magnetic heading by applying the variation existing in the locality. All headings and vectors given to pilots must be in terms of magnetic rather than true headings to correspond with the magnetic

compass. When operating from a permanent base, this is a simple addition or subtraction of a constant figure, but when operating from a shipboard the controller is confronted with the problem of a continual change in the amount of variation as his ship changes localities. When the controller wants a blip on one part of his scope to go to another part of his scope (perhaps a point of intersection with an unidentified blip), he must give the pilot of his friendly aircraft a heading which makes that blip move across the scope to that point. The heading given will not be the true bearing of the point of destination from the present position of the blip but will be a heading which takes into account relative wind (i. e., ship's motion relative to the winds aloft) and magnetic variation.

I. SPEED OF RELATIVE MOTION WITH RESPECT TO SHIP

Winds aloft and ship's motion are also factors in determining the true air speed of a target. The speed of movement of the target's



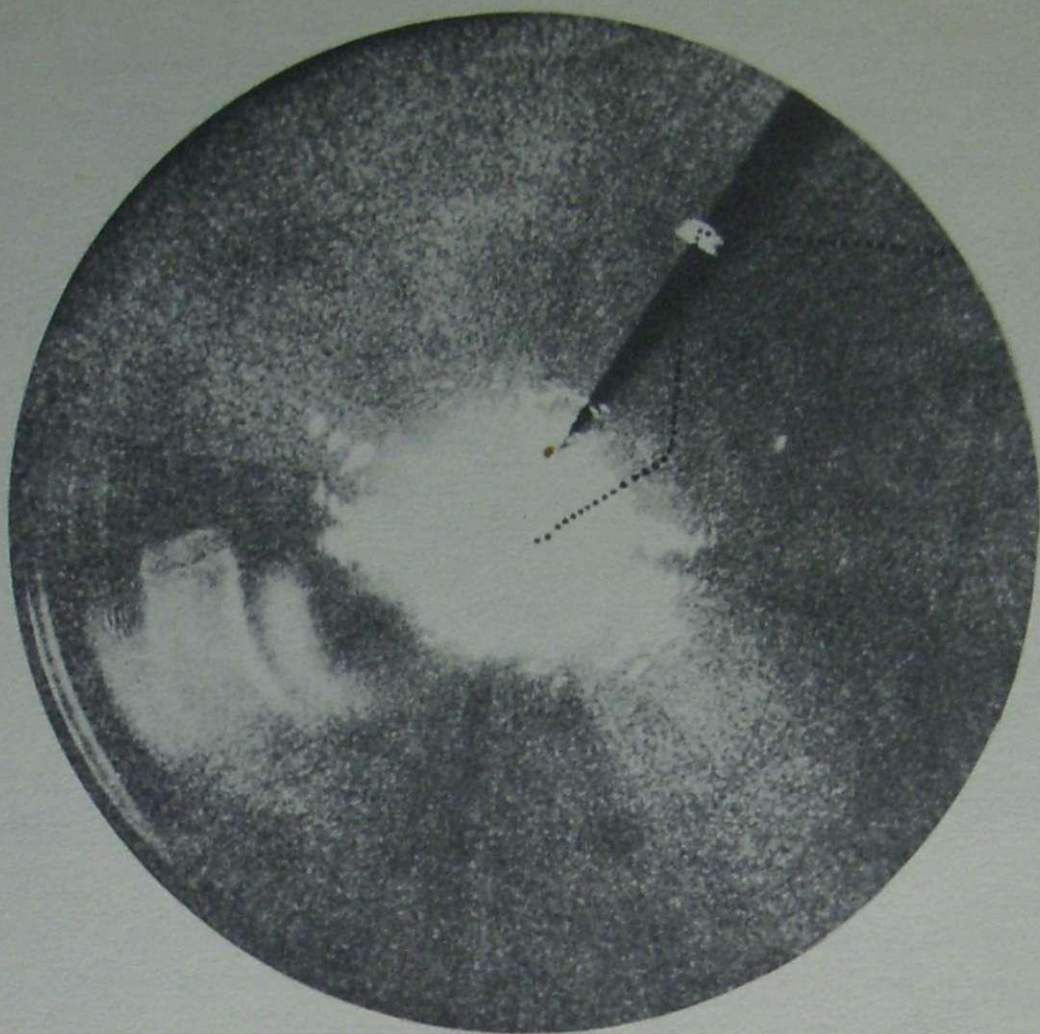


Figure 41b.—Tracking on the PPI scope.

across the scope is speed of relative motion with respect to the ship.

This figure can be fairly accurately obtained by plotting the movement against accurate times and converting to nautical miles per hour. The resulting figure must be adjusted to allow for the effect of ship's motion and the winds aloft. To illustrate: if a ship is on a heading of 180° at 20 knots and there is a 10-knot wind aloft from 360° , it is evident that the speed of relative motion (speed of the blip across the scope) of a plane heading south indicating 200 knots will be less than the speed of relative motion of a plane heading north at the same indicated speed. By using the dot method of tracking, the controller can make rough estimates of the relative speed of two aircraft, or two groups of aircraft but he must consider the relative wind (i. e., ship's motion and wind at altitude) in

can be obtained for the controller by the use of a plot table and computer.

J. RANGE OF COVERAGE

The size of the PPI scope and the range of coverage used have considerable bearing on the amount of information which can be obtained from the scope. A 12-inch scope will give a much clearer picture than a 5-inch or 7-inch scope. The blips are larger and their movement is more pronounced and noticeable. Consequently, a change in heading by a target can be picked up on the larger scope more quickly than on a smaller one.

Further, utilizing the same range scale on a 5-inch scope as on a 12-inch scope, it will be apparent that range resolution is considerably finer on the larger scope. Thus two targets which will merge on the smaller scope will be resolved on the larger one.

plane to within a mile of the target without loss of control on a large scope whereas on a smaller scope this minimum distance may be as much as 3 or 4 miles. The question of what range to use on the scope is decided by the controller in view of the tactical situation. If interception of the enemy is desired at maximum range, a long-range scale will be used on the scope. This will result in less accurate target information but greater range of pick-up.

If accurate close control is desired, a shorter range will be used, but one which will still give an initial pick-up at sufficient range to make an interception before the enemy has closed too near.

K. FADES

Certain defects in the PPI picture are attributed to the fault of radar rather than the type of presentation. Fading is present in all air search radars of the SK type. At certain ranges and at certain altitudes the target blip fades from the scope because the plane passes through a null area in the lobe pattern of the radar. These fades may be of short duration or may extend for several miles.

In centimeter-wave sets, where the concentrated cone of energy is beamed at the target, there theoretically should be no fading; and normally, at angles of elevation above 4° there is no fading in the true sense of the word. Below 4° there is some reflection of energy from the earth and narrow fade zones may appear. It is also possible that lack of information on the scope may be due to the inability of the operator to keep the beam on the target. At extreme ranges the return may fluctuate in strength to such an extent that it fades in and out on the scope.

More modern radars, designed toward the end of the war, and still in service use, have eliminated much of the fading problem. However, this was done at the expense of range.

But controllers can work through fading. If the controller accurately tracks a target blip on his PPI scope and the blip fades, he can continue the track in the same direction and

tion. The greater the controller's skill in tracking, the more accurate this dead reckoning will be.

L. IFF SIGNALS IN TRACKING

Another aid to the tracking is the IFF signal on friendly aircraft which may continue to appear even through the blip has faded. The IFF signal, more accurate in range than in bearing, gives the controller useful information. Therefore, by simply continuing the direction of the friendly track to the range indicated by the IFF signal, an even more accurate position is possible.

M. LOW-FLYING AIRCRAFT

A further weakness in the PPI picture, again the fault of radar itself, is its inability to detect low-flying aircraft. In this respect the centimeter sets are superior in performance to the SK, SC-2 sets. If the controller has available only the latter type set, he must keep the friendly aircraft under his control at an altitude high enough to insure a return on the scope. In some instances the IFF signals can be used to approximate the position of a plane too low to produce a return on the scope.

N. JAMMING

A defect inherent in radar itself is its susceptibility to jamming. This is explained in greater detail in chapter VII of RADONE A.

O. CORRELATION OF PLOTTING AND THE

The controller of aircraft needs a continuous graphic presentation of the total air situation to enable him properly to evaluate all known information and thus decide how best to control his available aircraft. This presentation can either be on a plotting board or, if the screen is not excessively cluttered, on a PPI tube, with increasing use being made of the PPI as the medium through which to control.

In using the plotting board, information received from the various radars is plotted on appropriate symbols, and continuous tracks are kept of both friendly and enemy planes.

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chanics of air plotting; and its relation to control of aircraft is self-evident to the reader of that publication. Therefore for the purposes of the present manual, the principles and techniques of plotting will not be repeated.

Though the PPI whenever available is being used by the controller to control aircraft, the plotting board still has a definite place in the

the controller, whereas the plotting board is visually accessible to everyone in the room. Figure 1 shows how course, speed, altitude and other pertinent information are recorded in plain sight for ready reference. Furthermore, speeds and courses can be determined more accurately on a large plotting board than on a 12-inch PPI scope.

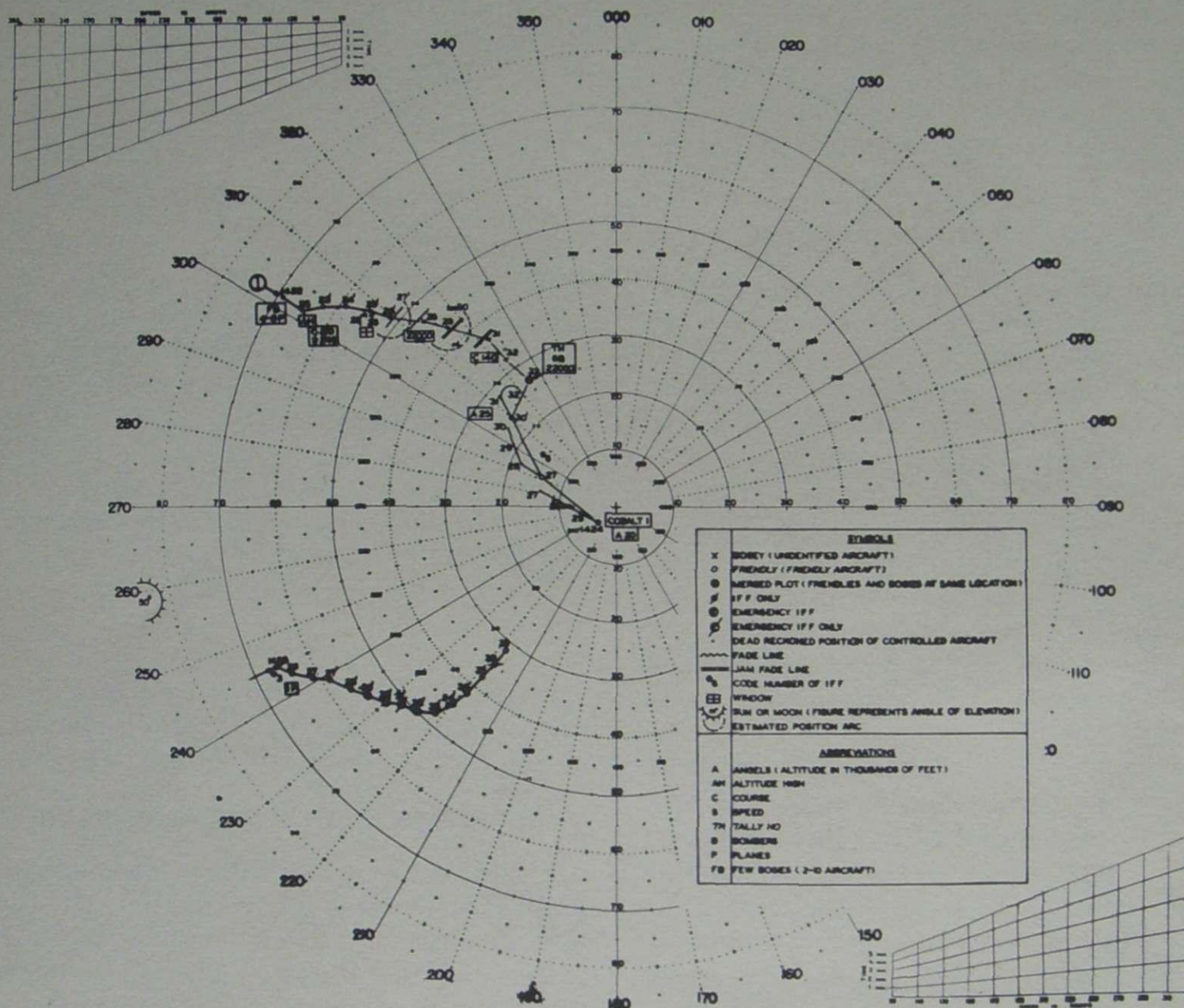


Figure 42.—The air-plot.

control picture. It may assume a secondary role but its importance cannot be minimized in presenting a graphic, current display of air events.

A great deal of information not readily avail-

From an interception standpoint the maintenance of a plot is very necessary even though the actual interception is being controlled by the PPI. The much larger presentation of the plot gives a clearer picture of the relative

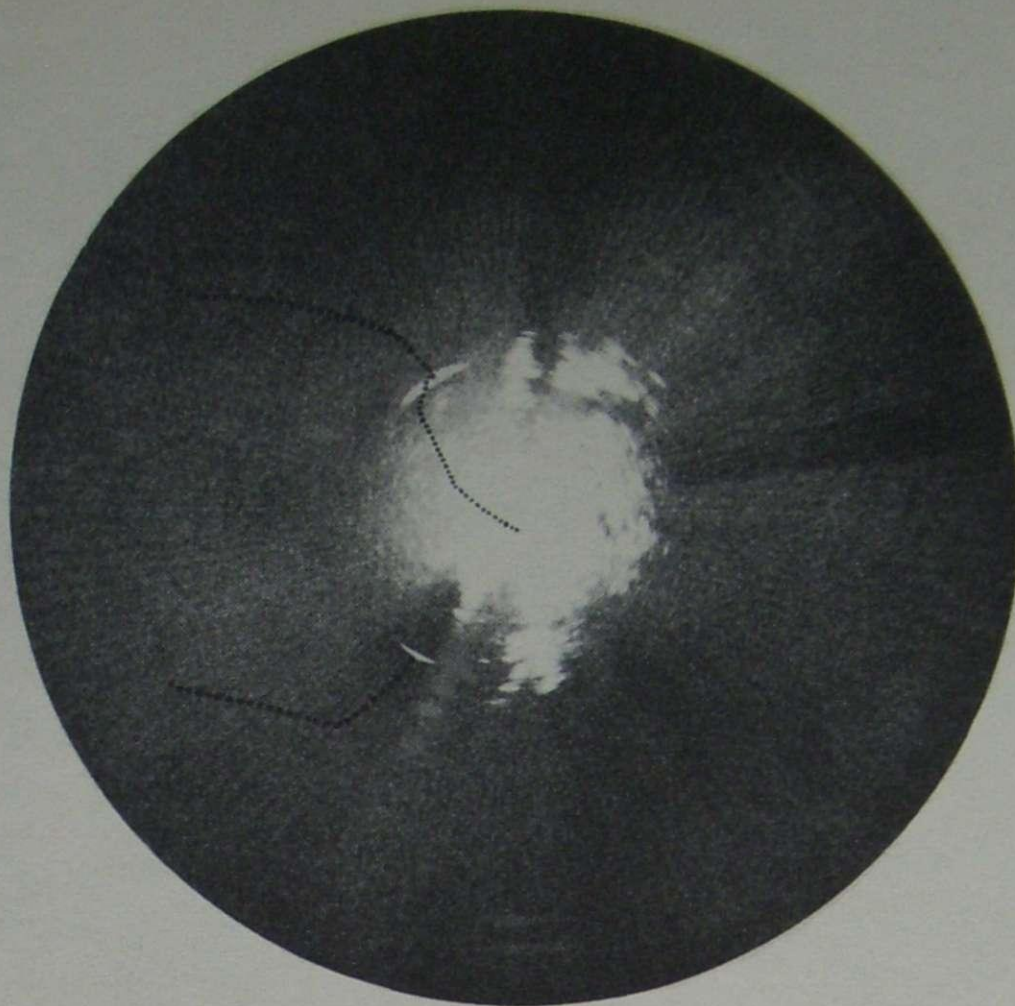


Figure 43.—Human error and time lag is eliminated on PPI plot.

PPI is necessarily restricted to one radar source at a time. Power failure, mechanical defects, jamming, and other radar countermeasures may ruin the PPI picture whereas the plot presents a continuous picture by dead reckoning or from information received from other sources aboard ship or from other ships.

The chief advantage of the PPI over the plot for conducting interceptions is a current, electronic picture which eliminates time lag and the possibility of human error, but the plotting

board still has a vital back-stop function in the control of aircraft.

A relative plot showing the location of several planes is maintained at all times in hunter-killer work. Though the DRT gives the overall picture of the situation, most controllers prefer the plotting board with the PPI for actual control. Its use is covered more fully in the chapter on Hunter-Killer operations (chapter 17).

CHAPTER SEVEN

ALTITUDE DETERMINATION

- A. INTRODUCTION.
- B. RADAR HORIZON.
- C. FADE CHARTS.
- D. USING THE FADE CHART.
- E. CALIBRATION FLIGHTS.
- F. ADVANTAGES OF FADE CHART.
- G. DISADVANTAGES OF FADE CHART.
- H. SM, SP RADARS.
- I. ADVANTAGES OF THE SM AND SP.
- J. DISADVANTAGES OF THE SM AND SP.
- K. THE SX RADAR.



Figure 44.

CHAPTER 7

ALTITUDE DETERMINATION

A. INTRODUCTION

Successful aircraft control is dependent on accurate information in a three-dimensional plane. This is particularly true in aircraft interceptions where the controller officer must have continuous accurate information on the relative position of his own planes with respect to their target. Bearing and range of air contacts are read directly from the radar, but positive determination of altitude is a more difficult problem. If the SM/SP model radar is available, altitude may be read directly within the known limits of variation and accuracy for the specific set. If no such altitude-determining radar is at hand the fade chart and radar horizon methods will serve to provide a reasonably approximate altitude solution.

The fact remains that accurate height reading on target aircraft is one of the hardest problems which a controller faces. Despite improvements in equipment, such as SM/SP

information and knowledge of combat tactics, observation post reports, other aircraft, optical height finders must be utilized to the fullest extent possible.

B. RADAR HORIZON

Radar transmissions are of extremely high frequency and so fall into the category known as line-of-sight propagation. This means that except under special conditions of anomalous propagation, targets below the visual horizon cannot be detected by radar.

An aircraft approaching a radar from below the optical horizon will pass through a critical point at which it enters the field of coverage of the radar. Due to peculiar characteristics of high-frequency transmissions this point is generally at a slightly greater distance than the visual horizon. Because of this an artificial horizon known as the "Radar Horizon" is used to determine the maximum range of detection of an aircraft.

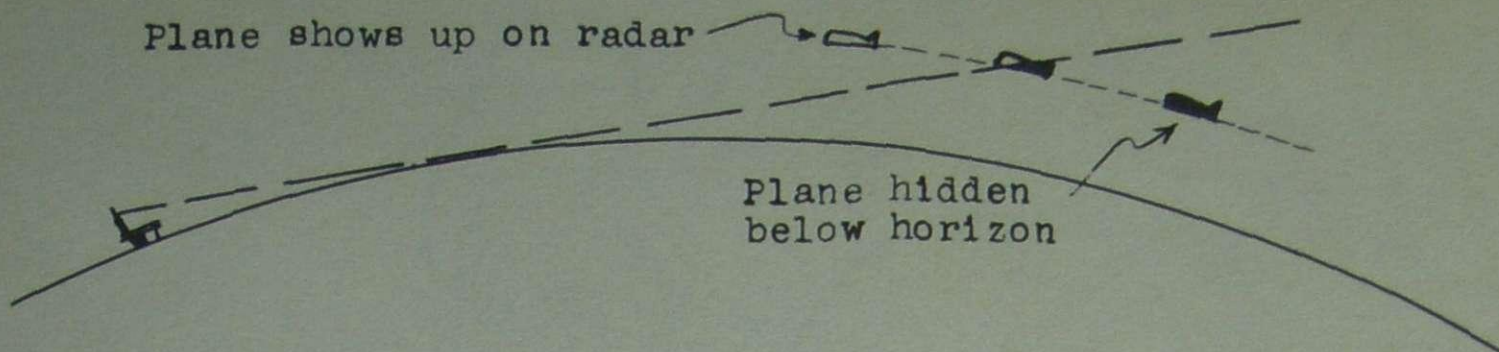


Figure 45.—The radar horizon.

tude of an air target from the range at which it is first detected. When the characteristics of the radar being used are not known, the altitude of a plane may be judged to be not less than $0.86(R)^2$ feet, where R is the maximum range of detection in miles.

In using this method of altitude determination it must be remembered that if the plane changes altitude after appearing on the screen this change will not be evident unless the plane drops below the radar horizon. Furthermore it must be assumed that the radar is sufficiently powerful to detect any plane in its field of coverage.

C. FADE CHARTS

Within the field of coverage of a radar there exist areas where the echo strength from a target will be at a maximum or a minimum. These areas are caused by the energy echo from a target returning along two paths, the direct path and the reflected path. When the waves along both paths arrive at the antenna in phase, they reinforce each other and create a maxi-

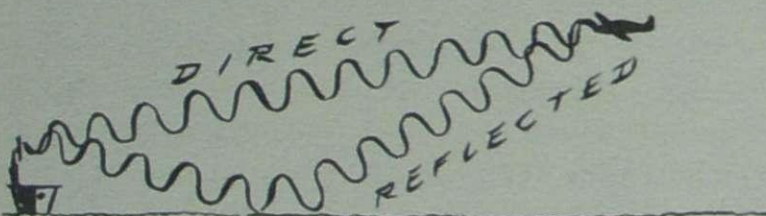


Figure 46.—In phase, strong echo.

mum echo. When the waves arrive 180° out of phase they tend to cancel each other and produce a minimum echo. It has been found

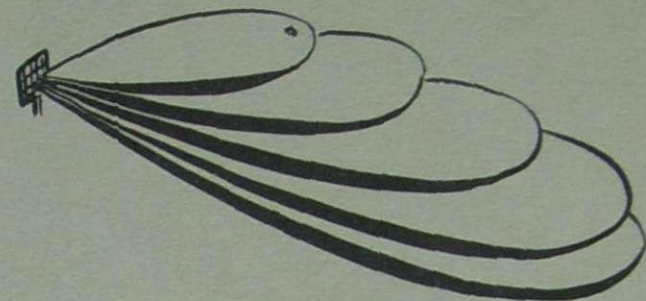


Figure 47.—If it were visible, energy from the antenna would look like this.

A vertical cross section would look like t

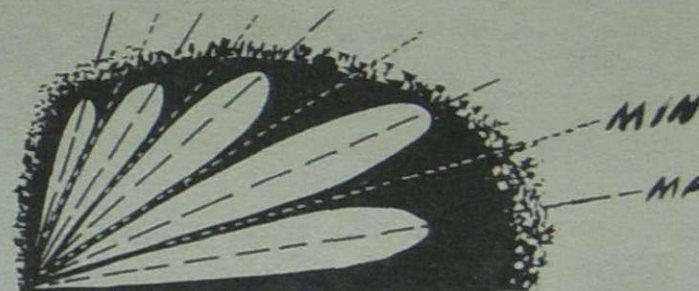


Figure 48.—Vertical cross-section of lobe pattern.

A "fade chart" can be drawn that will locate these areas for any radar of given frequency and antenna height.

D. USING THE FADE CHART

Best results will be obtained by stationing a trained person thoroughly familiar with the chart and the radar at the "A" scope where he can observe the echoes. The echo amplitude should be observed as it varies in range, to determine at what ranges the echo height is a minimum (or in a "fade") and at what range

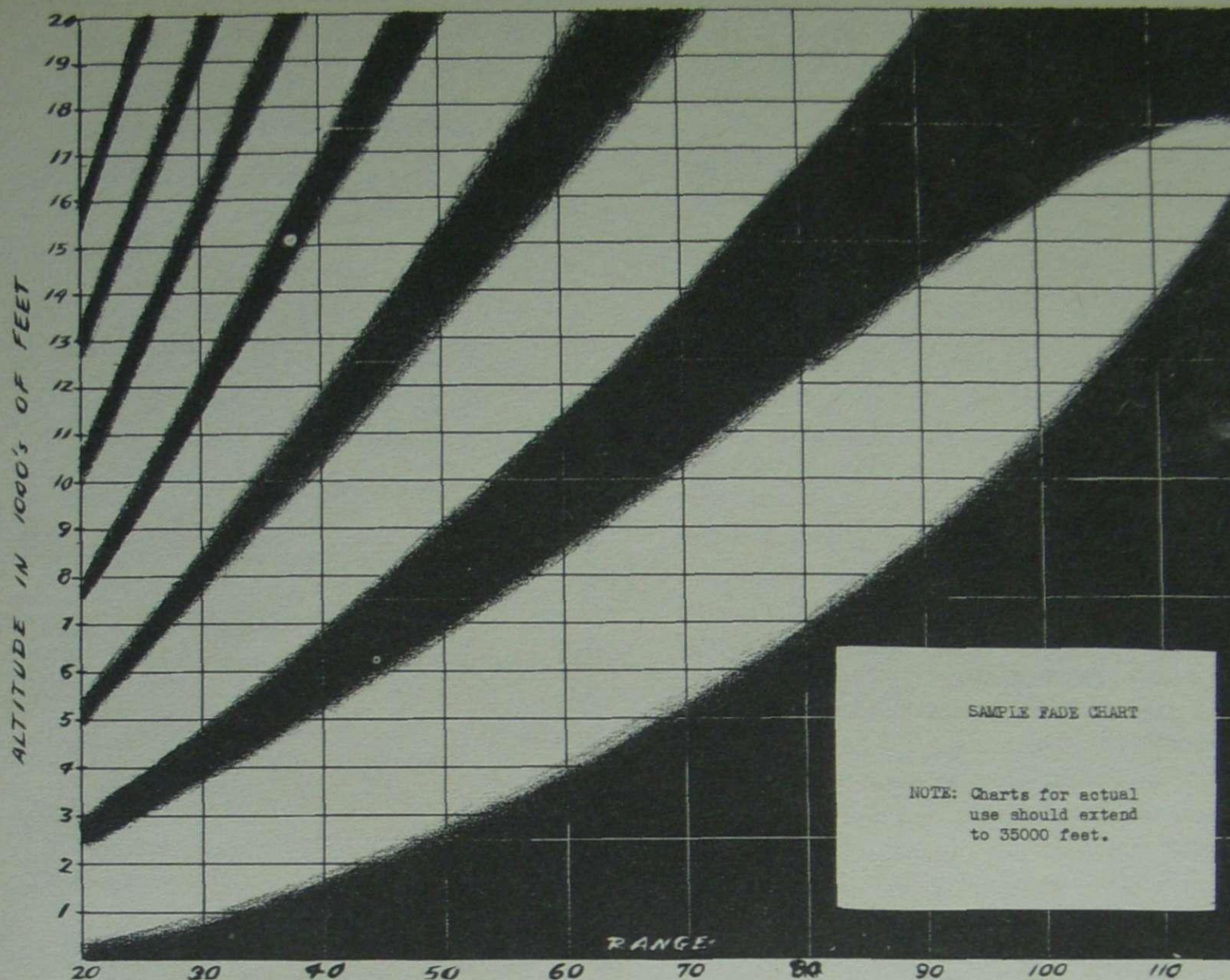


Figure 49.—Sample fade chart.

determined by noting on the "fade" chart the ranges of *successive minima and maxima* which coincide with the observed successive minimum and maximum echo heights. The "pick up" range will yield two or three possible heights. The first minima or maxima will most likely pin the aircraft height to a specific height. The second minima or maxima will establish the aircraft height. At least two ranges (either a successive maximum and minimum or two successive minima or maxima) are needed for an altitude determination, but all further minima (or "fades") and maxima help corroborate the result. Best results are obtained on aircraft in *level flight*. This system requires *time* in

ing radar and can always be used to advantage in supplementing results of those radars (SP, SX). The height data determined by should be correlated with cloud conditions, known enemy tactics in arriving at a decision as to the altitude of the aircraft. Unfavorable atmospheric conditions (weather fronts, different humidity at varying altitudes) can change the position of the radar horizon but will not materially affect the positions of the null lobes. The information within 20 miles of the ship is of little if any value since the lobes and nulls are so close together. At extremely high altitudes (20,000 feet or higher) the echo from an aircraft or group of aircraft is so weak that it is difficult to detect.

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ditions. It also is possible for aircraft to glide down a fade and get in close to the radar set before it is detected. Among the ships of a task force or task group fade areas will vary for the different types of radar and for different antenna heights so that fairly adequate over-all coverage is insured. However, small groups of planes or single planes will often close a task group undetected at high altitude due to the inherent weakness of present air search radars at altitudes above 25,000 feet. Fade charts must be utilized at all times even though altitude determining radars (SP, SM, SX) are available and in use.

E. CALIBRATION FLIGHTS

Calibration flights furnish the best means by which to check the calculated fade chart and to gain accuracy in its use. A single plane, a small group, and a large group should be used at different times to observe the echoes of targets of different size. Depending on the type radar, its range and characteristics, a schedule of altitudes and distances should be made up. Usually flights at 1,000, 5,000, 10,000, 15,000, 20,000, 25,000, and 30,000 feet out to distances slightly beyond the maximum range of detection are desirable. The runs should be made on different relative bearings so as to detect any effects of the ship's structure on the radiation pattern. For best results the planes should fly straight out and straight back toward the radar. This will facilitate tracking them through null areas, and will enable radar operators to anticipate where they will reappear. Remember that IFF will often furnish good ranges when the blip is not visible in a fade.

A good system for recording the results of a flight is to make up a list of ranges with a blank space alongside for noting blip sizes. This should be measured as a ratio of the blip height to the height of the grass, and recorded as E-1, E-2, etc.

Additional sources of information on fades are: (1) Tracking own searches and patrols fly-

chart and afford valuable practice in estimating sizes of targets.

F. ADVANTAGES OF FADE CHART

- (1) It is a fairly accurate system for use with each air search radar.
- (2) It provides some degree of height-finding in the absence of more precise height-finding radars.
- (3) It is of value as a check on the more precise radars.

G. DISADVANTAGES OF FADE CHART

- (1) It requires excessive time before a definite estimate of height can be made on planes in flight; i. e., ambiguities exist on the initial range of detection.
- (2) It doesn't detect changes in altitude quickly. It is only good for aircraft in flight.
- (3) Weather affects the lower edge of the lowest lobe, whereby a possible error may be introduced. Weather conditions, however, do not affect the fades.

H. SP RADARS

This type of radar differs from others in that it has a tiltable antenna and a very narrow beam similar to that of a searchlight. When the antenna is trained on a plane, the altitude can be read directly from a height marker on the set. However, it is possible to supplement this source of information with an elevation angle altitude chart. When on target the elevation angle at which the antenna is tilted can be read from the radar, as well as the range. The elevation angle which is measured from a horizontal plane is the elevation or position angle.

Knowing it and the range, altitude can be computed from the formula:

$$\text{Altitude} = \sin \text{Elevation Angle} \times \text{range}$$

This formula, however, is accurate only for ranges of a few miles as it does not take account the earth's curvature.

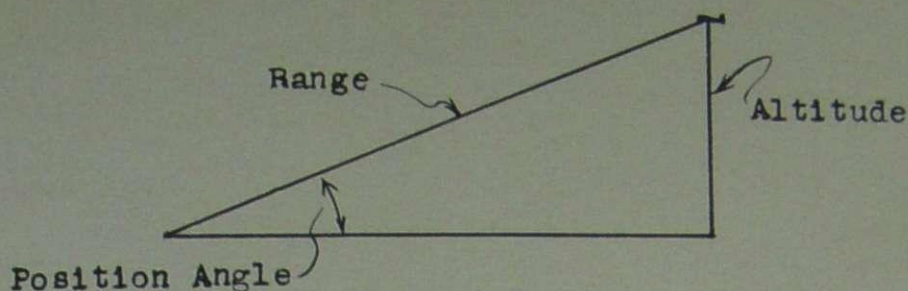


Figure 50.

must be corrected for. The chart to be used in conjunction with the SP radar will give true altitude quickly without lengthy calculations, thereby supplementing meter readings.

I. ADVANTAGES OF THE SP

- (1) They provide reasonably quick and accurate altitude determination.
- (2) They can detect changes in altitude.

J. DISADVANTAGES OF THE SP

- (1) The equipment is heavy and complicated.
- (2) The number of aircraft that can be followed simultaneously is small as the antenna must be stopped on each to obtain the altitude.
- (3) The accuracy of results is largely dependent upon the skill of the radar operator.
- (4) Below an elevation angle of 2° the re-

sults are less accurate due to reflections from the sea.

K. THE SX RADAR

The SX radar, the latest type of altitude determining radar, employs really two radars with their antennas mounted on one antenna pedestal. The search system is similar to other air-search systems except for details as to power, frequency, beam width and pulse repetition. The altitude determining radar is an entirely separate radar, except that its antenna is permanently fixed ninety degrees behind the antenna of the search system. By a mechanical drive, the altitude beam is "rocked" vertically thus giving a vertical scan which can be presented on an RHI scope, enabling us to read elevation in feet directly.

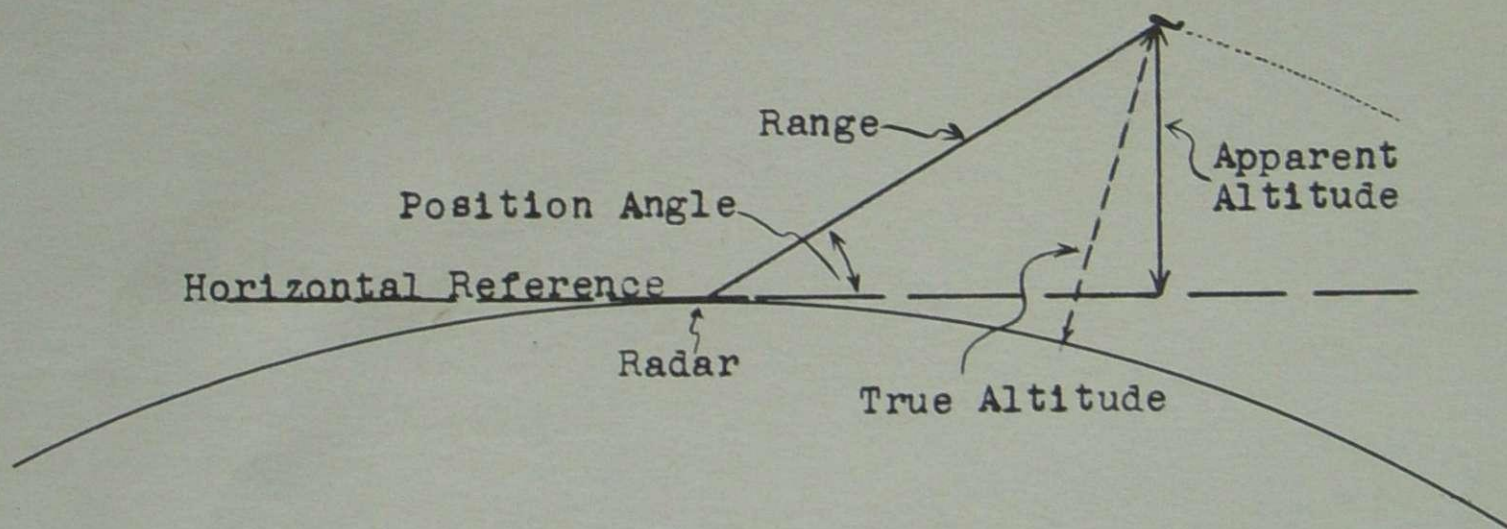


Figure 51.—Apparent vs. true altitude.

CHAPTER EIGHT

IFF AND THE CONTROL OF AIRCRAFT

- A. INTRODUCTION.
- B. USE OF IFF IN THE CONTROL OF AIRCRAFT.
- C. LIMITATIONS OF IFF IN LARGE AIR OPERATIONS.
- D. CONDITIONS OF IFF SILENCE.

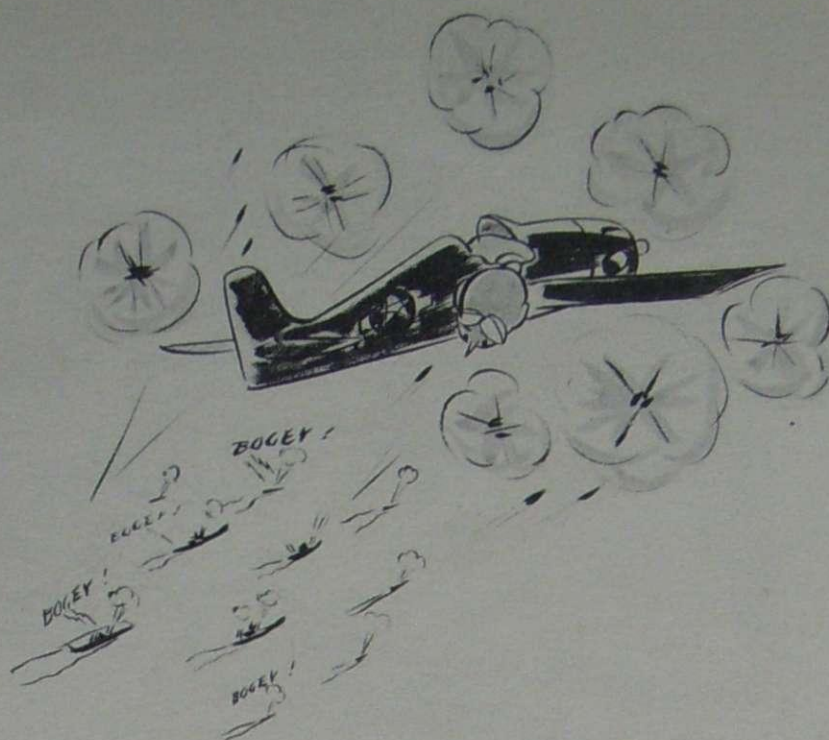


Figure 52.

CHAPTER 8

IFF AND THE CONTROL OF AIRCRAFT

A. INTRODUCTION

IFF is an electronic system installed in ships and aircraft which serves to indicate their friendly nature to other friendly units properly equipped. Its nature is such that identification is possible at great distances and when visual contact is impossible.

The development of IFF began almost as soon as the first radar set was built. Early difficulties were experienced, among them the introduction of new radar equipment using different frequencies, and the persistent demands for greater identification range. These were in part overcome by the successive introduction of IFF Mark I and Mark II. Both of these systems employed a combined receiver-transmitter which was energized by the receipt of a radar signal. The tuning of the set was mechanically swept through the bands of radar frequencies then in use, so that any radar would receive periodic identification signals as the receiver-transmitter passed through the radar

that it has become impractical to produce a single IFF set capable of tuning to all of the frequencies. This difficulty has been overcome by the introduction of a universal frequency band for IFF separate from that of the radar equipment. The first of this type of equipment installed on ships and aircraft is the IFF Mark III which is in use at the present time.

B. USE OF IFF IN CONTROL OF AIRCRAFT

In control of aircraft, IFF provides a method of distinguishing friendly from hostile aircraft as they are detected by radar. This permits appropriate action to be taken when the aircraft are first detected. It allows defensive action to be planned against hostile aircraft. Interference with friendly aircraft can be started immediately and anti-aircraft screens and batteries can be alerted. The chances of enemy aircraft approaching above the radar horizon without being engaged and brought to battle are substantially reduced.

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Consequently, needless alarms and expenditure of effort on the part of other friendly forces can be avoided.

Aircraft which encounter mechanical or other difficulties—lack of fuel, battle damage, weather conditions, or other reasons—can use the system to identify themselves by switching their IFF to the **EMERGENCY** code position.

by assigning different codes to aircraft on various missions (such as one code for CAP, and one for ASP, etc.). However, when dealing with a group of planes showing MK III IFF, it is very difficult to distinguish between codes 1 and 2 or between codes 4, 5, and 6.

Friendly aircraft can be tracked by "IFF ONLY" when aircraft are in radar fade and

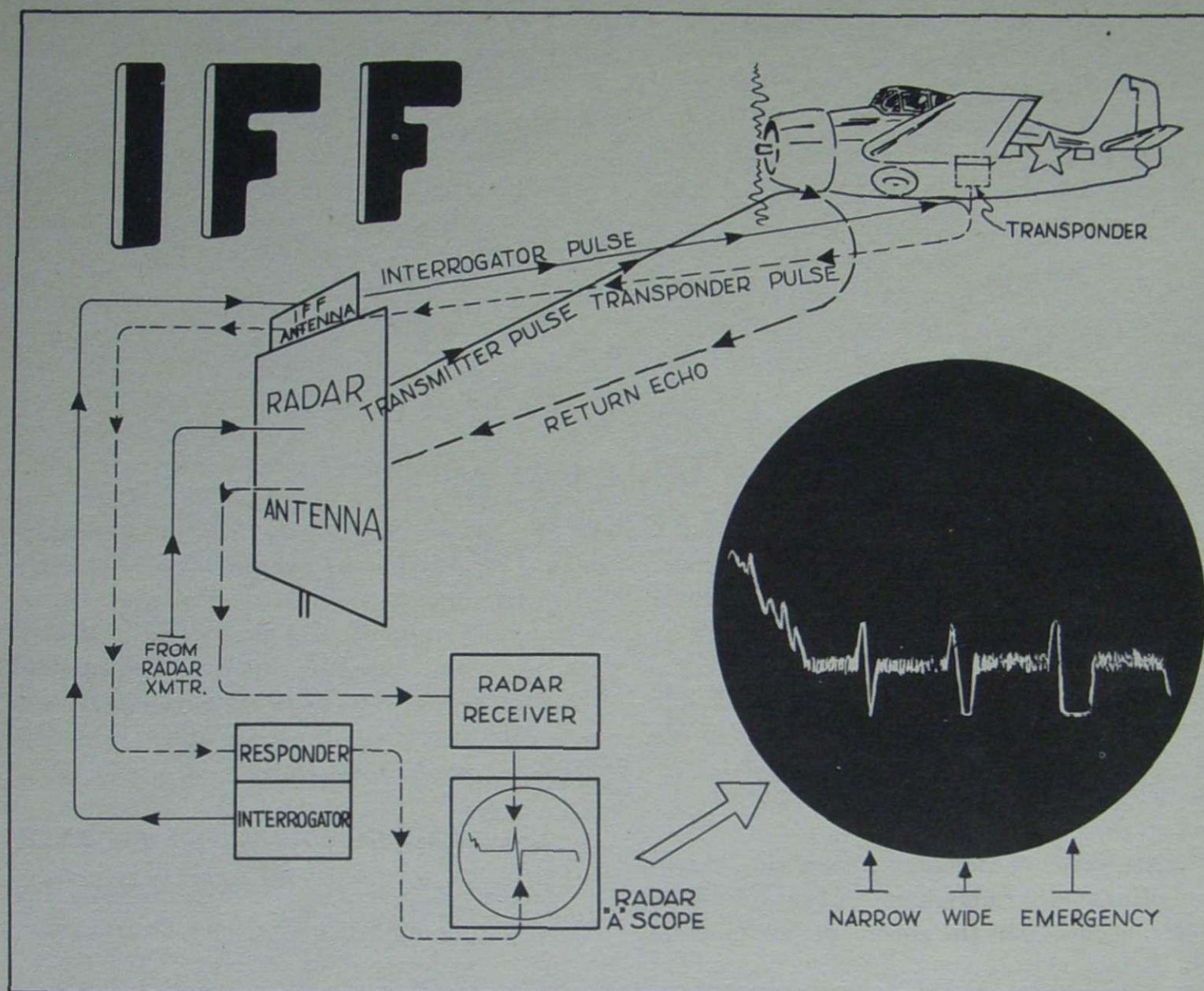


Figure 53.—The Mark III IFF system.

Lost planes are frequently located and homed through use of the **EMERGENCY** signal.

If radio silence is in effect, friendly aircraft, which have a contact or are shadowing enemy surface units or aircraft, can alert CIC by switching to the IFF code prescribed by doc.

If an aircraft is believed to be friendly but does not show IFF for the flagship CIC, the responsibility of the task group CIC is to request confirmation from other ships in the task group or force. The plane in question may be in an IFF fade for the flagship's radar.

dicating the friendly nature of the plane in question.

Information of the search plans for all aircraft in the operating area, approach and return routes of strike aircraft, air transport routes in the area, and information concerning the day to day movements of friendly planes on special missions must be kept up to the minute. Comparison of the track of an unidentified air contact with these prescribed routes may explain some "friendly bogeys." However, it is absolutely imperative that all questionable air contacts be investigated by combat air patrols to insure the safety of the task force or task group. The characteristics of the Mark III IFF system are such that it is subject to many weaknesses, both human and mechanical.

Battle damage to IFF units can be expected and an aircraft suffering this damage can sometimes identify itself by following the prescribed route of approach. If conditions permit, attempt should be made to identify the aircraft by calling it on voice radio and having the pilot identify himself by orbiting or changing course.

Whenever possible an aircraft with faulty IFF should be ordered to join up with other friendly planes which may be in the vicinity. It is also imperative that all aircraft with faulty IFF be relieved immediately and landed as soon as the air operation schedule permits. Whenever a pilot realizes that his IFF equipment is inoperative, he must report his approximate position, course, and speed to all bases in the vicinity.

C. LIMITATIONS OF IFF IN LARGE AIR OPERATIONS

The Mark III IFF system is the primary electronic means of establishing the friendly nature of air and surface targets. Certain limitations in its use, however, must be thoroughly appreciated by all CIC personnel and pilots.

The distinctive coded response of aircraft IFF is readable over a sector in azimuth which corresponds roughly to the width of the transmitted beam. However, it does correspond to

of which has its IFF equipment energized, and both appear to be transmitting the proper signal. The same is true for planes at the same range and bearings but at radically different altitudes.

No positive method for overcoming this condition has been devised. Skilled radar operation may reduce the inherent dangers, but the possibility of enemy planes sneaking in under cover of our friendly planes' IFF signals can never be ignored. This "parasitic" use of IFF exploits the major weakness of the system. It makes mandatory the employment of all methods of identification when many friendly planes are operating in the vicinity, for scopes which are saturated with IFF returns are not conducive to the easy recognition of bogey signals.

D. CONDITIONS OF IFF SILENCE

Conditions of IFF silence have been prescribed in fleet publications for two purposes. The first is to avoid interference caused by excessive functioning of transponders, and the second is to prevent the enemy from employing the IFF signals of our planes to his advantage. The first of these is by far the most important.

In a task group consisting of 8 capital ships and 12 destroyers, there may be as many as 20 interrogators. Many of these will operate on the same, or nearly the same, frequencies. When an interrogator energizes its transponder in a friendly target, the transmitted signal will appear on all other responses of the same frequency as interference. When there are a large number of interrogators operating simultaneously, the interference caused may render it extremely difficult to distinguish a target's IFF. This frequently occurs when the task force is tactically concentrated.

To alleviate this condition, the OTC will put into effect a condition of interrogator silence. This will deny the use of the interrogator to many of the ships and so cause a considerable decrease in transponder transmissions. For instance, a typical condition of interrogator silence might require that only carriers

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frequencies which do not fall into the IFF band. Enemy radars, however, may, and often do operate in our IFF band. When this happens, the transpondors are energized and the IFF signal appears on the enemy radar screen. This may enable the enemy to detect and track our planes beyond the normal range of his radar. Furthermore, it definitely indicates to the enemy the identity of the planes.

To obviate this possibility, it is occasionally desirable to have our planes turn off their IFF when approaching an enemy target. This should be done only in areas where it is certain that the planes will not appear on friendly

radars. When this is done, the necessity of turning the IFF on again when returning to their bases must be stressed to the pilots. The advantages and disadvantages of having friendly planes turn off their IFF's should be carefully weighed before any condition of transponder silence is imposed.

Mark III IFF is compromised and is being superseded by every major power. In the interim period until new equipment is in the Fleet, Mark III IFF is valuable for training. Some identification is possible by the use of codes (in the "A" and "G" bands), but such identification is not positive.

CHAPTER NINE

CONTROL OF AIRCRAFT THROUGH WINDOW AND JAMMING

- A. OBJECTIVE OF JAMMING AND WINDOW.
- B. CONTROL THROUGH JAMMING.
- C. CONTROL THROUGH WINDOW.
- D. LIMITATIONS OF WINDOW.
- E. DEFENSE AGAINST ELECTRONIC JAMMING.
- F. DEFENSE AGAINST WINDOW.

CHAPTER 9

CONTROL OF AIRCRAFT THROUGH WINDOW AND JAMMING

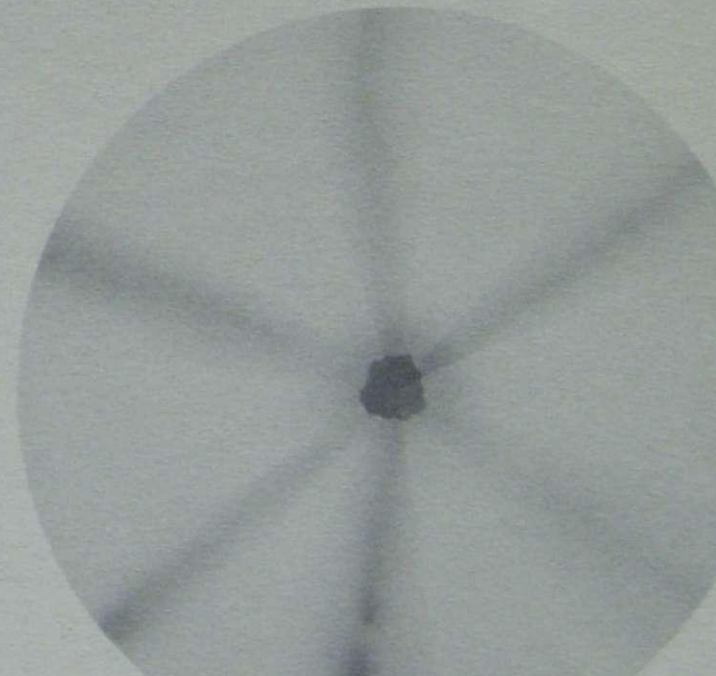
A. OBJECTIVE OF JAMMING AND WINDOW

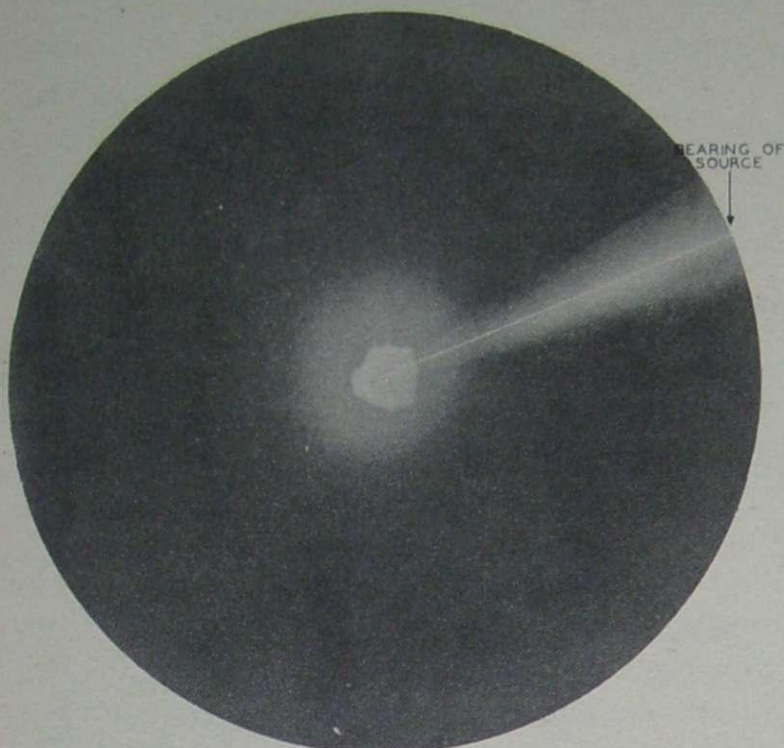
Air control demands accurate and continuous radar information. Enemy countermeasures are one form of action which seeks to deny to us the full measure of radar information which is required for control. The primary objective which an enemy hopes to accomplish when he uses jamming and window is to deprive fleet units of radar information which ordinarily would be available. He may "hide" target echoes by electronic jamming, through the use of window, or he may use other decoys to present falsifying or confusing echo patterns. Whatever action the enemy takes, his purpose is the same—to deprive fleet units of radar information. For more definite information on electronic countermeasures, see RADSEVEN, RADELEVEN, and RADTWELVE.

B. CONTROL THROUGH JAMMING

Electronic jamming will completely block whole sectors of the PPI picture and make impossible to control aircraft in those sectors other than through dead reckoning. The jamming may occur only in a certain sector of the scope representing the direction from which jamming comes, in which case a patrol plane across the path of the jamming may block attempt on the part of the enemy to ride down the block-out path of the force.

If jamming is strong enough, large sectors of the scope may be jammed so that most of the picture is obscured. As electronic jamming affects the PPI much more strongly than it does the "A" type indicator, control in such a case should be continued from the intercept plot board.



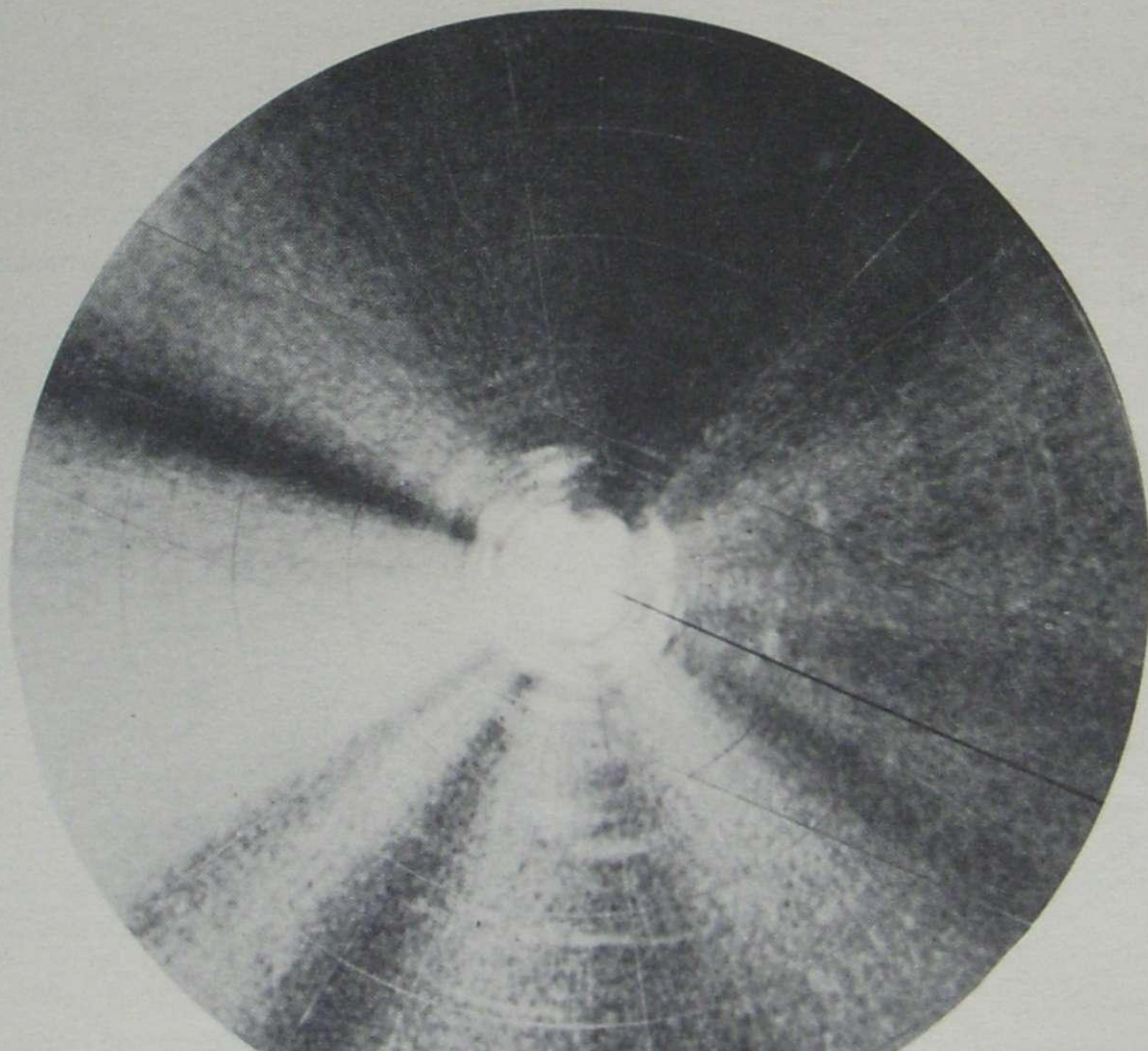


TO GET AN ACCURATE BEARING ON THE JAMMING SOURCE,
BISECT THE JAMMED SECTOR.

Figure 56.—Getting bearing of jammer.

Electronic jamming cannot jam all radar simultaneously, however, and the controller must stand prepared to shift immediately to a radar which is still unaffected. Control may be continued on a jammed radar outside of the "affected" sector if there are targets or contacts which are clear of the interference.

By means of so called "saturation" jamming a window can be used to "hide" a target. This method of deception is relatively simple in execution and is probably the most effective manner in which window can be used. The procedure for execution consists of one or more planes preceding an attack group en route to target and each of the preceding planes sowing or "sowing" window throughout an area through which the attack group will pass. Usually the window-sowing planes will spread out over a relatively broad front to form a wide lane through which the attack group can fly.



C. CONTROL THROUGH WINDOW

Window consists of strips or ropes of metalized paper dropped from a plane to simulate air and surface target echoes. This type of deception usually is employed by aircraft at extreme ranges to confuse the control picture.

Window will affect radars in widely spaced frequency bands to a greater or less degree. Its strongest effects will be evident on radars whose frequencies are closest to the wavelength of the window.

Where the window is spotted rather than sown wholesale, it produces only small areas in which the information is blanketed. Where the window has been sown in sufficient quantities, it effectively blankets the area and renders extremely difficult any degree of accuracy in controlling in that area.

Window may be used to cloak an incoming raid or to divert attention from a raid pressing in from another sector. When window appears on the scope, the controller must be alert to analyze the situation and prepare himself for any type of attack. What was the indicated size of the target before the window appeared? Are there any other indications outside the window? Are there other unidentified blips appearing in any other sector?

If the controller vectors planes to intercept a closing path of window, he can try for the closest blip as the probable source of much of the window, but once his planes enter the window area it becomes extremely difficult to track them by radar.

The night controller tries to bring his planes in just astern of the lead blip and try for contact on the window dropping plane.

If only scattered drops are made, the fighter director by avoiding these areas can retain control of his fighters. As the window begins to fade, it is possible to read a strong return through the lighter mass.

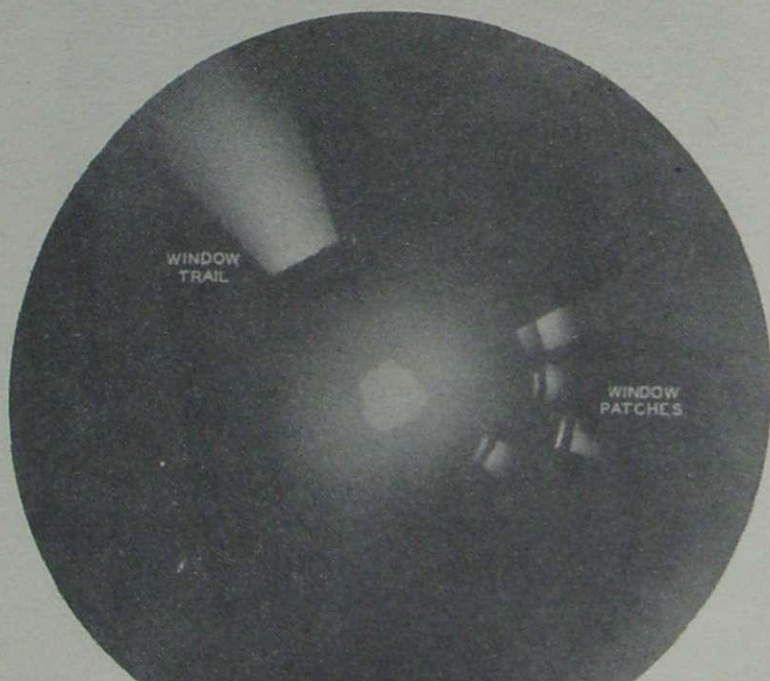
D. LIMITATIONS OF WINDOW

Window can only present an echo at the specific range and bearing at which the window is dropped, unlike electronic jamming which interferes with radar reception over the whole range of a radar on a specific bearing. Window is *not* a radar smoke screen. In order for targets to be "hidden" by window, they must be in the immediate vicinity of the window.

Window cannot indefinitely "hide" a target because the window will fall below and out of the radar beam or may be dispersed by the wind. It is most effective about 3 to 5 minutes after it is dropped. From then on the effectiveness decreases because the window strips drop and disperse, causing a less intense echo.

Window cannot easily "hide" a target from radar with a narrow beam and short pulse duration (i. e. SM, SP, or SX). The amount of window necessary to form a cloud with which to "hide" targets is inversely proportional to the beam width and pulse duration of the radar used. It follows that a large amount of window must be used to "hide" a target from radars such as the SM and SP. It is often impractical for an attacking force to carry enough window to do a good job in this case.

Even though window can cause echoes on radars over a fairly wide range of frequencies it cannot be effective against two radars on radically different frequencies. For example, w



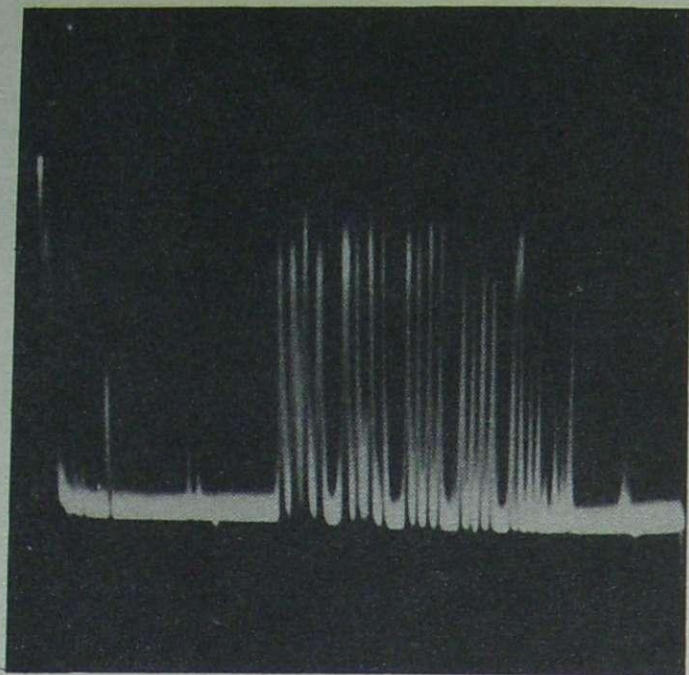


Figure 59.—Packages too far apart.



Figure 61.—Long trails of window on PPI.

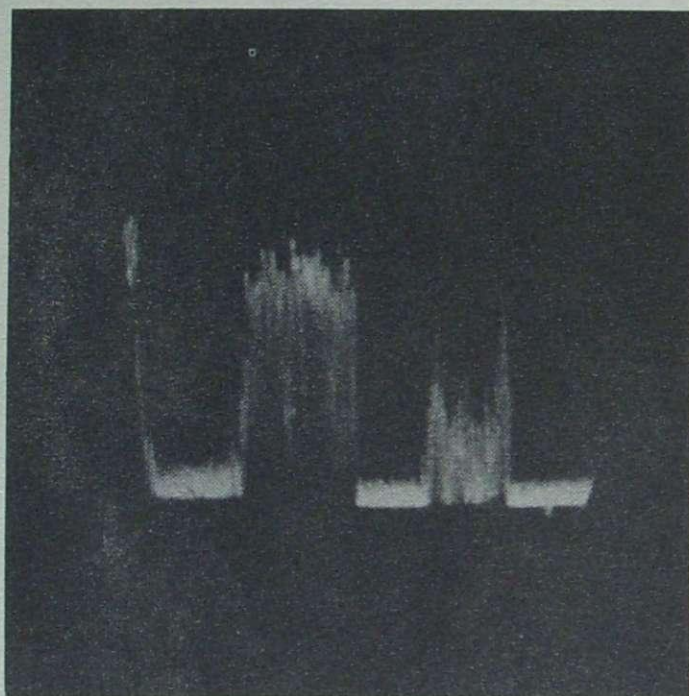


Figure 60.—Packages spaced right.



Figure 62.—Dense window clouds on PPI.

"WINDOW" on the radar screen used deceptively.



Figure 63.—Arrows point to "WINDOW" areas.



Figure 65.—"WINDOW" areas starting to fade.

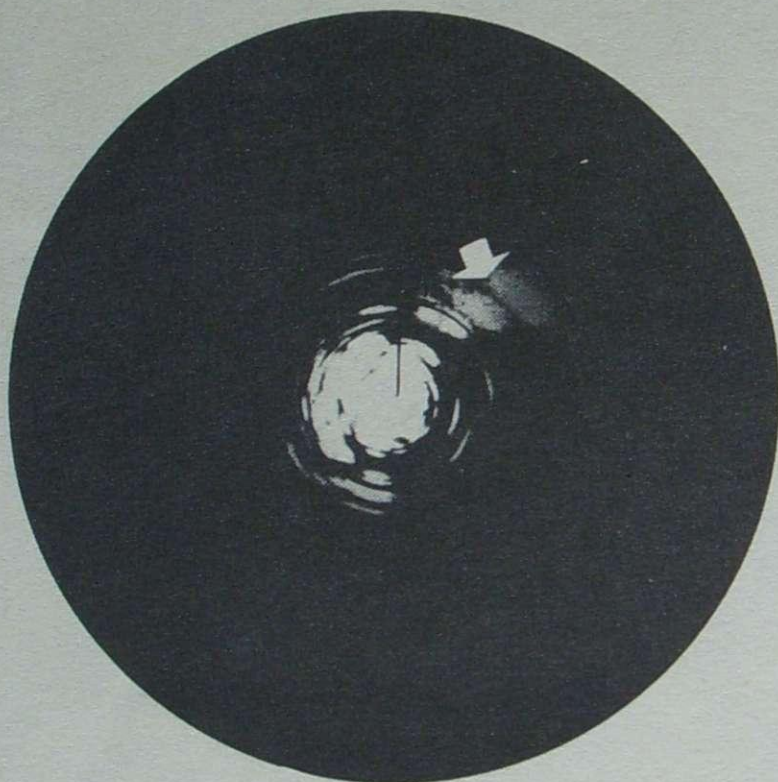


Figure 64.—"WINDOW" areas starting to fade.

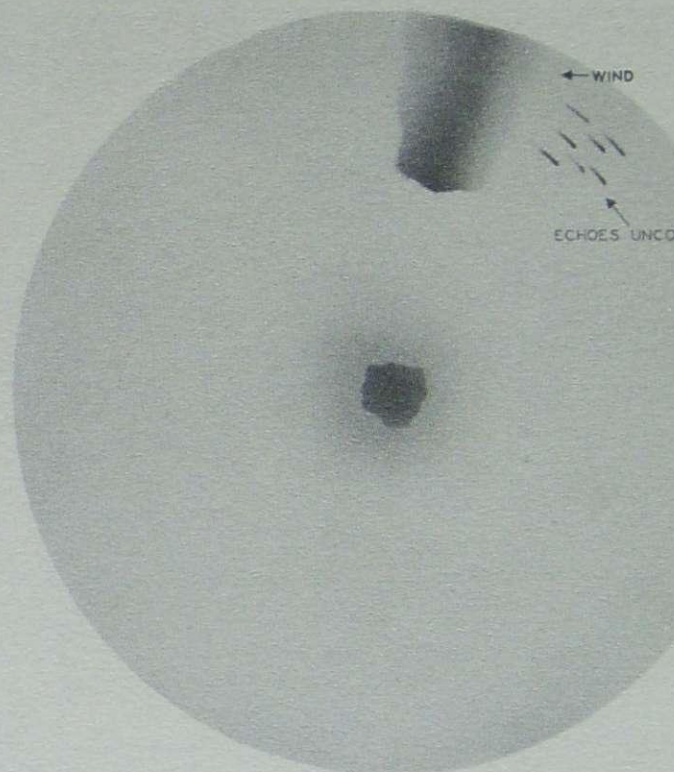


Figure 66.—"WINDOW" has been blown away by wind.

When window is used to simulate target echoes, it has one important limitation. Window cannot accurately simulate a moving target because it lacks motion of its own except as it may be blown by wind.

E. DEFENSE AGAINST ELECTRONIC JAMMING

The best defense against a jamming attack is trained and experienced personnel. There are several methods by which CIC officers can combat jamming. If they are thoroughly familiar with available means with which to combat jamming, it may be possible to get good radar information in spite of the jamming.

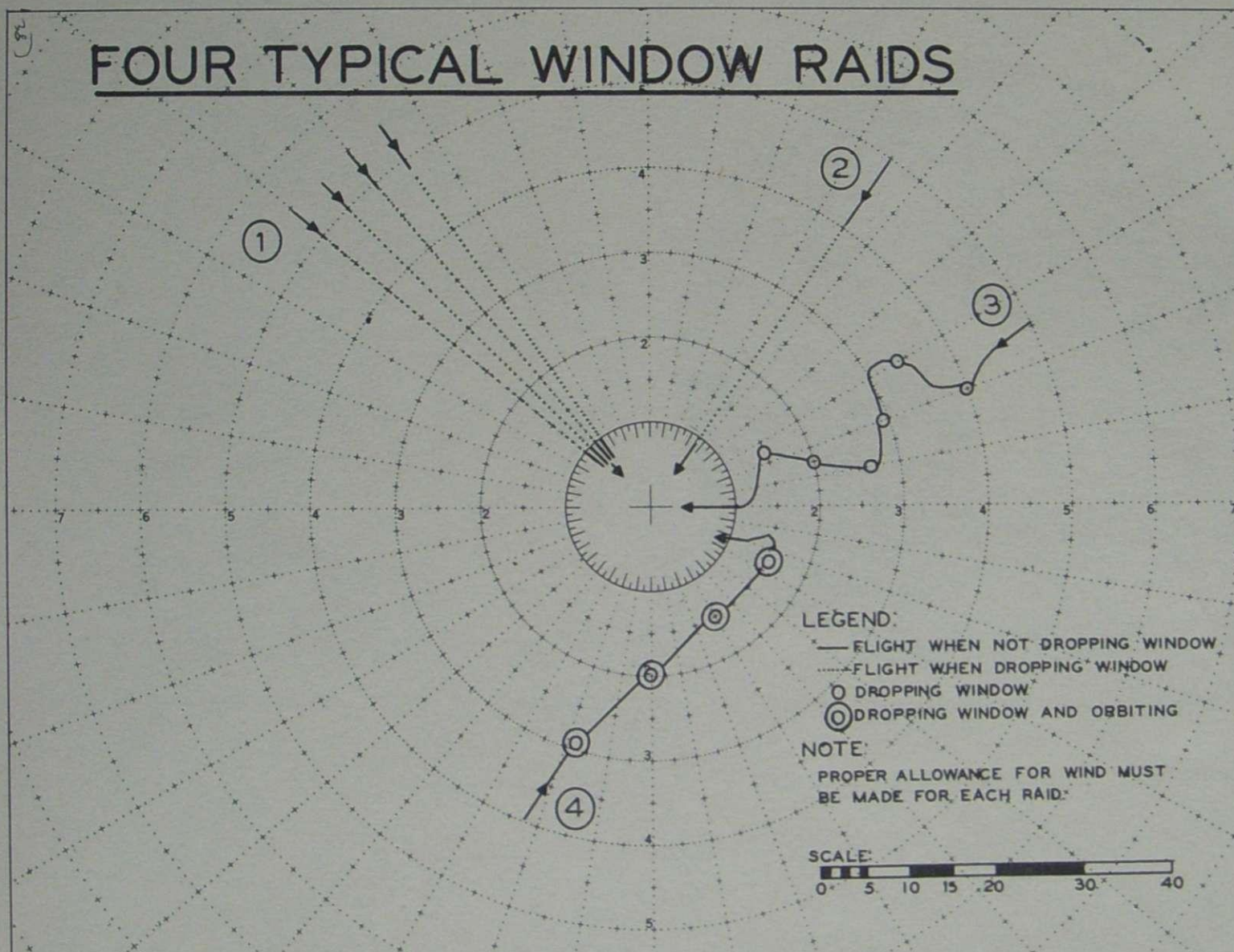
Some ways the CIC officer can combat jamming are given below:

1. When one radar is jammed, *turn on a radar*

of different frequency. The enemy jammer which jams the one frequency will not jam other; therefore, information can be obtained from the latter radar.

2. *Keep in operation the jammed radar.* jammed radar usually is jammed in only one sector. Keep the antenna sweeping always watching for an attack from another bearing. Keep a close watch on the jammed sector as they approach. Also there is a tendency of enemy jammers to drift off frequency, and when the jammer is off frequency information can be obtained. There is the factor that the enemy may not realize he is effectively jamming a radar if it is continued in operation. *Don't turn it off.*

FOUR TYPICAL WINDOW RAIDS



3. Use IFF to track friendly planes through jamming. By using IFF responses accurate information on friendly planes might be obtained through jamming.

4. Change of gain might assist in tracking through window.

F. DEFENSE AGAINST WINDOW

It is just as important for COC personnel to be able to combat window as electronic jamming. Several points for controllers to consider when subjected to window attacks are given below:

1. *Intercept window dropping planes.* The window dropping planes themselves are not "hidden" by their own window so interception of them is a routine job. The important reason for intercepting the window dropping planes is that their window may be intended to "hide" other planes. An important tactical maneuver for controllers to remember is to keep their own fighters out of window insofar as possible. Even though they can be tracked through window by using IFF responses, it is difficult to control them accurately.

2. If a target is "hidden" from one radar by a window cloud, train another radar of a radically different frequency on it. The window will probably affect all radars but it will not be equally effective on the different frequency radars.

3. *Watch for feints.* There are three basic types of feints which an enemy may use with window: (a) *Off-bearing:* In this case a small group of window dropping planes close and simulate a large attack while the main attack group closes from a different bearing and usually at a low level.

(b) *On bearing at different altitudes:* In this case a small group of planes closes at high altitude dropping window, and on the same bearing a large attack group closes at low altitude. The

objective of this attack is to cause interception of high level feint groups while the main attack group closes at low altitude unmolested. This type of attack is very effective when early warning radars are available. It can be countered by using height finding radars and a narrow vertical beam.

(c) *Rendezvous simulations:* In this case a small group of planes or single plane simulates the formation of a large attack group by opening and dropping window.



Figure 68.

CHAPTER TEN

TYPES OF AIRCRAFT PATROLS

- A. TYPES OF PATROLS CURRENTLY IN USE.
- B. CONTROL.
- C. THE DAY COMBAT AIR PATROL (DCAP).
- D. THE DAWN OR DUSK CAP (DADCAP).
- E. THE NIGHT CAP (NCAP).
- F. RESCUE CAP (SUBCAP) (BIRDCAP).
- G. RADAR PICKET CAP (RAPCAP).
- H. TARGET COMBAT AIR PATROL (TARCAP).
- I. ANTISUBMARINE PATROLS (ASP).
- J. AIR STRIKES AND SWEEPS.
- K. BLANKET ATTACK OPERATIONS (BLANKET).
- L. ANTISNOOPER ANTISUBMARINE PATROLS (SNASP).
- M. LONG RANGE AIR SEARCHES DAY (DRECCO).
- N. NIGHT INTRUDER UNIT (INTRUDERS).
- O. NIGHT HECKLERS (HECKLERS).
- P. PHOTO MISSION (GRAPHIC).
- Q. PHOTO MAPPING MISSION (MAPHO).
- R. BARRIER CAP (BARCAP).



Figure 69.

CHAPTER 10

TYPES OF AIRCRAFT PATROLS

A. TYPES OF CONTROL CURRENTLY IN USE

Aircraft are used offensively, defensively and on noncombatant tactical missions. "Patrols" as used here, refers to any flight, regardless of its mission.

This section outlines the standard offensive and defensive patrols in use today in carrier warfare. New patrols are frequently devised to meet new situations which arise. As naval tactics change, some of the established patrols may become obsolete and be discontinued. Definitions and abbreviations for the various patrols currently employed in the fleet are set out below:

1. Day CAP (DCAP)—Fighters launched for combat air patrol during daylight.
2. Dawn or Dusk CAP (DADCAP)—Night fighters launched at dusk or dawn.
3. Night CAP (NCAP)—Night fighters launched for combat air patrol duty during darkness.

5. Rescue CAP (SUBCAP)—Fighters launched to assist and protect rescue submarine operations.

5A. (BIRDCAP)—Fighters used to protect aircraft employed on rescue missions.

6. Air strikes and sweeps—Powerful offensive missions made up of VF and VA in various combinations designed to destroy the enemy's offensive and defensive strength.

7. Blanket Attack Operation (BANKET)—An offensive operation designed to neutralize enemy airfields and installations.

8. Target Combat Air Patrol (TARCAP)—A combat air patrol similar in composition to the DCAP, designed to protect friendly forces in the objective or target area.

9. Radar Picket CAP (RAPCAP)—Fighters launched as combat air patrol for detection radar pickets or Tomcats.

10. Scouting Line CAP (SCOCAP)—VFNs stationed over a surface scouting line.

side a surface formation to detect and destroy low-flying enemy aircraft.

12. **Antisub Patrol (ASP)**—A patrol flown by patrol units of varied composition to detect and destroy submarines and low-flying enemy snoopers. Also known as SNASP.

13. **Long Range Air Searches Day (DRECCO)**—Long-range day search units, comprised of various combinations of aircraft.

14. **Long Range Air Searches Night (NRECCO)**—Long-range night search unit comprising two planes, one VF (N) and one VT (N) operating as a section and covering an assigned sector.

15. **Night Intruder Unit (INTRUDERS)**—A combat air patrol maintained over enemy airfields during darkness.

16. **Night Hecklers (HECKLERS)**—An attack unit of two to four VT (N) or VF (N) whose mission is to neutralize enemy airfields during darkness.

17. **Photo Mission (GRAPHIC)**—A routine photographic mission.

18. **Photo Mapping Mission (MAPHO)**—A photographic mission to obtain special mapping coverage of an area.

19. **Weather Recco (WXRECCO)**—Special weather flights.

20. **Barrier CAP (BARCAP)**—A barrier across the probable direction of approach of enemy aircraft.

The more important of the patrols listed above are discussed in detail in the following paragraphs. More detailed descriptions of all aircraft patrols and missions are set out in Carrier Task Force Tactical Instructions (USF4).

B. CONTROL

The control of all patrols rests with the OTC who is generally a task group or task force commander. Since radio is the principal means of communicating with airborne aircraft, CIC acts as a middleman between OTC and the pilots. Nearly all communications between pilots and OTC pass through CIC.

1. Functions of CIC Officer

maximum amount of air control authority to the CIC officer on his staff. The staff CIC officer in turn delegates responsibility to CIC officers on the individual ships. The most important responsibility of the CIC officer is usually the handling of the CAP in defense of fleet.

2. Change of Mission

Any airborne plane may be diverted from its mission for which it was launched and given a different task when the need arises. For instance, fighters on ASP, strikes or searchers may be, and frequently are, recalled and employed as a CAP for defensive purposes. Bombardment ASP can be formed into a small strike force ordered to attack enemy surface units. Any plane, regardless of type or mission, may be required to orbit survivors in the water and become a part of a search and rescue mission. Ordering pilots to change their missions is done by the CIC officer with express authority of the OTC.

C. DAY COMBAT AIR PATROL (DCA)

1. Purpose

The day combat air patrol, commonly referred to as CAP, is a patrol of fighter aircraft flown primarily for the protection of fleet forces, afloat or ashore, against enemy attack. The CAP may be drawn either from land or a carrier-based squadron(s). CAP task groups generally furnish their own

2. Composition

The four-plane fighter division is the most fundamental combat team. Divisions are further subdivided into two-plane sections. Experience has amply demonstrated that the trained, two-section team of four is the most deadly and efficient fighting unit. Tactical training are based on the concept that a division is the smallest element which should normally be employed for any combat task. Under exceptional circumstances will be permitted officers permit divisions to split up into constituent sections.

It may become necessary for CAP

understood that control of the CAP under such conditions is seriously impaired through the multiplicity of echoes and that successful defense rests to a very great extent on the unassisted efforts of the pilots themselves.

Six to 15 divisions comprise a fighting squadron. Squadrons receive a certain amount of training as a unit, but the bulk of it is aimed to produce efficient combinations of a smaller number of divisions.

3. Assignment of CAP.

The size of the CAP is prescribed by the OTC in his operation order, but it may be modified by him as the situation changes. In the case of a carrier task group the patrol duty for the day may be assigned to a single carrier, or may be divided among several carriers.

4. Control

The CAP is under the control of the task force commander, who normally delegates this authority to the task group commanders. This delegation of authority normally moves from the task force CIC officer to the task group CIC officers. Each task group CIC officer keeps the OTC informed of the position, course, speed, and size of all unidentified targets and of what action is being taken.

When radar has picked up a bogey, it is the responsibility of the task group CIC officer to assign control of a portion of the CAP to a ship's CIC to effect interception.

The OTC may elect to launch additional fighters to augment the CAP in the event of a potentially heavy raid. All the fighters in the force are available in such an eventuality. An arbitrary proportion of the available fighters will be in condition 10, that is, with pilots in their planes, engines warmed up and plane(s) on the catapult(s) when heavy enemy attacks are imminent; or a number equal to the airborne CAP will be maintained in Condition 11, that is, planes with engines warmed up, armed and gassed, spotted for launching and pilots in the ready room standing by. It usually requires

condition 10 are all that is necessary to defend the force, the high speed of aircraft and the rapidity with which an attack may develop makes airborne patrol mandatory.

It is desirable that the CIC of the carrier whose planes are on patrol control the interception. When this is not practicable, the OTC having the best information on the raid is given the job. Occasionally control may be shifted during the course of an interception, particularly when another ship has more complete information than the controlling ship. Frequently a CIC officer on a picket ship will be the logical controller, especially against a low flying attack which his ship has been the first to detect.

In the case of long-range interceptions it is sometimes advantageous to shift control from one task group to another. In this connection when several task groups are tactically concentrated, the over-all defense of the force is coordinated by the task force CIC officer who may assign certain sectors of basic responsibility to each task group comprising the force.

5. Launching and rendezvous

The CAP is launched by the carrier having the duty in sufficient time to relieve on station. The first day CAP is generally launched at dawn (one-half hour before sunrise).

It must be remembered that planes flying independently prior to rendezvous have very little defensive value. Should it be necessary to commence an interception before the join-up has been effected, the CIC officer should inquire if any individual divisions are joined up and control such a division. In cases of extreme emergency planes may join up at random to form an improvised division and operate together as such.

The CAP after launching should rendezvous as quickly as possible, reporting to CIC when joined up.

"Mohawk, this is Mohawk One—Rendezvous. Over."

"This is Mohawk—Roger. Out."

Generally in the briefing of the pilots the

"Mohawk, this is Mohawk One—Rendezvoused. Request instructions. Over."

"This is Mohawk—Orbit base—Angels Ten. Over."

"This is Mohawk One—Wilco. Orbit base. Angels Ten. Out."

Often the CIC officer will wish to join up two divisions of the CAP which are at different altitudes.

"Mohawk Three, this is Mohawk. Join on Mohawk One at Angels Ten. Over."

"This is Mohawk Three—Wilco. Join on Mohawk One at Angels Ten. Out."

Experience dictates that when divisions are to be joined up for a patrol it can be done more expeditiously if they make their rendezvous in their assigned rendezvous sector prior to proceeding to station.

6. Detaching Division of CAP

If two or more divisions are in one flight and it is desired to send one or more divisions on a mission, while the remaining divisions stay on station, the separation will be achieved in the following manner:

MOHAWK 1, 2, and 3 are joined up orbiting base at Angels 10. It is desired to send MOHAWK 1 and 2 intercept a bogie and have MOHAWK 3 remain on station.

"MOHAWK 1 this is MOHAWK—Vector 090—Buster—Angels 10—MOHAWK 3 Detach and Resume—Over."

"This is MOHAWK 1—Wilco—Vector 090—Buster—Angels 10—Out."

"This is MOHAWK 3—Wilco—Detach and Resume—Out."

7. Stationing

The CAP is flown in the immediate vicinity of the force it is covering, the usual station being directly overhead. When there are indications that attack is probable from a certain direction, all or part of the CAP may be stationed on this bearing generally within sight contact of the group, but always in radio and radar range.

Altitude of the CAP is a very critical factor

tionate to the altitude of the target, group high-flying planes will be detected at a considerable distance, and during an intercept the altitude of the CAP can be adjusted as necessary.

It might appear that the ideal CAP altitude would be the ceiling of the aircraft being employed, but a very high patrol has definite advantages. Pilots must use oxygen masks above 10,000 feet and low temperature are countered at higher altitudes. These factors cause a marked decrease in alertness and combat efficiency. Furthermore, a high CAP makes an excellent target for enemy radars and may indicate to the enemy the position of the task group.

A special situation arises when large masses appear on the radar screen. In this case high-flying attacks may be initially detected at short range, and a high CAP is essential for adequate protection. The CAP at high altitude (20,000 feet or above) is also necessary to combat the tactics of high-flying, high-speed reconnaissance aircraft and suicide planes.

One of the most difficult types of attack to intercept is the low-flying attack which is initially detected at 30 miles or less from the group. These planes are usually 2,000 feet or less above the water and must be countered by a low patrol since it is very difficult to sight a low-flying plane from high altitudes. When the CAP consists of several divisions, at least one division may be kept at a low altitude for this purpose.

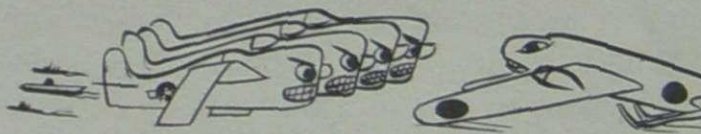


Figure 70.

8. Interceptions

Interceptions are controlled by a controller designated by the CIC officer. He controls the CAP until they report "tallyho." When contact is made, the flight leader takes

that he *must* obtain "splash" and "heads up" information from the CAP.

When the enemy attack is dispersed or destroyed, fighters should immediately rendezvous and request further orders. It is imperative that the previous stations of the combat air patrol be resumed as soon as possible so as to prepare for any subsequent attacks.

After they have rendezvoused, they will report to the controller who will give them further instructions. The CAP should report their "state."

"Mohawk, this is Mohawk One. Fuel 150, Ammo Plus. Over."

"This is Mohawk. Understand Fuel 150, ammo plus. Out."

If the controller has another bogey to intercept, he will give the CAP another vector. If he desires them to return to station, he will so order them, giving them a "steer" to fly to bring them back to base.

"Mohawk One, this is Mohawk. Steer 1-6-0. Over."

9. Other uses

The primary purpose of CAP is defensive—to protect friendly forces from attack, but the CAP may be used for other purposes.

(a) Part of the CAP may be used for a high-speed search when action with the enemy is imminent and his location is not known exactly. This search would be ordered by the OTC who would designate the size of the CAP to be detailed for such a task.

(b) If a plane goes in the water, the low section CAP may be ordered to orbit the position of the downed personnel until the OTC can detail a destroyer or other rescue facility to pick them up.

(c) The low CAP acts as a high surface lookout.

(d) The CAP may act as a radio relay station.

(e) The CAP may be used to investigate surface contacts.

(f) The CAP may be used to obtain weather information.

deems it inadvisable to continue the flight should report the fact to the controller (or may report this to the division leader first then relays it to the controller). The controller will take whatever action is necessary. If it is something that is within his control, he should advise the troubled pilot what to do. If something beyond his scope, he should immediately advise the appropriate officers (Captain, or air officer) and await instructions. If a plane requests permission to make a forced landing, the pilot should state the length of time he can remain airborne so that the controller may be informed and determine whether it is time to respot, turn into the wind, or contact the OTC for instructions.

One plane by itself is an easy target for enemy fighters whereas a division, or section, presents a tight defensive organization. The controller should bear this in mind when he has instructed a plane in trouble to return to base. It is always advisable to have the wingman accompany

11. Pancaking

It is very important to land the CAP on time. If there is any variation from the scheduled landing, the captain of the ship and the task group CIC officer should be informed so that the turn into the wind may be delayed and time out of formation minimized.

In giving landing instructions to the CAP, "Prep Charlie" is used to instruct them to enter the landing circle. They are normally given "Charlie" by blinker, which means the ship is ready to receive them and they can commence their approach. The average duration of a CAP is 2 to 4 hours.

12. Radio check

It is presumed that when the planes leave the deck their radio gear has been checked and is in good operational order. No radio check is made with the CIC until they are airborne and this is usually done when they are rendezvoused and/or on station. The manner of radio checking may vary with task groups or carriers within a group, but its chief purpose

C.A.P. STATIONS

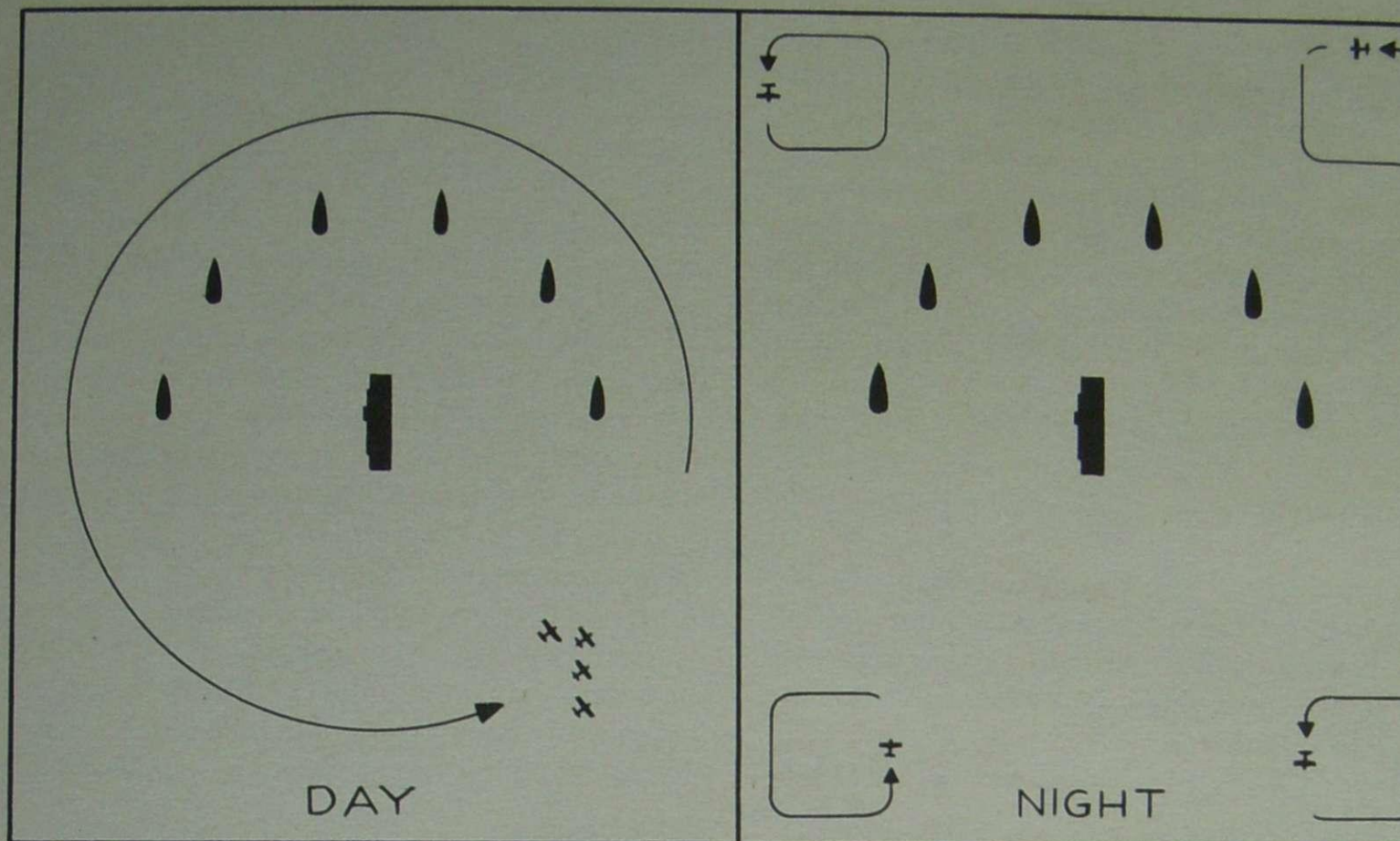


Figure 71.—Day and night CAP stations.

to a minimum so as to leave the channel clear for priority messages.

13. Radio failures

If, in a one-division CAP, the flight leader's radio fails, he should relinquish the command to some other experienced pilot in the flight, generally the second section leader. If the flight leader fails to respond immediately to the controller's order, the wingman calls "Mohawk this is Mohawk 1—2. Mohawk 1—1's radio is out, over" and at the same time he pulls up alongside the leader and hand signals radio failure. The section leader is then designated by the controller to reverse sections and assume the lead. If his radio goes out, the lead will then be given to the next most reliable pilot. The controller will, when necessary, designate a new division leader when the original division leader's radio has failed.

will be reported as often as necessary to the CIC fully informed of the weather conditions aloft.

15. Plane to plane communication

The planes in a division communicate each other by visual methods when practicable thereby avoiding much unnecessary traffic on the radio channels.

D. DAWN AND DUSK COMBAT AIR PATROL (DADCAP)

1. Purpose

The twilight period between daylight and night, either in the morning or the evening, is the time when ships are most vulnerable to attack. There is a short period both at dawn and dusk when the light is such that planes can make effective attacks, en masse, against ships, but the ships and also fighter aircraft have

STATIONING THE C.A.P.

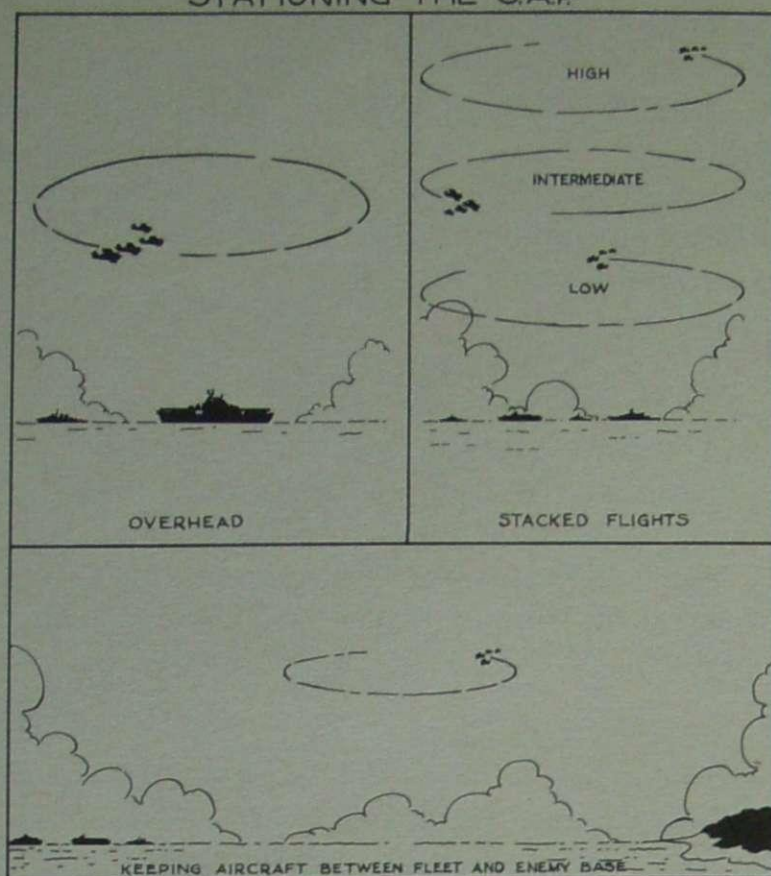


Figure 72.—Stationing the CAP.

in before the carriers are able to launch their day CAP. An effective attack might, in fact, force the ships to take a down-wind course and prevent their launching planes even after dawn.

The DADCAP is used for protection during these periods.

2. Composition

The DADCAP consists of one or more divisions of night fighters.

3. Employment

The DADCAP requires a combination of day and night techniques.

The dawn CAP is launched so as to be on station at least 1 hour before sunrise. They are stationed as a night CAP until conditions of light become such that they may be joined up and used as a day CAP. The first day CAP relieves the dawn CAP on station.

The dusk CAP relieves the last day CAP so that the latter may be landed by sunset. At the appropriate time the dusk CAP is usually

ADJUST CAP STATIONS AS CLOUD COVER CHANGES !

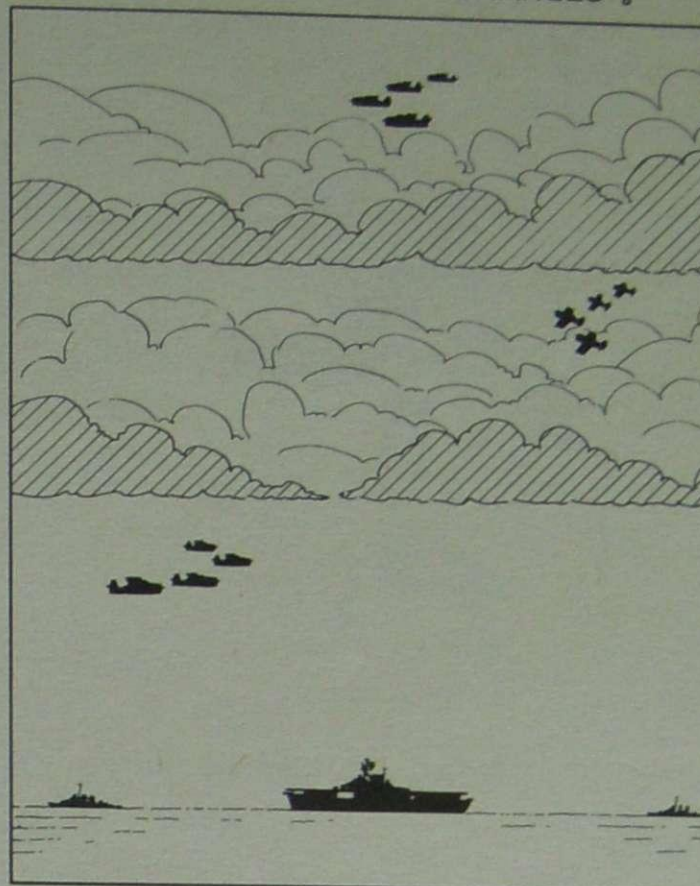


Figure 73.—Clouds and CAP stationing.

CAP the controller must determine the most effective type of control to use as dictated by the visibility. The opinions and suggestions of the pilots are of much value to him in connection.

4. Landing

The dawn CAP is landed by normal procedure, while the dusk CAP must use normal procedure. In ordering the planes to land the signal bridge gives the dawn CAP a "Change"



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by blinker, while the controller must give the dusk CAP a "Charlie" by radio and direct them into the traffic circle using the night fighter carrier controlled approach system.



Figure 75.

E. NIGHT COMBAT AIR PATROL (NCAP)

1. Purpose

The principal function of the night CAP (NCAP) is the protection of friendly forces against enemy air activity during hours of darkness. They may, in addition, be used to make surface searches, bring home lost planes, or to act as a radio relay station. Night fighters are also used to make weather hops through overcasts, and with DCAP'S for cloud interceptions.

2. Composition

The NCAP should be composed of a number of specially designed, radar-equipped fighter planes flown by qualified night pilots. Due to the increased difficulties of control, the size of the NCAP is considerably less than that of the day CAP. Night fighters may be flown in sections, or even divisions, but individual VFN each under positive close control are normally used.

3. Employment

The night CAP may be launched whenever night attacks or snoopers are considered likely.

struction of snoopers or small groups of enemy planes and in breaking up larger raids. Because of poor visibility it is extremely difficult to shoot down all of a large group of attacking planes. Frequently, however, the effectiveness of the attacks can be drastically lessened by destroying one or two key planes which direct the attack.

4. Launching

The NCAP is usually launched by catapult since this method is safer and permits the flight deck to be spotted forward so that the planes can be landed with very little response. It is not necessary for ships in the formation to show any lights while the NCAP is being launched.

5. Control

Prior to take-off the pilots are assigned to their rendezvous station. Immediately after take-off the planes proceed to their assigned stations and maintain rendezvous.

There are several methods used in stationing NCAP. The individual planes may be ordered to fly at widely separated positions; they may be employed as two-plane sections; or an entire formation may be joined up. The orbit point is usually out of gun range of any ships, and is located so as to be visible at all times on the radar screen.

The control of NCAP is flexible. It can be handled by its own CIC, other CIC's in the task group, or control may be passed from group to group or to a qualified destroyer out of picket station.

Technique of interception with the NCAP is discussed at length in the chapter on night interceptions.

6. Landings

The restriction on visibility at night makes it necessary for the night controller to exercise a high degree of control over his NCAP. One of the night controller's most important functions is to bring the planes in to the land, maintaining the carrier controlled approach

reduce the danger of midair collisions, not more than two night fighters should be in the landing circle simultaneously. Generally some or all of the ships of the formation will show truck lights to indicate their position to the planes during night landings. See USF8 and Chapter 20 part II this book.

7. Communications

Good communications with every plane of the night CAP is essential. To insure proper performance VFN are equipped with two complete VHF/UHF sets. Each plane makes a radio check on both while still on deck and again immediately after take-off.

When a plane's radio fails, the plane must be landed as soon as possible. If necessary, another plane should be employed to lead the plane in question into the landing circle.

NCAP's are often used for radio relay purposes and act as a VHF/UHF link between task groups which are not tactically concentrated.

8. Night fighter radar

Night fighters are equipped with a special radar for interception work. The set is designed for detecting aircraft, but the equipment is also valuable to the pilot in making a surface search and in maintaining his proper station.

F. RESCUE SUBMARINE SEAPLANE COMBAT AIR PATROL (SUBCAP) (BIRDCAP)

1. Purpose (SUBCAP)

During air strikes against fixed enemy objectives one or more submarines are customarily assigned the task of rescuing personnel from planes which are forced down in the water near the target. When possible, a CAP is supplied to each submarine for the following purposes:

1. To afford air protection for the submarine.
2. To act as a high lookout and guide the submarine to downed personnel.
3. To act as a radio relay station.
4. To minimize shore fire by strafing, in event of submarine rescue near enemy beach.

3. Employment

The SUBCAP generally is supplied by one of the carriers in the striking task group(s). Its normal station is in the vicinity of the submarine at such an altitude as to obtain the optimum visual surface coverage. On receipt of a downed personnel report, the nearest SUBCAP proceeds to the position indicated and the CAP makes a search of the area. When survivors have been sighted, the CAP leads the submarine to the spot either by visual or radio signals. If it is necessary to attempt a rescue within range of enemy gun fire, the CAP may be required to make continuous attacks on the gun positions until the submarine has effected rescue and is out of danger.

4. Control

En route to and from station, the SUBCAP is under control of the task group CIC. The SUBCAP, like any other team of fighters, may be diverted from its original mission and operate as a normal CAP when necessary. While at station the SUBCAP is under control of the submarine through visual or radio communication. Submarine radar is such, however, that controlling the CAP in making interception is not generally practicable.

5. Communication

Standard VHF/UHF and HF rescue frequencies are designated on which all survival reports are made. All submarines in rescue work are suitably equipped to cover both channels. The SUBCAP must relay messages to the sub, and must keep the OTC informed of the sub's activities. This includes the names and condition of all rescued personnel.

6. Purpose (BIRDCAP)

During rescue operations where seaplanes are employed in the rescue, a cover of fighter aircraft will be furnished. These aircraft will afford protection for rescue aircraft and forward rescue information to the control station.

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8. Employment

The BIRDCAP is generally supplied by one of the carriers in the striking group, and shall accompany rescue aircraft to the scene of rescue and protect both down personnel and rescue aircraft until rescue is completed or until ordered to return to base by the coordinator of search and rescue.

G. RADAR PICKET COMBAT AIR PATROL (RAPCAP)

1. Purpose

The radar picket combat air patrol (RAPCAP) is a CAP assigned to cover a radar picket ship, "Tomcat" or "Watchdog." Its functions are as follows:

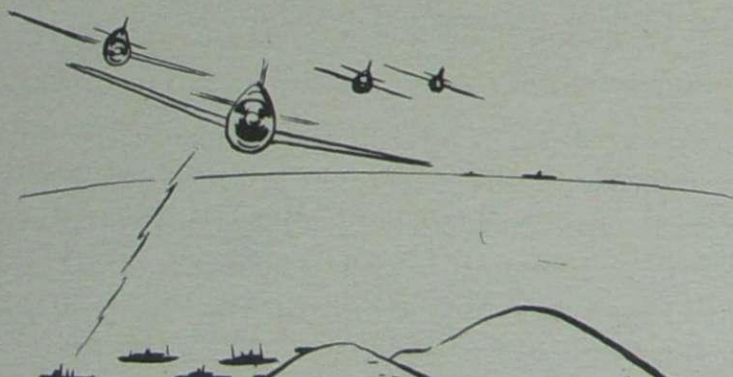
1. The RAPCAP orbits the radar picket or "Tomcat" at an altitude sufficiently high to check returning strike planes as they make their identification orbit around the picket ship. This visual check is designed to detect and eliminate any enemy aircraft which might be trailing groups of returning strike planes.

2. It serves to protect the picket ship from air attack.

3. It is used to investigate and intercept bogey contacts, under control of the picket ship CIC.

2. Composition

The RAPCAP is usually composed of from one to four divisions of fighters, depending on the tactical situation. During the hours of darkness one or two night fighters may be assigned to the control of the picket ship CIC.



3. Employment

The RAPCAP is launched by a carrier group and is under control of the task group commander while en route to and from station.

While on station the picket's CIC takes control and employs the RAPCAP in the manner most appropriate for their task and for their own defense. The planes may also be used as radio relay stations for the pickets.

H. TARGET COMBAT AIR PATROL (TARCAP)

1. Purpose

The target combat air patrol (TARCAP) is a patrol identical in organization with the RAPCAP, which is flown over an enemy objective to prevent attack by friendly forces. Its size depends on the amount of air opposition expected and the number of fighters available. The purpose of the TARCAP is to clear the areas of enemy aircraft which might attempt to disrupt the attack or to counterattack our surface forces.

2. Control

When there is a base, ashore or afloat sufficiently near the objective with the necessary facilities for fighter direction, it may control the TARCAP. Often, however, the pilots must rely on their own vision together with reports from attacking forces in the vicinity.

3. Secondary functions

The TARCAP reports to the OTC the location of any survivors of plane crashes which have not been reported by the strike group. They may also be required to direct rescue parties to the downed personnel. The TARCAP may launch bombs and/or rockets before returning to station or, after being relieved, join in the attack prior to returning to their base.

In the absence of a target coordinator, the TARCAP keeps the OTC informed of the situation at the target. This includes:

- (a) Weather reports. A detailed knowledge of weather over the objective is necessary in determining the most effective type of attack.

most profitable targets without delay. The decision by the OTC to discontinue the attack and withdraw may be partly based on reports from the TARCAP.

4. Duration

It is desirable to have the TARCAP relieved on station, but when the base supplying the patrol is at a considerable distance from the target, this policy necessitates numerous flights. The pilots are informed before take-off of the length of time they are expected to remain on station. They must keep a careful check on their fuel, and must have enough when they arrive at the base to carry them through a short unexpected delay in landing. Thus it is sometimes necessary for the TARCAP to leave station without being properly relieved.

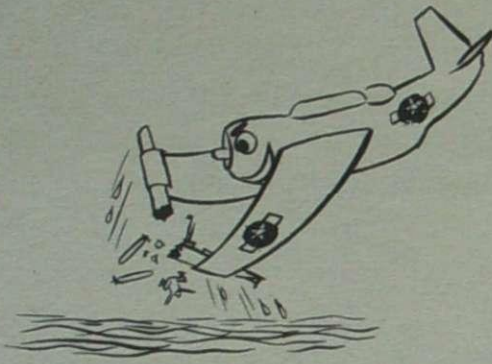


Figure 77.

1. ANTISUBMARINE PATROL (ASP)

1. Purpose

The primary mission of the antisubmarine patrol, or ASP, is the detection and destruction of enemy submarines in the vicinity of friendly ships. The ASP supplements and extends both the visual and radar coverage of the task group. In addition it can effectively attack enemy surface units and can detect and occasionally destroy low-flying enemy aircraft.

2. Composition

ASP is a patrol giving 360° coverage at intermediate ranges and may be flown in equal sectors or its coverage may concentrate in the direction of movement of the task group. The

cover. The sectors are covered by single plane VA armed with depth charges and carry machine guns and sometimes rockets as secondary armament. If insufficient (VF) VA available, fighters may be used, but these are less effective. In some cases fighter aircraft VF, are assigned to the ASP's for augmentation of the VA aircraft patrol and for destruction of low flying aircraft or "snoopers." The altitude of these VF aircraft is slightly below and about 500 feet above the VA.

3. Employment

The ASP is flown concurrently with and usually from the same ship as the CAP. It is under the control of the launching ship although tactical responsibility may be assigned to any ship in the task group. All contacts are immediately reported to the OTC, and he will prescribe the course of action. When an enemy contact has been reported, a part or all of the ASP may be ordered to join in the attack, and sometimes the CAP can be of assistance depending on the nature of the contact. If the contact is a submarine close to the task group, one or two units of the screen may be ordered to work with the ASP and form a hunter/killer team. In the event the screen units and the planes exchange information and the detection gear and hearing armament of the ships are employed to the fullest advantage. The ASP is not usually employed on strike days by the fast carriers.

4. Responsibility of CIC

CIC has the responsibility of knowing the position of each plane on ASP at all times. The normal ASP altitude is approximately 1,000 feet at which height the planes can be continuously tracked by the task group radar. When it becomes necessary for the planes to fly at a lower altitude, due to cloud or sea conditions, CIC keeps an accurate DR plot of the planes not appearing on the screen. When contact is made, the estimated position is given by the pilot, and this is checked by the plot position on the plot. The CIC officer is the

the individual ASP planes. To decrease the resultant confusion, a task force ASP is flown. In this case the planes from one task group may give coverage to the entire force or each group may be assigned a sector to patrol.

5. Coordination with CAP

If the ASP sights a low-flying enemy plane which has escaped radar detection, the pilot will immediately turn on emergency IFF to verify his position. The air controller will then coach CAP to the scene of the contact with the assistance of the ASP pilot.

6. Communications

ASP is assigned a VHF/UHF channel with an HF frequency for secondary use. The individual planes may or may not make radio checks with the base depending on the condition of radio silence in effect and the amount of traffic on the channel. Usually severe restrictions are placed on use of HF, and it is only to be employed in an emergency and when VHF/UHF communications cannot be established. CAP can be quickly shifted to ASP frequency when close coordination between the patrols is required.

7. Radar

VA type aircraft carry search radar which increases the effectiveness of their search, especially in low visibility. In addition, the radar serves as an aid to navigation and helps the pilot to stay in his assigned sector.

8. Launching and landing

ASP planes are relieved on station which means the relieving plane must be in the proper sector, but need not necessarily make visual con-

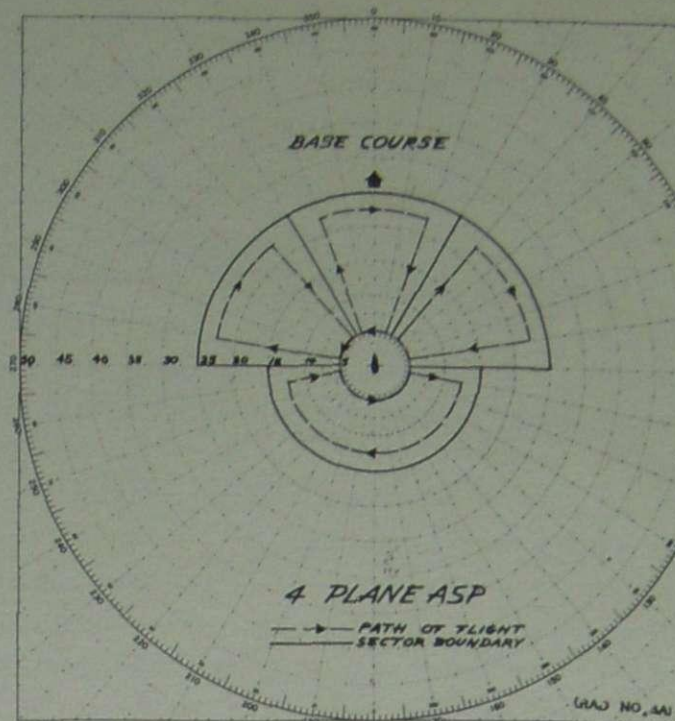
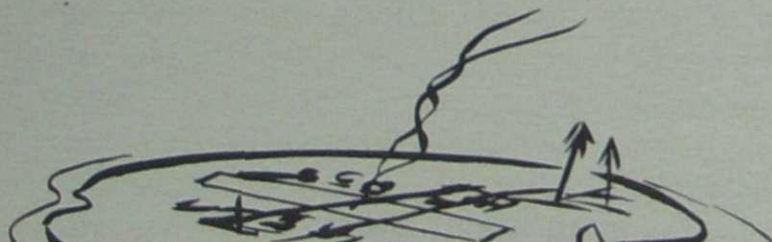
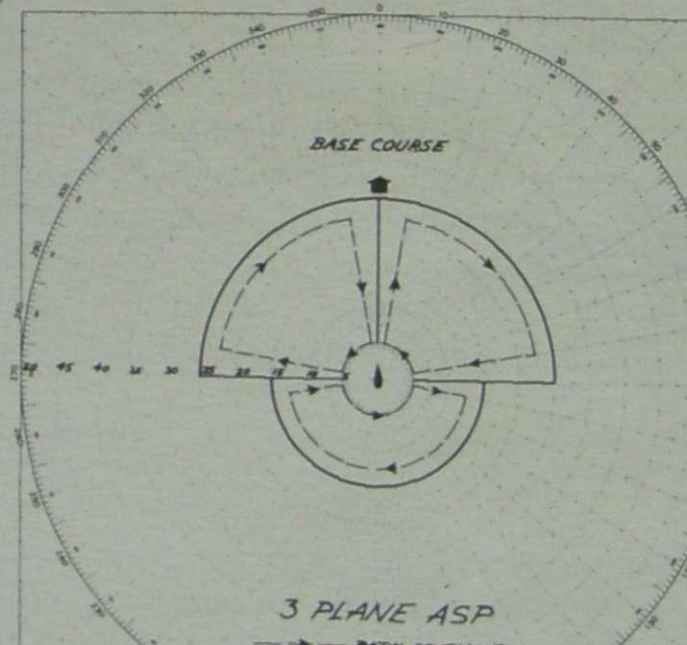


Figure 79.—Four plane ASP pattern.

tact with the plane it is relieving. On the turn leg of each sector sweep the planes proach close enough to the task group so visual identification is possible by the ship the formation. After being relieved they turn to the task group, join up, and await order by blinker to land. Planes from the ASP are frequently used to orbit over personnel in water until they are rescued by a destroyer from the formation.



J. AIR STRIKES AND SWEEPS

1. Mission

An air strike is a major offensive effort carried out by a group of planes assigned to inflict damage on an enemy target ashore or afloat.

2. Composition

A strike group may consist of any combination of VF and VA. The principal weapons available to carrier aircraft are bombs, incendiaries, torpedoes, rockets, depth charges, and machine guns. If the need arises, fighters from a strike group may be recalled and used as a normal CAP.

3. Employment

The exact composition of a strike and the armament to be carried are determined by the OTC in accordance with the nature of the target. The strike pilots are briefed prior to take-off on all available information concerning the objective. They are given the necessary navigational data, such as the course and speed of "Point Oboe," bearing and distance of the target, time of take-off, estimated length of time over the target and ETA. They are thoroughly indoctrinated in rescue procedure.

4. Launching

In launching a large number of planes from

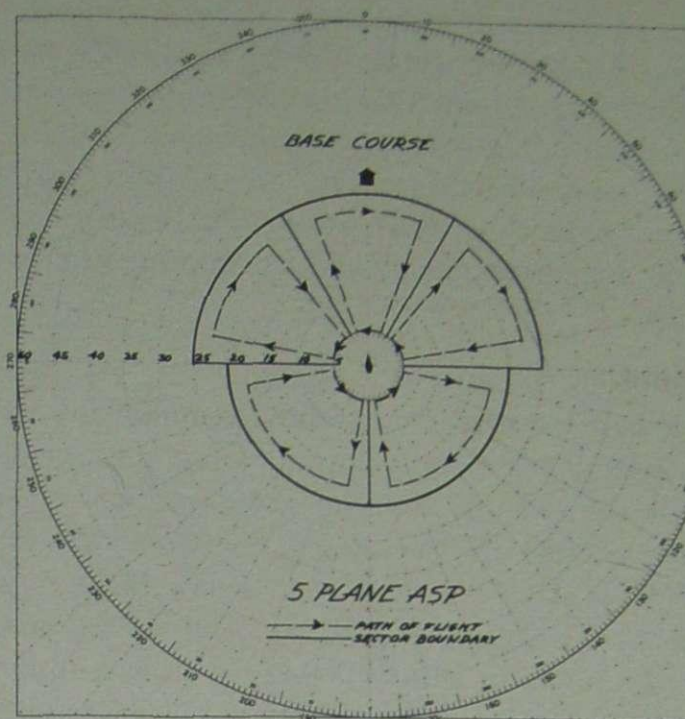
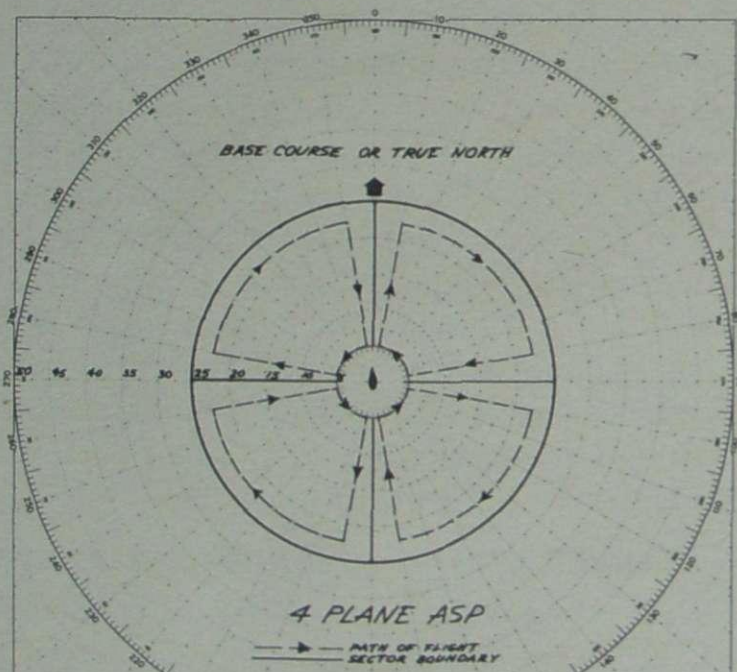


Figure 82.—Five plane ASP pattern.

a task group as in a strike, the problem of rendezvous may be difficult. Explicit instructions are essential in order to avoid confusion and delay, and the ACI Officer will brief the pilot prior to take-off according to the plan drawn up by the strike leader. The planes from each carrier are assigned a sector and an altitude at which to join up. As each carrier group is rendezvoused, the fact is reported to the strike leader by the individual leaders. The strike leader then joins up the groups to form the strike and takes departure. During predelay launches destroyers are sometimes stationed at each sector with distinctive lighting arrangements to serve as reference points for the various groups.

5. Target Coordinator

It is frequently found expedient to maintain a one or two plane patrol over the objective, the lead pilot acting as target coordinator. The target coordinator is usually an air group commander from one of the striking carriers. In his task to assign targets to and coordinate strikes, keep the OTC informed of the weather conditions over the target at all times, and furnish a running account of the progress of

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ships in a harbor whereas intelligence reported otherwise, he so informs the OTC in order that the loading of following strikes can be changed accordingly. The target coordinator's evaluation of the military value of the objective is taken into consideration by the OTC in deciding when to augment, change, or discontinue the attack.

6. Control

Strikes are under the tactical control of the strike leaders en route to and from the target. While they are in the objective area, they are under control of the target coordinator. On arrival at the objective the strike leader reports to the target coordinator giving the number of planes in his strike and the armament carried. He then leads the attack as instructed, rendezvous his group and takes them back to the base. If no target coordinator is assigned a designated strike leader takes over his duties.

7. Function of CIC

The principal duty of CIC in connection with strikes is the relaying of information. All information concerning the situation at the target must be reported to the OTC. When the course or speed of "Point oboe" is changed, the strike leader must be notified. ITC must receive all survivor reports that are made. When a returning plane reports that it is damaged, the captain of the parent carrier must be informed of the fact. In addition CIC will frequently be called upon to home lost planes. Further, CIC is responsible for keeping the OTC or the task group commander informed of the location of strike groups at all times. This information may be based on a radar fix or on the dead reckoned position of each strike group.

In order to maintain a continuous flow of pertinent information CIC must at all times have a comprehensive picture of the progress of a strike group. For this purpose a large scale geographic chart of the area should be used on a horizontal plot with the location of all target areas, rescue reference points, rendezvous points, and similar information clearly laid out. Routes to and from the target may be drawn in and all flights should be dead reckoned thereon when they move out of radar range.

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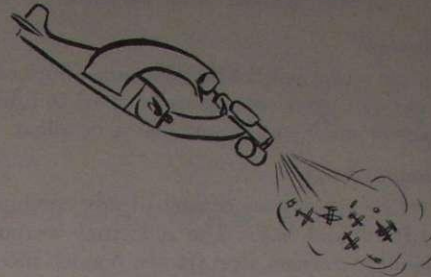


Figure 83.

8. Fighter Sweeps

When heavy enemy air opposition is expected at the target, the first strike may consist entirely of fighters and is called a fighter sweep. The purpose of the fighter sweep is the destruction of all enemy planes which might provide opposition for the strikes that are to follow and of enemy bombers which might constitute a threat to the carrier task groups.

9. Communications

Carrier strikes can be made against targets at any distance up to about 300 miles from the task group. In the majority of cases the target is between 75 and 125 miles distant. At this range VHF/UHF communications between the base and planes over the target are fairly reliable if the planes have sufficient altitude. When direct communications cannot be established, any of the patrols in the vicinity of the task group may be used for relay purposes, or special planes may be launched to do so. Picket ships have proved helpful in this function.

It is frequently desirable to employ HF for plane-to-plane communications in the target area. This serves to reduce congestion on VHF/UHF channels without loss of security. In addition, the ships of the task group and other interested activities can listen in on the circuit and learn the progress of the strike.

K. BLANKET ATTACK OPERATIONS (BLANKET)

Blanket operations are normally conducted against enemy land-based air forces where it is desired to inflict maximum damage to enemy aircraft and at the same time prevent enemy air operations from fields in the areas under

attack. The smothering effect of the Blanket attack method is obtained by use of the "Three strike" system under which each carrier group maintains one strike at the target, another en-route to the target, and the third rearming on deck. This is an OFFENSIVE operation, not simply a patrol over the target.

Each operational airfield (or system of fields) is assigned to a flight of strike aircraft, the size of the flight depending upon the expected opposition (including AA opposition). The "Three strike" system is designed to permit pilots to remain in their assigned area until arrival of the next strike and give them time to hunt out camouflaged or hidden aircraft and to conduct intermittent frag bombing, rocket and strafing attacks on carefully selected targets. Obviously pilots sent to distant fields will not be able to remain over the target until the arrival of the next strike; however, a time gap of 20, 30 or even 40 minutes at the target may not give the enemy time enough to mount an attack with his aircraft widely dispersed.



Figure 84.

L. LONG RANGE AIR SEARCHES DAY (DRECCO)

1. Purpose

Long-range air searches are flown to give visual and/or radar coverage of a sector extending several hundred miles from a force or base. Land bases in the advanced areas launch daily searches to cover areas where the enemy might be found. Carrier-based searches are flown when there is a possibility of enemy forces being in the area or when information or photographic intelligence concerning an enemy land base is required.

visual or radar coverage at the outer limits of the search. The composition of search units varies greatly depending on plane availability and the probability of encountering enemy forces. One or two VA with or without escort is the usual search group, but when contact with major enemy units is expected, a search group may constitute a small strike itself. The latter reinforced group is known as a REDRECCO.

3. Communication

The OTC is kept informed, communicating, permitting, of all enemy contacts made by searches. Since searches may be flown out 400 miles from the base VHF radio is inadequate for reporting contacts from the outer limits of the search. This difficulty can be overcome by using lower frequencies or by stationing VHF/UHF relay planes every hundred miles along the median of the search sector.

4. Employment

The leader of a search group may elect to attack an enemy contact if such a course of action is consistent with his previous instructions. In deciding whether or not to attack, the leader must bear in mind the importance of covering the rest of the search sector, the strength of the enemy, the fuel on hand, the distance from base, and the armament available.

5. CIC in Control of Searches

Search pilots are assigned calls and sectors to cover prior to takeoff.

After launching the groups rendezvous and report their time of departure by VHF/UHF when conditions of radio silence permit. CIC then tracks each group by radar until it falls from the screen. After radar contact is lost, the planes are dead reckoned until they reappear on the screen on their returning leg.

If a contact is reported, CIC can make a fairly accurate estimate of its position from the dead reckoned track of the reporting plane.

To aid CIC in identifying returning planes

the task group often render it difficult for the returning planes to find their base. For this reason it is of paramount importance that both the pilots and CIC personnel be well versed in homing procedure. CIC should have the plans, including sectors, calls and types of planes, for all land based searches which might be encountered. When a radar contact is suspected to be a land based search, it can be identified by its track and position. This can be checked by calling the plane on assigned frequency.

Example: (From search dispatches 7 Victor Mohawk Baker is supposed to be in the vicinity of the force (group).)

"7 Victor Mohawk Baker, this is Mohawk. Over."

"Mohawk, this is 7 Victor Mohawk Baker. Send your message. Over."

"This is Mohawk. What is your course, speed and Angels. Over."

"This is 7 Victor Mohawk Baker. Course 028° speed 168. Angels seven. Over."

"This is Mohawk—Roger. Out."

This information is then evaluated against the track in CIC for confirmation. If further confirmation is required, the plane may be told to make an alteration in course or one 360° turn.

M. NIGHT INTRUDER

1. Purpose

The night intruder is a CAP maintained over an enemy airfield during darkness. The Intruders harass enemy planes attempting to take off, inform OTC when enemy planes are airborne, and keep OTC advised of the weather in the target area.

2. Composition

An intruder unit will normally consist of two night fighter planes.

3. Employment

Prior to take-off the pilots are briefed on the position of the target with respect to the ship, the expected movements of the task group during the patrol, and latest information concern-



Figure 85.

has little value unless the visibility is such that pilots can see the planes on the ground.

Except in rare cases, the intruders will be directed by CIC in a controlled intercept if they are in the target area.

N. NIGHT HECKLER MISSIONS

1. Purpose

The purpose of hecklers is the continuation of the attack during the night of a daytime attack against an enemy area. The planes attack at regular intervals throughout the night in an attempt to keep the enemy in a state of disorganization. Some material damage will be inflicted, but the greatest value of the hecklers is psychological.

2. Composition

The heckler mission usually consists of one to four VF(N)'s or VA(N)'s.

3. Employment

The pilots are thoroughly briefed prior to take-off on their mission. The planes carry bombs regardless of whether VF(N) or VA(N) are employed. It is desirable to have a heckler patrol on station throughout the night. The patrols should therefore relieve on station and each patrol should make intermittent attacks.

ditions permit, the hecklers may strafe as well as bomb.

CIC exercises control over the hecklers only while they are en route to and from their station.

O. PHOTO MISSION (GRAPHIC)

1. Purpose

The purpose of a photo mission is to get photographs in order to obtain information concerning an enemy objective or to assess the damage done by an attack.

2. Composition

The photo mission consists of one or more specially equipped fighter planes which may or may not be accompanied by fighter escort.

3. Employment

The pilots are given a definite area which they are to photograph and are instructed as to the type of photographs desired. When weather conditions prevent their getting the required photos, they have previously assigned alternate areas to photograph or they may contact OTC via CIC and request a new target.

CIC may be called on to home the photo missions.

P. PHOTO MAPPING MISSION (MAPHO)

1. Purpose

The MAPHO mission is flown in order to get precise photographs of a given area so that a map of the terrain can be made from them.

2. Composition

The mapho mission usually consists of two or four specially equipped fighter planes escorted by a division of fighters.

3. Employment

Specially trained pilots are usually employed for MAPHO. The patrol is very similar to photo except that a great deal more precision is required.

Q. BARRIER CAP (BARCAP)

1. Purpose

The BARCAP is an added protection for task force (group) against raids that use the most direct route of approach.

2. Composition

The BARCAP will usually consist of one or more divisions of fighter aircraft.

3. Employment

The BARCAP is employed between the force and the objective area as a barrier across the probable direction of approach of enemy aircraft, and as far from the force requiring protection as satisfactory radio communication and other considerations will permit. Normally the BARCAP will be employed to intercept raids which are not surprise attacks, raids that have as their only mission the inflicting of damage to the forces with no intentions of returning to an enemy base.

CHAPTER ELEVEN

EMPLOYMENT OF COMBAT AIR PATROLS AGAINST ENEMY AIR ATTACKS

- A. AREA OF RESPONSIBILITY.
- B. DEPLOYMENT OF FRIENDLY FIGHTERS AGAINST ALL
ENEMY RAIDS.
- C. DECISION TO INTERCEPT.
- D. NUMBER OF FIGHTERS TO USE.



Figure 86.

CHAPTER 11

EMPLOYMENT OF FIGHTERS FOR DEFENSE AGAINST AIR ATTACK**A. AREA OF RESPONSIBILITY**

A CIC officer has at his disposal a number of fighter aircraft with which to defend friendly forces against enemy air attack. His area of responsibility is the area of coverage of the radars available to him.

When defending forces are deployed over a considerable area, it is desirable that the responsibility for defense be divided among several CIC officers and coordinated by one officer to whom control has been delegated by the OTC. This system was developed and extensively employed in the fast carrier task forces. When several task groups of the force operate together, the group CIC officer is responsible for the defense of his own group, but the force CIC officer coordinates the work of all group CIC officers in such a way as to provide the best over-all defense of the task force as a whole.

When the groups separate so that they are no longer tactically concentrated although

group and enters that of another, the officer of the first group must pass to the officer of the second group all pertinent information concerning the raid. On occasion may even be desirable to have the CIC officer of the second group assume control of fighters which have commenced the interception from the first group. Here also coordination must be effected by the force CIC officer if present.

Any officer charged with the responsibility of control must intercept every enemy air raid or carry the interception to a point where there is no prospect of success. Such procedure demands the persistent application of every facility available. In general, only those interceptions may be terminated which endanger friendly fighters to extreme ranges from the controlling base. The factors which will govern the decision to break off an interception are failure of voice radio communications, lack of radar information on both raid and friendly

enemy raid which is obviously acting as a decoy, or one which is opening and cannot be overtaken, should be ignored as soon as it is no longer a threat to the force (group). Sound judgment on the part of the task force or task group CIC officer is absolutely essential in the assignment of friendly fighters to the interception of enemy air attacks and in the tactical deployment of combat air patrols.

B. DEPLOYMENT OF FRIENDLY FIGHTERS AGAINST ALL ENEMY RAIDS

It may not always be possible, with the means at hand, to destroy completely every enemy attack. However, though an enemy air attack is hit with only a handful of fighters and some enemy aircraft actually penetrate the inner zone of defense, that small number of fighters may be just enough to disconcert the enemy and so break up the coordination of his attack. So if it is at all possible, *allow no attack to come in completely unopposed*, even though the opposition may only be a token. To accomplish this, at least some fighter cover must be kept in a position to defend the force at all times. In other words, there must always be a reserve left to use against the next raid. To accomplish this, it may be necessary to launch additional fighter aircraft or to request additional fighter cover from the "source of supply."

This is not to be construed to mean that an attack will be allowed to approach the area unopposed due to the reluctance of the CIC officer to part with his last division of combat air patrol. It is merely intended to make the CIC officer cognizant of the fact that there is always the possibility of another attack developing and that some steps should be taken in advance to cope with that contingency.

When combat air patrols are augmented by scrambled fighters, it is often advantageous for the task group CIC officer to station these fresh divisions on the bearings of expected enemy attack. Fleet experience has shown that it is necessary to promulgate in advance a control

VF	Station	Altitude
Randolph fighters-----	270° 15 miles---	10
Yorktown fighters-----	090° 15 miles---	10
Belleau Wood fighters---	000° 10 miles---	15
Cowpens fighters-----	000° 10 miles---	15

Such a plan is set up each day prior to the initial launch of the day's patrols. It has the advantage of reducing confusion in time of emergency and of providing strategic strength for reserve fighters.

C. DECISION TO INTERCEPT

The decision to intercept bogies may depend on several factors, but as a general rule it may be stated that any bogey appearing on the screen should be intercepted. A notable exception to this might occur in the case of an enemy plane detected in the vicinity of a task force (group) during its high speed approach on its objective. If it appears that the bogey will not detect the force and if the presence of the force is not known to the enemy, it is often desirable not to intercept. The reason for this is that if the bogey is intercepted, it may be able to determine its base that it is under attack by combat based planes. Also the fact that the plane has not returned may alert the enemy.

If other combat air patrols are in the vicinity, this fact may affect the decision to intercept. In such a situation, the bogey may be more expeditiously handled by the CAP of another group, and that group CIC officer may have commenced an interception. The decision as to who is to conduct the interception normally rests with the task force CIC officer.

Another factor which may influence the decision to intercept is the case where the bogey is not picked up until he is within anti-aircraft range, or nearly so. In such a case the task force may "release batteries," and order the bogey officer not to intercept.

There will be times when the CIC officer cannot afford to commit his defensive fighters to any and every bogey appearing on the screen. Such is the case where the CIC

be wise to wait until it is reasonably certain that the bogey is a menace to the force before committing all or part of the fighter cover.

D. NUMBER OF VF TO USE

In deciding how many defending fighters will be sent out to intercept an attack, the total number of fighters on combat air patrol must be weighed against the estimated number and types of planes in the attack. There is no hard and fast rule, and the number of fighters used against a raid of a given size will vary with the situation. Obviously an overwhelming numer-

erical superiority of defending fighters would be desirable if the CIC officer could afford it, but this is seldom the case. When possible, attacks should be matched plane for plane.

The decision as to how many fighters to send against a designated raid rests with the group's CIC officer. He must carefully balance several factors as his knowledge of enemy tactics, the vulnerability and importance of his area of responsibility, the number of other combat patrols in the vicinity, the action being taken by their CIC officers, and the need for a reserve cover to throw against any other attack which might develop.

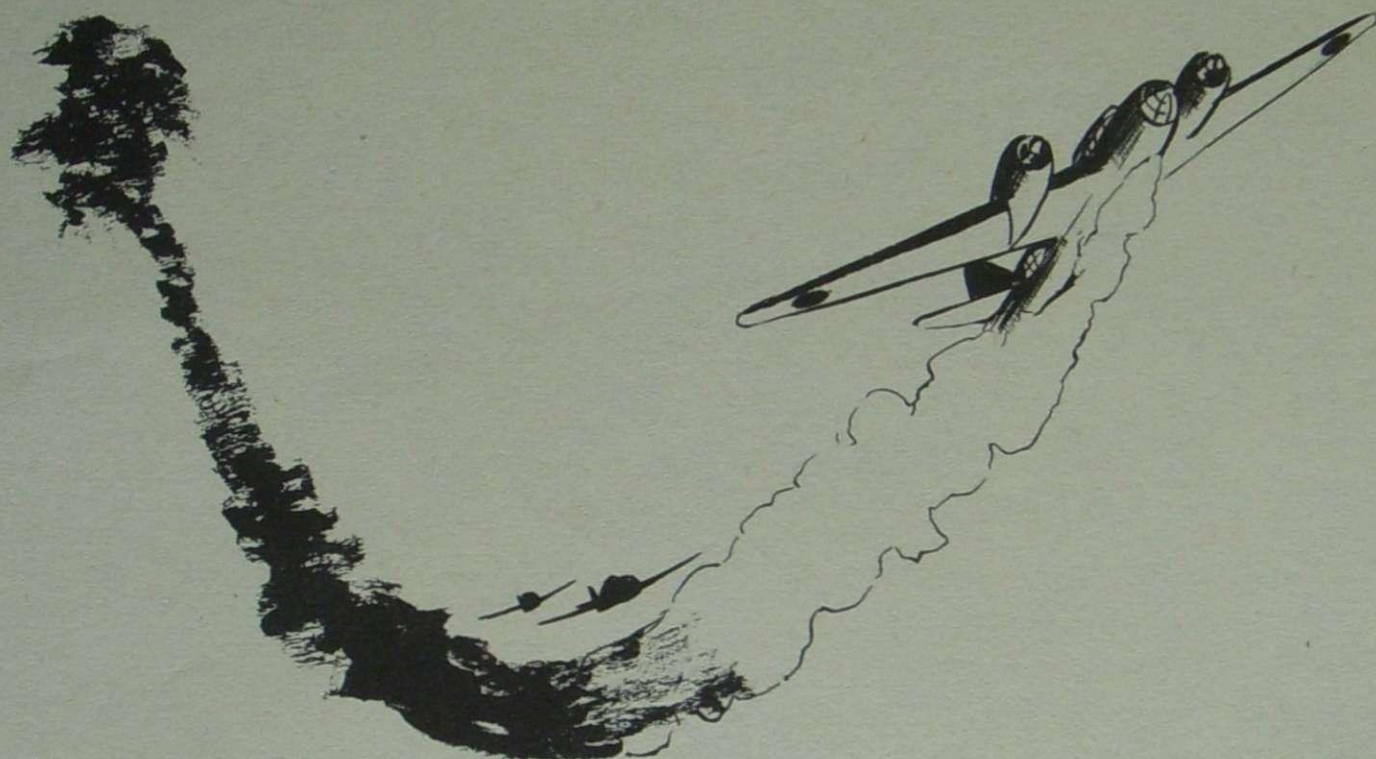


Figure 87.

CHAPTER TWELVE

DAY INTERCEPTIONS

- A. EARLY VECTOR IMPERATIVE.
- B. FIGHTERS MUST STAY JOINED UP.
- C. ALTITUDE ADVANTAGE IMPERATIVE.
- D. STACKING FOR INSURANCE.
- E. BACKSTOP THOSE THAT BREAK THROUGH.
- F. IMPORTANCE OF ACCURATE INFORMATION ON STARTING POINT OF FIGHTERS.
- G. FIGHTERS MUST BE KEPT BETWEEN RAID AND BASE.
- H. THE HEAD-ON ATTACK.
- I. THE CROSSING RAID.
- J. RANGE AT WHICH TO INTERCEPT.
- K. SPEED OF FIGHTERS.
- L. FLIGHT LEADER MUST BE KEPT FULLY INFORMED.
- M. ADVANTAGES OF SUN AND CLOUDS TO FIGHTERS.
- N. RADIO DISCIPLINE.
- O. ABBREVIATION OF R/T PROCEDURE.
- P. THE TALLY-HO REPORT.
- Q. TYPES OF INTERCEPTION.



Figure 88.

CHAPTER 12

DAY INTERCEPTIONS

Note: The methods, procedures, and techniques, described in this chapter, for effecting Day Interception with conventional type aircraft, were evolved and proven during World War II. These methods, procedures, and techniques are still effective and will continue to be effective for some time to come. New methods to meet the future requirements for high speed, high altitude type interceptions using jet aircraft are presently being developed. As changes to the existing procedures are adopted they will be promulgated.

A. EARLY VECTOR IMPERATIVE

When a bogey is detected by radar, it is important that defending fighters be vectored out to intercept at the earliest possible moment. The speeds of present-day combat aircraft are such that the elapsed time between initial pick-up and arrival of the attack over the force does not permit waiting until all desirable information has been obtained before starting fighters out.

will be the distance of the interception from the force. This means that the fighters will be able to make more runs on the enemy group, the chances of the attack being broken up before it reaches the force will be greater.

The controller should not unduly delay when a check is being made with other sources for confirmation of the bogey as such. Fighters should always be brought back if the bogey later turns out to be friendly. Nor should he wait until the track of the bogey has been determined. Corrections by change of vector or speed should be made while the interception is in progress.

B. FIGHTERS MUST STAY JOINED UP

A raid can be broken up much more effectively if the fighters attack in one large group rather than several small groups. For example, if a controller can commit 20 fighters to an attack it is much better to hit it simultaneously with all 20 rather than hit it first with 12 and several minutes later with 8. Furthermore, the up-

C. ALTITUDE ADVANTAGE IMPERATIVE

When fighters are vectored out to intercept a raid, the bulk of them *must* be placed higher than the probable altitude of the bogey. Altitude advantage is a cardinal rule of fighter tactics. The controller must see that this is always the case when vertical visibility permits. An actual altitude advantage of at least 2,000 feet is necessary, of 3,000 to 4,000 feet usually desirable.

The altitude to which the controller actually

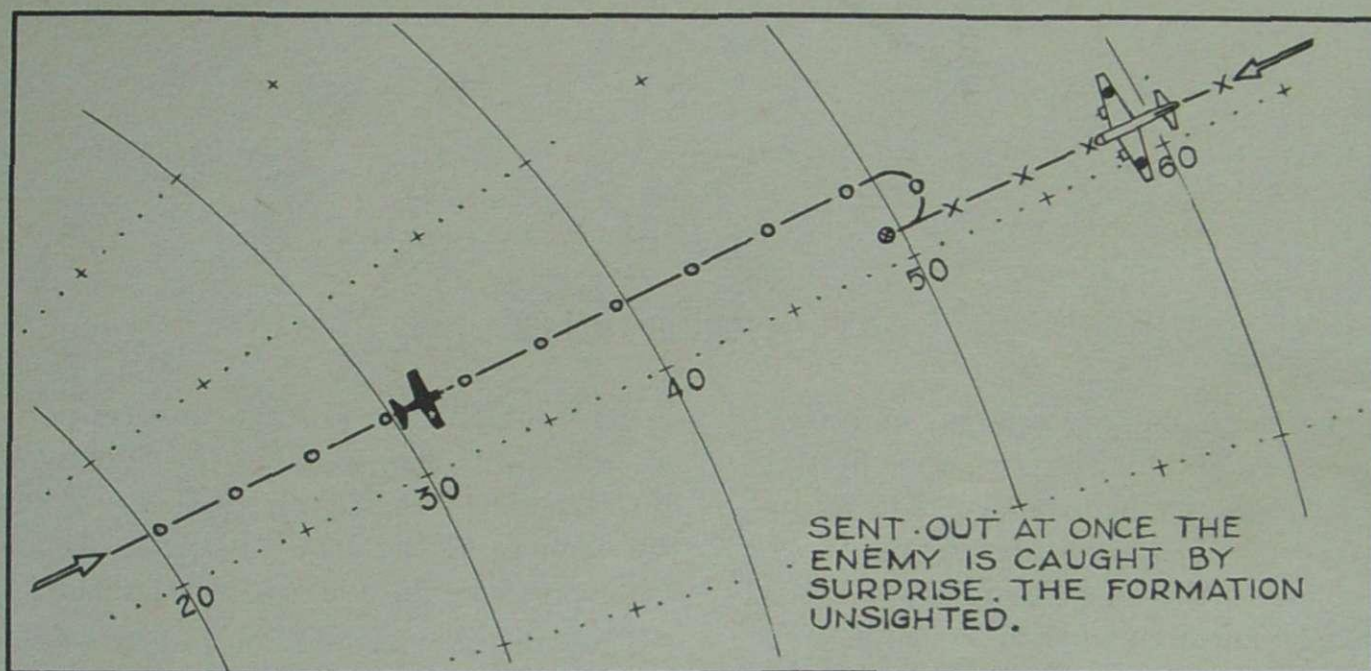
as they can go in the time it takes them to the bogey.

During the periods of low visibility, or when a raid is coming in low on the water, it is necessary to reduce the altitude advantage of the intercepting fighters in order to improve the chances for visual contact with the enemy.

D. STACKING FOR INSURANCE

The practice of keeping fighters higher than the highest altitude estimate of the bogey.

SEND YOUR PLANES OUT AT ONCE



HIT THE ENEMY BEFORE THEY CAN BREAK UP.

HIT THEM BEFORE THEY CAN SIGHT YOUR FORMATION

Figure 89.—Intercepting before enemy sights formation.

orders the fighters will depend on the reliability of the CIC's altitude estimate on the bogey. *The less reliable the estimate, the greater should be the difference in altitude between fighters and bogey.*

When fade charts are being used to determine altitude, there will often be two or more altitude possibilities. In such a case, *take no*

result in having the fighters at 25,000 feet when the bogey is at 5,000 feet. This situation is because a plane that is low on the water is hard to see from a high altitude. The solution is in stacking the fighters in altitude.

Normally, it is the duty of the controller to indicate the necessity of stacking to the fighter leader, adding any information such as the

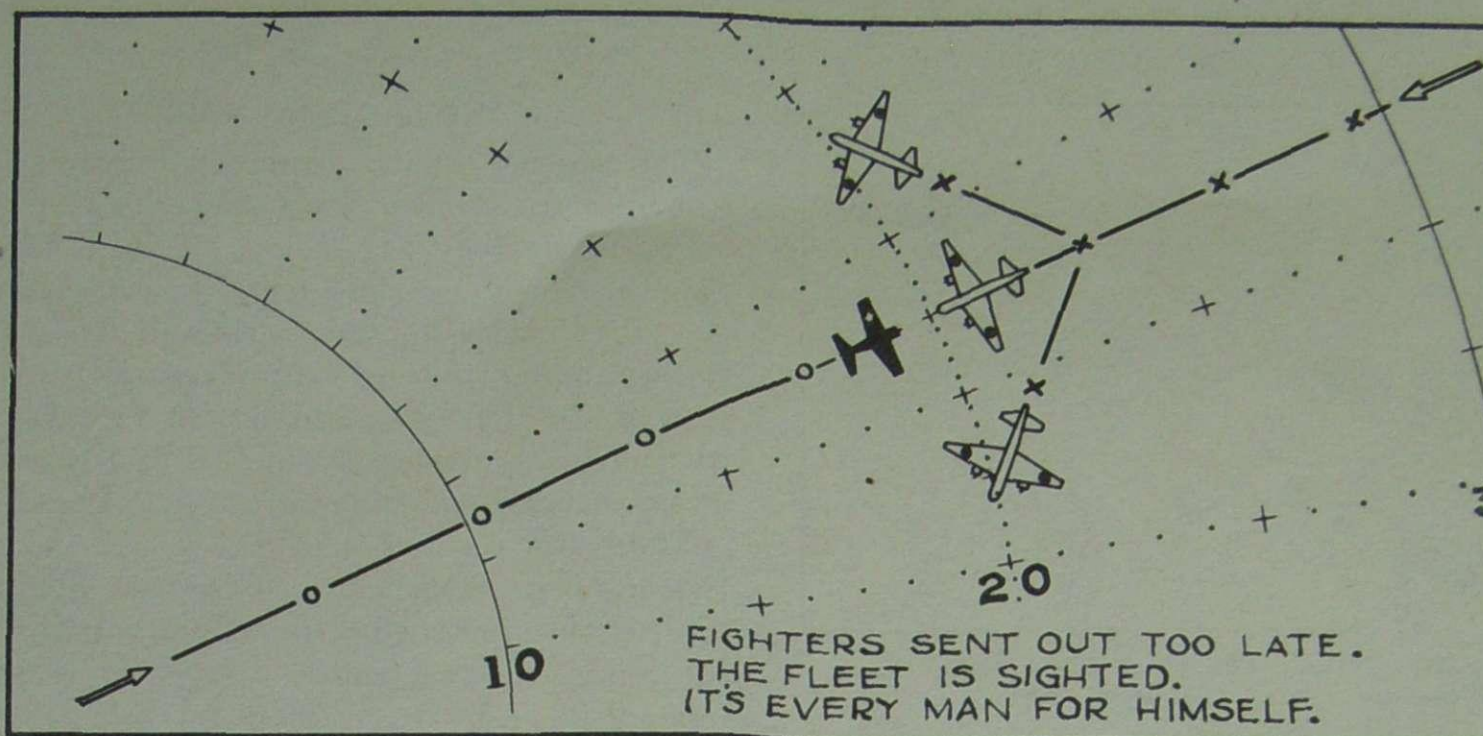


Figure 90.—Too late.

what type of stacked formation he will use and how many fighters he will send down to a lower altitude. Flight leaders must advise the controller of decisions and actions taken.

Stacking will also be necessary if there is an appreciable amount of cloud cover between any two altitude possibilities of the bogey, or if bogey altitude indicates he is flying just below or in the clouds.

It should be remembered that stacking of fighters complicates identification and control as well as dispersing the strength of fighters sent out to intercept. Therefore, such tactics should be employed with discretion and only when necessary.

E. "BACKSTOP" THOSE THAT BREAK THROUGH

When large groups of enemy aircraft are being intercepted and sufficient fighters are available, it may be advisable to send out a second group of fighters about 10 miles behind and below the main intercepting group to be used as "backstop" against enemy aircraft which may escape the main intercepting force. The "backstop" fighters should be orbited about 10 to 20 miles inside the point of interception to

of interception from base. If too close, "backstops" may complicate the intercept picture.

F. IMPORTANCE OF ACCURATE INFORMATION ON STARTING POINT OF FIGHTERS

In order to facilitate identifying fighters among other friendly aircraft in their vicinity and in order to make dead reckoning more accurate, it is highly desirable to have the approximate position of the fighters when they are sent out on vector.

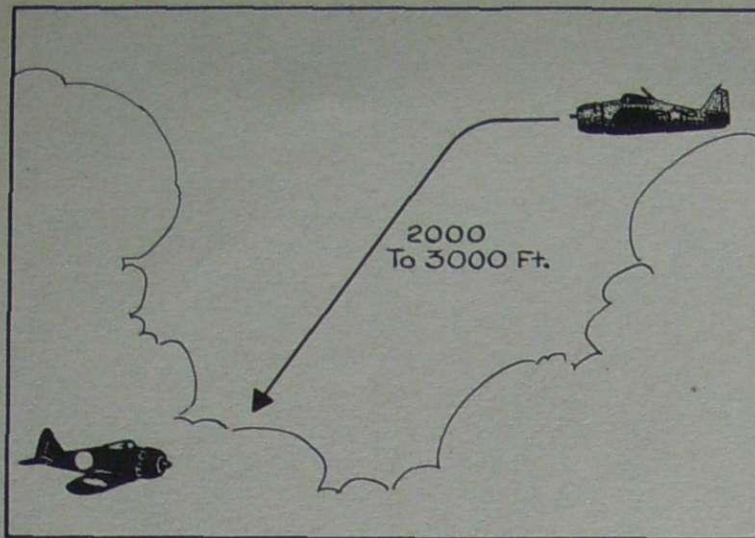
A common method is to have the flight leader report his position with respect to the controlling station or to some known geographic point when he reports steady on vector. Advantages of this method is that it allows pilots to go on vector and commence closing the bogey at a minimum of time. One disadvantage of this method is that pilots' position reports tend to be inaccurate. However, it is usually accurate enough for the purpose it serves.

G. FIGHTERS MUST BE KEPT BETWEEN BASE AND BOGEY

This rule, in addition to meaning that intercepting fighters on approximately the same

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GIVE YOUR FIGHTERS ALTITUDE ADVANTAGE !



NO MATTER HOW FAST A FIGHTER CAN CLIMB,
HE CAN DIVE 2 OR 3 TIMES FASTER.

Figure 91.—Altitude advantage.

have the fighter slightly ahead of the bogey bearing, to prevent the development of a tail chase. Only when fighters are in such a position can the controller correct for any course changes or evasive tactics on the part of the bogey.

H. THE HEAD-ON ATTACK

The case of enemy aircraft approaching the task group head-on is comparatively simple to handle. So long as the fighters are sent out on the bearing of the bogey and the bogey's bearing does not change appreciably, one vector should be sufficient.

R/T Transmissions

0800 —“Mohawk Two-one, this is Mohawk. Vector zero-five-zero. Gate. Angels three. Over.” “This is Mohawk Two-one. Wilco. Vector zero-five-zero. Gate. Angels three. Out.”

0801 —“Mohawk, this is Mohawk Two-one. Steady. South two. Over.” “This is Mohawk, Roger. Out.”

0801¹ —“Two-one, this is Mohawk. Eight Bogies, one thousand, 12 o'clock ten. Over.” “This is Mohawk Two-one,

one thousand. Over.” “This is hawk. That is your bogey, out.”

I. THE CROSSING RAID

The crossing type raid presents a more difficult intercept problem since the bearing of the bogey is constantly changing. To aim for a point at which the bogey might be expected to be at the time the fighters reach it would necessitate “leading” the bogey considerably, so much so that the fighters might be too far off the bearing of the bogey to catch it if it turns away, reversed course or turned over the head.

The better method is to give vectors which lead the bogey sufficiently to keep the fighters slightly ahead of the bearing of the bogey. By so doing, the controller always keeps the fighters in position to correct for any rapid changes in the bogey's course.

Avoid getting behind the bearing of a crossing target.

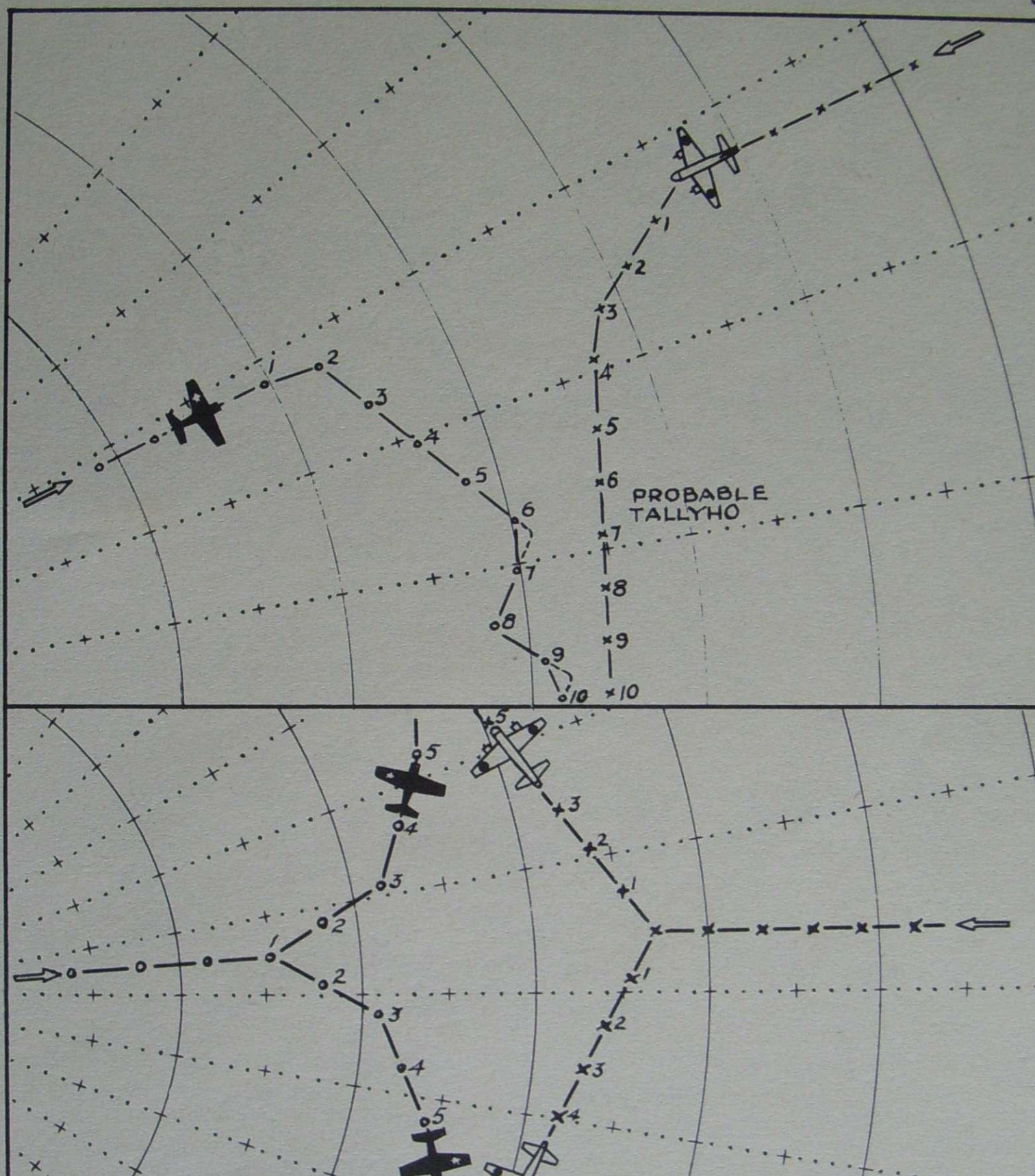
J. RANGE AT WHICH TO INTERCEPT

Always try to intercept at a maximum range consistent with plane performance, reliable communications, and radar information. Interceptions made beyond visual range are normally preferable since the enemy planes cannot sight and report the friendly forces. Once enemy planes have sighted our forces, the difficulty involved in repelling their attack is greatly increased. The enemy can break up the formation and let each plane make its own separate approach. When this happens, a portion of the enemy planes may be able to slip through and press home their attack. If the enemy initiates these tactics outside of visual range and he is not sure of the exact position of his objective he has the further problem of navigation. In addition, planes that have sighted our force are less likely to anticipate interception.

There are several factors that may alter this rule.

In the event of meager fighter cover for the force, it may be wise to sacrifice some distance so as not to allow fighter cover to be drawn

KEEP YOUR FIGHTERS BETWEEN THE BOGEY AND BASE



force, and particularly if there is some doubt as to the intentions of the bogey, most economical cruising speed, or "Liner" is indicated. If the bogey is not detected until it is dangerously close, maximum possible speed, or "Gate" is mandatory. However, maintenance of this speed for more than a few minutes may result in aircraft engine failures; it is certain to cause excessive fuel consumption.

Owing to the excessive number of variable factors involved (type of plane, altitude, loading, etc.), it is not possible to compute indicated air speeds for speed terms under all conditions. Such can be worked out with individual squadrons but for practical purposes the terms better represent *urgency* of the mission.

L. FLIGHT LEADER MUST BE KEPT FULLY INFORMED

The amount of information given to the flight leader about the bogey will be governed by the amount of traffic on the Fighter Air Defense Net. If there is a load on the circuit, information must be limited to the barest essentials in order not to "hog the circuit" and keep someone else from getting essential transmissions through to his fighters.

Information that must get through to the flight leader includes whereabouts of the raid immediately after flight leader has reported steady on initial vector; estimated altitude; estimated numbers and type; heading; and as frequent reports on position of bogies as possible once intercepting fighters are within possible visibility range.

If the Fighter Air Defense Net is not overloaded, it is desirable to give the fighters as much information as is obtainable about the raid including very frequent position reports.

This serves several useful purposes:

1. It assures the flight leader that communications are still functioning and he is not missing any vital transmissions. Long periods of silence during an interception tend to make the pilots uneasy.

3. Frequent information gives the pilot a good idea of the amount of time he has to prepare for combat before sighting the bogey.

M. ADVANTAGES OF SUN AND CLOUDS FIGHTERS

When possible, fighter pilots will make the runs on a target from up-sun. This means that the controller should vector them to a position which makes this possible on tallyho, for the bogey is much easier to spot from such a position. *However, the controller should not sacrifice any of the foregoing principles in order to achieve this situation.* It is desirable, but of less importance does not justify getting the fighters too far off bearing of the bogey or running the risk of a tail chase in order to achieve it.

The same rule applies to clouds. If the fighters can be placed in a position so that the bogey is silhouetted against a bank of clouds, it is easier in spotting the bogey; but do not take the chances of missing the tallyho to achieve this.

N. RADIO DISCIPLINE

It is the responsibility of the controller to see that radio discipline is maintained, keep the Fighter Air Defense Net clear of all but essential transmissions at all times. This is especially necessary when an interception is in progress or fighters are in combat.

Good radio discipline is 90 percent good judgment. *Be clear, be concise, be quick. Say what you have to say, then get off the air.*

O. ABBREVIATION OF R/T PROCEDURE

Normally in day interceptions a full voice call is used for each transmission. This is done even though the transmissions are consecutive between the same two stations and only two stations are on the circuit. When the action is fast, however, and it becomes desirable to abbreviate the voice radio transmissions, *no possibility of confusion can exist*, it is possible to reduce the length of the transmissions by eliminating part, or even all, of the voice

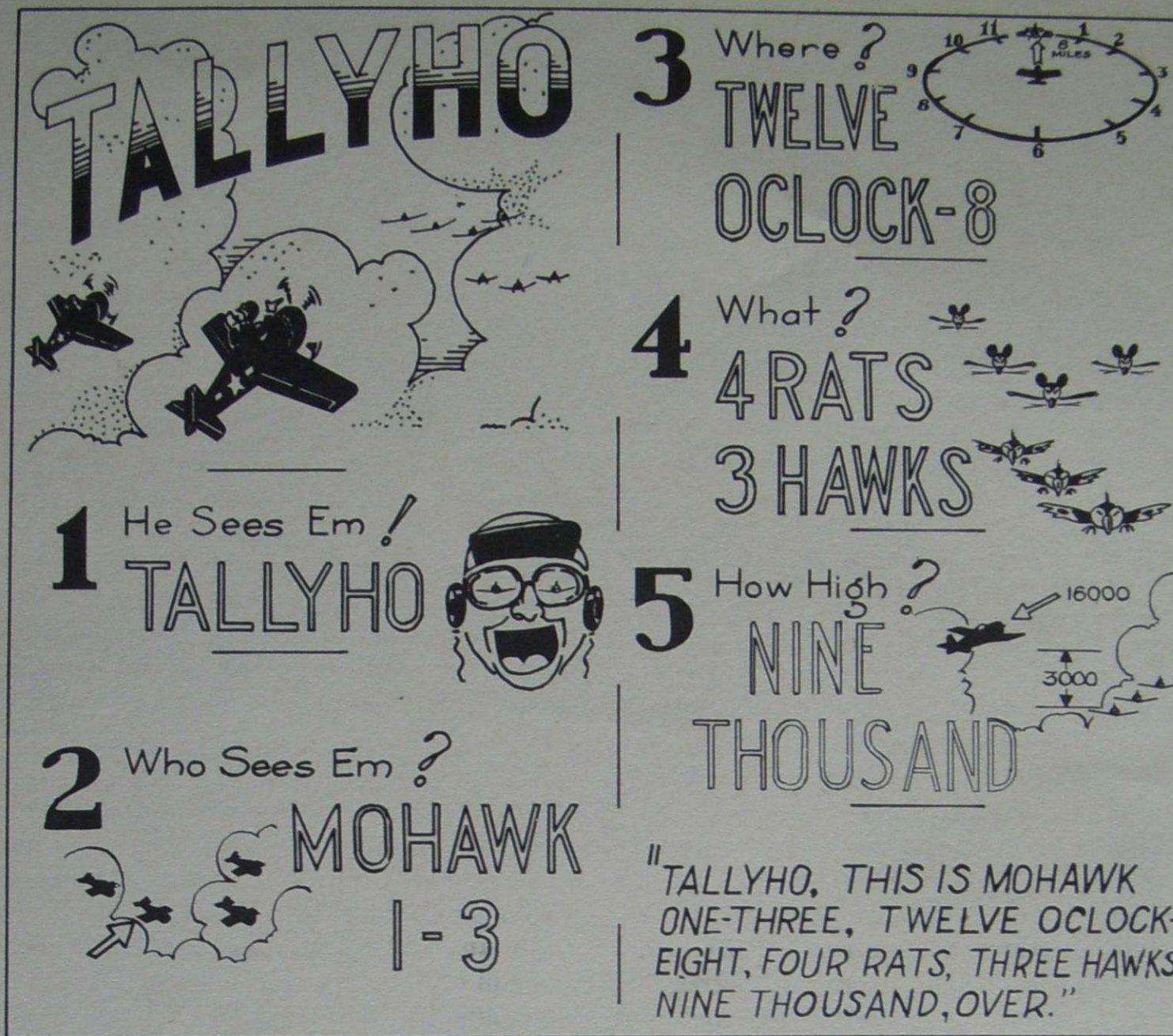


Figure 94.—The tallyho report.

enemy in sight give approximate number of attacking planes, type or types and altitude.

(See Tallyho reports under R/T procedure.)

Clock code is used by either controller or pilot in reporting the position and range of other aircraft relative to the fighter plane with twelve o'clock being dead ahead, six o'clock dead astern, etc. In the majority of cases, the pilot will be concerned with clock code primarily in making a tallyho report. Clock code is usually used when fighters are within 20 miles of target or at range where the size of the bogey and visi-

Q. TYPES OF INTERCEPTION

In the following paragraphs several types of interceptions are discussed. The type used for a given case is determined by the controller in the light of experience and the following factors: number of bogies, course, speed, altitude of the raid, weather conditions, the number of fighters in CAP. For instance, when a large group of fighters is being sent to intercept a large flight of aircraft in poor visibility and accurate altitude information

keeping fighter between the bandit and the base, apply in all cases.

1. Head-on Interception

This type of interception may be employed against closing bogies. Ideally, the interception is not exactly head-on but the fighters are offset sufficiently in bearing so that visual con-

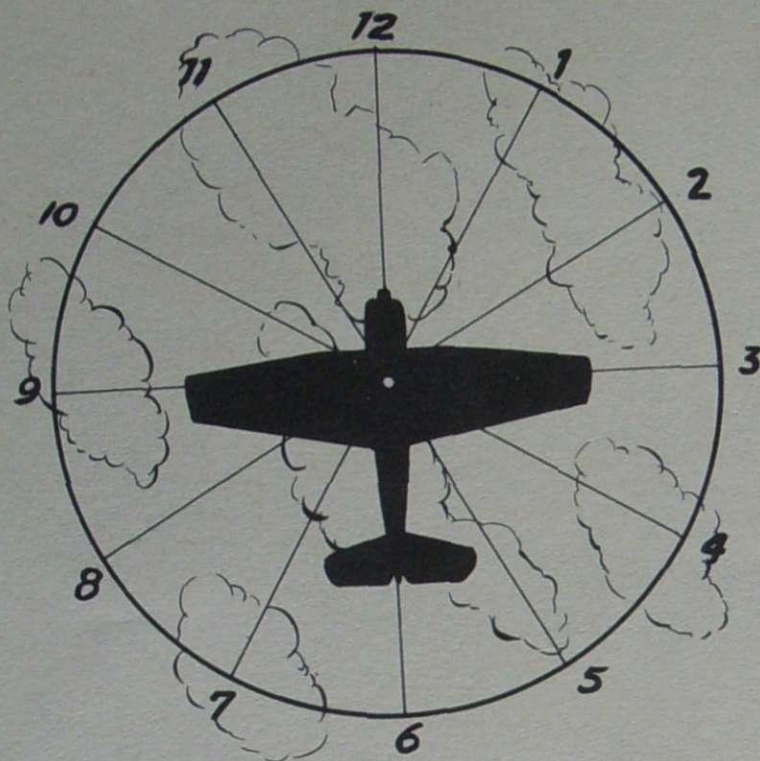


Figure 95.—The clock code.

tact of the bogey is made in the 1 o'clock or 11 o'clock position.

If altitude estimate of the bogey is good and visibility conditions are satisfactory, tallyho will usually be made while fighters are still several miles from the bogey. If this does not happen, the controller must be sure to turn the fighters on to the approximate course of the bogey soon enough to insure that they remain between the bogey and the base. The point at which this turn is made will depend upon the relative speed of fighters and bogey.

When using a head-on type of interception the fighters will weave in flight to obtain a clear view ahead if told bogey is at 12 o'clock.

Vector zero-three-zero. Buster. gels Ten. Over."

"This is Mohawk Two-One. W Vector zero-three-zero. Buster. gels Ten. Out."

0801 —"Mohawk, this is Mohawk Two- Steady, south Five. Over."

"This is Mohawk. Roger. Single ahead, Sixty. Over."

"This is Mohawk Two-One. R Out."

0803 —"Mohawk Two-One, this is Moh Bogey ahead forty-five. Over."

"This is Mohawk Two-One. R Out."

0805 —"Mohawk Two-One, this is Moh Bogey ahead thirty-five at S thousand. Over."

"This is Mohawk Two-One. R Out."

0807 —"Mohawk Two-One, this is Moh Bogey ahead twenty-five. Over"

"This is Mohawk Two-One. R Out."

0809 —"Two-One, this is Mohawk. I eleven o'clock, level. Over."

"This is Two-One. Roger. Out."

0810¹ —"Two-One, this is Mohawk. V Starboard zero-nine-zero. Over"

"Two-One, Wilco. Vector Star zero-nine-zero. Out."

0811 —"This is Two-One. Steady. Out" "Two-One, this is Mohawk. Boge o'clock, six. Over."

"Two-One. Roger. Out."

0812 —"Two-One, this is Mohawk. Boge o'clock three. Over."

"Two-One. Roger. Out."

0813 —"Tallyho, this is Mohawk Two Ten o'clock two, one Hawk sixt hundred. Over."

"This is Mohawk. That is your b Out."

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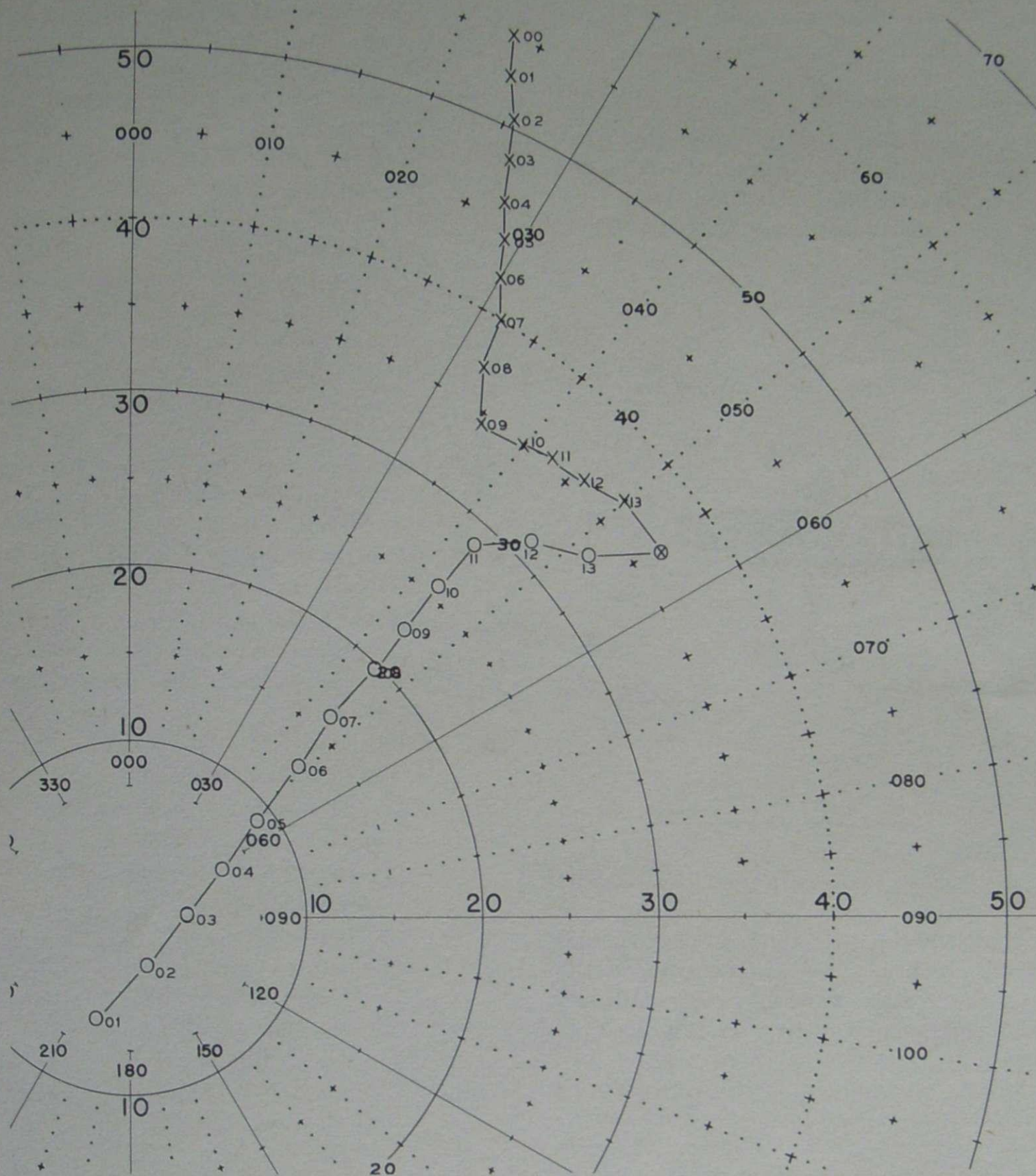


Figure 96.—The head-on interception.

ahead if bogey is crossing, until the fighters have reached a position of not less than 12 miles from the bogey and on approximately the same bearing as the bogey's head-on track.

bogey's track will pass through or very near orbit area.

A simulated orbit consisting of short dashes is shown by the controller in an

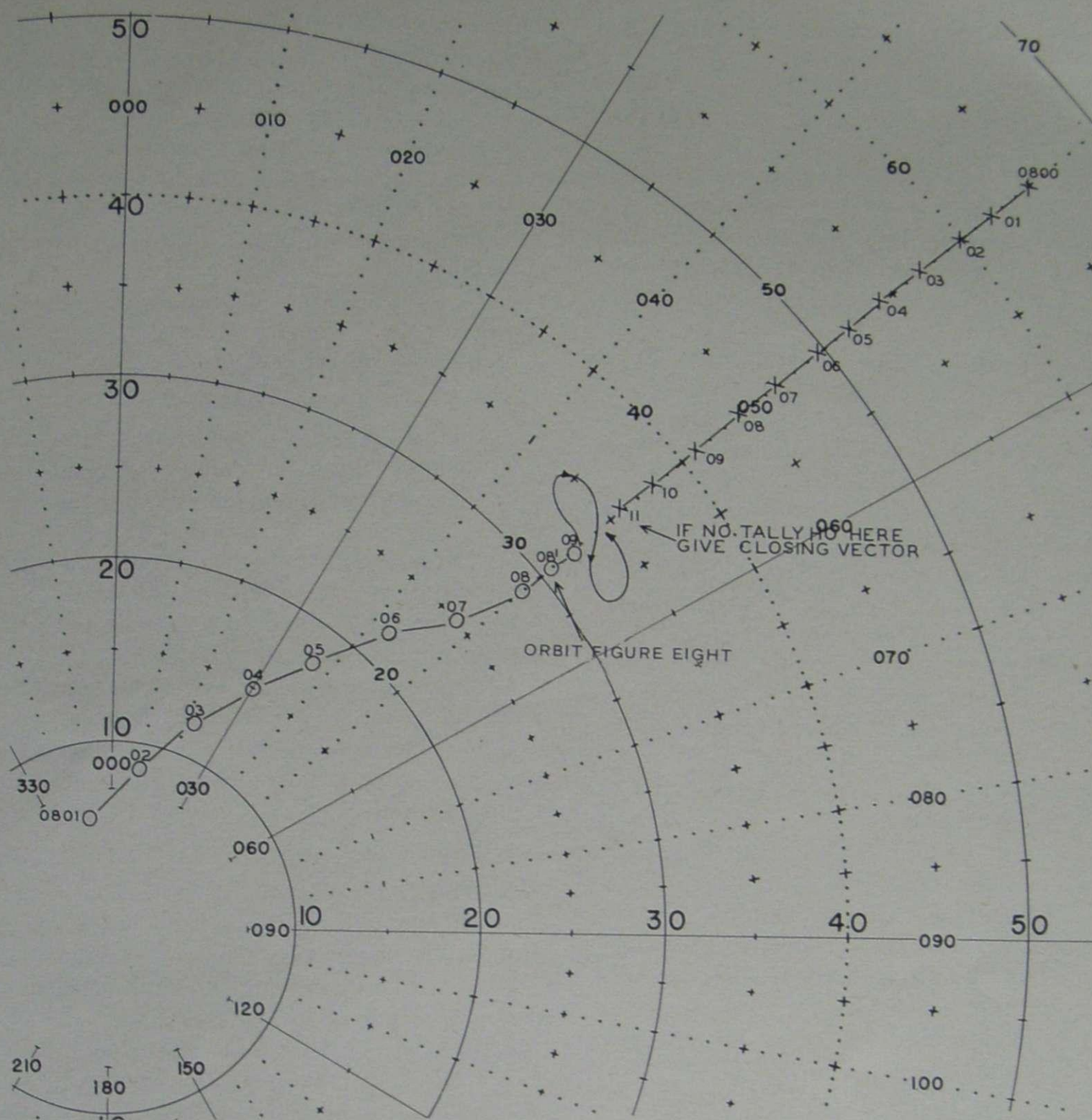


Figure 97.—Orbit type interceptions, closing bogey.

ORBIT TYPE INTERCEPTION—CLOSING BOGEY **R/T Transmissions**

0800¹—"Mohawk Two-One, this is Mohawk.
 Vector zero-five-zero. Buster. An-
 gels ten. Over."

"This is Mohawk Two-One. Wilco.
 Vector zero-five-zero. Buster.

0801¹—"Mohawk Two-One, this is Moha
 One bogey ahead sixty. Over."

"This is Mohawk Two-One. Ro
 Out."

0803—"Mohawk Two-One, this is Moha
 Bogey ahead forty five seven th
 sand. Over."

Vector starboard zero-eight-zero.
Over."

"This is Mohawk Two-One. Wilco
vector starboard zero-eight-zero.
Out."

0804¹—"This is Mohawk Two-One. Steady.
Out."

0805—"Mohawk Two-One, this is Mohawk.
Bogey ahead thirty. Over."

"This is Mohawk Two-One. Roger.
Out."

0807—"Two-One, this is Mohawk. Bogey
eleven o'clock twenty. Over."

"This is Two-One. Roger. Out."

0807¹—"Two-One, this is Mohawk. Vector
port zero-five-zero. Over."

"Two-One. Wilco vector port zero-five-
zero. Out."

0808—"This is Two-One. Steady. Out."

"Two-One, this is Mohawk. Bogey
twelve o'clock twelve. Over."

0808¹—"Two-One, this is Mohawk. Orbit
Figure eight. Over."

"Two-One. Wilco orbit figure eight.
Out."

0809—"Two-One, this is Mohawk. Bogey
northeast six. Over."

0809¹—"Two-One, this is Mohawk. Bogey east
five. Over."

"Two-One. Roger. Out."

0810—"Tallyho. This is Mohawk Two-One.
One o'clock four. One Hawk seven
thousand. Over."

"This is Mohawk. That is your bogey.
out."

3. Types of Orbits

Pilots should be indoctrinated in the flight
patterns of each type orbit.

The figure-of-eight pattern is superior to the
simple orbit in that the fighters have the bogey
roughly on their beam throughout most of the
orbit, assuming the figure-of-eight to be nor-
mal to the flight path of the bogey. Also, the
pilots never have their backs turned to the
bogey. Pilots should be indoctrinated to make

(a) *Advantages of Orbit*

1. Keeps VF between raid and base. It may
be necessary to shift position of orbit from time
to time to effect this.

2. Controls range of interception, keeping
within limitations of radar, radio, fuel, and
tactical requirements.

3. Requires less skill and timing on part of
controller.

4. Reduces danger of excessive relative
speeds.

5. Increases search area of VF.

(b) *Disadvantages of Orbit*

1. Reduces range of interception.

2. Reduces "positive" control of controller
over VF since they are no longer "on the string"
of a vector, since he is no longer able to deter-
mine the heading of the leader, and since the
orbit will drift with or without the wind.

3. Reduces VF speed so as to minimize
tactical advantage.

4. Tends to spread out VF formation,
reducing its immediate combat efficiency.

5. Requires good visibility in order that
may have time to close their formation and
build up speed.

(c) *May be Used*

1. Raid fades and controller has no knowl-
edge of bogey course at a time when raid
from VF to bogey is nearing a critical distance.

2. Raid turns away and it is not considered
desirable to pursue it.

3. Weather conditions ahead are poor.

4. CAP is at maximum desired range from
base (Radar, Radio, Endurance, Tactical
requirements).

5. In some cases when continuation of orbit
might allow bogey to turn in behind VF.

6. Jamming and Window is in use by enemy.

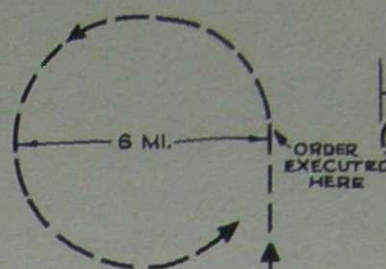
(d) *Hazards to Avoid*

If a tally-ho has not been made by the
the bogey by actual plot or dead reckoning,
approaches to within about five miles of
orbit, fighters should be given a vector to

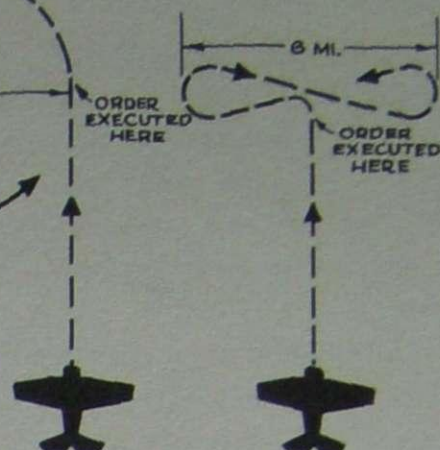


USE ORBITS WISELY!

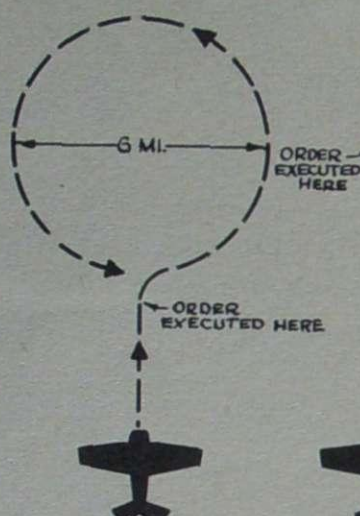
3. ORBIT PORT



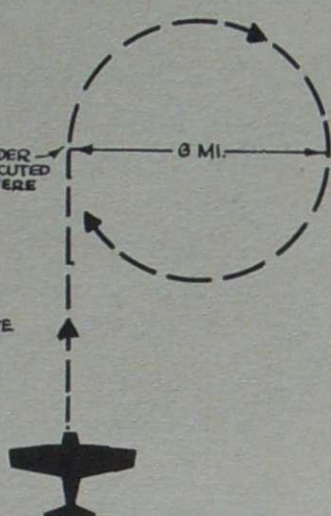
4. ORBIT EIGHT



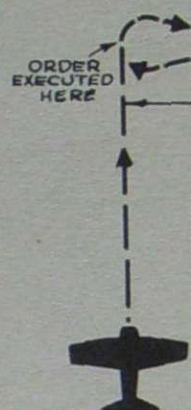
1. SIMPLE ORBIT



2. ORBIT STARBOARD



5. ORBIT EIGHT STARBOARD



6. ORBIT EIGHT PORT

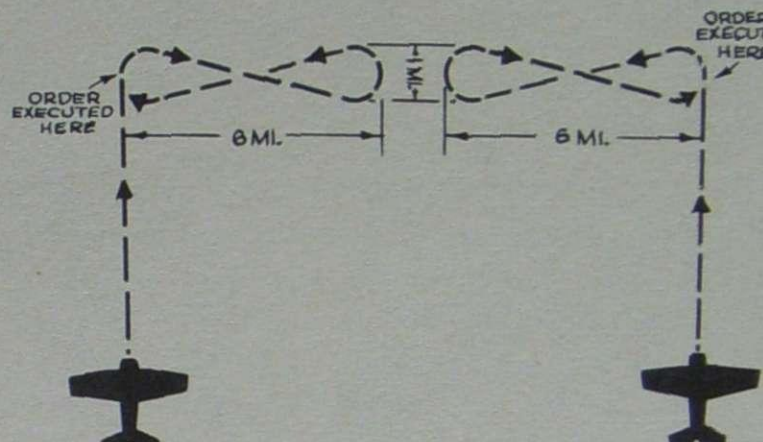


Figure 98.—Types of orbit.

mate bearing of the bogey but will also close the base sufficiently to exclude the chance of the bogey getting inside the fighters.

(e) *Need for Good Visibility*

This type of interception works best when there is good visibility.

(f) *Clock Code Not Used in Orbit*

When fighters are in an orbit, the controller does not have the tight control over them that he had when he had them on a vector. He is unable, for instance, to determine with any degree of accuracy the heading of the fighters at

Instead, fighters should be given the true direction of the bogey from them. For example, "Bogey Northeast 5 ———."

(g) *Use of Orbit*

Though the head-on interception may generally be the most effective way of directing fighters and should be used when possible, there are several situations where an orbit type interception can be used to advantage.

When radar information is poor or not up to date or if information on bogey is coming from one radar and information on fighters from

may not be possible. Here the orbit type interception may be used to advantage.

(h) Use of Orbit Over Land

The orbit type interception may be used to advantage in air control or amphibious operations where land masses or large numbers of aircraft saturate the radar and make accurate tracking of fighters impossible, or where the use of geographic reference points in preference to vectors is more desirable in positioning fighters for an interception. Fighters are told to orbit a particular geographic point near which the bogey is expected to pass. The pilots are then given frequent information on position of bogey, and the interception is made in this fashion rather than by vector.

This type of interception can also be used when the controller is unwilling to commit his fighters beyond recall to that particular raid.

(i) Orbit's Use To Safeguard Against Break-through

After a raid has been tally-hoed by one group of fighters, the controller may have another group of fighters orbit out in the direction of the dogfight in a position where it can stop anything that might break through, and yet is not so far "off base" that it cannot be used against any new attack which might develop.

(j) Orbiting Stacked Divisions

When fighters are stacked in altitude, the lower group may be unable to keep station on the higher group, resulting in two separate friendly groups on the radar. Here the controller may be unable to determine which group is which, making a controlled interception largely guess work. His best remedy is to order one group to orbit its present position.

(k) Orbits Due to Weather

There may be a cloud bank or rain squall out in the intercept area between fighters and bogey. Rather than send the fighters into such an area of low visibility to intercept, it may be advisable to orbit the fighters until the weather clears.

*(v) Use of Orbit To Counter Movement
Bogey Crossing at Extreme Range*

When the track of an unidentified aircraft indicates that it will clear the task group task force beyond air-borne radar range, it is often be advisable to orbit the combat air in positions calculated to counter any future hostile moves of the bogey. This procedure is illustrated in the following diagram.

**USE OF ORBIT WHEN RAID PASSES OUTSIDE
ENEMY AIRBORNE RADAR RANGE**

R/T Transmissions

0800 ¹—"Hello) Mohawk Two-One, this is Mohawk. Vector zero-three-zero. Inter—Angels Ten. Over."

"This is Mohawk Two-One, Wilco. Vector zero-three-zero—Buster—Angels Ten. Out."

0801 —"Mohawk, this is Mohawk Two-One. Steady northeast six. Over."

"This is Mohawk, Roger. Out."

0801 ¹—"Mohawk Two-One, this is Mohawk Two-One. Bogey ahead forty-five. Over."

"This is Mohawk Two-One. Out."

0803 —"Mohawk Two-One, this is Mohawk Two-One. Bogey ahead thirty-five at ten thousand. Over."

"This is Mohawk Two-One. Out."

0805 —"Mohawk Two-One, this is Mohawk Two-One. Bogey ahead twenty-five. Over."

"This is Mohawk Two-One. Out."

0807 —"Mohawk Two-One, this is Mohawk Two-One. Bogey eleven o'clock twenty. Over."

"This is Mohawk Two-One. Out."

0807 ¹—"Mohawk Two-One, this is Mohawk Two-One. Orbit starboard. Over."

"This is Mohawk Two-One. Orbit starboard. Out."

0808 —"Mohawk Two-One, this is Mohawk Two-One. Bogey northeast seventeen he

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"This is Mohawk Two-One, Roger. Out."

0817 — "Mohawk Two-One, this is Mohawk. Bogey nine o'clock seventeen. Over."

"This is Mohawk Two-One, Roger. Out."

0818 — "Mohawk Two-One, this is Mohawk. Orbit. Over."

"This is Mohawk Two-One. Wilco orbit. Out."

NOTE: When bogey has opened to a safe distance, resume fighters.

4. The Controlled Interception

The controlled interception is another effective system for directing fighters. It is well to note, however, that the head-on interception must be used in coping with numerous simultaneous raids, or when the radar picture is badly confused by the presence of numerous friendly aircraft. There are several factors which will influence the decision to use the controlled type of interception.

(a) *Factors in Control*

The radar picture must be clear and up to date enough so that the controller knows where bogey and fighters are at all times and can give fighters accurate position of bogey in clock code at all times.

In this connection, the use of the PPI or other devices which will give an instantaneous radar picture is essential. A plot can be used if the information is good and up to date.

(b) *Control*

The controlled interception consists of controlling the fighters by a series of vectors until they are in a position ahead of the bogey 1 to 3 miles, on a heading approximating that of the bogey, with the bogey in an area of good visibility.

The controller should guide the fighters as the flight leader would if he could see the enemy. The controller is the fighter's eyes until the tally-ho; he guides the fighter division into the best position for a run on the target. For a smooth, quick run in good visibility when the fighter is

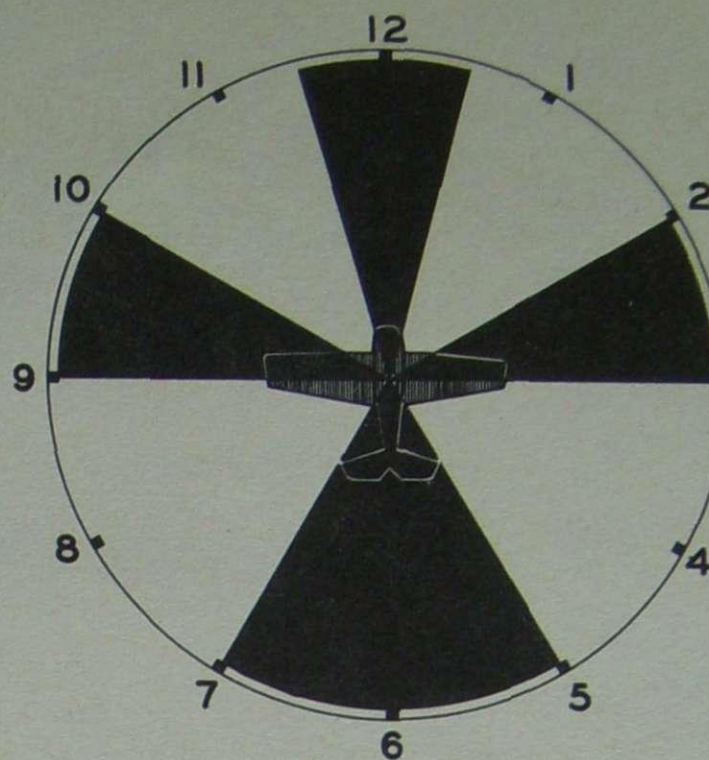


Figure 100.

the friendly is turning onto the target's heading, the target is likely to be 10:00 or 11:00 from the fighter, an excellent position for visibility and a run.

(c) *Use of Safety Vector*

In order to achieve this position, the fighter must be given a vector called the safety vector which brings them around to a course approximating the bogey's track in sufficient time to allow them to make their turn and steady ahead of the bogey rather than astern. In the case of a closing bogey, the safety vector should cross the bogey's track by about 20°. Speed of fighters and bogey and turning rate of fighters will govern distance apart when the safety vector is given.

(d) *Speed of Turns*

A standard rate turn (3°/sec.), which all fighters should always use unless otherwise directed, requires 2 minutes to turn 360°. A half turn can be made in half that time or less depending on the number of fighters in the group.

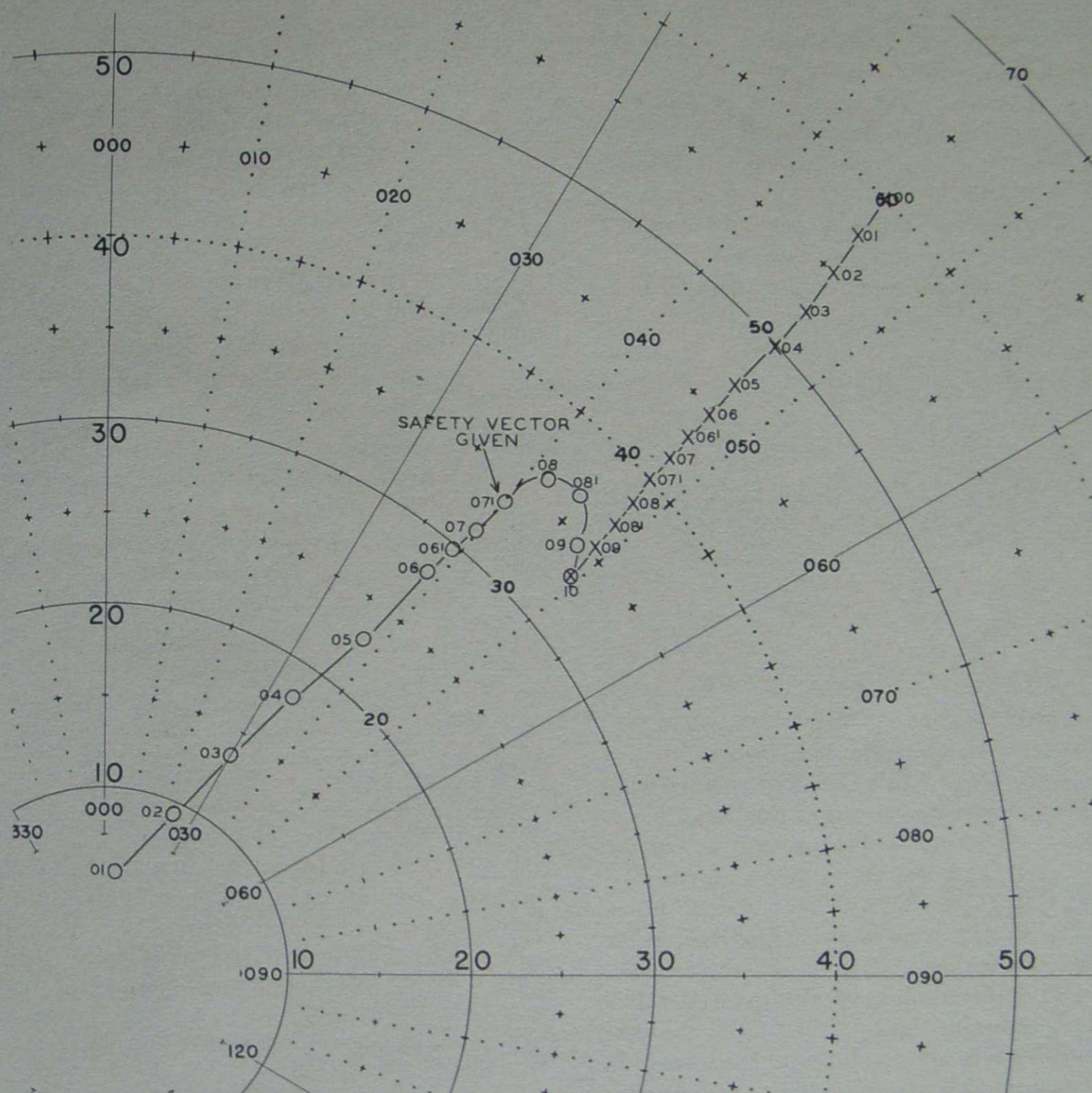
(e) *Timing of Safety Vector*

Assuming fighters making 240 knots and

change of something near 180° , 1 minute would be consumed in making the turn. Allowing for a time lag in execution of orders of between 15 and 20 seconds and allowing for a certain decrease in relative speed during the turn, a safety vector given when fighters and bogey are an actual distance of 9 miles apart would mean that the fighters would "steady on" approximately 2 miles ahead of the bogey.

The exact distance at which to give the safety vector varies with the situation, and rests in the judgment and skill of the controller, bearing in mind relative speed and turning rate. If the controller miscalculates and lets the bogey and fighters get too close together, a hard turn may save a tail chase.

It is desirable to have an offset of 3 to 4 miles between the bearing of the bogey and the po



tion of the fighters when the safety vector is given. This allows for turning circle of fighters and puts them approximately on the bearing of the bogey when they steady on.

CONTROLLED INTERCEPTION—OFFSET IN BEARING

R/T Transmissions

- 0800 ¹—"Mohawk Two-one, this is Mohawk. Vector zero-five-zero. Buster. Angels ten. Over."
 "This is Mohawk Two-one. Wilco vector zero-five-zero. Buster. Angels ten. Out."
- 0801 —"Mohawk Two-one, this is Mohawk. Steady at Angels. North five. Over."
 "This is Mohawk Two-one. Roger. Out."
- 0801 ¹—"Mohawk Two-one, this is Mohawk. Bogey ahead fifty. Over."
 "This is Mohawk Two-one. Roger. Out."
- 0803 —"Mohawk Two-one, this is Mohawk. Bogey ahead forty at seven thousand. Over."
 "This is Mohawk Two-one. Roger. Out."
- 0805 —"Two-one, this is Mohawk. Bogey ahead twenty-two. Over."
 "Two-one. Roger. Out."
- 0806 —"Two-one, this is Mohawk. Bogey ten o'clock seventeen. Over."
 "This is Two-one. Roger. Out."
- 0807 —"Two-one, this is Mohawk. Bogey one o'clock ten. Over."
 "Two-one. Roger. Out."
- 0807 ¹—"Two-one, this is Mohawk. Vector starboard two-zero-zero. Over."
 "Two-one. Wilco vector starboard two-zero-zero. Out."
- 0809 —"Tallyho. This is Mohawk Two-one. Eight o'clock one. One fish seven thousand. Over."
 "This is Mohawk. Roger. Out."

If fighters and bogey are directly head-on when the safety vector is given, they should be vectored around 90° to 10° past the bogey.

CONTROLLED INTERCEPTION—NO OFFSET BEARING

R/T Transmissions

- 0800 ¹—" (Hello) Mohawk Two-one, this is Mohawk. Vector zero-five-zero. Buster—Angels ten. Over."
 "This is Mohawk Two-one. Wilco vector zero-five-zero—Buster—Angels ten. Out."
- 0801 —"Mohawk, this is Two-one. Steady at Northeast five. Over."
 "This is Mohawk. Roger. Out."
- 0801 ¹—"Two-one, this is Mohawk. One bogey ahead fifty-five. Over."
 "Two-one. Roger. Out."
- 0803 —"Mohawk Two-one, this is Mohawk. Bogey ahead forty at seven thousand. Over."
 "This is Mohawk Two-one—Roger. Out."
- 0805 —"Mohawk Two-one, this is Mohawk. Bogey ahead twenty-five. Over."
 "Two-one—Roger. Out."
- 0806 —"Two-one, this is Mohawk. Bogey ahead twelve o'clock fifteen. Over."
 "Two-one—Roger. Out."
- 0806 ¹—"Two-one, this is Mohawk. Bogey ahead twelve o'clock eleven. Over."
 "Two-one—Roger. Out."
- 0807 —"Two-one, this is Mohawk. Vector port two-zero-zero. Over."
 "Two-one, Wilco vector port two-zero-zero. Out."
- 0808 ¹—"Tallyho, this is Mohawk Two-one. Eight o'clock two. One rat seven thousand. Over."
 "This is Mohawk—Roger. Out."

(f) Use of Zig-Zag Procedure

If the fighters do not sight the bogey when they cross its track, give them a vector which will take them back across the bogey's track. Continue this zig-zag procedure until the bogey is sighted.

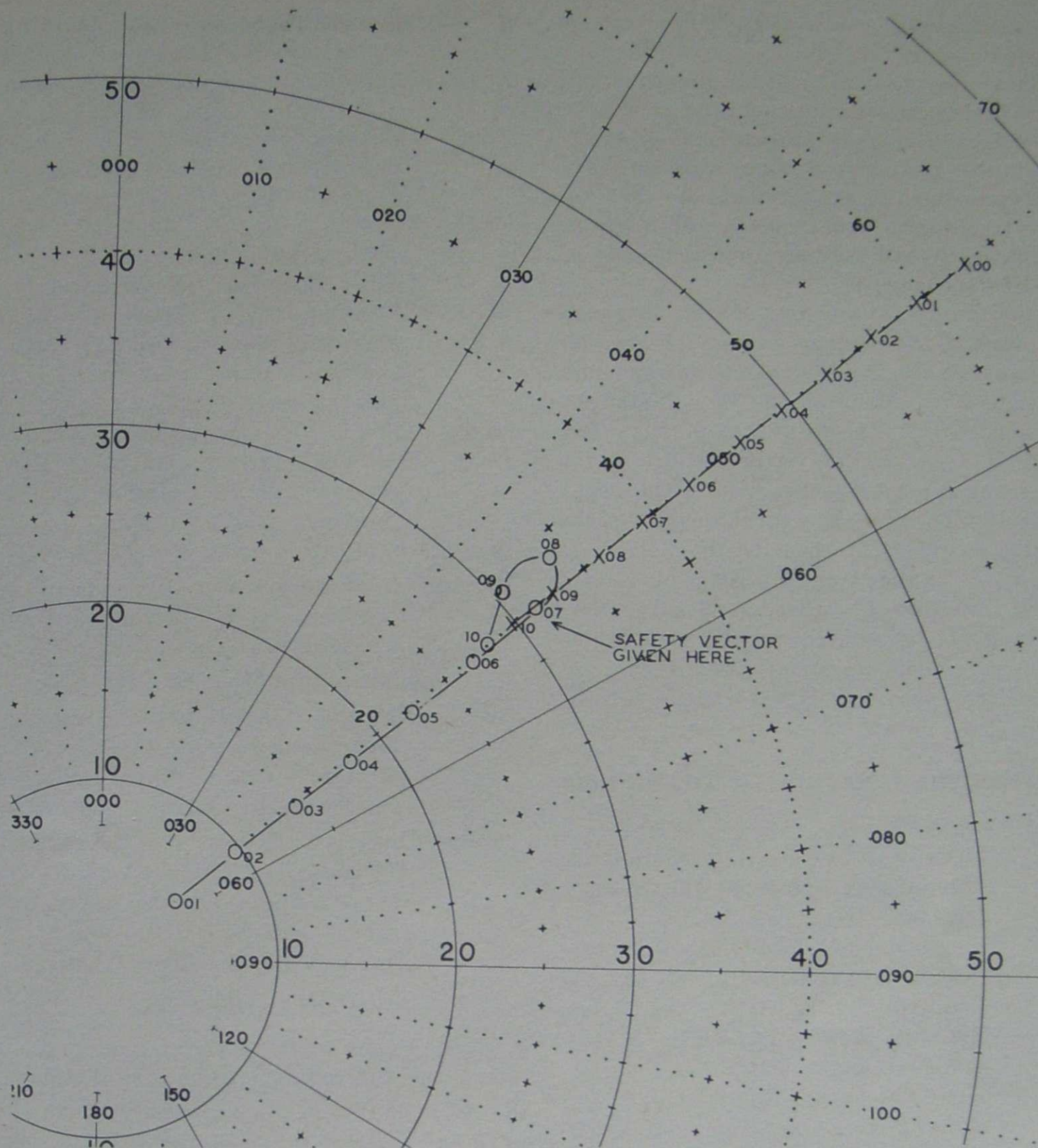


Figure 102.—Plot of controlled interception, no off-set in bearing.

and unrestricted communications with the fighters. In the absence of one or both, the controller may be unable to exercise the precise control necessary to make a successful interception. In a controlled interception a late turn

(h) Intercepting a Crossing Target

The "20° to 40°" rule for the safety vector does not apply to a crossing target. If fighters crossed the bogey's track, the bogey would be between the fighters and the base, if the bogey was to turn in towards the base.

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mean that the bogey would get even farther inside the fighters.

Since the relative speed is considerably slower in the case of a crossing target, the fighters can be allowed to approach closer to the bogey before the safety vector is given. The safety vector, in this case, should not cross the bogey's track, but should come to within definite visibility range of the bogey and then parallel inside of the bogey.

Always turn in the direction the bogey is traveling. For example, if a bogey bears 090° from base on a course 180°, a good safety vector would be 230°, assuming that the fighters were on same bearing as bogey at the time the safety vector is given. Such a vector would keep the fighters in a good position even if the bogey suddenly turned in. The turning circle of the fighters would carry them to the immediate vicinity of the bogey, and a tally-ho should result in the turn or immediately after they steady on. If not, and the range between fighter and bogey commences to open, turn them back toward the bogey and repeat the above procedure at the proper time.

CONTROLLED INTERCEPTION—CROSSING RAID

R/T Transmissions

0800¹—"Mohawk Two-One, this is Mohawk. Vector zero-four-zero—Buster—Angels ten. Over."

"This is Mohawk Two-One. Wilco vector zero-four-zero—Buster—Angels ten. Out."

0801—"Mohawk, this is Two-One. Steady northeast nine. Over."

"This is Mohawk—Roger. Out."

0802—"Mohawk Two-One, this is Mohawk. One bogey ahead forty. Over."

"This is Mohawk Two-One. Roger. Out."

0804—"Mohawk Two-One, this is Mohawk. Bogey ahead twenty-five, at seven thousand. Over."

"This is Mohawk Two-One—Roger. Out."

"This is Mohawk Two-One. Wilco vector starboard zero-eight-zero. Over."

0805¹—"This is Mohawk Two-One. Steady. Out."

0806—"Mohawk Two-One, this is Mohawk. Bogey eleven o'clock fifteen. Over."

"Two-One. Roger. Out."

0807—"Two-One, this is Mohawk. Bogey eleven o'clock ten. Over."

"This is Two-One. Roger. Out."

0808—"Two-One, this is Mohawk. Vector starboard two-two-zero. Over."

"Two-One. Wilco vector starboard two-two-zero. Out."

0809—"This is Two-One. Steady. Out."

0810—"Two-One, this is Mohawk. Bogey seven o'clock five. Over."

"Two-One. Roger. Out."

0811—"Two-One, this is Mohawk. Vector hard port one-zero-zero. Over."

"Two-One. Wilco vector hard port one-zero-zero. Out."

0811¹—"This is Two-One. Steady. Out."

0812—"Two-One, this is Mohawk. Vector starboard two-two-zero. Over."

"Two-One. Wilco vector starboard two-two-zero. Out."

0812¹—"Two-One. Steady. Out."

"Tallyho—This is Mohawk Two-One. Bogey seven o'clock. One fish seven thousand. Over."

"This is Mohawk—Roger. Out."

(i) No Clock Code During Turns

When steady on safety vector, fighters should have bogey in a position for prompt sighting. If not, change the vector to accomplish this. Position of the bogey should be given in clock code to the pilots when steady. It is impractical to give clock code position of bogey while fighters are in a turn.

(j) A "Must" Precaution

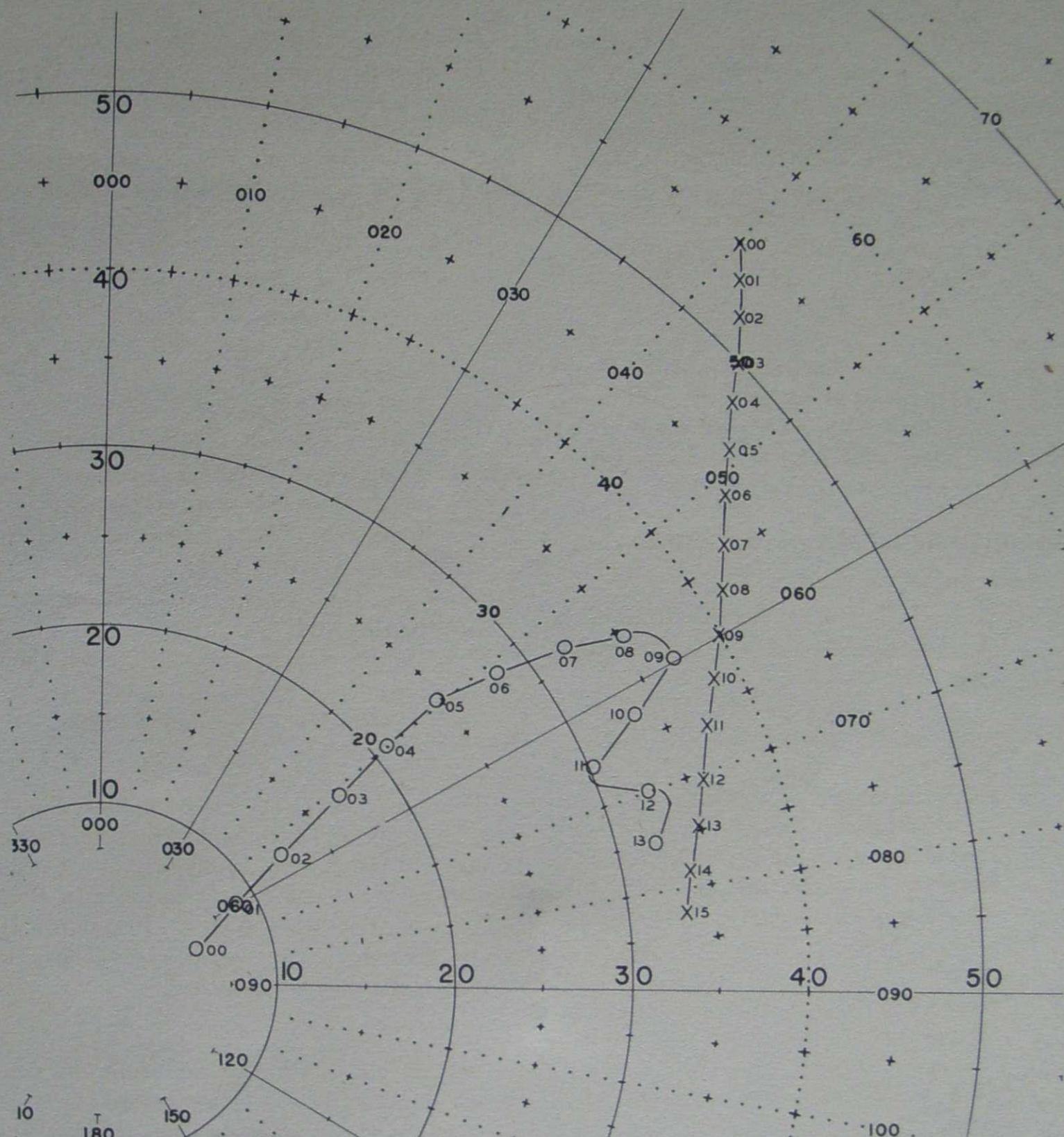
There is one precaution in using the controlled interception that *must* be observed. Information is lacking on position of fish.

another sweep." If this procedure results in turning too soon and steadying on too far ahead of the bogey, there are ways to remedy the situation. The fighters can be slowed down; or if this is impractical, they can be given a vector normal to the bogey's track, and after the bogey

has "caught up" turned to a course that will cross the bogey's track by 20° to 40° .

(k) *Control Requires Skill*

A successful controlled interception requires a large degree of skill, and should not be attempted by an inexperienced controller.



CHAPTER THIRTEEN

NIGHT INTERCEPTIONS

- A. INTRODUCTION.
- B. THE PPI.
- C. USE OF PLOTTING BOARD AND COMPUTERS.
- D. ALTITUDE DETERMINATION.
- E. NIGHT FIGHTER AIRCRAFT.
- F. AIRBORNE INTERCEPT RADAR.
- G. R/T PROCEDURE.
- H. RELATIVE SPEED.
- I. RELATIVE ALTITUDES FOR APPROACH.
- J. STANDARD RATE TURNS.
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- L. TYPES OF INTERCEPTION:
 - 1. The Curve of Pursuit Method.
 - 2. The Cut-Off Vector Method.
 - 3. Precautions in Executing the Cut-Off Method.
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- O. TRANSFER OF CONTROL OF NIGHT FIGHTERS.

"(Strictly speaking, positive control means that the controller has radar contact on the plane and two-way communication with the pilot.) The controller must insure that the night fighter is kept clear of navigational hazards such as mountains and fixed obstructions. The pilot should at times be advised of the proximity of such hazards.

In order to insure that safety of flight is maintained, it is mandated that the controller inform the pilot immediately when the night fighter is not under positive control, and that he is being dead reckoned. When positive control is lost the pilot should be advised to use the facilities at his disposal in order to remain clear of navigational hazards."



Figure 104.

CHAPTER 13

NIGHT INTERCEPTIONS

Note: The methods, procedures, and techniques, described in this chapter, for effecting Night Interception with conventional type aircraft, were evolved and proven during World War II. These methods, procedures, and techniques are still effective and will continue to be effective for some time to come. New methods to meet the future requirements for high speed, high altitude type interceptions using jet aircraft are presently being developed. As changes to the existing procedures are adopted they will be promulgated.

A. INTRODUCTION

The function of the night controller is to employ the equipment, facilities, and personnel at his command in such a manner as to place a night fighter plane in a favorable position within A. I. radar range of a designated hostile aircraft in the minimum time. Tactics vary with the situation but certain successful methods have been worked out, tested, and adopted as standard procedure. It has been established that for night air control it is best to bring the fighter astern of the bogey, on the same heading,

the bogey and within the operational limit of its radar gear, the pilot is able to take over and complete the interception.

Whereas the day controller is satisfied with giving the day pilot an accurate vector to the bogey and an estimated altitude, the night controller must be explicit in his direction of the night fighter. The confidence of the pilot in the night controller must be absolute, and this is accomplished only where the controller, having accepted the responsibility for the control, has fitted himself for the job.

The night controller must be thoroughly familiar with the performance figures for the type aircraft he is to control. He must know the operational limitations of his search radars and the characteristics of the air-battle radar in use at the time. Furthermore, he must be proficient in the use of the abbreviated procedure employed in night air control. The night controller must at all times maintain positive control of the night fighter, and must insure that the night fighter does not enter within range of friendly ships or bases.

DIFFERENCE BETWEEN NIGHT AND DAY INTERCEPTION

B. THE PPI

The night controller in all cases controls directly from the PPI scope while exact information as to the bogey's heading and speed is furnished him by a plotter. Controlling directly from the PPI enables the controller to:

1. "see" his aircraft and its position relative to a bogey without time lag;
2. read the positions of both intercepting and intercepted aircraft simultaneously on one instrument.

It is sometimes advantageous to conduct the initial stages of the interception from search radars, and then shift to microwave sets for the final stages. During the final moments of an interception, the fighter is more easily distinguished from the bogey on the PPI scope of a microwave set.

The day controller normally controls his intercepts directly from a PPI scope also, but in

some instances a successful day interception can be made from an air plot.

C. USE OF PLOTTING BOARD AND COMPUTERS

Although the night controller controls directly from the PPI scope, an accurate plot should be maintained on either a plotting board or the DRT. A summary plot of the tactical situation, both air and surface, is mandatory.

Instructions to the pilot should be as simple as possible. The pilot should not be required to perform any computation that can be furnished for him by CIC. For instance, the heading should be given to the pilot as magnetic heading, the speed as indicated air speed, and the altitude as indicated altitude.

D. ALTITUDE DETERMINATION

(See Chapter 7)

The altitude of hostile aircraft may be determined by a number of methods. These are

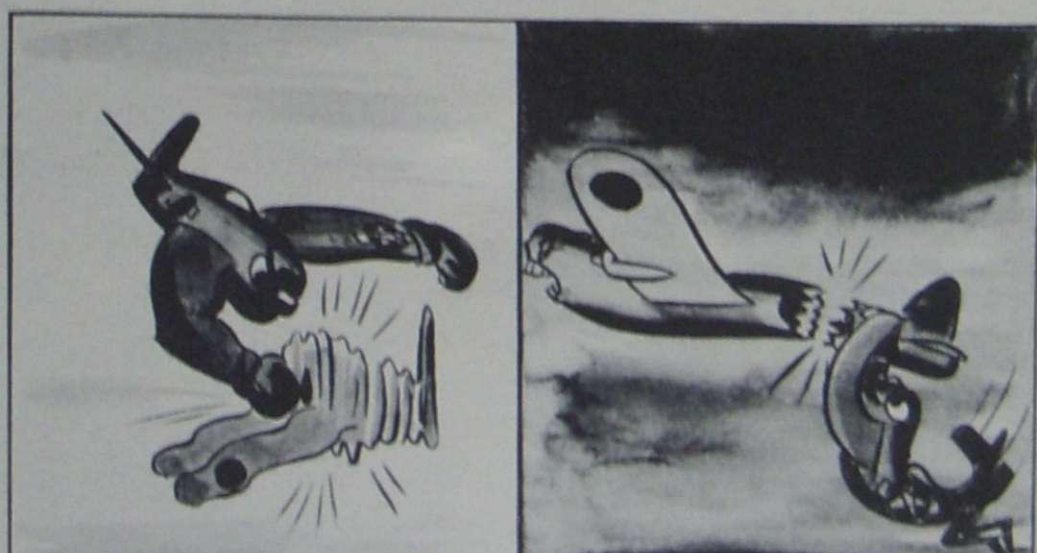




Figure 106.

1. Fade charts.—Fade chart findings hold true only for bogies at a constant altitude, however.

2. Microwave sets.—These sets either read altitude directly or give the elevation angle which is converted to altitude by reference to a chart. (See Chapter V.)

3. Airborne gear.—The airborne radar will give the fighter's altitude relative to bogey once AI radar contact has been made.

E. NIGHT FIGHTER AIRCRAFT

The following are requirements for effective night fighter aircraft:

1. Efficient radar gear.
2. Heavy firepower.
3. Adequate field of visibility for night identification of bogies.
4. Stability in flight.
5. Speed.

8. Endurance.

Night fighter aircraft may be either single or multiengined. The usual multiengined plane has greater firepower, carries more fuel, and has heavier radar gear. However, a single-engine fighter is better suited for carrier operations because of its smaller size.

F. AIRBORNE INTERCEPT RADAR

Airborne radar gear used for night and visibility interception generally searches a field of 120° forward of the plane. The gear has several settings:

1. Search.—Used for mapping, intruder detection, and homing.
2. Intercept.—Used in interception, the intercept setting gives range, azimuth, and altitude of the bogey relative to the fighter.
3. Gunsight.—Used in the final moment of an interception, the gunsight setting enables

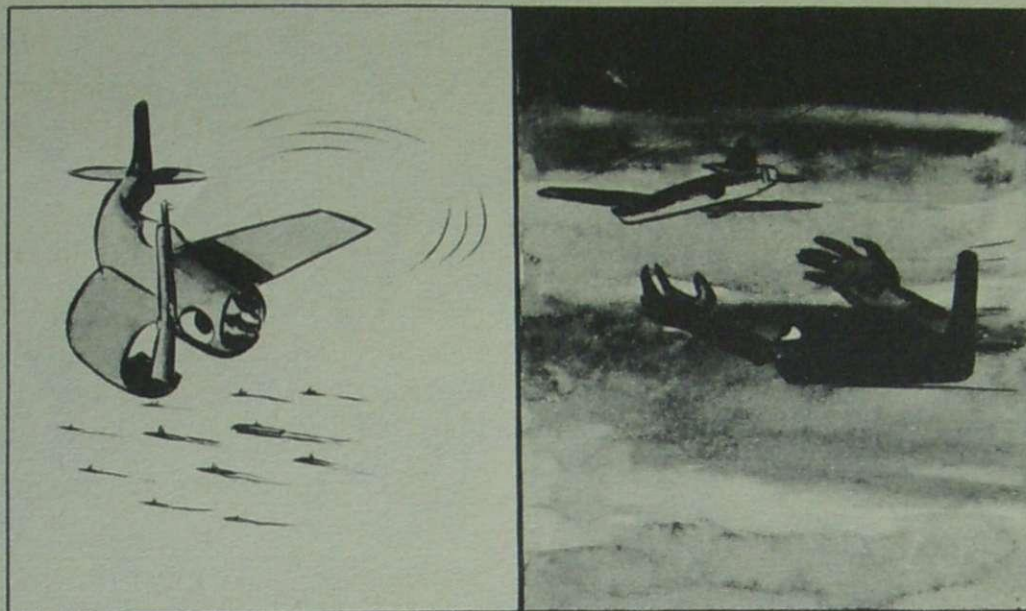


Figure 107.

G. R/T PROCEDURE

In low-visibility interception, action is much faster and more instructions are given by the fighter director than during any other form of interception. Because of this, the R/T for low-visibility interception is greatly shortened and very informal. When a night fighter is on the tail of a bogey, the night controller has no time for long call signs or for wordy instructions. Directions must be given as quickly as possible.

In general, there are five important transmissions which should be given to the pilot during the approach period of night interception.

The five basic transmissions are:

1. Pilot is given the original vector plus the phrase. "For bogey." *Example:* "Mohawk One This is Mohawk. Port zero-seven-zero for bogey. Over." This starts the pilot on the

angels to fly. *Example:* "One. Speed twenty. Angels ten. Over."

3. Pilot is told the position of the bogey. *Example:* "One. Bogey northeast thirty. Over."

4. Pilot is given security check on his altitude after he has reported "Level." This lets the controller know that he is at the altitude the controller believes is right for the interception. *Example:* "One. Bogey eight thousand. Your altitude? O. K.? Over." (This is the pilot's opportunity to request a different altitude in view of local conditions.)

5. Bogey's heading and indicated air speed are given to pilot. This may take the form of two separate transmissions as very often the heading of the bogey is known before the indicated air speed has been calculated. *Example:* "One. Bogey heading two-zero-zero indicating one eighty. Over."

The five general transmissions listed may

All orders are always followed by "Over." However, after the safety vector (the vector which is approximately 40° off the target's heading) all information given by the controller is followed by "Out."

When giving fighter aircraft a new heading, the controller should always indicate whether the turn should be made to port or starboard. This indication of direction of turn should be given *before* the heading, for instance: "Port three-four-zero." This enables the pilot to start this turn in the proper direction immediately, even if he fails to understand the vector and finds it necessary to ask for a repeat. It also obviates the need for the pilot's deciding which way to turn, with consequent delay and possible confusion.

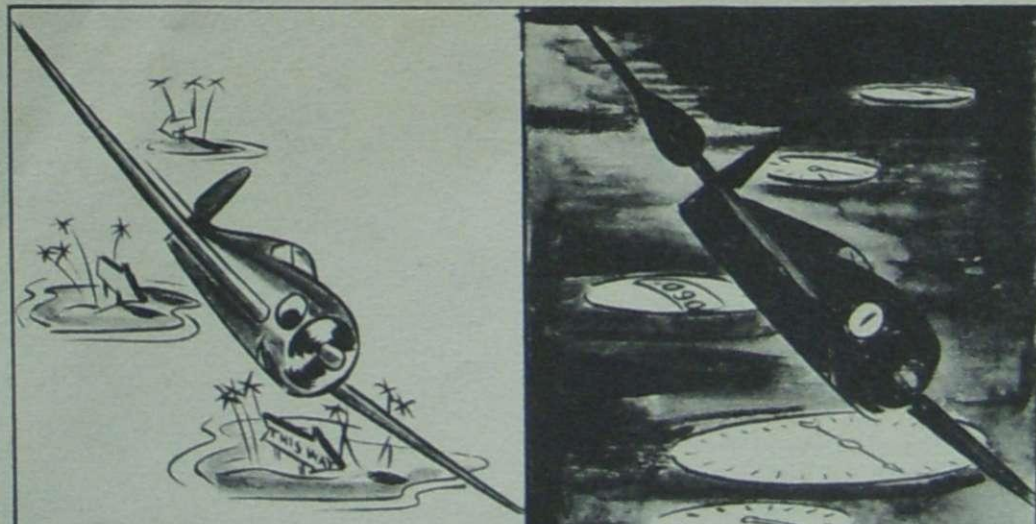
Throughout the interception, the controller should keep the pilot advised of the bogey's position and action in a sort of "running commentary" on the situation. Information passed to the pilot will usually include range, clock-code bearing, direction of flight, bogey's speed, alti-

tude, and any type of evasive action that may be noted.

H. RELATIVE SPEEDS

It is reasonable to assume that in the majority of his operations the night controller will be dealing with a fighter aircraft possessing a definite speed advantage over the bogey, which will ordinarily be a larger and more heavily loaded plane. Full use of this advantage should be made at the start of the interception. It is desirable to complete the interception as quickly as possible, and the use of high speed by the fighter is one means of accomplishing this. It is much easier to bring the fighter down in the late stages of an interception than it is to gain speed in an emergency.

However, once the fighter has been turned behind the bogey on the proper heading and is within theoretical AI radar range, care must be taken that his overtaking speed is not so great that he "overshoots" the target. The night controller at this time should adjust the fighter's speed so that it exceeds that of the bogey.



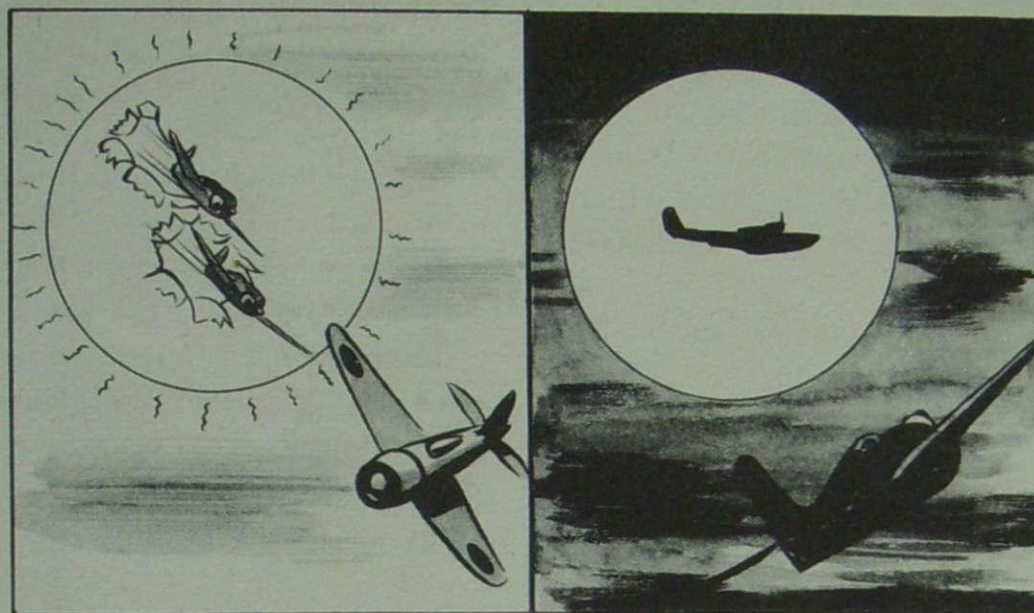


Figure 109.

10 to 30 knots. Should the fighter be too far behind the bogey for AI radar contact when turned onto course, his speed can be increased until he gets within range.

I. RELATIVE ALTITUDES FOR APPROACH

Standard procedure is to direct the fighter 500 feet below and a mile or two astern of the bogey. It is far easier for the fighter to climb up to meet the bogey than to descend upon it from above. If the fighter is placed too high he will have difficulty in descending during the AI radar phase without overshooting.

However, the desirable relative altitudes of fighter and bogey will depend on weather and visibility conditions. On a moonlight night, above an overcast, the fighter may prefer to approach from above, thus avoiding the chance of being silhouetted against the light background

should direct his fighter in such a way to avoid approach from a direction that will place him between a brilliant moon and the target.

J. STANDARD RATE TURNS

For accurate timing of turns, the standard rate turn ($3^\circ/\text{sec.}$) is prescribed for general use. A hard turn may be used when necessary ($6^\circ/\text{sec.}$).

K. THE THREE BASIC VECTORS OF A STANDARD INTERCEPTION

A standard interception consists of three basic vectors: the *cut-off vector*, the *safety vector*, and the *on-course vector*, in that order.

The *cut-off vector* is the initial vector used to put the fighter in the vicinity of the target and in such a position that he can then



Figure 110.

directly astern of the bogey on the bogey's course.

Figure 112 illustrates the use of these vectors in a standard interception.

L. TYPES OF INTERCEPTION

Probably the three most common methods of interceptions are the curve-of-pursuit method, cut-off vector method and head-on.

1. The Curve-of-Pursuit Method

The curve-of-pursuit method is simply a matter of keeping the fighter pointed toward

the bogey. A succession of vectors is given the fighter to keep him constantly on a heading toward the bogey. If the fighter has a speed advantage, he will eventually overtake the bogey and get on the proper heading. To execute the method of pursuit, the controller has only to establish the compass bearing from fighter to bogey and give this to the fighter as heading. A new heading is given with each change of bearing. As a result the fighter will fly a gradual curve until the bogey is overtaken. New vectors may be given as often as every 10 seconds, resulting in a very steady approach.

Figure 113 illustrates the curve-of-pursuit method.

The curve-of-pursuit method of interception has disadvantages. It is slow, and therefore time is wasted. Furthermore, it may result in a tail chase unless the fighter has a very considerable speed advantage, and a long tail chase is something definitely to be avoided. Keeping the fighter in 3 or 4 miles behind the bomber may be fatal, for the tail gunner in an enemy bomber, given enough time, may spot the fighter before the latter can close for a kill.

Turns

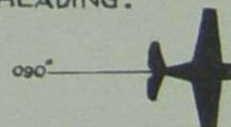


YOU CAN'T
OUTGUESS 'EM!

"PORT THREE-THREE-ZERO"
MAKE A STANDARD RATE TURN
AND STOP WHEN STEADY ON
330° HEADING.



"HARD PORT THREE-THREE-ZERO"
FORGET STANDARD RATE AND
MAKE A TIGHT TURN TO
330° HEADING.



INSTRUCT YOUR PILOTS TO MAKE
STANDARD RATE TURNS!

... AND MAKE 'EM RIGHT ...

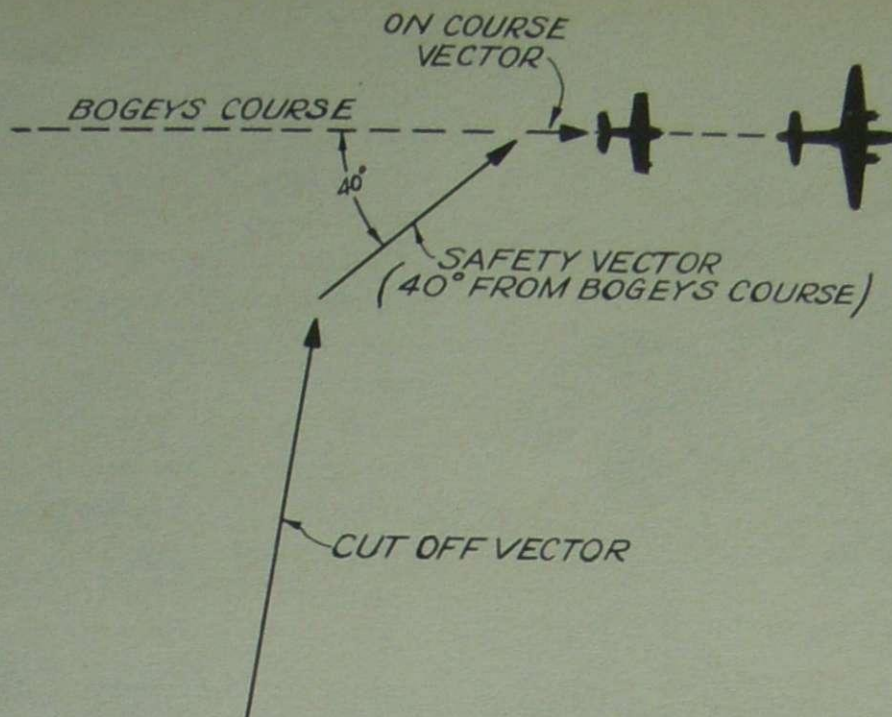


Figure 112.—Basic vectors of night interception.

TARGET HEADING=270

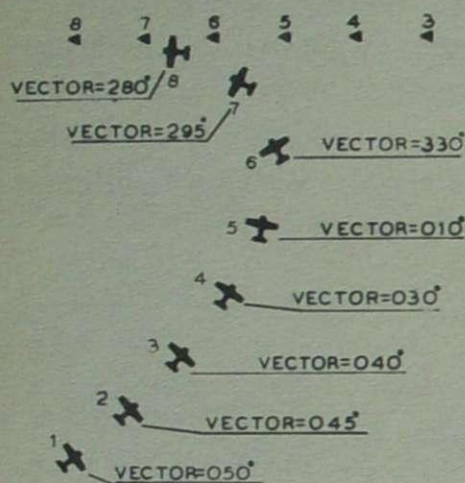
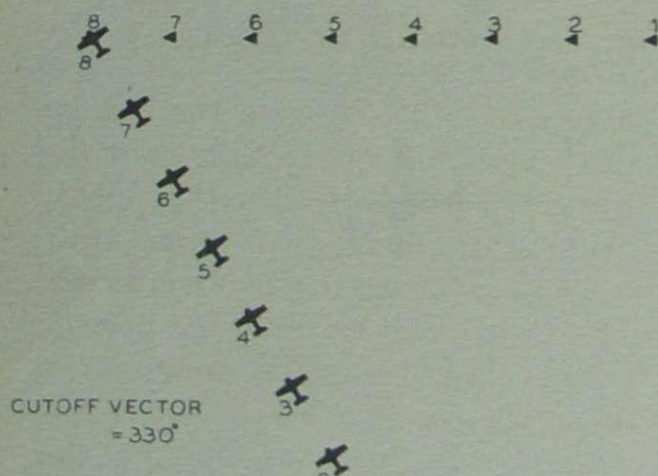


Figure 113.—Curve of pursuit method of interception.

TARGET HEADING = 270°



2. The Cut-off Vector Method

This type of interception is accomplished with fighter and bogey travelling at almost equal speeds, the fighter requiring no more than a 10 to 30 knot advantage over the bogey. The controller gives his fighter a vector which will cut off the bogey at a point some distance ahead. The controller determines this course on the basis of almost equal speeds. Therefore, given equal speeds, he must send his fighter towards the one point on the bogey's projected track at which both fighter and bogey will reach simultaneously. Since the speeds are almost equal, the distance travelled by the fighter and target will be equal. Thus, set on a collision course, the fighter would meet his target at the apex of an isosceles triangle, as shown in the diagram below (fig. 114).

A few miles before this collision point is reached the controller turns his fighter onto the safety vector (40° less than a complete turn onto the bogey's heading). This safety vector is quickly followed by a final turn onto the bogey's heading which puts the fighter in the proper position (a mile or two directly astern

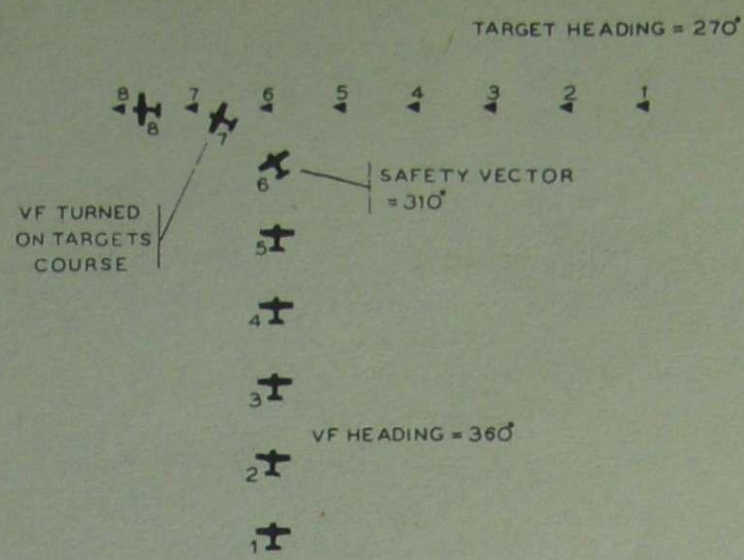


Figure 115.—Cut-off interception.

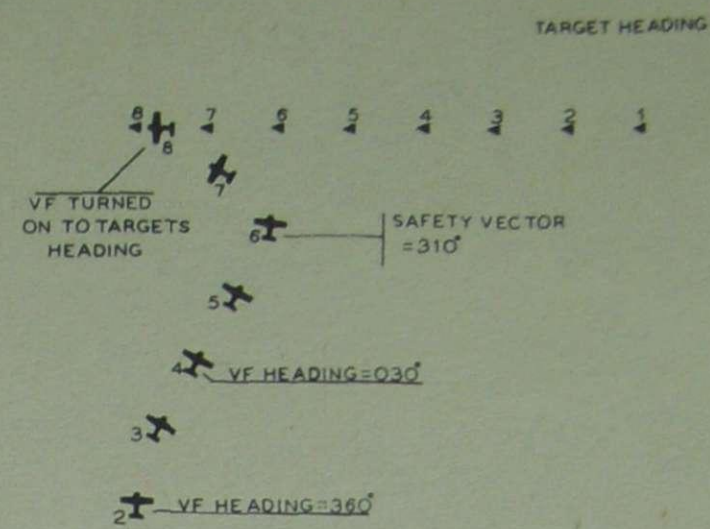


Figure 116.—Precautionary use of cut-off vector.

3. Precautions in Executing the Cut-off Method

When selecting a cut-off vector, the night controller should bear in mind the danger of putting his night fighter in such a position that a tail chase is necessary. To lessen this possibility, he may give a vector which, if continued, would place the fighter slightly ahead of the bogey. He may, in addition, order the fighter to assume a speed of 10 to 15 knots greater than that of the bogey. If, as the fighter approaches the position to execute the safety vector, he is too far advanced, he can be directed to the proper position by altering the vector in the direction of the bogey.

Roughly 3 miles before the fighter reaches the bogey's projected track (the mileage depending on the distance covered by the fighter's standard rate turn), the fighter is turned onto the safety vector.

Finally, a half to three-quarters of a mile from the point where the safety vector would cross the bogey's course, the fighter is turned onto the bogey's heading. The fighter's radar contact should then be immediate if he has not already made a contact on the safety vector.

The precautionary use of a cut-off vector which projects beyond the collision point is illustrated in figure 116.

4. The Head-on Interception

This is probably the most difficult type of

rocal or nearly reciprocal courses is very gr
Consequently, timing of orders must be pre
and R/T lag estimated much more accurat
than usual. The controller running his f
head-on interception is almost invariably
tonished at the rapidity with which the
aircraft come together.

The generally approved method of handl
the head-on interception is to vector the figh
slightly off the reciprocal, allowing 4 miles
placement. This means that there will be

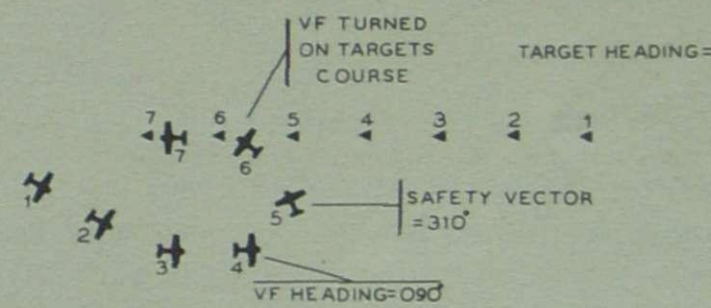


Figure 117.—Head-on interception, high relative speed.

off-set distance of 4 miles between the bog
projected track and that of the fighter at
time the latter is turned. When the figh
reaches a point approximately 5 miles av
from the bogey, he is turned to a new course
off the bogey's course and crossing the boge
track. This new heading is the same as
safety vector in the cut-off method and is f
lowed by a turn onto the bogey's heading at

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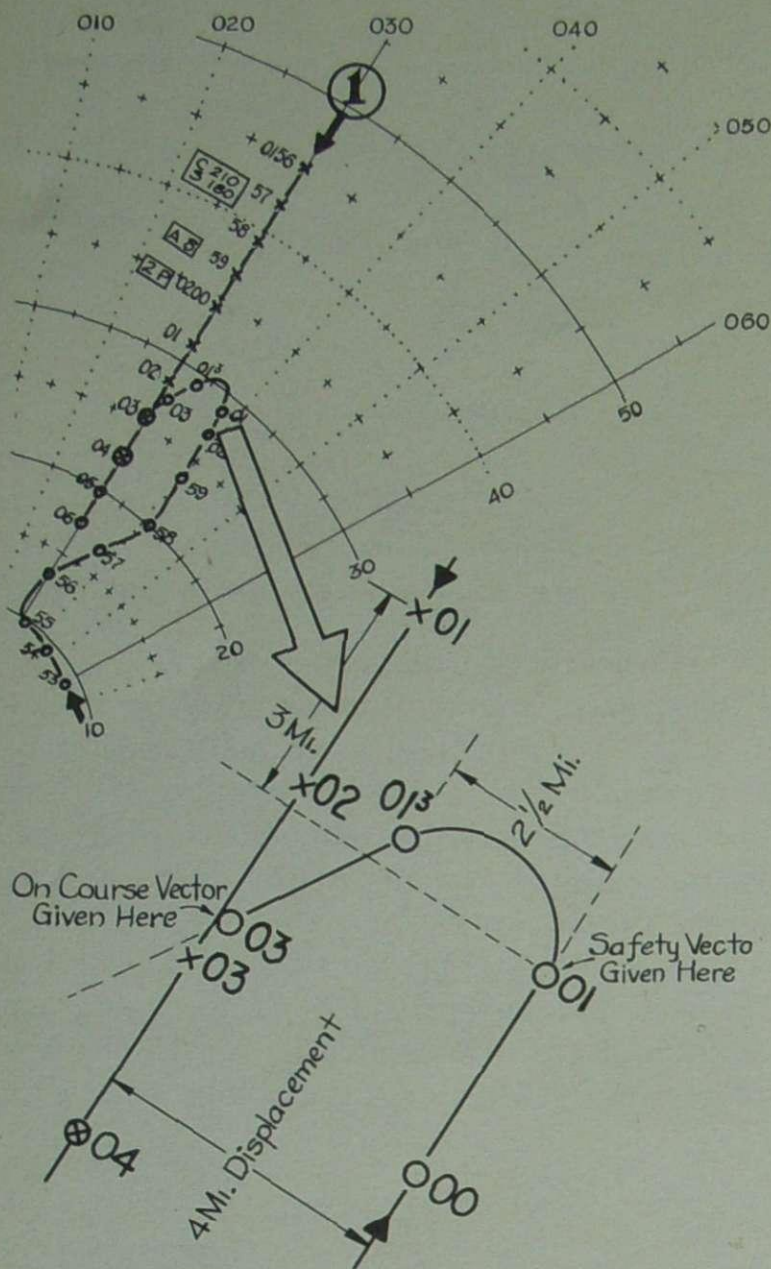


Figure 118.—A head-on night interception.

to shorten the tail chase and to avoid the tail warning set in the bandit. It also may be necessary to have the night fighter turn off his IFF when within 10 to 15 miles of the bandit to prevent the latter from picking up the IFF signal.

A HEAD-ON-NIGHT INTERCEPTION

R/T Transmissions

0155—Con- "Mohawk Fifteen-Two. This is
troller: Mohawk. Starboard zero-
three-zero for bogey. Over."
VF: "This is Mohawk Fifteen-Two.

VF: "Speed two twenty. A
seven point five. Out."
Controller: "Two. Bogey northeast
Over."
VF: "Roger. Out."
VF: "Steady. At Angels. Out."
Controller: "Two, Starboard zero-five
Over."
VF: "Starboard zero-five-zero. Out."
VF: "Steady. Out."
Controller: "Two. Bogey eleven o'clock
twenty-eight. Over."
VF: "Roger. Out."
0157—Con- "Two. Bogey heading two
troller: zero, indicating one e
Over."
VF: "Roger. Out."
0158—Con- "Two. Port zero-three
troller: Over."
VF: "Port zero-three-zero. Out."
Controller: "Steady. Out."
Controller: "Bogey eleven o'clock, eight
Over."
VF: "Roger. Out."
VF: "Level. Out."
Controller: "Bogey eight thousand.
angels Okay? Over."
VF: "Affirmative. Out."
0159—Con- "Two bogeys eleven o'clock
troller: fifteen. Over."
VF: "Roger. Out."
Controller: "Bogey eleven o'clock, tw
Over."
VF: "Roger. Out."
Controller: "Throttle back twenty. Ov
VF: "Throttle back twenty. O
0200—Con- "Bogey eleven o'clock,
troller: Over."
VF: "Roger. Out."
0201—Con- "Two, port two-four-zero. O
troller:
VF: "Port two-four-zero. Out."
0201²—Con- "Bogey twelve o'clock, t
troller: crossing. Punch. Over."
VF: "Punch. Out."

0203—Con- "Port two-one-zero, bogey's head-
troller: ing. Over."
VF: "Port two-one-zero. Out."
VF: "Contact. Out."

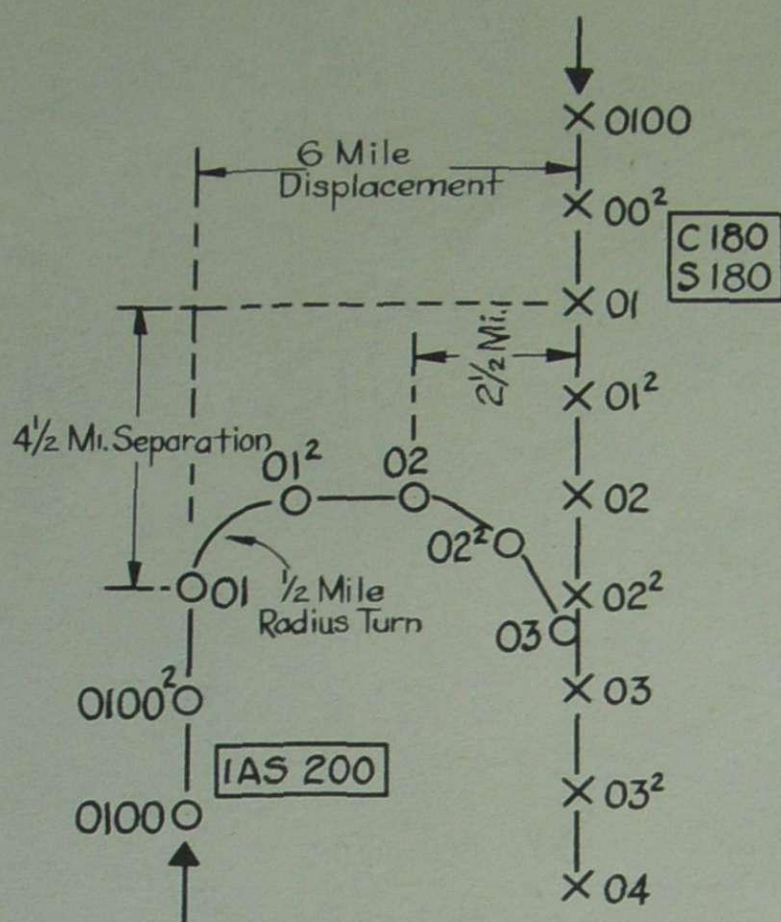


Figure 119.—Large displacement in a head-on raid.

5. Displacement

Displacement is the distance between the bogey's projected track and the fighter's position when it commences to turn. A displacement of 3 to 6 miles allows for the fighter's turning diameter, avoids enemy air-borne radar and gives the night controller maneuvering room. In a head-on raid 4 miles should separate fighter from bogey when the turn is given. In a jinking raid, 5 to 6 miles is allowed.

Factors influencing the amount of displacement are the fighter's turning diameter, the presence or absence of enemy jinking, and the ability of the enemy to detect the fighter either electronically or visually.

The choice of side on which to get displacement is conditioned by the following:

(a) Light conditions.—When time allows.

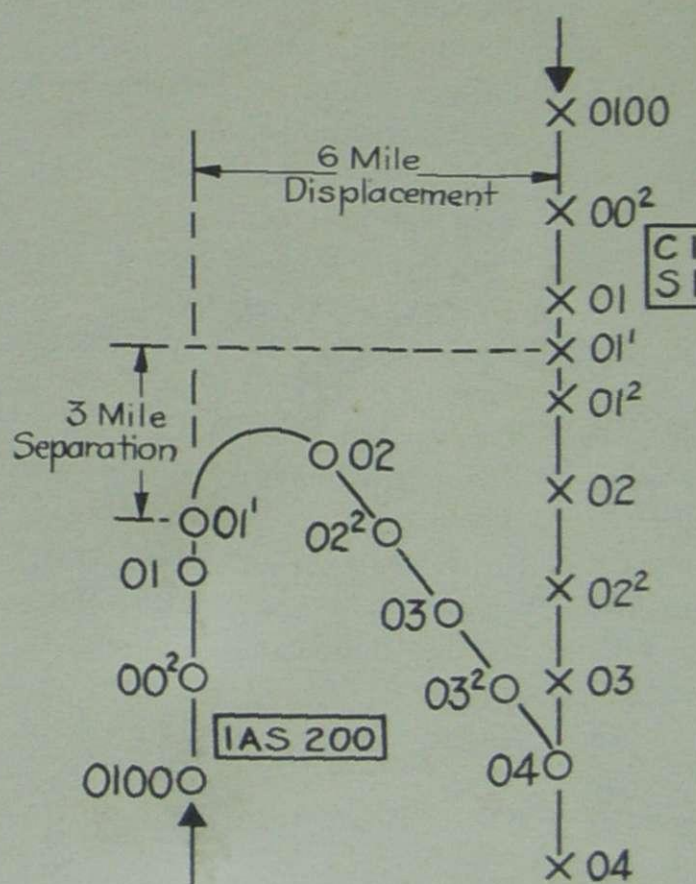
(b) Position of the base.—If there is otherwise equal choice of side for displacement the side toward the base might well be chosen. If the enemy turns toward the base, the gain is evident; if he turns away, there is still time for the development of the interception.

LARGE DISPLACEMENT IN A HEAD-ON

R/T Transmissions

0100^2— At this time the bogey is at ten o'clock ten miles. The 10-mile displacement is usually considered too much.

0101—Con- "Two. Starboard zero-nine-
troller: Over."
VF: "Starboard zero-nine-zero. Out."
0101^2—VF: "Steady. Out."
Controller: "Two. Bogey eleven thirty and one half. Over."
VF: "Roger. Out."
0102—Con- "Two. Starboard one-two-
troller: Over."
VF: "Starboard one-two-zero. Out."



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Controller: "Bogey twelve o'clock. Two. Crossing to starboard. Punch. Over."

VF: "Punch. Steady one-two-zero. Out."

0102²—Con- "Starboard one-five-zero. Over." troller:

VF: "Starboard one-five-zero. Out."

Controller: "Bogey twelve o'clock one and a half. Out."

0103—Con- "Two. Starboard one-eight-zero. troller: Bogey's heading. Over."

VF: "Starboard one-eight-zero. Out."

FD: "Bogey twelve o'clock, one. Out."

VF: "Contact."

A Crossing Raid

The procedures to follow in dealing with a crossing raid are illustrated and set forth in the following diagrams.

R/T Transmissions

2200—Con- "Mohawk Fifteen-Two. This is troller: Mohawk. Port-zero-four-zero for bogey. Over."

VF: "This is Mohawk Fifteen-Two. Port-zero-four-zero. Out."

Controller: "Two. Speed two twenty. Angels five. Over."

VF: "This is Two. Speed two twenty, at Angels five."

Controller: "Two. Bogey northeast thirty-five. Over."

VF: "Roger. Out."

2201—Con- "Two. Starboard zero-nine-zero troller: Over."

VF: "Starboard zero-nine-zero. Out."

Controller: "Two. Bogey heading one-eight-zero, indicating one-eighty. Over."

VF: "Roger. Steady zero-nine-zero. Out."

Controller: "Two. Bogey ten o'clock, thirty. Out."

VF: "Roger. Out."

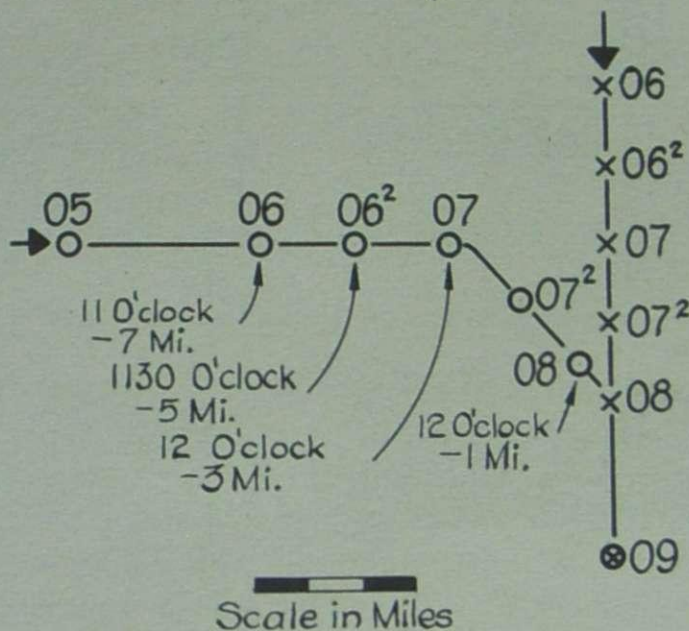
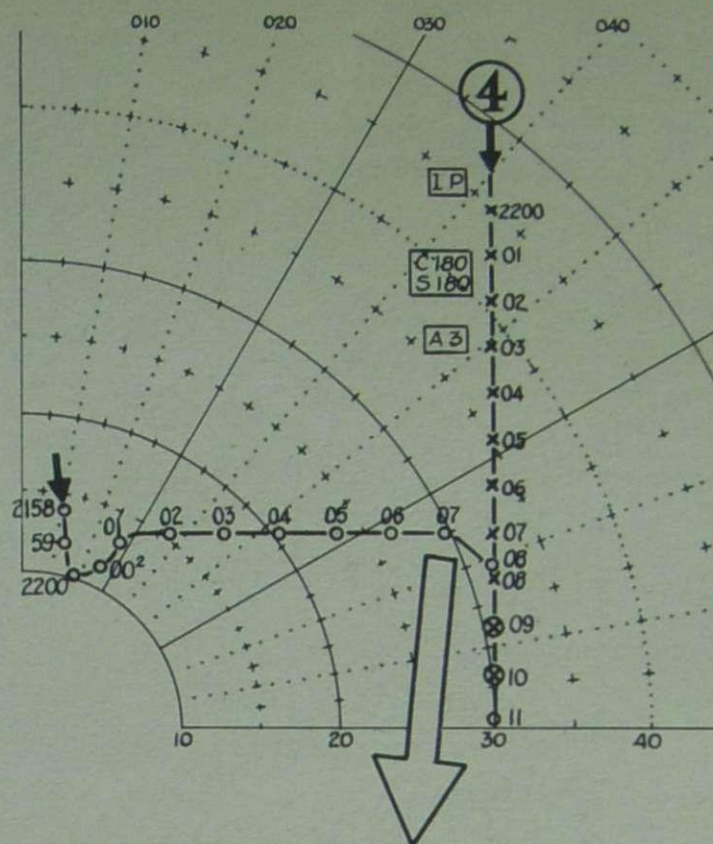


Figure 121.—A crossing raid.

Controller: "Two. Bogey three thousand. Over."

VF: "Roger. Out."

Controller: "Two. Single bogey, eleven o'clock, twenty. Over."

VF: "Roger. Out."

Controller: "Two. Bogey heading one-eight-zero, indicating one-eighty. Over."

0411²—Con- "Two. Bogey eleven o'clock.
troller: One. Out."
Controller: "Two. Starboard one-eight-zero
bogey's heading. Over."
VF: "One-eight-zero. Out."
Controller: "Look up. Over."
VF: "Contact. Out."

CORRECTION WHEN FIGHTER CLOSES AHEAD OF BOGEY

R/T Transmissions

0329—Con- "Fifteen-Two. Bogey eleven
troller: o'clock. Nine. Over."
VF: "Roger. Out."
0330¹—Con- "Two. Starboard one-eight-
troller: zero. Bogey's heading. Over."
VF: "Starboard one-eight-zero. Out."
0331— VF: "Steady. Out."
Controller: "Two. Hard starboard two-
seven-zero. Over."
VF: "Hard starboard two-seven zero.
Out."
0331²— VF: "Steady. Out."
Controller: "Bogey six o'clock. One. Over."
VF: "Roger. Out."
0332—Con- "Two. Hard port zero-nine-zero.
troller: Over."
VF: "Hard port zero-nine-zero. Out."
0332²— VF: "Steady. Out."
Controller: "Two. Starboard one-two-zero.
troller: Over."
VF: "Starboard one-two-zero. Out."
VF: "Steady. Out." *
Controller: "Bogey eleven thirty. Two.
Punch. Over."
VF: "Punch. Out."
0333—Con- "Two, Starboard one-five-zero.
troller: Over."
VF: "Starboard one-five-zero. Out."
VF: "Steady. Out."
Controller: "Bogey eleven thirty. One and
one half. Over."
VF: "Roger. Out."
0333²—Con- "Two. Starboard one-eight-zero.

A MERGED PLOT WITH NO CONTACT

R/T Transmissions

0329—Con- "Fifteen-Two. Bogey ele
troller: thirty. Nine. Over."
VF: "Roger. Out."
0330¹—Con- "Two. Starboard one-eight-z
troller: Bogey's heading. Over."
VF: "Starboard one-eight-zero. O
0331— VF: "Steady. Out."
Controller: "Two. Bogey twelve o'cl
one. Over."
VF: "No joy. Out."
Controller: "Two. Speed one eighty. Ov
VF: "Speed one eighty. Out."
Controller: "Two. Make "S" turns. Ov
VF: "Make "S" turns. Out."
VF: "No joy. Out."
0331²—Con- "Two. Starboard two-two-z
troller: Over."
VF: "Starboard two-two-zero. O
VF: "Steady. Out."
Controller: "Two. Bogey nine o'clock. O
0332²—Con- Two. Port one-four-
troller: Over."

VF: Port-one-four-zero. Out."

0333—VF: "Steady. Out."

Controller: "Two. Bogey eleven o'clock one and one half. Over."

VF: "Roger. Out."

Controller: "Bogey twelve o'clock. One. Over."

VF: "Roger. Out."

0333²—Con- "Two. Starboard one-eight-zero.
troller: Bogey's heading. Over."

VF: "Starboard one-eight-zero. Out."

VF: "Steady. Out."

Controller: "Bogey twelve o'clock. One. Over."

VF: "No joy. Weapon bent. Over."

Controller: "Speed two hundred. Try for a visual. Over."

VF: "Speed two hundred. Out."

M. EVASIVE ACTION

The night bogey can be expected to depart from the normal routine of straight and level flight at any stage of the approach. The type and scope of evasive action employed will generally depend on the type of plane, the ability

the night fighter in an orbit between the enemy plane and base to await further developments.

When the weave is encountered, the fighter director can either follow the zigzag course, turn for turn or have his fighter fly a straight heading along the middle path of the weave at some reduction in speed. This will enable him to get AI contact during the time the bogey is crossing the mean course on one of the legs of his weave.

When the bogey spirals while it also climbs or dives, care must be taken that the fighter does not overshoot the bogey. Successful interception will depend on the controller anticipating the dive or climb at the time the fighter moves within normal AI radar range.

The abrupt reduction of speed is used by the enemy to cause the fighter to overshoot. The best counteraction is to vector the fighter onto the course at a sharp angle, then turn him onto course.

Naturally all these methods of combat and evasive action are dependent on the tactical situation at the time.

N. CONTROL OF MORE THAN ONE NIGHT FIGHTER

Although generally only one plane is directed by one night controller, several planes can be controlled by one man, or from one base by intensification of teamwork, accurate communications, and the briefest R/T. Simultaneous raids should be treated as separate interceptions. Even if an incoming raid is but a single plane, it may be well to have a second plane in the area to take over the shoot-down if the guns or communications of the first plane are ineffective.

O. TRANSFER OF CONTROL OF NIGHT FIGHTER

It is not unusual for several bases to control the fighter during the course of a single interception. This transfer of control must be accomplished with a minimum of delay. The pilot need not know more than the call of the controlling base, the shift being announced to him only by the use of a new call. The fighter

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Op-34IDII
Serial:059
28 Sept.

From: Chief of Naval Operations

To: Distribution List

Subj: Radar Bulletin No. 8A (RADEIGHT-A); Change No. 2

Encl: (1) Chapter 13-A of RADEIGHT-A

1. Enclosure (1) is a new chapter of RADEIGHT-A. It is directed that this chapter be inserted between pages 144 and 145 in subject publication.

2. In addition it is directed that the following changes be entered in pen and ink. The entry of Change 2 will be indicated on the inside of the front cover.

Chapter 10, page 81, second column, lines 14 and 15:

Delete the words "low-flying" from the sentence beginning, "Frequently a CIC officer picks up a picket ship, etc. . . ." Delete the word "a" and insert "an" line 14 page 81.

Chapter 10, page 82, first column, change first sentence of section 7 to read:

"The CAP is flown in the vicinity of the force it is covering."

Chapter 10, page 83, first column, second sentence, second paragraph, change to read:

"It is imperative that the CAP stations be reassigned as the tactical situation dictates in preparation for any subsequent attack."

Chapter 10, page 88, second column, change the first sentence in section 3 to read:

"The RAPCAP is launched by a carrier group (unit) (ship) and is under the control of the ship designated by the TGCICO, while en route to and from station."

J. W. JAMISON,
By direction



DEPARTMENT OF THE NAVY
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
WASHINGTON 25, D. C.

IN REPLY REFER
Op-341D1/
Serial: C

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From: Chief of Naval Operations
To: Distribution List

Subj: Radar Bulletin No. 8A (RADEIGHT-A); Change No. 1 to

1. It is directed that the following change be entered in Radar Bulletin No. 8A (RADEIGHT-A). The change will be entered in pen and ink and the date of entry indicated on the inside of the front cover.

Chapter 13, Page 129 - After last sentence, add:

"(Strictly speaking, positive control means that the controller has radio contact on the plane and two-way communication with the pilot.) The controller must insure that the night fighter is kept clear of navigational hazards such as mountains and fixed obstructions. The pilot should at times be advised of the proximity of such hazards.

In order to insure that safety of flight is maintained, it is mandatory that the controller inform the pilot immediately when the night fighter is not under positive control, and that he is being dead reckoned. When positive control is lost the pilot should be advised to use the facilities at his disposal in order to remain clear of navigational hazards."

Chapter 13, page 132 - After last sentence, add:

"However, the night controller should make at least one radio transmission to the pilot each minute in order to verify communication contact."

CHANGE NO. 2 TO RADAR BULLETIN EIGHT-A

CHAPTER 13-A

HIGH SPEED, HIGH ALTITUDE INTERCEPTIONS

- A. INTRODUCTION.
- B. AIR CONTROL TECHNIQUES.
- C. STATIONING AND ORBITING THE CAP.

CHAPTER 13-A

A. INTRODUCTION

This chapter has been written to supplement the two preceding chapters in accordance with the note at the head of page 129. The information in this chapter should not be construed as replacing any of the foregoing material. The proven basic methods of intercept control still obtain, though there are some noteworthy differences in effecting air intercept control with turbo-jet aircraft as opposed to piston engine aircraft.

Any qualified air controller can learn to effect high-speed intercepts after reasonable practice against high-speed raids. It is important that controllers have the support of the CIC team. Radar operators must quickly and accurately give ranges and bearings from the PPI without resort to cursor or range bug. Plotters must keep continuous tracks on the air summary plot, without allowing the display to degenerate

into a series of disconnected and scattered plots. Radars must be maintained at the absolute peak performance since turbo-jet aircraft, due to their aerodynamic "cleanness," may not reflect radar pulses as effectively as piston engine aircraft.

The controller working with jet aircraft will also find it necessary to be much more familiar with the performance capabilities and limitations of the planes under control. Since turbo-jet engines are characterized by widely varying fuel consumption rates and, in general, will realize greatly improved fuel economy at high altitudes, the controller must keep himself informed of the "state" of aircraft under his control, and must employ them, whenever possible, with fuel economy as a major consideration.

B. AIR CONTROL TECHNIQUES

In general, the controller making an intercept with turbo-jet aircraft should use all-weather intercept voice procedure and vocabulary, since the entire action is speeded up, with less time for call signs and extraneous instructions.

The greatest problems confronting the controller who is using turbo-jet aircraft to defend against high-speed raids result from the high closing speeds between interceptor and bogey. With closing speeds of 800 knots and greater, a small error in timing the fighter's turn to attack will result in a large displacement error.

The problem is further complicated by the effect of poor radar information on jets. In order to alleviate the latter, Mk 10 IFF, when available, should be used to the maximum in tracking the CAP. When either target or fighter have been lost, dead reckoning on the

Good DR work by the controller may make the difference between an interception and a miss. In the continued absence of either IFF or radar response, having the fighter turn will frequently result in a radar blip since his effective radar reflecting area varies greatly with different aspects of the aircraft.

If, when DR'ing a fighter, the calculated time comes to give him a vector, the turn must be made on the basis of DR information alone. The controller should not wait for a blip, for if the turn is more than slightly late the fighter will end up many miles astern of the bogey and a long tail chase or a complete miss will result.

Under all conditions of poor radar information the controller should so inform the pilot so that the pilot may maintain safety of flight.

It is also important that the controller use bold cut-off vectors to insure that the interceptor is in such a position that tally-ho will be made with the interceptor on the bow of the bogey—the best attack position. If tally-ho is not made while on the cut-off vector, a fighter with small speed advantage over the bogey must be ordered onto a heading parallel to the bogey's course to permit him to remain forward of the bogey while searching.

Vectors should be handled cautiously when general-purpose fighters are being employed for the intercept and are temporarily operating in an overcast. If at all possible, planes in an overcast should be kept in a steady condition of flight since maneuvers in weather may result in pilot vertigo or loss of formation. Accordingly, pilots should be instructed to notify controllers whenever they enter an overcast, and conversely controllers should require frequent weather reports in order to avoid the necessity for giving vectors under these circumstances.

When contrails are lacking a preferred position for the jet fighter is with the target above and forward of the beam. This is not the best attack position, but it does afford the best opportunity for sighting. On the other hand, when contrails are present, positioning the fighter for optimum sighting will not be much of a problem, since tally-ho should be made at extreme ranges. The controller need only vector the fighter for earliest possible intercept and let the pilot take his own best attack position. In this connection, and when otherwise feasible, controllers should station fighters under their control at altitudes where contrails do not form in order to avoid unnecessary disclosure of the CAP's position.

STATIONING AND ORBITING THE CAP

Time-proven basic procedures for stationing and handling the CAP still hold with high-speed interceptors. However, it may be possible under certain circumstances to keep a minimum

and can be used only when it is definitely known that sufficient early warning will be available as with an extensive picket system, to get on-deck CAP airborne, on proper heading at altitude in time to intercept the raid if it is in an attack position.

In order to minimize fuel consumption jet CAP should be placed on station at altitudes greater than 20,000 feet since turbo-jet engine fuel consumption increases rapidly below this altitude. It follows that orbit speeds or vector speeds should always be those resulting in maximum fuel economy at the given altitude consistent with the tactical situation. As a general rule of thumb, piston engine fighters should be used in making interceptions up to 15,000 feet whenever possible. Whenever twin engine fighters are being employed as an orbiting CAP it should be borne in mind that it is not advisable to place the aircraft on single engine operation in order to conserve fuel.

Visibility will have an effect on the number of CAP that can be maintained in the assigned station since a high altitude CAP may not be able to anchor visually on a ship as a reference point. When overcast or other low visibility conditions preclude such visual homing orbits, the number of CAP that can be effectively handled is considerably decreased. In any event, eight sections or elements of aircraft are about the most that can be adequately controlled near the main force.

It is usually best practice to hold the CAP on a bearing and distance from the contact ship which will assure good radar information on them, whether the CAP can see the ship or not. This is particularly true for a CAP which is orbiting at 20,000 feet or more, where the orbit diameters will increase with the altitude. The result is that when an overcast CAP is given a vector it is likely to come out of the radar clutter area, or the cone of silence, in a tactically poor position. On the other hand, when the planes are held near their assigned station on a bearing where the

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tunity to arrive at a reasonable estimate of the force and direction of the winds aloft.

A secondary advantage of keeping the CAP on a controlled orbit is that it reduces traffic on the CI net by minimizing the relay of CAP information between the controlling ship and the OTC.

When holding jets on station in this manner it is usually best to do so at a range of 25 to 30 miles from the control ship. Since the fighters may not show up even at this range on every sweep of the radar, it is still necessary to dead reckon carefully along the legs of the holding vectors. Determining the force and direction of the winds aloft assumes great importance in high altitude work, since winds as great as 100 knots may be encountered. It can be appreciated that such a wind will have a very considerable influence on interceptions, and that an allowance of as much as 20° or 30° to compensate for drift may not be unusual.

Perhaps the best type of holding pattern is a long rectangle since this affords a good opportunity for determining wind. Although this holding pattern requires strict attention on the part of the controller, a reliable track can be kept on the plane. On the other hand, circular or figure of eight patterns do not afford as good an opportunity to judge the wind, and will require frequent adjustment as planes drift off station. However, circular type patterns will yield a higher percentage of radar returns due to the increased reflective area of the plane presented to the radar, and so may be preferred at times when radar information is critically poor.

There is even greater necessity for holding the CAP on station under night or low visibility conditions. Pilots may be skillful enough to hold over the ship, using electronic aids available to him, but this method should be used only as a last resort.

When a RAPCAP is being vectored out from the carrier to a picket which is to exercise

control, it can be ordered to climb to assigned altitude at the same time. Since many of the outlying ships being used for pickets will have electronic navigation aids, it will frequently be necessary to closely control the RAPCAP's as they proceed to their assigned stations. This means that each ship along their course must control them, passing control along to the next ship until they arrive at station.

When enemy raids offer real business for controllers, the CAP under control of the picket should be used to hit the raids early. In general, this RAPCAP should be vectored inside the outer line of pickets in pursuit of a raid once when he has a good chance to effect an intercept. If the RAPCAP can't reach an intercept position by the time the raid is over the outer picket stations, it should normally drop out of chase, providing there is a backstop CAP available.

If this first RAPCAP does have to break off but manages to make tally-ho, information from the RAPCAP regarding the raid and its composition should be passed on to the backstop CAP. Even though the outer RAPCAP might be at a lower altitude or of inferior speed, it should be used to try for a tally in the hope of gaining this information on the raid. Altitude information gained in this manner may prove especially valuable. However, the RAPCAP should not be pulled so far off station that a hole is left in the outer defense.

When altitude information on a raid is being supplied by height finding radar, the CAP should be initially ordered to an altitude equal to the raid altitude plus the known maximum error likely in the radar.

If the intercept is being conducted under low visibility conditions, and the PPI indicates that the pilot should have made tally-ho, he should be dropped in 5,000-foot increments until he has done so. Normally in conducting low visibility intercept, a quick check at each 5,000-foot level will suffice.

CHAPTER FOURTEEN

AIRBORNE CONTROL OF AIRCRAFT AND AIRBORNE EARLY WARNING—(AEW)

- A. INTRODUCTION.
- B. LOCATION.
- C. FUNCTIONS.
- D. EQUIPMENT.
- E. PERSONNEL.
- F. DISPLAYS.
- G. SUMMARY.

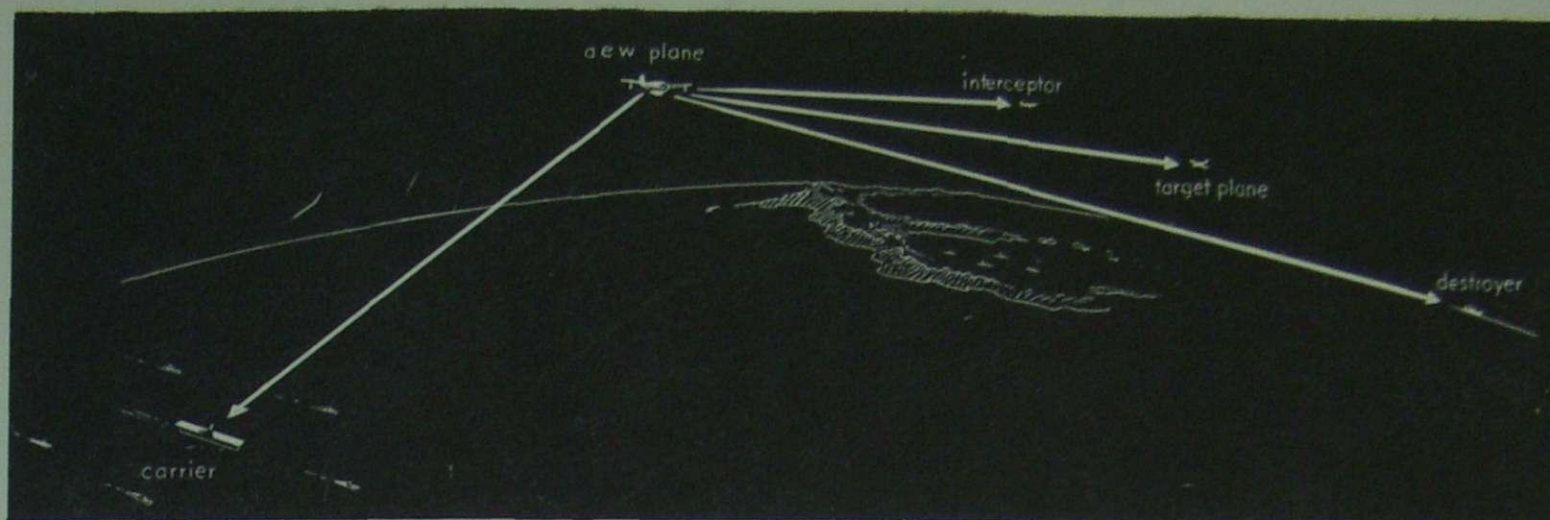


Figure 126.

CHAPTER 14

AIRBORNE CONTROL OF AIRCRAFT AND AIRBORNE EARLY WARNING

A. INTRODUCTION

Constantly improved radar equipment and operating techniques have brought to fleet units and advanced shore bases a high degree of protection against enemy air and surface attacks through the early warning of the approach of such attacks. There are, however, certain weaknesses in present radar coverage. One of these is the inability of present shipboard radar equipment to detect the approach of low-flying aircraft until they are close aboard. It is this weakness that the air-borne combat information center is designed to overcome by providing early warning of the approach of low-flying enemy air attacks and the interception of such attacks at greater ranges than are now possible with existing equipments.

An air-borne combat information center, within the limits of space, weight, personnel, and equipment, is designed to function in much the same manner as a shipboard combat information center, as outlined in the various effective fleet doctrines. It is designed to operate independently or in close liaison with shipboard, or land based CIC's, or other air-borne CIC's.

B. LOCATION

devices, communications (external and internal), and the specifically trained personnel for the collection, display, evaluation and dissemination of all combat information, and for the control, as delegated, of aircraft, surface craft and own aircraft.

C. FUNCTIONS

The primary function of an air-borne CIC is to provide feet and/or shore units with early warning of the approach of enemy aircraft and surface forces. It keeps all interested commands informed of the location, identity, and movement of friendly aircraft and ships within their area of operation. This information may be transmitted via radio voice circuits or via the radar relay system.

The secondary function of an air-borne CIC is to exercise fighter direction to intercept and destroy the enemy. There are two types of interceptions that may be affected:

1. Controlled interceptions. Made directly from PPI scopes in the air-borne CIC according to standard air control practices.

2. Geographic placement interceptions. Made by using all available information to place intercepting fighters in the same geographic area as the enemy, but leaving the

friendly fighters and enemy is so limited as to preclude a controlled interception.

Possible additional functions of an air-borne CIC are:

1. An advanced weather station.
2. Acting as a strike coordinator.
3. Communications relay plane.
4. Radar relay plane.
5. Assist in homing lost aircraft
6. Assist in search and rescue work.
7. Anti-submarine patrols.
8. Beachhead cover and ASP.
9. Convoy ASP.
10. Task Force cover and ASP.

D. EQUIPMENT

The equipment within an air-borne combat information center includes one APS-20 radar, three APA-23 systems with 12-inch CRT's, one radio direction finder, radar and radio relay systems, three VHF/UHF radios, medium frequency radio, two intercommunication systems, vertical display board, combat air patrol status board, call operations status board, plotting clock, 12-hour clock, course and speed indicators, altimeter, one projection device, and various plotting and computation aids.

E. PERSONNEL

An air-borne CIC is manned by a team of four officers and three enlisted men.

1. *CIC Officer*.—Officer in charge of CIC. He is in command of the plane in the patrol operating area except when under attack and when proceeding to and from the patrol area. He handles all exterior communications (except CAP); coordinates all activities of the CIC; interprets and evaluates all information on the display board; designates all raids; and assigns interceptions to Air Controllers. He also keeps all interested commands informed of the tactical situation; transmits all warnings and receives transmissions from all commands; and makes amplifying reports on contacts as necessary.

CIC officer. Evaluates targets. Controls Plots on scope during interception. Maintains radar telling circuit. Mans primary CAP frequency. May interrogate contacts within 120°.

3. *CIC Watch Officer*.—Suitably experienced officer. Maintains fighter status board. Maintains conversion plots on main display board. Works Mk. V maneuvering board problems and makes changes necessary in operations based on work. Available to relieve at any station in an emergency. Monitors the air control channel for interceptions have been designated by the controller officer and then shifts to the primary frequency, or may monitor the CAP frequency while controllers are on intercommunication radar reporting circuit. May dead reckon interceptions on display board. Supervises play board.

4. *Display Board Plotter*.—Mans the communications radar reporting circuit. Plots all radar contacts in the standard manner for computations and information. Dead reckons faded radar contacts. Plots own plane's position from projection.

5. *APA-23 Scope Reader*.—Mans the intercommunications radar reporting circuit. Reports all contacts within his assigned area. May interrogate targets within his assigned area. Stands by to report the bearing and visibility of a controller engaged in an interception.

6. *APS-20 Operator*.—Keeps set tuned and adjusted. Maintains long-range guard. Maintains IFF guard. Mans the CIC intercommunications radar reporting circuit.

F. DISPLAYS

An air-borne center is designed to operate in a manner similar to that of a shipboard CIC set forth in effective fleet doctrines and doctrines.

1. *Display Board*.—Operations are centered around the information display on the play boards as provided by radars, radio, and

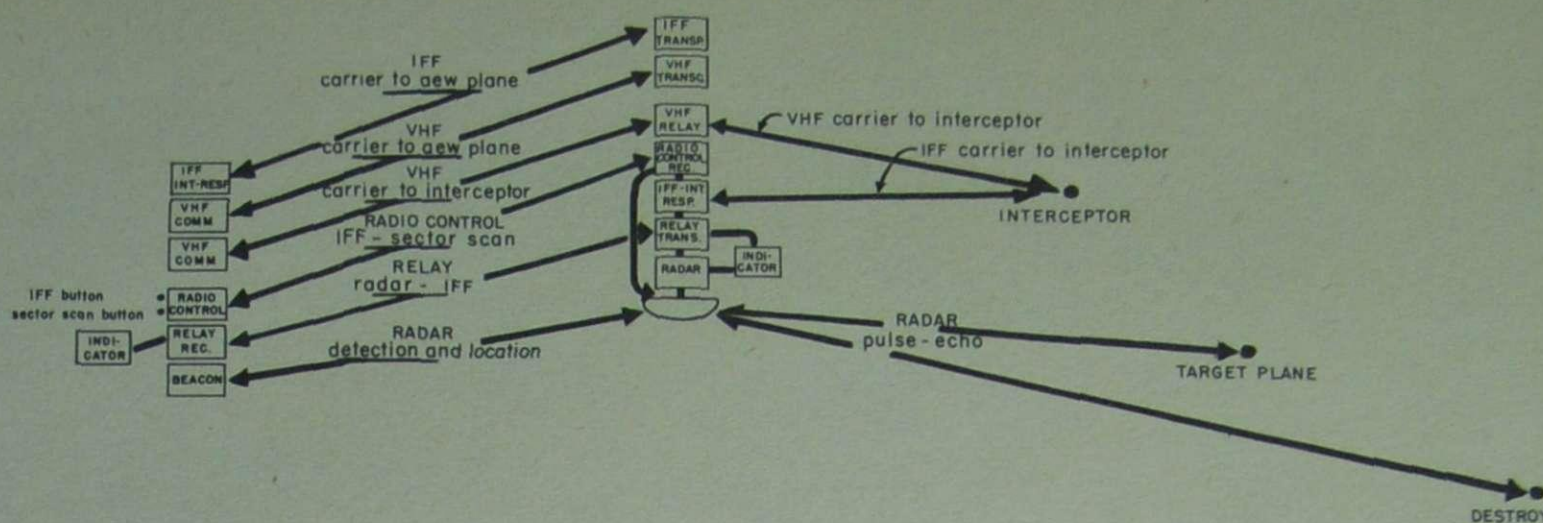


Figure 127.—Electronic system diagrammed.

glass board on which a geographical plot of the operating area, including reference points, fleet operating areas, all friendly and known enemy contacts, patrol areas of other air-borne CIC planes, search and strikes areas, patrols, and rescue facilities, is plotted on the forward face prior to take off. Projected on the forward face of the display board is a polar coordinate chart which, by means of an Air-borne Position Indicator (API), follows the track of the Air-borne CIC, thus providing a DRT and, in effect, eliminating the movement of the CIC plane in relation to the ground. All available radar and radio data are plotted on the rear of this board. Should the API system go out the problem of high relative movement is introduced and the solution of courses and speeds of targets must be computed by the use of a Mk. V maneuvering board and dead reckoning the track of the CIC plane, by periodic radar or navigation fixes, on the main display board. It is the responsibility of the navigator to inform CIC of the position of the CIC plane when the API equipment fails or when the CIC plane is out of land range for radar fixes.

2. *Fighter Status Board.*—An edge-lighted plexiglass board for ready visual reference.

This status board contains all pertinent data relating to the combat air patrol.

3. *Call Operations Board.*—An edge-lighted plexiglass board for ready visual reference containing all pertinent plane and base calls, authenticators, codes and operational instructions and others.

G. SUMMARY

Inasmuch as the air-borne CIC is still in the experimental stages of development, the information contained herein is general and will be subject to revision, amplification, and change at a later date. New problems of control undoubtedly will bring about the development of new techniques. However, by the use of the API, air-borne control of other aircraft from the CIC plane has proven not only feasible, but similar in all fundamental respects to control from ship or shore bases.

When air-borne early warning planes are used simply for relay purposes, the techniques of control differ in no way from current practices. In effect, it simply extends the radar coverage of the parent ship to greater effective ranges which will permit control and interception work to be carried on within a considerably expanded operating area.

CHAPTER FIFTEEN

VISUAL AIR CONTROL

- A. INTRODUCTION.
- B. EQUIPMENT AND PERSONNEL NEEDED FOR VISUAL CONTROL.
- C. VISUAL AIR CONTROL PROCEDURE.
- D. VOCABULARY.
- E. SUMMARY.

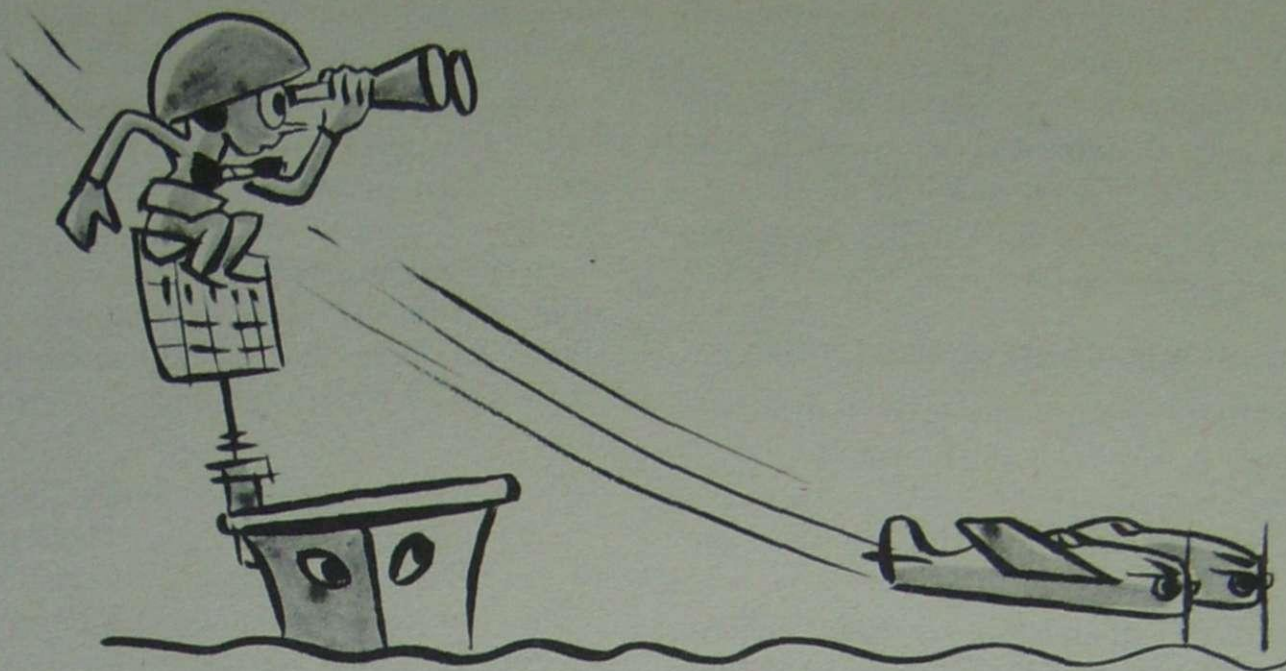


Figure 128.

CHAPTER 15

VISUAL AIR CONTROL

A. INTRODUCTION

The effectiveness of visual aircraft control methods has been sharply reduced as a result of the increased speeds of aircraft. No other method has yet been evolved to replace it under the conditions to which it is applicable. Visual air control has been used under the conditions listed below:

- (a) Saturation of radar by land echoes.
- (b) Enemy planes below radar horizon.
- (c) Enemy planes inside minimum range of radar cover.
- (d) Enemy countermeasures render radars useless.
- (e) Radar equipment suffers material failure.
- (f) Too many friendly planes make visual recognition necessary.

B. EQUIPMENT AND PERSONNEL NEEDED FOR VISUAL CONTROL

1. Equipment

Visual air control stations are no longer being instrumented in new construction. However, existing facilities should possess the largest

VHF/UHF radio outlets, including a remote control unit for changing channels, should be installed in the visual control center. It is suggested that a throat-microphone or a new type aircraft lip microphone be used with the keying button mounted on the controller's binoculars.

Binoculars, size 7 x 50, should be provided for all lookouts and the controller. A telescope may be used as a substitute or to complement one pair of binoculars.

Sound-powered phone connections to the following stations are necessary: (a) bridge, (b) CIC, (c) lookouts (d) such battery control stations as necessary to insure close coordination of ship's gun fire with the tactics of the intercept and safety of friendly fighters.

2. Personnel

The personnel required to successfully man a visual control station are as follows:

- (a) Visual controller, using the appropriate VHF channel to direct any aircraft under his

times and making a running commentary on the target's movements.

(c) Enlisted talker to serve as friendly tracker to keep the visual controller informed as to the position of his own VF at all times.

(d) Enlisted plotter on the JS or appropriate radar reporting circuit.

C. VISUAL AIR CONTROL PROCEDURE

The vocabulary and tactics used in directing aircraft under visual control follow the standard form of air control very closely. However, the time element makes certain modifications necessary.

The standard call-sign for all visual control stations is "SNAP." If the designation of the ship is MOHAWK, the visual station will be "MOHAWK SNAP." The fighters continue to use their normal call signs.

On initial transmission, full call signs should be used. For subsequent transmissions, however, the SNAP can be omitted, and if no confusion results, the fighter call sign can also be omitted.

Because of the fact that compliance or non-compliance with any orders can be observed visually, no "wilcos" are necessary from the pilot. This saves time and keeps the circuit free for the visual controller to put out information.

All pilots flying aircraft controlled by the visual controller should fly at top speed during interceptions and make all turns hard turns. The time factor does not allow for the changing of speeds or the controlling of turns.

The SNAP-controlled plane or planes should be stationed tactically to give the best maximum visibility or to combat the latest enemy tactics.

The initial vector for a visually controlled fighter may be one of two types; the magnetic vector, in which the plane will fly a magnetic heading, or an informative heading, in which the pilot is informed the bogey is closing over a known point of land, the parent ship, or the like. The initial vector may be started at a

sible and go out on the vector indicated"; "Vector pronto one-three-zero").

After the initial vector, control of the interception becomes a problem of relative movement. Port or starboard turns of a specified number of degrees are not advisable. The fighter must be searching for the bogey so it is impossible for him to watch his compass. A port or starboard from the visual controller will be "STEADY" when the plane is on proper heading is sufficient for control.

An altitude advantage for a fighter intercepting a bogey low on the water is not available; the lower the fighter, the greater his vulnerability. More information can be given to fighters in visual intercept work than can be given during radar interceptions; i. e., the number of planes, a more accurate altitude, the type of planes that are being intercepted. The same information given the fighter during radar interceptions is given in visual interceptions. The bogey's height, course, and if crossing, closing, etc., should be given to the friendly planes. Clock-code positions and distance from the bogey from the fighters should be given at frequent intervals and as accurately as it is possible to estimate. Also, information as to whether the bogey is closing the friendly—"Closing on," "crossing port to starboard,"—etc., is necessary.

D. VOCABULARY

All transmissions to the visually controlled plane(s) should end with "OUT". It is necessary for the pilot to acknowledge or not any transmission since visual contact will be lost immediately whether or not he is complying with the order.

Other words used primarily in visual control are listed below:

A. Continue Port

Continue Starboard—"Continue turn to starboard (starboard) at present rate of turn. If instructed to straighten out."

B. Climb—"Climb number of feet indicated."

E. *Steady*—"Straighten out or maintain present height." (Used to stop a plane turning.)

F. *Tally-ho Punch*—"I see the enemy aircraft and can get him before he reaches effective AA range."

G. *Tally-Ho—Heads Up*—"I see the aircraft but am not able to intercept before he reaches AA range."

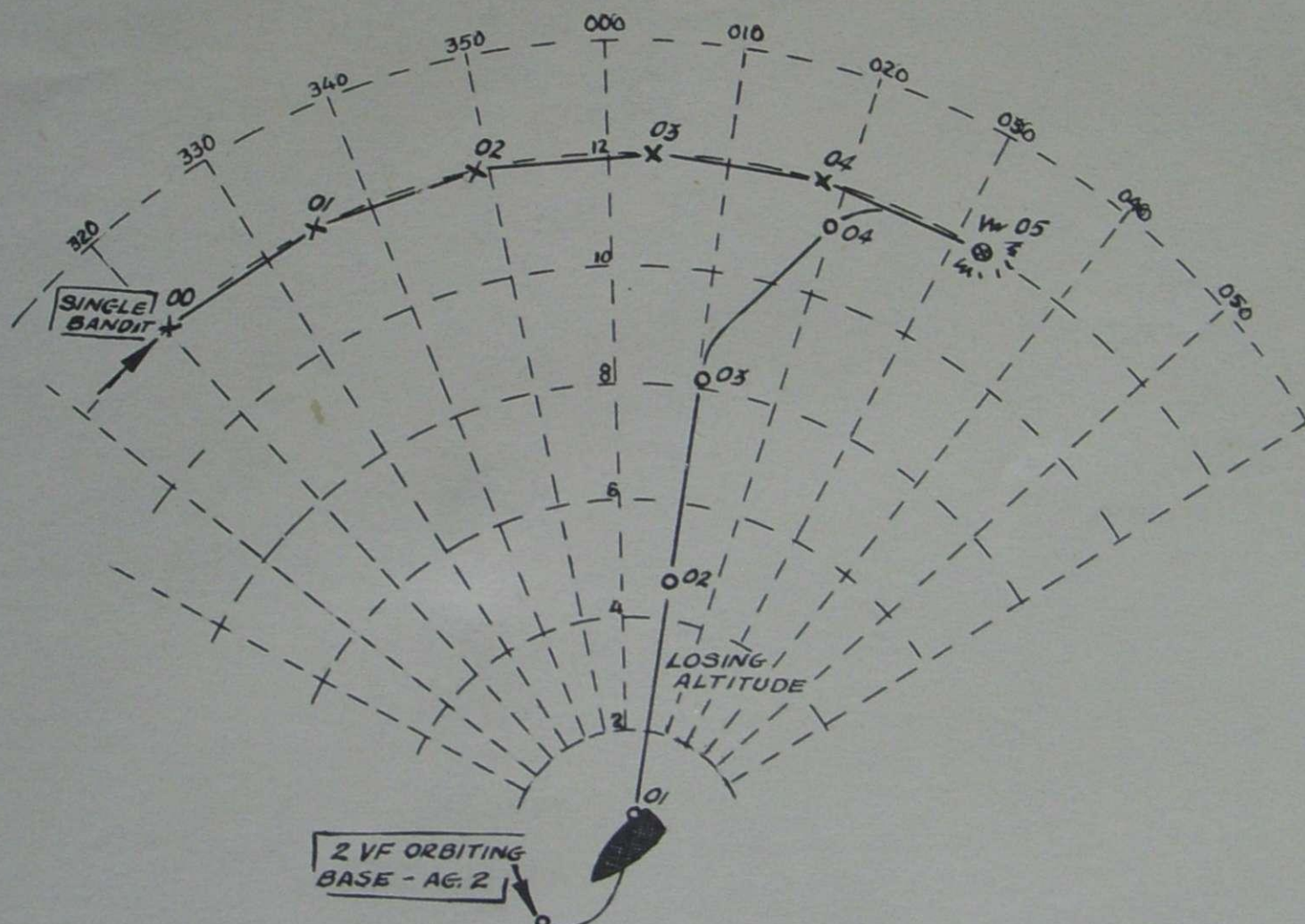
H. *Masthead or On the Water*—"Fly at sea level (may be used to indicate target is at sea level)."

The control of a visual plane or planes must be absolute, i. e., the plane should not be a part of the regular CAP and switched to SNAP control when the bogey has closed to visual range. Time will not permit the breaking off of sections of the regular CAP or shifting frequencies when enemy planes are spotted close aboard. Passing control of the fighters from ship to ship

should be resorted to only in the case of emergency. There can be no loose arrangements whereby one ship, spotting a bogey, can gra control.

SUMMARY

Visual fighter direction differs from other types of fighter direction in several respects. First, immediate compliance with the controller's orders is far more important than exact accuracy in the execution of the order. Second, position advantages are often sacrificed to enable the pilot to make visual contact as quickly as possible. In many cases this may mean that the fighter will be below rather than above the target when he gets the contact because the visibility is so much better. The possible disadvantage in altitude however will not be more than a few hundred feet, and, furthermore, an altitude advantage of several thousand feet is neither necessary nor desirable.



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where the target is low on the water. Third, as already indicated, acknowledgments by pilots under visual control are not necessary.

For the most part, visual fighter direction is useful against low-flying aircraft. If targets

are high, the radars should pick them up and permit normal radar control to prevail. Visual control may also be used at close ranges for a variety of other routine activities, including traffic control in carrier landings.

CHAPTER SIXTEEN

AIRCRAFT CONTROL IN AMPHIBIOUS OPERATIONS

- A. INTRODUCTION.
- B. AIRCRAFT CONTROL ORGANIZATION AFLOAT.
- C. AIRCRAFT CONTROL ORGANIZATION ASHORE.
- D. ESCORT CARRIER FORCES.
- E. FORCE CIC OFFICER.
- F. GROUP CIC OFFICER.
- G. SHIP'S CIC OFFICER.
- H. OTHER CIC UNITS.
- I. THE THREE PHASES OF AN AMPHIBIOUS OPERATION:
 - 1. Approach Phase.
 - 2. Assault or Attack Phase.
 - 3. Consolidation Phase.
- J. COMMUNICATION CIRCUITS.
- K. PROCEDURE FOR STRIKE PLANES.
- L. AIR OBSERVERS, AIR COORDINATORS, AND PHOTO RECON PLANES.
- M. JOINT OPERATIONS ROOM.
- N. EXAMPLE OF A STRIKE MISSION.
- O. CONTROL OF OTHER MISSIONS.
- P. COMBAT AIR PATROLS.
- Q. USE OF NIGHT FIGHTERS.
- R. INTERCEPTION TECHNIQUE IN AMPHIBIOUS OPERATIONS.
- S. SUCCESSFUL CONTROL OF THE CAP.
- T. GENERAL.



Figure 130.

CHAPTER 16

AIRCRAFT CONTROL IN AMPHIBIOUS OPERATIONS**A. INTRODUCTION**

Air control during an amphibious operation is conducted from carriers, command or amphibious ships, cruisers, destroyers, and shore bases. The number of such ships varies with the size of the operation and the number of amphibious task groups approaching the objective.

Air control in such an operation is handled by a great many different units before the over-all responsibility for air defense is formally assumed by the forces ashore.

B. AIRCRAFT CONTROL ORGANIZATION

force is composed of the necessary groups and units to accomplish the mission. The Joint Amphibious Task Force may contain one or more Attack Forces, each under its own commander.

Under the Commander Joint Amphibious Task Force is the Tactical Air Commander who is charged with operational control, in the objective area, of all the aircraft assigned to support the Joint Amphibious Task Force. He performs this mission through the Tactical Air Control Center. At the next echelon below the Joint Amphibious Task Force, command

Air control and air warning functions are performed for the Commander Joint Amphibious Task Force by the Tactical Air Commander through the Force CIC Officer. The Tactical Air Commander (afloat) retains this responsibility during the approach and assault phases, and thereafter until the Tactical Air Commander (ashore) is directed to relieve him of these duties.

The Tactical Air Commander designates the air control ships and units which are to exercise primary, secondary, or standby control. He also designates their areas of responsibility and recommends stations for such ships and units from time to time so as to secure the most effective coverage.

He initiates all requests to the carrier support group for aircraft for combat air patrols and for emergencies.

C. AIRCRAFT CONTROL ORGANIZATION ASHORE

In addition to the CIC organization afloat there are also shorebased air control and air warning units in the assault and consolidation phases. These units set up ground control intercept (GCI) stations as soon as possible. In addition, tactical air direction centers are set up ashore to control and coordinate the activities of these GCI stations in their respective assigned areas, as soon as possible.

Over-all air control and air warning responsibilities are usually the last to pass from afloat to ashore control. This control is not passed until there is practically complete radar and radio coverage, until practically all CAP aircraft are shorebased and in adequate strength, and until the air control and air warning system ashore is complete. Emergencies such as forced withdrawal of naval forces might necessitate transfer of control before this set-up ashore is complete.

These units ashore should, during the interim period, cooperate closely with the air control units afloat, receiving instructions from the Force (Group) CIC officer. When over-all con-

troller while they remain in the area of responsibility of the TACC (ashore).

All air control units should be notified with the Tactical Air Commander (ashore) has assumed control.

D. CARRIER SUPPORT GROUP

The carrier support group supporting operation is under the Commander Joint Amphibious Task Force.

E. FORCE CIC OFFICER

The force CIC officer has his battle station in the CIC of the force flagship.

His duties and responsibilities are more of an advisory nature than operational control.

(a) He recommends to TAC which air control ships should exercise primary, secondary, and standby control during each phase of operation.

(b) He recommends areas of responsibility where more than one CAP is employed.

(c) He disseminates to air control ships information all phases of air operations affecting air control.

(d) He initiates requests through the TACC for additional fighters when the tactical situation requires them.

(e) He is responsible for the efficiency of air control and CIC organization on the command ship.

(f) Control of the CAP in an amphibious operation requires organized assignment of responsibility. It is significant that all CAPs are assigned to the force CIC officer for coordination, and he in turn delegates the various CAP units to control specific divisions of the CAP.

(g) Requests for additional CAP, permission to secure existing CAP, permission to use CAP for direct support missions and requests for use of direct support fighters as CAP are also handled by the force CIC officer. Working with the TACC, the force CIC officer requests changes of CAP from the escort carrier group through their respective group

trols antiaircraft fire both ashore and afloat for the Commander Joint Amphibious Task Force.

(i) He disseminates these reports to all units ashore and afloat over the warning nets.

(j) He coordinates the reporting of all radar contacts so that all air control ships and radar guard ships employ the necessary conversion to the fleet center or designated reference points and further use the accepted grids when applicable.

(k) He should coordinate all air control units under the accepted air control plan for the operation and in general serve as liaison between the TACC and the air control teams.

F. GROUP CIC OFFICER

The group CIC officer's duties and responsibilities are similar to those of the force CIC officer as they affect his group. The group CIC officer is responsible to his immediate TAD and to the force CIC officer.

G. SHIP'S CIC OFFICER

A CIC team may be attached permanently to an air control ship, or it may be assigned to the ship for a particular operation.

(a) The CIC officer of the ship exercises tactical control of the CAP assigned to him for the defense of all forces in his area of responsibility.

(b) He intercepts all unidentified air contacts threatening own forces so far as the fighters available permit.

(c) He maintains a careful check of fuel, duration of patrol, effective fighting time and approximate distance to fighters' base so the fighters may be returned safely.

(d) He initiates appropriate warnings.

(e) He maintains a plot of all information affecting the air defense of own forces.

(f) He trains the ship's CIC organization to the highest degree of efficiency.

H. OTHER CIC UNITS

Special air control units may operate in LST's, cruisers or battleships in coordination

ers supporting mine sweeping or underwater demolition operations.

I. THREE PHASES OF AN AMPHIBIOUS OPERATION

The duties of a CIC officer differ in the three phases of an amphibious operation: *approach*, *assault (or attack)*, and *consolidation*.



Figure 131.

1. Approach Phase

In the approach phase the duties of the CIC officer may or may not include air control, depending upon the location of the carriers furnishing the air cover. If they travel in the same convoy with the transports, air control may be retained by the carriers themselves. However, if the carriers are operating independently some distance from the formation, or if the CAP is furnished from nearby land bases, then the responsibility of defending the formation from air attack falls upon the CIC organization which has been set up to operate in the vicinity of the objective.

During the approach, the duties of the CIC officer are practically the same as those of the carrier CIC officer charged with the defense of a carrier task force except that the number of planes available will probably be smaller. The size of the CAP on station underway will depend on the probability of attack in the area and the number of planes available to protect all forces in the area.

Since it is imperative that the location, size, composition, course, and speed of the force be kept secret, the CIC officer during the approach is vitally interested in snoopers and shadowers. They must be destroyed before they can report the position of the force.

A low flying antisnoopers patrol may be

ship in that vicinity. In the event of the approach of low-flying enemy planes, these ships would be best suited to intercept through visual air control.



Figure 132.

2. Assault (or Attack) Phase

At the objective, control of all planes over the Joint Amphibious Task Force shifts to the command ships and air control destroyers. As the carriers are usually stationed at a considerable distance from the enemy-held objective, a separate combat air patrol will be controlled by them for their own protection.

During the assault phase of an amphibious operation, the CIC officer normally faces his heaviest task. Both day and night air raids are a practical certainty. The CIC officer must protect the ships at anchor, the troops and equipment ashore, search planes at anchor and aloft in the area, and at times independent surface units operating separately but in the same general area. The latter may include forces retiring from and approaching the objective. This responsibility rests with the force CIC officer at a time when, in all probability, there is no landing strip for shore-based planes and little or no radar gear ashore. He may be called upon to protect a rather large area with a small CAP and with little likelihood of obtaining more planes in time to repel a large attack. *This requires that the CIC officer exercise caution and judgment in the use of his planes, their ammunition, and their fuel.*

In designating station for the air control ships, the following factors should be considered:

(a) Air control is concerned with the defense

gle ship may have 360° of radar vision. Therefore, these stations should be chosen so as to provide the maximum radar coverage possible under existing conditions.

(c) The air control ships should be stationed within radio communications range of the command ship and the shore bases so that air control teams may work closely with each other in handling the combat air patrol.

(d) When it becomes necessary for an air control ship to leave its station, provision should be made for another ship to relieve it on station prior to its departure.

During the assault phase the technique of radar reporting takes on added importance. A large portion of the ships of an amphibious force depend upon information put out by air control ships because of different instrumentation. With ships dispersed in a wide area around an objective, positioning of contacts with relation to the reporting ship is confused. Therefore, a common geographical reference point, known to all ships, is used. A jet of spit of land, a high mountain or other prominent marks affording good radar fixes are chosen. All ships must know at all times their position with relation to the reference point. Ships under way at the objective should keep their position plotted on the DRT to insure up-to-date positioning at all times. Thus a ship picking up a contact converts the position of the contact to the reference point before putting it out to the air for consumption of other ships in the area. The reference point is used not only for aircraft radar reports but also for all position reports around the objective, including surface and rescue, surface contacts, etc.

There are generally primary, secondary and stand-by air control ships operating with the attack group having air cover.

Primary Air Control Ship

This ship is designated by and responsible for the TAC, and it is responsible for air control in the specified area.

Secondary Air Control Ships

other duties and responsibilities of the primary air control ship in an emergency or when directed by the force (group) CIC officer.

Destroyer Air Control Pickets

A large percentage of air control work may fall to air control destroyers in connection with an amphibious operation. Controllers and their teams are assigned to designated air control destroyers for the specific operation. Such teams generally consist of two officers: A CIC officer and a controller. Such teams also include several enlisted operators. This personnel is in addition to the regular ship's company CIC team aboard. Close cooperation between this team and ships' company CIC personnel must be maintained. Both work for the commanding officer of the picket vessel who has an assigned mission to accomplish.

Areas of Defense

All air control ships are instructed as to the forces and areas, including sea and land area, which they are required to defend. Whenever there are separate CAP's employed to defend a carrier force and to cover the objective area or to cover separate forces operating in close proximity to each other, each air control ship would be instructed as to its primary area of defense by the Tactical Air Commander. This provision is intended to designate the ship which will undertake the interception of any small unidentified contacts where there is a choice as to which ship would be responsible. In any event it should be understood that it is the responsibility of all air control ships oper-

ating with any force to intercept every enemy contact where his own force is endangered.

3. Consolidation Phase

After the attacking forces have established a sufficient beachhead, shore based air control units are set up as quickly as possible. The fighter airstrip is rushed to completion so that the combat air patrol can operate from it and thus relieve the supporting carriers.

When the shore based air control units are set up and ready to assume control of the CAE, the TADC (ashore) notifies the TACC. The TAC, after consulting with the Force CIC officer would then recommend to the Joint Expeditionary Force Commander that the TADC (ashore) assume control.

J. COMMUNICATION CIRCUITS

Any instructions for the control of aircraft during an amphibious operation must include a brief description of the important aircraft circuits. CIC personnel should bear in mind the fact that monitoring these circuits is not their responsibility, but on occasion they may be required to do so.

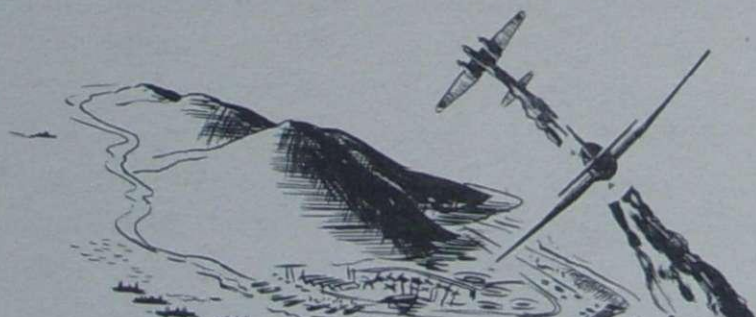
It is the responsibility of the force CIC officer on the flagship to see that interested CIC personnel on all ships receive the necessary information from these circuits.

1. Tactical Air Request (TAR).—This net links Tactical Air Direction Centers with Tactical Air Control Parties, and is used for tactical and general information.

2. Tactical Air Direction (TAD).—This net links the controlling TACC, TADC, or TAC with the Tactical Air Coordinator Airborne and aircraft assigned to offensive missions. It is used for controlling aircraft in flight on offensive missions and is only for air-ground and air-air communications.

3. Tactical Air Observation (TAO).—This net is used for communication between aircraft for observation or reconnaissance missions and Tactical Air Control and Direction Centers.

4. Tactical Air Command (TAC).—This net



5. Fighter Air Defense (FAD).—This net provides direct communication between aircraft in flight assigned to defensive missions and the Fighter Defense Controller and Directors.

K. PROCEDURE FOR STRIKE PLANES

The operating procedure is carefully planned well in advance, for control of aircraft in such large groups requires painstaking preparation. When a scheduled strike group arrives in the target area the leader reports in to TADC for instructions, giving the flight leader's call, number and type of planes, time available, armament, and location. They are then directed by the TADC in execution of an assigned mission.

Because of the increasing number of aircraft participating in all phases of an amphibious operation and the growing difficulty of properly identifying these aircraft, an approach-identification procedure is often introduced to simplify the problem for the TACC and the force CIC officer. Approach channels are often designated for all itinerant aircraft coming into the area and an operating area is defined (usually 50 to 75 miles in radius from the reference point). All aircraft before coming into the operating perimeter must call the TACC, giving position, nature of mission, composition of flight. The TACC then designates approach route, orbit points, etc., for aircraft. The force CIC officer notifies all air control ships of flights coming into the area in an attempt to simplify the identification procedure. The air coordinator—always an important assignment—perfects the timing of the groups from his position in the air over the target. The flight leaders direct the movements of their groups as ordered by the air coordinator and the TACC.

After scheduled strikes are completed against prescribed targets, the flight leaders report to the TACC in the same manner and await further assignment of targets or instructions to return to base. These targets (outlined the first few days in the operation plan) are designated by the landing force commander through

mend control of shore bombardment and lery fire to avoid danger to support aircraft.

L. AIR OBSERVERS, AIR COORDINATORS, PHOTO RECON PLANES

Air observer, air coordinator, and recon planes work closely at all times with TADC and observe the results of the attack and spot new targets for further strikes. schedules are made from this information as soon as possible.

M. JOINT OPERATIONS ROOM

The joint operations room aboard the flag (generally an AGC) of the force is the controlling center for all support aircraft operations. As an operation progresses, the landing force may take over some of these duties as well. Recording strike compositions, target information, front lines and many other items of tactical information, front lines and many other items of tactical information are done by the flag.

N. EXAMPLE OF STRIKE MISSION

An example of a typical strike illustrating various controls exercised:

On the tactical air request circuit at 0825 the air liaison party No. 3 asks of the TACC ("Warhorse") a strike to support a Marine infantry advance in the Agaña area (Guam). Strike is to knock out pill boxes. Grid position—Guam Sheet 2, Target 851 Dog. At 0830 strike Able, party 1, which is 15 VSB (SB2C) from the Fleet Air Base (FAB) at Eniwetok, arrives on station. At 0825 the following transmission is heard on the tactical air direction net (TAD):

"Warhorse. This is 61 Hellbender. 15 Helldivers on strike Able. Time of departure from area 1000. Carrying 1,000-lb. bomb and two 250-lb. bombs. We are approaching Point King at Anguilla. Request instructions. Over."

This transmission is recorded and the information put on the status boards in joint operations room. The TAO decides to use this flight to bomb the pill boxes requested by the landing force commander.

for you. Guam Sheet 2. Target Area 851 Dog. Bomb pill boxes, observing front lines marked by Panels 2,000 yards south. Drop 1,000-lb. bomb first run, 250-lb. second run. Report to Copper 2 (Air Observer over target area) for direction. Acknowledge. Over."

61 Hellbender wilcoes. By this time the air coordinator has the information. He knows that at 0845, 12 VTB's finished dropping frags several miles west of the area, and since then the air has been clear. When 61 Hellbender reports in for instructions, Copper 2 tells him on TAD net:

"61 Hellbender, this is Copper 2. Approach target from Point King. Make your bombing run from west to east. Do not pass over own front lines. Attack must be completed by 0915. Pull out over Eastern shore and rendezvous Point Mike. Report when you are commencing run. Acknowledge. Over."

The flight leader wilcoes and gathers up his group for the attack. He may give them instructions concerning push-over point, pull-out altitude and other instructions. The air coordinator, who has been over the target area since daylight, may have additional information on heavy AA areas and other important data. If the flight leader has trouble locating target, the air coordinator may even make a dummy run.

Before the attack is carried out, the TAC checks with the gunnery officer in joint operations to make sure there will be no firing in the area which would endanger the aircraft in their runs. He will closely coordinate the ceasing of gun fire with the start of the attack.

During the actual attack the air coordinator, or possibly an air observer or a photographic plane, may move to the target area to observe and record results. All parties report the results to the TAC. The TAC may then order the strike to return to base or remain at orbit until other strikes are returning.

pletion of the scheduled patrol, often these aircraft are used in special strikes on targets opportunity.

Many other special air missions arise which also require coordinated and close control by the TACC. "Smokers" report on station to the TACC for missions as needed. Photographic planes, special flights for dropping propaganda pamphlets, supplies, arms, and other missions report to the TACC for coordination with strikes and for air traffic directions. Artillery spotters in carrier aircraft—other than Grampians—are also coordinated by the TACC although they are controlled directly by the ships. Cruiser and battleship spotters are not controlled directly by the TACC but by the respective ships or those to which they are assigned. Aircraft with message or photo duty report in to the TACC before entering the objective area.

Passenger flights made by sea planes or amphibious planes are cleared by the TACC until facilities ashore are set up to handle such operations. The TACC is responsible for all rescue duties during missions in the objective area.

It can be said that the TAC during the early phases of an amphibious operation actively controls or coordinates every phase of air operations. The purpose of the organization is apparent—to coordinate and to make the efficient use of all aircraft and armament available in direct support of troop movements and defense of the force.

P. COMBAT AIR PATROLS

A number of specialized problems arise in administering control of the CAP. The flagship CIC officer seldom handles the CAP himself. The flagship CIC may control the CAP if he is in a better position as to location, communications, and radar information, but usually the flagship CIC is more concerned with the tactical responsibility attendant to acting as the combat information center for the entire force.

Generally the force (group) CIC officer

CAP. This type of control is generally in or near the target area with emphasis on the control of night fighters.

(a) Source and Type of CAP

In explaining control of the CAP during an amphibious operation it should be remembered that there are several possible sources of CAP. The CAP is furnished primarily by the carrier support groups. Where additional strength is needed, fast carrier groups operating in the area may supply CAP. The night CAP is usually from the fast carrier group.

The CAP over an extended period may be furnished by as many as dozen different fighter squadrons and include several different types of fighters. The amphibious controller should know the characteristics of every type of fighter plane—Air Force or Navy—and should be prepared to control any or all of them at any time.

The amphibious controller is seldom acquainted with the fighter squadrons he controls. He does not know the individual characteristics of the pilots nor the experience and qualifications of each.

(b) Reinforcements

In an emergency the amphibious controller cannot scramble another division of fighters but must request them through the proper channels, realizing that the carriers may be under attack and unable to comply. In the defense of the force this factor must not be forgotten—reserves may be limited.

In some operations the TAC may make provisions for turning over certain "call strike" aircraft to the force CIC officer for use in an emergency. From D-day until several days thereafter, the TAC normally has several groups of strafers on station at various points awaiting a request for a direct support mission from the landing force ashore. Thus, if an emergency arises and the force CIC officer needs additional aircraft immediately, it is often

(c) Reporting in of Combat Air Patrol

Because of the number of air control ships in the area, the reporting combat air patrol must not know which ship has control at the time of its arrival over the area. The CAP generally reports in to the force (group) CIC officer. He then turns them over to the ship having the control duty at the time.

(d) Stationing of CAP

A successful interception may depend upon the manner in which the CAP is stationed.

Depending on the radar coverage, the CAP usually should be anchored to land in preference to a point over water. Orbiting over the transport area is seldom the best practice. Convenient landmarks can be selected for the fighters to use as anchor points. It will facilitate station keeping. In addition a quick vector from a land mark may be more accurate than one from over water.

In most cases the CAP over the target area is assigned geographical orbit points or ordered to patrol between two points to afford complete visual coverage of radar blind spots.

(e) Duration of CAP

Dawn alert on the morning of D-day finds most of the amphibious CIC officers embarked in destroyers near the beach and the transport area awaiting instructions. A CIC officer may start his day with orders from the force CIC officer that he is to "control 16 plane Combat Air Patrol." This may be the extent of his instructions. He may have no specific information as to the carrier from which they will come. Regardless of their source it is probable that they will be flown in from the escort carriers who are in an area often as much as 50 or more miles from the objective. Later, when local fields are secured, land based fighters will fly combat patrol. In any case in the early stages of the assault phase the amphibious CIC officer must have a minimum fighter cover from the escort carrier. Also because of the distance flown from their own group, their effective fighting time at the objective is somewhat restricted.

possibility of a relief flight being held up due to operational difficulties makes the problem of maintaining air cover over the objective more difficult as the operation progresses.

(f) Before the combat air patrol is relieved, it contacts the force (group) CIC officer to determine whether the TAC has a support mission for the CAP prior to returning to base. If there is no support mission for the CAP, the controlling ship so instructs the flight leader as directed by the force (group) CIC officer).

If the flight leader asks for a steer home, the CIC officer would give him a vector to his base.

(g) *Types of Control*

Once control of the CAP has been assumed by the TAC and his CIC officer, the type of control to be used must be determined. When radar information is adequate, the regular method (the directive method) of vectoring CAP to intercept is used.

Often due to land echoes at the target area and unsuitable radars, control of CAP can best be accomplished by giving CAP reports of bogey from established reference or orbit points. This is often referred to as the informative method. The CAP then vectors itself in line with points mentioned conducting its own interception solely on reports of bogey's location in respect to established points.

(h) *Visual Control*

Visual air control is used primarily by air control pickets or screening air control destroyers to knock down low-flying snoopers or attacks. This method is useful in conjunction with the CAP's visual patrol in areas of poor radar information.

Q. CONTROL OF NIGHT FIGHTERS

The use of night fighters over the target area is highly desirable, and control can be accomplished by the following methods:

1. Land based air control and search radar.

R. INTERCEPTION TECHNIQUE IN AMPHIBIOUS OPERATIONS

The interception itself may be conducted along lines not adaptable to air control in normal carrier operations. The fighters are vectored out in the general direction of attack and their angles increased on the first warnings. When the raid appears to be crossing, the fighters may be orbited or held back at a position 25 miles from the base in the direction of the attack. If anchored to an island or some other geographical point at this distance from base. Since amphibious forces must be protected before any other group, the CAP is held back until the last possible moment. It must be certain the raid is closing the amphibious force and not going elsewhere before the CAP is released. The raid may turn and close on the escort carrier whose CAP has been vectored to intercept.

In giving the fighters information, it should preferably be in reference to easily identifiable landmarks. If the bogey can be described over "X-ray bay" for example, the fighter will have a better understanding of the bogey's position. In the absence of an altitude determining radar and as the fade chart is reliable only to a certain point, more frequent stacking of the fighters is required when working with several divisions. This action may be necessary even at the risk of decreasing the effectiveness of the CAP. Radical changes in the altitude of the CAP may be necessary to overcome fade chart limitations.

S. SUCCESSFUL CONTROL OF THE CAP

High cover as well as low at the objective is advisable. When visibility is limited, a second altimeter may be good insurance, particularly in the event of a chase for a snoopers. When operating near land masses off an objective, cover may be required and sometimes visual control must be employed.

If the amount of CAP available permits "defense in depth" is advisable. If CAP is sufficiently backed up by other divisions,

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to stop the attack in the event an early Tally-ho is missed.

T. GENERAL

Amphibious operations require coordination and teamwork above everything else. In the

use of orbit points, reference points, and many other ways amphibious control resembles land based air control. The duties and responsibilities are manifold and versatility is keynote.

CHAPTER SEVENTEEN

HUNTER/KILLER OPERATIONS

- A. DEFINITION.
- B. OUTLINE OF HUNTER/KILLER TACTICS.
- C. SEARCH PATTERNS
- D. PLOTTING AND TRACKING.
- E. RELATIVE PLOT.
- F. COMMUNICATIONS.
- G. IFF.
- H. RADAR.
- I. CONTACT REPORT.
- J. CIC PROCEDURES IN HANDLING A CONTRACT.
- K. ADDITIONAL FUNCTIONS OF CIC.
- L. HUNTER/KILLER OPERATIONS WITH FAST CARRIER TASK FORCES.



Figure 134.

CHAPTER 17

HUNTER/KILLER OPERATIONS**A. DEFINITION**

Hunter/killer operations are combined air-sea actions against enemy submarines. An offensive hunter/killer unit, normally a task group composed of one CVE or CVL and six to ten DD's or DE's, searches out, tracks down, and destroys submarines. Hunter/killer operations are one phase of antisubmarine warfare (ASW).

B. OUTLINE OF HUNTER/KILLER TACTICS

The initial detection is normally done by the carrier planes, usually a bomber (VA). The planes fly search patterns which extend out as far as 150 miles from the carrier. When a plane detects an enemy submarine, either visually or by radar, it notifies the carrier and immediately initiates an attack with depth charges, automatic weapons, and rockets when possible. If an attack is not possible, the plane attempts to keep track of the submarine by use of sonobuoys until a DD or a DE can arrive and develop the sound contact. The CIC aboard the carrier vectors additional planes to the scene of the contact which aid in the attack. The task group heads toward the contact closing to an effective

DD's/DE's from the screen are vectored to the scene of the contact. When the planes reach the contact area, they are coached by the CIC to make a sound or visual contact with the submarine. After making contact the DD's/DE's attack according to prescribed doctrine until the submarine has been destroyed. During the period that the DE's are attacking the submarine the planes remain in an orbit over the submarine to assist in any way possible. They are in radio communication with and are controlled by the DE's making the attack. Good team work between the DE's and the planes aids in getting a definitive kill. After the submarine has been destroyed all attacking units are homed.

C. SEARCH PATTERNS

The search patterns followed by hunter/killer planes are very carefully planned with due regard for visual and radar limitations and the probability of encountering submarines in the area being searched. Modern submarines normally operate submerged during daylight hours and surface at night for as short a time as possible in order to recharge batteries and ventilate the boat. Snorkel equipped submarines may be

In conducting night flight operations from carriers it is important to design the search plan in such a way that the navigation is as simple as possible. It is also essential that the pilots obtain frequent checks on the position of the carrier. The following search plan is considered one of the most efficient consistent with these requirements. A basic flight plan is shown as it appears on the DRT in figure 137 and as it appears on the relative plot in figure 138. Two planes take off together and fly duplicate tracks on opposite sides of the base course of the task group.

The plan is laid out so that the planes make contact with the carrier at the end of each return leg. In this way navigational errors can be corrected at the termination of each sweep, and there will be no cumulative error. The algebraic formula for the track is

$$w = a \left(\frac{V_p}{V_c} - 1 \right), \text{ where:}$$

w = maximum distance of search from base course.

a = length of leg paralleling base course.

V_p = ground speed of plane.

V_c = speed of advance of task group.

When any three of these factors are known, the fourth can be determined by the formula. It is desirable to limit the length of a to twice the distance of visibility in order that visual coverage of the entire area being swept can be had. When a is so limited, the maximum length of w is also limited.

Additional search patterns may be found in USF 8. Any plan may be modified by the OTC to meet existing circumstances.

D. PLOTTING AND TRACKING

During search operations both a DRT plot and a relative plot are maintained in CIC, showing at all times the location of each search plane and the position of each DD/DE in the group. Radar plots are used whenever possible, with dead reckoning employed to track the planes below the radar horizon.



Figure 135.

should be drawn on the DRT, and any marked deviation of the actual track from the intended pattern should be noted and brought to the attention of the OTC. Ground speed rather than air speed must be used in dead reckoning of planes on the DRT. If radar silence is in effect, plots must be maintained entirely by dead reckoning.

The DRT plot should also contain land area, other friendly forces, recent or expected enemy contacts and any other pertinent data desired by the OTC. All friendly submarine locations and the location of friendly submarines should be plotted on the DRT as well as on a separate chart of the area. In addition the DRT plot should also contain evaluated intelligence of submarine locations obtained by RDF, radio search receivers, and plots from ashore. All information is, of course, plotted with other search information if it is pertinent.

If the ship deviates substantially from "Position Option," or the course on which the planes have based their navigation, the picture on the DRT is not distorted.

E. RELATIVE PLOT

The relative plot gives a picture of the progressive positions of the search planes as they appear on the PPI. The relative diagram of the search pattern should be laid out on the relative plot, and any marked deviation from the pattern by a search plane should immediately be called to the attention of the pilot by CIC along with corrective vector(s) guiding him back to the pattern.

the DRT plot, dead reckoning must be employed to track the searches below the radar horizon. The planes must be dead reckoned along the relative track, at the speed and in the direction of relative movement. If the task group is changing course or speed, it is desirable to correct the relative track with plots taken from the DRT.

F. COMMUNICATIONS

Carrier, screen, and planes are all equipped with voice-modulated VHF/UHF radio equipment. Two VHF/UHF frequencies are generally employed in hunter/killer operations. One of these frequencies is common to all units, the other is used solely for intership communications. HF is assigned as standby for the VHF/UHF and guarded by all units involved. This is to be used only in case of emergency or when directed by the OTC.

Under conditions of strict radio silence, communications can be maintained over very short range by visual methods. The planes can use message drops, blinker, hand signals, and radical maneuvers. Ships can use flag hoist, blinker, and occasionally puffs of smoke or steam. In addition, the planes can use their IFF for communications to a limited extent.

When search planes are beyond VHF/UHF range of the carrier, a plane, called an "Auto-cat," may be stationed above the ship or between the ship and the plane in question for relaying messages on VHF/UHF.

G. IFF

Standard procedure requires that the pilot shift to a specified IFF code when a contact has been made. If for any reason there is doubt about identity of the particular plane which has the contact, further verification can be obtained by ordering the pilot to energize his "G" band equipment. When IFF only appears on the screen, it can be used to get an accurate distance, and the bearing can sometimes be obtained from D/F equipment.

H. RADAR

search radars from sunset until one hour after sunrise. YE/YG and YJ are operated as navigational aids to the pilots as long as planes are air borne.

I. CONTACT REPORT

When a plane makes contact with the enemy, the procedure followed by the CIC officer will depend upon doctrine as set forth by the OTC and conditions of radio and radar silence obtaining. If, as is frequently the case, radio and radar silences are relaxed as soon as contact is made, the CIC officer's problem is much simplified.

In that case, the plane will make a contact report in plain language or in simple voice code. This report should be made, unless absolutely impossible, before the plane goes into attack. This insures against the possibility of the plane being damaged by AA to such an extent that it is unable to make a report.



Figure 136.

J. CIC PROCEDURES IN HANDLING A CONTACT

The CIC officer must first locate the plane having contact and direct air reinforcements to the scene of action. The first estimate of position will come from the DRT track, supplemented by the plane's own estimate included in the contact report. If the plane is with

horizon, but he must not climb so high that he loses contact with the enemy.

The directing of additional planes to the scene will be in accordance with the operation order or orders of the OTC. Many CVE hunter/killer group commanders have found it advantageous to give the CIC officer standing orders to direct the nearest air-borne plane to the scene as soon as contact is made. This eliminates the delay inherent in alerting the OTC and awaiting his orders, and on many occasions has saved valuable minutes in getting reinforcements to the scene of a contact.

When so directed by OTC, CIC directs two or more H/K vessels from the screen to the contact area. Orders of the OTC are generally put out from CIC. The surface attack group of H/K vessels maintains a complete, duplicate CIC plot in each ship. Upon arrival at the scene of action the senior vessel takes charge of the aircraft at the scene.

During the progress of an attack, the CIC must keep track of all forces, both air and surface, aid in joining them up when necessary and coordinate their efforts.

Pilots of relief planes are thoroughly briefed on the tactical situation prior to take-off, and the planes are directed to the scene of contact by CIC, using air control methods.

When the submarines have been destroyed, it may be necessary for CIC to home both the planes and the DE's.

K. ADDITIONAL FUNCTIONS OF CIC

The following additional functions must be carried out by CIC:

1. A log of all events pertaining to the development and destruction of the contact shall be kept including:

- (a) When the first attack is made.
- (b) Time and type of each attack.
- (c) Number, time, and axis of pattern of sono-buoy drops.
- (d) Time arrival of H/K vessel at scene of contact.

2. The commanding officer must be kept informed of the progress of the attack throughout the entire operation.

3. The DRT must be kept up to date and show a complete picture of the operation.

L. HUNTER/KILLER WITH FAST CARRIER TASK FORCE

Provisions for hunter/killer operations made by fast carrier task force command are purely for defensive purposes. The task group flies antisubmarine patrols during normal operations. When one of the planes makes a submarine contact, additional planes are ordered to the spot, and destroyers from the screen are ordered to join in the attack. Unlike the offensive hunter/killer group, the fast carrier group proceeds on its mission, leaving the planes and destroyers behind. The planes, if of necessity, return to the group when fuel runs low, and frequently it is not considered practicable to launch relief planes. Destroyers, however, may remain in the area for a considerable length of time and rendezvous with the group the next day.

TYPICAL DRT PLOT OF HUNTER/KILLER OPERATIONS

Conditions.—81 Mohawk and 82 Mohawk conducting a search as shown in figure 1. Radar silence is in effect and planes have been dead reckoned completely around their sector. Note that intelligence reported a D/F fix at 45°N, 20°W during the night and that at 0100 the carrier made an HF/DF contact on bearing 100°. Also note that a neutral ship was reported at 44°N, 19°W at 0000 on course 90° and speed 15 knots.

INTERCEPT PLOT OF HUNTER/KILLER OPERATIONS

Actual direction of planes will usually be determined from an intercept plot. This plot shows the same search plotted on the DRT plot. The plots obtained from the DRT at times 20, 30, and 40. Deviation of the carrier's course

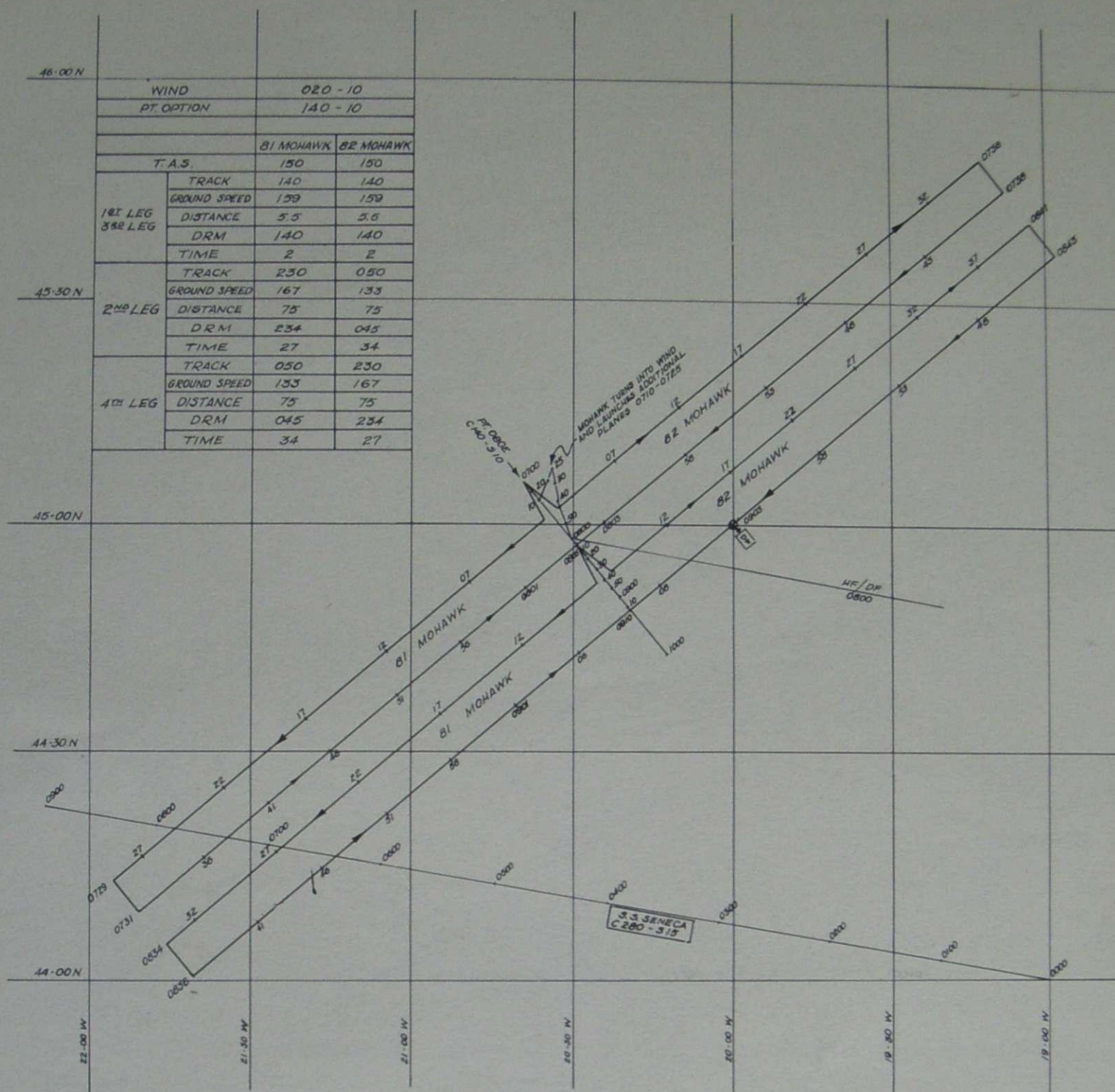


Figure 137.—Typical DRT plot of hunter/killer operation.

Past DR tracks on the intercept plot are erased to keep the plot clear.

RADIO LOG OF HUNTER/KILLER OPERATIONS

Figure 138 shows the intercept plot and DRT plot of a typical search. At 1350, 85 Mohawk sights a submarine. The sequence of events might be as follows:

"This is Mohawk. Roger. Out."

1351—"87 Mohawk. This is Mohawk. Vector 280, 50 miles for contact. Over."

"This is 87 Mohawk. Wilco vector 280. Out."

1352—OTC is informed of contact and vector. CIC goes to partial GQ. OTC decides not to launch additional planes.

1353—DRT places contact at 201, 51.

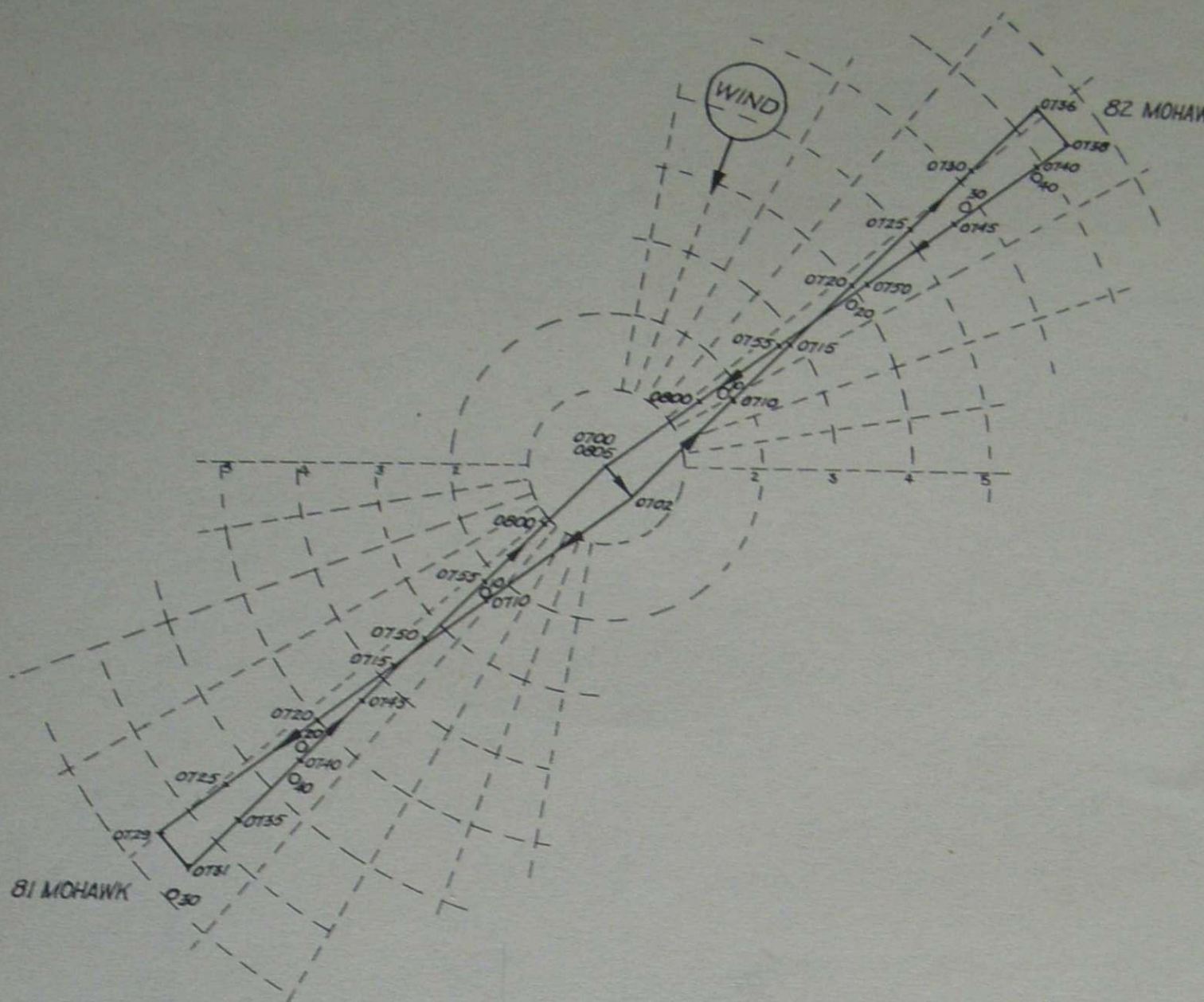


Figure 138.—Typical intercept plot of hunter/killer operation.

"This is 87 Mohawk, Wilco Angels 8. Out."

1355—"Mohawk. This is 85 Mohawk. Have attacked with automatic weapons, rockets, and depth bombs. Sub damaged. Still on surface. Have two rockets, 1 depth bomb. Request instructions. Over."

"This is Mohawk. Stand by. Out."
OTC is consulted.

1356—"85 Mohawk. This is Mohawk. Withhold attack until 87 Mohawk joins
... unless target is ..."

1358—SK reports 1 or 2 aircraft at 174, 66 m
presumed to be 87 Mohawk and
Mohawk.

1400—OTC decides to send two DE's to sc
of contact. They are directed by T
or flag hoist on course recommended
CIC. They are tracked on DRT u
out of radar range; then dead-reckon
to scene. Task group also chan
course to close contact.

1402—"87 Mohawk. This is Mohawk. Vec
starboard 295. Target ahead
..."

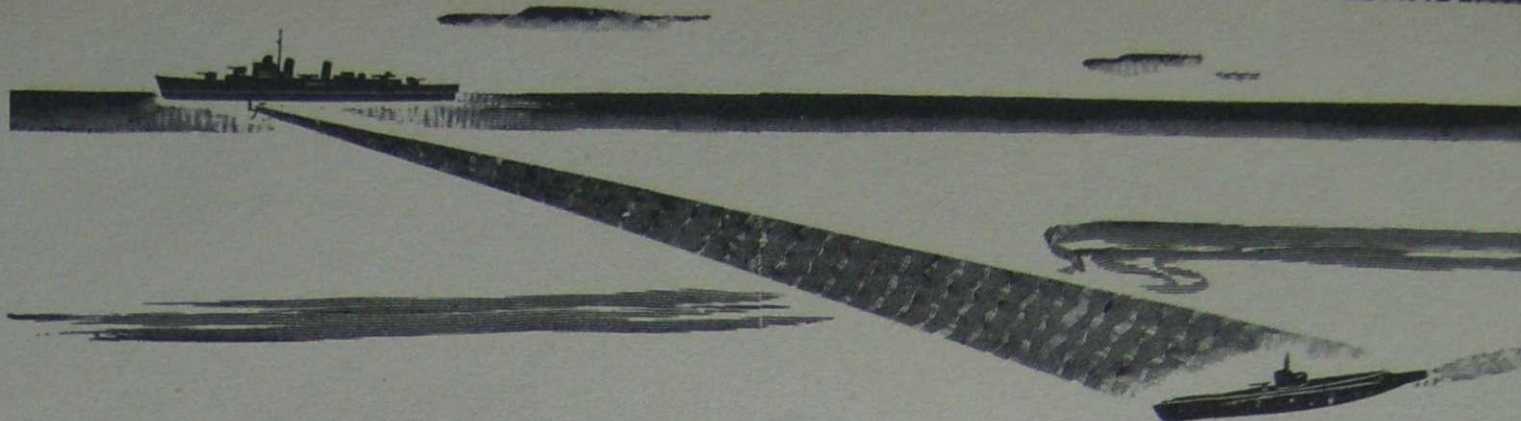


Figure 139.

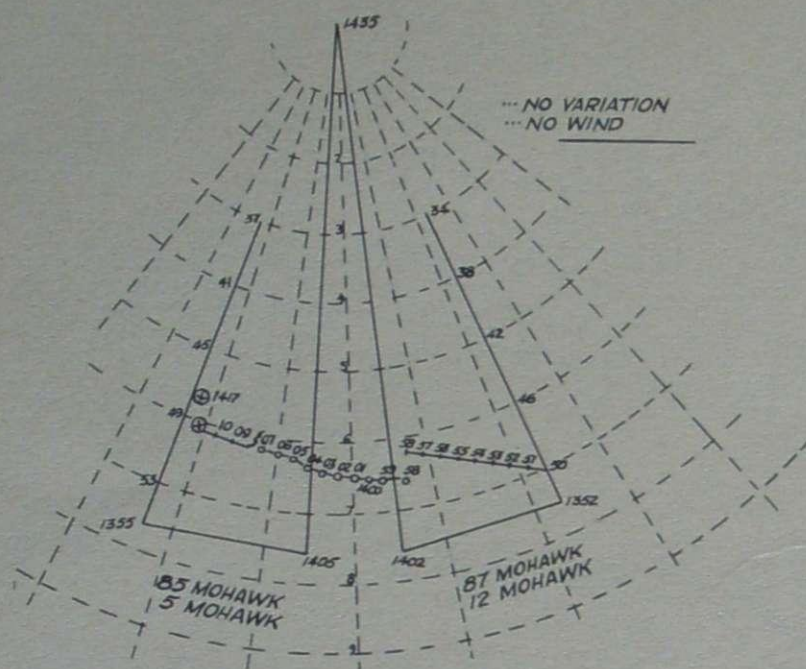


Figure 140.—Intercept plot of a typical search.

1403—"85 Mohawk. This is Mohawk. 87 should join you in six minutes. Chief and Papoose (calls for DE's) on their way."

"This is 85 Mohawk. Roger. Out."

1406—"87 Mohawk. This is Mohawk. Target ahead 10. Go down for visual contact. Over."

"This is 87 Mohawk. Wilco. Out."

1408—SK reports 87 Mohawk has faded from screen.

1411—"87 Mohawk. This is Mohawk. You should be over target. Commence expanding square search. Over."

"This is Mohawk. Roger. Proceed with attack. Have one plane climb for when possible. Over."

1417—SK reports plane orbiting at 202, 56 miles showing IFF #4. This is plotted on intercept plot and DRT.

1420—"Mohawk. This is 85 Mohawk. H delivered second attack, sub submerged. Believed damaged. S noises on sono-buoys. Over."

"This is Mohawk. Roger. Out."

1422—Controller checks fuel and ammunition on all planes. Leaves 87 and 12 orbiting area. Brings 85 and 5 back to base.

1500—87 Mohawk and 12 Mohawk relieved station by 86 Mohawk and 7 Mohawk.

1545—"86 Mohawk. This is Chief. Believe have you at 200-25. Over."

"This is 86 Mohawk. Roger. Believe sub still in area. Out."

Chief takes course 200.

1615—Task group about 25 miles from contact remains in that area.

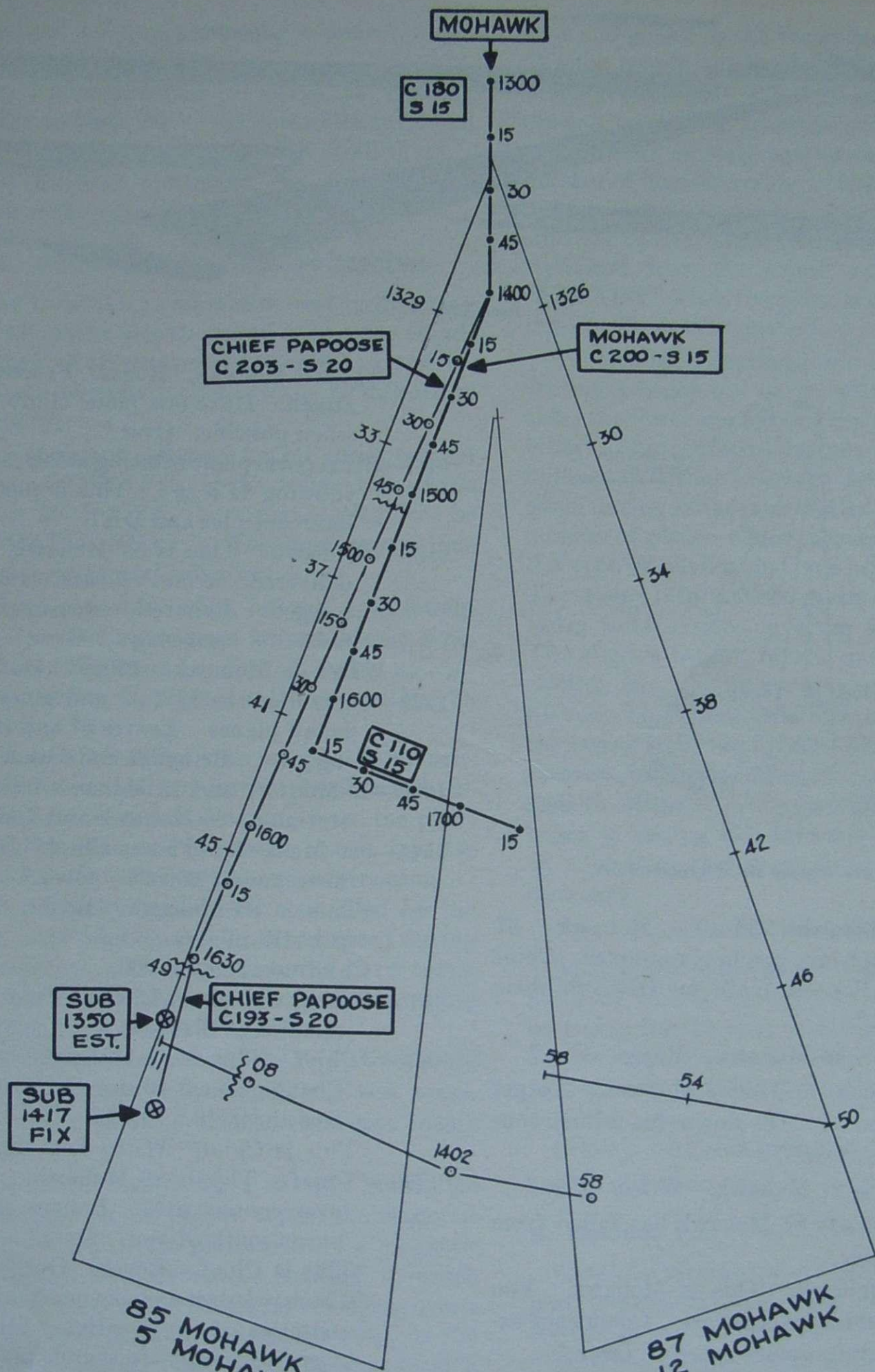
1630—"Chief. This is 86 Mohawk. See you. Change course 10 degrees port. Contact ahead 10. Over."

"This is Chief. Wilco Port 10. Out."

1700—"Chief. This is 86 Mohawk. You over contact area. Believe sub 1, yards south of you. Over."

"This is Chief. Roger. Out."

86 Mohawk drops smoke bomb on his best estimate of sub position. DE's commence appropriate search plan.



CHAPTER EIGHTEEN

HOMING PROCEDURE

- A. INTRODUCTION.
- B. RECOGNITION OF LOST PLANES.
- C. HOMING EQUIPMENT.
- D. PROCEDURE FOR AIDING A LOST PLANE.
- E. HOW TO RECOGNIZE A LOST PLANE.
- F. COMMUNICATION PROCEDURES.
- G. CONTROL PROCEDURES UNDER VARIOUS CONDITIONS.
- H. DIRECTION FINDING EQUIPMENT.
- I. NIGHT HOMING.
- J. PILOT RESPONSIBILITY.



Figure 142.

CHAPTER 18

HOMING PROCEDURE

A. INTRODUCTION

In air operations conducted over wide expanses of ocean it frequently happens that planes become completely lost. This is especially true in the case of planes operating from a mobile base such as an aircraft carrier. The reasons for this are several: The plane may be damaged so that the navigation equipment is not working properly; the task group may change course and be unable to notify all planes of the new "point OBOE"; there may be a radical change in winds; and, finally, there is always the possibility of pilot error.

B. RECOGNITION OF LOST PLANES

An important function of CIC is the homing of lost planes. CIC may become aware of the fact that planes are lost in a number of ways. The failure of a plane to return for a scheduled landing or the appearance of emergency IFF may indicate a lost plane. Sometimes a lost plane can be recognized by tracking with radar the course of an otherwise unidentified friendly

sider himself lost, however, he has certain aids which he may utilize. The most important of these are the YE/YG, YJ, and YM homing beacons. The first requires a radio receiver and a compass in the plane, the latter two require air-borne radar.

C. HOMING EQUIPMENT

YE/YG is a ship-borne CW transmitter, automatically keyed, which transmits via a rotating directional antenna. It is synchronized with a gyro compass so that each letter is beamed from the ship on a certain true bearing. The letters used are A, D, F, G, K, L, M, N, S, U, and W. At maximum range of equipment, one and only one of these letters can be heard in each of the twelve 30° sectors of azimuth. However, as range for the YE/YG decreases, the ZB equipment in the aircraft will begin to pick up letters in adjacent sectors, but they will be weaker than the correct sector letter. At close ranges as many as two letters either side of the correct sector letter may be distinguished. The pilots carry the letter

pose the sector letters are changed daily or according to existing instructions. The YE/YG of the parent ship can be distinguished from others by the frequency and also by two letter identification signals which are transmitted automatically every $4\frac{1}{2}$ minutes. The ZB, which is a special receiver for YE/YG, is installed in all carrier planes.

YJ is a radar beacon which is operated by certain types of air-borne radar. It is nondirectional, but the pilot or air-borne radar operator can determine both distance and bearing of his base and also distinguish between his base and other bases. Since both YE/YG and YJ operate in the VHF band, the range over which they are effective is in proportion to the altitude of the aircraft. YM is a similar beacon for air-borne radar of higher frequency. It operates on the same principles as the YJ, but its response is coded in a different manner.

D. PROCEDURE FOR AIDING A LOST PLANE

Even though differences in procedure will arise, depending on whether the lost plane is alone or part of a formation or whether it is damaged and low on fuel, certain basic principles apply to the homing of all aircraft. A lost plane damaged and/or low on fuel demands quick action and accurate judgment. The CIC officer may be able to bring him all the way home, but if not, he may be in a position to direct him to the base closest to the plane. Even though the plane has ample fuel, quick and accurate judgment is still mandatory, to insure that the pilot receives a proper homing vector before communications fail. Regardless of the different situations, however, the CIC officer must immediately check on two factors:

1. Communications with the lost plane.
2. The position of the lost plane, i. e., attempt to identify it on the radar scope.

Once the plane is thus located and communications are established, the CIC officers will utilize such homing procedure as the situation

A brief outline of procedures to follow is set out below:

E. HOW TO RECOGNIZE A LOST PLANE



Figure 143.

1. Its pilot calls you or another ship for a vector home.
2. Appears to be lost on your plot.

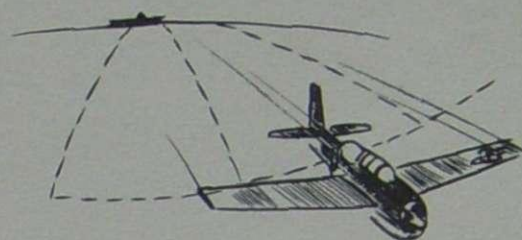


Figure 144.

3. Strays out of his search sector.

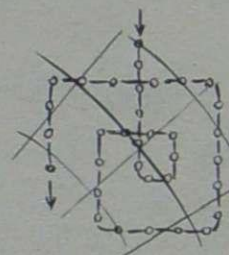


Figure 145.

4. Flies an expanding square. (As shown in USF 77.) May not show emergency IFF.

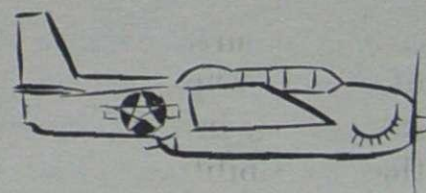


Figure 146.

5. Appears to be passing base on return from mission.



Figure 147.

F. COMMUNICATIONS PROCEDURES



Figure 148.

1. Notify OTC.



Figure 149.

2. Establish communications with the plane. (Check your condition of radio silence.)

3. Call him on assigned frequency.

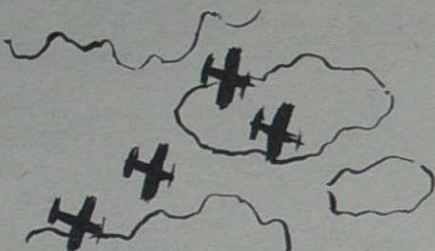


Figure 150.

4. If this fails, he may be below the horizon. Call one of the highest air-borne planes and have him relay for you.



Figure 151.

5. If you still cannot raise him, you can send a section of planes in his direction and try relaying again.



Figure 152.

6. Call on secondary or alternate frequency and go through steps.



Figure 153.

7. If communications cannot be established, the pilot may still be able to receive but not transmit. If you have a good fix on him, follow your instructions and watch your plot.

G. CONTROL PROCEDURES UNDER VARIOUS CONDITIONS



Figure 154.

1. You have the plane definitely located and are in communication with him.

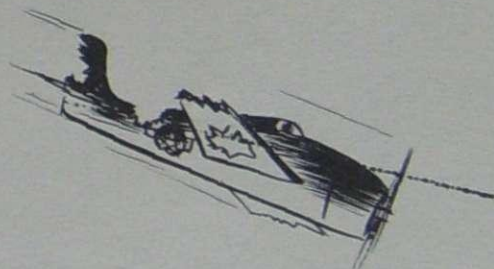


Figure 155.

Get a fuel report and find out if he is in any trouble. Then give him a steer. (If he has to get back in a hurry, keep a good plot, notify the other ships of the formation if the plane is to ignore assigned approach procedure.)



Figure 156.

2. You are not sure which of several planes on your plot he is. Ask him his heading. This may identify him.

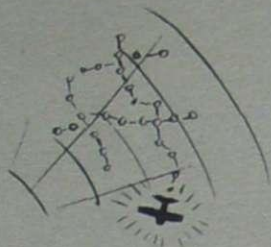


Figure 157.

If not, have the plane turn on emergency IFF. Do this only long enough to get his straightened out. Notify the other radar guardships as they may be able to help spot him.



Figure 158.

If several planes are showing emergency IFF, the individual one can be picked out by having him switch his on and off at specific times. Clear the screen by taking care of the close ones first.



Figure 159.

3. Plane does not show on the screen at all. Instruct him to climb, showing emergency IFF.

Note: The IFF will often show when the actual pip does not.

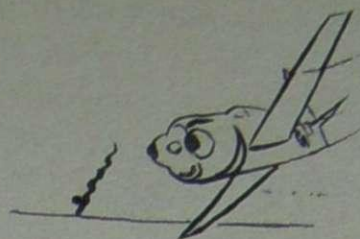


Figure 160.

4. Depending upon the situation the ship may fire anti-air bursts or make smoke as described in USF-77A.



Figure 161.

5. D/F can also be invaluable in finding your plane or in finding him out when several planes are showing emergency IFF. As described later.

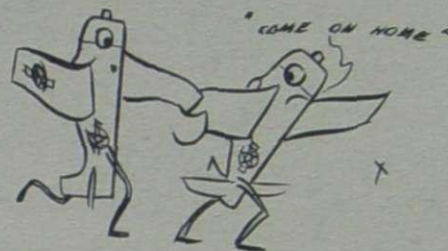


Figure 162.

6. You have no communications but have a good plot on the screen. Here you may be able to vector other planes to bring him home. This might be done even with communications if the lost plane's coordinates were out of order.

H. DIRECTION FINDING EQUIPMENT

Direction-finding equipment consists of a radio receiver with a loop antenna. When the antenna is trained so that the plane of the loop is perpendicular to the direction from which the signal is being received, the strength of the signal is at a minimum. In this way the signal is ascertained to be coming from one of two reciprocal directions. "Sensing gear" on the

equipment enables a trained operator to distinguish between the correct bearing and its reciprocal. It is generally safest to check the operator's decision by having the plane fly at right angles to the line of bearing and observing the bearing to see if it increases or decreases.

I. NIGHT HOMING

At night, or under conditions of very low visibility, the problem of homing is made more difficult by the fact that the planes cannot sight the base until they have closed to extremely short range. An exception might be found in radar equipped planes, but even they frequently must rely on instructions from the CIC officer until visual contact has been made. Searchlights and flares may be used when the tactical situation permits.

J. PILOT RESPONSIBILITY

The responsibility for homing planes is not the CIC officer's alone.

The pilot should be thoroughly briefed in the

procedure outlined above. He should also be familiar with *Lost Plane Procedure in USF-A*.

The successful homing of a lost plane by radar will do more to sell your pilots on CIC than anything you can do.

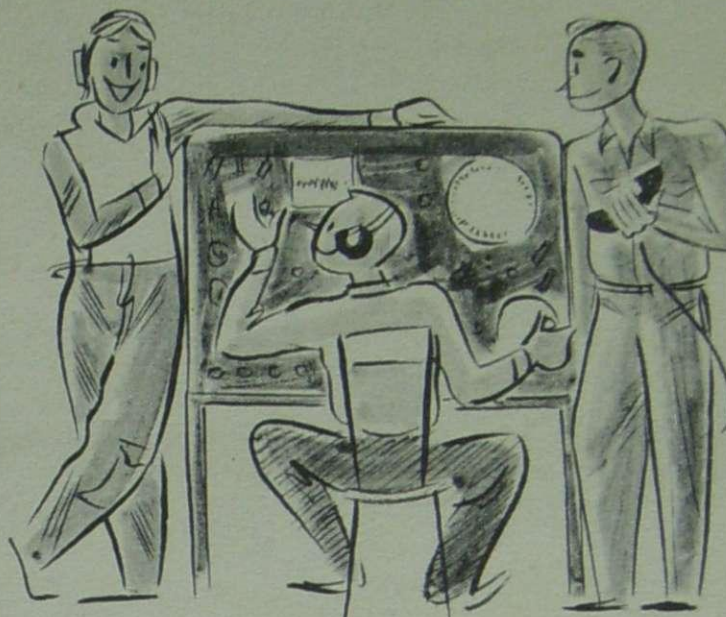


Figure 163.

CHAPTER NINETEEN

SEARCH AND RESCUE

- A. IMPORTANCE.
- B. GENERAL PRINCIPLES.
- C. RESPONSIBILITY.
- D. PILOT PROCEDURE IN A FORCED LANDING.
- E. INSTRUCTIONS FROM BASE TO PILOT.
- F. SEARCH AND RESCUE POINTS AND CODE NAMES.
- G. REPORTING IDENTITY AND CONDITION OF SURVIVORS.
- H. ORBITING SCENE OF CRASH.
- I. LIFEGUARD SUBMARINES.
- J. THE SUB CAP.
- K. SEAPLANE RESCUE.
- L. DUMBO PLANES.
- M. DESTROYERS WITH AND WITHOUT PLANE COVER.
- N. DUTIES OF CAP ON DESTROYER RESCUE MISSIONS.
- O. LAND-BASED CRASH BOATS.

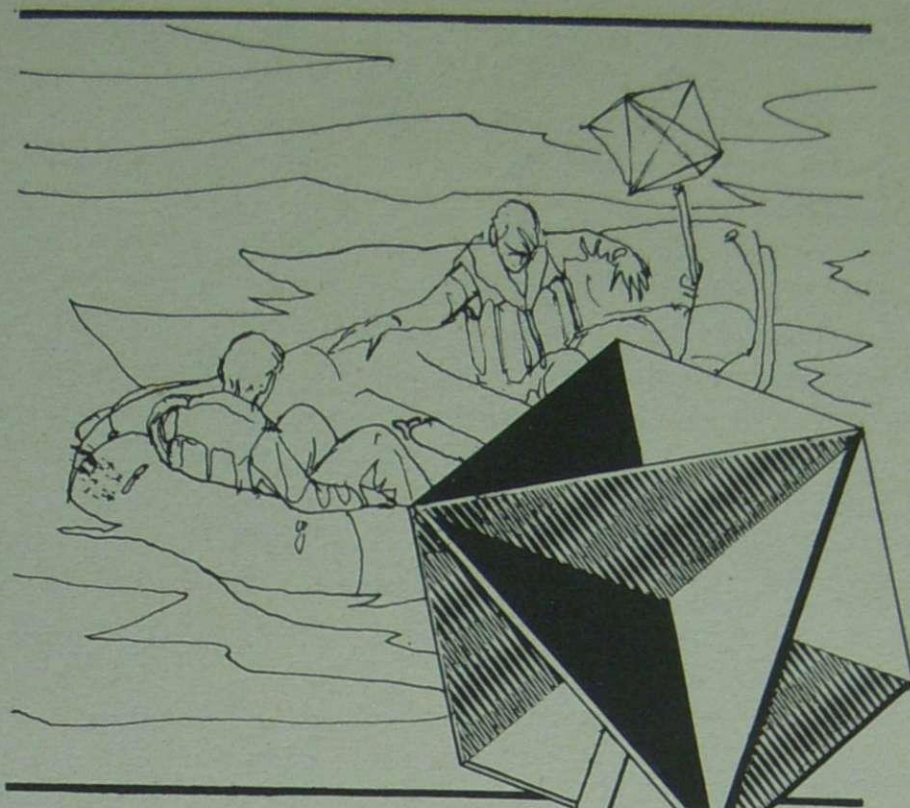


Figure 164.

CHAPTER 19

SEARCH AND RESCUE

A. IMPORTANCE

The United States Navy places high value on her airmen and every effort is made to rescue them when downed. An extensive program for rescue facilities has been set up within the fleet. Pilots know that everything humanly possible will be done to pick them up when downed at sea.

B. GENERAL PRINCIPLES

Rescue operations very often require closer understanding and cooperation in operating procedure between separate commands and task forces than is the case for any other type of operation. In addition to units which have been specifically designed as rescue agencies during an operation, any surface ship, small craft, submarine, or aircraft participating in the operation may at any time be called upon to participate in a rescue.

C. RESPONSIBILITY

It is the responsibility of the OTC to see that downed personnel under his command are rescued. It is therefore imperative that all reports of survivors be immediately relayed to him. In this connection the DRT can be of great help in determining the geographic position of the survivors.

The OTC must know all rescue facilities which are at his disposal. He must consider the location of the survivors with respect to land and friendly ships in order to determine what type of rescue is most practicable. He must be kept informed of the progress of all rescue attempts and of their ultimate success or failure.

D. PILOT PROCEDURE IN A FORCED LANDING

When a forced landing is imminent, the pilot should attempt to establish communication with his own base immediately turning

estimated position and present altitude. This may be given as range and bearing from his base or other reference point, or in latitude and longitude. He should also give the base his call sign and type of plane, and the nature of the emergency.

Prior to ditching at night, the pilot will turn on emergency IFF and turn on all running lights. Position will be broadcast either with reference to reference point or point option, whichever is closest.

Other aircraft, if observing a crash, will drop float lights, transmit a report, and orbit the survivors turning on lights to guide rescue vessel. Survivors may assist by firing red Very star, signalling with flashlight, or by firing tracer ammunition.

E. INSTRUCTIONS FROM BASE TO PILOT

1. The pilot should be instructed to turn on his emergency IFF.

2. The pilot should be instructed to head for the nearest rescue facility, and advised to land well ahead of it. Planes which land astern or alongside of a ship underway increase the ship's difficulties by forcing it to back down or turn in order to effect rescue.

3. The pilot should be advised of the sea conditions, the direction and velocity of the surface winds, and any other pertinent weather information.

4. If several vessels are in the vicinity of the rescue ship, the pilot may be informed of the ship's identity and the type of signal the ship may employ.

Example: "Bird Dog—Destroyer is 3-6-0. She is on course 2-7-0 degrees. She will make smoke to identify."

F. SEARCH AND RESCUE POINTS AND CODE NAMES

In the interest of security as well as simplicity, land reference points are established in those areas where it is anticipated that the majority of water landings will occur in connection with combat operations. These points may be used in reporting the position of forced

and bearing from the nearest reference point. The following sequence is used to report position:

1. Distance in nautical miles from reference point.

2. Code word for reference point used.

3. True bearing from reference point.

Example: "15 Hairbreadth Harry
Meaning survivor (or survivors) down 15
bearing 180° true from reference point (as-
ing "Hairbreadth Harry" to be the appli-
code word).

It should be noted that the code name serve not only to identify the reference point but also as the voice call for any or all rescue agencies to whom the position report is addressed. No further voice call is required. Thus a complete message might read: "T-99 Mohawk. 15 Hairbreadth Harry Over." This message would be regarded as addressed to a lifeguard submarine station, rescue PMB on station, a surface ship or rescue VOS that might be concerned in the rescue incident, or to several of such rescue agencies.

G. REPORTING IDENTITY AND CONDITION OF SURVIVORS

In addition to position, the identity and condition of survivors is necessary for effective rescue operations and should also be reported. The following is an example of a possible report code.

1. The call of the survivor's parent command or base should be stated where known.

2. The type of aircraft, if known, using standard language or the following code:

CHICKEN—fighter.

HAWK—dive bomber (2-man crew).

FISH—torpedo bomber (3-man crew).

EAGLE—medium bomber (6-man crew).

BOX CAR—heavy bomber (9- or 10-man crew).

MONSTER—VLR aircraft (11- or 12-man crew).

3. The condition of survivors, in accordance with the following words:

DAVEY JONES—survivor(s) without life jackets.

4. The number of survivors.

5. If dye marker is showing, the word "EVERGREEN" should be added.

Example: "15 Hairbreadth Harry 180. Mohawk Chicken. Goodyear One. Evergreen."

Meaning: One fighter pilot of (ship with call of "Mohawk") down 15 miles, bearing 180° true from the reference point, in a life raft with dye marker showing.

H. ORBITING SCENE OF CRASH

Any pilot sighting survivors of a forced landing or ditching is responsible for circling their position and for making a detailed report to his controlling base or to the nearest rescue facility. Further, it is mandatory that he remain on station over the survivors so long as fuel and weather conditions permit, making periodic reports to the base controlling rescue efforts. The pilot may also drop smoke bombs or a dye marker to advertise the location of the survivors. If necessary, the controlling base will instruct the pilot to turn on his emergency IFF in order to obtain an accurate fix. If other planes are also at the scene of the crash, the controlling base may direct one or two to orbit as high above the area as visibility permits in order to facilitate communications and to insure accurate radar fixes. The controlling base will keep all elements concerned in the rescue efforts fully informed of the progress being made at all times.

I. LIFEGUARD SUBMARINES

During fleet operations one or more fleet submarines are designated as "Lifeguards" and are

assigned stations as close as practicable to the target areas covered by our aircraft.

Any pilot expecting a forced landing because of damage, engine failure, or for any other reason before being able to return to his base is instructed to proceed to the position of the nearest lifeguard submarine. (This is not contrary to instructions covering utilization of rescue DD's but rather applies to those cases or near the immediate target area where it would be impracticable for destroyers to cruise

J. THE SUBCAP

For the protection of the submarines against attack and for assistance in the protection and rescue of downed personnel, the OTC designates certain fighters as SUBCAP. The fighters assume patrol station near the submarine under the control of submarine personnel.

If VHF/UHF radio can be used, that will be the normal means of communication. If not, the assigned HF will be used, having due regard for the conditions of security involved. If no radio contact can be made or maintained, the best available visual means will be utilized, such as light signals, circling, zooming in and indicating direction, rocking wings, course changes, and other means.

The SUBCAP monitors the assigned rescue frequencies. At its higher altitude it is in a better position than the submarine to intercept messages. If information of such nature cannot be picked up by the submarine, the SUBCAP will endeavor to maintain an exchange of necessary information to effect the location and rescue of downed personnel.



(a) Duties of the SUBCAP

The CAP under the control of the lifeguard submarine will:

1. Locate and protect survivors.
2. Guide submarine to location of survivors.
3. Protect submarine from enemy action.
4. Act as a radio relay station.
5. Keep record of all downed personnel, knowing position and time, rescued or not.
6. Inform relief SUBCAP of all personnel not rescued and reports not receipted for.

(b) Physical Procedure for Making a Sub Rescue

The lifeguard sub upon receiving a survivor report will proceed to the reported point and with the aid of its CAP will effect rescue. The rescue may be made difficult by enemy shore or surface ship fire, in which case the CAP will try to divert the fire or destroy its source. On such occasions it may be necessary for the sub to proceed to the downed pilot, submerged to periscope depth, in which case the pilot should try to hang on to the periscope tube and be towed out of range of enemy fire. This type of rescue has been successfully accomplished a number of times in enemy waters during World War II.

(c) Need for Reporting Results of Rescue Mission

Rescue CAP must immediately report to its base all unsuccessful rescues so that other means may be employed.

(d) Use of Other Subs for Rescue

Normally lifeguard submarines are employed only in the immediate target area.

Submarines other than designated lifeguard submarines may attempt to communicate with any impending forced landing in their vicinity and they will utilize the above procedure to effect rescue where possible.

K. SEAPLANE RESCUE*(a) Purpose*

Seaplanes can effect rescue in areas which marines cannot reach because of shoals or low water. On the other hand seaplanes not operate in rough waters whereas this little effect on the submarine.

(b) Composition

The flight consists of an appropriate number of seaplanes or helicopters accompanied by a fighter escort (BIRDCAP). The seaplanes are kept in readiness for immediate launch and take off as soon as a mission is assigned. The fighters may be drawn from any source, their primary mission being protection of the slow, vulnerable seaplanes.

In a carrier task force operating with battleships and/or cruisers, one battleship or cruiser may be designated by the OTC to maintain seaplanes in condition 11 (10 minutes' notice) and a second battleship or cruiser to maintain seaplanes in condition 12 (20 minutes' notice). The OTC will also assign the rescue CAP.

(c) Briefing of Seaplane and CAP Personnel

Both seaplane and CAP personnel are thoroughly briefed on all the available information so as to expedite the rescue. This briefing should include position of survivors, type of rescue, calls of CAP and rendezvous position, frequencies assigned for mission, and character of whatever enemy activity may be in the vicinity.

(d) Departure for Mission

Once rescue planes and fighter escort are airborne, they should rendezvous as quickly as possible and proceed on their mission. The OTC tracks them by radar and maintains a DR after they have faded from the screen.

(e) Responsibility for Flight

The responsibility of leading the flight and directing rescue operations falls to the senior fighter pilot. When the seaplane is too heavily loaded for take-off after picking up survivors, it may sometimes taxi to the nearest friendly position, always under the protection of the fighters.

As in the case of the submarine rescue (C)

that escort fighters keep rescue seaplanes in sight at all times from time of departure until return to base.

L. DUMBO PLANES

Dumbo missions are similar in nature to air-sea rescue missions but employ long-range flying boats in lieu of seaplanes. The principal advantage of flying boats over seaplanes lies in their long endurance and great carrying capacity. If rescue is not possible, they may drop survivor gear. They generally operate from shore bases and tenders, and their crews are carefully briefed before each mission; however, task force or task group CIC officers of forces operating at sea may assist Dumbo aircraft in numerous ways.

when the rescue mission requires protective cover.

The actual rescue operations are carried out by the crew of the plane, without assistance.

(b) *Warning Friendly Forces of Dumbo's Approach*

All friendly forces in Dumbo's operating areas should be informed of Dumbo's approach and mission. This is usually done in operation orders or dispatches, and should be given wide dissemination.

(c) *Pluto*

Another type of plane used in the rescue of downed airmen is the Pluto. This may be either land- or carrier-based, but it functions as a lifeboat-dropping aircraft. Fully equipped

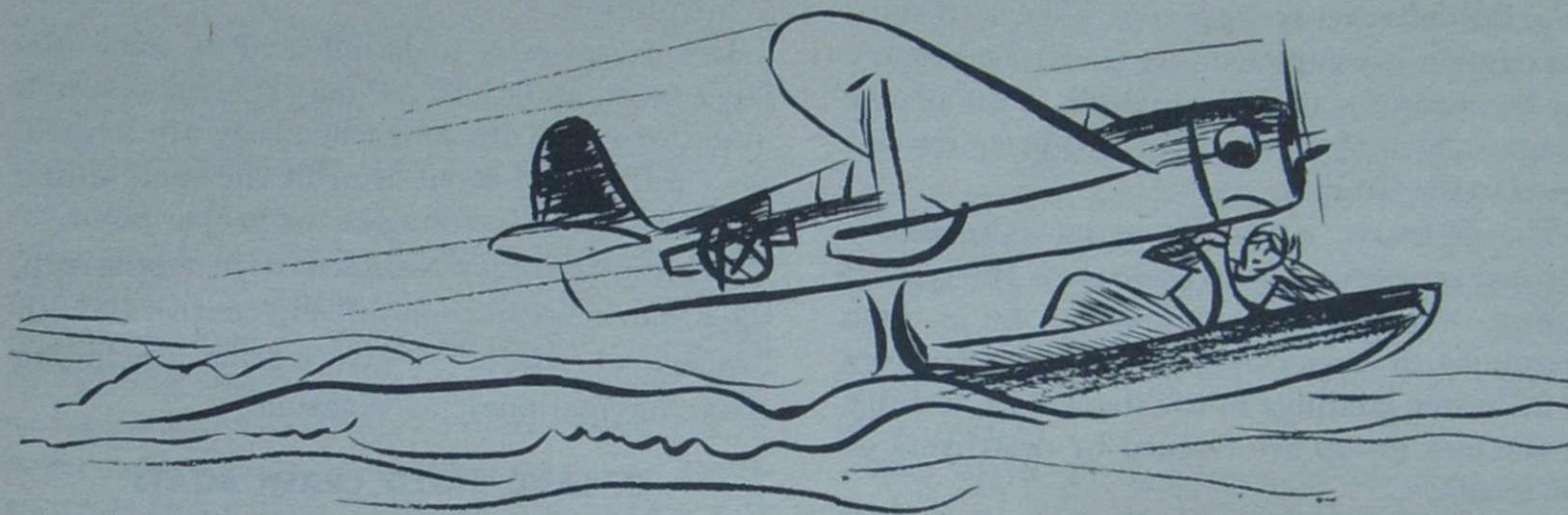


Figure 166.

(a) *Dumbo Communications Facilities*

Dumbo's communication facilities should be known, so that Dumbo planes in the area may be contacted if needed. Since the Dumbo operates far from base, usually beyond VHF and radar range, all position information may have to be given in latitude and longitude supplemented by grid coordinates or bearing and distance from a known reference point.

When it is necessary for a task group CIC to furnish information to a Dumbo, the plane should be informed of all known enemy activity in the vicinity and of friendly movements in

lifeboats are carried slung under the fuselage and are dropped by parachute to personnel in areas where water landings or submarine maneuvers would not be possible. Equipped with sail and motor, these small craft are steered out of the area and toward the most convenient rescue facility.

M. DESTROYERS WITH AND WITHOUT PLANE COVER

Destroyers are assigned rescue missions because of their maneuverability, shallow draft, speed, and protective firepower.

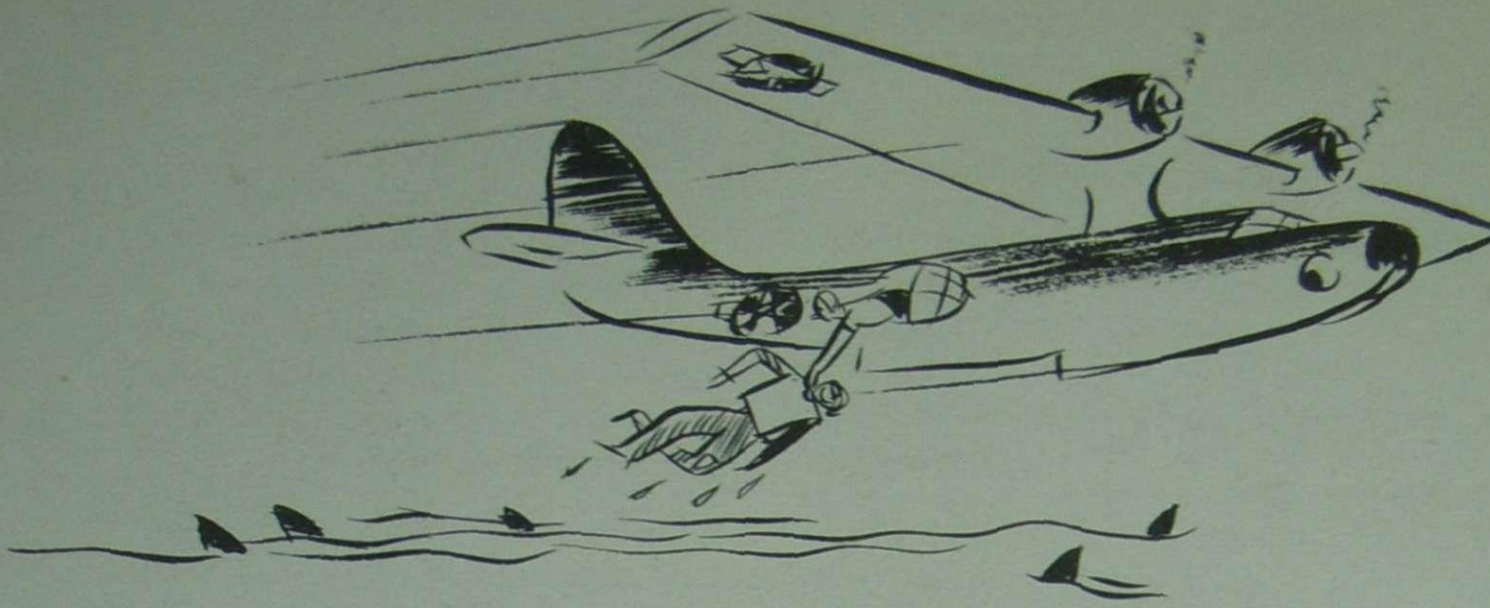


Figure 167.

signed as plane cover, the force (or group) CIC officer will give them their orders. They report in to the destroyer and are controlled by it until the mission is completed. It is often necessary for the destroyer to indicate itself to the planes assigned, by making smoke or giving course and speed to the CAP.

The destroyer is usually assigned to rescue downed air crews whose position is fairly well known, and who may or may not be in close proximity to enemy-held territory. Survivors of all water landings in the immediate vicinity of the task group are rescued by destroyers of the screen.

N. DUTIES OF CAP ON DESTROYER RESCUE MISSIONS

If aircraft are assigned as escort, they are employed to protect the destroyer by acting as combat air patrol and are controlled by the destroyer's CIC. They may further be used to strafe enemy shore installations and surface vessels. This, of course, means that adequate intelligence or visual information of enemy forces must be available and close coordination of ship control is necessary. This is achieved

by controlling the aircraft visually or by having special CIC lookouts relay information directly to air plotters.

If the rescue is to be effected at some distance from land, the CAP may be used as search units for survivors, and when they are located the CAP should zoom or orbit the spot, alerting the destroyer in arriving at the proper point.

If aircraft are not assigned to the rescue mission, the problem becomes one of ship control and coordination of available information, including radar navigational information.

O. LAND-BASED CRASH BOATS

Land rescue boats of this type are available only at established bases. By their nature they are of short range and are under shore-based control.

In a few instances other surface units may be assigned to effect rescue. In such cases the problem is one of coordination between the ships, and available aircraft. The ship generally acts as coordinator, using aircraft as search units, the crash boats acting as search and rescue units.

CONTROLLED APPROACHES

CHAPTER TWENTY

A. GROUND CONTROLLED APPROACH

- I. INTRODUCTION.
- II. EQUIPMENT.
- III. GCA PROCEDURE.
- IV. PPI LANDING PROCEDURE.
- V. COMMUNICATION INFORMATION.
- VI. BASIC GCA PHRASEOLOGY.
- VII. R/T PHRASEOLOGY—TYPICAL APPROACH.
- VIII. SAMPLE GCA EMERGENCY.
- IX. SAMPLE GCA PPI AND NO GYRO APPROACH.

B. CARRIER CONTROLLED APPROACH

- I. INTRODUCTION.
- II. CCA PROCEDURE.
- III. PICK-UP CONTROL.
- IV. MARSHALL CONTROL.
- V. TRAFFIC CONTROL.
- VI. FINAL CONTROL.
- VII. COMMUNICATION PROCEDURE.

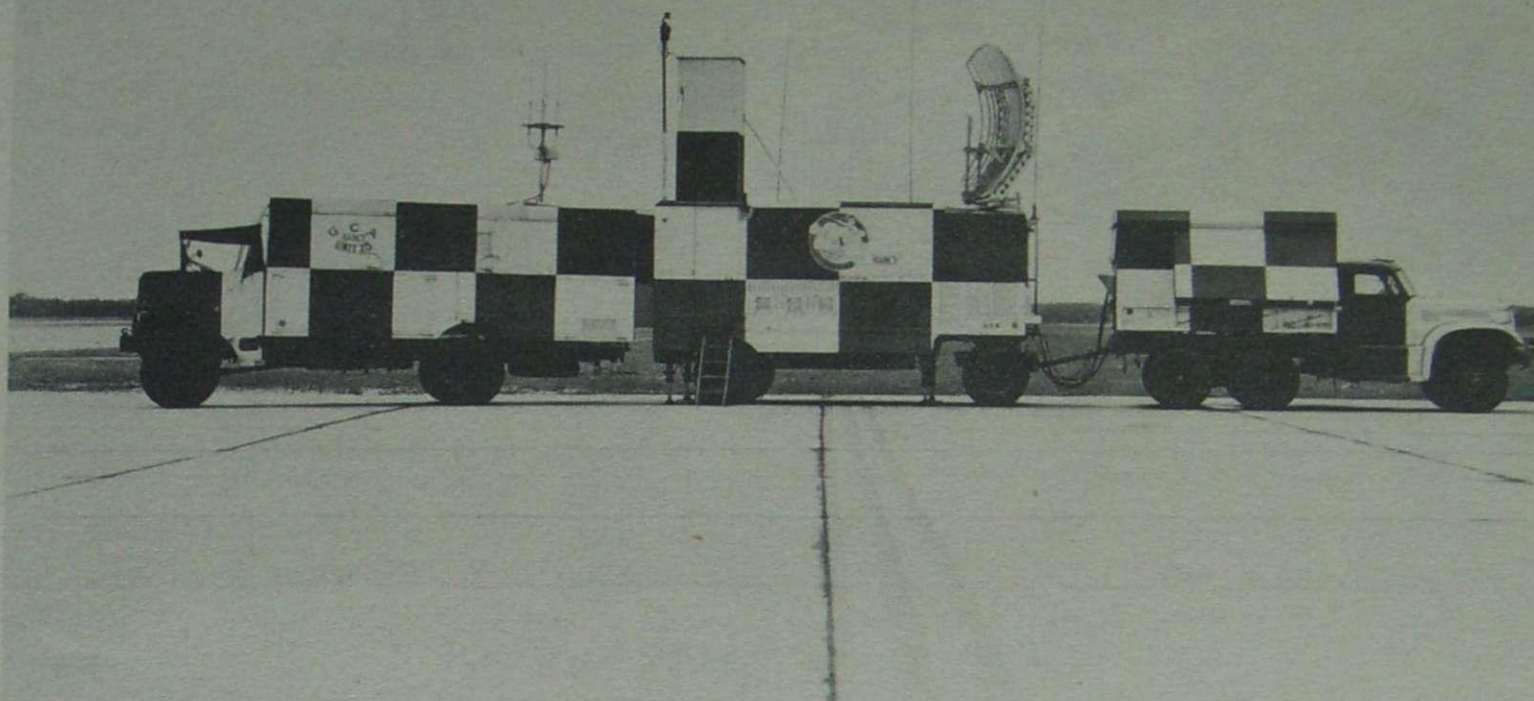


Figure 168.

A GROUND CONTROLLED APPROACH

I. INTRODUCTION

Ground Controlled Approach (GCA) AN/MPN-1A equipment is a mobile radar talkdown system of aiding a pilot to a landing under conditions of reduced visibility and ceiling. No special airborne electronic component is required, and pilot check-out and familiarization with the gear, while highly desirable, are not absolutely essential. These factors make GCA the best available equipment from a flight safety point of view for Navy planes operating or caught out in adverse conditions.

II. GCA EQUIPMENT

Mover provides the trailer's mobility, and means of its two 14 KW. diesel generators power to operate all electronic equipment in unit. GCA is thus freed of dependence on outside power sources. The Spare Parts trailer serves as a mobile repair base for the GCA trailer and permits field repairs to be performed, when necessary, in a matter of minutes and seconds during actual operations.

Housing all the electronic equipment actually utilized in GCA, the GCA trailer is the heart of the unit. All equipment in the trailer may be divided into two major classifications, Radar and Communications. The Radar equipment

the position and course of all aircraft flying below 6,000 feet within thirty miles of the trailer. These indications (targets) are received on 2 PPI (Plan Position Indicator) scopes in the trailer and by viewing the scopes and giving instructions to the pilot, an aircraft is directed into position for a low approach to the duty runway.

This low approach is made under the control of operators of the Precision Radar scan. The precision scan searches through an arc of 20° and has a maximum range of 10 miles. However, by proper trailer placement the area scanned by the Precision Radar includes the entire final approach leg. Thus, the aircraft is directed onto the final leg of the approach by Search Radar indications; picked up in the Precision Radar scan, and is guided along a sloping approach path (which is in direct alignment with the duty runway) to a position directly over the end of the runway at, or before, which point the pilot is enabled to establish visual contact with the ground to effect a landing. Since the Precision Radar system is accurate to ten feet of elevation and ten feet of lateral displacement, it is not possible to effect a completely "blind landing" in heavier type aircraft but present regulations call for GCA to operate only as a low approach aid and not as an instrument landing system, except in genuine emergency conditions.

As accurate and helpful as the radar indications in the trailer may be, they are of no value unless the information may be relayed to the pilot. Hence, the trailer is equipped with six transmitters and receivers covering all standard frequencies from 2 to 9 mcg, and 100 to 156 mcg. This wide coverage of frequencies insures that it will be possible to establish communications with all military aircraft desiring GCA. One low frequency transmitter is included to contact civilian aircraft equipped only with a low frequency receiver.

GCA accuracy is obtained electronically by

III. GCA PROCEDURES; ORDERS AND INFORMATION CONCERNING

Aircraft desiring to make GCA approach shall first call Navy ----- Tower and receive a GCA approach stating frequencies available. The Tower shall arrange a frequency with the aircraft and direct the aircraft to change to that frequency and to give GCA a call. When positive radio and radar contact have been established between GCA and the aircraft, the GCA shall direct the pilot to report over the radio station or shall give a number of identification turns in order to assure a definite fix. From the range station, or other definite fix, the pilot shall be given headings to steer in order to bring the plane around in the normal GCA traffic pattern, i. e., downwind, base and final. Altitudes shall be assigned during the approach with 1,500 feet on downwind, 1,200 feet on base, and 1,000 feet on final approach. Aircraft speed is left entirely to the pilot's discretion. It is suggested, however, that the speeds normally used in the traffic pattern on a contact approach be used for GCA. Upon reaching the final leg the pilot shall be told to acknowledge no further transmissions and the final controller shall talk the plane down to a landing by giving headings to fly and informing the pilot of position with reference to the glide path. Should an approach be missed, the pilot shall be given a wave-off and instructed to proceed to assigned holding point and altitude or directed around for another approach. Identification turns in the approach must be standard rate (one turn per second).

Aircraft may be handled in other than normal approaches on request or in an emergency.

Navy ----- Tower shall keep the GCA advised of any other aircraft they have knowledge of which are operating under reduced visibility (5 miles or less), in the control area where GCA is working on aircraft. This is particularly important if any of the aircraft are at low altitude (1,500 feet or less). The re-

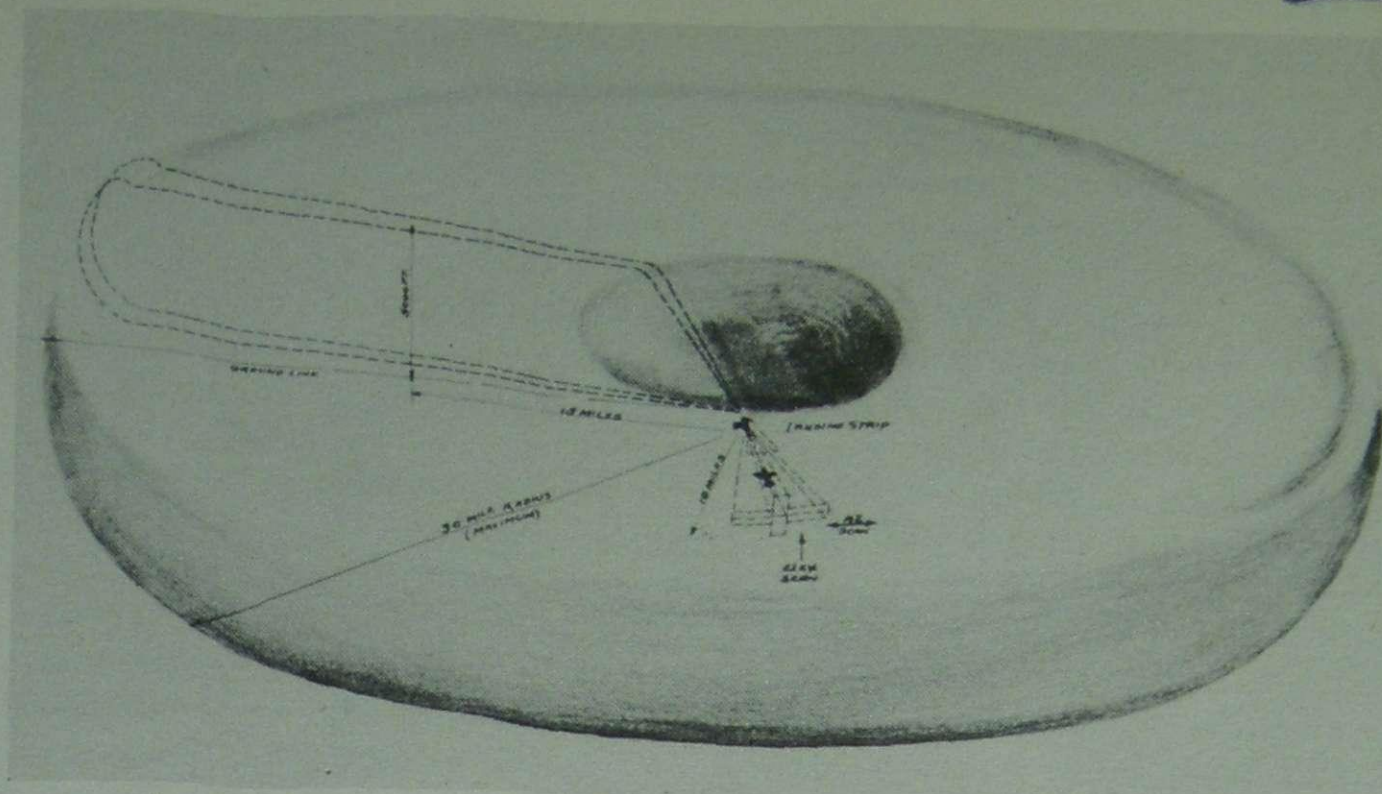


Figure 169.—Ground control approach system.

mately the following altitudes as indicated below:

	(Miles)
500' to 1,000' at	2 to 7
1,000' to 3,500' at	7 to 10
3,500' to 5,000' at	10 to 20
4,000' to 6,000' at	20 to 30

An aircraft approaching the field at 800', for instance, might not reflect a strong enough signal to be readily identified by radar as an aircraft at a distance greater than seven miles, depending upon atmospheric conditions, current output, etc. An aircraft directly above the unit will not be seen at any altitude. If aircraft is at 4,000 feet it will have to be at least seven miles from the station to reflect a recognizable target on the GCA radar scope. At five hundred feet (500') an aircraft would have to be within two (2) to five (5) miles to reflect a dependable signal.

The control tower shall endeavor to coordinate local traffic with GCA practice runs during VFR (visual flight rules) weather, consistent with its responsibility for flight safety, in order that no confusion or hazard is created.

cleared to a full-stop or touch-and-go, the tower may, at its own discretion, give the GCA pilot a modified clearance, such as, "Cleared to go over field at 200 ft." or "Cleared to continue approach, make an immediate right turn at end of runway," etc.

When GCA is controlling an actual IFR (instrument flight rules) approach and requires the Tower for a present weather report, the tower shall not use last sequence but shall pass the request to Aerology and relay the report to GCA as soon as practicable.

When GCA reports that they have established positive radio and radar contact with an aircraft, and that the pilot has requested a direct approach, the control tower shall transfer control of the aircraft to GCA. It should be borne in mind by Tower Duty Officers and Tower Personnel that once GCA has assumed control of an aircraft, and started an approach, that GCA is responsible for that aircraft, insofar as collision is concerned, and they should not interfere with the approach for any other reason than that the field or runway in use becomes closed by weather minimum or obstruction.

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control and clear the range as soon as possible, than to run the risk of having two or more lost aircraft on the possibility that the lost aircraft is anywhere near the aircraft that are under control and would not be observed by GCA. (Pertains only to IFR.)

When more than one aircraft are holding on the range and for some reason, such as communication difficulties, the aircraft at the lower altitude cannot be controlled to a landing in the normal time or manner, the tower shall transfer control of an aircraft at a higher altitude to GCA to avoid loss of time. When GCA has established communication with the higher of two aircraft and radar contact with both aircraft, the aircraft to be landed shall be steered clear of the range until at least three miles horizontal distance exists between the two aircraft regardless of altitude, and shall then be immediately reduced to a proper altitude to commence a normal GCA approach. At no time shall the two aircraft be allowed to close to within three miles of each other in horizontal distance, regardless of altitude, after GCA has assumed control of either aircraft.

Aircraft shall not be assigned altitudes of less than 1,200 feet in the GCA landing pattern by the GCA unit except on final leg. Neither shall the GCA unit assign altitudes above 1,500 feet without first obtaining proper clearance from the tower.

If GCA has assumed control of an aircraft, during instrument weather, and has given the standard emergency transmission to hold on the Southeast leg at 1,500 feet, a second holding point and altitude shall be obtained from the control tower before assuming control of a second aircraft, etc.

The GCA unit shall notify the tower immediately when it has turned on aircraft on "Crosswind" (or "base"), and on "final", giving bearing and distance, and shall also obtain landing clearance for the aircraft from the control

During instrument or closed field approach the GCA unit shall inform the pilot how down the runway the touch-down point is from end of runway and altitude of glide-path over end of runway. This should enable the pilot to estimate whether or not he should be cleared when called "over end of runway", and shall be given on base leg immediately following standard "runway dimension" transmission.

No planes shall be landed under GCA control with ceilings reported below 100 feet, visibility reported less than one-half mile, except in emergency, or as directed by the Operations Officer or higher authority designating landings to be of a test, evaluation, or of an experimental nature. It must be understood that GCA operators are working inside the tower and may be unaware of sudden changes in weather. It will therefore have to be assumed that a pilot will take a voluntary wave-off if he reaches those minimums and is not in the clear; otherwise the unit will continue giving instructions as long as the aircraft is properly aligned with the runway within the minimums as set forth in A/C/L 75-47.

In addition to wave-off limits established in A/C/L 75-47, all aircraft, shall be given a wave-off who are 50 feet or more above the glide path over end of runway. This is necessary as a guard against the possibility of over-running the runway in event of short runways, low speeds, brake failures, etc.

A wave-off by the GCA unit is mandatory and shall be executed by the aircraft without hesitation. There shall be no wave-off's given without qualifications, such as, "take a wave-off upon contact", etc. If the pilot persists in the landing, he does so on his own responsibility.

A wave-off shall be given by the GCA unit controller when it appears that the aircraft is not taking corrections properly and the pilot is informed of reason for wave-off.

An alternate MHF frequency shall be

aircraft during instrument weather, when available in the aircraft, and transmissions made simultaneously, when practicable.

During all actual instrument approaches while one radar channel is in use, the other channel, including the stand-by diesel generator, shall be warmed up, checked, and placed in a stand-by status in order that a quick change-over may be effected in the event of a sudden failure or breakdown.

While working aircraft near the extreme range, such as at seven miles on the ten mile PPI scope, during reduced visibility (5 miles or less), the GCA operator shall frequently shift to the twenty mile scope and "scan" for any other aircraft that may be approaching his aircraft on a collision course.

A qualified GCA officer shall be present at the trailer during all closed field approaches (500' ceiling and 1 mile visibility or less) to render quick decisions in case of an emergency.

The Tower Duty officer shall, when practicable, monitor all IFR and closed field GCA approaches on available Tower VHF receivers as an added assurance that all approaches are made in accordance with local and standard safety and flight regulations.

Recordings shall be made of all transmissions between GCA and aircraft during actual instrument approaches and shall be played back to interested persons when requested.

When a new heading assignment is given an aircraft, the transmission is, turn right (or left) to (heading) 195°. Normally the direction of turn indicated will be the shortest one to reach the new heading but it is not always so. For reasons of pattern formation, aircraft separation or to enable an aircraft to avoid an area of heavy turbulence (usually apparent on a radar scope) it is sometimes necessary to assign the longer turn. Therefore, the pilot will always make the turn in the direction assigned and not the shortest turn.

The transmission, "turn right (or left.)" without a heading being included may be given at two times while directing GCA. The first case is when two aircraft are on collision courses.

The turn is given and when the danger of collision has been averted, the turn is stopped and the plane returned to its original heading and the pilot informed of the reason for the turn. This is normally the only transmission given concerning the proximity of other aircraft while flying in an overcast. However, during training flights in contact weather and during such times as flight is being conducted on top of an overcast, the pilot of the aircraft under GCA control will be advised as to the clock position and range of any plane within three miles and whether such aircraft is opening, closing, or holding relative position. However, with the heavy traffic during VFR it is the prime responsibility of the pilot to avoid collision.

The second case is when the aircraft's transmission on the radar scopes make it appear that the directional gyro is unreliable. The transmission is then given, "Disregard your directional gyro and steer right." The pilot will then commence a one needle width turn and hold it until the transmission, "Stop turn," is given after which he will hold straight flight without reference to his directional gyro. This procedure will be continued through the remainder of the approach. Very precise final approaches are possible if the pilot is moderately careful and make all turns at standard rate.

Other emergency procedures are incorporated in GCA procedures and become immediately effective upon the pilot advising a unit of emergency. These procedures include emergency approaches for aircraft operating on single engine, icing, acute gas shortage, fire, landing gear, flap and transmitter failure.

The only emergency condition for which GCA has no answer is complete receiver failure in the aircraft. If only the receiver on which the pilot is receiving GCA instruction fails the pilot should immediately proceed as directed by local instructions, land and attempt to re-establish communications with the tower for a new GCA frequency assignment. In case of complete voice failure in the aircraft the pilot must make a standard instrument let down at his

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discretion. The GCA Unit will retain radar contact as long as practicable with all aircraft experiencing communications failure, and will keep the tower advised in order that all planes under control may be steered clear of approaching aircraft.

Most of the GCA Emergency procedures are routine in nature and need no explanation. However, because of the complexity of the instructions issued in case of engine failure in multi-engined aircraft, a brief word of explanation is included here. When the Unit is informed that the plane has experienced engine failure, the first instruction transmitted will be a reminder to the pilot to check his fuel and vacuum selector valves. The pilot will be asked if he can maintain altitude on the power remaining. If altitude can be maintained, or only a slight rate of descent is reported, the pilot will be directed to a normal approach except that all turns assigned will be into the good engine. If the pilot reports a rapid loss of altitude, he will be directed to the field along the shortest possible line of approach. The resulting approach may not be into the wind, nor may it necessarily be in direct alignment with any runway in all cases, but the pilot will be able to effect a landing on some portion of the field.

The GCA approach pattern conforms very closely to the normal field pattern except that the legs are straight courses and of necessity a little longer and wider in relation to the duty runway. Left, right or straight-in approaches may be made depending on wind, point of positive contact and similar circumstances.

At several points in the pattern, the pilot will receive transmissions concerning cock-pit procedures. These are not intended as mandatory instructions but only as a reminder to the pilot that he is preparing for a landing and to make such preparations as he deems necessary.

IV. PLANNED POSITION LANDING PROCEDURE (PPI)

If the precision radar system should fail, the plane can be safely brought around for a land-

but no glide path formation will be available. The downwind and crosswind legs will be the same on this approach as in the regular GCA approach. All information such as ceiling, visibility, altimeter setting and wind will be transmitted before the pilot starts on final approach. When on final, the pilot will receive accurate information concerning his range, plus corrections in range so as to keep him aligned with the centerline of the runway. Eight miles or more from end of runway, pilot will be told to fly at 1,500 ft. above the terrain. Six miles from the end of runway, pilot will be told to descend to 1,000 ft. above the terrain, four miles he will be told to descend to 500 ft; so that by the time he is two miles from the end of the runway he will be 500 ft. above the terrain. At this point, the pilot will be told to descend at his own discretion, but range and azimuth information will continue to be given. On this type of approach, the pilot can be brought safely to within 150 ft. of the centerline of runway in use, and with the operator giving him accurate ranges, the pilot can compare his altimeter versus range and successful landings will be made.

V. COMMUNICATION INFORMATION

All GCA transmissions must be acknowledged unless the pilot is otherwise instructed. Whenever possible, the R/T procedure used in transmitting GCA instructions is taken directly from the standard R/T procedure used in other groups to plane transmissions. However, GCA transmissions are unique to GCA and the pilot will find it helpful to be familiar with the instructions before making an approach.

VI. BASIC GCA PHRASEOLOGY

The purpose of GCA R/T phraseology standardization is to assure pilots of receiving standard "Wording" from GCA controllers regardless of whether the GCA Unit is operated by Navy, Air Force, or CAA personnel. The wording listed herewith is "Standard" wording and should not be interpreted to be a complete actual transmission. The following

PRIOR TO FINAL

Basic Phraseology Example

Turn right/left heading-----

Descend climb to and maintain altitude feet--

We have you in radar contact-----

Runway—length distance in feet—width distance feet—ceiling distance feet—visibility distance miles—wind direction velocity—Field elevation altitude feet—Additional information as pertinent.

I say again—instructions-----

Negative. I say again—instructions-----

Read back headings and altitudes-----

Altimeter setting-----

This will be downwind/base leg-----

Check gyro and do not reset for remainder of approach. This instruction should not be given when aircraft is on a northerly heading.

Perform landing cockpit check-----

You are on Downwind/Base Leg miles direction of field.

If no transmissions are received for a period of, instructions.

What will be your airspeed on final leg base leg Downwind leg.

How do you hear me?-----

Your reply not received. If you hear name GCA instructions.

Your turn observed—will continue instructions—do not acknowledge.

Change to frequency and instructions-----

You are distance direction of the field-----

Your heading should be-----

Your altitude should be ----- feet----

Stand-by for turn on downwind leg, base leg, final leg.

Explanation

To change heading of aircraft.

To change altitude of aircraft.

To inform pilot that target of his aircraft appears on the radar scope.

To be given as convenient by GCA controller.

In event previous instruction has not been acknowledged by pilot.

In event pilot acknowledges an instruction correctly.

To inform pilot to acknowledge headings and altitudes.

To inform pilot of altimeter setting.

To inform pilot of position in pattern with given the appropriate change in heading.

To inform pilot to set gyro with magnetic compass.

To inform pilot to prepare plane for landing.

To inform pilot of the distance and direction of his aircraft relative to the field when downwind or base.

To inform pilot of procedure to be followed in event of communications failure.

To request airspeeds of aircraft if desired by GCA Controller.

To check communication reception.

To visually check on radar scope whether pilot is receiving the GCA Controller instructions.

If aircraft is receiving but not heard, further instructions shall be repeated twice.

To change frequency.

A fill-in transmission to give pilot the position of his aircraft relative to the field.

A fill-in transmission to give pilot the heading he should be flying.

A fill-in transmission to give pilot the altitude he should be flying.

To alert pilot for change in heading for specific legs of approach.

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Turn right/left immediately heading-----
—reason—Acknowledge.

This is final controller. How do you hear me?

Maintain your present altitude-----

You are now on final-----

You are approaching the glide path-----

Do not acknowledge further instructions-----

Distance from touchdown—distance miles or
distance from end of runway—distance miles.

You are on course-----

You are on glide path-----

Begin your descent at number feet per minute--

You are distance feet right/left of center-line
of runway—turn right/left heading.

Turn right/left heading-----

You are correcting rapidly to course. You are
correcting slowly to course. You are correct-
ing nicely to course.

You are correcting rapidly to glide path. You
are correcting slowly to glide path. You are
correcting nicely to glide path.

You are distance feet above/below glide path—
bring/ease it down/up—count down/of the
number of feet as aircraft correct to GP/feet
above/below—you are now on the glide
path—adjust your rate of descent.

You are cleared to land-----

You are over the end of runway—distance feet
right/left of the center-lines of runway.
Instructions will continue until aircraft
reaches the theoretical touch-down point.

Take a wave-off—pull up—immediately and
climb to and maintain altitude feet heading—
heading—give reason for pull-up and further
instructions if necessary.

Immediate turn-right/left heading ——— rea-
son—Acknowledge.

To inform pilot that an immediate turn is nec-
essary to avoid collision with an object or
objects—Example—other aircraft, obstruc-
tions, etc.

To check communication with final controller
when desired.

To keep aircraft level until time to begin de-
scent.

A fill-in if appropriate.

To inform pilot of his position relative to glide
path while still flying in level flight.

To prevent pilot from cutting out final con-
troller with MIC button.

To inform pilot of distance from touchdown to
end of runway as applicable.

To inform pilot that his aircraft is on course

To inform pilot that his aircraft is on glide
path.

To start aircraft down the glide path when de-
sired position relative to glide path is reached

To correct aircraft to course. Either to be used
as desired by controller.

To be used as applicable.

To be used as applicable.

To correct aircraft to glide path.

To inform pilot that tower has given aircraft
clearance to land.

To inform pilot that his aircraft is over the end
of runway and landing is now possible.

To inform pilot to take a wave-off and pull-up
in event circumstances necessitate such in-
structions. The reason for such action should
be transmitted to pilot.

To inform pilot that an immediate turn is nec-
essary to avoid collision with an object or ob-
jects. Example—other aircraft, obstruction
etc.

VII. R/T PHRASEOLOGY FOR A TYPICAL GCA APPROACH

NAN ZERO TWO—Navy Patuxent Radio—this is Nan Zero Two—How do you hear me?—Over.

PATUXENT RADIO—Nan Zero Two—This is Navy Patuxent Radio—Hearing you loud and clear—Over.

NAN ZERO TWO—Navy Patuxent Radio—this is Nan Zero Two—entering control area—two five miles north-west at five-five—altitude five thousand feet—request GCA and further instructions—Over.

PATUXENT RADIO—Nan Zero Two—This is Navy Patuxent Radio—entering control area—two five miles north-west at five five—altitude five thousand feet—descend to and maintain three thousand feet—report reaching three thousand feet—contact Navy Patuxent Tower when over Patuxent Range Station for Patuxent GCA frequency—Over.

NAN ZERO TWO—Navy Patuxent Radio—This is Nan Zero Two—Roger—Descend to and maintain three thousand feet—report reaching three thousand feet—contact Navy Patuxent Tower when over Patuxent Range Station for GCA frequency—leaving five thousand feet at five six—Over.

PATUXENT RADIO—This is Patuxent Radio—Roger—leaving five thousand feet at five six—Out.

NAN ZERO TWO—Navy Patuxent Radio—This is Nan Zero Two—at three thousand feet—approaching on north-west course—estimate the range station at zero five—Over.

PATUXENT RADIO—Nan Zero Two—This is Navy Patuxent Radio—at three thousand feet—approaching on north-west course—estimate the range station at zero five—cleared to Navy Patuxent Tower—Out.

NAN ZERO TWO—Navy Patuxent Tower—This is Nan Zero Two—How do you hear me?—Over.

PATUXENT TOWER—Nan Zero Two—This is Navy Patuxent Tower—Hearing you loud but distorted—Over.

bound on southwest course—Altitude three thousand feet—request Ground Controlled Approach—Over.

PATUXENT TOWER—Nan Zero Two—This is Navy Patuxent Tower—position over Patuxent Range Station—time zero five—outbound southwest course—altitude three thousand feet—you are cleared for Ground Controlled Approach—contact Patuxent GCA on channel six—one three four point six four megacycles—Over.

NAN ZERO TWO—This is Nan Zero Two—Roger—Cleared for Ground Controlled Approach—switching to channel six—one three four point six four megacycles—Out.

NAN ZERO TWO—Patuxent GCA—This is Nan Zero Two—How do you hear me?—Over.

PATUXENT GCA—NAN ZERO TWO—THIS IS PATUXENT GCA—HEARING YOU LOUD AND CLEAR—WHAT IS YOUR APPROXIMATE POSITION—HEADING AND ALTITUDE—OVER.

NAN ZERO TWO—Patuxent GCA—This is Nan Zero Two—position one minute out on southwest course of Patuxent Radio Range heading two four zero—altitude three thousand feet—Over.

PATUXENT GCA—NAN ZERO TWO—THIS IS PATUXENT GCA—ROGER—WHAT HAVE YOU IN RADAR CONTACT SEVEN MILES SOUTHWEST OF FIELD—HEADING TWO FOUR ZERO—ALTITUDE THREE THOUSAND FEET—TURN LEFT HEADING ZERO SIX ZERO—DESCEND TO AND MAINTAIN ONE THOUSAND FIVE HUNDRED FEET—OVER.

NAN ZERO TWO—This is Nan Zero Two—Roger—Turning left heading zero six zero—descending to one thousand five hundred feet—Out.

PATUXENT GCA—NAN ZERO TWO—THIS IS PATUXENT GCA—IF NO TRANSMISSIONS ARE RECEIVED FOR A PERIOD OF ONE MINUTE DURING THIS APPROACH—MAKE AN EMERGENCY PULL-UP—CLIMB TO AND MAINTAIN ALTITUDE OF ONE THOUSAND

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ENT RADIO RANGE BETWEEN THE STATION AND A POINT FOUR MINUTES SOUTH-EAST—CONTACT PATUXENT GCA OR PATUXENT TOWER FOR FURTHER INSTRUCTIONS—OVER.

NAN ZERO Two—This is Nan Zero Two—Roger—Emergency Instructions—Out.

PATUXENT GCA—NAN ZERO TWO—THIS IS PATUXENT GCA—ALTIMETER SETTING TWO NINE FIVE EIGHT—OVER.

NAN ZERO Two—This is Nan Zero Two—Roger—Altimeter setting two nine five eight—Out.

PATUXENT GCA—NAN ZERO TWO—THIS IS PATUXENT GCA—FIELD ELEVATION THREE FIVE FEET—OVER.

NAN ZERO Two—This is Nan Zero Two—Roger—Three five feet—Out.

PATUXENT GCA—NAN ZERO TWO—THIS IS PATUXENT GCA—REQUEST TYPE AIRCRAFT. PILOT'S NAME AND WHAT WILL BE YOUR AIRSPEED ON FINAL—OVER.

NAN ZERO Two—This is Nan Zero Two—Type Aircraft—Roger Five Dog—pilot Thomas—Approach airspeed one two zero knots—Over.

PATUXENT GCA—NAN ZERO TWO—THIS IS PATUXENT GCA—ROGER—ROGER FIVE DOG—THOMAS—ONE TWO ZERO KNOTS—OUT.

PATUXENT GCA—NAN ZERO TWO—THIS IS PATUXENT GCA—TURN LEFT—HEADING ZERO TWO ZERO—OVER.

NAN ZERO Two—This is Nan Zero Two—Roger—Turning left—heading zero two zero—Out.

PATUXENT GCA—NAN ZERO TWO—THIS IS PATUXENT GCA—YOU ARE FOUR MILES EAST SOUTHEAST OF FIELD—OVER.

NAN ZERO Two—This is Nan Zero Two—Roger—Four miles east southeast of field—Out.

PATUXENT GCA—NAN ZERO TWO—THIS IS PATUXENT GCA—YOU ARE

NAN ZERO Two—This is Nan Zero Two—Roger—On downwind leg—landing cockpit check completed—Out.

PATUXENT GCA—NAN ZERO TWO—THIS IS PATUXENT GCA—CHECK GYRO AND DO NOT RESET FOR REMAINDER OF APPROACH—OVER.

NAN ZERO Two—This is Nan Zero Two—Roger—Check Gyro—Out.

PATUXENT GCA—NAN ZERO TWO—THIS IS PATUXENT GCA—YOU ARE THREE MILES EAST OF FIELD—YOUR ALTITUDE SHOULD BE ONE THOUSAND FIVE HUNDRED FEET—YOUR HEADING SHOULD BE ZERO TWO ZERO—OVER.

NAN ZERO Two—This is Nan Zero Two—Roger—Three miles east—Altitude one thousand five hundred feet—heading zero two zero—Out.

PATUXENT GCA—NAN ZERO TWO—THIS IS PATUXENT GCA—PRESENT PATUXENT WEATHER—CEILING ONE HUNDRED FEET—VISIBILITY ONE QUARTER MILE—LIGHT FOG—LIGHT RAIN—SURFACE WINDS SOUTH SOUTHWEST ONE FIVE KNOTS—OVER.

NAN ZERO Two—This is Nan Zero Two—Roger—Ceiling one hundred feet—visibility one quarter mile—light rain—light fog—surface winds south southwest one five knots—Out.

PATUXENT GCA—NAN ZERO TWO—THIS IS PATUXENT GCA—REDUCE TO APPROACH AIRSPEED—OVER.

NAN ZERO Two—This is Nan Zero Two—Roger—Reducing to Approach airspeed—Out.

PATUXENT GCA—NAN ZERO TWO—THIS IS PATUXENT GCA—TURN LEFT—HEADING TWO NINE ZERO—DESCEND TO AND MAINTAIN ONE THOUSAND TWO HUNDRED FEET—OVER.

NAN ZERO Two—Patuxent GCA—This is Nan Zero Two—you were blocked out—again—Over.

PATUXENT GCA—NAN ZERO TWO—THIS IS PATUXENT GCA—I SAY AGAIN

ONE THOUSAND TWO HUNDRED FEET—OVER.

NAN ZERO TWO—This is Nan Zero Two—Roger—Turning left heading two nine zero—descending to one thousand two hundred feet—Out.

PATUXENT GCA—NAN ZERO TWO—THIS IS PATUXENT GCA—YOU ARE NOW ON BASE LEG SEVEN MILES NORTHEAST OF FIELD MAKING A LEFT HAND APPROACH TO RUNWAY TWO ZERO—OVER.

NAN ZERO TWO—This is Nan Zero Two—Roger—On base leg seven miles northeast of field making a left hand approach to runway two zero—Out.

PATUXENT GCA—NAN ZERO TWO—THIS IS PATUXENT GCA—RUNWAY TWO ZERO IS SIX THOUSAND FOUR HUNDRED FEET LONG AND THREE HUNDRED FEET WIDE—OVER.

NAN ZERO TWO—This is Nan Zero Two—Roger—Six thousand Four Hundred by three hundred—Out.

PATUXENT GCA—NAN ZERO TWO—THIS IS PATUXENT GCA—TOUCHDOWN POINT IS ONE THOUSAND FEET FROM APPROACH END OF RUNWAY—OVER.

NAN ZERO TWO—This is Nan Zero Two—Roger—One thousand feet from approach end of runway—Out.

PATUXENT GCA—NAN ZERO TWO—THIS IS PATUXENT GCA—TURN LEFT HEADING TWO ZERO ZERO—DESCEND TO AND MAINTAIN ONE THOUSAND FEET—OVER.

NAN ZERO TWO—This is Nan Zero Two—Turning left heading two two zero—descending to one thousand feet—Out.

PATUXENT GCA—NAN ZERO TWO—THIS IS PATUXENT GCA—NEGATIVE—I SAY AGAIN—TURN LEFT HEADING TWO ZERO ZERO—DESCEND TO AND MAINTAIN ONE THOUSAND FEET—OVER.

NAN ZERO TWO—This is Nan Zero Two—Roger—Turning left heading two zero zero—

TROLLER—COME OUT OF YOUR TURN HEADING TWO ZERO ZERO—MAINTAIN ONE THOUSAND FEET—OVER.

NAN ZERO TWO—This is Nan Zero Two—Roger—heading two zero zero—one thousand feet—Out.

PATUXENT GCA—NAN ZERO TWO—THIS IS PATUXENT GCA—YOU ARE NOW ON FINAL—DO NOT ACKNOWLEDGE FURTHER INSTRUCTIONS—DISTANCE FROM TOUCHDOWN SEVEN MILES—IF NO TRANSMISSIONS ARE RECEIVED FOR A PERIOD OF FIVE SECONDS—TAKE A WAVE-OFF—MAKE AN EMERGENCY PULL-UP—CLIMB TO AND MAINTAIN ONE THOUSAND FIVE HUNDRED FEET AND HOLD ON THE SOUTHEAST COURSE OF THE PATUXENT RANGE—YOU ARE THREE HUNDRED FEET LEFT OF CENTERLINE OF RUNWAY—TURN RIGHT HEADING TWO ONE ZERO—MAINTAIN YOUR PRESENT ALTITUDE—YOUR NEW HEADING IS TWO ONE ZERO—DISTANCE FROM TOUCHDOWN SIX MILES—PRESENT HEADING BRINGING YOU NICELY TOWARD THE CENTERLINE—DISTANCE FROM TOUCHDOWN FIVE MILES—ALTITUDE STILL GOOD—YOU ARE APPROACHING THE GLIDE PATH—BEGIN YOUR DESCENT AT FIVE HUNDRED FEET PER MINUTE—ONE HUNDRED TWENTY FIVE FEET BELOW GLIDE PATH—ON HUNDRED FEET BELOW—SEVENTY FIVE FEET BELOW—FIFTY—FORTY—THIRTY—TWENTY—TEN—ON GLIDE PATH—ADJUST YOUR RATE OF DESCENT—TURN LEFT HEADING TWO ZERO FIVE—YOUR NEW HEADING IS TWO ZERO FIVE—GOING ABOVE GLIDE PATH—TEN FEET ABOVE—EASE IT DOWN A BIT—DISTANCE FROM TOUCHDOWN FOUR MILES—TURN LEFT HEADING TWO ZERO TWO—THIRTY FEET ABOVE GLIDE

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PATH TWENTY FEET—TEN FEET ABOVE—ON GLIDE PATH—DISTANCE FROM TOUCHDOWN THREE MILES—CHECK WHEELS DOWN AND LOCKED—YOU ARE CLEARED TO LAND—TURN LEFT HEADING TWO ZERO ZERO—YOUR NEW HEADING IS TWO ZERO ZERO—GOING BELOW GLIDE PATH TEN—TWENTY FEET BELOW—BRING IT UP A LITTLE—STILL TWENTY FEET BELOW GLIDE PATH—DISTANCE FROM TOUCHDOWN—TWO MILES—TEN FEET BELOW GLIDE PATH—TWO ZERO ZERO IS YOUR HEADING—STILL TEN FEET BELOW GLIDE PATH—EASE IT UP A BIT—DISTANCE FROM TOUCHDOWN ONE MILE—ON GLIDE PATH AND HOLDING NICELY—ON COURSE—YOUR RATE OF DESCENT EXCELLENT—DISTANCE FROM TOUCHDOWN ONE HALF MILE—ON COURSE—ON GLIDE PATH—OVER END OF RUNWAY—ON GLIDE PATH—CENTERLINE OF RUNWAY IS DEAD AHEAD—ON GLIDE PATH—ON COURSE—OVER TOUCHDOWN—TAKE OVER VISUALLY—CONTACT PATUXENT TOWER ON CHANNEL TWO—ONE FOUR TWO POINT SEVEN FOUR MEGACYCLES FOR TAXI INSTRUCTIONS—THIS IS PATUXENT GCA—OUT.

VIII. SAMPLE GCA EMERGENCY

Representative of Low on Fuel, Single Engine, Fire, Iceing-Up, Etc.

FIGHTER—Navy Patuxent Tower, this is Navy 478, Over.

TOWER—Navy 478, this is Patuxent Tower, Over.

FIGHTER—Navy Patuxent Tower, this is Navy 478, estimating 10 miles northwest of field at 2,000 feet, unable to land at Washington, have ten minutes of fuel, request immediate GCA, Over.

TOWER—Roger 478, Stand by.

TOWER—GCA, this is Patuxent Tower, we

GCA—Roger Tower, Stand by.

GCA—Navy 478, this is Patuxent GCA, what is your present position, heading and altitude, Over.

PLANE—Estimated position 8 miles northwest, heading 160, alt. 2,000 ft., 478, Over.

GCA—Roger 478, Patuxent GCA, turn left heading 080, maintain present altitude, Over.

PLANE—Roger GCA, turning left, heading 080, maintaining 2,000 feet, 478, Out.

GCA—Navy 478, Patuxent GCA, Request type aircraft, pilot's name, and what will be your airspeed on final, Over.

PLANE—Type aircraft Fox Seven Fox, Pilot Johnson, airspeed on final, 100 knots, Over.

GCA—Roger 478, type aircraft F7F, pilot Johnson, airspeed on final, 100 knots, Patuxent GCA, Out.

GCA—Navy 478, This is Patuxent GCA, you turn observed, I have you in radar contact five miles northeast of field, I say again northeast of field, stop your turn heading 200 TWO ZERO ZERO, descend to and maintain 1,000 ft., Over.

PLANE—Roger position, stopping turn heading 020 ZERO TWO ZERO, descending 1,000 ft., 478.

GCA—Negative 478, negative, I say again stop your turn heading 200 TWO ZERO ZERO, descend to and maintain 1,000 feet, Over.

PLANE—Roger Patuxent GCA, stopping turn, heading 200, descending to 1,000 ft., Over.

Patuxent GCA notifies tower they have positive radio and radar contact with Navy 478 and he is turning on final at five miles for runway 20. (Pickup Controller turns Navy 478 over to Final Controller with necessary information.)

GCA—FINAL CONTROLLER—Navy 478, this is Patuxent final controller, you are coming out of turn, heading 200, altitude 1,000 feet. Over.

PLANE—Roger, 200, altitude 1,000—478.

FINAL CONTROLLER—Roger 478, when out of your turn you will be on final leg do not request knowledge further instructions, your turn v

ing the glide path, begin your descent at 500 feet per minute, reduce to final approach air-speed, turn left, heading 210, 100 feet below glide path, coming up nicely, 75 ft. below, 60, 50, 40, 30, 20, 10, on glide path, distance from touchdown three miles, check flaps and props as desired, wheels down and locked, going above glide path 20 ft., 30 ft. above, distance from touchdown two and one half miles, turn left, heading 200, coming down to glide path, 20, 10, on glide path, on course, winds on surface south southwest 15 knots, ceiling 100 feet, visibility one-quarter mile, distance from touchdown two miles, on glide path, turn right, heading 203, holding 10 feet below glide path, ease it up a bit, on glide path, on course, distance from touchdown, one and one-half miles, turn left, heading 200, on glide path, going slightly above glide path, distance from touchdown, one mile, touchdown is 1,000 feet from approach end of runway, turn right, heading 200, on glide path, centerline is 20 feet to your right, over end of runway, on glide path, on course, on glide path, "touchdown," take over visually, contact Patuxent Tower on channel 2, 142.74 mges, for taxi instructions or further assistance. Patuxent GCA, Out.

IX. SAMPLE GCA PPI AND NO GYRO APPROACH

PLANE—Navy Patuxent Tower, this is Navy 276, Over.

TOWER—Navy 276, This is Navy Patuxent Tower, Over.

PLANE—Navy Patuxent Tower, this is Navy 276, 20 miles northeast approaching on Northeast course of Patuxent Radio Range, Altitude 2,500 Item Fox Roger, request direct GCA Approach, Over.

TOWER—Roger 276, Standby.

TOWER—Patuxent GCA, this is Patuxent Tower, Navy 276, 20 miles northeast at 2,500 feet, estimating Meekins Neck Fan marker at 1019, requesting direct GCA, Over.

GCA—Roger Tower, Assign Channel 6, 143.64 megacycles, Over.

contact Patuxent GCA on Channel 6, 143.64 megacycles, Over.

PLANE—Roger Patuxent Tower, contact Patuxent GCA on Channel 6, 143.64, Out.

PLANE—Patuxent GCA, this is Navy 276, Channel 6. How do you hear me? Over.

GCA—Navy 276, Patuxent GCA, hearing loud and clear, what is your present position, heading and altitude, Over.

PLANE—Present position over Meekins Neck Fan Marker approaching on Northeast course of Patuxent Radio Range, Altitude 2,500 feet, heading 240, Over.

GCA—Roger 276, this is Patuxent GCA, have you in radar contact over Meekins Neck Fan Marker, approaching on Northeast course of Patuxent Radio Range, Altitude 2,500, heading 240, turn right, heading 270, descend to maintain 1,200 feet, Over.

PLANE—Roger GCA, this is 276, turning right, heading 270, descending 1,200 feet, Over.

GCA—276, this is Patuxent GCA, request type aircraft, pilot's name and what will be your airspeed on final, Over.

PLANE—Type aircraft Tare Baker Mike, pilot Brown, airspeed on final, 90 knots, Over.

GCA—Roger 276, type aircraft Tare Baker Mike, Pilot Brown, airspeed on final 90 knots, turn right, heading 280 m. you are now on final leg making a left hand approach to runway, Over.

PLANE—Roger GCA, turning right, heading 280, making left hand approach to runway, 276, Out.

GCA—276, Check Gyro and perform landing cockpit check, Over.

PLANE—Landing Cockpit check complete, gyro checked, 276.

GCA—Navy 276, Patuxent GCA, altimeter setting 29.58, field elevation 35 feet, ceiling 100 feet, visibility 1/4 mile, surface winds South Southwest, 15 Knots, Over.

PLANE—Roger altimeter 29.58, ceiling 100 feet, visibility 1/4 mile, surface winds South Southwest, 15 knots, 276.

GCA—Navy 276, this is Patuxent GCA, y

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PLANE—Roger, no gyro, turning left, 276.

Controller checks clock for 30 seconds (3 degrees per second) for 90 degrees turn into final.

GCA—Navy 276, descend to and maintain 1,000 feet, Over.

PLANE—Descending to 1,000 feet, 276.

Traffic Controller attempts to turn 276 over to Final Controller but the precision trackers have no targets and the technician passes the word that the precision system is out, forcing the traffic controller to continue with a PPI approach.

GCA—276, this is Patuxent GCA, our precision system is out of commission, we will make a PPI approach, stop turn, Over. 30 seconds have elapsed.

PLANE—Stopping turn, Roger PPI Approach, 276.

GCA—276, you are now on your final leg, we will have no control of your glide path, distance from touchdown six miles, your altitude should be 1,000 feet, Over.

PLANE—Roger GCA on final leg, six miles, altitude 1,000 feet, 276.

GCA—276, your turn was wide, turn left, Over.

PLANE—Turning left, 276, Controller checks clock for four seconds representing 12 degrees, then

GCA—276, GCA, stop turn, Over.

PLANE—Stopping turn, 276.

GCA—276, distance from touchdown four miles, descend to and maintain 500 feet, Over.

PLANE—Roger four miles, descending to 500 feet, 276.

GCA—276, you are approaching the centerline, turn right, Over.

PLANE—Roger, turning right, Controller watches the clock for two seconds or 6 degrees, then,

GCA—276, stop turn, Over.

PLANE—Stopping turn, 276.

GCA—276, distance from touchdown three miles, check wheels down and locked, you are cleared to land, Over.

PLANE—Roger, three miles, check wheels down and locked, cleared to land, 276.

GCA—276, the center line is dead ahead, turn right, Over.

PLANE—Turning right, 276, Controller checks clock for two more seconds or 6 degrees, then,

GCA—276, stop turn, Over.

PLANE—Stopping turn, 276.

GCA—276, distance from touchdown two miles, descend further at your own discretion, Over.

PLANE—Roger, distance two miles, will descend to and maintain two hundred feet, 276, Over.

GCA—Roger 276, two hundred feet, you are drifting slightly to left of centerline, turn right, Over.

PLANE—Turning right, 276 Controller immediately follows with:

GCA—Stop turn, Representing one second or 3 degrees.

PLANE—Stopping turn, 276.

GCA—276, distance from touchdown one mile, Over.

PLANE—One mile, 276.

GCA—276, you are now crossing centerline, turn slowly left to right, turn left, over.

PLANE—Turning left, 276.

GCA—276, stop turn, Over immediately.

PLANE—Stopping turn, 276.

GCA—Distance from touchdown 1/2 mile, you should be content, if not, take a wave-off and make an emergency pull-up, Over.

PLANE—Roger GCA, sighted high intensity approach and runway lights at 1/2 mile, 200 feet about 150 feet right of centerline, thanks for a nice approach, 276, Out.

GCA—Roger 276, as soon as you have landed shift to Tower Frequency Channel 2, 142.1 megacycles for taxi instructions. Patuxent GCA, Out.

All reports to tower will be made as for Navy Zero Two.

B. CARRIER CONTROLLED APPROACH

I. INTRODUCTION

CCA test operations recently concluded have resulted in the below pattern and procedure which has been recommended by the 1948 CIC Conference for adoption as an interim procedure. The below procedure exploits potentialities of present ship's equipment, planes and pilots. The load imposed on personnel is considerable; however, with smaller numbers of aircraft and with a compromise on length of interval, results can be obtained with a less complex set-up, using the same flight pattern. The pattern has also been found to have effective day application. Future CCA procedures will use special CCA stations and associated equipments now under development.

II. CCA PROCEDURE

A. General

1. The Carrier Controlled Approach Procedure outlined herein is *not* designed to land aircraft aboard under zero/zero conditions. It *is* designed to position an aircraft, in the landing attitude, at such an altitude, airspeed and position relative to the carrier that a successful visual, LSO directed landing may be made aboard under ceiling and visibility conditions that would preclude contact carrier approaches. It is also designed to provide an evenly spaced flow of aircraft to the LSO. With present electronic equipment, aircraft instrumentation and state of personnel training, the following minimums are considered to be the best obtainable without undue risk to both the aircraft and the carrier:

- (a) Landing interval—one minute.
- (b) Ceiling—200 feet.
- (c) Visibility—500 yards.

2. The CCA pattern is diagrammed in figure 170. Under contact conditions this pattern may be flown visually and will produce landing intervals comparable to the present standard contact procedure. The only difference be-

degree of control exercised by the CCA controllers.

3. The aircraft is controlled to Point "A" by PICK-UP CONTROLLER and from Point "A" to Point "B" by MARSHALLING CONTROLLER.

4. The aircraft reaches "B" at an altitude of 750 feet, airspeed 150 knots and is turned over to one of two TRAFFIC CONTROLLER. TRAFFIC vectors the aircraft along the 21° relative bearing line to Point "C" where the aircraft is turned to reach Point "D"; 2 miles, 215° relative from a point 250 yards astern the ship. During this turn, the landing check-off list is completed and speed is reduced to 100 knots and altitude to 500 feet at Point "D".

5. At Point "D", the aircraft is turned over to one of two FINAL CONTROLLER. FINAL vectors the aircraft to make good a 3° track relative to the ship and to intersect the wake 250 yards astern. The aircraft descends at 300 feet/min. to 150 feet, reaching this altitude about $\frac{3}{4}$ mile from the ship, and further reduces to approach speed and altitude. When LSO sights the aircraft, he broadcasts "CONTACT" and approach is continued visually to landing or wave-off port. If the LSO does not sight the aircraft, a wave-off to starboard is ordered by FINAL. If the pilot does not sight the LSO immediately after hearing "CONTACT", an automatic starboard wave-off is taken.

B. Aircraft Procedure—Contact Conditions

1. The pattern under contact conditions is shown in figure 171.

2. Under contact conditions the returning group orbits at 1,200 feet in an ellipse with one of the focal points over "A" (the DDR). The squadron orbit about "A" is at 800 feet, the division orbit at 500 feet.

3. Aircraft break up by divisions and proceed to "B" at 150 to 300 feet, turn on to the 21° relative track from "B" to "C" and break up at

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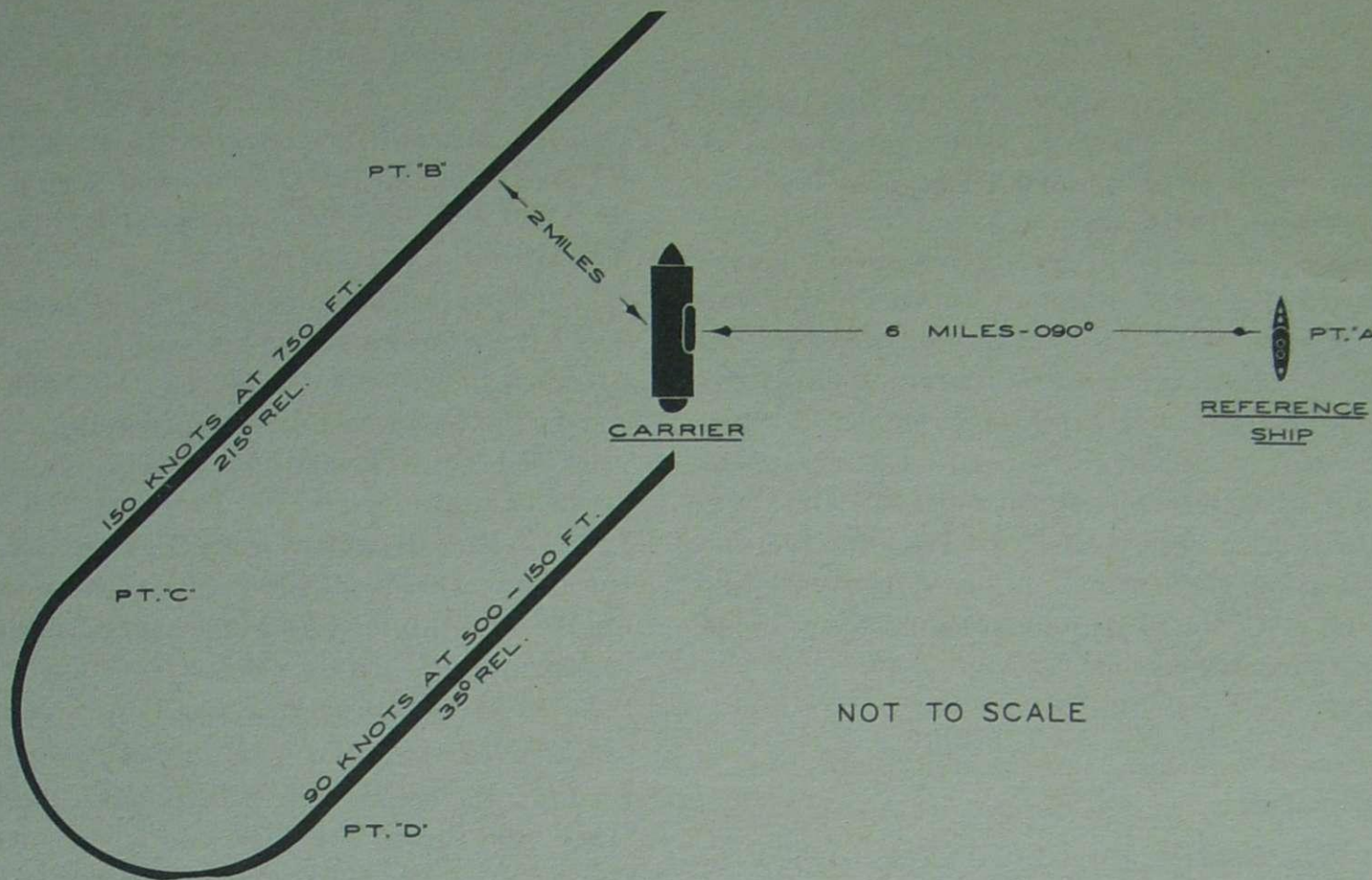
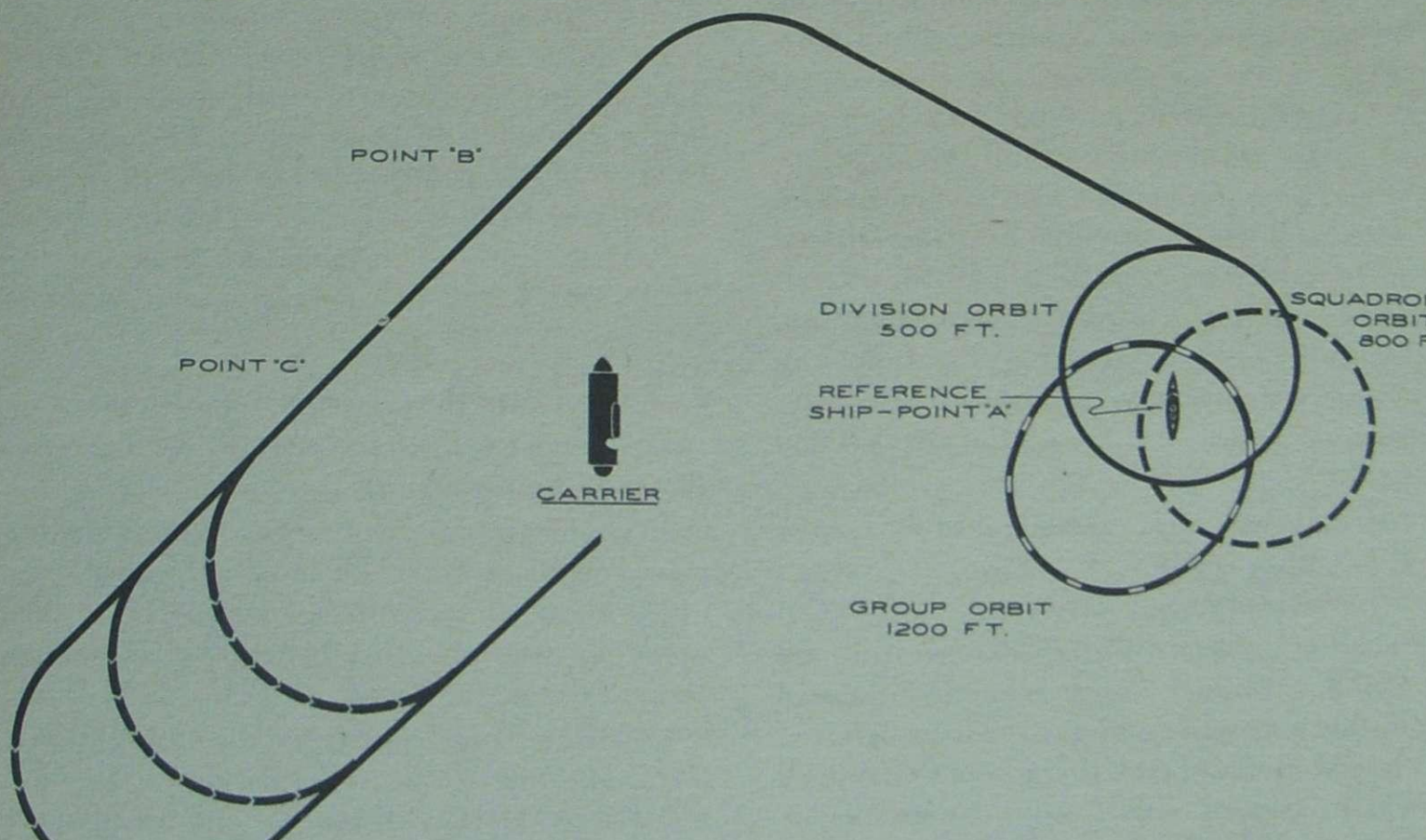


Figure 170.



out of the turn on the 35° relative approach line and make a visual approach.

4. Second and succeeding divisions should time departure from "A" to begin breakup as the last plane on the approach is about 500 yards astern of the ramp. Wave-offs continue ahead to clear the ship's bow and turn to parallel the 215° relative downwind track, taking interval behind the divisions coming downwind.

5. Under full contact conditions, points "B" and "C" move upwind and closer to the ship. CCA control is limited to advising the heading to fly to make good the 35° relative approach.

6. Under marginal weather conditions, CCA could control departure from "A" and if conditions become worse, gradually assume full control. If the ship moves into bad weather the group leaves point "A" and remains in the clear as CCA control takes over.

C. Aircraft Procedure—Instrument Conditions

1. The CCA pattern conditions is shown in figure 172.

2. Assumptions:

(a) Formations of aircraft will return above the overcast or, if clouds extend to great heights, will orbit in a clear area within radar range of the ship.

(b) The ship will be ready for recovery when aircraft arrive.

(c) Positive control will be exercised by CCA and all aircraft movements will be made on order except as noted below.

3. Strike leader will establish communications with PICK-UP as soon as possible, and will give PICK-UP radio calls of aircraft (side numbers) in order of landing, designating section leaders. Notify PICK-UP if group is on top or when group approaches bad weather area if not on top. PICK-UP will order orbit if group is on top, otherwise, group will begin orbit at discretion of strike leader.

4. PICK-UP will begin breakup immediately. Sections will leave the orbit as directed and follow vectors at altitude assigned by PICK-UP. As Point "A" is approached,

from CCA, descending if directed. When over DDR report EUREKA to PICK-UP).

5. Continue homing on DDR at 150 knots. As each section passes over DDR at assigned altitude, section leader report EUREKA (EUREKA—I am over DDR at assigned altitude) and PICK-UP will order switch to MARSHALL. MARSHALL will vector section "B". When directed by MARSHALL, section will descend to 750 feet. Follow MARSHALL's vectors maintaining 150 knots until ordered to shift to TRAFFIC at "B".

6. Report to TRAFFIC and follow vectors given, maintaining 750 feet and 150 knots. TRAFFIC will peel off section leader at "C" and wingman about 15 seconds later. Complete landing check-off and reduce speed. When directed shift to FINAL.

7. After steady on vector at "D", reduce approach speed and begin let-down at 300 feet per minute to reach 150 feet when $\frac{3}{4}$ mile from ramp. Follow vectors given by FINAL and check rate of descent with altitude checks given by FINAL. At 500 yards, expect CONTACT from LSO.

8. When LSO says CONTACT, look over port side and attempt to make visual contact with LSO. If LSO is not in sight, a slight turn to starboard should bring him in view. When LSO is sighted, report CONTACT and proceed visually to landing.

9. If LSO does not report CONTACT at 500 yards, expect wave-off from FINAL. If given, turn 20° to starboard, climb to 400 feet, shift to MARSHALL, and report. Retract gear and home on DDR at 400 feet. When over DDR report EUREKA and MARSHALL will give vector back to "B". If LSO is not sighted immediately after he reports CONTACT take wave-off as above.

10. If visual wave-off is given by LSO, take wave-off to port and turn to home on DDR when clear of the bow. Report to MARSHALL and home on DDR at 400 feet. Report EUREKA when over the DDR.

11. If wave-off is given by TRAFFIC

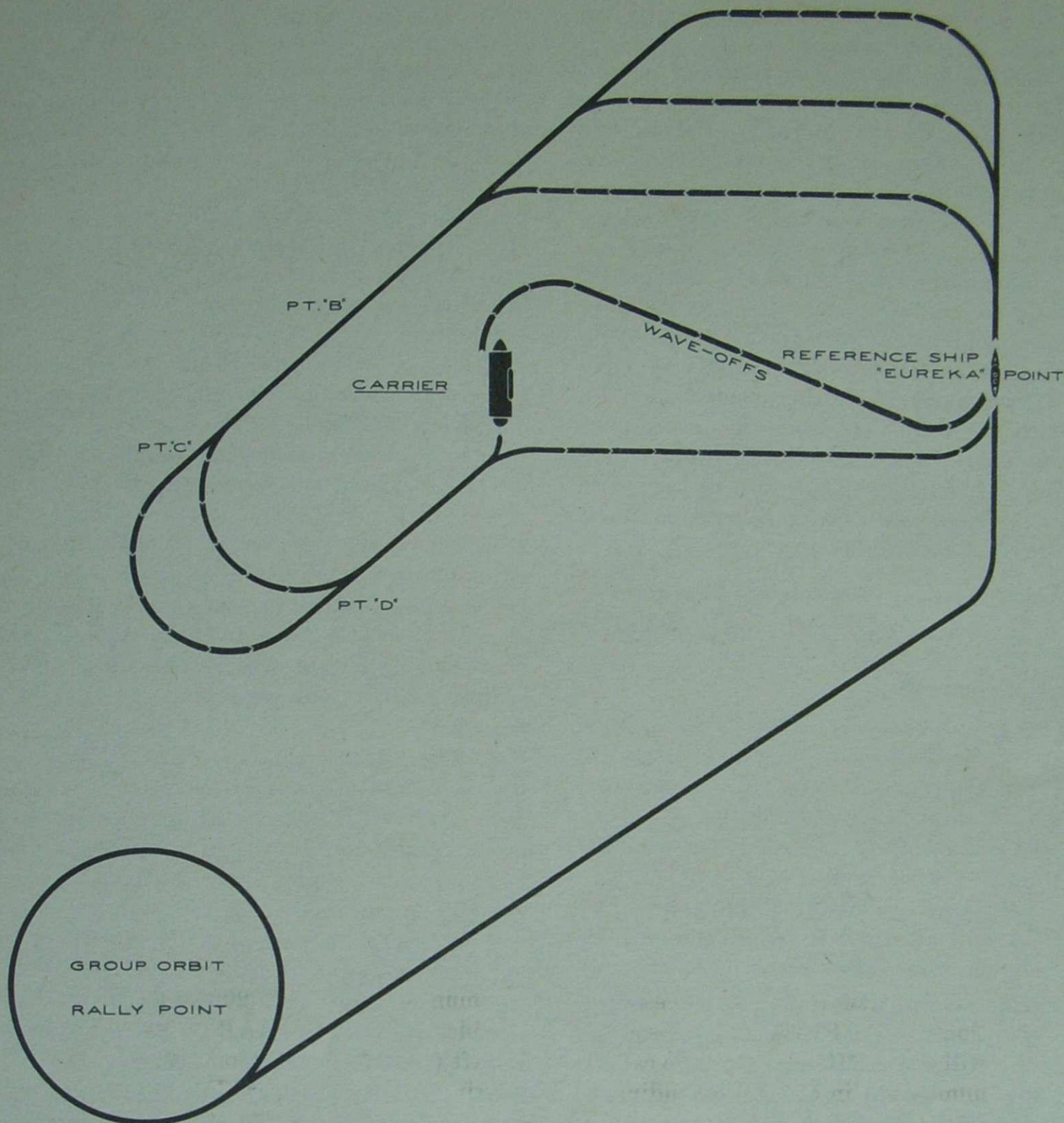


Figure 172.

III. CCA PICK-UP CONTROL

A. General

1. The function of the PICK-UP CONTROLLER is to control aircraft from the time of initial radar contact to RALLY POINT and from RALLY POINT to HOLD.

establish a two minute interval, between tions, at Point "B".

2. In order to maintain the above inter the following points must be observed:

(a) Close liaison between PICK-UP and MARSHALL

(c) Aircraft to be at lowest available altitude upon arrival at Point "A" (normally, 1,500 feet).

B. Pick-Up Control Procedure

1. The CCA pattern to be followed is shown in figure 3.

2. PICK-UP control aircraft as follows:

(a) Establish communication (initiated by group leader or leaders returning from mission) and report weather and altimeter setting at base.

(b) Receive from leader, estimated position and side numbers of accompanying aircraft in landing order and weather en route.

(c) Vector group(s) to RALLY POINT as determined by weather encountered by aircraft.

(d) Break off sections at intervals. Vector to DDR, assign a YE holding sector and altitude starting at 1,500 feet with sections at 1,000 foot intervals up to 4,500 feet.

(e) When the first two sections are steady on their assigned vectors, they are given HOMER.

(f) When a section reports EUREKA, direct aircraft to switch to designated button for MARSHALL control.

3. The following liaison is required between PICK-UP and MARSHALL:

(a) MARSHALL inform PICK-UP when ready to receive aircraft and designate button.

(b) PICK-UP inform MARSHALL of aircraft identification and altitude.

(c) MARSHALL inform PICK-UP when he has control of aircraft and when the aircraft vacate an altitude.

4. PICK-UP assign next lower altitude to succeeding sections as soon as MARSHALL clears the lowest section to 750 feet.

5. When informed by the MARSHALL controller that he cannot handle succeeding air-

IV. CCA MARSHALL CONTROL

A. General

1. The function of MARSHALL controller is to control sections or individual aircraft after they have established their position over Point "A", the designated holding base, either landing CV or a remote ship, so that sections arrive at Point "B", the traffic control area, at two minute intervals.

2. The establishment of the above interval can be achieved by:

(a) Close liaison with PICK-UP and TRAFFIC.

(b) Precise timing in turning aircraft over when ahead of holding base so as to establish a two minute interval for sections through Point "B".

(c) Ordering aircraft to 750 feet when positively identified.

(d) Precision in turning aircraft over to TRAFFIC at Point "B" on the proper heading and at the proper altitude (750 feet).

3. MARSHALL will, in the event that TRAFFIC has reported saturation, return aircraft to Point "A" to be fed into the pattern again.

B. Marshall Control Procedure

1. The CCA pattern to be followed is shown in figure 3.

2. The following liaison between MARSHALL and other controllers is required:

(a) MARSHALL inform PICK-UP that he is ready to control aircraft.

(b) PICK-UP inform MARSHALL that aircraft are over Point "A" at a specific altitude.

(c) TRAFFIC inform MARSHALL when he is prepared to take aircraft and then designates radio button to be used.

(d) TRAFFIC inform MARSHALL when he is saturated so that MARSHALL and PICK-UP can prevent saturation of the entire pattern.

3. MARSHALL controls aircraft as follows:

(a) Establish communications (initiated by aircraft).

(b) Order aircraft to hold (or turn to) heading parallel to ship's heading until further orders.

(c) The first turn given the aircraft after passing over DDR on ships heading will be 90° to port. The time at which this turn is made determines the interval at "B" (two minutes per section) and depends on the time elapsed since the previous section passed over the DDR.

(d) After completing the 90° timing turn, vector the aircraft to pass through "B" on the 215° relative bearing line and control let-down to have aircraft at 750 feet at this point.

(e) When TRAFFIC is ready, with a clear button, order aircraft to shift to TRAFFIC.

V. CCA TRAFFIC CONTROL

A. General

1. Control of aircraft from "B" to "D", in such a manner as to establish a one minute interval between aircraft on final approach, is the function of TRAFFIC.

2. The establishment of the above interval can only be achieved by:

(a) Close liaison with MARSHALL and FINAL.

(b) Precision in detaching section leaders at "C" to arrive at "D" two miles from the ramp and one mile astern any preceding aircraft.

(c) Accurate timing of wingman prior to turning to "D" to arrive one mile astern section leader.

3. TRAFFIC will, in the event of saturation, wave-off aircraft by vectoring them to the DDR and returning them to MARSHALL to preserve the requirements of 2 (b) and (c) above.

B. Traffic Control Procedure

1. The CCA pattern to be followed is shown

(a) TRAFFIC inform MARSHALL that he is ready for aircraft and designates button.

(b) MARSHALL inform TRAFFIC the aircraft identification, heading, position and order the aircraft to shift to TRAFFIC when at "B".

(c) TRAFFIC notify MARSHALL when aircraft identification and communication established.

3. TRAFFIC controls aircraft as follows:

(a) Establish communications (initiated by aircraft).

(b) Soon after aircraft pass "B", direct aircraft to set directional gyro and reset for remainder of approach. Give pilots landing check for gas, mixture, propeller and shoulder straps.

(c) Inform aircraft of heading to fly to reach "C" at altitude 750 feet, speed 90 knots and give corrective vectors if necessary.

(d) When aircraft arrive at "C", direct section leader to detach, vector port to heading for "D", descend to 500 feet and slow to 90 knots.

(e) Keep wingman on heading to establish one mile interval behind leader when upon direct wingman to vector port to heading for "D", descend to 500 feet and slow to 90 knots. Experience shows that this interval may be established by timing so that the wingman continues on heading for 15 seconds prior to turning port to "D".

(f) Aircraft arriving at "D" are informed of that fact and given a further cockpit landing check for wheels, flaps and hook.

(g) Upon arrival at "D", when FINAL is prepared, direct aircraft to shift to designated button for FINAL.

VI. CCA FINAL CONTROL

A. General

1. The function of FINAL CONTROL is

FICER or by a wave-off prior to such contact.

2. FINAL must maintain liaison with TRAFFIC, LSO and PRIMARY FLY.

3. FINAL will wave-off aircraft by vectoring them to the DDR and returning them to MARSHALL in the following cases:

(a) Aircraft not in position to make successful visual LSO controlled approach or cannot be safely vectored to such position.

(b) Aircraft not visible to LSO at minimum contact range and visibility.

(c) LSO not visible to pilot at CONTACT.

(d) Overrunning of preceding aircraft.

(e) Foul deck.

B. Final Control Procedure

1. The CCA pattern to be followed is shown in Figure 172.

2. The following liaison between FINAL and TRAFFIC is required:

(a) Inform TRAFFIC when ready for aircraft and designate button.

(b) TRAFFIC inform FINAL of aircraft position and identification.

(c) FINAL notify TRAFFIC when aircraft identified and communication established.

3. FINAL control aircraft as follows:

(a) Establish communication initiated by aircraft and require acknowledgment of first transmission only.

(b) Vector aircraft to position for contact with LSO.

(c) Direct aircraft to descend from 500 feet at 300 feet per minute and have pilot check wheels, flaps, and hook for landing condition.

(d) Advise pilot of range at each half mile and minimum altitude at that range until at one-half mile.

(e) At three-quarters of a mile instruct the pilot to reduce to approach altitude and approach speed.

(f) From one-half mile to CONTACT

for landing, FINAL wave-off aircraft by directing vector 20° starboard, climb 400 feet and shift to MARSHALL.

4. Liaison with LSO is required:

(a) To permit LSO to monitor FINAL communication with aircraft.

5. Liaison with PRIMARY FLY is required to determine the deck condition for landing aircraft.

VII. CCA COMMUNICATION PROCEDURE

A. General

1. For the CCA procedure, six (6) clear VHF Channels are required. For purposes of this discussion, these are designated herein as follows:

(a) Button 2—PICK-UP.

(b) Button 3—MARSHALL.

(c) Button 4—TRAFFIC.

(d) Button 5—TRAFFIC.

(e) Button 6—FINAL.

(f) Button 7—FINAL.

2. The procedure requires the pilot to shift channels three times; from 2 to 3 at Point "A", from 3 to 4 or 5 at Point "B", and from 4 or 5 to 6 or 7 at Point "C". In the event of a wave-off, pilot shifts from 6 or 7 back to 3 when level at 400 feet. All shifts except the shift from 3 after wave-off are made when ordered. It is the responsibility of the pilot to establish communications after each shift.

3. Each order given will be repeated by the pilot to insure correct reception except orders given by FINAL.

4. The LSO transmits and receives on 6 and 7 and overrides all transmissions on these channels.

B. Emergency Procedure for Loss of Communications

If the pilot loses communication for 1 minute with Marshall or pick-up, 30 seconds with traffic, or 10 seconds on final, he calls in. If communications are lost, planes turn 10° to right and climbs to top of overcast or to 10,000 feet.

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holding stack before climbing to higher altitude. Another plane, preferably a night fighter, is sectored to intercept and brings plane

in formation to the LSO contact. If plane cannot top forecast and cannot fly formation at time, there is no solution.

B. A Sample Communications Procedure is Given Below:

Button	Ship	Pilot
2	-----	"Oyster—this is Oyster 100; on top at angel steering 160, airspeed 160, hayrake says will over."
2	"Oyster 100; this is Oyster PICK-UP: roger, I see you at 340, 50 miles, weather at base point five, ten, six, point four, altimeter two niner eight seven, surface wind 280, sixteen. Tell off in landing order, over."	
2	-----	"This is 100: roger. Sixteen chickens, first section 101, 102; second section 103, 104; third section 105, 106; fourth section 107, 108; fifth section 110, 109; sixth section 117, 118; seventh section 111, 113; eighth section 100, 115; over."
2	"This is PICK-UP: roger, vector port to 120, slow to 150 knots, over."	
2	-----	"This is 100: vector port to 120, slow to 150, over." "This is 100: steady on 120 at 150 knots, over."
2	"This is PICK-UP: roger, out."	
2	"This is PICK-UP: orbit present position, over."	
2	-----	"This is 100: orbit present position, out."
2	"101 oyster, this is PICK-UP: detach your section vector 170, take altitude, 1,500, over."	
2	-----	"This is 101 oyster: vector 170, altitude 1,500, over."
2	"103 oyster, this is PICK-UP: detach your section vector 170, take altitude 2,500, over."	
2	-----	"This is 103 oyster: vector 175, altitude 2,500, over."
2	"105 oyster: this is PICK-UP: detach your section vector 170, take altitude 3,500, over."	
2	-----	"This is 105 oyster: vector 180, altitude 3,500, over."
2	"107 oyster: this is PICK-UP: detach your section vector 170, take altitude 4,500, over."	
2	-----	"This is 107 oyster: vector 170 altitude 45, over."
2	"101 this is PICK-UP: vector starboard 280, homer, over."	
	-----	"This is 101: starboard 280, homer, out."
(PICK-UP continues to vector sections into homing position assigning clear altitudes. If a lower altitude is cleared before a section is switched to MARSHALL, PICK-UP will order let-down.)		
2	-----	"This is 101: EUREKA, over."
2	"101 this is PICK-UP: switch to button 3 for MARSHALL, over."	
2	-----	"This is 101: button 3, out."
3	-----	"MARSHALL this is 101 with 102 on button 3, over."
3	"101 this is MARSHALL: roger, continue present vector, over."	
3	-----	"This is 101: continue present vector, out."
3	"101 this is MARSHALL: vector port 190, take 750 feet, over."	
3	-----	"This is 101: port 190, 750 feet, out."
3	"103 this is MARSHALL: roger, continue present vector, take 1,500 feet, over."	"MARSHALL this is 103 on button 3, over."
3	-----	"This is 103: continue vector at 1,500, out."
3	"101 this is MARSHALL: vector port 140, switch to button 4 for TRAFFIC, over."	
3	-----	"This is 101: port 140, switch to 4, out."
3	"103 this is MARSHALL: take 750 feet, vector port 190, over."	
3	-----	"This is 103: take 750 feet, vector port 190, out."

(MARSHALL continues vectoring sections to point "B" after sections report on button 3, to achieve two minute spacing downwind and ordering descent to 750 feet as soon as radar shows such descent to be safe. Sections alternately assigned to the two TRAFFIC frequencies.)

Button	Ship	Pilot
4	-----	"TRAFFIC this is 101: over."
4	"101 this is TRAFFIC: you are at point Baker, your heading 140, check gas, mixture, prop and shoulder straps. Set gyro and do not reset, over."	
4	-----	"This is 101: heading 140, roger, out."
4	"101 this is TRAFFIC: vector starboard 150, over."	
4	-----	"This is 101: starboard 150, out."
4	"101 this is TRAFFIC: you are at point Charlie. Detach, vector port 300. Descend to 500 feet, over."	
4	-----	"This is 101: port 300, 500 feet, out."
4	"101 this is TRAFFIC: check wheels, flaps, hook and hood, over."	
4	-----	"This is 101: roger, out."
4	"102 this is TRAFFIC: vector port 300. Descend to 500 feet, over."	
4	-----	"This is 102: port 300, 500 feet, out."
4	"102 this is TRAFFIC: check wheels, flaps, hook and hood, over."	
4	-----	"This is 102: roger, out."
4	"101 this is TRAFFIC: switch to button 6 for FINAL, over."	
4	-----	"This is 101: button 6, out."
4	"102 this is TRAFFIC: continue port 290, switch to button 7 for FINAL, over."	
4	-----	"This is 102: port 290, button 7, out."
6	-----	"FINAL this is 101: over."
6	"101 this is FINAL: maintain present heading, over."	
6	-----	"This is 101: maintain heading, out."
6	"101 this is FINAL: do not acknowledge further transmissions. Continue present heading, speed 90 knots, start descent, 300 feet per minute. Check wheels, flaps, hook and hood."	
6	"This is FINAL: you are at two miles, your altitude should be 400 feet, vector starboard to 305. You are at 1 3/4 miles, continue starboard to 310. 310 is your new heading."	
6	"This is FINAL: you are at 1 1/2 miles, your altitude should be 300 feet, you are holding nicely on the line."	
6	"This is FINAL: you are at 1 1/4 miles, vector port to 300. You are at 1 mile, your altitude should be 200 feet. 300 is your heading. You are at 3/4 mile, starboard to 305. Reduce to approach speed and altitude."	
	"You are at 1/2 mile, you should be at approach speed and altitude, port to 303. 900 yards, 800 yards, 600 yards, starboard to 305, you are at 500 yards."	
6	"CONTACT" (from LSO).	
6	-----	"CONTACT" (from pilot).

CHAPTER TWENTY-ONE

THE CONTROL OF SPOTTING PLANES

- A. DEVELOPMENT OF NAVAL GUNNERY.
- B. CIC CONTROL.
- C. SPOTTING PLANE PROCEDURE:
 - (a) Position of Spotting Plane.
 - (b) Radar as Spotting Aid for Surface Gunfire.
 - (c) Estimation of Surface Distances.
 - (d) Communications for Surface Spotting.
 - (e) Frequency Assignments.
 - (f) CW Abbreviations.
 - (g) Line of Fire.
- D. DUTIES OF AERIAL SPOTTER.
- E. RADAR AS SPOTTING AID FOR SHORE BOMBARDMENT.
- F. DETERMINING SPOTTING.
- G. THE GRID SYSTEM.
- H. SPOTTING CHARTS.
- I. TARGET DESIGNATION.
- J. COMMUNICATIONS FOR GRID SPOTTING.
- K. SECONDARY METHODS OF SPOTTING.
- L. COMMUNICATIONS FOR LINE OF FIRE SPOTTING.
- M. CLOCK CODE.
- N. MISCELLANEOUS INFORMATION.
- O. NIGHT OBSERVATION.

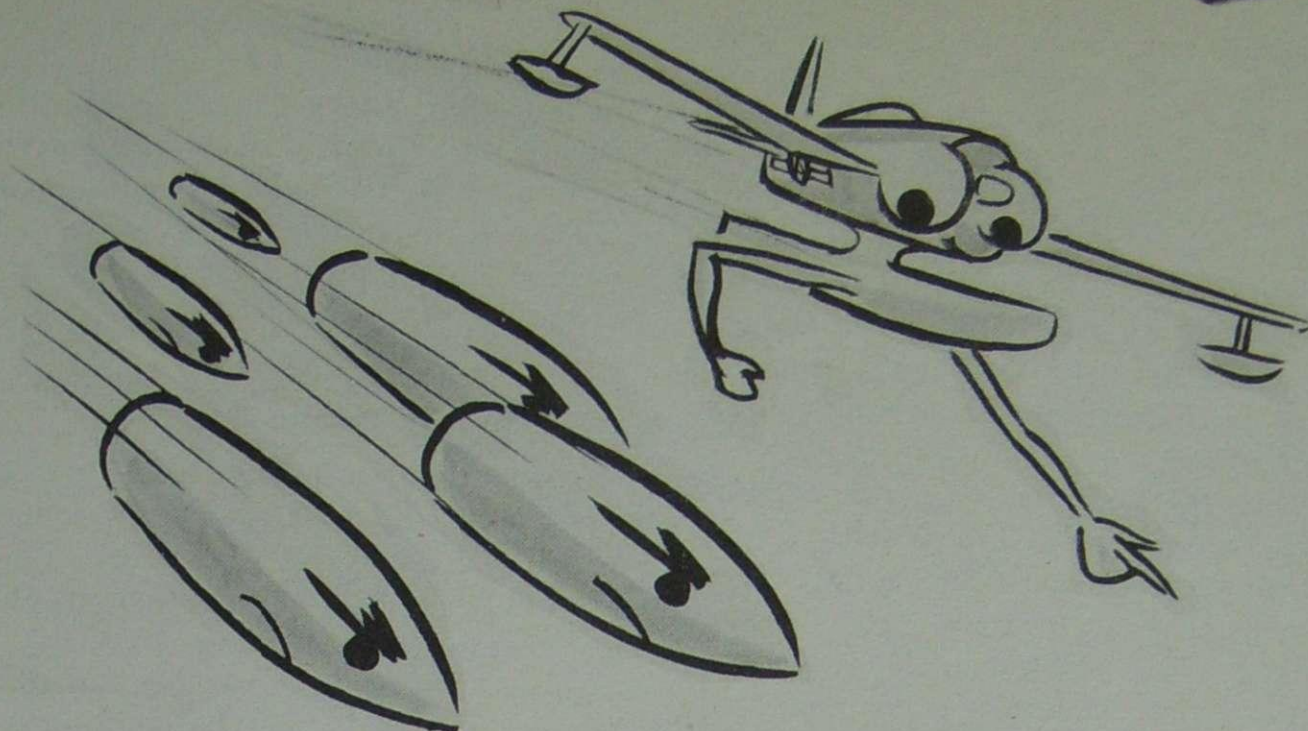


Figure 173.

CHAPTER 21

THE CONTROL OF SPOTTING PLANES

A. DEVELOPMENT OF NAVAL GUNNERY

Naval gunfire has proven its value by its effective destruction of the enemy. New and improved methods of fire control have been devised, enabling our guns to hurl tons of shells over long ranges with deadly accuracy. Modern amphibious warfare has placed greater demands on naval gunnery than ever before. Firing at extremely long ranges, or on island targets, obviously requires an effective method of directing the full impact of a salvo onto the target. Aerial spotting has undergone changes in keeping with the increased demands of ships' batteries. Many methods have been tried, with varying degrees of success, and from these our present standardized spotting procedure has been derived.

B. CIC CONTROL

The aerial spotter is directly responsible to the gunnery officer. To assure the most efficient communications the spotter transmits directly to plot (gunnery). Plot makes all necessary adjustments to correct the ship's fire.

and keeping him informed of the position of friendly planes in the area. All transmissions from the spotter must be received by CIC as well as plot, in order to maintain a complete picture of all activities.

C. SPOTTING PLANE PROCEDURE

Aircraft spotting is divided into two main classifications: *Spotting for surface engagements* and *spotting for shore bombardment*. Different procedures are used for each and will be covered separately in accordance with current spotting doctrine.

(a) Position of Spotting Plane

Taking into account cloud conditions, wind, fire, and air action, the spotter selects an area as close as possible to the target where maximum visibility is offered. The ship may keep a steady fix on the plane, or receive its position by radio. IFF and orbits may be used to identify the spotting plane.

(b) Radar as Spotting Aid for Surface Gunfire

Spotting has been greatly aided by the introduction of radar as a very accurate method

An accurate range and bearing can be taken by radar from the splash (geyser of water thrown in the air when a shell lands); and in case of a full salvo, the deflection and range of the MPI (mean point of impact) may easily be obtained from the radar scope. Normally, in a full salvo, the shells land in a ladder-like pattern covering an area of approximately 50 yards in width and up to 500 yards in length, depending on the caliber of the guns and the range being fired.

Radar, observers aboard ship, rangefinders, and directors are all utilized in spotting, as well as the aerial spotter. Sometimes radar will be used to spot deflection, and the aerial observer to spot range only. However, deflection spot by the aerial spotter is usually considered preferable to radar deflection spot.

The aerial spotters usually spot both range and deflection in yards since use of MIL scale would require aerial spotter to know range from firing ship to target.

(c) Estimation of Surface Distances

Estimating distance on the surface is extremely difficult under any conditions. The aerial spotter is helped a great deal in range estimation by knowing the pattern length of a salvo and using it for a yardstick in spotting. Estimates of deflection spots require a great deal of experience in order to obtain any degree of accuracy. Pilots most commonly use target size as guide in spotting range and deflection. Example, DD is 100 to 125 yards long, OBB 200 yards long, etc.

Estimations of range from firing ship to target are best learned from experience. Distance charts of altitude to horizon are of some value in aiding the aerial spotter, but are too dependent on visibility to be relied on solely.

(d) Communications for Surface Spotting

Aerial spotting may be successfully accomplished by either voice or key transmissions, and blinker can sometimes be used when all else has failed. In order to meet the high speed requirements of modern warfare, direct

force operations the situations are too varied to establish a standard doctrine. Local distance to the target, weather conditions, enemy opposition must be considered in determining the method of communicating. OTC will determine whether voice or CW will be used, having due regard for the tactical situation, the requirements of security, and the prevalence of interference.

(e) Frequency Assignments

Normally each battleship and cruiser will be assigned a different spotting frequency to be controlled solely by that ship. When a destroyer wishes an aerial observer, the assignment of a spotter is made by OTC. The destroyer must use the frequency of the assigned plane. The plane may be required to spot the destroyer and its own ship simultaneously.

(f) CW Abbreviations

Standard abbreviations are used on CW communications in aircraft gunnery observation and are shown in CSP 2156 series.

(g) Line of Fire

The line of fire is the primary factor controlling surface spotting. The aerial spotter must keep the position of the firing ship clearly in mind relative to the target ship or any spots sent will be of no value whatsoever.

D. DUTIES OF AERIAL SPOTTER

It is the responsibility of the aerial spotter to keep the OTC and CIC, in addition to himself, informed at all times of the following:

1. Course and speed changes of enemy force.
2. Formations or disposition of the enemy force.
3. Damage inflicted to enemy force.
4. Activity on CV decks, if carriers are involved.

For more detailed information concerning surface spotting, refer to USF-75.

spot for naval units engaged in a shore bombardment. Amphibious warfare requires a highly accurate method of spotting since shelling may be carried on against targets as close as 100 yards to our own troops. An area bombardment, such as in a raid to destroy or neutralize enemy bases, does not require as high a degree of accuracy from the spotter, but every effort must be made to make every salvo count.

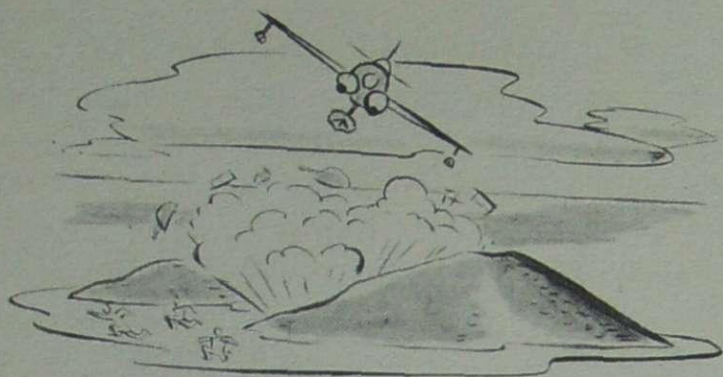


Figure 174.

Many factors must be taken into consideration to determine what method of spotting can be used effectively in shore bombardment. The target will not be visible to shipboard observers or within the line of sight of radar unless it is situated on the shore line or beach area. Aerial observation and shore fire control parties are relied on to a great extent both for spotting the fall of shot and selecting targets of opportunity.

The use of special fighter unit spotters is frequently resorted to during amphibious operations when AA or enemy air opposition is too heavy for the regular aerial spotters. On such occasions the ships fire when the fighter calls for "salvo," at which time the plane commences the dive, timing his dive so as to be in the best position to spot at the expiration of the time of flight given by the bombarding ship.

F. DETERMINING SPOTTING PROCEDURE

Familiarity with the area under attack together with weather conditions, range to the target, terrain, and enemy opposition will all

be able to keep the firing ship and the target area in view at the same time. The spotter will be required to correct for both range and deflection. Landmarks, such as roads, pointed targets, hills, and rivers, will greatly aid in locating target areas and spotting the salvo correctly. Having no visible contact with *both* the firing ship and target area, the spotter cannot depend on the line of sight as a reference in his spotting. Many procedures have been attempted to eliminate use of the line-of-fire as a reference. Only the most widely used and standardized procedure will be discussed here. Other systems are variations which are used as the situation demands.

G. THE GRID SYSTEM

The most widely used method of spotting a shore bombardment is the grid system. Targets may be quickly and easily located by reference to the grid square. Fire may shift from one target to another by reference to the grid. New targets of opportunity, targets previously not located, may be pinpointed accurately. Each department concerned may thus keep a running plot of the entire engagement. An over-all picture of the situation is available at all times to the entire chain of command.

H. SPOTTING CHARTS

Grid maps may be constructed from charts, overlays on maps, or by superimposing the grid on photographs. The grid map used by aerial observers must be pictorial—showing roads, buildings, cleared areas, hills, and other landmarks visible from the air. Color should be used wherever possible, showing water in blue, reefs in white, and wooded areas in green. Contour lines should be shown every 20 feet, with hachure marks for peaks and cliffs. Maps should be as large as can be conveniently used.

I. TARGET DESIGNATION

Targets definitely located should be marked as to type and circled with red ink. They need not be numbered as fire will be called on

ship will adjust fire to shoot into the desired target area.

J. COMMUNICATIONS FOR GRID SPOTTING

Frequencies for spotting will be as assigned in the communication plan. VHF will be used if possible. All spotting and communications will be in plain language, using voice transmission only.

K. SECONDARY METHODS OF SPOTTING

There are times when the aerial spotter will be able to keep visual contact with the firing ship and still maintain an unobstructed view of the target. If maps or grids are not available, the easiest method of spotting is to use the line-of-fire from ship to target for spotting deflection and range. As long as the line of fire is known the spotter may estimate the correction to apply to place the salvo on the target. An experienced spotter may not need visible contact with both ship and target as familiarity with the salvo pattern will show the direction fired from. This system is impracticable, however, when single-round salvos are being fired.

L. COMMUNICATIONS FOR LINE OF FIRE SPOTTING

Voice communication, using plain language, is mandatory. Spotting may be done, as in surface gunfire, by giving the necessary correction to place the salvo on the target. No abbreviations are used in voice spotting. To raise a salvo 100 yards the spotter will say "Up 100. Up 100, This is Ace Turfclub." Deflection is also spotted in the actual yardage desired. Range is spotted first and then deflection. This is repeated and followed by the spotters call. The aerial observer may report targets of opportunity and request the ship to shift fire by telling in a clear and concise report exactly what is seen. A reference point must be used and a prominent landmark is usually selected.

M. CLOCK CODE

There is one other system of spotting indirect

spot where the salvo lands by using a clock code. True north is 12 o'clock and the target being fired on is the center of the clock. To spot a salvo landing 300 yards west of the target would be called by the spotter as "9 o'clock 300 yards." The ship will apply the correction adjustment to fire on the target. To shift fire or report targets of opportunity, the spotter uses the same procedure of clocking, giving a known landmark or target as the reference point.

N. MISCELLANEOUS INFORMATION

In view of the many situations which may arise, the spotting plane must remain in a grid area as much as possible to aid CIC in keeping the plane's position plotted. Normally the spotting plane will be a seaplane (VO-V type aircraft) and it should be remembered that as such there may be presented the opportunity of utilizing such aircraft for sea and rescue. The spotting plane is near to the target area and valuable time may be saved using the spotting plane during a lull in firing thus saving the launching of other craft or fleet units.

In order for a ship to maintain accurate plot must keep a running fix on the ship's track. Radar has proved invaluable in maintaining accurate position reports of the ship on its firing run. Whenever radar spots may be utilized, whether with or without aerial spotting the average spots given will be used in order to give the best possible service to the parent ship.

During both surface engagements and shore bombardments each battleship and cruiser normally launches its own spotting planes.

Secondary frequencies will be assigned for use in case of jamming or interference by the enemy on the primary spotting frequencies.

O. NIGHT OBSERVATION

Spotting may be conducted during night bombardments if conditions permit. Normally the launching and recovering of VO type aircraft is too hazardous after dark, but in many

CHAPTER TWENTY-TWO

ANTIAIRCRAFT (AA) FIRE AND CONTROL OF AIRCRAFT

- A. PURPOSE.
- B. RESPONSIBILITY.
- C. APPROACH SECTORS.
- D. ALERTING FRIENDLY AIRCRAFT.
- E. AA FIRE AND THE COMBAT AIR PATROLS.
- F. KEEPING FRIENDLY AIRCRAFT INFORMED.
- G. NIGHT INTERCEPTIONS.
- H. CIC's RESPONSIBILITY FOR ALL FRIENDLY AIRCRAFT.
- I. SHIP'S CIC OFFICER'S RESPONSIBILITY TO GROUP CIC OFFICER.
- J. TASK GROUP COORDINATION.
- K. NEED FOR ALERTNESS.

CHAPTER 22

ANTIAIRCRAFT (AA) FIRE AND CONTROL OF AIRCRAFT**A. PURPOSE**

The purpose of AA fire is to destroy all enemy planes threatening our units. When enemy aircraft are approaching AA gun range, split-second action is often necessary to prevent damage to fleet units. At such times radar alone, because of the inherent weaknesses of the IFF system, cannot be depended upon to identify all air contacts. It is then that visual recognition assumes the burden of locating enemy aircraft.

B. RESPONSIBILITY

The OTC is ultimately responsible for prescribing the conditions for ordering "Hold Fire" or "Release Batteries," but his decision will be made on the bases of accurate information furnished by the CIC. If friendly aircraft are within AA range, it is the responsibility of the controlling CIC to warn all friendly aircraft to clear the area.

C. APPROACH SECTORS

Certain doctrines have been established which serve as an aid to AA personnel in distinguishing between friendly and enemy aircraft. One of the most common of these is the assignment of approach sectors to be used by planes closing a formation from beyond visual range. While such a system is by no means foolproof, it can be a great help to lookouts and gunners. Regardless of the assigned sector of approach, planes should never approach out of the sun nor make any other maneuvers which may arouse suspicion. In addition to the approach

D. ALERTING FRIENDLY AIRCRAFT

Usually the OTC leaves it to individual ships to open fire on enemy aircraft when necessary and feasible. Therefore, as soon as there is a probability of AA fire, CIC personnel must alert all friendly aircraft.

In the past, if the enemy was not intercepted by the time he reached the limits of our AA screen, gunnery opened fire and all friendly aircraft were told to stand clear. When AA personnel are engaged in the destruction of enemy planes they cannot be expected to readily distinguish friendly planes. In the heat of battle, all incoming aircraft are considered by gunnery to be enemy until proven otherwise. CIC is in the best position to know the location of friendly aircraft and forewarn them of imminent AA fire. But how soon and when friendly aircraft will be ordered to stand clear of the task group will depend on the tactical situation. If an interception is being run, the OTC may order "Hold fire" under the following conditions: 1) if our fighters are ready for the "kill," 2) if the bogey is determined to be reconnaissance rather than attack, or 3) if in a night interception the need for task force security makes it more practical to continue the interception than to open fire.

E. AA FIRE AND THE COMBAT AIR PATROLS

Fighters are generally more effective than AA. Often, therefore, it is left to the pilot either to continue the interception in the face of AA or to break-off at clear range. In any event the warning "Salvos" should first be given

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may either clear the formation or remain on station when the batteries open up. High CAP is rarely bothered by such fire because of its altitude. Intermediate and low CAP, although within range, are sometimes more successful in shooting down the enemy over our formation than our AA fire. The important thing is for CIC to keep the pilot informed of the probability of AA fire and give him time to fly clear if he chooses. When the responsible authority has given the order to "Release batteries," CIC must broadcast the warning "Salvos" to all friendly aircraft in the vicinity. When fighters are ordered clear of formation they should be given a definite station in order that positive control may be maintained over them.



Figure 175.

F. KEEPING FRIENDLY AIRCRAFT INFORMED

Even after "Salvo" has been given, the air controller should pass adequate information on the bogey's action to the friendlies in the area. The air controller should keep the friendlies informed of the probable retirement area of the bogey. If he has enough time, he should vector the friendlies into the best position to intercept the bogey as it moves out of gunnery range. A bogey attacking from the east and crossing the formation, for example, could be intercepted on his outward flight by friendlies standing by in the west. As soon as the bogey opens from the formation, assuming it has eluded AA fire, it can then be engaged by the friendlies.

G. NIGHT INTERCEPTIONS

The problem of AA fire in relation to air

the air controller—he cannot be recognized by AA personnel, and he may not even know the bogey is over the force until greeted by salvos of AA fire. Once the bogey has come within range of the AA screen, the night fighter is generally vectored away from the formation and it becomes the AA batteries' task to destroy the bogey. Again, at what time the AA batteries take over in place of the night fighter depends on the tactical situation. The night fighter may be closing the bogey, and the AA batteries may have him within range, either radar or visually, with a "kill" probable. In this particular situation the OTC might give the order "Hold fire" while the night fighter is allowed to make a run over the formation. On the other hand, if a "kill" does not seem probable, or for other reasons the OTC orders "Batteries released," the night fighter must be vectored immediately away from the formation, giving the AA batteries freedom of action against the bogey.

H. CIC'S RESPONSIBILITY FOR ALL FRIENDLY AIRCRAFT

At all times, CIC's responsibility covers not only the formation's fighter planes but also all friendly planes in the area, whether on patrol, rescue missions, or in launching or landing. CIC must know the status of all friendly aircraft. When attack is imminent, such aircraft should be directed to a "safe" or disengagement area and joined up.

I. SHIP'S CIC OFFICER'S RESPONSIBILITY TO GROUP CIC OFFICER

It is the further responsibility of a ship's CIC officer to keep the group CIC officer advised of the position of any planes which might complicate the use of AA fire. In turn, the group CIC officer is responsible for passing this information to all units in the groups, advising the OTC of the desirability of opening or holding fire.

J. GROUP COORDINATION

CIC officer must inform the force CIC officer and other group CIC officers of the progress of all interceptions within his area, the condition

of night planes air-borne, the release of batteries and other pertinent information affecting control of aircraft.



Figure 176.

K. NEED FOR ALERTNESS

CIC's relation to AA fire in control of aircraft is very important. Whether the order "Release batteries" or "Hold fire" is issued may depend entirely on the information CIC has passed to the OTC. Conversely, the amount

of protection given to friendly planes from own AA fire will be in direct proportion to alertness of CIC personnel. CIC has the most comprehensive picture of the total air situation and the CIC officer or watch officer should not hesitate to make recommendations promptly concerning conditions of batteries.

CHAPTER TWENTY-THREE

CONTROL OF AIRCRAFT IN TRAINING

- A. INTRODUCTION.
- B. TYPES OF TRAINING EXERCISES.
- C. SIMULATED GROUP ATTACKS.
- D. VARIATIONS OF THE GROUP ATTACK.
- E. CALIBRATION RUNS.
- F. COUNTERMEASURES AND DECEPTION EXERCISES.



Figure 177.

CHAPTER 23

CONTROL OF AIRCRAFT IN TRAINING

A. INTRODUCTION

The control of aircraft in training exercises is an important function of CIC. Nothing can better prepare a ship's CIC for battle than conscientious drills before action begins.

Radar and radio equipment must be checked and pilots and CIC must drill together to become a smooth-running team.

B. TYPES OF TRAINING EXERCISES

Generally speaking, training exercises fall into four categories:

1. Air group attacks: detection and interception.
2. Radar calibration runs.
3. Countermeasures and deception exercises.
4. Gunnery, torpedo, and bombing runs.

Some of these exercises involve the use of CIC communications facilities only. Gunnery runs, for example, in which a sleeve is towed as a short range AA target, are conducted too close to the ship to permit good radar detection and plotting.

C. SIMULATED GROUP ATTACKS

The simulated attack in which a large proportion of the air group launches an air attack

provides the only chance to practice air control against sizeable raids at sea.

To give the fullest training to the air group and CIC, the attack is treated as an actual raid. Within CIC reports are passed to bridge, flag, gunnery, and air plot on the progress of the attack. If the ship is operating in a group, a report is also made to the group CIC officer who directs interceptions, deploys the fleet, and broadcasts warnings to the other ships in the group. When the attacking group comes within range, the group gunnery coordinator and CIC liaison officers take over and begin feeding plots, courses, and speeds to battle plot and the ship CIC officers report "torpedoes" and splashes as they come in from the CAP.

D. VARIATIONS OF GROUP ATTACK

To give the fullest practice to the air group as well as CIC, the attacks should vary from torpedo to glide or dive bombing attacks. For example, an exercise called "Moosetrail" has been developed which closely simulates the tactics used by Japanese suicide bombers. It has taught both pilots and CIC officers

cise is used for the whole force en route to or from an operating area. Because the practice here involves the closest approach to reality that can be achieved, it is by far the most useful type of training exercise yet devised.

E. CALIBRATION RUNS

Calibration runs, the second general type of exercise, are an essential to CIC operations. They entail the control of aircraft in flights designed to calibrate search and fire control radars and the ship's range finders. Since these runs require flights of predetermined patterns it is normally necessary to brief the pilots before take-off. Because of the fact that many of these runs call for long flights which may extend beyond VHF/UHF range, it is essential to define safety procedures in advance.

F. COUNTERMEASURES AND DECEPTION EXERCISES

Countermeasures and deception exercises are relatively new to the fleet. With the development of enemy radar and fuller use of jamming, "Window," "balloons," and other types of deception, training exercises of this sort have assumed increasing importance.

For CIC personnel, these exercises provide an opportunity to practice scope reading through jamming and "Window." It is usually true that, once observed and identified, "Window" presents a relatively minor prob-

lem to our air search gear. The same cannot be said for some fire-control radar unfortunately. However, an operator experienced detecting "Window" can immediately begin to take corrective steps.

For pilots, countermeasures exercises are useful in teaching them the best methods of using "Window" and "balloons." Night fighter pilots, whose scopes have sometimes been jammed successfully by the enemy pilot under pursuit, also gain experience in combatting this type of evasive tactics.



Figure 178.

CHAPTER TWENTY-FOUR

FUNCTIONS OF AIR OPERATIONS IN THE CONTROL OF AIRCRAFT

- A. AIR DEPARTMENT AND ITS ORGANIZATION.
- B. AIR OPERATIONS.
- C. SHIPS OPERATION PLAN.
- D. GENERAL TACTICAL AND INTELLIGENCE DATA SHEET.
- E. RECORD OF PERSONNEL, MATERIAL, AND AIRCRAFT
AVAILABILITY.
- F. FLY SHEETS.
- G. NUMBERING AIRCRAFT.
- H. STATISTICAL LOG.
- I. FLY CONTROL.
- J. METHODS OF AIR OPERATIONS.
- K. LAUNCHING AIRCRAFT.
- L. RENDEZVOUS.
- M. LANDING OPERATIONS.
- N. CIC RESPONSIBILITIES.

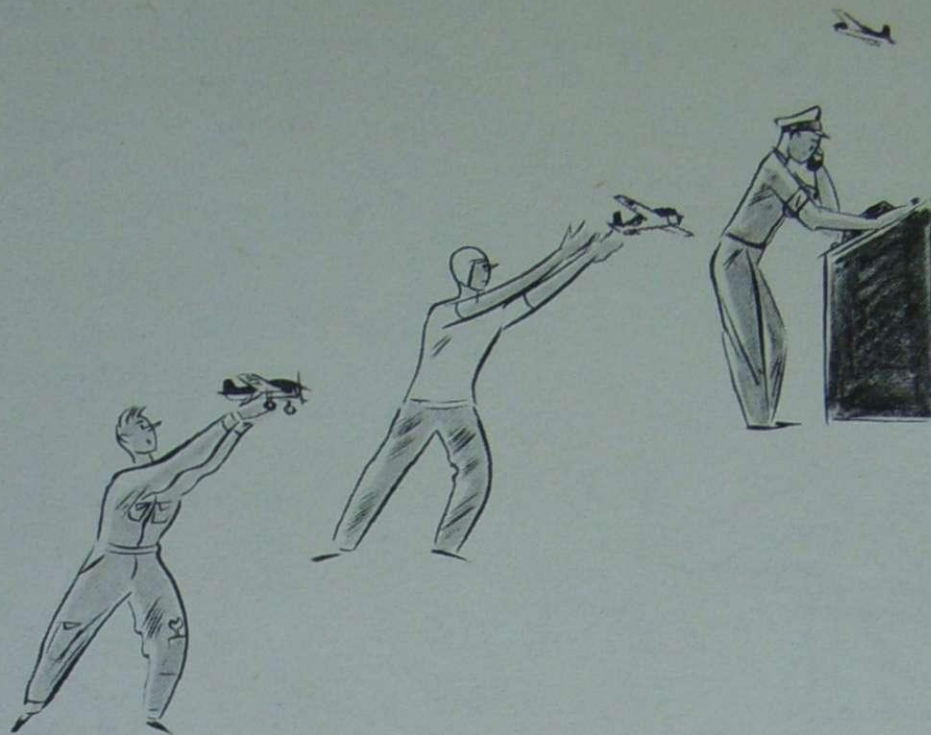


Figure 179.

CHAPTER 24

FUNCTIONS OF AIR OPERATIONS IN THE CONTROL OF AIRCRAFT

A. AIR DEPARTMENT AND ITS ORGANIZATION

The task of conducting air operations aboard a carrier falls to the air department and the operations department.

The functioning of the air and operations departments are the responsibility of the air officer and the operations officer under the supervision of the commanding and executive officers of the ship. Under the air officer is a group of officers each of whom is responsible for one phase of the air department work. Among these are the ACI officer, ordnance officer, flight deck officer, hangar deck officer, landing signals officer, supply officer, engineering officer, catapult officer, arresting gear officer, gasoline officer, photographic officer, and air group commander.

Under the operations officer are the CIC officers, air controllers, communication officer, Navigator, Aerological officer and air plot officer.

When a flight has been ordered, the engineering officer announces which planes are available

ordnance; fueling is done by the gasoline crew; photographic details are handled by photography; radio and radar personnel set up prescribed radio frequencies; pilots are briefed on all intelligence by ACI officers; aerology supplies current weather data; and lastly the planes for the individual planes are assigned by air group organization.

B. AIR OPERATIONS

Air operations is the center of information where this work is coordinated and directed and though the air department organization on different carriers will vary somewhat in accordance with individual policies and experimentation, they all follow the same general pattern.

C. SHIP'S OPERATION PLAN

It is the responsibility of operation department administration to prepare, prior to operation, a ship's operation plan. While

the individual ship and its embarked air group.

The arming plan is a supplement to this and is prepared by the air officer, air group commander and their ordnance advisors, in accordance with the task group commander's directives.



Figure 180.

D. GENERAL TACTICAL AND INTELLIGENCE DATA SHEET

A general tactical and intelligence data sheet is supplied to pilots daily by the air combat information (ACI) officer. This gives a brief outline of the day's objective, rescue information, intelligence summary, communications outline, disposition of friendly forces, etc. Just prior to take-off pilots are also briefed on "Point option" course and speed, aerological information, ships position, and last minute instructions.



Figure 181.

responsibility for keeping an up to date record on the status of air department personnel, material, and aircraft availability. It is essential that complete records be kept on the number of planes operational and on the number of pilots and crewmen ready to fly.

F. FLY SHEETS

Air operations also supply CIC with "fly sheets," the daily flight plan, which list aircraft numbers for each flight, names of pilots, each pilot's call designation, and/or any change that may have occurred in scheduled flight.



Figure 182.

G. NUMBERING AIRCRAFT

Aircraft group calls and individual number calls are established in Joint Army Navy Force Publication 119. *Example:*

- Ø Mission or flight leader
- 99 Collective call for all aircraft.
- 1Ø1 VF (A) leader
- 2Ø1 VF (B) leader
- 3Ø1 VA (B) leader
- 4Ø1 VA (A) leader
- 5Ø1 VO leader
- 199 Call for all VF (A)
- 299 Call for all VF (B)
- 399 Call for all VA (B)
- 499 Call for all VA (A)
- 599 Call for all VO
- 1Ø1-187 Individual VF (A) calls
- 2Ø1-287 Individual VF (B) calls
- 3Ø1-387 Individual VA (B) calls



Figure 183.

H. STATISTICAL LOG

Air operations also maintains a statistical log, recording number of launching and landing, daily bomb loads dropped, number of sorties, crashes, rescues, and planes lost and recovered.



Figure 184.

I. FLY CONTROL

From fly control the air officer and the assistant air officer control the movement of all aircraft on the flight deck, all launchings and landings, use of elevators, the jettisoning of irreparably damaged planes, spotting of the deck, gassing and degassing of aircraft, etc.

J. METHODS OF AIR OPERATIONS

For conducting air operations three methods

BAKER—Independent maneuvering general within the screen by carriers concerned.

CHARLIE—Not a distinct method, by a procedure combining methods **ABLE** and **BAKER** with the principle air giving maximum protection to carriers operating under method **BAKER**. For clarity it is called method **CHARLIE**. In the method the carrier(s) scheduled to operate aircraft proceeds to an initial position near the downwind arc of the screen and turns into the wind as in method **BAKER**. At an appropriate time before the carrier passes out of the screen the commander should turn the entire remainder of the disposition by method **ABLE** to parallel the course of the operating carrier(s). (See USF 4 for specific details.)



Figure 185.

All carriers display one large Fox flag from each yardarm during flight operations, hoisting them at the dip when preparations are being made or during a temporary delay, two blocking when into the wind or when conducting or resuming operations.

When the ship is steady into the wind, the officer of the deck or captain on the bridge

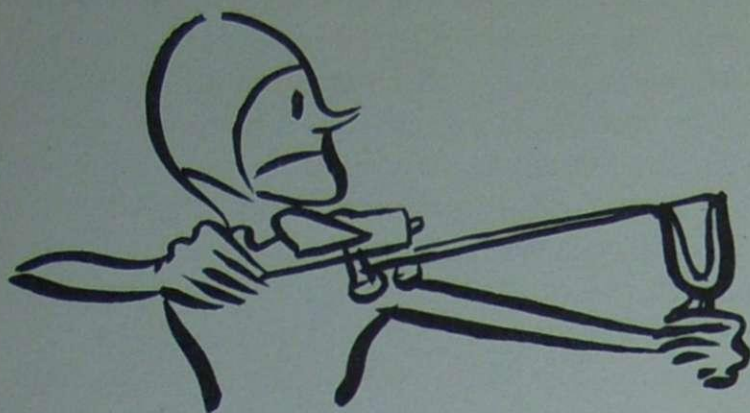


Figure 186.

K. LAUNCHING AIRCRAFT

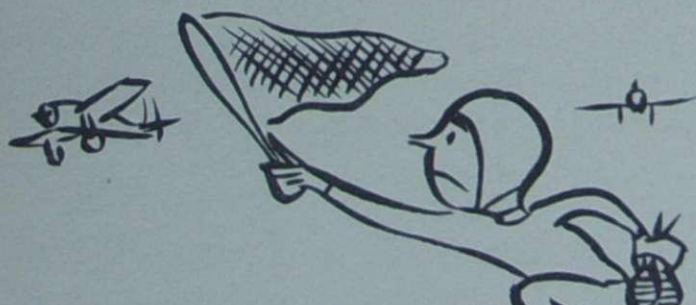
For deck run take-off, planes are centered on the deck with sufficient run for launching, the position varying with the type of plane and its load condition. When the pilot completes check-off list and signifies readiness by a nod of the head, the starter drops his flag toward the bow, and the pilot commences take-off.



Figure 187.

L. RENDEZVOUS

When launched, the flight will rendezvous at a predetermined altitude in a prescribed sector relative to the formation axis.



M. LANDING OPERATIONS

The normal landing order for return planes is usually VF and VA, unless some usual deck spot or condition requires that it be otherwise. Returning planes will rendezvous and remain in their own sectors (break-up sector is the same as the rendezvous sector) under the control of the group CIC officer until the officer signals "Prep Charlie." After receipt of "Prep Charlie," landing control of the group is shifted automatically to parent carrier and break-up procedure is commenced. When signal "Charlie" is given by parent carrier, planes will begin landing aboard.

Air operations should inform CIC when landing operations are completed.

N. CIC RESPONSIBILITIES

Once air-borne the planes come under direct control of CIC. In the event of aircraft emergencies (such as oil or gas leak, lack of oil pressure, critically low "star" hydraulic leak, structurally damaged plane, etc.) the CIC officer should as quickly as possible ascertain the nature of the trouble, the pilot's estimation of how long he can remain airborne. CIC should inform air operations immediately and request instructions for procedure. The pilot house, flag operations, and the group CIC officer should also be notified immediately.

The decision for emergency recoveries



mally lies with the OTC and/or the commanding officer of the parent ship. Authority does not rest with CIC, whose function in such case is primarily as an intermediary between pilot and proper authority. If water landing is required, plane should land approximately 1,000

yards ahead of and slightly on the lee bow of one of the screening or plane guard destroyers. Look-outs, bridge, and all others responsible should be informed, and information regarding the expected landing is given over the primary tactical maneuvering and warning net.

CHAPTER TWENTY-FIVE

SOURCES OF INFORMATION FOR CIC IN CONTROL OF AIRCRAFT

- A. INTRODUCTION.
- B. OPERATIONS PLANS.
- C. THE ACI OFFICER.
- D. INFORMATION FROM AIR OPERATIONS.
- E. AEROLOGY.
- F. LOOKOUTS.
- G. COMMUNICATIONS DEPARTMENT.
- H. PICKET DESTROYERS.
- I. PILOT HOUSE.
- J. VISUAL CONTROLLER.
- K. PATROLS AND STRIKES.
- L. AIR CONTROL CHANNEL.
- M. RADIO INTELLIGENCE.
- N. RADAR INFORMATION.

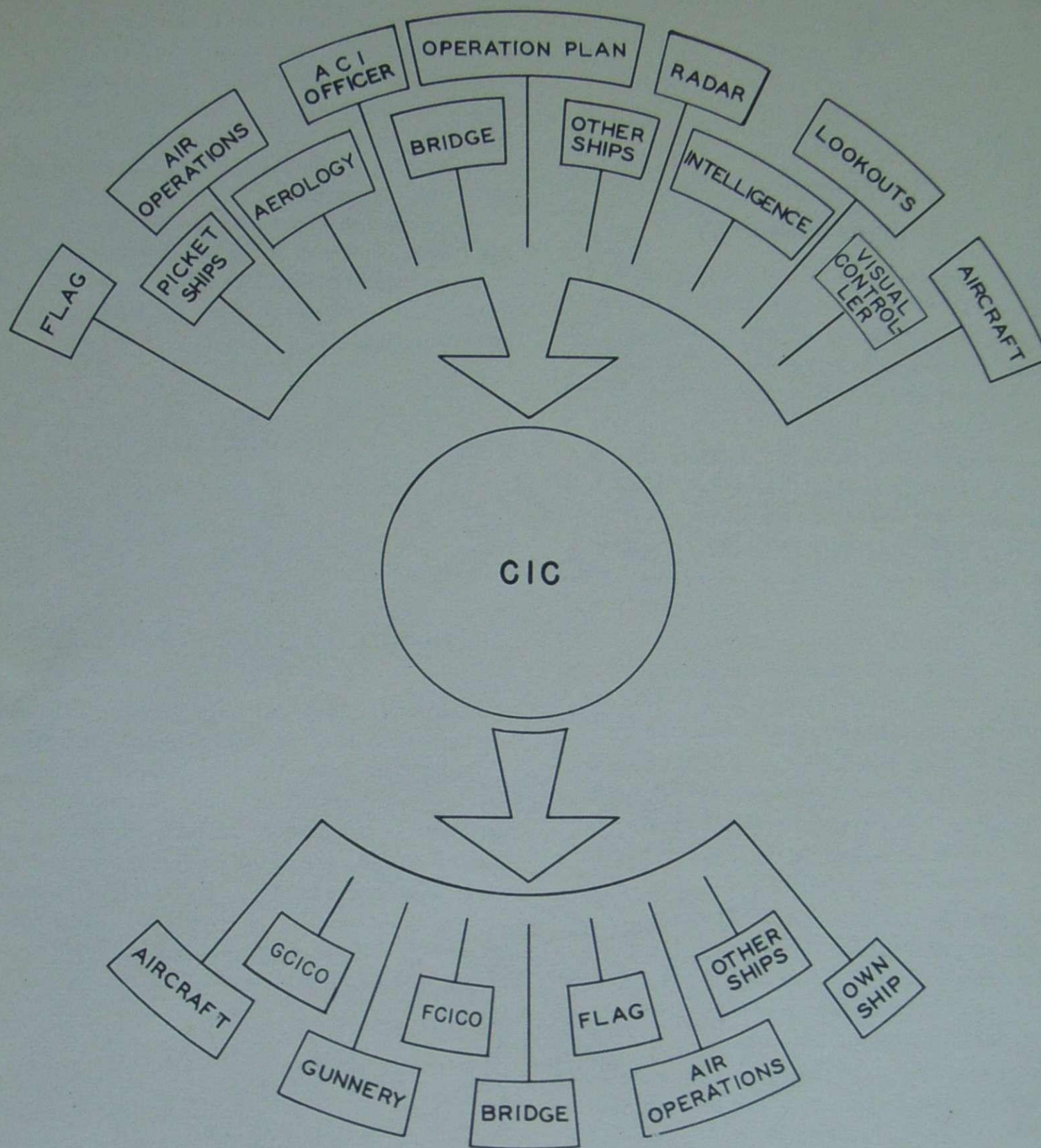


Figure 190.

CHAPTER 25

SOURCES OF INFORMATION FOR CIC IN CONTROL OF AIRCRAFT

A. INTRODUCTION

Sources of information within CIC include

ogy, lookouts, visual controller, radio intelligence communications and others. CIC



Figure 191.

B. OPERATIONS PLAN

The operations plan is a directive issued by the OTC which specifies the details necessary for the execution of an operation. The plan is divided in several sections, the following of which are of concern to the CIC Watch Officer:

(a) *Cruising Instructions* outlines the various cruising dispositions and formations to be used under specific conditions, lists geographical reference points, submarine sanctuaries, and the safety lanes in the area of the operation.

(b) *General Operating Instructions* list special instructions for miscellaneous operations such as hunter/killer missions, VF (N) procedure and aircraft emergency doctrine.

(c) *Air Plan* schedules times of landing and launching, the type of patrols to be flown and the number of aircraft prescribed for each patrol. A strike schedule with bomb loadings for each mission is included.

(d) *The Communications Plan* states the conditions of radio and radar silence, the various frequencies to be employed and the designated use of each, authenticators, and both radio and radar guard assignments.

(e) *Search and Rescue* provisions will describe measures to be employed, submarine life-guards, rescue frequencies, reference points, and all general instructions.

(f) *Radar and Air Control Instructions* include force and group CIC assignments, designated duties and air control doctrine, plus special instructions for the tactical use of radars, deployment of CAP, "scramble" plans, etc.

aircraft, and equipment and the type of assistance the force may expect to meet.

(h) *Battle Plan* details the maneuvers the task force commander will employ in the event of enemy attack and the procedure to be used in emergency maneuvers or in the case of damaged ship casualties.

(i) *Training Exercises* are also listed in the operation plan and include descriptions of various intercept and tracking drills the task force will perform where conditions permit such practice.



Figure 192.

C. THE ACI (AIR COMBAT INFORMATION OFFICER)

The ACI officer supplies geographical data pertinent to the operation, maps, and charts covering the area. ACI is also a source of intelligence regarding enemy strength, tactical aircraft performance, pattern of enemy friendly searches, daily movement of friendly ships within the general area, submarine movements, sanctuaries, and other information. The ACI may likewise be consulted for current evaluation of all strike results.



Figure 193.

D. INFORMATION FROM AIR OPERATIONS

Air operations furnishes CIC with accurate daily flight schedules listing arming plans

craft and pilot availability, condition of aircraft readiness and all "Point OBOE" data, also side numbers of planes taking off and landing provided from primary or secondary fly.



Figure 194.

E. AEROLOGY

Aerology provides daily weather forecasts, direction and velocity of winds aloft, barometric pressure, and other pertinent information.



Figure 195.

F. LOOKOUTS

Aircraft recognition is an important function of the lookouts. Other lookout reports are changes within the formation, spotting of decks, position of CAP, and reports on returning strikes and any water landings.



Figure 196.

G. COMMUNICATION DIVISION

The communications department should keep

tional despatches. These despatches are received either visually or by radio. Communications is also responsible for supplying CIC with the daily shackle code, authenticators and recognition signals, and reporting any important information overhead on frequencies that CIC does not monitor.

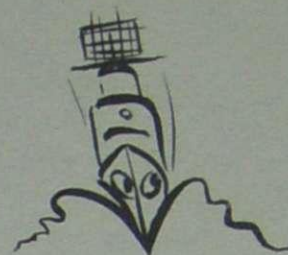


Figure 197.

H. PICKET DESTROYERS

Picket destroyers are playing an increasing important role in providing information to C and in controlling aircraft themselves. They are able to give information on returning strikes, enemy activity, weather, and combat engagements of CAP under their control. (See USF4 for employment of radar picket)



Figure 198.

I. PILOT HOUSE

The pilot house supplies the night order captain's intentions, maneuvers, and any important command changes affecting the plan of operation. The charthouse can be called up for periodic check on DRT.



J. VISUAL CONTROLLER

Visual controller may in addition to intercept duties be very useful for aircraft recognition and for reporting information concerning condition of other carrier decks.



Figure 200.

K. PATROLS AND STRIKES

Patrols and strike leaders can supply weather facts, rescue information, target information, air emergency aid, contact reports, status of returning strikes, time of departure and ETA (estimated time of arrival).



Figure 201.

L. COMBAT INFORMATION NETS

Combat information nets provide radar in-

formation from other ships and are the means by which all CIC officers may exchange information regarding task group operations. It is important that CIC's working together have a reliable method of interchanging pertinent information.



Figure 202.

M. RADIO INTELLIGENCE

Radio intelligence may supply information concerning the enemy's strength, location, and movements.

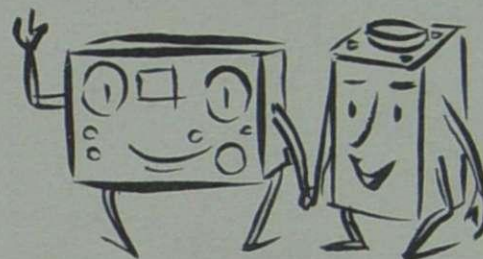


Figure 203.

N. RADAR INFORMATION

Finally CIC obtains information from radars which is naturally so vital to the effective control of aircraft.

CHAPTER TWENTY-SIX

CONTROL WITHIN THE CIC TASK FORCE ORGANIZATION

- A. INTRODUCTION.
- B. COMMAND OF A FAST CARRIER TASK FORCE.
- C. CIC COORDINATION AND FUNCTIONS.
- D. AIR CONTROL SHIPS.
- E. RADAR GUARDSHIPS.
- F. PICKET VESSELS.
- G. APPROACH PICKETS.
- H. STRIKE PICKETS, TOMCATS, AND WATCHDOGS.
- I. CIC CHAIN OF COMMAND.
- J. THE FORCE CIC OFFICER.
- K. THE GROUP CIC OFFICER.
- L. SHIP CIC OFFICER.



Figure 204.

CHAPTER 26

CIC CONTROL WITHIN THE TASK FORCE ORGANIZATION

A. INTRODUCTION

Understanding of the control of aircraft within large-surface dispositions first requires a review of the organization of the force itself. Numerous types of task forces may be called upon to control aircraft, but those which are of primary concern in this discussion are the carrier task forces. These may be divided into two principal types: fast carrier task forces and escort carrier forces.

The fast carrier task force consists of two or more task groups, each of which is built around the aerial offensive power of large carriers. Each group has a nucleus of three or more CV's and CVL's, a heavy support unit of several BB's and CA-CL's, and a screening unit of approximately 20 DD's. The size and composition of a task force and its constituent task groups is variable, changing frequently to conform with tactical requirements and ship availability.

Escort carrier forces correspond broadly in

port units are normally present, however, and DE's commonly are used for the screen in place of DD's.

B. CARRIER TASK FORCE COMMAND

A fast carrier task force is under the command of an officer who flies his flag on one of the CV's. Similarly each task group commander flies his flag in one of the carriers in his group, and is directly responsible to the task force commander.

Normally the task force operates as a tactically concentrated disposition of task groups which cruise in a single huge disposition close enough together to permit VHF/USF and visual communications at all times. Task group stations in the force disposition are such that the group containing the force commander's flagship is always near the center. At other times the groups may be widely separated, in which case the task force commander exercises

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to whom the force commander is immediately responsible, is embarked in one of the vessels of his force. His flag is normally flown in one of the heavy ships.

The term "Officer in Tactical Command" (OTC) refers to the officer in immediate command of a task organization. In order to exercise tactical command, it is necessary for all units to be within effective communications range on a large number of VHF/USF and visual channels. When a task force is tactically concentrated, the task force commander is OTC.

When a task group operates independently the task group commander becomes the OTC. If two or more task groups operate together and the force commander is not present, the senior group commander is OTC. Finally, when any part of a task group is detached for special duty the senior officer in the detached unit becomes the OTC.

In carrier forces the OTC and task group commanders are always carrier admirals during normal air operations. If surface action is imminent, however, tactical command may be transferred to the senior battleship admiral present. The latter will be prepared to execute a battle plan drawn up in advance in which the ships other than carriers play a major role. At the conclusion of a surface engagement tactical command reverts to the senior carrier admiral.

C. CIC COORDINATION AND FUNCTIONS

Task force and task group CIC ships are the flagships of the force and group commanders respectively. The force CIC ship coordinates and the group CIC ships direct all phases of aircraft control and CIC activities. Although the facilities and personnel of these flagships are put to use for the flag, their efforts are directed by the force and group CIC officers whose authority stems directly from their respective admirals. The duties of these officers differ somewhat. The force CIC officer is pri-

marizes the total tactical situation for the OTC and insures that each of the group CIC officers knows what the others are doing at all times. During night attacks he may assume positive control of the night fighter defense of the force to good advantage, but the complexities of day control picture are so great that the task is better handled by group CIC officers independently.

The group CIC officers have duties of assigning air and surface radar guards, air combat designation of group raids, and challenging identified surface contacts. They carry out the directions of the force CIC officer with respect to radar counter-measures and conditions of radio, radar and IFF silence.

D. AIR CONTROL SHIPS

As their name implies, air control ships are responsible for controlling fighters assigned to intercepting enemy raids. They are not normally assigned radar guard duties but are required to use their equipment to best advantage for control of aircraft. Air control ships are designated by the group CIC officers. Normally the CIC of the carrier whose CAP is airborne will control its own planes, but if a raid is picked up the interception will be assigned to the ship which has the best information. Battleships, cruisers, and destroyers are frequently assigned air control duties for training; they may operate independently—as pickets or on detached bombardment missions—they control both day and night CAP provided for their own protection. Each task group contains several air control ships which operate simultaneously and as a closely knit team. When the need arises to shift control of interception, the task group CIC officer does so, giving control to the ship with the most comprehensive picture at the time. It is therefore unnecessary to designate specific standby air control ships. Air control ship functions are coordinated through the Air Control Net.

E. RADAR GUARD SHIPS

basis of capabilities and past performance of the CIC's in the group, the group CIC officer assigns long, medium and short range air searches, low-flying and zenith air coverage, long and short range surface search, and the like. Such assignments may be given individual ships for the duration of an operation, or ships may be paired so that the guard duties rotate daily. Ships assigned special radar duties are called radar guard ships. Any ship having special electronic gear aboard may be assigned the specific guard which utilizes that gear to best advantage. The heavy work load carried by the group CIC officer may be spread more equally, however, by his assigning ancillary responsibilities such as control of radar countermeasures to one of the battleship CIC's in the group.

F. PICKET VESSELS

Picket vessels, which may be DD, DE, or SS types, function as advance warning scouts for other vessels of the force or group. They are stationed by the task force and group commanders according to standard plans set forth in the operation order. They are employed on occasion during the day but their principal task is performed at night. It is customary to station pickets in pairs at ranges within which VHF/USF radio communications can always be heard. If pickets are deployed in a scouting line well ahead of the force, linking vessels are normally provided to act as communications relay units.

G. APPROACH PICKETS

The function of approach, or scouting line, pickets is similar to that of night pickets. They serve as advance scouts for the force during the critical period of the high speed approach toward the target area. They consist of DD's designated by the force and group commanders and are stationed 50 to 60 miles ahead of the force in a line normal to the line of bearing of the target.

H. STRIKE PICKETS TOMCATS AND

units according to special plans in the operation order or in fast carrier task force instructions. These picket stations normally consist of an entire destroyer division (4 DD's). Their functions are to provide advance warning (radar or visual) of approaching enemy aircraft, to act as forward air control ships, to assist in homing and inspecting all returning friendly strike groups and to rescue downed pilots as required. These pickets are generally stationed 40 to 50 miles from the task force center approximately 60° on either side of the target bearing line. By means of radar and frequent navigational information these pickets maintain station with great accuracy throughout the day operations.

At least one destroyer in each strike picket station is equipped with aircraft homing gear (YE or YG) to assist returning strike groups in following proper approach procedures. Such groups home on the pickets where they orbit and are inspected by the picket CAP to insure that no enemy aircraft have trailed them. When the groups have been cleared by their respective group CIC officers they follow a prescribed course to their base. This procedure not only insures positive control of the aircraft but helps to keep radar screens clear of miscellaneous confusing tracks in the area of most probable enemy air attacks.

Sections or divisions of destroyers are also employed as "watchdogs" whose function is to act as forward air control units at ranges approximately the same, but between, the strike pickets. They are provided with their own CAP, but are not used to control returning strikes.

I. CIC CHAIN OF COMMAND

There is no specific CIC chain of command apart from the normal echelon of command within the force and group organization. Task force, group and individual ship CIC officers are responsible to their own respective admirals and captains. Nevertheless, for the routine air control functions which come under

tives of the admirals. Even though many normal and routine actions may be ordered by a higher authority in the CIC chain of control, the individual CIC is in no way relieved of the responsibility of keeping its command completely informed of all information passed and actions taken.

J. THE FORCE CIC OFFICER

As a member of the staff and the representative of the OTC, the force CIC officer acts as coordinator for all CIC activities within the force. His primary concern is with the group CIC officers, and he normally works through and with them. Although he has his battle station in the CIC of the ship in which the OTC is embarked, he has no aircraft at his immediate disposal, controls no radars directly, and, in general, exercises direct control only at night or when the situation of the force demands it and then only within the limits of his broad responsibility as representative of the OTC. When several task groups are operating together, he may be called upon to perform any of the following duties:

1. Designate the number of divisions of CAP to be used over the force as a whole.

2. Designate force raids by number for all enemy contacts threatening the force, leaving the initiation and planning of the actual interception, however, to the group CIC officers.

3. Coordinate the activity of group CIC officers in controlling multiple raids, advising them of interceptions in progress and counseling them, when necessary, on the best means of defending the whole force.

4. Evaluate intelligence provided by the staff of OTC and the task group CIC officers and ship's CIC officers. Such information may include the disposition of friendly and enemy forces, in the area; the possible composition of enemy attacks reported by intelligence or other sources; establishing the identity of friendly search planes encountered and maintaining up to date information on their where-

5. Maintain, as a responsibility to the OTC, an accurate summary of the availability of air and surface units of the force as well as information regarding the progress of missions undertaken by the task groups or units.

6. Coordinate all night fighter activity within the force, specifying the number of aircraft to be flown by each task group, assigning their stations, and assigning deck spots to allow for both scheduled and emergency landings.

7. Collate all radar countermeasures information, and, in conjunction with the force radar countermeasures officer, recommend appropriate action to the OTC.

8. Disseminate vital information to group CIC officers, radar countermeasure staff intelligence, and other interested activities.

9. Arrange the disposition of radar picket ships, make provision for an adequate CAP for these ships, receive information from them on returning strikes, rescue missions; and other activity effecting the force.

10. Specify the conditions of radar and silence and, at the direction of the OTC, designate the use to be made of radar countermeasures and deception.

The force CIC officer, in substance, may be said to coordinate rather than control activity in the force. It is important to remember that as representative of the OTC he is responsible for the best and fullest employment of the CIC facilities of the force, defensively and offensively.



K. THE GROUP CIC OFFICER

The group CIC officer occupies the same position on the task group commander's staff as the force CIC officer does on the task force commander's staff. The group CIC officer, however, exercises, a far greater degree of direct control over the radars, aircraft and radio frequencies than does the force CIC officer. Primarily his function is to insure the execution of orders and directives of the OTC and his task group commander. Since the duties of the task group are clearly defined in the operations plan, his function in relation to the CIC's of the ships in the group is executive rather than advisory. In brief, the group CIC officer is the officer charged with the defense of his group and the integration of all CIC activity in the group.

The group CIC officer normally maintains his battle station in the CIC of the task group flagship. There he receives information from all the ships of his task group and is in a position to initiate action immediately. Although he utilizes the facilities and employs the personnel of the group flagship CIC, he is primarily concerned with the task group as a whole rather than the ship. Specifically, the group CIC officer—

1. Coordinates the air and surface search radar within the group, insuring that conditions of radar and IFF silence set by the OTC are maintained, designating radar guard ships, and executing orders concerning jamming and deception.

2. Receives, plots, evaluates, and reports to the OTC and, where necessary, disseminates to other ships in the group, all pertinent air and surface radar contacts, pilot reports of interest, intercepted radio messages and enemy radar emanations reported by the ships of his group.

3. Maintains an air-borne CAP according to the specifications of the OTC in sufficient strength and at stations appropriate for the defense of the group.

4. Designates the ship which is to control an interception, shifting control from ship to ship

fighter aircraft in defense of the group. He arranges, for example, for sufficient numbers of aircraft in conditions of readiness and provides for the launching of adequate reliefs. He also maintains an accurate summary of the status of their fuel and ammunition and orders the scrambling of planes after consultation with the task group commander.

6. Arranges, after consultation with the task group commander, for the assignment of surface pickets, linking and communications vessels, scouting forces, radar pickets, jamming and intercept ships, and other detached missions and specifies the schedule of launchings, landings, and reliefs.

7. Arranges for the execution of radar countermeasures plans specified by the OTC or task group commander.

8. Maintains an accurate information summary of the status of strike, sweep, and search and attack planes in his group, informing CIC officers of changes in target assignments, whether over targets, and either makes recommendations or initiates action to counter jamming or to utilize deception against enemy radars.

9. Maintains up to date information on the flight-deck conditions of all carriers in the group.

10. Schedules and supervises varied and complete training exercises for aircraft and ships in the group.

11. Designates raids which approach his group when the force CIC officer has not already done so.

12. Maintains liaison with the force CIC officer and the ship CIC officers of his group, with the aim of keeping the OTC, task group commander and the commands of the vessels of his group fully informed on all information derived from the CIC's of the force.

The group CIC officer should make sure that the necessary information goes to the OTC and the task group commander and also to the individual CIC officers. He must be prompt, decisive and fully informed. He must know the capabilities of the radars and the aircraft in his group.

L. SHIP CIC OFFICER

The ship's CIC officer is the representative of the commanding officer of his ship. In the task force organization, he is responsible for the final

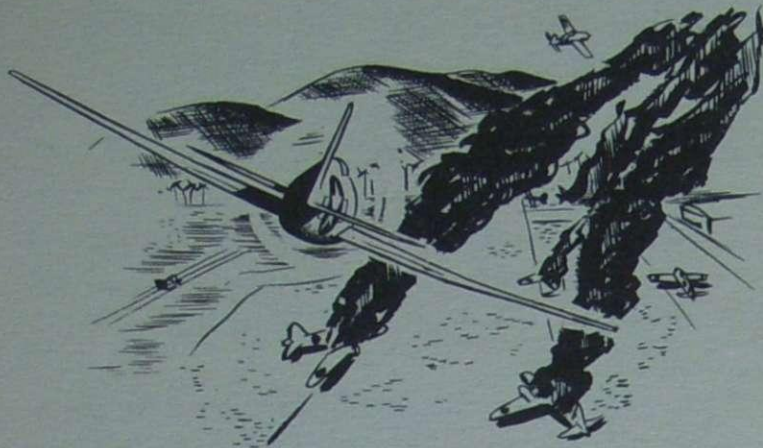


Figure 206.

execution of the orders of the OTC and the task group commander and for dispatching upward the information gathered by his CIC. Besides integrating CIC activity with the rest of the ship under cruising conditions or in action, he, or his representatives, the CIC watch officers, should:

1. Carry out the orders of the group CIC officer in employing the ship's radars in air and surface search.
2. Intercept raids with fighter aircraft when directed to do so by the group CIC officer.

3. Handle virtually all communications of his ship's planes, whatever their mission, receiving pertinent data from the pilots to his ship and to the group CIC officer when necessary.

4. Maintain an accurate information primary on the status of fuel and ammunition of the aircraft from his ship and insure that the group CIC officer is kept fully informed of status.

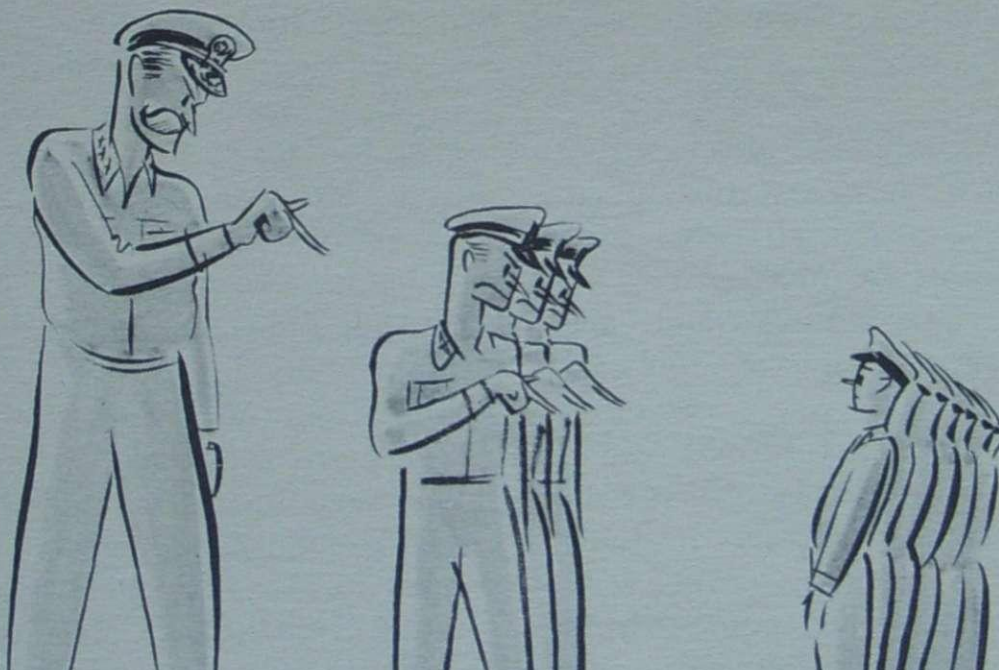
5. Home lost planes, notifying the group officer of all downed pilots and aircrewmen, conducting rescue missions as the latter direct.

6. Maintain accurate, up-to-the-minute information on the status of all aircraft air-landed from his ship in CAP, strike, search and rescue, or other missions.

7. Exercise fighter pilots and CIC personnel in problems in air control and CIC operations to insure a continually high peak of operating efficiency.

8. Brief pilots on the details of all procedures, frequently coaching them on details of procedure, methods of interception, and, in general, acquainting them with air control and procedures.

9. Maintain close liaison with all departments of the ship—notably, gunnery, navigation and communications—whose operations coordinate with the CIC.



CHAPTER TWENTY-SEVEN

SIGNALS PERTINENT TO THE CONTROL OF AIRCRAFT

- A. INTRODUCTION.
- B. FLAG SIGNALS.
- C. HAND SIGNALS.
- D. BLINKER SIGNALS.
- E. PLANE-TO-SHIP SIGNAL.

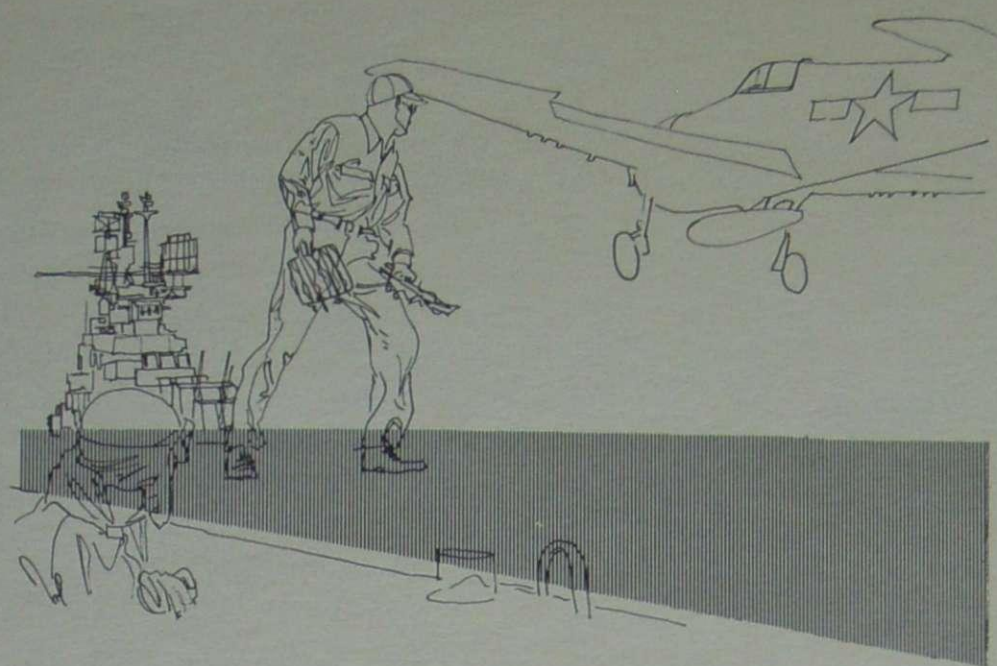


Figure 208.

CHAPTER 27

SIGNALS PERTINENT TO THE CONTROL OF AIRCRAFT

A. INTRODUCTION

In joint operations where both ships and aircraft are employed close coordination between the units involved is necessary. Rapid and accurate communications are essential in order to attain this coordination. In large-scale operations the heavy volume of radio traffic becomes a serious problem. Numerous visual methods and abbreviations are used to help solve the difficulty and lessen traffic on radio circuits.

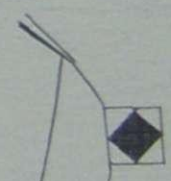
The majority of these signals are taken from the General Signal Book. It is mandatory that CIC personnel familiarize themselves with this book, at least to the extent of knowing how to use it. There are in addition a number of signals in general use derived from sources other than the General Signal Book. These may come from standard fleet publications or may come into being from continuous usage or may even be devised by a task group commander for a specific operation.

to CIC personnel. If report comes in sound powered phone or squawk box that "Fox is at the dip on Mohawk," the CIC watch officer understands that the ship whose call Mohawk is preparing to launch or receive planes. "Fox is two-blocked on Mohawk" means Mohawk is actually ready to receive launch.

In periods of low visibility, or when a carrier is so far from its group that flags cannot be clearly seen, the position of the signal may be stated verbally over an appropriate voice radio circuit, such as TBS.

"Clipper this is Topaz. Fox is two blocked Out."

This will advise the formation that though they cannot see the Fox flag on Topaz, the latter is ready to launch or receive planes.



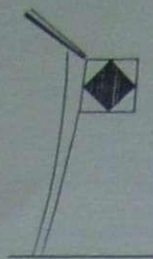


Figure 210.



Figure 211.



Figure 212.

Flags are used at the ramp to relay messages to planes and these in turn will be announced to CIC via sound powered phones or the squawk box.

(a) A red flag displayed at the ramp means: Ship not ready. Do not attempt to land.

(b) A red flag and a yoke flag displayed at the ramp means: All planes except disabled planes stay clear of the landing circle.

(c) A white flag displayed at the ramp means: Planes may land.

C. HAND SIGNALS

To lessen traffic on circuits and to keep the channels clear for priority information, the pilots have an elaborate set of signals for routine messages. Also if radio silence is in effect or radio in a plane(s) is out, these visual signals are the means of communicating plane to plane. Planes flying in close proximity can always communicate with one another by Morse

times when these signals may also be used relaying messages between plane and ship.

(a) How much fuel do you have? (The pilot cups his hand to his mouth as if drinking.) 155 gallon (the answer is made by holding up the appropriate number of fingers—finger, five fingers, and five again).

(b) Are you injured? (The pilot holds forearm over his face then points to plane in question.) I am injured. (Pilot holds forearm across his face.)

(c) Is your radio out of commission? (The pilot points to his own earphones, then holds his nose and points to the plane in question.) My radio is out of commission. (The pilot points to his earphones, then holds his nose.)

(d) An affirmative is indicated by the pilot nodding his head.

(e) A negative is indicated by the pilot shaking his head.

D. BLINKER SIGNALS

Blinker signals are also used to supplement or replace flag signals. Low-flying CAP are generally given landing instructions by blinker. High-flying CAP are generally given "Prep Charlie" via radio and then at low angles are given "Charlie" by blinker signal. To reduce volume of radio traffic ASP may be instructed to check visually and not to open radio except in emergencies, receiving landing instructions via blinker signal.

(a) P . — . . C — . — . "Prep Charlie" meaning: Prepare to land.

(b) C — . — . "Charlie" meaning: Land aboard.

(c) D — . . "Dog" meaning: Delay landing return to P. C. status.

(d) K — . — "King" meaning: Proceed on mission assigned.

(e) M — — "Mike" meaning: Proceed to base or carrier in accordance with doctrine orders.

E. PLANE-TO-SHIP SIGNALS

(a) A plane which is orbiting low over the water may indicate

1. Water landing or survivors in the water.

2. Position of a submerged object that is a menace to friendly surface forces, i. e., mines, coral heads, reefs, etc.

(b) If a plane sights a submerged submarine and has no weapon to attack, it will make a series of dives to identify the submarine's position to nearby forces. The lowest point of the dive indicates the submarine's position.

(c) If a plane dives low over a surface vessel and stays low on a constant heading, it is indicating the bearing of a forced landing or of survivors in the water.

(d) A plane flying by on the portside with wheels, hook, and flaps down indicates the pilot desires a delayed forced landing.

(e) A plane flying by on the starboard side with wheels, hook, and flaps down indicates the pilot requests an emergency forced landing.

(f) Plane approaching from stern with flaps down, usually means the pilot is making a pass for a message drop.

(g) Rocking of wings after a message has been sent acknowledges receipt.

A few examples of special signals w pertain to control of aircraft have been explained here. It should be stressed that t signals are subject to frequent changes that new signals will come into use from to time as the need arises.

GLOSSARY

"A" BAND—An IFF frequency band.

"A" SCOPE—A radar cathode-ray tube w indicates the presence of a target and its r by means of trace deflection.

AA—Antiaircraft.

ACI OFFICER—Air combat information of
ADC—Air defense commander.

ADCC—Air defense control center.

AEW—Air-borne early warning radar sy

AGC—Auxiliary general command ship.

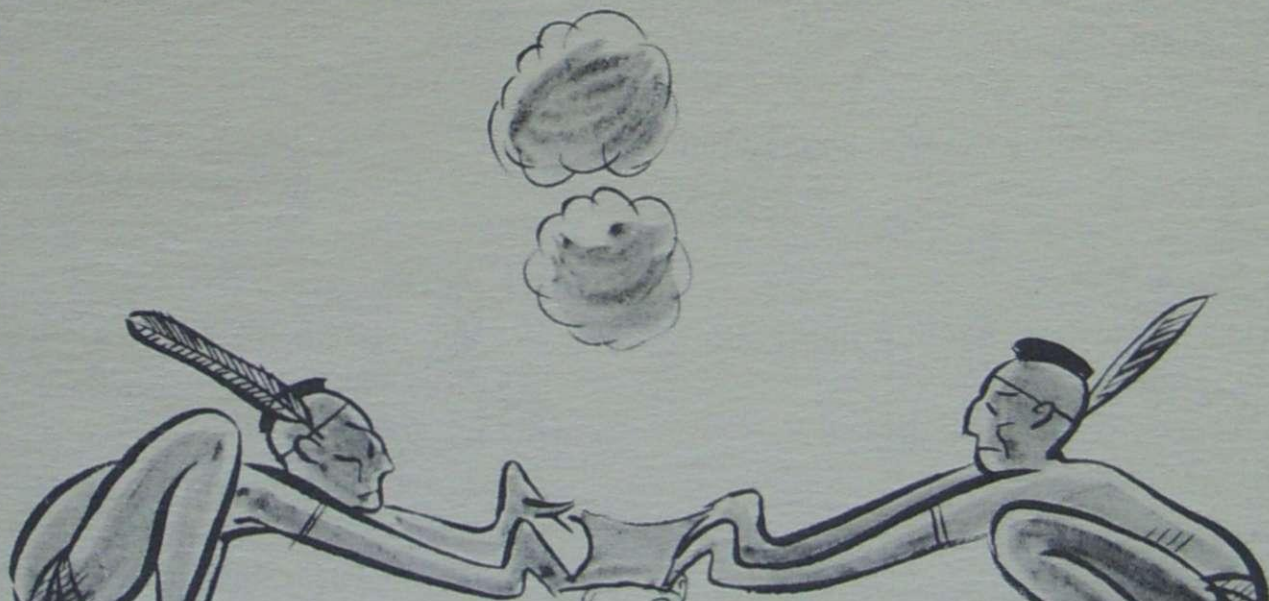
AI—Air-borne intercept radar equipmen

AIR CONTROL SHIP—Ship having air co duty.

AIR CONTROL NET—Radio circuit used b controller in controlling aircraft.

AIR COORDINATOR—An air-borne officer wh ordinates air activity during an amphi operation.

AIR LIAISON PARTY—The shore based inte diary between the air coordinator and gr troops.



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AIR OFFICER—Head of the air department on a ship.

AIR OPERATIONS—Space on a carrier in which air department work is coordinated.

AIR STRIKE—A flight of aircraft on an offensive mission against a ground or surface target.

APPROACH PHASE—Initial stage of an amphibious operation.

ASP—Antisubmarine patrol (air-borne).

ASSAULT PHASE—Intermediate stage of an amphibious operation.

ASW—Antisubmarine warfare.

BB—Battleship.

BLIP—Indication on a radar scope.

BPS-1—An attack radar for submarines.

BPS-2—An air search radar for submarines.

CAP—Combat air patrol.

CATHODE RAY TUBE—The indicating unit or time measuring device used on all radars.

CCA—Carrier controlled approach radar system (experimental).

CIC OFFICER (SHIPS)—Officer in charge of combat information center.

CIC WATCH OFFICER—An officer qualified to stand condition watches in CIC.

CLAA—Light antiaircraft cruiser with main battery of 5-inch guns.

CIC—Combat Information Center.

COMBAT INFORMATION NET—Radio circuit used for passing information between CIC's on different ships.

COMMAND SHIP—Ship from which an amphibious operation is directed.

CONSOLIDATION PHASE—Final stage of an amphibious operation.

CONTROLLER—Officer controlling fighters to effect an interception.

CSA—Commander support aircraft.

CV—Aircraft carrier.

CVB—Aircraft carrier, large.

CVE—Escort aircraft carrier.

D CAP—Day combat air patrol.

DADCAP—Dawn and dusk combat air patrol.

DD—Destroyer.

DE—Escort destroyer.

DEVIATION—Error in a magnetic compass caused by ferrous metals in the vicinity.

DR—Dead reckon.

DRECCO—Daytime long range air search.

DRM—Direction of relative motion.

DRT—Dead-reckoning tracer.

DUMBO—A PB type aircraft used for air-sea rescue purposes.

ETA—Estimated time of arrival.

FADE—Disappearance or weakening of echo on a radar screen.

FADE CHART—Chart of radar field showing areas where targets will fade for a specified time on radar.

FADN—Fighter air defense net.

FLY SHEET—Bulletin issued daily by air operations listing scheduled flights, with plane numbers and personnel.

FORCE CIC OFFICER—Officer who coordinates the work of all CIC's in a task force.

"G" BAND—An IFF frequency band used primarily with fighters.

GCA—Ground controlled approach radar system.

GRID—A chart laid off in rectangular coordinates.

GROUP CIC OFFICER—Officer who coordinates the work of all CIC's in a task group.

GULLS—Radar deception devices.

HECKLER—A small night air strike.

H/F or HF—High frequency.

HUNTER/KILLER—Combined air-sea operation conducted against submarines.

IAS—Indicated air speed.

IFF—Identification friend or foe—An instrument used to identify friendly units on a radar.

INTERCEPT SHIP—Ship which attempts to detect enemy radar transmissions.

JACK PATROL—A type of antisnooper patrol (air-borne) .

JAMMER—An electronic transmitter used to obliterate information on radar scope.

JAMMING—The obliteration of information on radar scopes.

JAMMING SHIP—A ship assigned the duty of operating a jammer in order to reduce the effectiveness of enemy radars.

JL—A sound-powered circuit aboard ship used principally by the lookouts.

JOINT OPERATIONS—A space aboard a command ship from which an amphibious operation is directed.

JS—A sound-powered circuit aboard ship used to pass radar information.

KITES—Radar deception devices.

"L" BAND—A radar frequency band.

LOBE—A part of the transmitting and/or receiving pattern of a radar antenna.

LSO—Landing signals officer aboard an aircraft carrier.

LST—Landing ship tanks.

MAPHO—A flight of aircraft assigned to make precision photographs of a land area.

MC—A designation used for certain internal communication systems aboard ship.

MPI—Mean point of impact of a salvo.

MRM—Measurement of relative motion.

NCAP—Night combat air patrol.

NIGHT AIR CONTROLLER—Officer controlling fighters to effect an interception at night.

NRECCO—Night-time long range air search.

NULL—An area in a radar field where no signals or weak signals returns occur.

OTC—Officer in tactical command.

"P" BAND—A radar frequency band.

PC—Patrol craft.

PHOTO PATROL—A flight of aircraft flown for the purpose of taking photographs.

PICKET—A unit of a task group operating at

PPI—Plan position indicator—A radar cathode-ray tube which gives a plan view of the area around the radar and from which bearing and range of a target can be obtained.

RADAR—A radio detection and ranging device.

RADAR COUNTERMEASURE SHIP—Identical with a jamming ship.

RADAR GUARD SHIP—A ship assigned to maintain a radar watch.

RADAR PICKET—A picket ship assigned to maintain a radar watch.

RADAR TELLING NET—A radio circuit used for exchanging radar reports over a large area.

RADCM—Radar countermeasures.

RAPCAP—Radar picket combat air patrol.

REDRECCO—Reinforced daytime long range air search.

RCM—Radio countermeasures (*See RCM-7*).

RELAY PLANE—A plane employed to relay radio messages.

RESPONSOR—The unit which receives IFF signals from the transponder which is in the challenged station.

R/T—Radio telephone procedure.

"S" BAND—A radar frequency band.

SA—An air search radar.

SC, SC-1, SC-2—Air search radars.

SCOCAP—Scouting line combat air patrol.

SCOPE—A radar cathode-ray tube.

SCR-527—Shore based altitude determining radar.

SG—A surface search radar.

SHACKLE CODE—A code used to encipher numbers.

SK—An air search radar.

SL—A surface search radar.

SM—An altitude-determining radar.

SMOKER—A plane equipped to lay smoke screens.

SP—An altitude determining radar.

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SPS-2—A long range air search radar designed for large ships.
SPS-3—A hemispherical search radar designed for destroyers and above.
SPS-4—A zenith and surface search radar for destroyers and above.
SPS-5—A surface search radar designed for PT's and above.
SPS-6—A series of new air search radars designed for destroyers, cruisers, and carriers.
SPS-7—A surface search radar designed for PC's and above.
SPS-8—A height finding radar designed for destroyers and above.
SRM—Speed of relative motion.
SUBCAP—Rescue submarine combat air patrol.
SWEEP—An air strike composed entirely of fighters.
TAC—Tactical air commander.
TACC—Tactical air command center.
TAD—Tactical air director.
TADC—Tactical air direction center.
TARGET COORDINATOR—An air-borne officer who directs and coordinates the execution of an air attack.
TAS—True air speed.

TCAP—Target combat air patrol.
TFC or CTF—Task force commander.
TGC or CTG—Task group commander.
TH—True heading.
TOMCAT—A destroyer picket which can home planes with YE or YG.
TRANSPONDOR—The receiving and answering unit of an IFF system.
UHF—Ultra high frequency.
USF—United States Fleet publication.
VARIATION—Difference in bearing between the North Pole and the Magnetic North Pole.
VA—Attack planes.
VF—Fighter planes.
VF (N)—Night fighter planes.
VHF—Very high frequency.
VISUAL FIGHTER DIRECTION—The controlling of fighters to effect an interception using visual data in lieu of radar data.
WATCHDOG—An advanced fighter direction picket.
WINDOW—A radar deception device.
"X" BAND—A radar frequency band.
YE—A radio device for homing planes.
YG—A radio device for homing planes.
YJ—A radar device for homing planes.
ZB—Radio equipment in aircraft to receive YE or YG signals.



Figure 214.—And it will be the end if this is the way you run your CIC.

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