







THE UNITED STATES STRATEGIC BOMBING SURVEY

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KAWANISHI AIRCRAFT CO.

(Kawanishi Kokuki Kabushiki Kaisha)

CORPORATION REPORT No. III

(Air frames)

AIRCRAFT DIVISION

April 1947



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This report was written primarily for the use of the United States Strategic Bombing Survey in the preparation of further reports of a more comprehensive nature. Any conclusions or opinions expressed in this report must be considered as limited to the specific material covered and as subject to further interpretation in the light of further studies conducted by the Survey.

FOREWORD

The United States Strategic Bombing Survey was established by the Secretary of War on 3 November 1944, pursuant to a directive from the late President Roosevelt. Its mission was to conduct an impartial and expert study of the effects of our aerial attack on Germany, to be used in connection with air attacks on Japan and to establish a basis for evaluating the importance and potentialities of air power as an instrument of military strategy for planning the future development of the United States armed forces and for determining future economic policies with respect to the national defense. A summary report and some 200 supporting reports containing the findings of the Survey in Germany have been published.

On 15 August 1945, President Truman requested that the Survey conduct a similar study of the effects of all types of air attack in the war against Japan, submitting reports in duplicate to the Secretary of War and to the Secretary of the Navy. The officers of the Survey during its

Japanese phase were:

Franklin D'Olier, Chairman.
Paul H. Nitze, Henry C. Alexander, Vice Chairmen.
Harry L. Bowman,
J. Kenneth Galbraith,
Rensis Likert,
Frank A. McNamee, Jr.,
Fred Searls, Jr.,
Monroe E. Spaght,
Dr. Lewis R. Thompson,
Theodore P. Wright, Directors.
Walter Wilds, Secretary.

The Survey's complement provided for 300 eivilians, 350 officers, and 500 enlisted men. The

military segment of the organization was drawn from the Army to the extent of 60 percent and from the Navy to the extent of 40 percent. Both the Army and the Navy gave the Survey all possible assistance in furnishing men, supplies, transport, and information. The Survey operated from headquarters established in Tokyo early in September 1945, with subheadquarters in Nagoya, Osaka, Hiroshima, and Nagasaki, and with mobile teams operating in other parts of Japan, the islands of the Pacific, and the Asiatic mainland.

It was possible to reconstruct much of wartime Japanese military planning and execution, engagement by engagement, and campaign by campaign, and to secure reasonably accurate statistics on Japan's economy and war production, plant by plant, and industry by industry. In addition, studies were conducted on Japan's over-all strategic plans and the background of her entry into the war, the internal discussions and negotiations leading to her acceptance of unconditional surrender, the course of health and morale among the civilian population, the effectiveness of the Japanese civilian defense organization, and the effects of the atomic bombs. Separate reports will be issued covering each phase of the study.

The Survey interrogated more than 700 Japanese military, Government, and industrial officials. It also recovered and translated many documents which not only have been useful to the Survey but also will furnish data valuable for other studies. Arrangements have been made to turn over the Survey's files to the Central Intelligence Group, through which they will be available for further examination and distribution.



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THE CORPORATION AND ITS IMPORTANCE IN THE AIRCRAFT INDUSTRY

The Kawanishi Aircraft Co. (Kawanishi Kokuki Kabushiki Kaisha) was the tenth largest producer of all types of aircraft in the Japanese aircraft industry. During the period 1941–45 it accounted for 3 percent of all the aircraft produced by the industry, increasing from 1.1 percent in 1942 to 4 percent in 1944 and 5 percent in 1945. The company produced 5 percent of all fighters built by the Japanese aircraft industry.

Kawanishi produced air frames only and its entire output went to the Japanese Navy. The principal products were used for George (N1K1–J and N1K2–J), a single-engine fighter, and Frances (P1Y2–S), a twin-engine fighter. Other important types of air frames were for Mavis and Emily, four-engine flying boats, and various types of naval observation planes and trainers (USSBS, Aircraft Division reports Nos. III–1 and III–2).

In November 1928 the Kawanishi Aircraft Co. was established with a capital of 5,000,000 yen, assumed the assets and operations of the Kawanishi Engineering Works at Kobe and continued producing airplanes. Kawanishi Engineering Works started producing seaplanes in 1921 for the Nippon Airplane Co. (Nippon Hikoki K K), an air transportation firm.

Upon the founding of the Nippon Aircraft Transportation Co. (Nippon Koku Yuso K K), the Nippon Airplane Co., which monopolized all civilian air transportation throughout Japan, had to be dissolved. In December 1928, since Kawanishi Aircraft Co. had no market for its products, it started to manufacture observation scaplanes and trainers for the Navy, as a naval-designated plant. In December 1930 the company moved to Naruo village and established a new plant.

In cooperation with Short Bros. Co. of England, the Kawanishi Co., in January, started to build all-metal, trimotor flying boats. During August 1934 an aircraft-engine department was established which experimented with but produced only two engines and then dropped the experiment. The capitalization was increased by 10,000,000 yen in September 1938, and, fully paid, to 15,000,000 yen by November 1939.

In December 1939 the Kawazoe Iron Works in the city of Fuse was purchased. This company produced machine tools and was later a branch of the Takarazuka plant. At the request of the Japanese Naval Ministry, the aircraft-engine department was dissolved in November 1940 and the engine-accessories department and machinegun parts department were established.

The capital was increased by 15,000,000 yen in October 1941. Thus the total authorized capital became 30,000,000 yen, which was paid up in full in April 1943. At the request of the Japanese Navy, the Takarazuka plant was established in December 1941 and started production of machined parts for aircraft, engine accessories, and power-driven, machine-gun turrets. In February 1942 the Konan plant was established to produce large flying boats, and in July of the same year the Himeji plant was established to produce fighter planes.

In September 1943 the capital was increased by 30,000,000 yen, making the total authorized capital 60,000,000 yen. The Government-owned Naruo airport was first utilized by the company in October 1943. In January 1944 the firm was designated a munitions company by the Munitions Company Act. Production of large flying boats was stopped in March 1945 by order of the Naval Ministry. In April 1945 the company started to establish new facilities at Fukuchiyama, in Kyoto prefecture, Honshu, and in Oc County, in Tokushima prefecture, Shikoku, as dispersal units of the Naruo plant.

By an order of the Minister of Munitions in July 1945, the entire firm became the Second Munitions Arsenal. The company remained as a mere holding company. At the end of the war, in August 1945, all production stopped and the Minister of Munitions ordered the munitions arsenals to be dissolved and all assets and personnel returned to the original companies.

Six members of the Kawanishi family owned 731,780 shares, or 61 percent, of the total 1,200,000 shares of capital stock of the Kawanishi Aircraft Co.

There were four principal plants of the Kawanish Aircraft Co., all in the Osaka-Kobe area and within a 40-mile area of each other. Three of them, the Naruo, Konan, and Himeji plants, were aircraft-assembly units, and the remaining one, the Takarazuka plant, produced air frame machined parts, gun turrets, and aircraft accessories (fig. 1).

The Naruo plant produced George (N1K1-J) and its modification, N1K2-J, a single-engine, land-based Navy fighter, Emily (H8K 1-2-3), a four-engine flying boat, and various trainers and scaplanes (USSBS, Aircraft Division Report No. 1II-1).

Konan plant produced Frances (P1Y2-S), a twin-engine, land-based fighter, and Emily (H8K2), a four-engine flying boat, while the Himeji plant produced only George (N1K1-J) and N1K2-J, a single-engine fighter (USSBS, Aircraft Division Reports Nos. III-2 and III-3).

From December 1928 through the end of the war, the Kawanishi Aircraft Co.'s entire production went to the Japanese Navy.

Government financial aid to the company came under three categories. The first covered direct loans of 100,000,000 yen from August 1941 to July 1943; 40,000,000 yen from August 1943 to December 1944, and 71,000,000 yen from May 1944 to May 1945. The second was a loan of 3,621 machine tools and equipment, valued at 24,069,000 yen. The third consisted of Government-furnished buildings and establishments valued at 81,000,000 yen, including an airport and maintenance shops valued at 25,300,000 yen. In

MAP OF PRINCIPAL PLANT LOCATIONS HONSHU HIMEJI PLANT TAKARAZUKA PLANT KOBE KONAN PLANT NARUO PLANT OSAKA BAY • SAKA U.S. STRATEGIC BOMBING SURVE KAWANISHI AIRCRAFT CO. AIRFRAME PLANTS

July 1945, by order of the Minister of Munitions, the entire firm and all employees came under direct supervision of the Government and was called the Second Munitions Arsenal.

Organization and Operation

The key officers of the corporation were as follows:

President	Ryuzo Kawanishi.
Vice president	Kenji Maebara.
Managing director	Shiro Takahashi.
Chief engineer	
Manager of Naruo plant	
Manager of Takarazuka plant	Meishin Saito.
Manager of Konan plant	Sakae Hamada.
Manager of Himeji plant	Mitsuo Suchisa.

The four plants were directly under the administrative section of the company.

FIGURE 2

President	Ryuzo Kawanishi.
Vice president	Kenji Machara.
Managing director	Shiro Takahashi.
Chief engineer	Yoshio Hashiguchi

Administrative section

Administrative department.	Personnel department.
Designing department.	Finance department,
Material and supply	Medical department.
department	

Naruo plant

Administrative department.
Production department.
Inspection department.
Personnel department.

Machining, forging, and easting department. Dispersed plants.

Takarazuka plant

Administrative department.	Gun turrets department.
A/C machined parts department.	Personnel department.
Aircraft accessories department.	Machine tool department.

Konan plant

Administrative department.
Production department.
Inspection department

Personnel department. Material section.

Himeji plant

Administrative department.
Production department.
Inspection department.

Personnel department. Dispersed plants (Uzurano plant).

Each of the three aircraft assembly plants of the company made wing, tail, and fuselage subassemblies in addition to complete aircraft assemblies (USSBS, Aircraft Division Report No. III-1).

The Kawanishi Aircraft Co. had five subsidiary companies which it owned outright, three companies in which it held over a quarter interest, and seven others in which it owned from 4 percent to 21 percent of the stock (table 1).

Table 1.—Subsidiary and affiliated companies of the Kawanishi Aircraft Co.

Name	Location	Year ac- quired	Per- centage of con- trol
Daido Precision Machine Co	Kobe City	1943	100
Kawanishi Wooden A/C Parts Co	Hyogo prefecture	1944	100
Toyo Casting Co	Osaka City	1943	100
Sanwa Commercial Co	Hyogo prefecture	1944	100
Awa Hotel	Tokushima City	1945	100
Teikoku Electric Co	Hyogo prefecture	1945	67
Second Hokuriku Engineering Co	Fukui City	1945	. 33
Hagoromo A/C Engineering Co	Osaka prefecture	1943	25
Tsubame Forging Co	Niigata prefecture	1944	21
Kamitsu A/C Engineering Co	Hyogo prefecture	1944	12
Kiyo Aircraft Engineering Co	Marugame City	1943	10
Hinode Aircraft Engineering Co	Tokushima City	1944	10
Asuka Aircraft Engineering Co	Osaka prefecture	1944	10
Nihonkai Aircraft	Tokaoka City	1945	9
Kasumi Aircraft Engineering Co	Fukui prefecture	1944	4

Assembly-line techniques were used throughout all plants.

Total employment rose steadily, increasing from 14,200 in July 1941 to 24,800 in July 1942; 41,450 in July 1943; 65,400 in July 1944; and reached a peak of 66,100 in January 1945. After that it dropped steadily to 33,700 in August 1945 (appendix A).

Throughout the war most of the plants worked one 10-hour shift. However, in the Konan plant two shifts were in operation from January to December 1944, when the plant returned to a one-shift operation. The Takarazuka plant worked two shifts from March 1944 to the end of the war, and the Naruo plant, upon direction by the Government, worked two 10-hour shifts for only 2 months, July and August, at which time the order was rescinded.

Labor turn-over for January 1942 was but 1 percent; it increased to 8 percent in January 1943, amounted to 6 percent in January 1944, and but 2 percent in January 1945. The highest rate of turn-over was in May 1942, reaching 16 percent, and in May 1943, 13 percent. In 1944, the highest rate was 11 percent in April. The average rate of turn-over for each year was 5 percent in 1942, 6 percent in 1943, 4 percent in 1944, and 2 percent in 1945.

Appended Plant Reports

Each of the four main plants of the Kawanishi Aircraft Co.—the Naruo plant (USSBS, Aircraft Division Report No. III-1), the Konan plant (USSBS, Aircraft Division Report No. IH-2), the Himeji plant (USSBS, Aircraft Division Report No. IH-3), and the Takarazuka plant (USSBS, Aircraft Division Report No. IH-4)—was investigated.

Dispersal

Dispersal of aircraft production began in October 1944 in the Naruo plant and in the early part of 1945 for the other plants of the Kawanishi Aircraft Co. The corporation policy was to disperse production of each plant under the various departments in the plant. The Naval Construction Corps assisted in building up dispersed plant sites and in many cases supplied all the labor and material necessary in digging underground plants and constructing buildings. Every type of construction was utilized—tunnels, semiunderground buildings, schools, basements of department stores, space under elevated railroads, converted woolen mills, tile shops, and space in various factories.

The principal bottleneck in dispersion was lack of sufficient transportation facilities. Railroads were overburdened because all types of plants were dispersing at the same time and there were not sufficient facilities to handle the tremendous load. Due to the magnitude of the undertaking, there were not enough automotive trucks to compensate for the deficiency in rail transportation. Provision of living quarters, in isolated areas, for the workers and their families, was a problem which in some cases retarded production.

At the end of the war, Kawanishi had dispersed, or planned to disperse, the facilities of its 4 major plants to 32 main sites.

The Naruo plant had eight dispersal areas, all but one of which were located on Honshu Island—six in the Osaka-Kobe area and one at Fukuchiyama, in Kyoto prefecture. The eighth, the Shikoku final-assembly plant, was in Oc County, a few miles west of Tokushima, on Shikoku Island.

There were 5 Konan plant dispersals, all in the Osaka-Kobe area, and 6 Himeji plant dispersals, while Takarazuka had a total of 13, most of which were inland from Kobe and Himeji (appendix B).

It was estimated by company officials that dispersals accounted for an over-all loss of 20 percent in production, although the program was only about 50 percent completed.

The dispersal of all types of Japanese industry at the same time, contributed greatly to the failure of the aircraft builders to meet production plans. Every type of plant was dispersing its activity at the same time, overloading the transportation system and hindering each other's production. For example, when component parts could not be provided by the plant's own shop, due to the fact that the shop was moving to another location, such accessories could not, in many cases, be provided by a subcontractor, as the latter also was dispersing at the same time.

AIR ATTACKS

The Naruo plant sustained one direct and two indirect attacks. The direct attack occurred 9 June 1945, during which 328 high-explosive bombs struck, causing heavy damage. The first indirect attack occurred on 19 July 1945, when 110 high-explosive bombs, part of those aimed at the nearby Nippon oil refinery, struck the plant and caused moderately heavy damage. On 6 August 1945, 385 incendiary bombs dropped in the Nishinomiya urban area attack struck the experimental section of the final assembly and caused medium damage to the plant.

In addition to these two indirect attacks, two other area attacks affected the plant. During one, a few bombs fell on the nearby dormitories, and during the other, a few fell on the Naruo airfield, near the plant. The plant itself was not struck.

The Konan plant suffered one direct attack, 11 May 1945, when 146 high-explosive bonds hit and caused the greatest amount of damage to the plant. There were two area attacks—the Kobe urban area attack of 5 June and the Nishinomiya attack of 6 August, a few incendiary bombs dropping on the plant and dormitories. Damage was negligible in each of these cases.

The one direct attack, on 22 June, leveled most of the Himeji plant. During this attack, 229 high-explosive bombs struck the plant area. Two fighter sweeps, on 24 and 30 July, caused some damage by strafing and fragmentation bombs.

During the 23 July direct attack on the Takarazuka plant, the 458 high-explosive bombs which struck destroyed 80 percent of the plant. An area attack on 15 June 1945 burned 30 percent of the dormitories by incendiary action.

Of a total of 13,221,747 square feet of floor space divided among the four plants, 4,765,476 square feet were severely damaged or destroyed and 8,456,271 square feet received superficial damage as a result of all air attacks (table 2).

Table 2.—Air attack damage

	Naruo plant	Konan Himejí plant plant		Takara- zuka plant	Grand total	
Square feet of floor area:						
Before attack	6, 350, 760	1, 994, 785	1, 431, 722	3, 444, 480	13, 221, 747	
Superficially damaged	5, 700, 760	1,097,982	50, 000	1, 607, 529	8, 456, 271	
Severely damaged or						
destroyed	650, 000	896, 803	1, 381, 722	1, 836, 951	4, 765, 476	
Machine tools:						
Number before attack	481	247	127	205	1,060	
Superficially damaged	69	53	94	35	251	
Severely damaged or						
destroyed	65	16	33	43	157	
Employee easualties:						
Injured	24	117	151	51	343	
Killed	23	184	74	108	389	

Area Attacks

Air attacks on the area surrounding the plants increased absenteeism, interrupted the supply of component parts, and in a few cases affected the supply of electric power. The Naruo, Konan, and Takarazuka plants were located near Osaka and Kobe, two cities which were very heavily bombed. The Himeji plant was in the city of Himeji, which also was heavily bombed. In the bombings of these areas, employees' homes were destroyed or damaged. This resulted in increased absenteeism, since workers took time off either to repair damage to homes or evacuate families and personal belongings into the country.

Production also was interrupted by attacks on subcontractor plants producing component parts. During the area attacks electric-power plants and transmission lines were bombed, causing shortages of power at the aircraft plants.

PRODUCTION STATISTICS

From 1941 through August 1945, this company produced a total of 1,606 combat aircraft coinpared with capacity of 3,835 and Government orders for 3,594. During this same period, the company produced an additional 348 flying boats and seaplanes.

George, Frances, and Rex were the only combatplane types produced. The most important were George and Frances; production of Rex was terminated in March 1944. Capacity for combattype aircraft increased steadily from 14 planes in December 1942 to 75 in December 1943, reaching 215 in December 1944, and a peak of 220 in May 1945. Capacity dropped to 85 after the first air attacks.

Government orders for the first 2 years of

combat aircraft production did not reach the scheduled capacity of the company. In December 1944 it was almost attained. In 1945, Government-planned production was well above capacity, reaching its peak in March 1945. Two hundred ninety-eight combat planes were ordered, though the company had a capacity of but 217. Only 97 were actually produced. Actual output exceeded Government-planned production from September 1943 to December 1943, inclusive, but from that time to the end of the war, the Government-planned production was never attained (appendix C and fig. 3).

Total aircraft production increased from 22 planes in 1931 to 1,028 planes in 1944, the peak production year, and maintained the average by producing 528 planes for the first 8 months of 1945. A total of 2,821 aircraft was produced from 1930 to the end of the war (appendix D and fig. 4).

The Naruo plant (USSBS, Aircraft Division Report III-1) produced 1,512 planes from 1939 to the end of the war, or more planes than the other two plants combined. The Konan plant (USSBS, Aircraft Division Report III-2) produced 510 planes and the Himeji plant (USSBS, Aircraft Division Report III-3) delivered but 246 planes for the same period (appendix E and fig. 5).

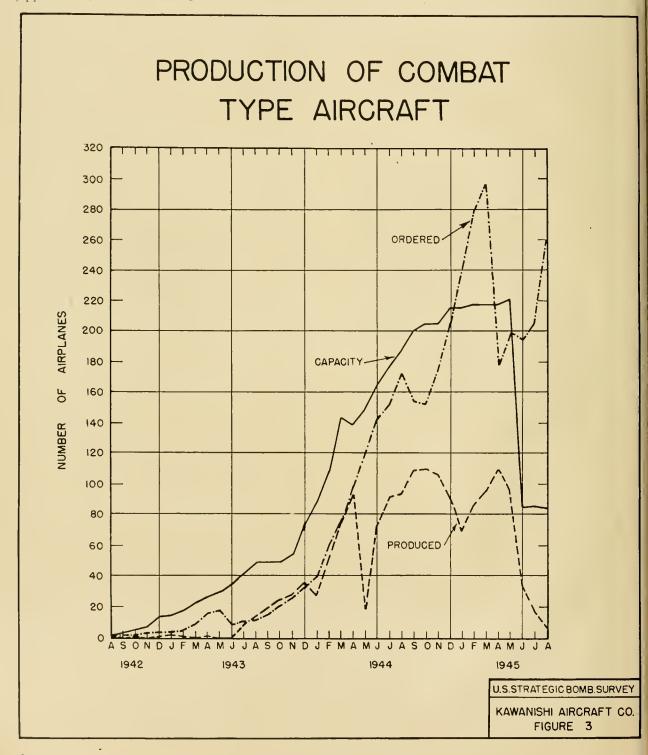
The Government-planned production for all types of aircraft built by the company was very close to actual production from 1939 to April 1944. Starting in March 1944, the Government program for combat-type aircraft was greatly expanded and orders were far above actual production. The peak of production occurred in October 1944 when 114 aircraft were built while Government-planned production called for 161 aircraft. Actual production dropped to 73 in January 1945, due to dispersion, modification of aircraft, and discontinuance of George, type N1K1-J. Production recovered in April 1945 when 112 planes were completed. Following the direct attacks in May, production suffered a sharp decline, from 97 planes in May to 33 in June. Only 17 were produced in July and 6 in August.

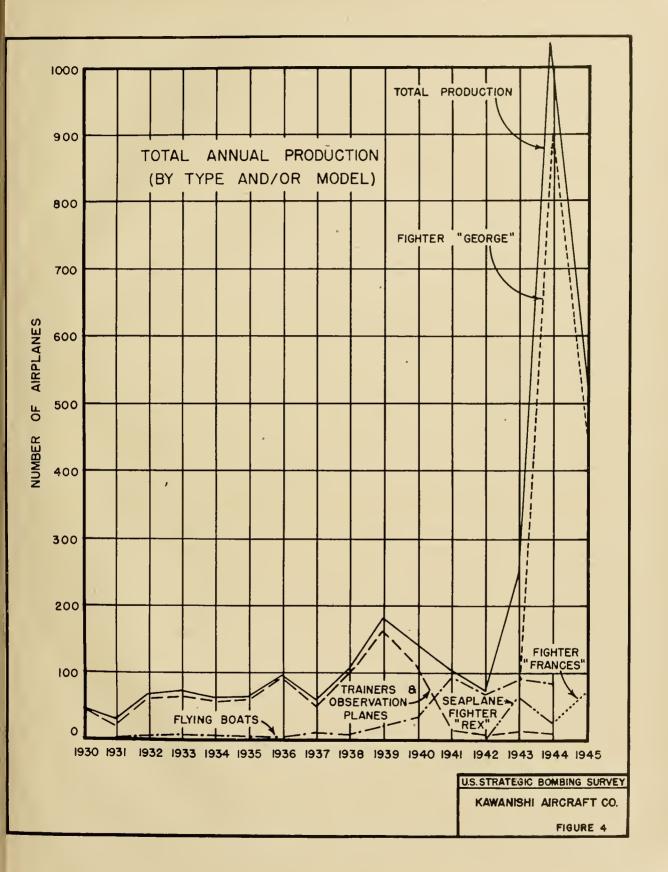
Considering a comparison of quarterly combat aircraft production following the air attacks with quarterly production immediately preceding, a 50 percent decrease was effected. This loss cannot be attributed directly to air attacks, since dispersal of production facilities, as well as shortages of material and component parts, during this period, contributed to the loss in output.

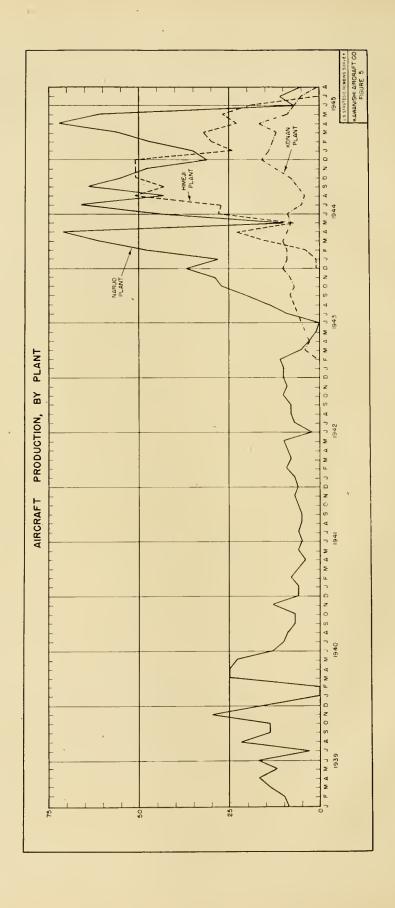
EVALUATION OF PREATTACK 1NTELLIGENCE

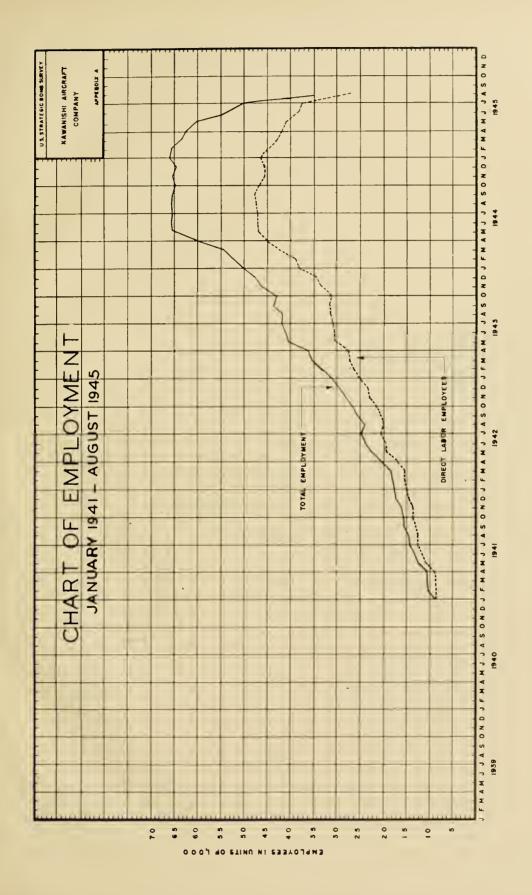
War Department Military Intelligence (G-2) estimates of combat-type aircraft production for 1944 and 1945 were 27 percent over the actual (appendix F). In estimating total aircraft pro-

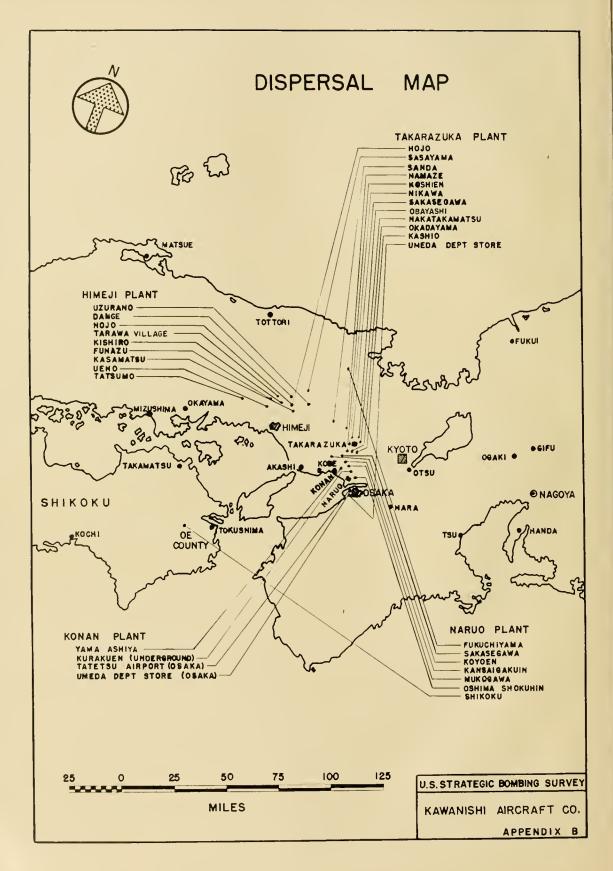
duction from 1941 to 1945, Intelligence exceeded the actual output by 18 percent. Intelligence information was correct concerning the type of aircraft produced by the company and the location of and type of operation at the four largest plants of the Kawanishi Aircraft Co.











Appendix B-1.—Kawanishi Aircraft Co.- Dispersal of aircraft manufacture

Location	Location Date dispersal Distance from plant (in miles)		Types of production planned	Area (square feet)	re feet) Percent of completion		
Jaruo plant:							
Fukuchiyama	October 1944	11	Final assembly	247,712	75		
Shikoku (Oc County) =	do	68	do	59,740			
Schools and buildings in Osaka- Kobe area.	December 1944		Office, engineering and warehouses				
Sakasegawa	Not started	7	Machine parts	11,733			
Mukogawa	do	3	Fuselage assembly.	2,637			
Koyoen	_ do .	6	Sheet metal parts	27,341	70.		
Oshima-Shokukin.	January 1945	3	Machine shop		100.		
Kansaigaknin	December 1944	4	do	22,766	15.		
Conan plant:							
Various locations near Kobe	November 1944		Raw material and machine tools		100.		
Tatetsu Airport (Osaka)	April 1945.		Final assembly	11, 625	100.		
Umeda branch, department store, Osaka.	May 1945		Machine parts.	15,070	100.		
Yama Ashiya	April 1945		Sheet metal parts	31,216	25.		
Kurakuen (underground)	do		Fitting shop	223,892.	25.		
limeji plant:							
Dange	March 1945	16	Final assembly	90,570	100 of building		
Uzurano	April 1945	17	Engine run and flight	1 hangar.	80 of runway.		
Kasamatsu	June 1945	11	Wing assembly.	16,275	50.		
Kishiro	do	16	Fuselage assembly	28,740	40.		
Hojo (Taka village)	March 1945	18	Machine shop.	107,640	30.		
Fnkuzaki Unit:							
Ueno		11	Sheet-metal shop	1			
Funazu		14	do	Planned construction			
Tawara village		17	do	not started.			
Tatsumo		25	. do	1			
Takarazuka plant:							
Kobayashi.	February 1945	1	Gun-turret parts		100.		
Namaze	March 1945	3	Gun-turret hydraulic parts		100.		
Sanda	do	11	Gun-turret parts		100.		
Kashien	February 1945	3	Jig and cutting tools		100.		
Kashio	June 1945	1/2	Sheet-metal parts and fuel-injection pump.		80.		
Sasayama	February 1945	22	Parts for fuel pumps		100.		
Sakasegawa	June 1945	1	Pumps assembly		100.		
Nakatakamatsu	April 1945	1	Jigs and tools		99.		
Nikawa	June 1945	1,2	Machine shop.		100.		
Umeda branch department store, Osaka.	do	9	Air-frame parts		100.		
Okadayama (school)	April 1945	2	do		100,		
Okadayama (underground)		2	do		50,		
Hojo (underground)		31	do.		50.		

	N1K1		N1K1-J N1K2-J				P1Y2-S				Total				
Year	Capac- ity	Ordered	Actual	Capac-	Ordered	Actual	Capac- ity	Ordered	Actual	Capac- ity	Ordered	Actual	Capae- ity	Ordered	Actua
1942;															
January															
February															
March															
April															
May															
June July															
August	1	1	1										1	1	
September	3	1	0										3	1	
October	5	'1	1										5	1	
November	7	2	0	0	1	0							7	3	
December	9	2	1	5	1	0							14	3	
Total	25	7	3	5	2	0.							30	9	
1943;															
January	10	2	2	5	1								15	3	
February	13	3	1	5	2								18	5	
March	15	7	0	8	2								23	9	
April	17	14	1	10	2								27	16	
May	20	16	0	10	2								30	18	
June	25	3	0	10	5								35	8	
July	30	4	5	13	6	4							43	10	
August	30	6 7	8	20	6	6							50	12	
September	25 20	9	9	25 30	8 12	11							50 50	15 21	
November	20	10	13	35	16	14 16							55	26	
December	20	10	15	50	22	20	5	1	1				75	33	
Total	245	91	65	221	84	71	5	1	1				471	176	1
1944:															
January	20	10	9	65	29	17	5	1	1				90	40	
February	20	10	10	85	48	40	5	3	1				110	61	
March	20	10	10	120	63	65	5	3	1				145	76	
April				135	93	93	5	5 5	2				140	98	
May June				145 155	115 135	17 71	10	5 6	1 1	0	3	0	150 166	121 144	
July				165	140	90	10	7	3	3	6	0	178	153	
August				175	145	92	10	6	2	3	12	1	188	173	
September				175	100	106	15	35	1	10	20	3	200	155	1
October				165	120	100	30	3	6	10	30	5	205	153	1
November				155	120	82	40	15	17	10	40	8	205	175	1
December				145	120	51	50	35	31	20	50	10	215	205	
Total	60	30	29	1, 685	1, 228	824	190	124	67	57	162	28	1, 992	1, 544	y
1945:															
January				130	120	24	65	60	35	20	60	10	215	240	
February				55	120	30	140	90	47	22	70	11	217	280	
March.				45	100	30	150	120	58	22	78	9	217	298	
April				40	40	15	155	97	80	22	40	16	217	177	1
May				40	40	7	155	120	81	25	40	9	220	200	
June						6	70	150	20	15	45	7	85	195	
July							70	160	12	16	45	5	86	205	
Angust			*				70	210	. — 5	15	50	1	85	260	
Total				310	420	112	875	1,007	338	157	428	68	1, 342	1, 855	5
Grand total	330	128	97	2, 221	1, 734	1, 007	1,070	1, 132	406	214	590	96	3, 835	3, 584	1, 6

Appendix D.—Kawanishi Aircraft Co.- Aircraft production by type and years, 1930-45

13 Type training seaplane		33 20 40 26 5
15 Type observation seaplane		40 26
3 Type training seaplane		26
3 Type MK II training plane 26		
		5
90 Type MK II observation scaplane 3 40 24		67
90 Type MK III observation seaplane 2 15		17
91 Type observation scaplane		8
91 Type flying boat		17
93 Type training plane 1 9 2 38 10		60
E 7 K 2—Alf		457
E 8 N 1—Dave		45
K 11 K 1		6
K 12 K 2	-	15
H 6 K 3- Mavis	-	36
H 6 K 1-2-4 - Mavis 1 1 1 6 16 26 82 34 10		176
E 13 K 1—Jake 1		1
E 15 K 1—Norm	3 .	15
H 5 Y 1 1		1
H 8 K 1-2-4—Emily	77 10	167
N 1 K 1—Rex	29	97
N 1 K 1-J—George	824 112	1,007
N 1 K 2-J-George 1	67 338	406
P 1 Y 2-S—Frances	28 68	96
Total all types 41 22 61 68 58 60 90 52 100 177 138 99 69 230 1.0	. 028 528	2, 821
Summary:		
Trainers and observation planes	3	
Flying boats 1 2 5 4 3 2 7 6 18 31 89 62 85	77 10	
Rex—scaplane fighter. 3 65	29	
	891 450	
Frances—fighter	28 68	
Summary total 41 22 61 68 58 60 90 52 100 177 .138 99 69 230 1,	.028 528	2,821

Appendix E.—Kawanishi Aircraft Co.—Actual airplane production, 1939-45

NARUO PLANT

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
939:													
E7K2	9	8	11	14	7	9		15	9	8.	20	6	116
E8N1			1	1	5	- 8	3	1	5	5	7	6	41
H6K1, 2, 4		2	2	2			,	3		1	3	3	16
H6K3								2					2
E13K1								1					1
Total, 1939	9	10	14	17	12	17	3	22	14	14	30	15	177
940:												0	
E7K2			21	11	16	9	6	6	5	4	9	2	89
E8N1			1	5									
K12K1				6	5	1				9	9	3	. 12
H6K1, 2, 4			3	3	2	2	4	3	2	2	2	3	26
H5Y1						1	· · · · •						
H6K3										1	2	1	-
Total, 1940			25	25	23	13	10	9	7	7	13	6	138
1941:													
E7K2	5	5											16
H6K1, 2, 4	1	3	5	4	6	4	4	4	5	6	6	6	54
H6K3						1	1	1					3
H8K1, 2, 3.			1				1				1		3
m . 1								5	5	6	7	6	70
Total, 1941	6	8	6	4	6	5	6	5	5	0		0	11

Appendix E.- Kawanishi Aircraft Co.—Actual airplane production, 1939-45.—Continued

NARUO PLANT—Continued

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1942:													
E15K1										2	1	1	4
H6K1, 2, 4	6	9	8	5	8	1	4	5	4	4	5	3	6;
	0		G	2	1	1	1	1	3	3	2	3	1: [
H6K3				2	1	1	2	1	1		1	2	1
1I8K1, 2, 3.	1			2	1		-	1	1		1	1	1.1
N1K1								1		1		1	
Total, 1942	. 7	9	5	9	10	2	7	8	8	10	9	10	9.
1943:													
E15K1	. 1	1		1	1		4			2		2	
			1		1							~	14
H6K1, 2, 4	4	5	1										11
H6K3	2	3	3	1									
H8K1, 2, 3	1	1	1										
N1K1	2	1		1			5	8	9	11	13	15	6
N1K2-J												1	
N1K1+J							4	6	11	14	16	19	70
Mar. 3, 1049	10	1.1	5	3	1		9	14	20	27	29	37	16
Total, 1943	10	11			1		9	14		21	20		10
1944													
E15K1 .	2	1											
			10										2
N1K1	9	10	10										
N1K1J .	16	36	50	70	9	43	63	41	63	49	31		47
N1K2-J	1	1	1	2	1	1	3	2	1	6	17	31	6
Total, 1944	28	48	61	72	10	44	66	43	64	55	48	31	57
1945: N1K2J	35	47	56	72	61	7	11	5					29
1070, 11114 0	- 007	1 11								1			
			H	IMEJI I	PLANT								
											1		
1943° N1K1-J	-											1	
1944: N1K1-J	1	4	15	23	- 8	28	27	51	43	51	51	51	3.8
1945;													
N1K1-J	24	30	30	15	7	6							11
N1K2-J			2	8	20	13	1						4
Total, 1945 .	24	30	32	23	27	19	1						18
2													
	,		K	ONAN I	PLANT								
			1	l l	1	ì	1	ì	1	_		1	1
1943: H8K2 and H8K2-L	1	1	4	3	4	5	6	7	8	7	8	10	
1944													
H8K2 and H8K2-L	9	9	10	9	8	8	5	3	3	3	4	6	7
	37	9	107	9	_ ^		0		3	5		}	2
P1Y2-8						1		1	9		8	10	
Total, 1944	9	9	10	9	8	9	5	4	- 6	8	12	16	10
1945:													
H8K2 and H8K2-L.	1	1 2	3	1									1
P1Y2-S	10	11	9	16	9	7	5	1					ϵ
Total, 1945	14	13	12	17	9	7	5	1					7
,					1		}						

Appendix F. Kawanishi Aircraft Co.-MIS estimate of production, 1941-45

Plant	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1941:													
Naruo								-					53
Himeji										,			
Total													53
				-			= _= _				.3.		
1942:													
Naruo													48
Kouau Himeji													15
Himeji													
Total													63
	====												
1943:													
Narno													85 39
Himeji													45
\													
Total													169
	=		-		====					=	=		
1941: Naruo	50	50	60	50	10	42	42	1/10	82	40	LOS	105	771
Konan	9	9	9	9	46	92	42	102		10	105 15	105	89
Himeji	3	3	3	10	10	15	20	25	30	30	40	50	239
Total	62	62	72	69	65	56	62	127	112	70	160	175	1, 102
1945:	=====												
Naruo	105	105	105	105	105	105							630
Konan_	100	10	14	20	14	15							83
Himeji	50	50	50	50	50	50							300
Total	165	165	169	175	169	170							1, 013
Grand total													2, 400
Citiani total													2, 4(1()



NARUO PLANT REPORT NO. III-1

(Air Frames)

Dates of Survey: 19 October 1945-3 November 1945

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KAWANISHI AIRCRAFT COMPANY—NARUO PLANT

THE PLANT AND ITS FUNCTION IN THE AIRCRAFT INDUSTRY

Introduction

The Naruo plant (Naruo Seisakusho) was located in the village of Naruo (Daito, Naruo-mura, Mukogun, Hyogo-ken), 8 miles west of Osaka. These properties were constructed in 1930 and represented the largest of four major plants of the

Kawanishi Aircraft Co. (Kawanishi Kokuki Kabushiki Kaisha). Subassembly and final assemblies of air frames were conducted in 90 buildings comprising a total floor area of 6,350,760 square feet. A combination of steel, concrete, brick, and wood buildings were constructed, over a continuous period of time, to meet the firm's expanding operations (appendix A). Extensive facilities were available to conduct the complete assembly

processes among the plant properties. Projected expansion programs were generally fulfilled up to the 1944 year end (appendix B).

The Kawanishi Aircraft Co. was an outgrowth of the Kawanishi Engineering Works, formed in 1921 for the production of commercial aircraft. The company commenced producing airplanes for the Navy in 1930 at the Naruo plant. In 1933 and 1934, experiments with 500-horsepower water-cooled engines were attempted. Only two engines were completed and a few others repaired. Mass production was never inaugurated. The company confined its activities to the production of air frames.

Government aid to the Kawanishi Aircraft Co. trom August 1941 to May 1944 amounted to 211,000,000 yen for equipment and airport facilities. The funds received by the Naruo plant were allocated as follows:

Facility:	Yen
Narno Airport	24, 000, 000
Maintenance shop at airport	1, 300, 000
Machine tools at Naruo plant	400, 000
Total	25, 700, 000

Plant Organization and Operation

The plant was managed by the following key personnel:

Masakiyo Nakamura	General manager.
Hiroshi Kono	Chief, planning department.
Masokiyo Nakamura	Chief, production department.
Masanori Konishi	Chief, inspection.
Shigeru Furukawa	Chief, Labor Department,

Manufacturing processes were conducted on a functional basis through various departments (appendix C).

Production-line techniques were used exclusively until the first attack in June 1945, after which job-shop practices were adopted. Material was processed through the plant on an established schematic production-flow basis. Manufacturing space appears to have been utilized with little waste.

Total employment in the Naruo plant increased from 7,850 in December 1939 to 35,100 employees at the peak in May 1944. From June 1944, as an increasing number of workers were called into the military service, and especially after February 1945, when the dispersal program got under way, employment at Naruo dropped rapidly until there were only 17,900 employees in August 1945 (appendix D).

Volunteers, including students, were pressed into service to assist in the manufacturing operations. The program started in late 1942 and reached its peak at the 1943 year end. This group of employees was very small in relation to the plant's total number of workers and evidently had no appreciable effect on production.

Under the Naruo plant's schedule of planned employment, a total of 36,000 workers were projected by March 1944. This goal was almost reached in May 1944 when 35,100 people were on the pay roll. The fourth employment plan contemplated a total force of 37,000 by March 1945, but was never attained. In fact, employment declined steadily from May 1944 until rapid deterioration set in toward the close of the war.

Man-hours reached a peak in May 1944. Inauguration of the dispersal program, shortly thereafter, was responsible for the gradual decline that set in (appendix E).

Excepting for the months of July and August 1944, during which period two shifts were conducted, operations were conducted on a one-shift basis. During the one-shift operation, employees worked (excluding overtime) the following schedules:

Direct labor (male)	 0730 to 1800
Direct labor (female)	 0730 to 1800
Students	 0800 to 1700
Staff	 0730 to 1800
Office personnel	 0800 to 1800

Women and students did not work overtime The two shifts, during 1944, were ordered by the Government and later discontinued. Men only worked the night shift, and they were very few in number: only 2 percent of the total direct-labor workers, or 400 men. Compulsory service in the war industry started August 11, 1941.

An involved system of compensation was in effect and carried with it many variations. The employees of the plant were paid on an average of 180 to 200 yen per month, working almost 300 hours per month. The base pay after the beginning of the war was 2 yen 80 sen for a 10-hour day. For the 2-hour compulsory overtime period, a 10-percent increase for each hour was allowed. For the next 3 to 6 hours, 15 percent of base pay, and after 6 hours, 20 percent of base pay per hour was given. In addition to base and overtime pay, each employee was allotted an additional bonus, based upon age, as follows:

			I e r
20	years of age		_ 10
21	to 25 years		20
26	to 30 years	 	30
31	and over		_ 40

Supplementing the above, general bonuses of 60 percent of base pay for direct-labor employees, and 50 percent of base pay for indirect-labor employees were paid.

Supply of Material and Components

When the Government ordered planes from the aircraft companies, it allocated the necessary major parts, engines, metal, instruments, radios, and other accessories. The smaller parts used in air-frame construction were contracted for by the individual companies. A committee in Tokyo, called the Shizai linkai, composed of members from the major aircraft companies, helped the Government to allocate major parts to the industry.

Technical supervision of production and inspection of the products were carried out by the Navy's Bureau of Aviation, and the First Naval Air Arsenal at Yokosuka. Supervision of production in general was a function of the Ministry of Munitions. Navy inspectors were stationed at the plant, one serving as munitions officer.

Wings, fuselage, tails, and ailerons were subassembled at the Naruo plant, for its own use as well as for production in the Konan and Himeji plants. Subassembly operations were conducted at the Konan plant and its dispersed units. The same was true at the Himeji plant, from 1942 through 1945.

Substitution of certain critical materials started in the fall of 1943. Chrome molybdenum steel was substituted for nickel because of the acute shortage of nickel. During 1943, silicon manganese steel was substituted for nickel chrome steel. In 1944, carbon steel was substituted for the nickel chrome and silicon manganese steels. During 1945, a lower grade carbon steel was substituted for nickel chrome steel. Steel was used for engine mountings, wing joints, spar fittings, wing fittings on fuselages and in their applications. Plastics were substituted for light alloys in control pulleys, fittings, and accessories. Plastics were never used in structural parts. Light alloys were employed as a substitute for brass or other copper alloys in fittings. Wood was substituted for light alloys in fittings and nonstructural parts, including floors. Experiments were made with substitutes of wood for rudders, elevators and wing tips, but had not received extensive utilization.

Production Statistics

The Naruo plant constructed a total of 903 interceptor fighters, George (N1K1-J and N1K2-J), during the last year and a half of the war. From January 1939 to August 1945, 16 different types of flying boats and land-based planes were produced, as follows:

Japanese designation	Japanese code name	Allied code name
94 type Mk II observation scaplane	E 7 K 2	Alf 12.
95 type observation scaplane	E 8 N 1	Dave 11.
Kawanishi 13 type experimental 3-seater observation scaplane.	E 13 K 1	Jake.
Shiun 11 type observation seaplane	E 15 K 1	Norm 11.
99 type flying boat	H 5 Y 1	
97 type Mk II flying boat	H 6 K 1	Mavis.
Do	П 6 К 2	Do.
Kawanishi 4-motor flying boat	Н 6 К 3	Mavis 11.
97 type Mk III flying boat	H 6 K 4	Mavis 22.
Do	H 6 K 5	Mavis 23.
2 type flying boat	H 8 K 1, 2, 3	Emily.
Kawanishi II type experimental seaplane.		
Advanced trainer (experimental only).	K 11 K 1	
O type Mk I primary trainer scaplane	K 12 K 1	
Kyofu 11 type seaplane fighter	N 1 K 1	Rex 11.
Shiden 11 type intercepter fighter	N 1 K 1-J	George 11.
Shiden 21 type intercepter fighter	N 1 K 2-J	George 21.

From 1928 through 1939, emphasis was placed on the production of type E7K2, known by our designation as ALF 12. During this period, a total of 241 planes of this type were produced (appendix F).

Production schedules of the Naruo plant were projected to meet Government-placed orders. Schedules were altered to meet the changing requirements of the Government. Emphasis on types were frequently shifted by the Government with corresponding changes occurring in the plant's production program.

The N1K1, known by our designation as Rex 11, was first developed in August 1942 as a single-engine amphibious fighter. The peak of production was attained in December 1943, when five plants were built. Manufacture of this model was terminated in March 1944. Total units produced aggregated 97.

This model was succeeded by a land-based, single-engine interceptor, termed N1K1-J, or in our terminology known as George 11. Actual production started July 1943 and continued through December 1944. A total of 541 planes were produced while 721 were planned by the Government for this period (appendix G).

Prior to February 1944, the policy of the Government was to accept all planes stated to be airworthy by the aircraft company. The Kawanishi Aircraft Co.'s policy was to test fly the airplanes before delivery. Therefore, all production figures prior to February 1944 represent actual production delivered to the Government. After February 1944, due to poor engine and air-frame workmanship, the Government's policy was to accept aircraft only after they had been test-flown and accepted by Navy registered pilots. For this reason, figures of production after Februrry 1944 are broken down to show both production and acceptance by the Government. Monthly orders by the Government, as distinct from yearly orders, began in April 1944.

Six types of wooden propellers were made at the Naruo plant in addition to engine test clubs from January 1939 to April 1945. A few were used by Kawanishi Aircraft Co., but most were sold to the Government. From 1939 to the end of 1944, when propeller production ended, 3,133 wooden propellers for small trainers and observation planes were produced (appendix H).

Actual production exceeded planned output as set by the Government.

Rebuilding and Repair of Airplanes

From January to October 1944 a total of 393 aircraft were repaired at the Naruo plant. In 1939, 21 aircraft were repaired, increasing to 95 in 1940, 98 in 1941, dropping to but 17 in 1942, and reaching a peak of 137 in 1943. This work tapered off in 1944, during which year only 25 we're repaired, and came to a stop by the end of that year. No airplanes were repaired in 1945. Repairs of diverse character were made for various contractors, including the Government and private builders (appendix I).

Experimental Aircraft

Early in 1939, only one experimental threeseater observation seaplane, Jake, was produced. In 1940, one large experimental flying boat was produced which never got into production. Also in 1940, 12 primary training seaplanes were produced and from October 1942 to February 1944, only 15 observation seaplanes, Norm 11, were subject to experiment.

The following experimental airplanes were produced in 1944 and 1945, chiefly in the design department and final-assembly shop of the Naruo plant:

Shiden 21 type interceptor fighter (N 1 K 2-J).

Shiden 31 type interceptor fighter (N 1 K 3-J).

Shiden 32 type interceptor fighter (N 1 K 4-J).

Shiden 42 type interceptor fighter (N 1 K 4- Λ).

Shiden 53 type interceptor fighter (N 1 K 5-J).

Jimpu interceptor fighter (J 6 K 1).

Soku transport flying boat (a modification of N 1 K 1-J George) (H 11 K 1),

N1K2-J

On 31 December 1943, the initial experimental plane N 1 K 2-J made its first flight at Naruo Airport. The second to eighth experimental planes were completed between January and June 1944. During this period, test flights and modifications resulting from the test flights were carried out. These numerous modifications were applied in the production of successive types of aircraft.

N1K3-J

In order to overcome the backward tendency of the center of gravity in the N 1 K 2-J, it was planned to move the engine and propeller forward approximately 150 millimeters. This type was called N 1 K 3-J but was never constructed.

N1K4-J

This was a modification of N 1 K 2-J. The main differences follow:

Type of engine changed:

(Installed injection pumps instead of carburetors.) 13-millimeter machine guns added in the fuselage. Arrangement of armament in wings modified.

The first to third experimental planes were completed in 1944. Numerous modifications were made after test flights and applied to later planes as well as to the above three experimental planes. The fourth plane was 95 percent completed at the end of the war.

N1K4-A

This was a modification of N1K4-J, for use on aircraft carriers. Two planes of the N1K2-J model were reconstructed in 1944 for the purpose of this experiment. The first experimental plane was completed on 20 September 1944, and the second plane about half a month later.

NIK5-I

This was also a modification of N1K2-J for performance improvement. The type of engine was changed from the Homare to the Kasei and the airframe strengthened.

Plans were started at the beginning of 1945, and design drawings were nearly completed. Just before the construction work was started in the Himeji plant, everything was destroyed by the air attack on the Naruo plant.

J6K1

This was a new type high-altitude interceptor. The first experimental plane was planned for completion at the end of 1944. When the design drawings were nearly completed, all the plans had to be abandoned at the request of the Government.

H11K1

This represented a new type of transport flying boat, with wooden construction members. This aircraft was planned in conjunction with J6K1, and was stopped at the same time. Design drawings were nearly completed and preparation for production was started. Approximately 50 percent of a half-size model plane, for structural tests, was completed at the end of the war.

SUICIDE PLANE

A modification of N1K1-J George 11, to carry a larger bomb load. From the end of 1944 to January 1945, four George 11's were reconstructed, employing 200 employees, including the designing department. These employees, worked exclusively on the modification of George 11.

Experiments in wind tunnel and experimental tanks, flight tests, structural tests and experiments in production methods were carried out at the same time.

Experimental planes were assembled in the final assembly shop, utilizing from 250 to 300 employees. Upon completion of the final assembly of the plane, officers in charge of the First Aviation Arsenal inspected the aircraft. Test flights were carried out in cooperation with officers in charge of the test-flight section, First Aviation Arsenal, and the company's test pilots.

ATTACK DATA

The attack data may be summarized as follows: Intelligence data:

Date and hour of attack, 9 June 1945, 19 July 1945, 6 August 1945.

Duration, 0832 to 0905, 1120 to 1200, 0050 to 0202.

Attacking unit, Twentieth Air Force.

Altitude, 20,500.

Number of aircraft over target, 44.

HE—Number, weight, and type, 263.5 tons M65GP's.

HE-Fuzing, 1/1000 nose, N. D. tail.

On-the-ground findings:

HE—

| Number in plant area, 328, 9 June 1945; 110, 6 August 1945. |
| Number of building hits, 213, 9 June 1945; 23, 6 August 1945. |
| Number of UXB, 1, 9 June 1945. |

1B—{Number in plant area, 385, 6 August 1915, Number of building hits, final assembly, Number of UXB, Building No. 101,

EFFECTS OF BOMBING

Direct Air Attacks

There were three attacks on the Naruo plant:

1.	9 June 1945	0832 to 0905.	
2.	19 July 1945	1120 to 1200.	
3	6 August 1045	0050 to 0202	

In addition to the above three attacks, there were two area attacks which affected the Naruo plant. On 15 June 1945, from 0850 to 1050, the plant area was not struck, but dormitories some distance away were damaged. On 10 July 1945, from 1030 to 1040, 31 bombs struck the Naruo airfield, 29 hitting the runway. Bomb plots (appendix J) show the three attacks on the plant. Damage caused by the first 2 attacks are revealed in appendixes K-1 and K-2. During the attack of 6 August 1945, only incendiaries were dropped. All fell on one part of the final assembly building, building number 101, causing very little structural damage and burning seven assembled airplanes.

A number of the least essential buildings were dismantled before the attacks, as precaution against fire. During the first attack, the subassembly shops for wings and tail units were severely damaged, therefore, the subassembly of these parts were subcontracted. Final assembly was consolidated from three different buildings to two buildings.

The total floor area before air attacks amounted to 6,350,760 square feet. Superficial damage to 5,000,000 square feet was sustained and 600,000 square feet of floor space was entirely destroyed in all air attacks. No attempt was made to repair the damage; everything was left in its damaged state to give the appearance of inactivity and severe damage. Temporary wooden roofs under the damaged original roof were erected over sections of the wing and tail assembly line to protect the material and workers from the weather and to camouflage their activity.

The air attacks caused extensive physical damage. (See photographs 1 to 10.) Much of the debris shown in the photographs was caused by the tidal wave of 17 September 1945. A copy of a report of the damage attributed to the air attack of 9 June 1945, as made to the Japanese Government by Naruo plant officials, is incorporated in the reference material.



Photo No. 1.—Building No. 602, lay-out shop. View west, showing damage of a direct hit.

Photo No. 2.—Building No. 601, sheet metal works. View northeast. Because of marshy ground, the floor was concrete reinforced with steel. Bombs exploded on strong floor and did not cause too much structural damage.





Photo No. 3.—Buildings 701, 704, 716, machine shops and sheet metal works. View northeast, showing slight damage to concrete buildings.



Photo No. 4.—Buildings 701, 704, 716, machine shops and sheet metal works. View north, showing bomb damage of direct hits and near-misses to a steel-reinforced concrete building.



Photo No. 5.—Building 401, final assembly. View west—roof damage over assembly line.

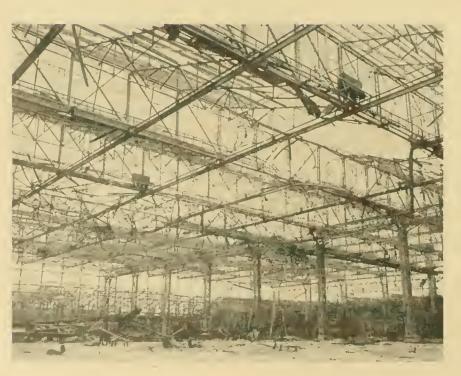


Photo No. 6.—Building 201, final assembly. View east, showing four bomb hits on the roof.



Photo No. 7.—Building 101, final assembly. View east—slight superficial damage.



Photo No. 8.—Buildings 201 and 202, wing assembly. View northeast—superficial damage.

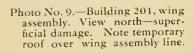






Photo No. 10.—Building 703, assembly of wings and spars. View northwest—structural damage.

ter the first attack, most of the machine tools removed from the plants and dispersed to us locations. Only the heaviest machinery few machine tools essential to the assembly reraft remained in the plant. Before the air ks, there were a total of 416 machine tools, his amount, 69 machine tools were superficient damaged but repairable and 65 were dambeyond repair.

re accompanying tables 1 and 2 list the extent amage suffered by the machine-tool and ament facilities.

the 3 reveals the casualties for each raid. It be seen that the 9 June 1945 attack was the one with major effect.

E 1.—List of machine tools damaged by air attacks

[At the end of the war]										
Name	Num- ber usable	or need-	Location							
	39	2	Machine shop and jig shop.							
S	17	4	Do.							
; machines	11	4	Do.							
g machines	118	13	Do.							
S	7	0	Do.							
rs	18	6	Do.							
3	9	0	Do.							
saws	6	0	Do.							
netal machines	85	47	Sheet-metal shops.							
3	24	24	Press shop.							
oe tools for wood	22	~]	Carpenter shop.							
g machines	4	5	Forging shop.							
rotal	360	106								

ABLE 2.—List of equipment damaged by air attacks
[At the end of the war]

Name	Capacity	Number	De- gree of dam- ages, per- cent	Location
npressor	200 hp	2	0	No. 1 air compressor room,
,	do	1	0	No. 2 air compressor room.
·	300 hp	3	45	No. 3 air compressor room.
amulator		3	100	Do.
		12	5	No. 1 boiler room.
D	400 hp	2	70	No. 2 boiler room.
)	do	3	0	No. 3 boiler room.
	do	5	10	No. 4 hoiler room.
onveyor		1	100	No. 2 hoiler room.
purification		1	50	No. 1 system.
m.				
·		1	30	No. 2 system.
		1	50	No. 3 system.
e furnace		1	0	Fitting shop.
		13	27	No. 1 heat treatment shop.
		12	30	No. 2 heat treatment shop.
ith		3	3	No. 1 beat treatment shop.
·		2	70	No. 2 heat treatment shop,
rotal		56		

Table 3.—Casualties for each raid

Date of raid	Number killed	Number severely wounded	Total		
9 June 1945	23	22	45		
15 June 1945	0	0	0		
10 July 1945	U	2	2		
19 July 1945	0	0	0		
6 Aug. 1945	0	0	0		

Countermeasures

The air-attack precaution system took the following form:

Alerts were telephoned through a direct communication line from Osaka Naval Garrison (Osaka Keibifu), and headquarters of the Middle Area Army. Alerts were given to the entire plant by sirens and situations were given by loudspeaker for everyone to take prearranged position. Employees were evacuated from the plant 20 minutes before the planes were overhead. Two observation posts were located on top of the roof in the plant.

Evacuation from the plant was carried out by decision of the plant defense chief (manager acted as chief) and in the following sequence: women, apprentices, students, and men employees. The fire-defense-party organization consisted of 30 regular firemen and 500 auxiliary firemen, and 4 fire engines. Beside 80 water hydrants, 40 static water tanks were constructed at various locations throughout the plant in case water supplies were cut.

There were dugouts, 4 feet deep, bridged with timber, and covered with earth (about 6 inches over the timber) for 4,000 men inside, and 18,000 men outside of the plant. Three underground control stations were prepared, one of which was regularly used.

The control station was equipped with direct telephone communication to observation posts throughout the plant, to the substation in the plant, to the Osaka Naval Garrison, Nishinomiya Police Station, military police station, fire station, and to the broadcasting and radio sets in the plant.

The organization of the plant defense party was as follows:

General affairs section, Defense section. Engineering section. Headquarters staff. Guarding party, Defense party.

Head of the party.

Acting head. Assistant. Fire defense party. Relief party. Antigas party. Engineering party. Transport party. Office defense party. Shop defense party.

An average of 2 or 3 hours were lost during each raid. The employees would run to their shelters outside the plant, but were very slow in returning to their work.

Interruptions to Production

Direct air attacks on the plant caused a great drop in the production of George, the only type of aircraft being produced in 1945. The accompanying table 4 presents actual production and Government-planned production for 1945.

Table 4.—Production of George 21-N1K2-J

Month (1945)	Government planued production	Actual production
January	60	35
February	80	47
March.	85	56
April	90	72
May	95	61
June	100	7
July	100	11
August	120	5
Total	730	294

During the early part of 1945, actual production was not equal to, but was quickly catching up with the Government-planned production. A drop in actual production in May was due to dispersal. Then after the first air attack in June, production dropped to seven aircraft that month and because of the other air attacks in July and August, never recovered. A certain amount of the drop in production was due to dispersal (the exact amount is unknown), but the greatest cause for the huge loss was due to the air attacks. From June, when the first attack occurred until the end of the war in August, the Government planned production of 320 aircraft while only 22 were actually produced over this period.

From November 1944 to August 1945, 1,405,510 man-hours were lost because of air-raid alerts (appendix L). The greatest loss occurred during May 1945, with 150,000 man-hours lost. During 1945, 2,458,800 man-hours were lost because of damage caused by air raids. From June 1945, after the first attack, until August 1945, 355,800 man-hours were required to repair air-raid damage (appendix M). The total number of man-hours lost due to all causes of air raids amounted to

4,220,110 from November 1944 to August (appendix N).

Electric-power consumption appeared adequate meet the plant's demands until May 1945 we power-transmission lines were destroyed by an raid (appendix O). Also, power requiremakers reduced due to dispersion of manpower clean up the debris.

The quality of aircraft started to declin 1942 and continued to become worse through the production period, due to defective elesystems, hydraulic systems, and magnetos w were made by the Yokogawa Electric Co., Toa Co. in Tokyo. Defective landing gears v made. During 1943 the performance of Homare engine also deteriorated.

Dispersal

The first dispersal, planned for January I was to take place at Fukuchiyama, Shikoku, Koyoen. The second planned for May 194. buildings near the plant. The third, the ac movement of machinery to begin in June 1 was to disperse to Fukuchiyama plant first then to the Shikoku plant. The fourth dispeincreased the movement of machinery, star in July 1945 (appendix P).

Beginning in early 1945, large cities sucl Tokyo, Osaka, and Kobe had been raided factories which produced munitions, especi aircraft, were damaged by air attacks. The \(\lambda\) istry of Munitions ordered the plant to be persed rapidly to avoid the air raids which v expected to come. Accordingly, the Naruo p. dispersed part of its production to Fukuchiva and Shikoku. By so doing, the Naruo plant 30 percent of its production. Material and co ponent parts were dispersed to many locations the Hanshin district, and after May 1945, disp sion was further increased. After the first raid on Naruo plant (June 1945) production at Naruo plant was not stressed and increased portance was attached to the dispersion of r duction to Fukuchiyama and Shikoku.

The Fukuchiyama plant was erected by Naval Construction Corps, since the Kawani Aircraft Co. found it impossible to do so due shortages in material and labor. Construct was conducted under great difficulties as the sof the dispersed plant was in an isolated h district. A great deal of delay was experience in negotiating for schools and warehouses to used as workshops.

Transportation was the principal bottleneck, is the dispersion of all types of industry took place simultaneously.

Rapid dispersion of employees was delayed by shortage of billets, food, etc., and especially because of the difficulties involved in transferring families and household goods of the employees to be dispersed locations.

The Naruo plant estimated that from 30 to 40 percent of production was lost during May 1945

lue solely to dispersion.

At the Naruo plant proper, production dropped rom a planned total of 190 to 120.

INTELLIGENCE CHECK

In the type and quantity of certain planes proluced, intelligence information was accurate. The intelligence information on the production of the most important plane, George, was incertate in that it was estimated that 1,280 deorges were produced while only 903 planes were actually produced over the same period. This was 377 planes or 30 percent less than had been estimated. In the production of Mavis, he estimated production was 156 planes while ctual production amounted to 186 planes from 940 to 1943. This amounted to an underestimate of 30 large 4-engine patrol bombers or 16 ercent less than were produced at this plant.

VULNERABILITY

The Naruo plant was vulnerable to air attack a that all the activities of the plant were centered n a small area. Subassembly of component parts nd final assembly of air frames were carried on n buildings bordering each other in much the ame way as they are in the United States. The act that the plant was situated on the shore at he mouth of a river, which could be used as a andmark, increased its vulnerability. No atempt was made to camouflage the plant. All he buildings were concentrated in a small area. After the first 6 months of the war, the labor orce was not very enthusiastic about war proluction. During the last few years of the war, bsenteeism always increased during the spring nd summer months, because many of the employees worked in their gardens and on their arms. From the beginning of 1945, ever inreasing numbers of employees stayed away from heir work to evacuate their families and homes rom the cities, in order to safeguard their lives and possessions from air attacks.

DATA RELEVANT TO OTHER DIVISION STUDIES

Railway transportation difficulties started in June 1944, and continually became worse. The Naruo plant had difficulty getting raw materials and component parts to its works, and in sending material to subcontractors and receiving finished parts in return. The greatest difficulty was experienced with the Hokuriku Railroad Line. Starting in the latter part of 1944, delivery of airplanes was held up due to a shortage of hydraulic parts, instruments, and electrical equipment which were for the main part manufactured in Tokyo and were not arriving at the aircraft companies because of transportation difficulties various aircraft companies used special couriers to carry the vital parts from Tokyo to the aircraft companies on regular passenger trains. During September and October of 1944, the Japanese Government ordered the railroad companies to provide special coaches for aircraft company couriers between Tokyo and Kobe, to eliminate the shortage of necessary parts and assist in the delivery of completed aircraft.

GENERAL IMPRESSIONS OF PLANT INSPEC-TION AND INTERROGATION

The Naruo plant was well constructed and the buildings were all of modern design. The plant lay-out was suitable for mass production and with full utilization of its productive capacity could have produced more aircraft than it actually did. With its two wind tunnels and one water basin, a greater experimental program could have been undertaken. The plant site was not too well chosen in that tidal waves flooded the entire plant each year, and no precautionary measures (i. e., flood walls) were undertaken to remedy this condition.

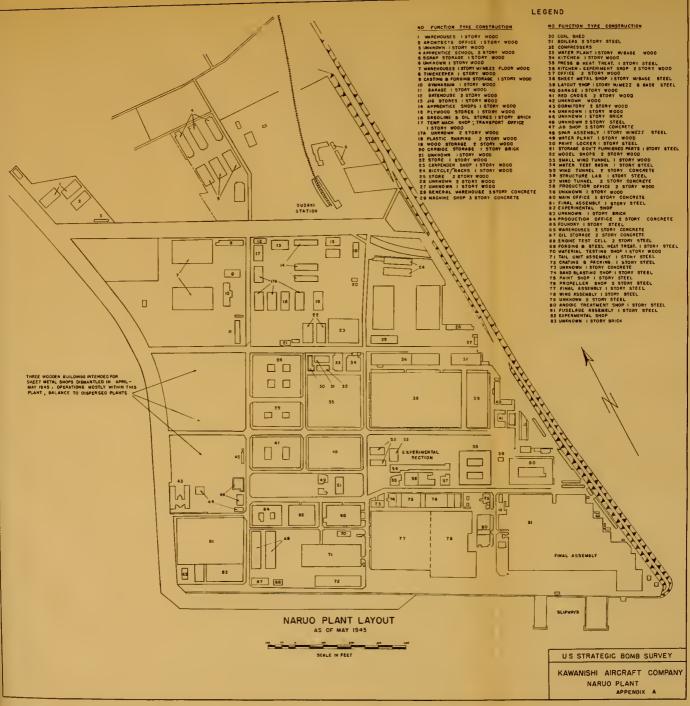
REFERENCE ITEM

The following reference item is filed with the records of the Aircraft Division, United States Strategic Bombing Survey, in the office of The Adjutant General, War Department, Washington, D. C.

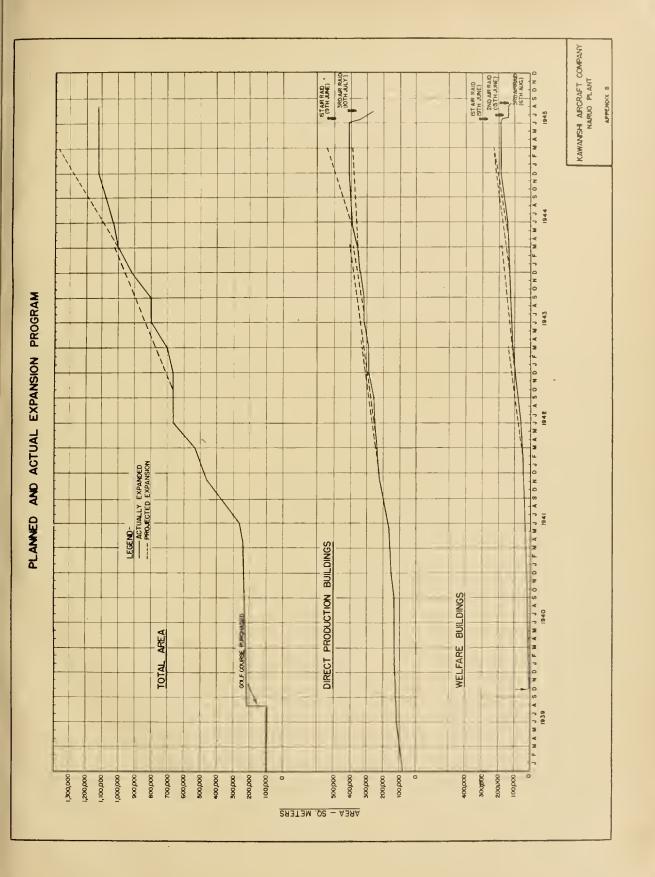
Reference Item 1. Sample of Report to Government.

> Report on Damages due to Air Raid of Naruo Plant. (The 1st report) June 9th 1945.

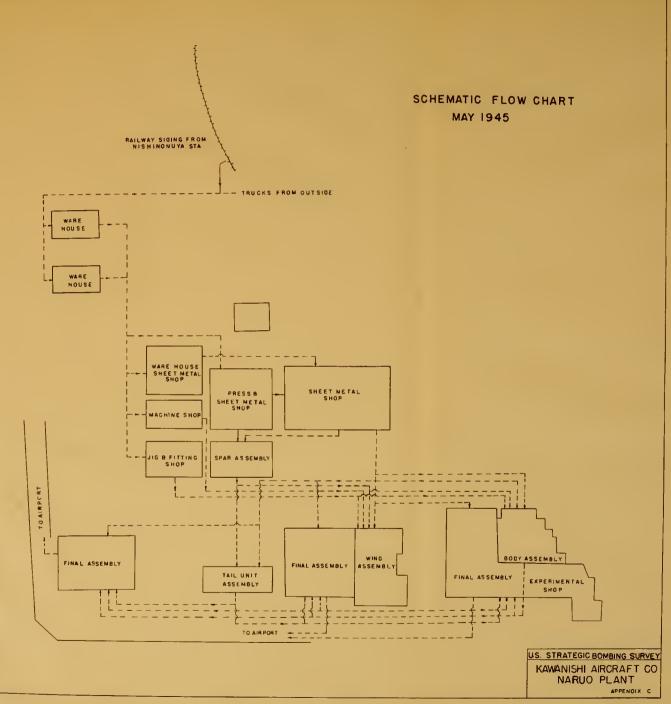


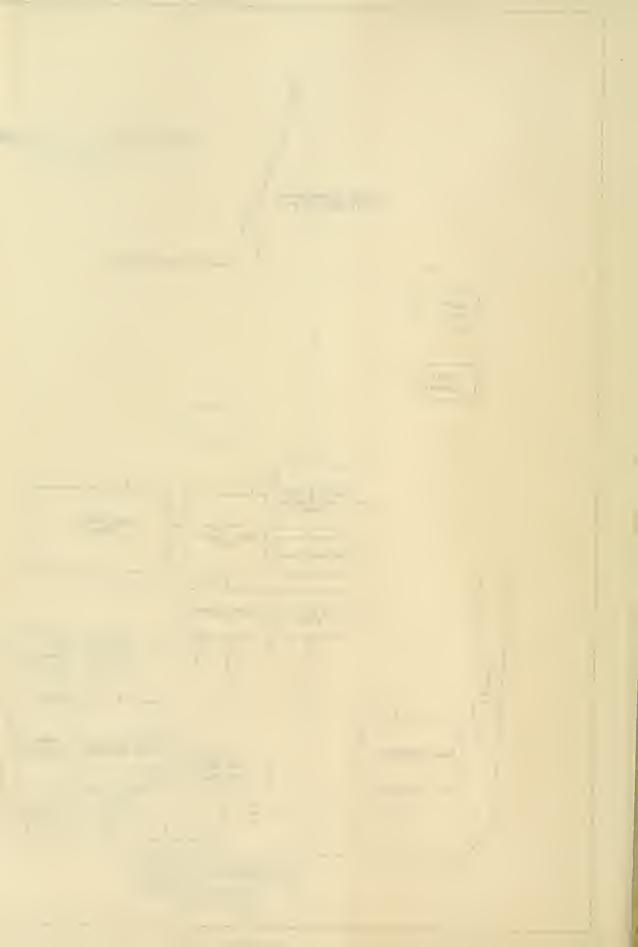




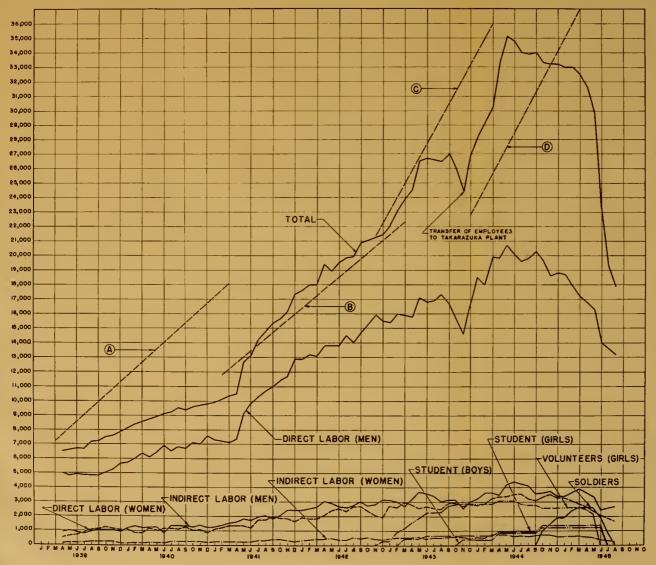








EMPLOYMENT CHART FROM APRIL 1939 TO AUGUST 1945



DIRECT LABOR [MEN]

- (I) SHEET METAL WORKERS
- (2) RIBGERS
- (3) CARPENTERS
- (4) MEN IN FOUNDRY
- (5) MEN IN FORGING SHOP
- (6) MEN IN LAYOUT SHOP
- (7) ELECTRIC MECHANICS
- (8) OPERATORS
- (9) MEN IN MACHINE SHOP
- (IO) FITTER9
- (II) AIR CRAFT MEN
- (12) AUTOMOBILE MECHANICS
- (I3) MEN IN HEAT TREATMENT SHOP
- (I4) PAINTERS

INDIRECT LABOR (MEN)

- (I) MEN IN PRODUCTION OFFICE
- (2) PORTERS
- (3) WARE HOUSE MEN
- (4) INSPECTORS
- (5) MEN IN WELFARE SECTION
- (6) COOK
- (7) DRAFT MEN
- (B) MEN IN LABORATORY

PLANNED TO BE COMPLETED

- A IST PROBRAM MAR 1939 MAR 1941
- B 2NO PROGRAM FEB 1941 MAR 1943
- C 3RD PROGRAM NOV 1942 MAR 1944
- (0) 4TH PROGRAM DEC 1943 MAR 1945

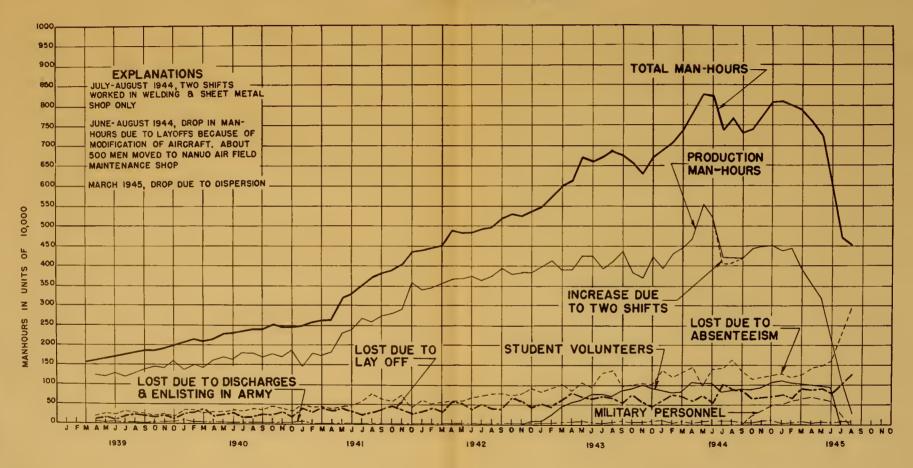
KAWANISHI AIRGRAFT COMPANY NARUO PLANT

APPENDIX O

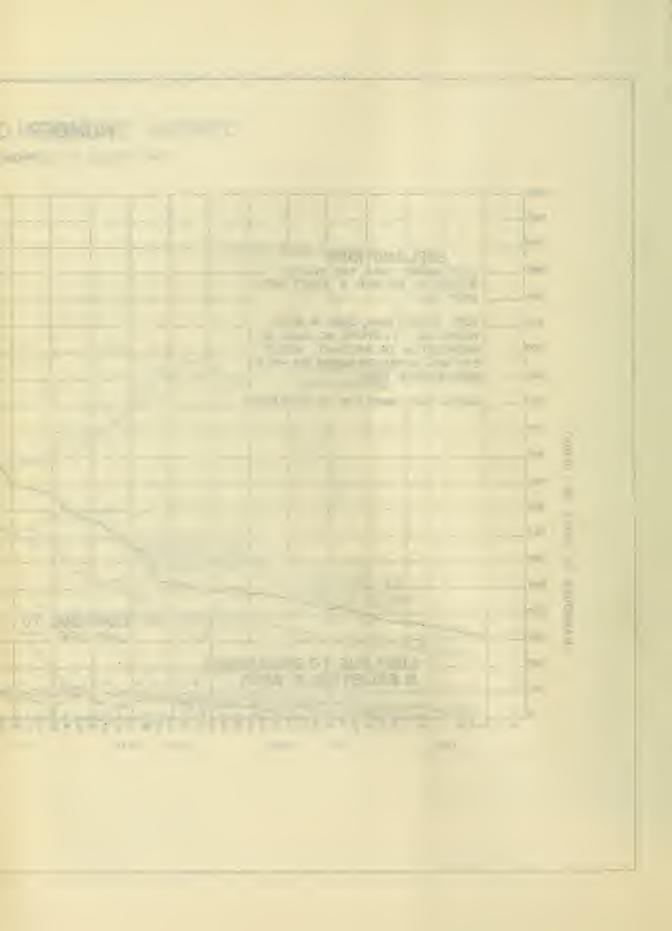


NUMBER OF MANHOURS WORKED

FROM APRIL 1939 TO AUGUST 1945



U.S. STRATEGIC BOMBING SURVEY
KAWANISHI AIRCRAFT CO.
NARUO PLANT
APPENDIX E



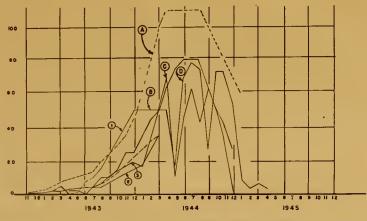
Appendix F.—Airplane production by types before 1939, Kawanishi Aircraft Co., Naruo plant

Туре	Number of engines used in aircraft	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	Total
	1	9	13			10	18						4
oe training seaplane	1	-	10	20	9	10	10						3
e training plane	1			21	11	5			******				4
e MKII training plane	1			-1	11	26				****			2
oe MKII flying boat	3				1	20	1	1					•
be MKII observation seaplane	1				1	3	40	24					6
oc MKIII observation scaplane	1				2	15	· 10	- '					1
ne observation seaplane	1				_	2.7	3		5				
oe flying boat	9 -				**		4	3	3	1	G		1
oe secondary training plane	1						i	9	2	38	10		
2	î						1	21	50	47	35	88	24
1	1												
K 1	1									3		3	
K 1	1											3	
3	4												
5 1, 2, 4	4									1	1	6	
3	4												
C1	4												
C 2-L	4												
K 1	1												
C 1	1												
C 1-J.	1												
7 2· J.	1												
2	2												



PLANNED AND ACTUAL PRODUCTION NIKIJ AND NIK2J

SHIDEN II TYPE INTERCEPTER FIGHTER - NIKI J- GEORE II



- A. OCT. DEC.1943 DRDP IN PRODUCTION QUE TO DELAYS IN PREPARING PRODUCTION FIGS (ESPICALLY ASSEMBLING FIGS)
- 8. MAY-AUG.1944 DRDP IN PRODUCTION DUE TO MODIFICATIONS BY WAR EXPERIENCES ETG.
- C. SEP 1944 DECREASE OF PLANNED PRODUCTION BY CHANGE IN TYPE OF PRODUCTS FROM NIKIJ TO NIK2 J

GOVERNMENT PLANNED PRODUCTION

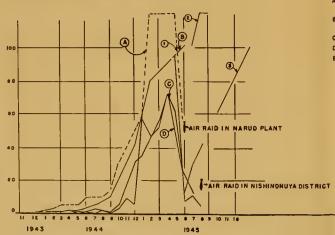
ſ	LINE	FISCAL	YEAR OF PRODUCTION	DATE ALLDGATED	NOTE
	0	FISCAL	YEAR 1942-1943		
	©	•	1943	FEB. 1943	LINE I MODIFIED
Į	<u>(§</u>	•	•	APRIL "	a
- 1					

TOTAL PRODUCTING OF NARUO AND HINEJI PLANTS ARE ALLOGATED

- (A) ----- MAXIMUM POSSIBLE PRODUCTION

 (B) GOVERNMENT PLANNED PRODUCTION
- C ACTUAL PRODUCTION
- O ACCEPTED

SHIDEN 21 TYPE INTERCEPTER FIGHTER-NIK 2 J GEDRGE 21



- A. MAY-OCT 1944 DESIGN MODIFICATIONS OF NIKIJ MADE THE PRODUCTION OF NIK2J IMPOSSIBLE TO FOLLOW THE PLANNED INCREASE.
- 8. DEC. 1944-MAY 1945 DROP IN QUANTITY OF PRODUCTION DUE DISPERSION OF
- G. MAR-MAY 1945 EFFECT DUE TO AIR RAID OF DISAKA AND KOBE
- D. MAY 1945 DROP IN PRODUCTION DUE RAPID DISPERSION.
- E. JUNE 1945 DROP IN PRODUCTION DUE AIR RAID.

GOVERNMENT PLANNED PRODUCTION

INE FISCAL YEAR OF PRODUCTION DATE ALLOCATED

1 ST. OUARTER FISCAL YEAR 19 43

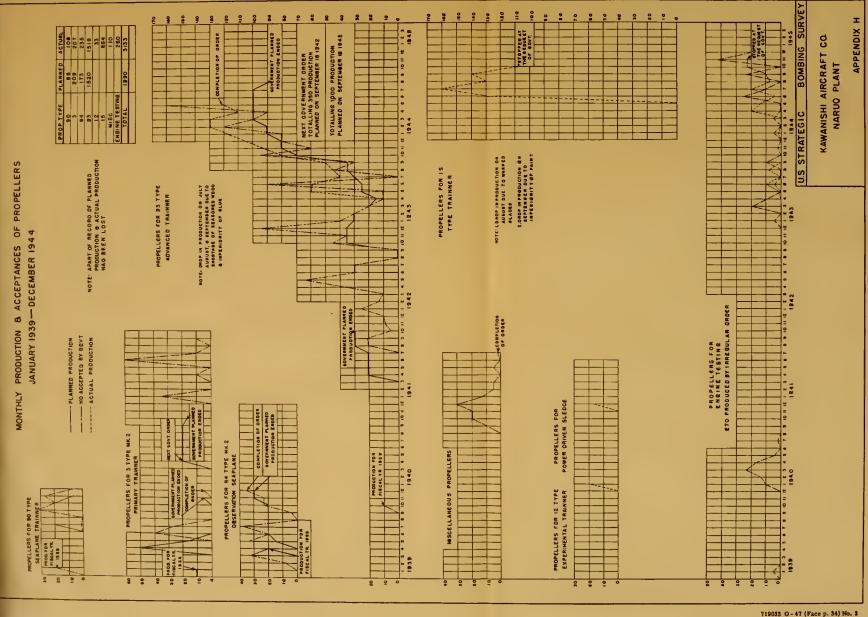
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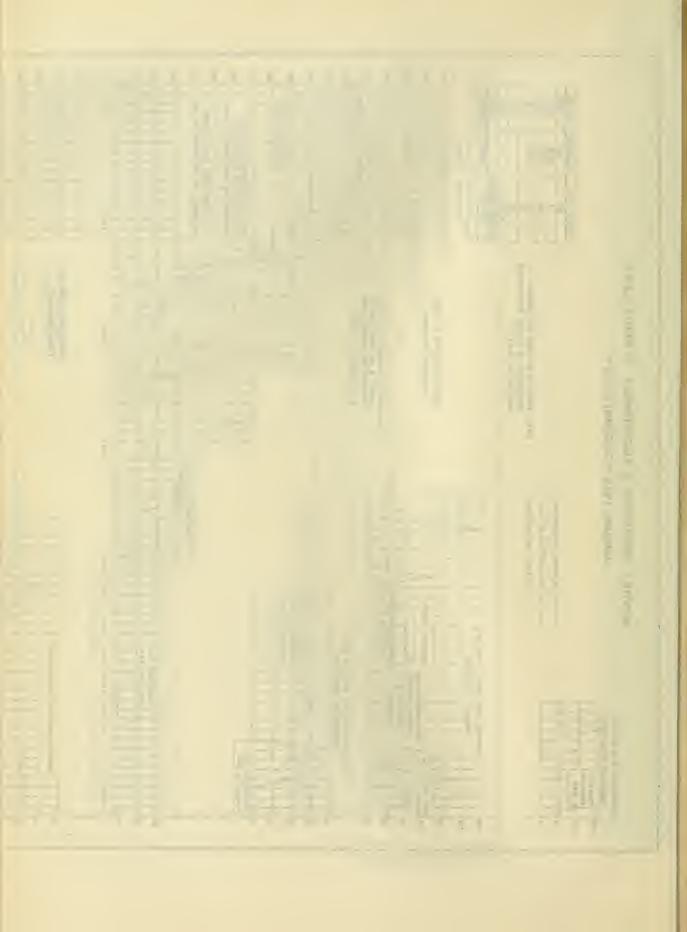
3) LATTERHALF " " JULY "

US STRATEGIC BOMBING SURVEY
KAWANISHI AIRCRAFT COMPANY

APPENDIX 0



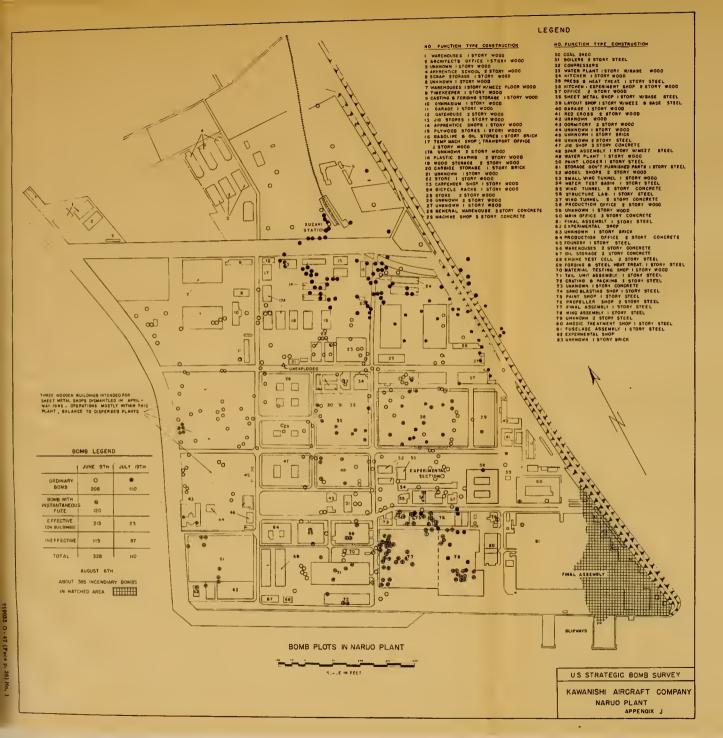




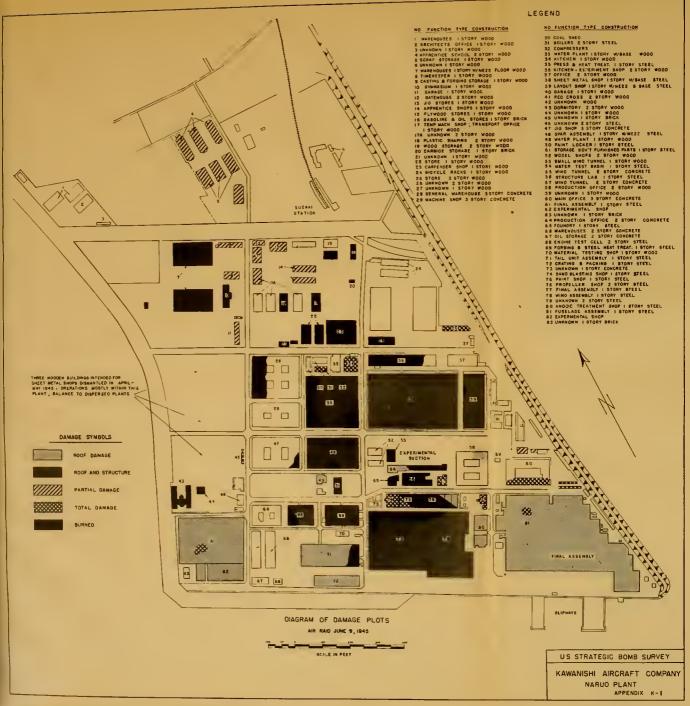
	Total num-		Number		
Year	ber of air- planes to be repaired	Туре	of air- planes repaired	Defective parts	Source
939:	0				
January	1	K11K1	1		Naval Air Arsenal.
Fehruary	2	H6K1	2	Hull	Do.
March	1	K11K1	1	do	Do.
April	0	VIIVI	'	40	Do.
May.	1	H6K1	1	Hull and fuel system	Do.
June	12	H6K1 .	12	Hull	Do.
July	1 12	KIIKI	1	Changing type of engine (motor Zimpu 6 type)	Do.
August September	0	KIIKI			Do.
October	1	H6K1.	1	Hulland equipment	Do.
November	2	H6K1	1	do	Do.
November	-	E13K1	i	Modification	Do.
December	0		1		Do.
940:	0				
January	0		(27 .141 .
February	14	H6K1	1	Modification to transporting flying boat.	Naval Air Arsenal.
		H6K1	6	Wing	Do.
		H6K1	2	Hull.	Do.
		H6K1	3	Repainting of hottom of hull	Do.
		H6K1.	2	Hull	Do,
March	2	H6K2	1	do	Do.
		H6K2	1	do	Naval Aviation Burean.
April	0				
May	. 9	H6K2	9	Repainting of bottom of hull	Naval Air Arsenal.
June	6	H6K2	1	Tail-plane and elevator	Do.
		E7K2	5	Wing	Do.
July	0				
August	2	H6K2	1	Modification of hull and equipment	Nippon Air-Ways Co. Hiro Naval Arsenal.
		H5Y1	1	do	Naval Air Arsenal.
September	3	H6K2	3	Hull	Do.
October	. 5	H6K2.	5	Wing	Do.
November _	32	H6K2	30	Hull	Nippon Air-Ways Co.
D I	00	H6K2		do	Naval Aviation Bureau.
December	22	H6K1.	1	Modification	Naval Air Arsenal.
		H6K2.	3	Overhaul	Do,
		H6K2	17	do	Nippon Air-Ways Co.
941:		H6K2	1	do	Attipon An-ways Co.
January.	2	H6K2	2	Hull	Naval Air Arsenal.
February	0	116K2	_		Navai Mi Mischai.
March .	0				
April .	19	Here	19	Modification of hull	Naval Aviation Bureau.
	19	H6K2		Modification.	Do.
May	19	H6K2	18 1	Hull	Naval Air Arsenal.
June	17	H6K2	17	Modification of hull and repairing	Naval Aviation Bureau.
July	10	H6K2	17	Modification of fight and repairing	
August.	6	H6K2	6	Modification of hull and repairing	Do.
September	29	H6K2	29	do	Do.
Oetober	5	H6K2.	5	do	Do.
	. 3		3		Naval Air Arsenal.
November December	0	H6K2	1	Repairing of bottom of hull.	14dvay III Histian
942:	0				
January_	0				
February	14	H6K2	12	Modification of hull.	Naval Aviation Bureau.
1 Cin uary	1.4	H8K1	2		Naval Air Arsenal.
March	. 1	H8K1	1	Repairing of hull	Do.
April.	0	Hoki	,		
May	. 0				
June	_ 0				
July.	1	H8K1	1	Repairing of hull	Do.
August .	0	HSKI	1	Kepairing of null	200
September	. 0				
October	- 0				
November	1	H8K1.		Repairing of hull	Do.
December					
Decentiol.	- 0				

Appendix I.—Aircraft repairs, Kawanishi Aircraft Co.—Naruo plant—Continued

Year	Total num- ber of air- planes to be repaired	Туре	Number of air- planes repaired	Defective parts	Source
1943:					
January	0				
February	72	H6K2, 4	72	Modification of hull	Naval Aviation Bureau.
March	1	H6K2	I	do	Do.
April	17	H6K2	17	do	Do.
May	0				
June	0				
July	0				
August	0				
September	0				
October	0				
November	38	H8K2	38	Installation of armor plate	Naval Air Arsenal.
* December	9	H8K2	9	do	Do.
1944:					
January	0				
February	0				
March	0				
April	0				
May	16	H8K2	16	Installation of armor plate	Do.
June	3 -	H8K2	2	Repairing of bottom of hull	Do,
		H8K2-L		đo	Do.
July	3	H8K2	3	do	Do.
August	0				
September	3	H8K2.	3	Repairing of bottom of hull	Do.

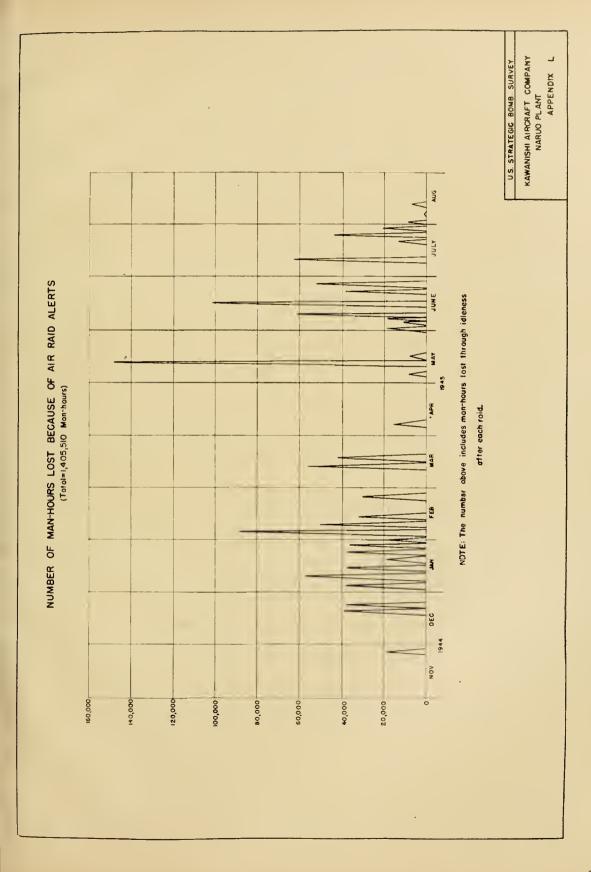


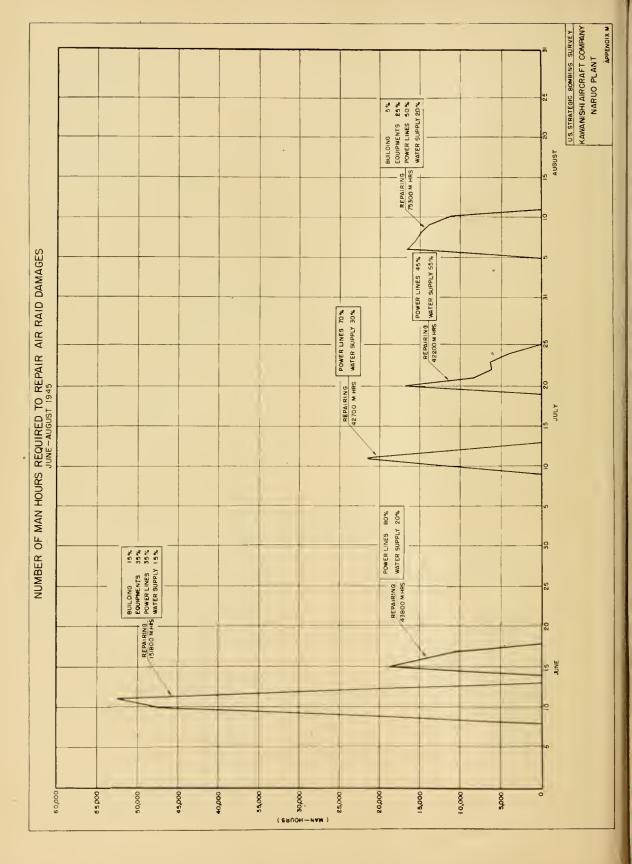


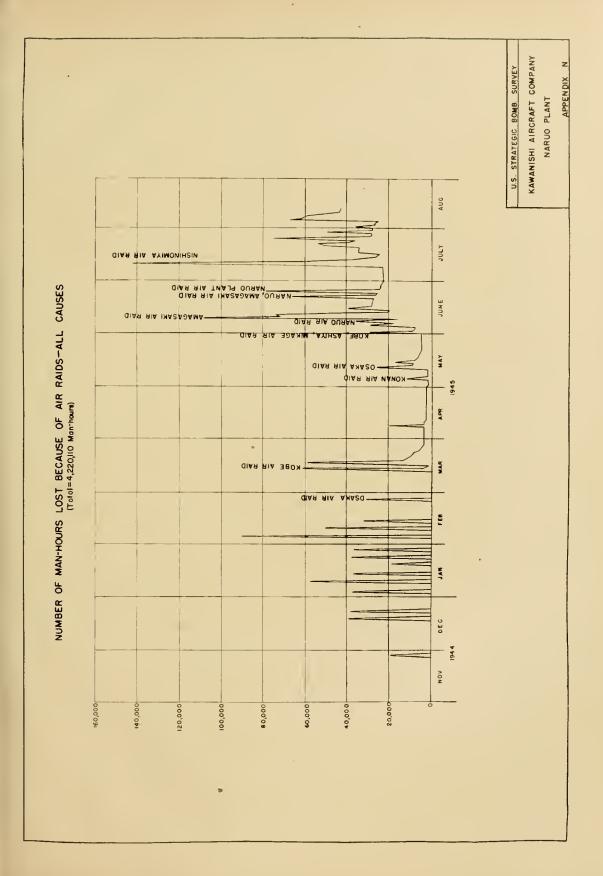


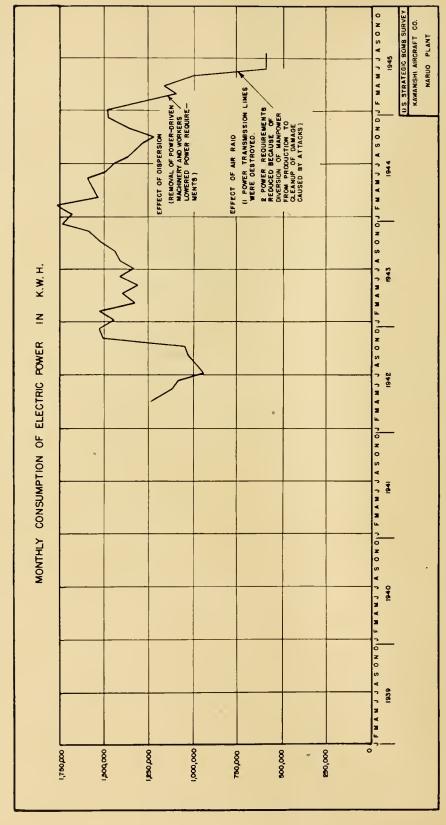












APPENDIX P

Dispersion Plan, Kawanishi Aircraft Co.-Naruo Plant

Dispersion of Naruo plant was started in October 1944 in the following order, but had to be altered often, due to air raids. The program started with precautionary measures against fire bombs, then against small bombs, and finally complete dispersion of production to other locations.

- 1. Removal of small wooden buildings and fixtures.
- 2. Thinning out wooden buildings.
- 3. Dispersion of machines, tools and shop equipment.
- Dispersion of main components for George 21 (N1K2J).
- Dispersion of assembling shops for George 21 (N1K2J).
- 6. Complete removal of wooden buildings.

1-A.—Design Department, Kansai-Gakuin, grounds and buildings (planned)

Name of shop	Protection	Area of building	Planned period	Actually completed
1.5-meter wind tunnel. Underground tunnel to store important gages Wind tunnel for eooling experiment (to test oil cooler, radiators, etc.). Streogth testing shop.	Above ground, camouflaged. Underground. Above ground.	Square feet 4,306 161 18,300	September 1945 July 1945 August 1945	
Storehouses Printing shop		22,766. Undecided	Undecided	

Employees (inclusive of research section, 1st, 2d, 3d design section, and printing shop)

I	Staff	Employees	Students	Girl volun- teer	Naval per- sonnel	Total
	160	252	110	136	0	658 100 percent completed on 15th July 1945.

2-B.—Miscellaneous power-operated machines dispersed

Destination	Number of ma- chines other than machine tools	Period of dispersion	Notes
Himeji plant	112	May 1945	Mostly sheet metal ma- chines including 2,000-ton
Morita Kokukogyo Co. Ltd.	114	Feb. 1945	press. Hand press and power press for extrusions and furnaces.
Hokuriku Kokukogyo Co.	24	Dec. 1944	Sheet metal machines.
Koyoen shop. Tsutsui Kokukogyo Co. Ltd.:	124	Aug. 1945	Do.
Kiyo Hinode Hagoromo Nipponkai Kasumi Miura	1 50	Jan. 1945 Apr. 1945	} Do.

2-C.—Assembly shop.—Fukuchiyama division—Planned monthly production

[No assembly of fuselages, wing and tails was done at Fukuchiyama plant Final assembly of 6 planes in total. Fuselage, wings and tail were mainly sent from Narno plant. A few fuselages were received from subcontractors.]

Planned monthly production	Planned period of maximum pro- duction	Actual produc- tion George N1K2J	
Final assembling	60	October 1945	6
Assembling of fuselages, wings and tail-planes.	40	February 1945	0
Parts	40	August 1945	0

Production at Fukuchiyama—1945

N1K2J	May	June	July	August
George .	1	2	2	1

I Total.

Ground and Buildings (planned)

Name of shops	Construction	Area (square feet)	Planned period to com- plete
Shomeiji	Camouflaged (completed)	103, 011 69, 869	Aug 1945 Aug 1945
Isa .	Camouflaged (completed).	63, 852 11, 840	Ang 1945 Ang 1945 Ang 1945
Total area		248, 572	

Principal machines (planned)

Number	of machines	Desired of		
Planued	Actually completed	Period of dispersion	Notes	
317	125	Aug. 1945	39 percent completed.	

Employees

Planned number	5, 000
Actual number	2,305, 46 percent completed

2-D. Shikoku division-Planned monthly production

Planned monthly production	Planned period of maximum production
Final assembling 50	November 1945.

Note: Assembled two airplanes completed by 24 July 1945, one of which was flown to Naruo plant. A few buildings near the Shikoku airport (naval hangars) were rented and assembly of aircraft was conducted there until the new buildings were completed.

Ground and buildings (planned)

Protection	Area of huildings (square feet)	Planned period	Actually completed
Camouflaged	46, 285 7, 104 6, 351	August 1945	Percent 0 0 0 0
Total	59, 740	August 1945	0

Principal machines (planned); no machine tools at Shikoku

Number of machines	Planned period	Actually completed
16	August 1945	0 percent.

Employees (planned)

	Staff	Em- ployees	Stu- dents	Girl volun- teers	Naval per- sonnel	Total notes
Planned	200 20	400	350	50	420	1, 0 42 percer

Note.—Shipping for Shikoku district was extremely bad because of $\mathfrak t$ raids and mines.

2-E.—Other contemplated destinations,—Sakasegawa she (not started)—Planned production

* Monthly production			Period of maxi
	Products	Amount	mum production
Steel parts		40	September 1945.

Ground and buildings (planned)

Protection	Arca (square Ieet)	Note
Under contemplation	11, 733	Completed in September II

Principal machines (planned)

Destination	Number of machines	Period of dispersion	Note
Sakasegawa shop	48	September 1945.	Not star

Note.—The ground was still being negotiated for and the detailed pla employment was not decided upon. Planned transportation consisted ϵ trucks.

Mukogawa shop-planned production (not in production

Monthly production (planned)	Period or plan	
Products Number (plauned)		maximum duction
Final assembling of fuselage	50	August 1945,

Ground and buildings (planned)

Protection	Area (square feet)	Note
Temporary house in forests	2, 637	20 percent completed at end of war.

No special machines were necessary,

Employees (planned)

Staff	Employee	Total
3	200	203

out 30 trucks were considered to be necessary transportation.

Koyoen shop—Planned production

the end of the war production had not started. Production was to be ed by the end of August after complete installation of machines, emes, and material.]

Monthly production	Period to acquire		
Product	Amount	the planned ability	
metal parts	60	August 1945.	

Ground and buildings (planned)

Protection	Area (square feet)	Note
rground ouflaged with soil ouflaged with other methods r contemplation	7, 804 11, 733 4, 575 3, 229	90 percent completed. 100 percent completed. Not started. Do.

Principal machines (planned)

	Number o	f machines	Period of	Note	
Destination	Planned	Com- pleted	dispersion		
Doyoen shop	211	160	August 1945	76 percent com- pleted.	

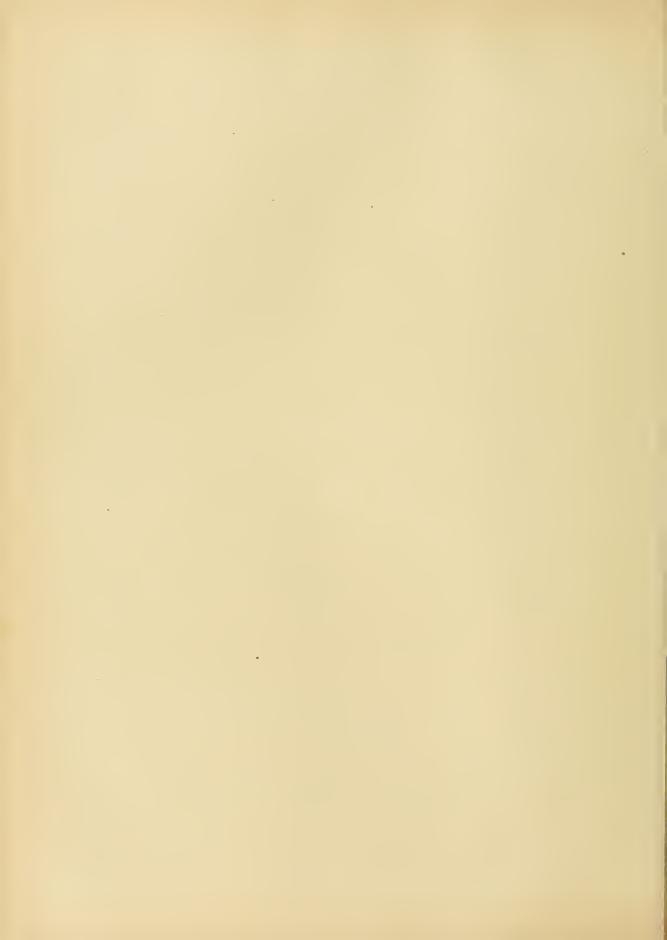
Employees (planned)

	Finisher		Girl yeal	Naval	Total		
Staff	Employ- ees Students	Girl vol- noteers	person- nel	Planned	Com- pleted		
30	1.750	50	50	0	1, 880	0	

 $775\ \mathrm{trucks}$ were planned for the transportation of machines, tools, material, etc.

Drop in productive ability due to dispersion—May 1945

	Monthly ity		Destination	Plan o ed	Actual	
	Planned	Actual		monthly		
Narno (no dispersion).	190		Naruo Fukuchiyama	80 60	(50) (20)	
			Shikoku	50	(10)	
Total	190	(120)		190	(90)	



KONAN PLANT REPORT NO. III-2

(Air Frames)

Dates of Survey, 22-24 October 1945

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THE PLANT AND ITS FUNCTION IN THE AIRCRAFT INDUSTRY

troduction

The Konan or Fukae plant (Konan Seisakuo), one of the four largest plants of the Kawanii Aircraft Co. (Kawanishi Kokuki Kabushiki
uisha), was located at Honjo village, 15 miles
st of Osaka. The plant consisted of 40 buildgs and over 30 dormitories. Total building
a of the Konan plant was 1,994,785 square
t, of which 1,070,000 square feet was devoted
direct production and 924,785 square feet was
lized for indirect labor. The plant, conucted in February 1942, comprised main
ildings of modern structural steel design. The
ido Seiki Industrial Co. in Kobe, which

machined air-frame parts, was acquired in December 1943.

This plant was one of three, belonging to the Kawanishi Aircraft Co., which assembled planes. The Kawanishi Aircraft Co. was founded in 1928 as a producer of seaplanes. The company grew and moved to Naruo village in 1930 to build air frames for various types of seaplanes, including large, four-engine transport planes. (For detailed history, see Aircraft Division Corporation Report No. III of the Kawanishi Aircraft Co.) In February 1942, at the request of the Japanese Navy, the Konan plant was established to build large seaplanes. In June 1944 the Konan plant

started production of Frances, a two-engine medium bomber.

Government aid to the Konan plant took the following form:

Facility:			Yen
Buildings			22, 400, 000
231 presses, furnaces, tran	sformers	s, sheet-	
metal machine, etc			1, 606, 000
52 machine tools			229,000
		-	
Total			24, 235, 000

Plant Organization and Operation.

The Kawanishi Aircraft Co. was managed by the following officers:

Ryuzo Kawanishi	President.
Kenji Maebara	Vice president.
Shiro Takahashi	Managing director.
Yoshio Hashiguehi	Chief engineer.
Sakae Hamada	Plant manager of Konan
	plant.

Plant responsibilities were delegated to other key personnel (appendix A).

The Konan plant, designed for production of large four-engine seaplanes, was located at the edge of a bay, and had two large slipways, but no airfield nearby. All land-based planes were ferried by barge 3 miles across the bay to the airfield at the Naruo plant of the Kawanishi Aircraft Co. The Konan plant was ideally organized for mass production (appendix B). The general arrangement of the plant made for efficient use of floor space.

Total employment showed a consistent rising trend. At the end of 1942 it was 2,000, growing to 5,050 at the 1943 year end. At the peak, in November 1944, employment totaled 7,900, decreasing to 7,500 as the war ended (appendix C). The total number of men engaged in direct labor accounted for the bulk of the employees. Men workers aggregated 2,000 at the 1942 year end, increasing to 4,000 a year later, and remaining above the 4,500 level until the end.

Students first began working at the Konan plant in May 1944, when 232 were employed. Girl volunteer workers first were employed in February 1944, when 354 were hired. Very few military personnel were employed at Konan, the first few being employed in June 1945.

One 10-hour shift worked until February 1944, when a second 8-hour shift was added. In December 1944 the plant went back to one 10-hour shift.

Total maximum man-hours were projected at

2,050,000 for March 1945. This was never a tained as actual man-hours worked totaled on 1,425,000 for that month. Planned schedul were never approached from August 1942 (appendix D).

Production Statistics

All production was for the Navy. Production H8K2, Emily 12, a four-engine flying bostarted in February 1943 when 63 air fram were produced. During 1944, 77 air frames we built, and in 1945, when production of this ty ceased, only 10 air frames were manufactured.

Production of H8K2=L, Emily 32, a four-engiflying boat which was a modification of Emily 1 started in November 1943 during which year fi air frames were manufactured. During 1944 were produced. Since production of this type aircraft was discontinued, only five airfrant were built during 1945.

Manufacture of both the above types of a craft was discontinued in favor of P1Y2S, Francisco 11, a twin-engine bomber, which started into p duction in June 1944. The Government plan production for 1944 was 162 aircraft, but the pla produced only 28 because of the difficulty changing over from one type to another. T Government plan for 1944 to the end of the v called for 605; the total aircraft produced v only 94. During 1945, only 66 aircraft were p duced while the Government plan was 4 Production was gradually increasing until the attack of 11 May 1945, which arrested manuf turing. It continued to drop after the 5 Ju 1945 attack until only one aircraft was produduring August.

The following is a list of planes produced si 1942:

Japanese code No.	Allied code name	Type of aircraft	To num prod
H8K3 H8K2 H8K2L	Emily 12 Emily 32	4-engine flying boat do do 2-engine medium bomber.	
Total air-frame production			

Government-planned production was net reached for the P1Y2 or Frances 11. A total 77 planes was projected for March 1945 but o 11 were produced (appendix E).

AIR DATA

	Date and hour of attack	11May 1945	5 June 1945	6 Ang. 1945 (
	Intelligence data			
A 40	ration acking unit itude	20th Air Force		
denta a	mber of aircraft over target Number, weight, and type Fuzing	461 500-pound 1400 nose; noudelay		
	Number, weight, and type On-the-ground findings	tail.		
Appe	Number in plant area. Number of building hits Number of UXB	96		

No information available.

EFFECTS OF BOMBING

rect Attacks

The first air attack occurred at 0954 hours, 11 ay 1945, when 1,838 500-pound bombs were opped. Seventy-one of these dropped in the unt, 56 falling on factory buildings. A total of bombs (40 direct hits) fell on the dormitories jacent to the plant.

The bombing on 11 May 1945 caused extensive mage (appendixes F and G). The fuselage sembly building was totally destroyed and the sembly of fuselages was transferred to building b. 4, wing assembly building. The four apentice shops were completely destroyed as well the tool shop, propeller assembly shop, and the int and medical store shop. About 70 percent the dormitories were destroyed. The wing sembly building, hangar, and heat-treating shop re partially damaged. The final assembly shop d only slight roof and glass damage. Because this attack, all but 13 of 234 machine tools re removed from the plant for repair, and of ese machine tools, 11 were totally destroyed. Le machine tools never were returned to the bnan plant, but were rented to about 10 subatractors in the Kobe-Osaka area.

On 5 June 1945, during an air attack on the is a near the Konan plant, a few incendiary onbs dropped on the plant. Slight roof damage is sustained on the final assembly building and aport control room in the plant, and the remains dormitories were burned (appendix H).

The last attack, 6 August 1945, was also an a attack, during which five HE's and a few rendiary bombs were dropped. HE bombs fell

on the air-compressor shop, boiler room and water-pumping station, destroying both, and causing a complete shut-down of the plant. The employees' dining room and hospital, as well as a garage and warehouse for Government-furnished equipment, were destroyed. Few buildings were repaired. A total of 202,400 man-hours were used to repair damage. The greatest amount of time was used to repair damaged power lines and the water-supply system. Very little time was spent repairing buildings. Temporary roofs were constructed under the damaged roofs which were left as they were. All the assembly work was performed there. The photographs (photos 1-5) show the amount of damage after all air attacks.

A total of 2,530,000 man-hours, or 44 percent of the total man-hours worked, was lost because of all attacks (appendix I).

During the attack of 11 May 1945, 160 employees were killed and 105 were wounded. In the 5 June 1945 attack, 15 employees were killed and 8 wounded and in the last attack, 9 were killed and 4 wounded.

Counter-Measures

In order to minimize the damage and to control the fire expected after an air attack, a few of the least essential buildings, warehouses, and dining rooms were dismantled. This removed fire hazards and provided ample space to be used as a firebreak between buildings.

In the air attack precaution system, alerts were telephoned through a direct-communication line from the Osaka naval garrison and headquarters of the Middle Area Army. Alerts were given to the plant by sirens. Instructions were delivered by public-address system, throughout the plant, for everyone to take his prearranged position. Two observation posts, manned by 10 men each, were situated on the plant roof top. Evacuation of the plant employees was carried out on the decision of the chief of the plant-defense party and in the order of women, apprentices, students, and men employees.

The fire-precaution system consisted of 20 regular firemen, 448 auxiliary firemen, 3 fire engines, 54 water hydrants, 12 static-water tanks and 1 siren. Within the plant there were air-raid shelters for 4,000 employees, while outside, a 20-minute walk from the plant, were air-raid shelters for 18,000 employees. An underground control station equipped with direct-telephone communication to observation posts, substation

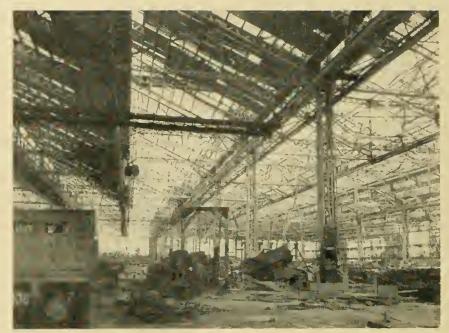


Photo No. 1.—Building 4, wing assembly shop. View interior, looking west in subassembly building. Slight roof damage.

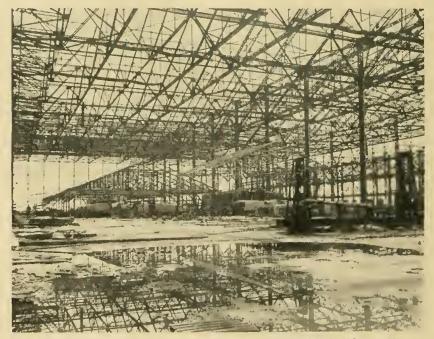


Photo No. 2.—Building 3, fuselage and wing assembly building. View southeast, showing slight superficial damage.



Photo No. 3.—Building 3, wing and fuselage assembly building. View north end looking west, showing slight superficial damage.

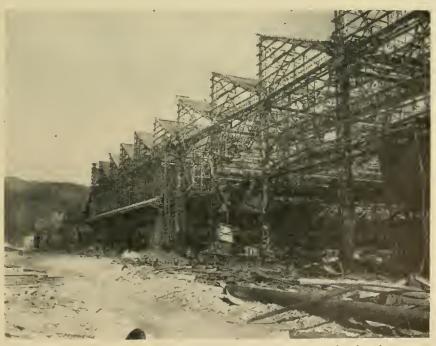


Photo No. 4.—Building 1, final assembly building. View north, showing superficial damage.



Photo No. 5.—Building 1, final assembly building. View interior, looking northwest, showing assembly lines and slight roof and glass damage.

in the plant, the Osaka naval garrison, police station, military police, fire station, public-address system, and radio room was constantly manned. A total of 266 employees was used in the air attack precaution and defense system.

Interruption Due to Alerts

A total of 370,902 man-hours was lost because of air-raid alerts from November 1944 to the end of the war (appendix J).

Interruptions Due to Direct Attack and Area Attacks

There were 3,103,300 man-hours lost because of air raids from November 1944 to August 1945 (appendix K). The greatest loss was in May 1945 as a result of the direct attack on the Konan plant.

Electric-power consumption was close to capatry from August 1943, when 1,040 kilowatts we used, with a capacity of 1,300 kilowatts, to Ma 1944. After May 1944, kilowatt consumptic dropped (appendix L).

Interruptions Due to Suppliers

In the production of Emily, a shortage of rubbe sheeting for bulletproof fuel tanks, supplied be Fujimura Industries (Fujimura Kogyo), was experienced in the middle of 1943. During 194 there was a shortage of waterproof paint from the Toa refinery (Toa Seiren).

During 1944 a shortage existed in springs supplied by Taisei Spring Co. (Taisei Hatsujyo), rubber parts from Nichirin Rubber Co. (Nichir Gomu), and in small aircraft parts supplied by

ther plants of the Kawanishi Aircraft Co. These parts were used in manufacturing Frances.

During 1945, in the production of Emily, a nortage existed in bomb-bay doors supplied by eiki Air Industries Co. (Seiki Koku), engine eds from Takata Aluminum Co., oxygen suplied by the Imperial Oxygen Co. (Teikoku anso), and many small air-frame parts supplied y many producers.

)ispersal

Dispersion was started in December 1944 by toving raw material and component parts to thools and other buildings near the Konan plant. The dispersion of component parts assembly and

final assembly was delayed in order to find suitable locations.

The dispersal of production was divided into five phases. Dispersal of raw materials, machine tools, and jigs to various schools and shops; final assembly to buildings of the Matsushita Aircraft Co. near the Tatetsu Airport; machine shop to part of the second floor and basement of the Hankyu Building, Osaka; sheet-metal shop to Yama Ashiya; fitting shop to buildings and tunnels in the hills near Kurakuen (appendixes M and N). It was estimated that a production loss of 20 percent was caused by dispersion alone. Table 1 presents the production-dispersal program of the Konan plant.

Table 1.—Dispersal of aircraft manufacture

Type of work	Period of dispersal	Location	Total area (square feet)	Number of machine tools	Products	Extent of completion
aw materials and ma-	November 1944- May 1945.	See appendix O				Completed,
nal assembly	April-May 1945	Matsushita Aircraft Co., Tatetsu Airport, Osaka,	11, 625		Aircraft assembly	1 plane assembled; 1 plane partially assembled.
achine shop	May-June 1945	Umeda branch, second floor and basement of Hankyn Building, Osaka.	15, 070	132	Machined parts .	Completed.
eet metal	April 1945	Yama Ashiya	31, 216	84	Sheet-metal parts	Not completed.
tting shop	.do	Sheds and tunnel in hills around Kurakuen.	223, 892	209	Fittings for jigs	25 percent completed.

INTELLIGENCE CHECK

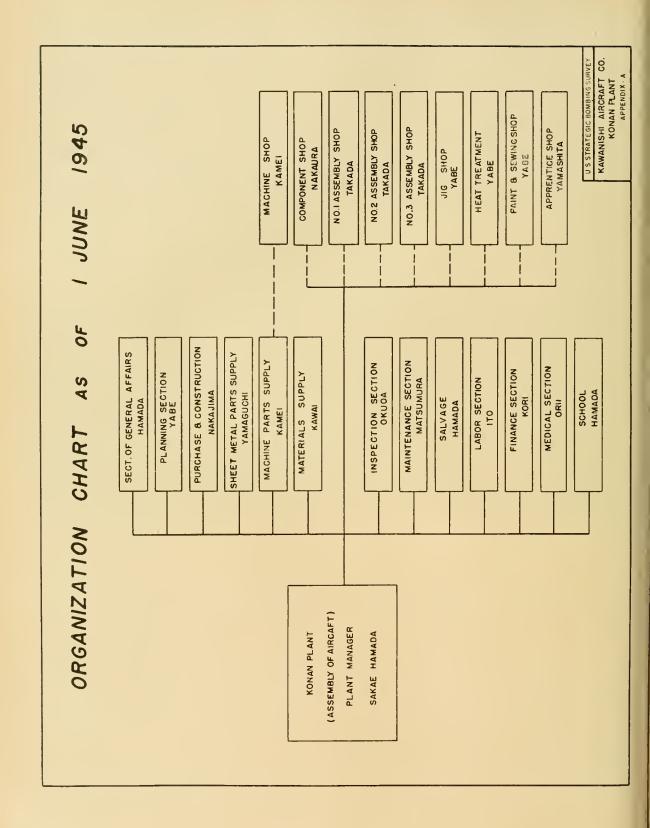
Military intelligence information on the producon of Emily at the Konan plant was quite ecurate, as can be seen by the following yearly abulation of production:

1	Year	Actual pro- duction	Military Intelligence Service
K	3	68	72
K	4	109	96
Ì	5	15	22
	Total.	192	190

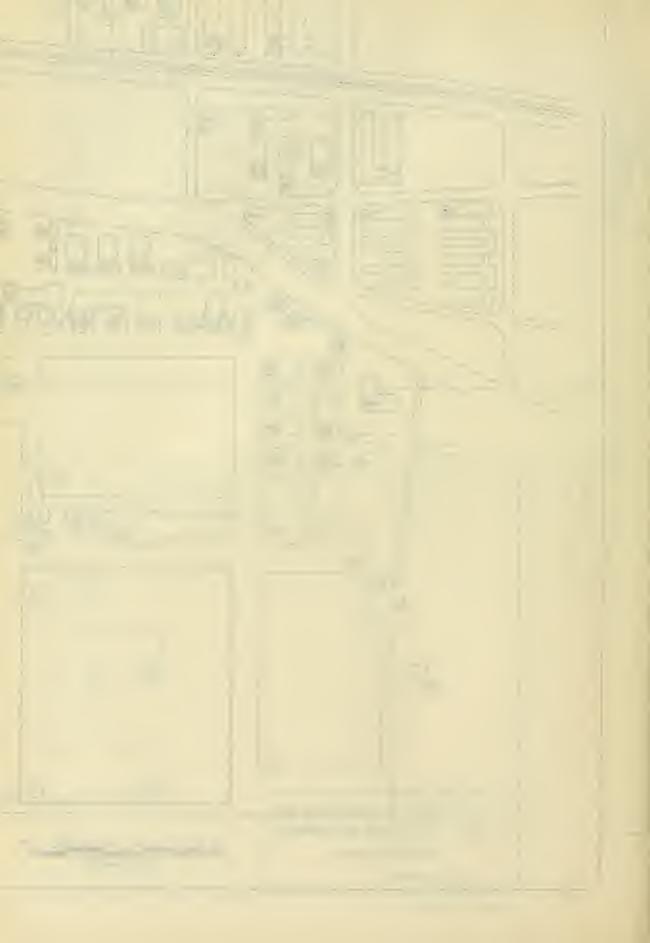
The intelligence information on Frances was not accurate, since there was a 25 percent overestiate of total actual production. The following

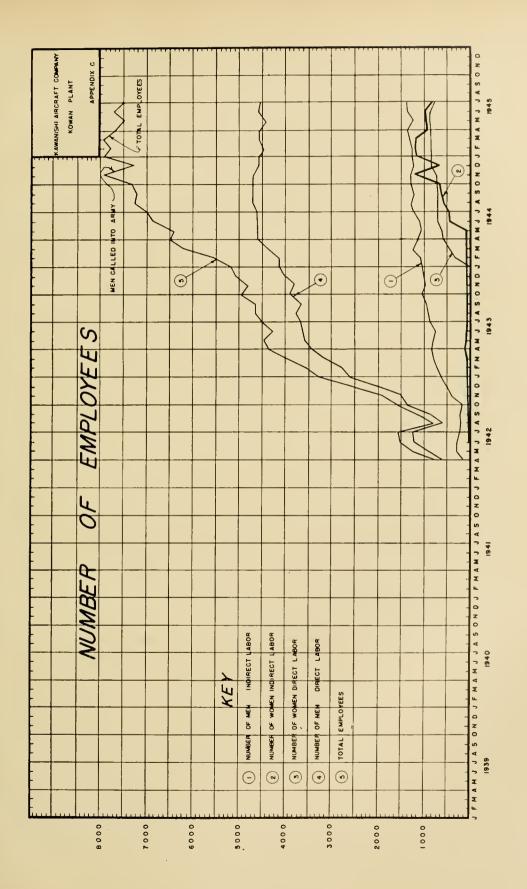
tabulation gives the intelligence monthly estimated production and the actual monthly production:

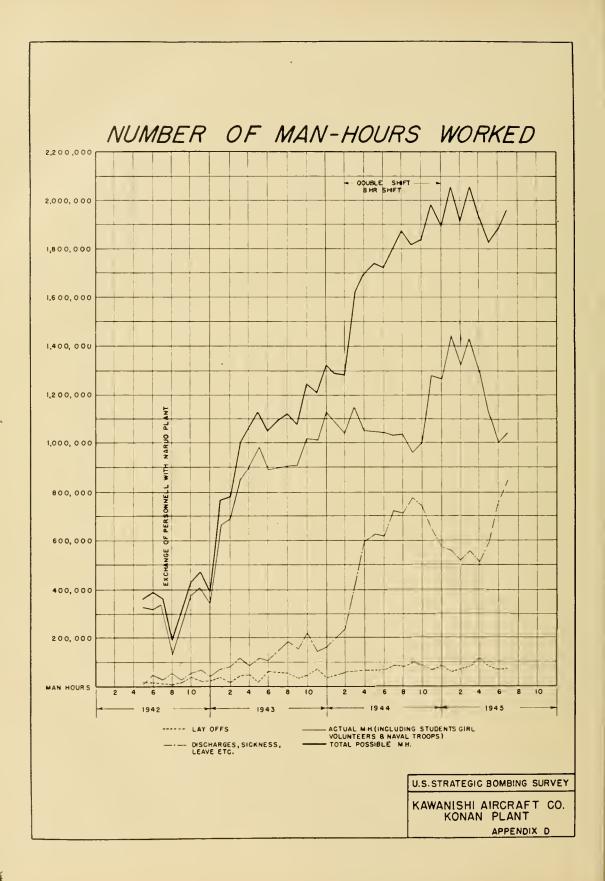
Year	Estimated production	Actual pro- duction
1944;		
June		
July		
August		
September		;
October		
November	15	
December	20	10
945:		
January.	10	10
February	10	1
March	14	
April	20	1.
May	14	
June	15	
July		
August		
Total	118	9

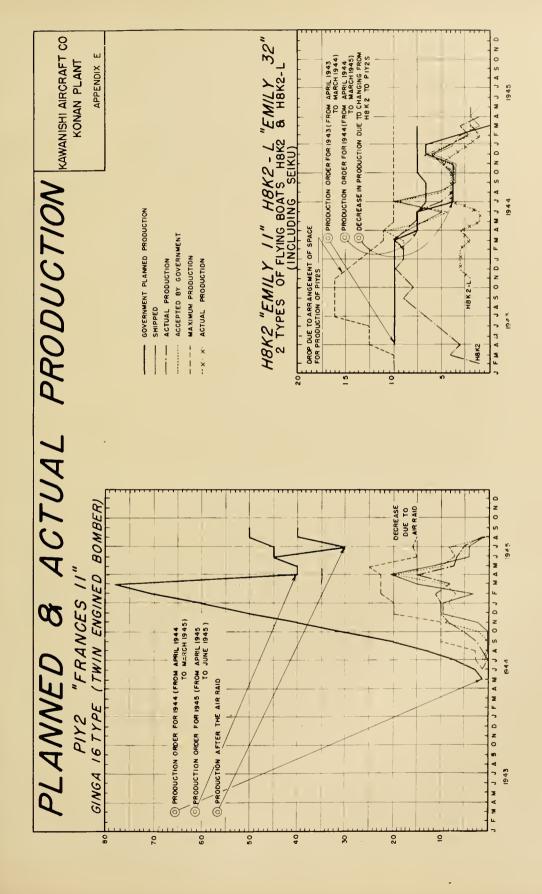


PLANT LAYOUT KEY TO BUILDINGS NO NAME OF BUILDING 38 APPRENTICE SHOP 39 APPRENTICE SHOP 40 APPRENTICE SCHOOL 41 AIR COMPRESSOR ROOM 42 AIR COMPRESSOR ROOM 43 JETTY 44 JETTY 45 GARAGE FOR TRUCK 46 GARAGE FOR FIRE ENGINE 47 HEAT TREATMENT SHOP NO NAME OF BUILDING I FINAL ASSEMBLY SHOP 2 HANGAR FUSELAGE ASSEMBLY SHOP WING ASSEMBLY SHOP PAINT SHOP STORE (GOVERNMENT FURNISHED STORE(GOVERNMENT FURNISHED PARTS) TOOL SHOP WAREHOUSE WAREHOUSE HEAT TREATMENT SHOP TELEPHONE EXCHANGE ROOM TELEPHONE EXCHANGE ROC TIME KEEPER CARPENTER SHOP SCRAP STORAGE REPAIR SHOP PROVISION STORE PROVISION STORE KITCHEN & BOILEN ROOM MITGHEN WAREHOUSE WAREHOUSE WAREHOUSE WAREHOUSE WEIGHING ROOM PAINT & MEDICINE STORE GARAGE FOR TRACTOR AIRPORT CONTROLLING ROOM PILOTS OFFICE BOILER ROOM WINCH HOUSE SLIP WAY SLIP WAY MESS ROOM NESS ROOM FIRST CORNITORY TEMPORARY BOILER ROOM SECOND CORNITORY TEMPONANT BOILER NOON SUB STATION WATER PLANT MESS ROOM MESS ROOM MESS ROOM MAIN OFFICE ELECTRIC SHOP PROPELLER ASSEMBLY SHOP GARAGE ELRED OFFICE 64 THIRO CORMITORY 65 FOURTH DORMITORY 66 FIFTH CORMITORY SIXTH DORMITORY SEVENTH CORMITORY EIGHTH CORMITORY NINTH CORMITORY TENTH CORMITORY **™** ELEVENTH CORNITORY KITCHEN STORE 33 GUARO OFFICE GATE HOUSE APPRENTICE SHOP PLANT AREA ---- 2,146,471 SQ FT. BUILDING AREA -- 1,994,784 SQ FT [0] (@ LEGEND: 43 (T) PULLED DOWN FOR DISPERSION 48 @ 26 **(6)** • 42 **17** 2 3 (24) (22) **4** 3 1 23 U.S. STRATEGIC BOMBING SURVEY KAWANISHI AIRCRAFT KONAN PLANT SCALE IN FEET APPENDIX-B





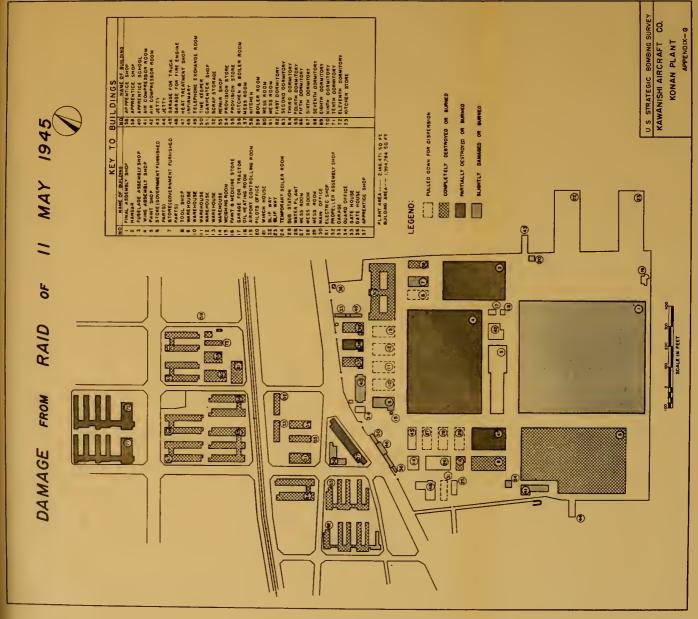




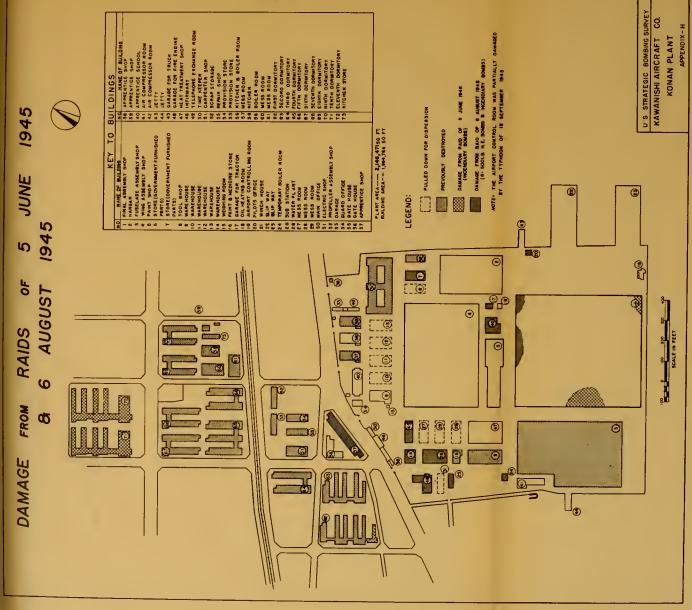




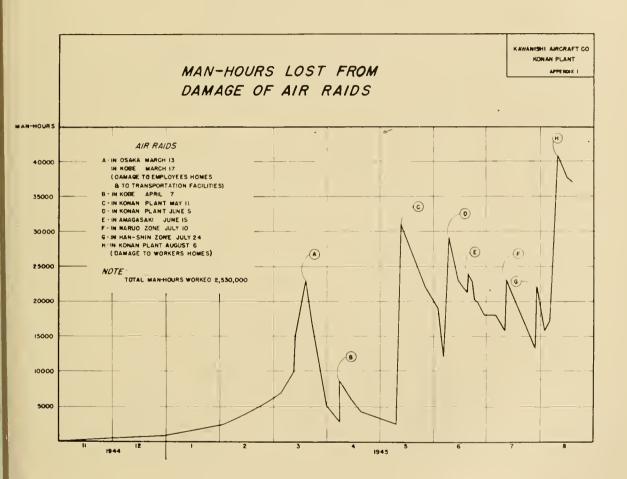


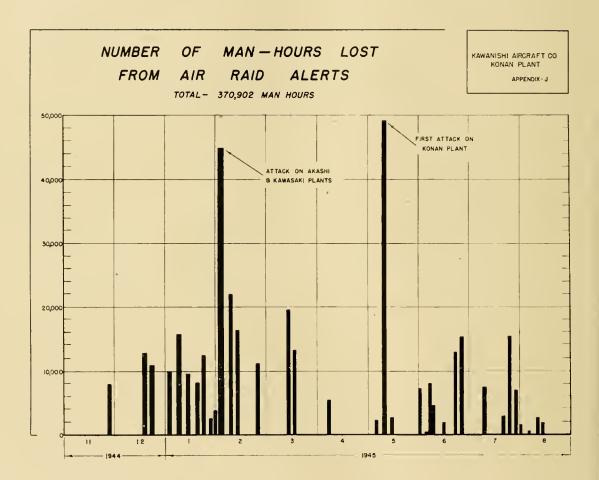


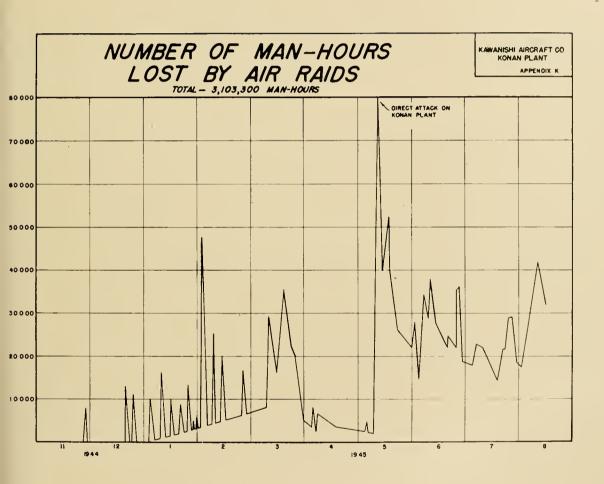


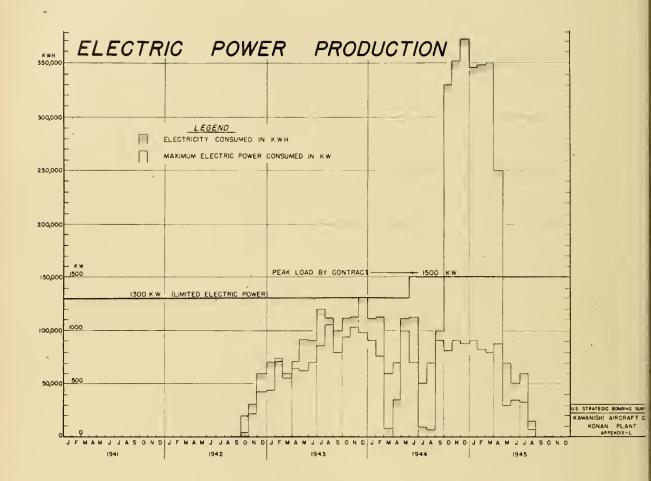


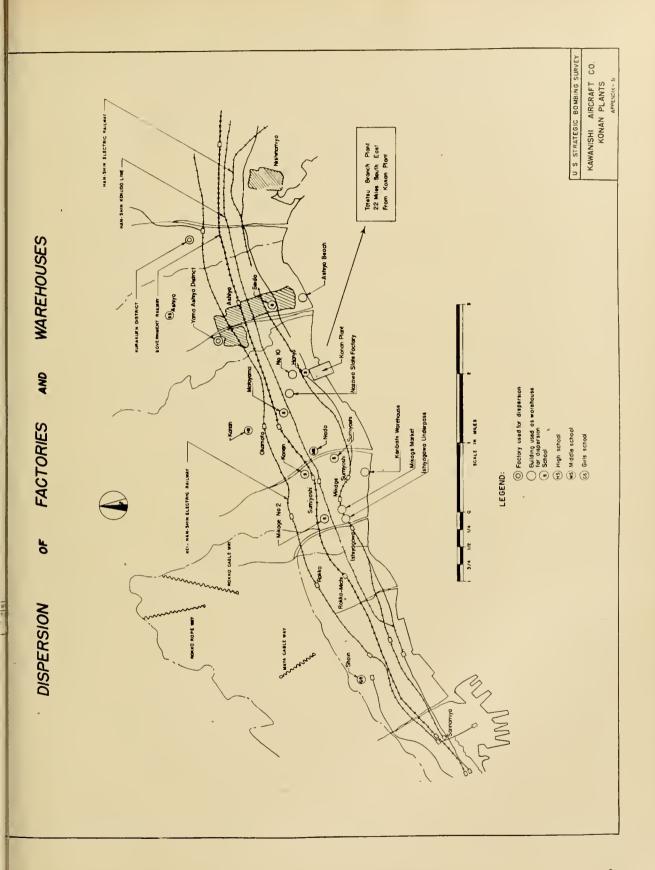












APPENDIX N

DISPERSAL OF PRODUCTION

Dispersion started in December 1944 by moving raw materials and purchased parts to schools and other buildings near the Konan plant, which dispersal was finished by May 1945.

Dispersion of assembly and of component shops was delayed in order to find suitable locations, but by May 1945 dispersion was carried out as shown below.

Original location	Destination	Period of dis- persion	Note
Raw material and purchased parts.		Nov. 1944- May 1945.	Completed as planned.
Final assembling shop.	Matsushita's A/C Co.shop, Tatetsu.	April - May 1945.	Completed as planned. 1 plane assembled; 1 plane part assembled.
Machine shop	Hankyu Bidg., Umeda, Osaka.	Мау-Јипе 1945,	Completed.
Sheet metal shop.	Yamaashiya	Started April 1945.	Machines other than machine tools were moved.
Fitting shop	Kurakuen	do	Only 25 percent of building crection finished.

Raw materials and purchased components were dispersed as follows:

Destination	Article dispersed	Quantity
Honjo Primary School.	Steel tube	6 tons.
Seido Primary School	Light alloy sheets	35 tons.
Do	Fabries	6 tons.
No. 10 dormitory garden.	Forged aluminum parts	13 tons.
Nozawa Slate Shop	Steel and aluminum sheet.	79 tons.
Motoyama Second Primary School.	do	60 tons.
Konan High School	do	74 tons,
Do	Paint	46 tons.
Nada Middle School	Wire	114 miles.
Mikage Second Normal School .	Steel tube, aluminum sheet	26 tons.
Mikage Market	Steel tube, aluminum tube	39 tons.
Sumiyoshi Primary School	do	11 tons.

Machine tools, tools, and jigs, etc., includi government-furnished parts, were dispersed follows:

Destination	Article dispersed
Shop near Ashiya Beach. Ashiya Girl's High School. Motoyama Second School. Nada Middle School. Konan Primary School. Mikage Second Normal School Under elevated railway, Ishiya- gawa. Mikage Market Kenhishi warehouse Under elevated railway. Final assembly shop (Tatetsu branch plant).	7 sets gages for jigs.

A part of the final-assembly buildings plam for dispersion were to be earth-covered shops n Tatetsu Airport, Osaka. While these shops w being constructed, a few buildings of the M sushita Aircraft Co. were used. At a later d the Government requested that the project abandoned.

Description of the plant (planned) as below

	Planned	First plan, actual completed		
Location	Shizo-mura, Nakaka- wachi-gun, Osaka-fu.	Completed.		
Planned monthly pro- duction.	15 airplanes	1 assembled; 1 par assembled.		
Type of production	Final assembling			
Buildings	8 earth-covered sheds, 11,625 square feet.	2 buildings of M shita Aircraft Co.		
Ground	213,127 square feet	1 air compressor.		

Note.—Period of first plan, May-June 1945.

HIMEJI PLANT REPORT NO 111-3

(Air Frames)

Dates of survey, 27-29 October 1945

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THE PLANT AND ITS FUNCTION IN THE AIRCRAFT INDUSTRY

roduction

The Himeji plant (Himeji Seisakusho) of the twanishi Aircraft Co. (Kawanishi Kokuki Kabuki Kaisha) was located about 45 miles west of the and about 15 miles from the Inland Sea. It is plant itself was in the city of Himeji, a edium-sized, semi-industrial city. The building of the factory was 1,431,722 square feet, ich consisted of 572,690 square feet of producte floor area, and 859,032 square feet of wareluses, service facilities, and office space. There are 32 buildings, 29 of brick and wood construction, and 3 modern steel-frame structures.

The Himeji plant was one of three final-assembly this of the Kawanishi Aircraft Co., and functed in that category until 9 July 1945, when Kawanishi properties were taken over by the panese Navy. At that time it became the orth plant of the Second Munitions Arsenal. Iring the naval regime no change was made in plant's management. At the end of the war properties were returned to the company.

The brick and wood buildings, which comprised the nucleus of the plant, were originally a woolen mill, purchased in July 1942. The three new buildings of modern construction, built shortly thereafter, were used as a final-assembly shop, a sheet-metal shop, and the third for storage of spares. They totaled 168,000 square feet in area. A branch plant of this organization was established in April 1945 at Uzurano. It was adjacent to the airport, 10 miles northeast of the main plant site. This branch plant consisted of 104,680 square feet and was originally intended as a flight-preparation shop.

Himeji produced only George fighters (N1K1-J and N1K2-J), with the Homare model 20 and model 21 engine, rated at 1,970 horsepower takeoff. All work at the plant was done on this Navy plane.

Organization and Operation

General manager of this organization was Mitsuo Suehisa, reporting directly to the president of the company, who was located at Naruo. The almost complete destruction of the plant made it impossible to judge its production methods. However, with converted facilities and only 9,000 workers, it was able to attain an average production of 25 air frames per month. Conventional organization methods prevailed in the production of aircraft (fig. 1).

FIGURE 1.—Himeji Plant—Organization chart, July 1945
Himeji plant, assembly of aircraft; plant manager Mitsuo Suehisa.

General affairs

Management, Masumi.
Material supply, Utsumi.
Inspection, Sasaki.
Scrap utilizing, Utsumi.
Labor, Aoyama.
Financial, Umetani.
Medical, Ota.
Private school, Saito.
Hospital, Ota.
Uzurano plant, Hirata.
Component shop, Kubo.
Machine shop, Matsumoto.

affairs
Component parts assembly
Sugihara.
Rigging shop, Kakiuchi.
Final-assembly shop, Tak ahashi.
Jig shop, Matsumoto.
Carpenter shop, Katsumura.
Heat-treatment shop, Naka-

Paint and sewing shop, Nakajima.

Apprentice school, Nakata.

. . .

Employment

The Himeji plant, although located in a medium-sized, semi-industrial city, was largely dependent for its labor on the rural population. Absenteeism reached 30 percent during the spring and fall months of 1944. Discharges and sickness during 1944, when the plant was reaching its production peak, averaged about 10 percent.

Plant officials said that their organization started with only 5 percent trained labor, taken from the Naruo plant. They stated that it took 1 year to recruit a minimum labor force, and train them into even a semblance of a production organization. The first large group of new employees was engaged in May 1943 when 1,000 were hired. In January 1944, 1,090 additional persons were employed in expectation of a mass production of George N1K1-J. The peak of new employment was reached in April 1944, when 1,290 new apprentices were engaged. The last large group of new employees entered the Himeji plant in January 1945, when 1,180 persons were employed in anticipation of mass production of the improved George N1K2-J (appendix A). Women constituted one-third of the plant's total employment, a slight majority being used in direct-labor activities.

The plant's employment broke down to about 2 to 1, direct labor workers over indirect. Among

the indirect-labor workers were 1,400 girl voluteers and students. The students divided a 9-hourday about equally between academic students and apprentice work in the plant. Although the plant felt seasonal surges of absenteeism through its 3-year history, the worst occurred in May 19 when there was an almost wholesale desertion the return to the farms. Throughout the war to plant worked one 10-hour shift (appendix B).

All told, there were 32,050,000 man-how worked at the Himeji plant. This was repsented by 930,000 during 1942, when the plant firstarted operations; 5,820,000 in 1943; 17,530,00 in 1944; and only 7,770,000 in 1945 up to the titof the bombing attack (appendix C).

Material and Components

Shortages of aluminum extrusions and sh stock, as well as shortages of forgings and caings, were experienced throughout 1944 and 19 Steel forgings were also in short supply.

During May 1944 a shortage of Momare engifrom the Eleventh Naval Arsenal at Hiro cause temporary sag in deliveries for the month. Shoages of magnetos, fuel pumps, and piston hewere, in turn, responsible for the engine shorta

During the early months of 1945, the Kay: Co. of Tokyo failed in making deliveries of la ing-gear assemblies, accentuating the product drop during this period.

There is no record of the use of substitute marials at this plant. In August 1945, however, a dispersion measure, the Himeji organizat was in the process of acquiring a large plyweeompany.

Production Statistics

During the war the plant produced 510 fight planes, Georges N1K1-J and N1K2-J. 5 Government-planned production from the beg ning of operations at the Himeji plant to the confidence of the war was projected at 683 planes. This value of the war was projected at 683 planes. This value of the war was projected at 683 planes. This value of the war was projected at 683 planes. This value of the war was projected at 683 planes. This value of the war was projected at 683 planes.

The company's first production peak vereached in April 1944 with the delivery of 3 Georges, N1K1-J. This was followed by a dein May, due to modification of the plane. The production started to climb again, and by Aug of the same year production had been boosted 51 planes per month. Production continued this rate, after a temporary drop in Septemburtil the end of that year. In January 1945 peduction dropped to 24 aircraft, recovered slight

30 aircraft for February and March, and, due a changeover to an improved model N1K1–J, opped steadily until June 1945 when production

this model stopped.

In January 1945 the Navy ordered extensive additional of the George fighter, incorporating former underslung cannon into the wing uctures. This required retooling, which reled production to 24 planes for the month, is new model got into production in February 1 March and reached its peak in May when 20 craft were produced. In June, however, the int went into its final production tailspin, due, previously mentioned, to labor difficulties.

ATTACK DATA

elligence data:

l	te and hour of attack	22 June 1945.
ĺ	ration	0930 to 1030.
ı	acking unit	Twentieth Air Force.
ŀ	itude	15,200 feet.
1	mber of aireraft over target.	52.
	(number, weight and type)	1403, 500-pound GP.
	the-ground findings:	
	mber in plant area	229.

EFFECTS OF BOMBING

mber of building hits_____ 183.

(number of UXB)_____ 3.

rect Attacks

The 22 June 1945 precision bombing attack on is plant carried out during daylight, and lasting nour, leveled the 29 brick and wood buildings the plant and seriously damaged the 3 steel odern-type structures. Bombs were of the 500-and HE type. There were 229 bombs dropped whin the plant enclosure, only 3 of which were XB's (appendix E).

The 22 June 1945 raid on the Himeji plant maged 100 percent of the machine tools—74 cent superficially damaged and 26 percent

lmaged beyond repair.

On 28 March 1945 raids, which consisted of safing and rocket attacks, started against the turano Airport plant, an aircraft final-assembly it of the Himeji plant. Subsequently, this cunt was harrassed by strafing raids which did the damage, but discouraged production. On 30 bly, however, considerable damage was done to te facilities and completed aircraft by a strafing ad fragmentation bomb raid.

Plant officials planned no recuperation at the

Himeji plant itself, which was almost entirely leveled. Recuperation of production at dispersed sites to 65 percent of the peak might have been possible within 6 to 9 months.

Casualties included 72 persons killed and 150 wounded by the 22 June 1945 daylight raid on Himeji. Two persons were killed and one wounded by the 30 July 1945 raid on the Uzurano branch plant.

Counter-Measures

No buildings had been placed underground nor had any attempt been made to camouflage existing structures. The air-raid warning system consisted of a control station equipped with radio and telephone communication systems, located in a bombproof dugout near the main office. The control station was notified by radio or telephone of approaching aircraft and the entire plant was alerted by siren, loud speaker system, telephone, and flags. One observation post was situated on the roof of the plant. The plant manager, acting as head of the air-defense system, ordered the evacuation of the plant when an air attack was threatened. The order in which the employees left the plant was students first, women next, and men employees who were not members of the air-defense system last.

The fire-defense system consisted of 60 regular firemen assisted by a group of auxiliary firemen and 3 fire engines. In addition to fire hydrants, water casks and static water tanks were situated at various locations throughout the plant.

There were air-raid shelters (dugouts) for 1,800 employees within the plant and shelters for 8,000 employees outside the plant.

Interruptions Due to Alerts

The first man-hour loss due to air-raid alerts occurred in the latter part of November 1944 when 5,000 man-hours were lost. For all of 1944, only 10,300 man-hours were lost because of air-raid alerts. The loss increased very greatly in 1945, with 32,200 man-hours lost in January and 35,100 in February. At the height of air alerts, June 1945, 62,100 man-hours were lost. The total for 1945 amounted to 164,000, making a total in both years of 174,700 man-hours lost because of air-raid alerts (appendix F).

Interruptions Due to Area Attacks

The area air attacks did not affect electric-power production in this district and there was no interruption of the plant's electric power supply. In 1943, when the plant started production of air frames, the electric-power consumption increased steadily. The rate of increase continued until the plant reached its peak of power consumption in December 1944, when 310,000 kilowatt hours were consumed. Then, in the early part of 1945, due to the dispersal program, the rate of power consumption decreased sharply and stopped completely at the time of the air attack on the plant in June 1945 (appendix G).

Dispersal

The Himeji plant planned six dispersed unit but none of them had been in production. The construction of the plants in the dispersal progra was under the direction of the Naval Construction Corps, which furnished labor and material. Before the air attack on the Himeji plant, 20 machine tools had been dispersed to the Hounit (appendix I).

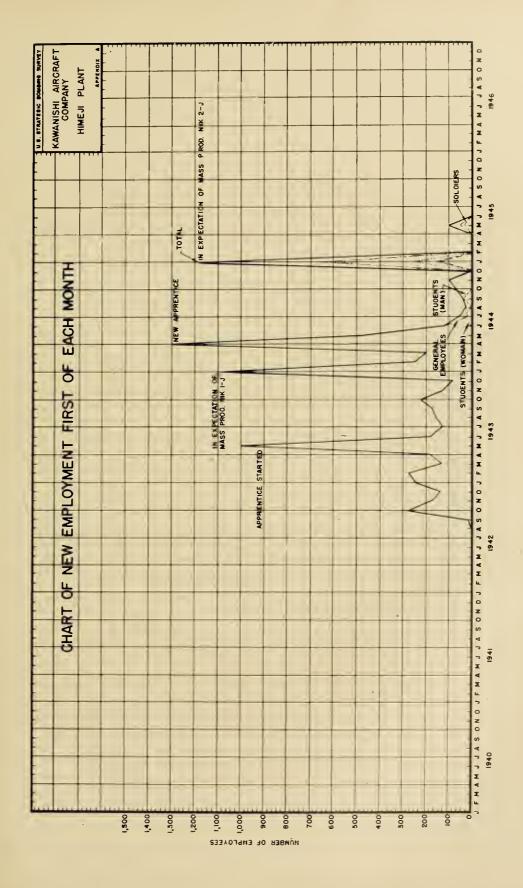
The dispersion program assumed the following pattern:

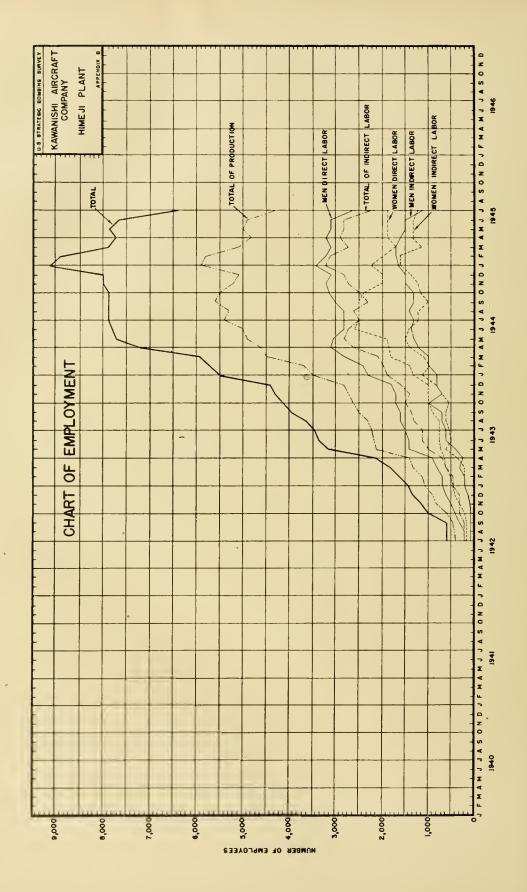
Location	Date started	Distance Irom Himeji	Type of production planned	Area (square feet) or number of buildings	Percent of completi
Dauge Uzurano	Mar. 1945. Apr. 1945 June 1945do Mar. 1945	Miles 16 17 14 16 18	Final assembly Engine run and flight Wing assembly Fuselage assembly Machine shop	90,570	100, of building; \$(runway, 0, 50, 40, 30,
Ueno Funazu Tawara village Tatsumo		11 14 17 25	Shect-metal shop	Converted tile shops; opera- tion not started.	

There was no production loss because of dispersion, because all work on dispersed locations was performed by the Naval Construction Corps and the Himeji plant did not furnish any men or material.

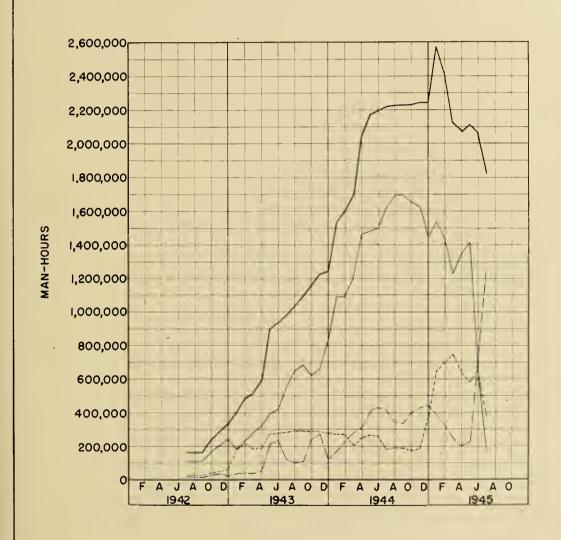
INTELLIGENCE CHECK

The War Department, Military Intelligence Service (G-2), estimate of total aircraft production at the Himeji plant was essentially correct. However, the estimated production for 1944 v 229 Georges, while actual production for t period was 354 aircraft, or 35 percent over emated production. In 1945 the estimated p duction was 300 aircraft, while only 156 w actually produced. Thus, for 1945 it was emated that 48 percent more aircraft were p duced than were actually made. The estimat total production for both years was 529 aircrawhile 510 were actually produced, or a 4-perceoverestimate.





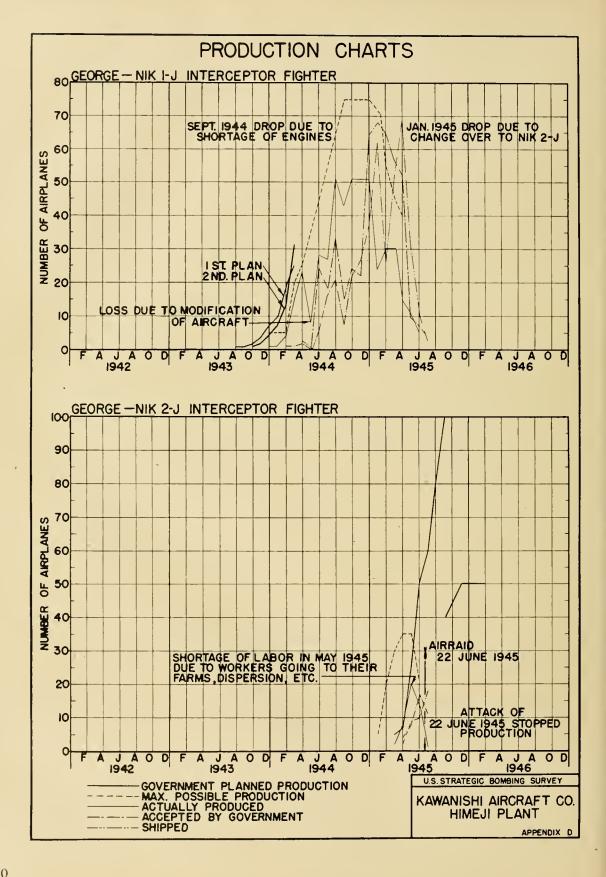
NUMBER OF MAN-HOURS WORKED

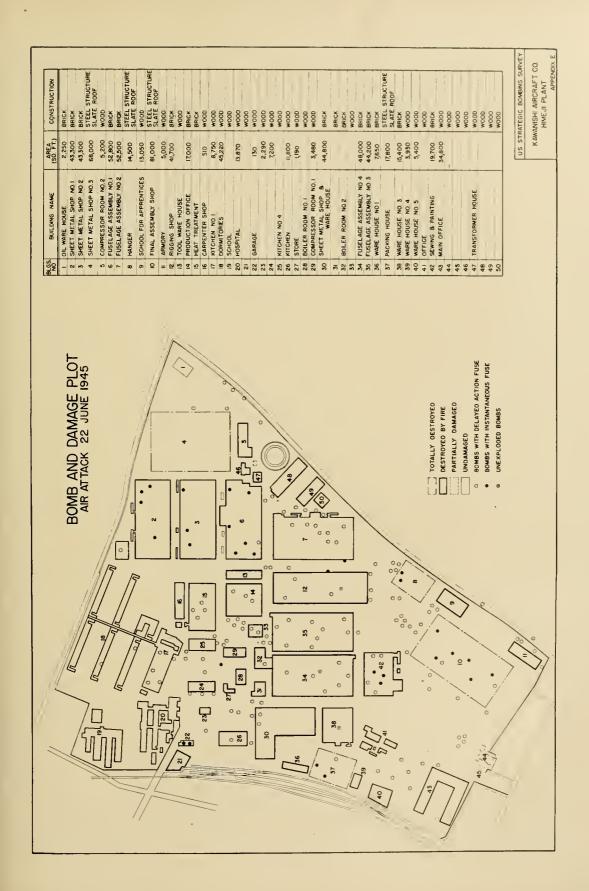


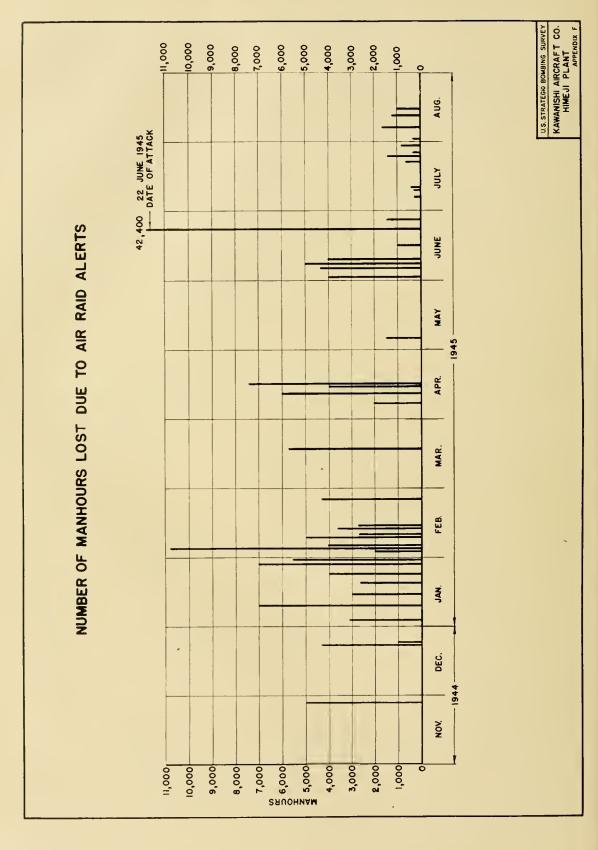
U.S. STRATEGIC BOMBING SURVEY

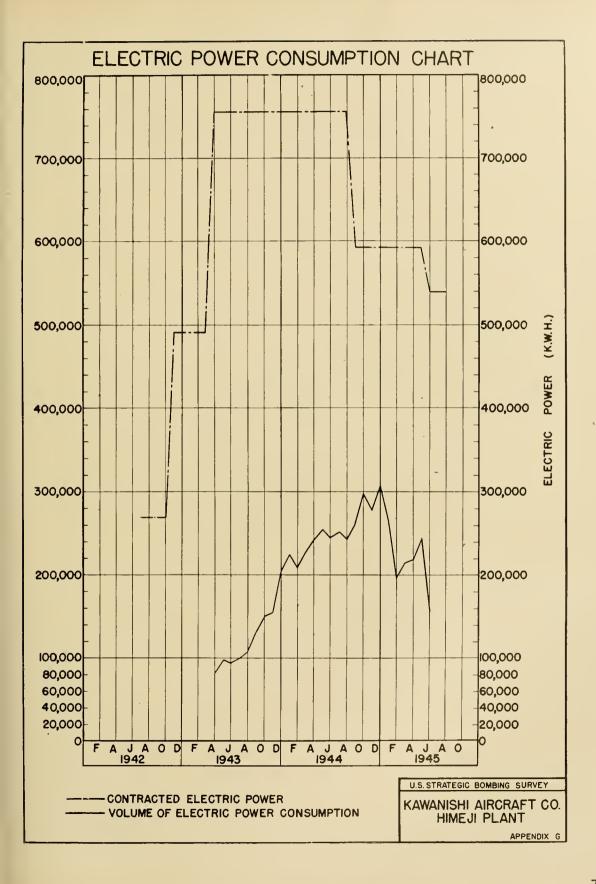
KAWANISHI AIRCRAFT CO. HIMEJI PLANT

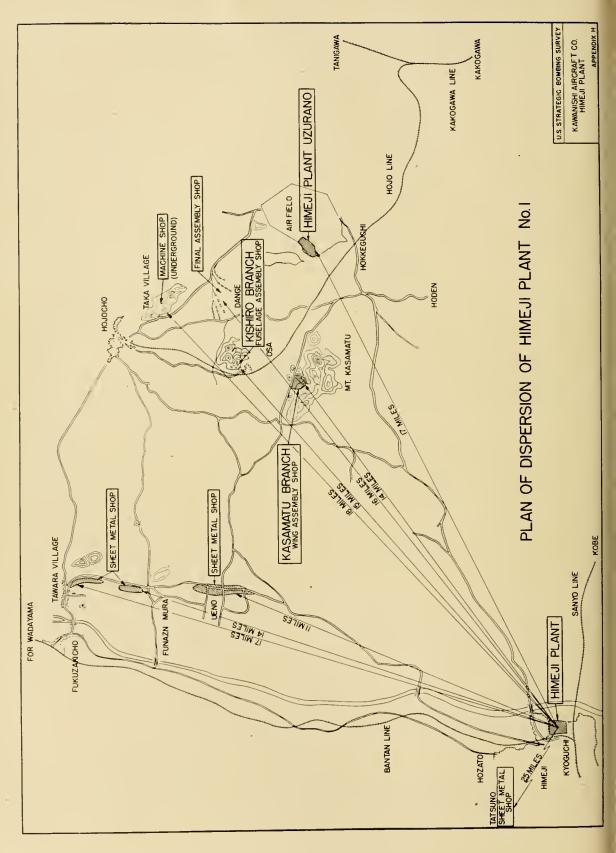
APPENDIX C











TAKARAZUKA PLANT REPORT NO. 111-4

(Components)

Dates of Survey, 23-25 October 1945

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THE PLANT AND ITS FUNCTION IN THE AIRCRAFT INDUSTRY

oduction

he Takarazuka plant (Takarazuka Seisakusho) ne Kawanishi Aircraft Co. (Kawanishi Kokuki bushiki Kaishi) was located 20 miles northwest Isaka, near the village of Takarazuka. It was blished in the fall of 1942 to machine aircraft is for the various Kawanishi assembly plants. It to this it was a machine shop producing gunets and various types of pumps; it also did is machining of aircraft parts. The total floor, before air attack, was 3,392,000 square feet, which 1,802,000 square feet was productive area. The general arrangement plan of the t (Appendix A) gives the area of each building, type of work performed, date and type of truction.

There were four production departments in the Takarazuka plant. The first one, the aircraft-machine-parts department, was constructed in June 1942. The material-treating department (easting, forging, heat treating, and galvanizing) was constructed in August 1942; the aero-engine-accessories department in September 1942; and the machine-gun-mounting department in February 1943.

On 1 November 1943, the Takarazuka plant acquired the Teikoku Electric Co. as its only subsidiary. This unit built electric parts, mainly for the gun-mounting department.

The Japanese Government loaned the Kawanishi Aircraft Co. a total of 211,000,000 yen for equipment and facilities. The Takarazuka plant received about one-fourth of this amount, as follows:

Facility:

iii,	Yen
2,896 machine tools	21, 053, 000
422 presses, furnaces, transformers, sheet-	
metal machines	1, 181, 000
Buildings	33, 300, 000
-	
Total	55, 534, 000

Organization and Operation

The names and functions of key personnel follow:

> Ryuzo Kawanishi, President. Kenji Maebara, Vice president. Shiro Takahashi, Managing director. Yoshio Hashiguchi, Chief engineer. Meishin Saito, Manager of Takarazuka plant.

Organization of the Takarazuka plant followed the general pattern for the industry (appendix B).

Plant officials furnished an outline of the plant by departments, date the sections began operation, the type of aircraft for which the parts were made, where the products were shipped, and the percent of production sent to the various companies (fig. 1). It should be noted that pumps and gun turrets originally were made at the Naruo plant of the Kawanishi Aircraft Co. (USSBS Aircraft Division Plant Report No. III-1), but production was transferred to the Takarazuka plant in 1943 to facilitate more efficient utilization of the separate plant properties.

Employment

From March 1944 to the termination of the war, the plant had two shifts, working 10 hours each day. Approximately two-thirds of the employees worked the day shift. Girl students and volunteers worked 9-hour shifts.

The number of employees increased gradually during the war, reaching its maximum in August 1944 when a total of 16,600 workers were employed. As the war situation changed, students (boys and girls), whether they had graduated or not, entered the plant as a patriotic-service corps, organized by labor-mobilization orders of the Government. Boy students worked 10-hour shifts and younger school boys worked 8-hour shifts.

The greatest number of man-hours worked was in October 1944, when 183,000 man-hours were recorded (appendix C). The great increase began in March 1944, when two 10-hour shifts were started. Man-hours lost, due to absenteeism were quite low in 1942—4,000 per month—but in creased very sharply, reaching 45,500 in March 1945 and finally 125,000 in August 1945.

The increased absenteeism was caused by ai attacks on the cities and towns. After such attacks many employees did not work regularly evacuating their families and personal belonging to safer places.

When Takarazuka started in 1942 as an ai craft plant, a number of employees were tran ferred from the Naruo plant of the Kawanis' Aircraft Co. Another large group of employe was transferred from Naruo in November 194 and yet another in April 1944.

The number of, employees reached a peak 16,600 in August 1944, declining steadily the after. It should be noted that there was a vesmall number of women workers in the plant 1,100 at the peak. Very few military person were employed at the plant—only 150 duri 1945 (appendix D).

Material and Components

The Takarazuka plant fabricated gun turre machine guns, various types of pumps, machin steel parts for aircraft, castings, and forgin Of the above products, 80 percent of the gunrets were produced for other plants and o 20 percent were used by the Kawanishi Aircr Co.; 90 percent of the pumps were produced outside plants; and all of the machined aircr parts, castings, and forgings were produced the various aircraft-assembly plants of the Karnishi Aircraft Co. (fig. 1).

Due to the difficulties in assembling mach guns until December 1943, there were no she ages of raw materials for this activity.

The most important critical shortages of iterial that existed in 1944 and 1945 were oxy for welding, small electric motors, and ammoused in metal plating (appendix E).

Production Statistics

The Takarazuka plant first started product in March 1941 with the manufacture of purrets. In April 1941 the manufacture pumps started and by April 1942 the manufact of air frame machined parts began.

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REMARK	PERCENTAGE SHIPPED	101	001 \ 08	ō	001	100	(ONLY FIVE PRODUCED)	001	100	000 mma	0.4	100	100	100	100	100	0000										CAPITAL #800,000 PERCENTAGE 67 OF CONTROL PRESIDENT FUJIMATSU ITO MANAGING													
SHIPPED	10	KAWANISHI (KONAN)	MITSUBISHI (MIZUSHIMA)	KAWANISHI (KONAN)	NAKAJIMA (KOIZUMI)	2	NAVY	ALCHI AIRCRAFT	MITSUBISHI (NACOYA)	NAKAJIMA KAWANISHI MAVAL DEPOT	TOKYO METER	KAWANISHI	MITSUBISH	KAWANISHI	II.	=	NAKAJIMA KAWANISHI NO II NAVAL ARSENA	KAWANISH! (KONAN)	KAWANISHI (KONAN)	KAWANISHI (KONAN)		(NARUO)	(TAKARAZUKA)			MACHINE GUN MDUNTING DEPARTMENT														
	NAME OF AIRCRAFT	EMILY FLYING BOAT (CENTER)	G-4 BOMBER	BOAT (TAIL)	OBSERVATION	FRANCES P-1 BOMBER												EMILY PLYING	INTERCEPTER	MEDIUM BOMBER																				
	SUB-TYPE	12	22	3.1				LINE	RADIAL																															
PRODUCTS	ARTICLES	TYPE I LARGE M G MOUNTING	Ξ	=	REMOTE CONTROL M.G. MOUNTING	TYPE 4 MEDIUM M G MOUNTING	TYPE 3 13 MM CALIBER M G	FUEL INJECTION PUMP	COMPLETED	HIGH PRESSURE OIL PUMPS	VACUUM PUMP	PRIMING PUMP	(FOR AEROENGINE "KASEI")	OIL MOTOR FOR FUEL PUMP	CUT-OFF VALVE FOR FLAP	OIL MOTOR FOR VARIABLE	METHANOL PUMP		AIRCRAFT MACHINED PARTS		CASTING	FORGING	HEAT TREATING	CALVANIZING			ELECTHIC PARTS													
	TYPE	F						PARTS MATERIAL																																
59.FT	BLDG AREA													3,444,460		FOR STORE	ANO ANO	1,629,880	RENTED	215,280	FOR	WELFARE L398.320					27,000													
AREA -	TOTAL AREA													15,000,000		FOR	7, 400,000	7,400,000 FOR WELFARE 7,600,000									43,000													
DATE							CONSTRUCTION ON STATO ON STATO ON STATO ON STATO SHOPS SHOPS CO JAN 1945															,	- JUNE 1944																	
DATE	Z ?					25 APRIL 843						15 APRIL 1843					15 APRIL 1043					15 APRIL 1943				N O V 104 5						5 NOV 1942			21 4 15	3		- DEC 1941	1 DEC 1941	
DATE OF														30 JUNE 1942		20 JAN 1943	0.001 2014 1.6		- A700	- 1	20 NOV 1941	29 NOV 1941 10 JULY 1945	1 NOV 1043																	
NAME	ENT		:	S ENION	DEPARTMENT						AEROENGINE	ACCESSORIES	DEPARTMENT					AIRCRAFT	MACHINED	PARTS	AATERIAI S	MATERIAL STATES	OF PARTMENT		GENERAL AFFAIRS DEPARTMENT	RECREATION	S TEIRORU C ELECTRIC C COMPANY R COMPANY													

US STATEGE BOMBING SURVET
KAWANISHI AIRCRAFT CO.
TAKARAZUKA PLANT
FIGURE NO 1

The complete list of products manufactured at the Takarazuka plant follows:

Department	Main products	Capacity of produc- tiou (per month)
Aero-engine-accessories department,	Fuel injection pumps (with fuel nozzles) complete.	400
	High-pressure oil pumps	900
	Vaenum pumps	600
	Oil motors (for variable-pitch-propeller).	200
	Cut-off valves (for flap)	300
	Methanol pumps	500
	Priming oil pumps	300
Machine-gun-mount-	Machine-gun mountings.	70
ings department.	13-mm. macbine guns (except barrel)	30
	M/G magnets	300
	M/G hand chargers	1,000
Aircraft machined-parts	Machined parts of interceptor fighters.	1 30
department.	Macbined parts, medium bombers	1 15
Materials-treating de-	Aluminum-alloy easting	2 35
partment.	Aluminum-alloy forging	2 17
	Steel lorging	2 33

1 For planes.

2 Tons.

Gun-turret production went to the following companies:

Mitsubishi Aircraft Co.__ 75 percent for Betty. Nakajima Aircraft Co.... 15 percent for Frances and Rita.

Kawanishi Aircraft Co___ 10 percent for Emily.

Total pump production was distributed in the following percentages:

$^{\circ}$	Percent
Mitsubishi Aircraft Co	40
Nakajima Aircraft Co	25
Aichi Aircraft Co	15
Kawanishi Aircraft Co., Tokvo. Instruments	
Factory, and Navy	20

The total production of machine guns went to the Navy. The Kawanishi Aircraft Co.'s Konan plant (USSBS, Aircraft Division, plant report No. HI-2) and Naruo plant (USSBS, Aircraft Division, plant report No. III-1) received the total production of aircraft machined parts, castings, and forgings.

There were three types of gun-turrets manufactured, the largest being the one for Emily and Betty. Of this type, only 1,869 were produced from 1941 to the end of the war, while the Government-planned production schedule called for 2,415 for the same period, or 546 gun turrets less than ordered (25 percent). This was caused by a reduction in production due to modifications and change-over to other types and air-attack damage to the Takarazuka plant and subcontractors. The other two types of machine-gun mountings were the remote-control model, of which production began in July 1942 and ended, by Government order in August 1943, and a medium machine-gun mounting which just started in produ tion the beginning of 1945. Only 154 were ma by the end of the war.

The Government-planned production of pur was well above actual production. Consideri only the four most important pumps, actual p duction, as compared with the Governme planned production schedules, is as follows:

Name of pump	Actual production	Planned produc- tion	Percen produc attair
Lubricating-oil pump	11, 755	15, 260	
Vaeuum pump	12, 955	21,050	
Fnel-injection pnmp	1, 434	2, 750	
High-pressure oil pump	6, 415	15, 490	

The aircraft-machined-parts department was first, located at the Naruo plant. In a little c 3 years, from April 1942 to July 1945, the Take zuka plant produced 7,099,000 machined air-fre parts.

It was planned to discontinue this type of w at the Takarazuka plant and have it carried o the other plants of the Kawanishi Aircraft but this was never done.

The Takarazuka plant produced machined frame parts for various types of aircraft in following percentages of total parts used:

Norm						-										_		_	_	
Emily																				
Rex					_	_	_	_											_	
George																				
Frances	_			_	_	_	_	_	_		 _	_	_	_	_	_	_			

Other articles, of a less important nature, duced at the Takarazuka plant were fuel-injectly pumps, fuel nozzles, methanol injection pu lit flap cut-off valves, oil motors for variable-1 propellers, priming-oil pumps; and oil motor fuel pumps.

ATTACK DATA

ATTACK DA	1 / 1
Intelligence data	
Date and hour of attack	24 July 1915 at
Duration	
Attacking unit	Twentieth Air F
Altitude	
Number of aircraft over target	78.
1713 You have mainly and tame	\$902-1,000-pounc
HE Number, weight, and type	7-2,000-pound (
4B, number, weight, and type	
On-the-ground findings:	
(Number in plant area	202 tons.
Number in plant area HE\ Number of building hits =	88 tons.
Number of UXB	
(Number in plant area	
IB Number of building hits.	
Number in plant area IB Number of building hits Number of UXB	

EFFECTS OF BOMBING

The Takarazuka plant was struck twice. The (st attack, at 1000 hours on 15 June 1945, was a area attack. The damage was confined almost clusively to the destruction of about 30 percent of the houses in the workinen's living area (appendixes F and G).

The second attack, which was directed at the cut, occurred at 0930 hours on 24 July 1945. I this, 458 tons of 1- and 2- thousand pound bmbs were dropped. Two hundred two tons suck the plant area, 88 tons striking buildings. One of the buildings was repaired. The few suctural steel buildings also sustained heavy image (photos 1-5).

During the first attack, 181,094 square feet, or percent, of the dormitories and kitchens were prize in addition to the destruction of power ies, causing a 50-percent loss of productive in-hours.

During the second attack, 100 percent of the inturret department, 99 percent of the aircraft-cessories department, 78 percent of machinedats department, 30 percent of the heat-treating, ating, and forging department, boiler and airmpressor room, 67 percent of the office, and spercent of the dormitory and mess room were stroyed. The damaged shops were not repaired. Tring the second air attack, 108 employees were seed and 51 wounded.

At the outset of 1945, before the attacks, 95 eent of all machines were dispersed to various ations within a few miles of the Takarazuka Int. Some were loaned to subcontractors and ters were installed in dispersed plants. After ls dispersal, there were 47 machine tools at the in plant. During the attack of 24 July 1945, nachine tools were damaged superficially but fairable and 39 were destroyed beyond repair. machine tools were replaced at the plant. ring various area attacks, many of the dissed machine tools were damaged and destroyed. Ifter the first air attack of 15 June, 14,200 in-hours were expended to repair damage (ap-(dix H). A total of 126,140 productive maners were lost as a direct result, requiring approxtely 1 week to recuperate to normaley (appen-I). During this same period, about 27,000 h-hours per day, or a total of 189,000 maners, were lost due to dispersal factors, indicating it dispersal was a great factor in keeping down

production. The day following the attack, only about 40 percent of the usual man-hours were worked.

No repairs were undertaken following the second attack of 24 July. About 58 percent of the total man-hours already were diverted towards dispersal and this attack stopped production; only 7,300 man-hours out of the normal 29,000 man-hours was worked the day after the attack.

Counter-Measures

Prior to the air attacks, 95 percent of the machine tools were either dispersed or rented to subcontractors. The least essential wooden buildings were dismantled as a precaution against fire.

The air-raid-precaution system at the plant consisted of 600 people, organized in various groups. The chief of the organization sounded the alarm by loudspeaker system throughout the plant. Alarm in the plant was given by loudspeaker system or siren. When this system did not function, messengers stationed at each principal shop gave the alarm by flag or siren during the daytime, and by siren or light signal at night. The heads of the various departments ordered the workers to go to the air-raid shelters in the following order: students of the primary schools, other students, apprentices and regular workmen, and finally members of the air-raid-precaution group.

Interruption Due to Alerts

A total of 795,581 man-hours was lost because of air-raid alerts. The alerts started in November 1944 and during the remainder of the year 36,800 man-hours were lost. In 1945, 758,781 man-hours were lost, with June 1945, the month of the area attack on the plant, having the greatest number of lost man-hours (181,200) due to air-raid alerts (appendix J).

Interruption Due to Area Attacks

A total of 585,500 man-hours was lost because of area attacks. The loss started in February 1945, the greatest occurring in June 1945, when 182,000 man-hours were lost due to air attacks in the area (appendix K), in addition to the loss resulting from alerts.

The peak load of electric power under contract was 2,500 kilowatts. Throughout the productive period at the plant, from 1942 to 1945, the maximum consumption was from February 1944 to May 1945, when 2,170 kilowatts were consumed.



Photo 1.—Building 1, machine shop. View southwest, showing structural damage.



Photo 2.—Building 159, sheet-metal shop.



Photo 3.—Building 159, sheet-metal shop view—interior looking west. Heavy bomb damage.



Photo 4.—Building 159, sheet-metal shop. View interior, southwest, showing bomb crater at base of column.

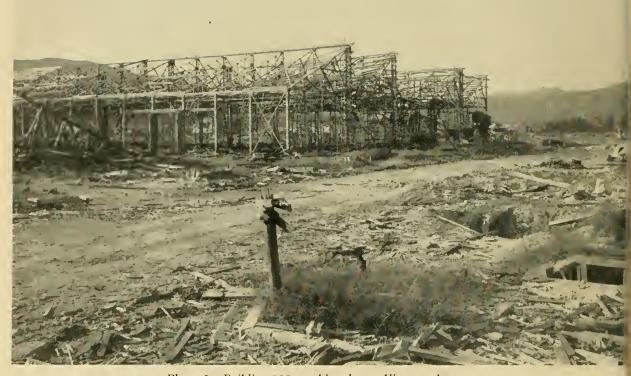


Photo 5.—Building 138, machine shop. View northwest.

Power consumption fell off at the beginning of 1945, due to dispersion, until, by June 1945, it had dropped to 1,430 kilowatts. After the attacks it dropped to zero in August 1945 (appendix L).

Dispersal

Each division of the Takarazuka plant cpersed its own production. The machine-gmounting department dispersed to the follow plocations:

			Plar	ined	Percent o	disperse
Location	Type of work	Dispersal began	Number of machine tools	Number of employees	Machine tools	Emple
Kobayashi Namaze Sanda Koshien Kashio	Structural parts Hydraulic parts Parts Jig and cutting tools Sheet-metal parts and assembly	February 1945. March 1945. March 1945. February 1945. June 1945.	124 206 52 107 237	300 470 400 220 750	100 100 100 100 80	

The chief bottleneck in the disperal program of the machine-gun-mounting department was transportation. The capacity of the plant to produce machine-gun mountings, before dispersal, was 180 per month. Capacity after disperal was 150 month, a 17 percent loss.

The aero-engine-accessories department persed to the following locations:

				Plat	nned	Percent dispersed			
	Location	Type of work	Dispersal began	Number of machine tools	Number of employees	Machine tools	Employ- ees		
				-					
1	sayama	Parts, fuel pump	February 1945	304	1, 100	100	100		
9	casegawa .	Assembly pumps	June 1945	357	1, 500	100	70		
	shio	Fuel-injection pump	June 1945,	185	1, 200	100	70		
1	katakamatsu	Jigs and tools	April 1945	160	350	99	99		
2	kawa	Machine shop	June 1945	123	150	100	30		

Transportation was the chief bottleneck, but a sortage of labor and electrical parts hindered the instruction and installation of machinery at the spersal locations.

The engine-accessories department loss of proaction capacity and potential due to dispersal as estimated as follows:

,	Description of products	Maximum possible production before dispersion	Maximum possible production after dispersion
1			
ī	el-injection pump (complete set)	750	550
ı	th-pressure oil pump	1, 200	1,000
	motor for variable-pitch propeller	400	300
١	ruum pump	700	600
9	t-off valve for flap.	400	360
Į	el nozzle	12,000	10, 000
I	thanol-injection pump	900	800
-	bricant-oil pump for starting	350	300

It was planned that the aircraft-parts machining opartment be dispersed in four districts under the entrol of each plant in each district. Only two wits, Osaka and Okadayama, were already dispresed and in operation at the end of the war. In the dispersed units, machines were all on hand between not in operation.

Plant dispersal assumed the following pattern: Osaka district (Hankyu department store in meda—bombproof building): This unit belonged the Konan plant and produced machined parts r Frances with 139 machine tools and 350 worken. It began to operate on the 15th of June 45.

Koyoen district: Okadayama unit (in the Kobe el's college) belouged to the Naruo plant and oduced machined parts for George with 54 maine tools and 170 school-girl workers. This unit gan production on 10 April 1945.

Koyoen unit (underground and in earth-covered bildings): Planned to produce parts for George th 123 machine tools and 500 workers. All the fachine tools were transported to this unit by 30 ne 1945, but were not in operation, due to lack power and homes for employees.

Fukuchiyama district (underground and in earth-covered buildings): This unit of 154 machines and 500 workmen was under the direction of the Naruo plant, and was planned to produce machined parts for George. Transportation of machines was finished on 10 July 1945 but operation did not begin because of lack of power.

Hojo district (underground unit): This unit planned to produce machined parts for Frances and George, with 309 machines, and 1,200 workers. However, to the termination of the war, only 261 machines were transported to this unit, which was never in operation.

Dispersal stopped operation of the aircraft-machine-parts department and all of the machined parts for George and Frances had to be supplied by subcontractors.

The easting, forging, heat-treating, and galvanizing department of the Takarazuka plant was to be dispersed near the plant in the hills of the Koyoen Park, but this was never done (appendix M).

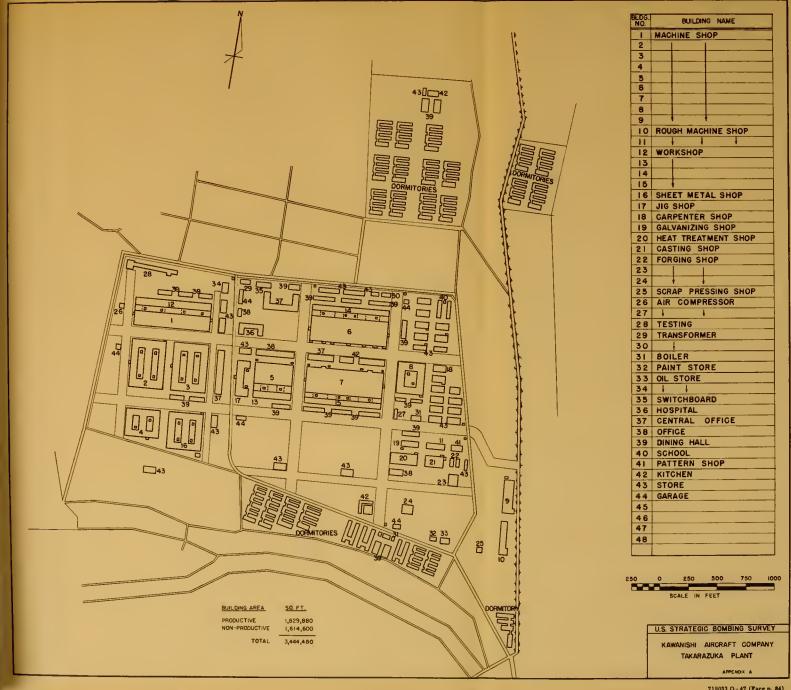
INTELLIGENCE CHECK

The pre-attack-intelligence information as to the type of manufacture engaged in at the Takarazuka plant and the photo interpretation after the air attack reporting the damage sustained were essentially correct.

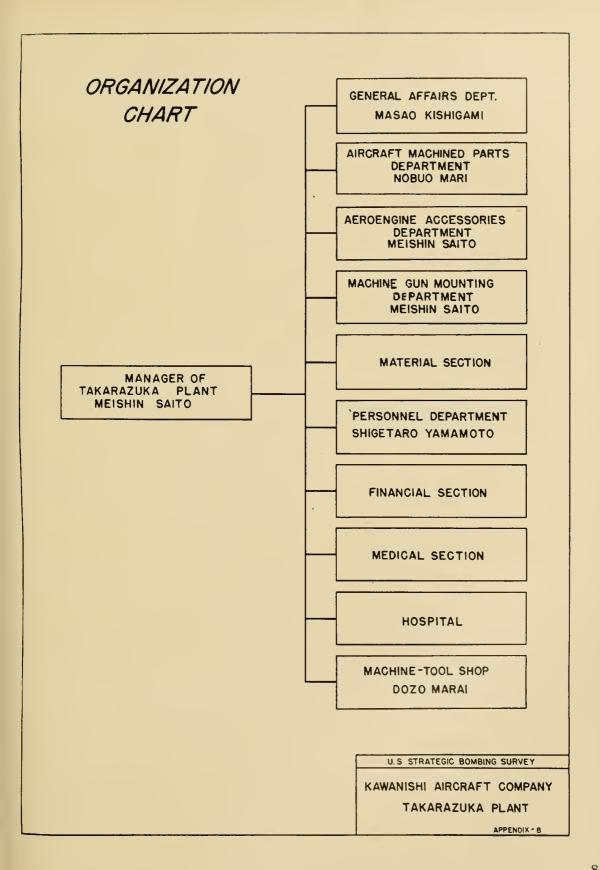
VULNERABILITY

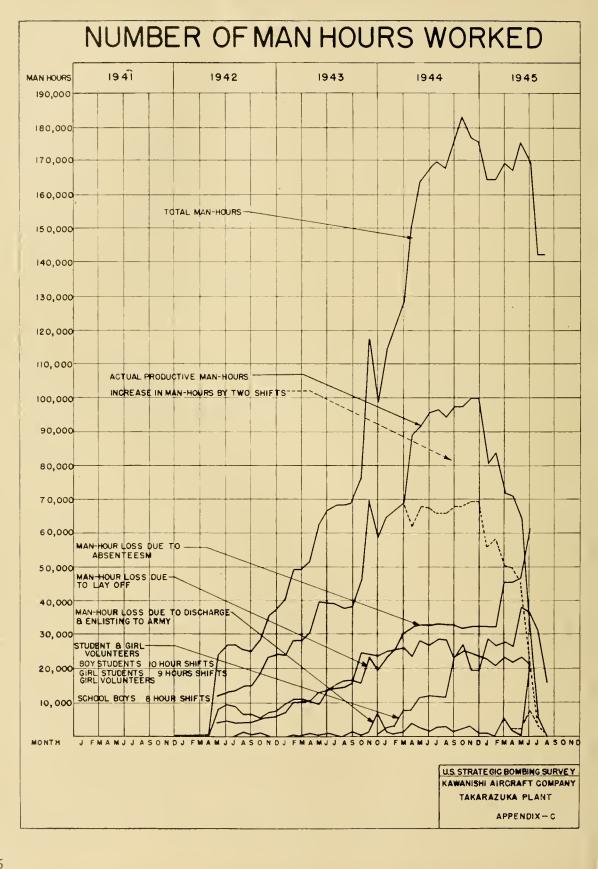
The Takarazuka plant was particularly vulnerable to air attacks in that all the buildings were completely of wooden construction, except four large shops, which were of structural steel and wooden roof and walls. This light construction was particularly vulnerable to incendiaries. No attempt was made to camouflage the plant. The morale of the employees was none too high, starting with the end of 1944 and continuing through 1945, during which time air attacks on nearby cities, as well as on the plant itself, made many of them homeless and caused others to evacuate their personal belongings and families.



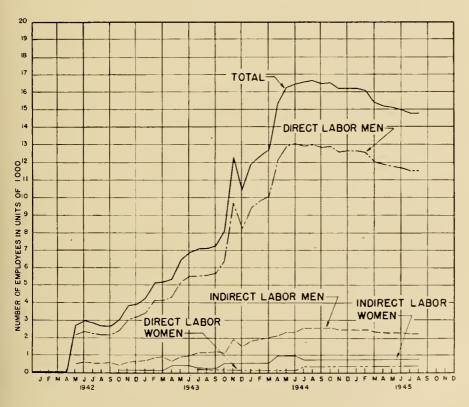








EMPLOYMENT CHART



INDIRECT LABOR CLASSIFICATION

PLANNING DEPT,
URAFTING
CLERK
TRANSPORTATION
FIREMEN AND DRIVER
CARPENTERS
LABOR
SCRAP SECTION
COOK
INSPECTION
ELECTRICIAN
WAREHOUSE
PRINTER
TOOL SHOP
CUTTER

US STRATEGIC BOMB. SURVEY KAWANISHI AIRCRAFT CO. TAKARASUKA PLANT APPENDIX O

APPENDIX E

LIST OF SHORTAGES OF RAW MATERIALS AND PARTS FOR THE ENGINE-ACCESSORIES DEPARTMENT

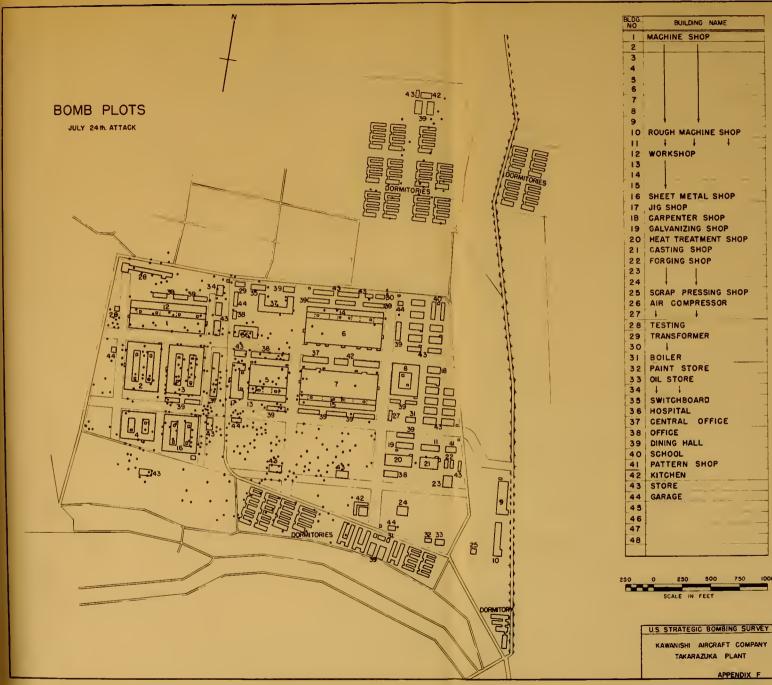
+044	1	
1944 October :	Steel bar less than 1 inch diameter. 1	Hitachi Manufacturing Works, Yasyki; Daido Steel Works, Nagoya.
November	Ammonia for nitrating 1,	Sumitomo Chemical Works, Niihama.
	City gas for heat treat- ment.	Koke Gas Co., Kobe.

¹ Shortages continued to the end of war.

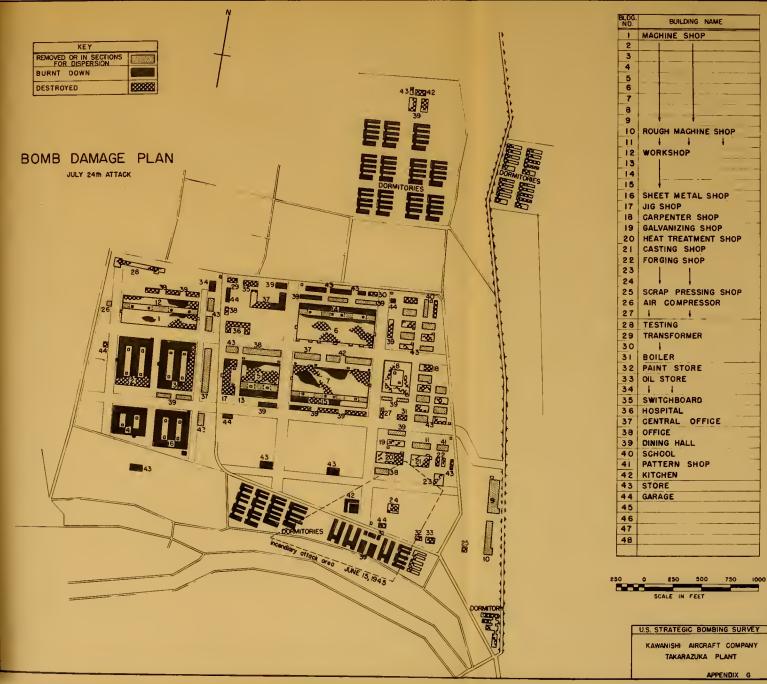
SHORTAGES OF RAW MATERIALS AND PARTS IN THE MACHINE-GUN-MOUNT DEPARTMENT

Date	Item	Supplier
1944		
January and Febru-	Forging for revolving	Sumitomo Metal Industry,
ary.	ring.	Osaka.
March	do	Do.
	Electric motors for ma-	Mitsubishi Electric Co.,
	chine gun mounts.	
	do	Do.
June-July	. do	Do.
	Optical sights	Nippon Optical Industry, Tokyo.
August	do	Do.
	Range scales	Tonaka Aircraft Arma- ment Co., Kawasaki.
September-October	do	
	Welding carbide.	Nippon Carbide Co., Toyama.
1945	Welding oxygen 1	Osaka Oxygen Co., Osaka.
January-February.	Welding carhide	Nippon Carbide Co., Toyama.
	Electric motors for ma-	Mitsubishi Electric Co.,
	chine gun mounts 1.	Fukuyama.
March	Welding carbide	Nippon Carbide Co., Toyama
	City gas for heat treat- ment. ¹	Kobe Gas Co., Kobe.

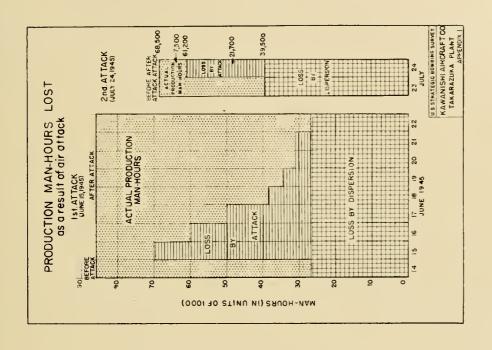
¹ Shortages continued to end of the war.

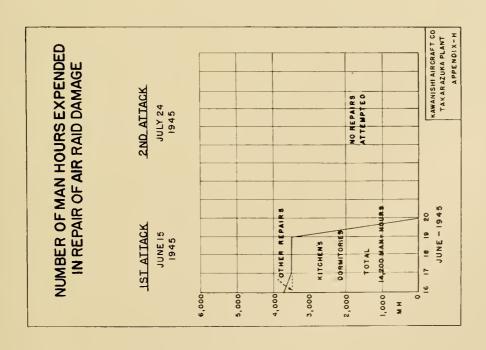


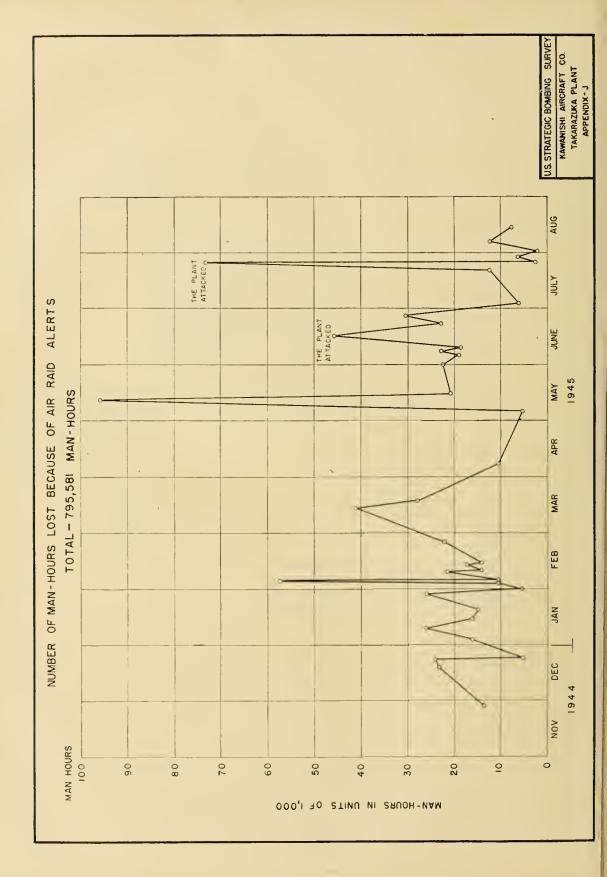




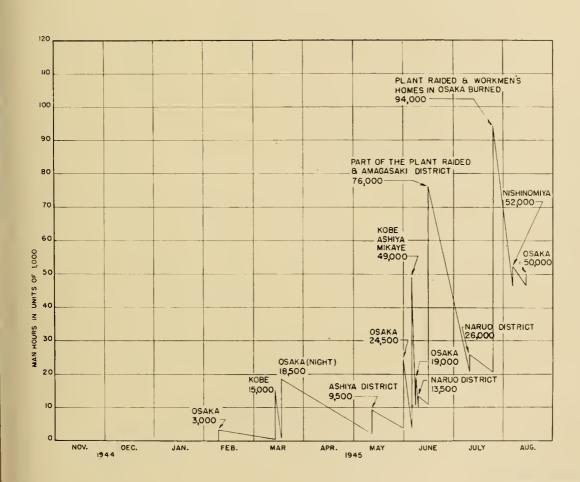








MAN-HOURS LOST DUE TO AIR RAID ATTACKS

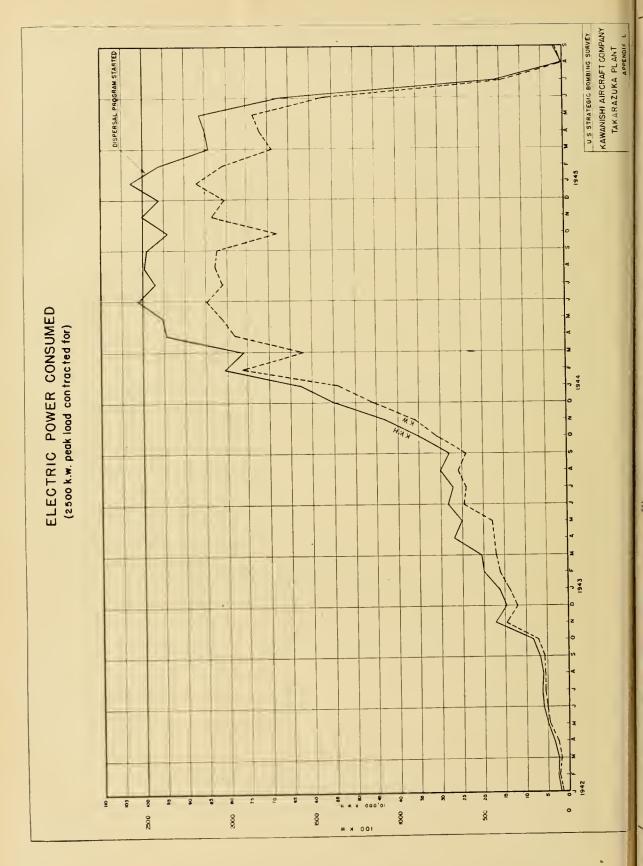


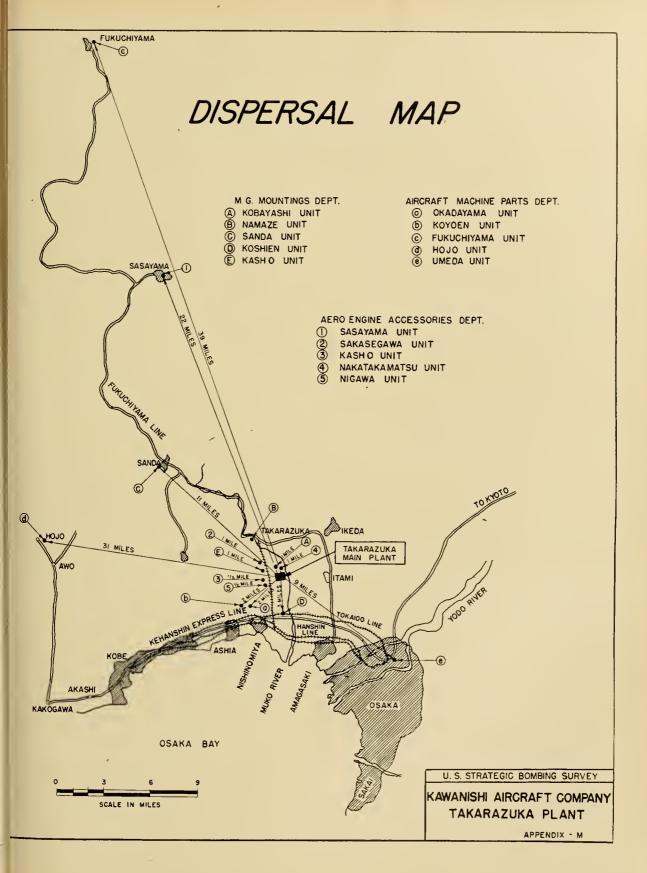
US.STRATEGIC BOMBING SURVEY

KAWANISHI AIRCRAFT CO.

TAKARAZUKA PLANT

APPENDIX K





UNITED STATES STRATEGIC BOMBING SURVEY

LIST OF REPORTS

The following is a bibliography of reports resulting from the Survey's studies of the European and Paeific wars. Those reports marked with an asterisk (*) may be purchased from the Superintendent of Documents at the Government Printing Office, Washington, D. C.

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- *1 The United States Strategic Bombing Survey: Summary Report (European War)
- *2 The United States Strategic Bombing Survey: Overall Report (European War)
- *3 The Effects of Strategic Bombing on the German War Economy

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(By Division and Branch)

*4 Aircraft Division Industry Report 5 Inspection Visits to Various Targets (Special Report)

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- 6 Junkers Aircraft and Aero Engine Works, Dessau, Germany
- 7 Erla Maschinenwerke G m b H, Heiterblick, German
 8 A T G Maschinenbau, G m b H, Leipzig (Mockau),
- Germany 9 Gothaer Waggonfabrik, A.G., Gotha, Germany
- 10 Focke Wulf Aircraft Plant, Bremen, Germany (Over-all Report
- 11 Messerschmitt A.G., Augsburg, Germany, Part A. Part B. Appendices 1, 11, 111
- Dornier Works, Friedrichshafen & Munich, Germany
 Gerhard Fieseler Werke G m b H, Kassel, Germany
- 14 Wiener Neustaedter Flugzeugwerke, Wiener Neustadt, Austria

Aero Engines Branch

- 15 Bussing NAG Flugmotorenwerke G m b H, Brunswick, Germany
- 16 Mittel-Deutsche Motorenwerke G m b II, Taueha, Germany
- 17 Bayarian Motor Works Inc., Eisenach & Durrerhof, Germany
- 18 Bayerisehe Motorenwerke A G (BMW) Munich, Germany
- 19 llenschel Flugmotorenwerke, Kassel, Germany

Light Metal Branch

20 Light Metals Industry {Part I, Aluminum of Germany {Part II, Magnesium

- 21 Vereinigte Deutsche Metallwerke, Hildesheim, Gemany
- 22 Metallgussgesellschaft G m b II, Leipzig, Germa 23 Aluminiumwerk G m b II, Plant No. 2, Bitterfe
- Germany 24 Gebrueder Giulini G m b H, Ludwigshafen, Germa
- 25 Luftschiffbau, Zepellin G m b H, Friedrichshaf on Bodensec, Germany
- 26 Wieland Werke A G, Ulm, Germany
- 27 Rudolph Rautenbach Leichmetallgiessereien, Sol gen, Germany
- 28 Lippewerke Vereinigte Aluminiumwerke A G, Lun-Germany
- 29 Vereinigte Deutsche Metallwerke, Heddernhei Germany
- Germany
 30 Duerener Metallwerke A G, Duren Wittenau-Ber & Waren, Germany

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- 32 A Detailed Study of the Effects of Area Bomb on Hamburg
- 33 A Detailed Study of the Effects of Area Bomb on Wuppertal
- 34 A Detailed Study of the Effects of Area Bomb on Dusseldorf
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- 37 A Detailed Study of the Effects of Area Boml on Darmstadt
 38 A Detailed Study of the Effects of Area Boml
- 38 A Detailed Study of the Effects of Area Bombon Lubeck
- 39 A Brief Study of the Effects of Area Bombing Berlin, Augsburg, Boehum, Leipzig, Hagen, D mund, Oberhausen, Schweinfurt, and Bremen

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- *40 Civilian Defense Division—Final Report
- 41 Cologne Field Report
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- 43 Hanover Field Report
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- 45 Bad Oldesloe Field Report
- 46 Augsburg Field Report
- 7 Reception Areas in Bavaria, Germany

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- *48 German Electrical Equipment Industry Report
- 49 Brown Boveri et Cie, Mannheim Kafertal, Germ

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*50 Optical and Precision Instrument Industry Rep

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52 Mayer and Schmidt, Offenbach on Main, Germany

Anti-Friction Branch

The German Anti-Friction Bearings Industry

Machine Tools Branch

Machine Tools & Machinery as Capital Equipment Machine Tool Industry in Germany

Herman Kolb Co., Cologne, Germany

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Naxos Union, Frankfort on Main, Germany

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The Coking Industry Report on Germany Coking Plant Report No. 1, Sections A, B, C, & D Gutehoffnungshuette, Oberhausen, Germany Friedrich-Alfred Huette, Rheinhausen, Germany Neunkirchen Eisenwerke A G, Neunkirchen, Ger-

many Reichswerke Hermann Goering A G, Hallendorf

August Thyssen Huette A G, Hamborn, Germany Friedrich Krupp A G, Borbeck Plant, Essen, Ger-

many Dortmund Hoerder Huettenverein, A.G., Dortmund, Germany

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German Motor Vehicles Industry Report

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Friedrich Krupp Grusonwerke, Magdeburg, Germany

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Tachikawa Aireraft Company Corporation Report No. X (Tachikawa Hikoki KK) (Airframes)

Fuji Airplane Company Corporation Report No. XI (Fuji Hikoki KK) (Airframes)

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