

RENDEZVOUS EVALUATION POD

TABLE OF CONTENTS

TITLE	PAGE
SYSTEM DESCRIPTION.	8-291
SYSTEM OPERATION.	8-291
SYSTEM UNITS.	8-294
TRANSPONDER.	8-294
ANTENNA SYSTEM	8-294
FLASHING LIGHT BEACONS	8-295
SQUIB BATTERIES.	8-296
RENDEZVOUS POD COVER	8-298

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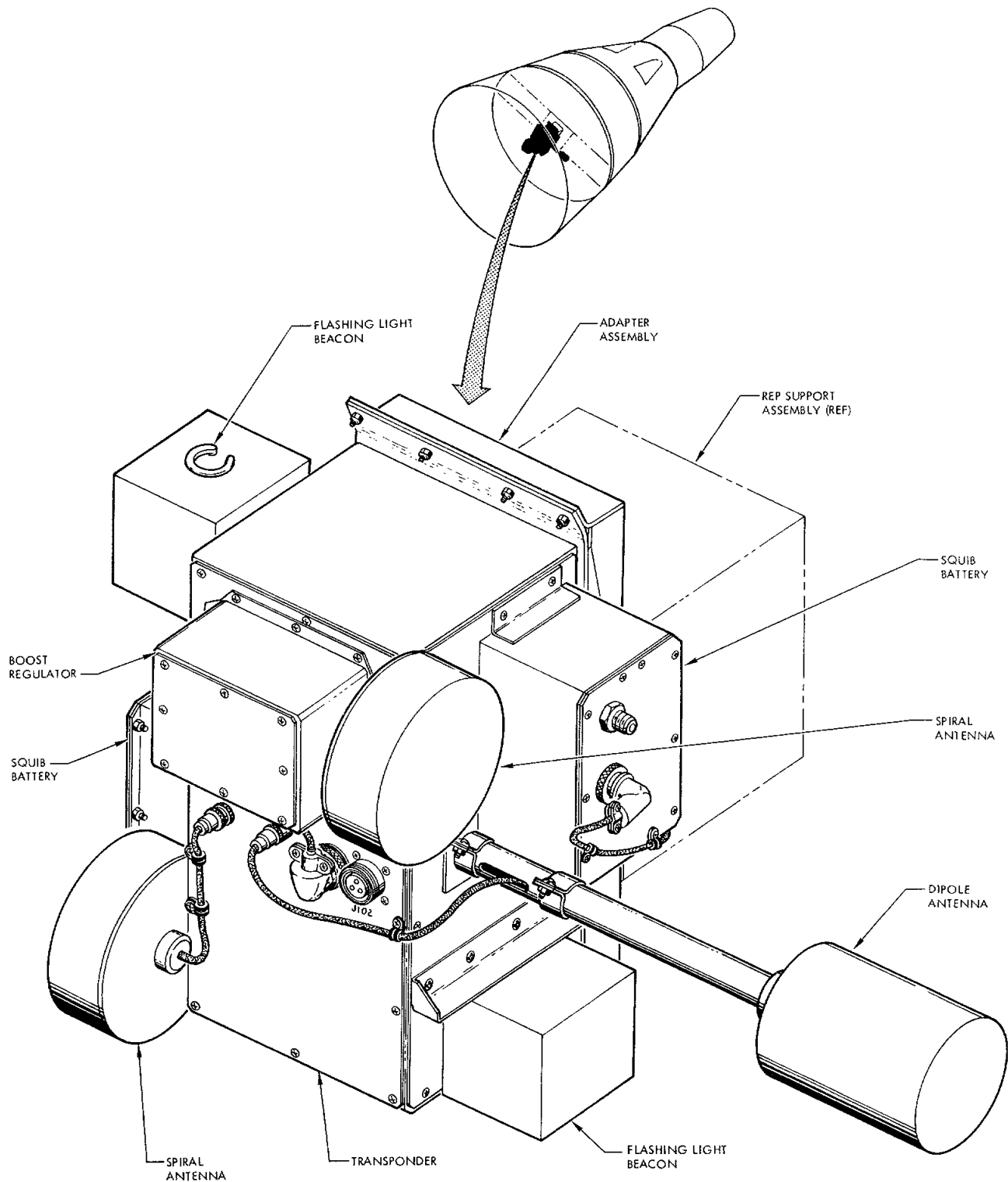
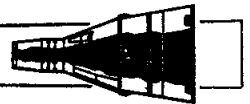


Figure 8-79 Rendezvous Evaluation Pod

8-290



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RENDEZVOUS EVALUATION POD

SYSTEM DESCRIPTION

The Rendezvous Evaluation Pod (REP) (Figure 8-79) is an assembly used during Gemini Spacecraft mission number five to simulate the Agena Target Vehicle. The REP consists of a transponder, two antenna systems, two flashing light beacons, and two squib batteries. The transponder is nearly identical to the transponder to be installed in the Agena. The flashing light beacons, which emit 80 ± 1 flashes per minute, are visible for approximately twenty miles. These beacons are to enable the crew of the Gemini to gain tracking experience by visually observing the REP in space. Observations are at measured distances from the spacecraft against both earth and sky background. This experience is used in determining the placement and intensity required for the Agena acquisition lights. The REP also provides a means of studying the man/equipment interface problems which might be encountered during an actual rendezvous mission with the Agena. The REP was installed in the center of the equipment adapter section of the spacecraft (Figure 8-79). Thermal protection for the REP prior to ejection is provided by the rendezvous pod cover. The REP is ejected into orbit by a pyrotechnic charge, after the spacecraft has been inserted into a satisfactory orbit.

SYSTEM OPERATION

During the first 65 minutes after lift-off, the REP remains stationary in the equipment adapter of the spacecraft (Figure 8-80). The REP is ejected from the spacecraft near the end of the first orbit. Other activities related to the REP occur primarily during the second orbit.

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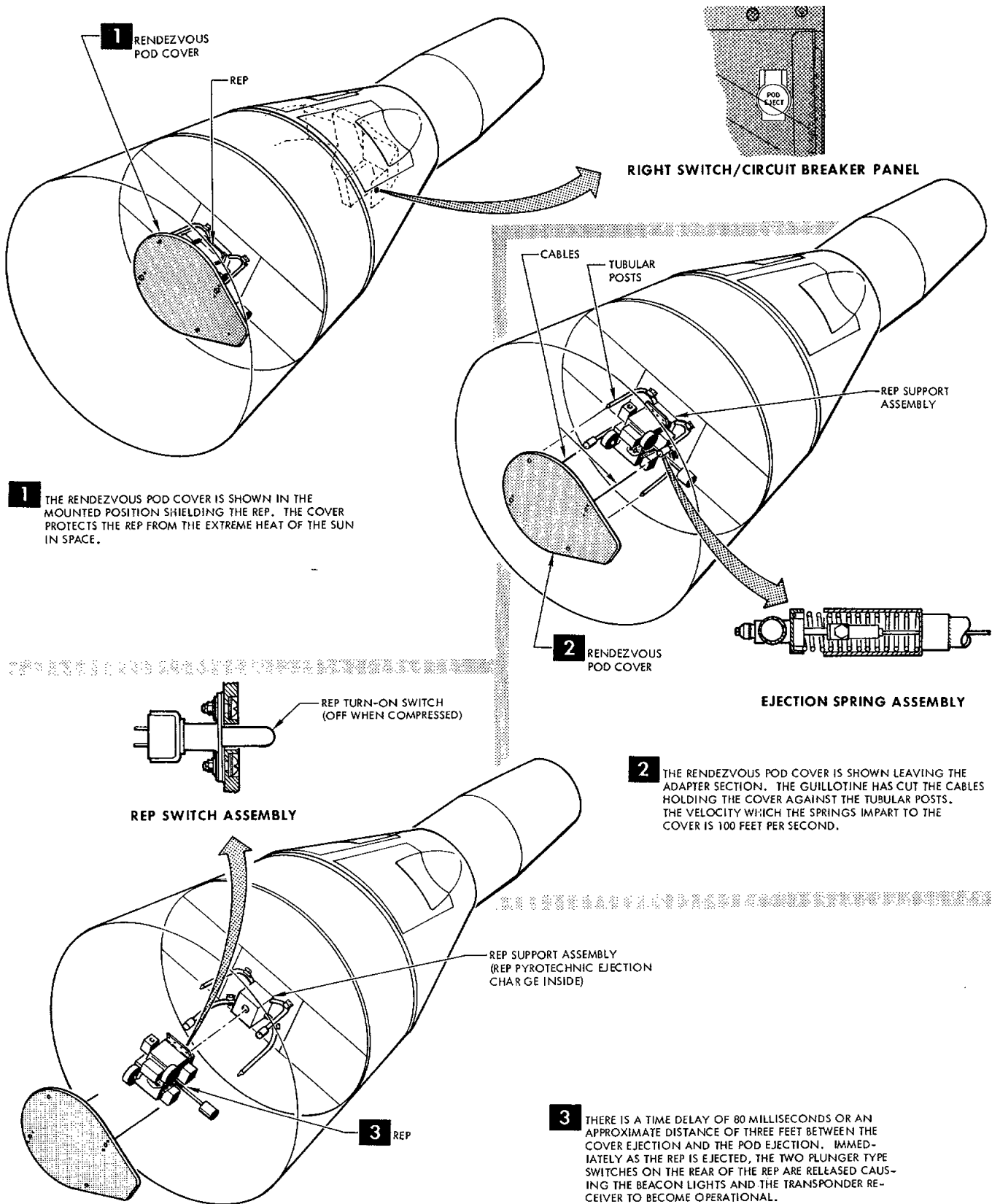


Figure 8-80 Mounting and Ejection of Cover and Rendezvous Evaluation Pod



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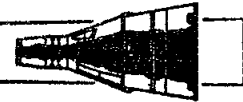


The REP has two spring-loaded, plunger-type switches (Figure 8-80) which control the battery power to the beacon lights and the transponder. Prior to ejection these normally closed switches are held depressed (open) so that power is conserved. The pilot will eject the REP approximately fifteen minutes prior to the first perigee. The spacecraft will yaw left 90° and the POD EJECT switch located on the right switch/circuit breaker panel (Figure 8-80) will be depressed. Pushing the POD EJECT switch activates two pyrotechnic charges (Figure 8-80). One charge drives a guillotine type cable cutter which severs the two cables shown in Figure 8-80. The cables, when released, allow the two compressed springs to expand, thereby propelling the rendezvous pod cover from the rear of the spacecraft. The relative ejection velocity of the cover is 100 feet per second. The other charge, initiated after an 80 millisecond time delay, propels the REP from the spacecraft with the relative velocity of 3.4 feet per second. The cover will not interfere with the ejection of the REP since the ejection velocity of the cover is much greater than and is prior to the ejection of the REP.

Since the REP will be orbiting outside the earth's atmosphere, it will experience extreme hot and cold temperature conditions. Therefore, a slow rate of rotation or tumble of the REP is desirable to allow uniform heating and cooling throughout the mission. If the retrograde thrust were applied to the exact center of gravity of the REP, no tumbling would result. Since a very minute error is anticipated in locating the exact center of gravity, a slow tumble within the required limits is expected. For successful operation, the rate of tumbling of the REP will be between one revolution per minute and one revolution per hour.



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Immediately upon ejection the compressed, spring-loaded, plunger-type switches are released causing the transponder receiver and the two flashing light beacons to become operational. It is estimated that the flashing lights on the REP at 20 nautical miles are equivalent to the intensity of a third magnitude star. Thus, a range of 30-35 nautical miles between the REP and the spacecraft is desired to assure exceeding the visible limit of the REP lights. The REP and the spacecraft trajectories will be designed so that the crew can make visual observations of the REP up to the maximum observational distance in both daylight and darkness. The ejection of the REP and the maneuvering of the spacecraft is performed over ground tracking stations to provide ground monitoring capability.

SYSTEM UNITS

TRANSPONDER

The transponder of the REP (Figure 8-79) is nearly identical to the transponder of the Agena Target Vehicle. The transponder, 10 by 10 by 20 inches, is the largest component of the REP. For this reason, the transponder serves as the basic component to which all other components are attached. For a detailed discussion of the operation of the transponder, refer to the Rendezvous Radar System portion of this section.

ANTENNA SYSTEM

The REP radar antenna systems (Figure 8-79) consist of two circularly polarized double-spiral antennas and one dipole antenna array. The REP antennas are the same type and size as the antennas used on the Agena, however, there are several slight differences in the manner in which the antennas are mounted. The spiral antennas of the REP extend outward approximately two inches from the case of the



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transponder. In comparison, the spiral antennas of the Agena are mounted flush with the outer surface of the Agena. The dipole antenna of the REP is mounted on the end of a two-foot long fixed boom, whereas the dipole antenna of the Agena is mounted on an electrically operated, retractable boom. The electrical operations of the two antenna systems are the same. All antennas have the capability of transmitting and receiving. Refer to the Rendezvous Radar System in this manual for a detailed discussion of the antenna system operation.

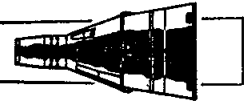
FLASHING LIGHT BEACONS

The REP has two toroid-shaped, xenon-filled, 25-watt beacon lights. These lights are the same type lights as the 100 candlepower Agena acquisition lights which are used on the Agena target vehicle. The lights are located on opposite sides of the REP so that at least one light is visible to the crew from any direction. The beacon lights assist the crew in maneuvering the spacecraft relative to the REP.

The flashing of the lights is regulated by a resistor-capacitor circuit located in each mounting case. The charging circuit is designed so that both lights operate simultaneously and assume the flashing rate of the light having the higher rate of flash. This rate can be manually adjusted within a range of 75 to 90 flashes per minute however the optimum rate is 80 ± 1 flashes per minute. The lights have a life expectancy of 25,000 flashes, or approximately 5 hours. This is more than sufficient time, since the REP will be used for approximately one and one half hours.



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Each beacon light has a thermal bonding strap attached. The thermal bonding strap is a $\frac{1}{4}$ inch thick strap of laminated copper which is used to help dissipate the heat generated by the light. The lights are connected through two redundant plunger-type switches to a 24 volt silver-zinc battery. The flashing circuit uses a dc to dc converter to increase the battery voltage to the 2500 volts required to flash the xenon filled lamps. The electrical schematic diagram of the lighting system is shown in Figure 8-81.

SQUIB BATTERIES

The REP utilizes two low impedance, 24-volt, silver-zinc squib batteries. The batteries are the same type of squib battery used in the spacecraft. Figure 8-79 shows one of the squib batteries attached to the case of the transponder. The other battery is on the other side of the REP and cannot be identified in the illustration. The squib batteries serve as the power source for the transponder and the two beacon lights. The transponder and the beacon lights are each served from a separate squib battery and operate independently of one another.

During spacecraft mission number 5 the REP will be required to function for only a very small time, approximately one orbit or 90 minutes. Therefore, it is not necessary that the batteries possess an exceptionally long life. The life of the lights is the limiting factor. Due to the short usage period, the size and weight of the batteries can be held to a minimum. For a detailed discussion of the internal structure and operation of the squib battery, refer to the section entitled Electrical Power System .

The battery supplying power to the transponder is augmented by a boost regulator. The operating level of the transponder is 28.3 volts and the rated voltage

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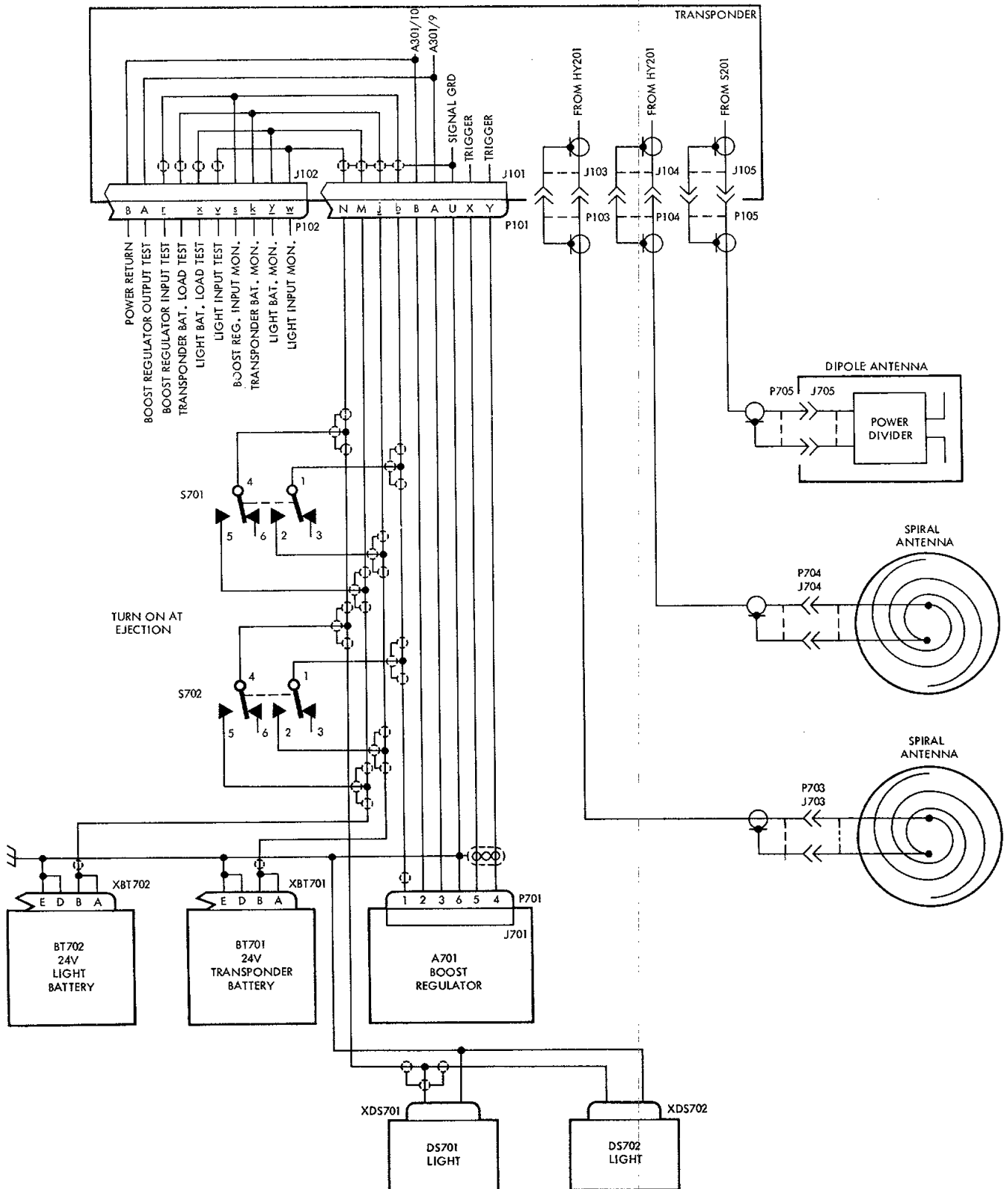


Figure 8-81 Rendezvous Evaluation Pod Schematic Diagram



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of the squib battery is only 24 volts, therefore it is necessary that a boost regulator be incorporated into the system. The purpose of the boost regulator is to increase the transponder input voltage to and maintain it at the required 28.3 volt operating level.

As the power is consumed and the voltage of the squib battery decreases, the boost regulator compensates for the decrease by adding a variable voltage in series with the squib battery. The additional voltage of the boost regulator varies so that there is a constant 28.3 volts input to the transponder at all times. Refer to the schematic diagram of Figure 8-81 for further information on how the batteries of the REP are employed.

RENDEZVOUS POD COVER

The rendezvous pod cover (Figure 8-80) is an oval, plane structure which is located directly behind the REP in the equipment-adaptor section of the spacecraft. The cover is like an umbrella which serves to protect the REP from the intense heat of the sun's rays in space. The cover is made of a tubular metal frame over which a thin fiberglass cloth is stretched. The outer face of the cover has a .00035 inch thick silvered surface. This silvered surface reflects the sun's rays, thereby ensuring that the temperature of the REP remains within the required limits.

Four tubular posts, which extend past the REP, are provided to support the cover. Two of the posts diagonally located terminate in guide pins. These guide pins are used to properly align the cover. The other two posts terminate



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in sockets which house the spring ejection assembly. The cover is held in place by two cables which pass through the springs, sockets, and tubes. Both cables pass through a pyrotechnic guillotine and are anchored to the REP support assembly. The other end of each cable is attached to the rendezvous pod cover by a screw and a nut. This screw and nut serves as a turnbuckle and is used to apply tension to the cable, causing the spring to be compressed.

Ejection of the cover is initiated in the same manner as the ejection of the REP. When the pilot pushes the POD EJECT switch, a pyrotechnic charge activates the guillotine-type cable cutter which severs the two cables. Cutting the cables allows the two compressed springs to expand, thus imparting a relative velocity to the cover of 100 feet per second. The cables remain with the cover after ejection.