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THE COMMANDING GENERAL
AAF BOARD, HQ. COMMAND
AAFB. 23 Feb. 45

Headquarters
ARMY AIR FORCES PROVING GROUND COMMAND
Eglin Field, Florida

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D 13411/2552

FINAL REPORT

PROJECT NO. 6-41-2-2e

AAF BOARD PROJECT NO. E-3916

"OPERATIONAL SUITABILITY OF THE RADIO EQUIPMENT
IN THE B-29 AIRPLANE"

Serial No. 13 No. of Pages 70 Date 23 February 1945

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US. 4510.

1. OBJECT:

To determine the operational suitability of the radio installations in the B-29 airplane.

2. INTRODUCTION:

a. Description of Equipment.

The radio installations in the B-29 aircraft used for this test consist of the following communication, navigation, and special purpose equipment: AN/ARC-8 Liaison Set; SCR-274-N Command Set; SCR-522 VHF Set; RC-36-B Interphone System; Microphone T-30; Headset HS-33; Emergency Rescue Radio Set SCR-578; SCR-269-G Radio Compass; Localizer Receiving Equipment RC-103; Marker Beacon Receiving Equipment RC-43; Range Filter ML-6-A; Radio Altimeter SCR-718; and SCR-695 IFF Transpondor.

3. CONCLUSIONS:

a. Many of the radio installations in the B-29 airplane are not operationally suitable.

b. Adoption of the major modifications enumerated in the RECOMMENDATIONS would make these unsatisfactory installations operationally suitable.

4. RECOMMENDATIONS:

a. The AN/ARC-8 Liaison Set Installation.

(1) The T-47/ART-13 transmitter be located on the radio operator's table to make it accessible for proper tuning. (See Fig. 24)

(2) The fixed wire antenna be located out of the field of fire of the upper aft gun turret. (See Fig. 6)

(3) The trailing wire antenna be retained.

(4) A different type of weight for the trailing wire antenna be used so the fairlead retracting mechanism for this antenna can be eliminated. (See Fig. 11)

(5) All B-29 radio operators be given a thorough training course in the operation of the T-47/ART-13 transmitter.

(6) Adequate illumination be provided for tuning the T-47/ART-13 transmitter.

(7) The antenna reversing switch be relocated in the interests of safety to the radio operator.

b. The SCR-274-N Command Set Installation.

(1) The controls for this set be mounted within easy reach of both the pilot and co-pilot. (See Fig. 17)

(2) The receivers be located behind the pilot, near the BC-733 localizer receiver, to shorten the flexible tuning shafts. (See Fig. 19) This will give improved correlation of the dial readings on the receiver control box.

(3) That a "decal" facing the radio operator be affixed to the side of the modulator warning that the power plug should be disconnected before changing fuses in the modulator. (See Fig. 26)

(4) The modulator be made more accessible for maintenance.

c. The SCR-522 VHF Set Installation.

(1) This equipment be installed in all B-29 aircraft.

(2) This set be used as a clear channel auxiliary interphone system by the bombardier and radar operator during bombing runs. (See discussion of Interphone System)

(3) The antenna lead-in be rerouted to provide for easier removal of the dynamotor and protection for the lead-in. (See Figs. 33 and 34)

d. The BC-36-B Interphone System Installation.

(1) The tail gunner's foot button microphone switch be made more accessible. (See Fig. 37)

(2) The bombardier's jack-box be relocated on the left-hand side of the compartment to make it more accessible and eliminate the confusion of cords. (See Fig. 13)

(3) All foot button microphone switches be modified to prevent "freezing-up" at the low temperatures encountered on high altitude missions.

(4) The hook for stowing the radio operator's headphones be located clear of the path of the exit hatch to pre-

vent damage to this equipment. (See Fig. 27)

(5) The liaison set be wired into every jack-box.

(6) The SCR-522 and the SCR-274-N sets be connected into the interphone system so the pilot can select either set for use on the command channel of the interphone system.

(7) The microphone switch on the top gunner's sight be clearly labeled.

(8) All hooks for stowing headphones, microphones, and microphone switches be painted a bright contrasting color.

(9) Foot button microphone switches be installed in the bombardier, engineer, and tail gunner positions.

(10) The microphone AMB-M-C1, installed in the A-14 oxygen mask, be used on high altitude missions.

(11) Microphone switches be built into the gun sights for the side gunners.

(12) The "cross-channel" interference on this system be eliminated.

e. The SCR-269-G Radio Compass.

(1) A porcelain insulator be used to feed the sense antenna lead-in through the fuselage skin (see Fig. 10) to reduce breakage at this point and to save time and materials required to replace a broken lead-in.

(2) The radio compass control box, now at the co-pilot's position, be made accessible to the pilot also. (See Fig. 18)

(3) The compass receiver be made more accessible to maintenance personnel.

(4) The compass control box and indicator, now at the radio operator's position, be located more conveniently to the navigator.

f. The RC-103 Localizer Receiving Equipment Installation.

(1) The RC-103 equipment as made by the Philco Corporation be used exclusively in the B-29 because of its lighter weight.

(2) An indicator be provided for the co-pilot also.

g. The RC-43 Marker Beacon Receiving Equipment Installation.

(1) A method of eliminating the excessive breakage of marker beacon antenna lead-in wires be devised.

h. The SCR-718 Radio Altimeter.

(1) An indicator be installed only in the bombardier's compartment.

(2) An "ON-OFF" switch be provided for the bombardier.

i. The SCR-695 IFF Transmondor Installation.

(1) The antenna be moved about three feet to the rear to prevent damage by ordnance personnel when loading bombs. (See Fig. 4)

j. The AN/APN-4 Loran Set Installation.

(1) The Loran receiver be relocated to provide more leg room for the radio operator. (See Fig. 22)

k. The SCR-578 Emergency Rescue Radio Set.

(1) The stowage compartment for this set be modified to fit the SCR-578-B. (See Figs. 30, 31 and 32)

(2) A more reliable method of bonding the felt padding to the walls of the stowage compartment be utilized. (See Fig. 30)

l. The Radio Operator's Compartment.

(1) The compartment be redesigned to better utilize available space. (See Fig. 24)

(2) Better illumination facilities be provided.

m. Noise Level.

(1) The grounding of all miscellaneous electrical equipment be improved.

(2) Wires for the various components of the radio equipment be rerouted.

n. Raven Equipment.

(1) An operational suitability test of the Raven equipment installation in this airplane be made.

5. RECORD OF TEST:

The tests were conducted in accordance with the Test Program, attached as Inclosure II.

6. DISCUSSION:

a. General.

(1) Except for the high noise level, performance of the radio equipment in the B-29 airplane was considered to be satisfactory. Altitude flying presented no unusual difficulties. Maintenance, except for excessive replacement of some antennas, was no problem. The pressure-sealed cabins of the B-29 gave excellent all-weather protection to the sets which was a big factor in eliminating many maintenance difficulties. Not all equipment locations were found to be entirely suitable.

(2) The radio equipment in the airplanes tested was located as shown in Fig. 1, Inclosure III, with the exception of one airplane, #42-24618. It was flown directly to this field from the factory without going through a modification center. Opportunities for some interesting comparisons were provided by several of the outmoded radio installations in this airplane. According to information from Headquarters, AAF and the Boeing Company, (see Inclosure IV and Fig. 2, Inclosure III), the radio installations now in effect on the latest production models differ somewhat from those tested.

b. AN/ARC-8 Liaison Set.

(1) The average reliable ranges experienced in this test were 150 to 200 miles on Voice using the fixed antenna; 250 to 300 miles on Voice using the trailing wire antenna; 300 to 350 miles on CW using the fixed antenna; and 600 to 700 miles on CW using the trailing wire antenna. However, ranges as much as 75% greater than

these were experienced under ideal conditions. The equipment functioned perfectly at high altitudes with no flash-over. In general, reception on this receiver was quite noisy. This tended to cut down the effective range of liaison communication. Operation of the remotely controlled gun turret was the source of much interference encountered on the liaison receiver. The tuning of the liaison transmitter for automatic channel selection was found to be very critical. It is very difficult to set up the automatic channel selector on the desired frequency because of the cumbersome locking devices on each dial. These necessitate much trial and error manipulation before a channel is satisfactorily locked on the desired frequency. It has also been found that over short periods of time, automatic channel selection becomes less accurate and constantly moves off frequency, necessitating resetting and relocking on the correct frequency. Under these conditions of operation the automatic features of this transmitter are superfluous. This trouble is due to the complexity of the locking devices which require a thoroughly trained and experienced operator, and also due to the inaccessible location of the transmitter which makes setting up this transmitter an almost impossible job, even for an expert.

Unless a full 28 volts was available during the tuning operations, difficulty was experienced in tuning up this transmitter on the desired frequency. The built-in pressure-operated relay, for reducing the power output of the transmitter to one-half of full power when an altitude of 25,000 feet is attained, was found to be a desirable feature. During comparison tests of the altitude performances of this equipment with the BC-375 transmitter, it was found that the BC-375 transmitter would "flash-over" at high altitude when the cabin was not pressurized. Such was not the case with the T-47/ART-13 transmitter.

(2) It would be advantageous to place the T-47/ART-13 transmitter on the radio operator's table in the position now occupied by the BC-348 receiver. It would then be more accessible to the operator for performing the critical tuning operations required on this set. The radio operator's compartment is so cramped that when the radio operator is wearing heavy winter flying clothing, it is almost impossible for him to tune

this transmitter in its present location. (See Fig. 24) The radio operator should have the use of both hands and an unobstructed view of the front panel with all its dials and meters when tuning this transmitter. With the set in its present location, one hand is required to hold the cockpit lamp in order to illuminate the face of the transmitter. The cord for this lamp is too short for efficient lighting of this set. Maintenance work on this transmitter is very difficult because of the plugs, which must be disconnected before the set can be removed from the rack, are too close to the rear of the engineer's fuse panel. (Note arrow on Fig. 25) The location of the receiver is not as critical as that of the transmitter, since it is tuned mainly by ear. Only one hand is actually required to tune the receiver, and a clear view of this set is not necessary for efficient operation. The antenna reversing switch is located too close to the operator's head. (See Fig. 27) Serious burns might result from contact with this switch while the transmitter is operating. The sharp corners of this switch would also result in physical harm to the operator if he happened to be thrown against it. With the fixed wire antenna in its present location between the forward part of the fuselage and the tip of the vertical stabilizer, it is frequently severed by gun fire from the upper aft turret. A possible solution to this difficulty might be the use of the "shunt-fed" type antenna leading out to the #3 engine nacelle, such as was formerly used on the BC-375 liaison transmitter installation in B-29 aircraft. One B-29 airplane used during this test had such an installation. Performance checks demonstrated that this installation performed as well as the current AN/ART-13 installation.

(3) The advisibility of deleting the trailing wire antenna from the B-29 airplane was considered. This would effect an estimated weight saving of 20 pounds. However, if reliable long-range communication facilities are desired with this airplane, the trailing wire antenna should be retained. Use of the trailing wire antenna nearly doubled the range of the liaison set. The trailing wire antenna is also used by the AN/ARN-4 Loran set, which is another reason for retaining it. It was found that the trailing wire antenna does not break off in flight when extended with the airplane cruising at normal cruising

speed in level flight. In the event that the fixed antenna was damaged during flight, due to gunfire or accidental release of the life raft, the trailing wire antenna would be very useful. The trailing wire antenna occasionally "jumped the tracks" and fouled up on the various pulleys and guides. Some difficulty has also been experienced with the locking mechanism on the control lever for the retractable fairlead. Use of a small fixed opening in conjunction with a smaller diameter weight on the trailing wire would allow the retractable fairlead mechanism to be eliminated. A multiple section lead weight similar to those used on British "Mosquito" bombers would be one possibility.

The trailing wire antenna lead-in wire within the body of the plane is too long. When this antenna is extended, it is shielded considerably by both the fuselage and the wing. The proposed shift of the radio operator's position to the rear cabin would allow the trailing wire antenna to be installed so that it would not be shielded by the plane.

c. SCR-274-N Command Set.

(1) The average reliable range of this equipment on "Voice" was 80 to 100 miles over water. However, several distance checks resulted in continuous contact out to a distance of 190 miles or more from the ground station. On several high altitude flights (30,000 to 35,000 feet) it was necessary to retune the transmitters before contact could be made with the ground station. Occasionally the noise on the command set would be so intense that the bombing mission would have to be cancelled. Complaints concerning the command set performance were made many times by pilots. Upon investigation it was found that in most cases the pilots depended too much on the dial reading of the receiver control box and not at all on their sense of hearing. Usually when they "rocked" the dial slightly, while listening for the station, the signal came in loud and clear. It seems advisable to include a note to this effect in the radio section of the pilot's flight operating instructions for the B-29 airplane. (T. O. AN 01-20JJ-1). This "rocking" is necessary because of the binding resulting from the many twists and turns in the long

lengths of flexible tuning shaft between the control box and the receivers. This friction causes discrepancies between the dial readings on the control box and the frequency settings of the receivers. Mounting these receivers behind the pilot, near the BC-733 localizer receiver, would allow the flexible tuning shafts to be shortened considerably. This would give a resultant increase in the accuracy of the receiver remote controls and a slight saving in weight.

(2) The receiver controls are conveniently located for the pilot's use at the left side of the compartment, but are out of the reach of the co-pilot. (See Fig. 17) All pilots desire that both the transmitter and the receiver controls be so located as to be accessible from either the pilot or co-pilot position. According to the latest information on standard radio installations in the B-29, only two receivers are to be retained. (See Inclosure IV) In this event it would be advantageous to mount two "single-receiver" control boxes (BC-473) in tandem behind the SCR-522 control box on the pilot's aisle stand where they would be accessible to both the pilot and the co-pilot. Switches and controls, with the exception of the receiver tuning cranks, are very small and difficult to handle while wearing heavy gloves. The transmitter controls are in an awkward position because of their proximity to the throttles.

(3) The receivers, antenna switching relay, and transmitters are easily removed for maintenance, but the modulator is not. (See Fig. 26) The flexible tuning shafts have to be disconnected from the receivers and the modulator support before the modulator can be removed. The nuts for the clips which hold the tuning cables to the modulator support are in a blind spot and considerable time is wasted trying to fasten the clips. If the nuts were bonded to the modulator support, considerable time would be saved in replacement of the modulator. It is possible to replace fuses in the modulator without removing it from the mounting. Poor visibility and awkward location of the fuses make it mandatory to disconnect the power plug before attempting replacement of the fuses. An appropriate warning should be affixed to the front of the modulator. The antenna is desirably

located out of the field of fire of the airplane's guns.

a. SCR-522 VHF Set.

(1) The antenna location for this equipment is considered satisfactory as the field patterns show that the variation in field strength averages about 6 db. (See Inclosure V) This is well within the allowable average. Performance at high altitude was very satisfactory. This equipment gave exceptionally good reception at all altitudes and very little noise interference was experienced. On a distance check at 10,000 feet altitude, communication was carried on out to a distance of 130 miles over land. Not all the B-29 airplanes under test had the SCR-522 set installed. This set was found to function satisfactorily as an auxiliary interphone system. With the proposed elimination of the SCR-274-N command transmitters, the need for additional channels of communication is foreseen. The AN/ARC-3 VHF communications set, which covers the same band of frequencies as the SCR-522, appears to be a solution to the problem of providing more communication channels.

(2) The location of the receiver-transmitter is satisfactory. The equipment is well protected from damage by personnel. It is easily accessible for maintenance work although the mechanic has to assume a somewhat awkward position to remove the equipment. The dynamotor can be removed independently of the receiver-transmitter, but the antenna lead-in has to be disconnected from the set. The antenna distance from the set is short. This is in keeping with accepted VHF practice. The control box is situated on the pilot's aisle stand. (See Fig. 15) The control box is within easy range of both the pilot and co-pilot. The antenna lead-in connection to the feed-through insulator in the forward bulkhead of the corner section is subject to damage from personal equipment thrown in that corner. (See Fig. 34) If the feed-through insulator were located below the floor level of the compartment, this connection would be protected. This modification would not necessitate increasing the antenna length. It would be desirable to change the routing of the antenna lead-in so as to shorten this cable and facilitate removal of the dynamotor.

e. SC-36-B Interphone Amplifier System.

(1) Amplification was ample and distortion was not a disturbing factor. Performance at high altitude was satisfactory under both pressurized and unpressurized conditions. Use of the microphone AEB-M-C1 in the oxygen mask A-14 resulted in better quality speech transmission than with use of the T-30 throat microphone. There is considerable cross-channel interference on this system due to the stray capacitance between the interconnecting wires. This interference is particularly objectionable when attempting to read a weak signal. Rerouting of the interconnecting wires should improve this condition. However, certain features of the system were found to be undesirable. The elimination of the "liaison" position from all interphone jack-boxes (except that of the radio operator) and the substitution of "VHF" has several disadvantages. The radio operator is excluded from all use of the "VHF" set. All other crew members can neither monitor the liaison receiver for reception of radio ranges, beacons, or time of signals, nor transmit over the liaison transmitter in event of failure of the command transmitters. The allocation of two interphone channels to command functions, and the exclusion of the liaison set--which has the most powerful transmitter and the most sensitive receiver of any set carried on the airplane--from general use, is not the most advantageous utilization of the available interphone facilities.

Provisions for switching the command channel of the interphone system to either the SCR-522 or to the SCR-274-N would make the best use of the command functions, and at the same time would provide all crew positions with the use of the liaison set. The modified SCR-274-N installation will be of secondary importance since it will consist of only two receivers, one of which duplicates a portion of the frequencies covered by the radio compass. It is also anticipated that the present interphone system would be congested on radar bombing missions since necessary conversation would occur between the gunners. This would interfere with the exchange of data between the radar operator and the bombardier. A workable solution to this difficulty would be to have the bombardier and radar operator use the SCR-522 as an auxiliary interphone system during the bombing run, while the

remainder of the crew would use the conventional interphone system. The bombardier could still be reached by the gunners, using "CALL" position on the interphone jack-box, in case it was necessary for the bombardier to bring his gun sight into action.

The AN/AIC-2 interphone system is to replace the AC-36 system in the B-29 airplane. The amplifier used with the AN/AIC-2 interphone system incorporates a control which is to be varied with altitude. It would seem practical to have this control conveniently located to the navigator for correlating this adjustment with the altitude of the airplane. The interchangeability of the tubes in this amplifier will partly redeem the increase in the number of tubes. This new interphone system was not installed in any of the aircraft under test.

(2) The present location of the interphone amplifier and dynamotor is very satisfactory from the standpoint of accessibility for maintenance. (See Fig. 26) The interphone jack-boxes are suitably located except for the bombardier's jack-box. (See Fig. 13) When the gun sight is in the stowed position, the bombardier's jack-box is very difficult to reach. When the bombardier has his safety belt fastened, the jack-box is out of reach. Mounting this jack-box on the left-hand side of the compartment would also eliminate tangling the microphone and headphone cords with the gun sight, and interference to the bombardier caused by the cords crossing in front of him. Space is available for mounting this jack-box on the armor plate in front of the pilot's instrument panel. Bombardiers expressed desires for a foot button microphone switch installation. This would be of great advantage to the bombardier as it would eliminate the search for the cord switch every time he desired to use his microphone. A Technical Order (T. O. 01-20EJ-95) has recently been issued ordering such an installation to be made in all B-29 aircraft. One B-29 airplane, of more recent manufacture than most of the airplanes tested, had foot button microphone switches at the engineer, side gunner, and tail gunner positions. The foot button microphone switch was found to be highly desirable at the engineer's position except that it would "freeze-up" at high altitudes. Moisture condenses and freezes in the switch. Greater clearance

for the button, or a more powerful loading spring might counteract this difficulty.

The foot button switch for the tail gunner was very difficult to reach because of the "walk around" oxygen bottle which is located just above the switch. (See Fig. 37) Moving this switch about three inches toward the center line of the airplane would allow the tail gunner to make the best use of this installation. The foot button microphone switches for the side gunners are a big improvement over the cord switches but are still awkward to operate when using the gun sights. The most convenient installation would be a switch on the gun sight. The microphone switch on the top gun sight should be labeled to avoid confusion with other controls on the gun sight.

The radio operator's headphones are being damaged by the careless opening of the escape hatch in the rear bulkhead of the forward cabin. Relocation of the stowage hook for the headphones, microphone switch, and throat microphone would correct this condition. (See Fig. 27) The stowage hooks for this equipment are difficult to find because of inadequate lighting conditions at most interphone stations. It was found that when those hooks were painted a bright contrasting color, the crew members were more careful about hanging up the equipment after use. The bright paint served as a reminder and also aided in finding the hooks in dark corners. Numerous instances of jack-boxes shorting out various interphone channels occurred because of moisture condensation in the jack-boxes. This trouble was eliminated by drilling two drainage holes in the bottom of each jack-box, in compliance with instructions in a recent Technical Order.

f. SCR-269-G Radio Compass.

(1) The radio compass performed very well at all altitudes up to 35,000 feet. On the continuous distance test 250 miles was attained, and the signal was still strong and reliable. On spot checks at high and medium altitudes, stations 250 to 300 miles away were received, and accurate bearings were possible. No directivity of the sense antenna was noted on the flight tests. Radio compass sense antennas frequently broke off at the point where the lead-in enters the fuselage. (See

Fig. 10) Use of a porcelain feed-through insulator, IN-86, considerably reduced breakage at this point and facilitated easy replacement of the antenna. With this insulator installed, only the wire on the outside of the plane needs to be replaced in case of antenna breakage. Without this insulator installed, the entire lead-in, including a long length of wire inside the plane, has to be replaced. This replacement was particularly difficult in airplanes which had auxiliary gasoline tanks installed in the forward bomb bay. The radio compass receiver in the forward bomb bay (see Fig. 28) is very difficult to get at for maintenance work. Both the proximity of the receiver to the tunnel and its remote location contribute to the difficulty of servicing this equipment. It would be impossible to reach this equipment for minor adjustments in flight. The tuning cranks on the control boxes are very "stiff" in operation. All pilots expressed the desire to have the radio compass controls accessible to the pilot as well as the co-pilot. It is suggested that the control box be mounted on the pilot's aisle stand or on the ceiling of the compartment above the aisle. The indicator and controls in the radio operator's compartment would be of more value to the navigator. The present installation is very inconvenient for the navigator, especially on high altitude flights where oxygen equipment must be worn. According to latest information, the SCR-269-G radio compass is being replaced with AN/ARN-7 radio compass. This is essentially the same set except for an additional band of frequencies (100 to 200 kc), and the incorporation of the "VOICE-CW" switch on the control box. This equipment was also tested and performance was found to be on a par with the SCR-269-G.

3. Localizer Receiving Equipment RC-103.

(1) Accuracy of the approaches was excellent. However, this equipment is of little value for "blind" landings without the companion equipment AN/ARN-5A Glide Path Receiving equipment, as it only indicates the position of the airplane with reference to the center line of the runway. The airplanes under test were not equipped with the glide path receiver although current directives specify that it is to be installed in all B-29 airplanes. The indicator is clearly visible to the pilot (see Fig. 16), but the co-pilot would not be able to use it. The receiver is mounted on a shelf

behind the pilot in an accessible location for maintenance work. (See Fig. 19) The controls are readily accessible to the pilot and are simple in operation. (See Fig. 17) The antenna is mounted according to the recommendations of the Technical Order in a location which will not be disturbed by airplane mechanics or armament personnel. (See Fig. 7) According to the Technical Order, the RC-103 equipment as made by Philco Corporation is 5.2 pounds lighter than that manufactured by the Western Electric Company.

h. RC-43 Marker Beacon Receiving Equipment.

(1) The marker beacon receiving equipment operated very satisfactorily. The receiver is very easy to reach for maintenance work. (See Fig. 36) The indicator on the pilot's instrument panel is in a favorable location, easily viewed by the pilot or co-pilot. (See Fig. 16) The proximity of the receiver to the antenna is a desirable feature of this installation. The chief maintenance problem connected with this equipment was the frequent replacement of the antenna lead-in. (See Fig. 5) Breakage occurs at the point where the lead-in passes through the insulation on the skin of the airplane. This may be due to turbulence created by the lower aft gun turret. The trouble might be corrected by the use of a rubber grommet at the point of entry, or by wrapping the end of the lead-in wire back on itself to achieve a bracing effect. Relocation of the antenna might be another solution.

i. SCR-718 Radio Altimeter.

(1) This installation was found to be of great value on bombing missions. It was of exceptional value above 20,000 feet. Only one indicator would be required, which would be most conveniently located in the bombardier's compartment. (See Fig. 18) It would be desirable to have an "ON-OFF" switch located near the bombardier. At present the same inverter supplies power for the Raven equipment and the SCR-718 radio altimeter; thus the bombardier has to contact the radar operator before the equipment can be used.

j. SCR-695 IFF Set.

(1) The performance of the IFF equipment was well up to expectations. Approximately line-of-sight distances

were achieved. At 6,000 feet the ground station followed the airplane out to a distance of 85 miles; at 26,000 feet, out to a distance of 110 miles; at 32,000 feet, out to a distance of 122 miles. Both the current installation (antenna just behind the rear bomb bay and the transpondor under the floor in the "blister" compartment) and the previous installation (antenna on forward bomb bay door and transpondor under radio operator's table) were tested but no appreciable difference in performance was noted. In the air-to-air test, a B-26 airplane at 10,000 feet altitude, equipped with a SCR-729 set, picked up the B-29 airplane at 30,000 feet altitude at a distance of 60 miles. At closer range passes were made from all probable angles of fighter plane attack, and in every case the B-26 operator was able to "home" perfectly on the B-29 airplane. Figure-eight maneuvers showed no appreciable directivity in the antenna pattern. This could be expected because of the unshielded location of the antenna. Maintenance was no problem with this equipment. The controls for the pilot and for the radar operator are easily reached. The transpondor, when located under the floor in the blister compartment, is protected from damage by personnel and is easily reached for any maintenance work. (See Fig. 35) The antenna in its present location (See Fig. 4) is frequently damaged when ordnance personnel are loading bombs in the rear bomb bay. Moving the antenna about three feet to the rear should correct this difficulty.

k. AN/APN-4 Loran Set.

(1) No operational flight tests of this equipment were conducted because of the long over-water flights involved. The indicator is conveniently located for the navigator. (See Fig. 21) If the receiver were relocated, additional leg room could be provided for the radio operator. (See Figs. 22 and 27)

l. SCR-578 Emergency Transmitter.

(1) No operational tests were conducted since operation of this equipment is independent of the B-29 airplane. Provisions for stowing were found to be inadequate for the SCR-578-B equipment. This is due to the radical difference in the exterior dimensions of the "A" and "B" models. (See Fig. 31) The dimensions of the bag for the SCR-578-A are 12½" x 10½" x 9, whereas

the dimensions for the bag for the SCR-578-B are 20½" x 17" x 14½". The dimensions of the compartment are 10½" wide by 14" high by 37" in length. It can be seen that the smallest dimension of the bag for the SCR-578-B exceeds the width of the compartment by 4½". Figure 32 illustrates the impossibility of fitting this equipment into the present compartment. This figure shows the equipment being placed in the compartment from the outside of the airplane. In actual practice, this set is placed in the compartment through the access door on the inside of the bomb bay. (See Fig. 30) The outside hatch of the compartment was large enough for removal of either bag. A minor change in the size of the radio section of this compartment would make it possible to stow either model of the emergency radio equipment. The felt padding of this stowage compartment peels off after a short time. The location of the stowage compartment is such that it would be very difficult to remove this equipment in mid-air in case it was necessary to drop this set. It would be exceedingly difficult for a man wearing a parachute to proceed along the catwalk and remove this equipment. From the standpoint of accessibility after the plane has been ditched, this compartment provides ideal conditions.

m. Radio Operator's Compartment.

(1) The radio operator's compartment was not designed for the comfort and efficiency of the radio operator. With the two-gun upper forward turret installation there is little room for the radio operator, but the four-gun turret, extending to within a few inches of the floor, is even more undesirable. (See Figs. 23 and 24) The four-gun upper forward turret is to be the standard installation in all B-29 airplanes. Illumination facilities are not adequate. Pilots complain of glare on the side window from the light in the radio operator's compartment during night operations. The location of the liaison transmitter is extremely unsuitable. There is not enough leg room, and when wearing heavy flying clothing, it is very difficult for the operator to squeeze himself into the chair provided.

The present location could be improved by modifying the compartment so as to place the radio operator

facing the rear wall of the forward cabin, with the liaison transmitter and receiver directly facing him. With the removal of the SCR-274-N modulator and transmitters, additional head room will be provided. A hinged work table would add to the convenience of this modification.

The proposed interchange of the radar and radio operator's positions has considerable merit from the standpoint of a more efficient radio operator's installation. Placing the radio operator in the rear cabin would effect a more convenient installation of the radio equipment used by the radio operator. However, the SCR-274-N command set receivers and the controls for the radio compass could not be located in this rear position because of the extreme lengths of tuning cable involved. An improved installation of the trailing wire antenna could be made in this rear cabin. In this new location a shorter lead-in wire could be used, and the antenna would be unobstructed by any part of the plane.

b. Noise Level.

(1) Several factors have been found to contribute seriously to the high noise level in all communication equipment in the airplanes tested. Ignition noise seems to be a predominant cause, with improper routing of wires and unsatisfactory grounding of the many units of electrical equipment as secondary causes. Numerous small fans and motors for miscellaneous equipments, as well as power inverters, contribute their share of noise. Intermittent disturbance is created by operation of the motors controlling the wing flaps, the landing gear, cowl flaps, regulators, and compressors. Lead wires to electrical equipment and associated filter condensers should be shortened, and in many cases, the grounding returns should be thickened.

c. AN/ARR-1 VHF Homing Adapter for the Radio Compass.

(1) This equipment was installed in the airplanes under test, but since current directives do not specify that this equipment is to be installed in subject aircraft, no operational tests were conducted. The installation is easily accessible for maintenance and tuning. (See Fig. 28) The controls are simple in operation. In some planes the controls were located

close to the co-pilot's radio compass controls. In other planes they were located near the localizer receiver controls on the pilot's side of the compartment.

o. Raven Equipment.

(1) The many different combinations of Raven equipment which can be used in the B-29 airplane, and the precise nature of RCM operations, precluded any tests of the Raven equipment under the conditions prevailing during this operational suitability test. However, several items concerning this unsatisfactory installation came to the attention of the Project Officer during the test. These items concerned such matters as accessibility of equipment, power requirements, comfort of the operator, and damage to antennas.

q. Static Dischargers.

(1) Servicing the static dischargers, located on the tips of the wings and stabilizers, with an ethylene glycol solution before each flight, definitely improved reception under atmospheric conditions.

7. ENCLOSURES:

Inclosure I - Test Historical Data.

Inclosure II - Test Program.

Inclosure III - Figures 1 through 37.

Inclosure IV - Official Installation Information.

Inclosure V - SCR-522 VHF Field Patterns.

SECRET

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Distribution:

Orig. and 1 cc (Serial No. 2): The President, AAF Board, Orlando, Fla.

1 Czalid copy: Proof Division File (Serial No. 12)

LIST OF TECHNICAL ORDERS AND CONFIDENTIAL ORDERS FOR REFERENCE

08-10-108	Handbook of Instructions for Operation and Maintenance of Test Equipment IE-12-A, IE-12-T2.
08-10-107	Handbook of Instructions for Operation and Maintenance of Frequency Meter BC-906-C.
08-10-151	Handbook of Maintenance Instructions for Test Set I-100-A.
08-10-157	Handbook of Maintenance Instructions for Radio Receivers BC-1033-A and BC-1033-B.
08-10-169	Instructions for Test Set I-173-A.
08-10-150	Instruction Book for Operation and Maintenance of Radio Receiver BC-1023-A.
AN-08-10-185	Handbook of Maintenance Instructions for Radio Set SCR-624-A.
AN-08-10-225	Handbook of Operating Instructions for Radio Transmitter BC-375-E.
AN-08-10-109	Handbook of Operating Instructions for Radio Sets SCR-695-A, SCR-695-AZ.
03-10-95	Handbook of Instructions for Operation and Maintenance of Test Set I-76.
08-40-SCR718-2	Handbook of Operating Instructions on SCR-718-A, AM, B, and C.
CO-08-10BB-1	Handbook of Instructions for Operation and Maintenance of Radio Sets SCR-695-A and SCR-695-AZ.
CO-AN-08-25BA-1	Handbook of Maintenance Instructions for Radio Receiving Equipment AN/ARR-1.
08-10-105	Handbook of Instructions for Operation and Maintenance of Radio Set SCR-522.
08-5-75	Microphones and Headsets.
08-5-34	Means for Reducing Precipitation Static

08-5-53	Resealing of Loops and Maintenance of Dehydrators—Radio Compass SCR-269.
AN-08-10-183	Handbook of Maintenance Instructions for Radio Set AN/MRN-1.
AN-08-10-187	Handbook of Operating Instructions for Radio Receiving Equipment RC-103-A or RC-103-AZ.
AN-08-10-209	Handbook Maintenance Instructions for Radio Receiver BC-348.
08-10-87	Handbook of Instructions Marker Beacon Receiving Equipment RC-39-B, RC-43-B.
AN-01-20EJ-1	Pilot's Flight Operating Instructions for the B-29.
AN-08-10-89	Handbook of Instructions Marker Beacon Receiver Equipment RC-39, RC-43.
AN-08-10-50	Handbook of Instructions for Operation and Maintenance Radio Set SCR-274-N.
AN-08-10-59	Operation and Maintenance Instructions Marker Beacon Receiving Equipment RC-39-A, RC-43-A.
AN-08-10-94	Handbook of Maintenance Instructions for Radio Set SCR-578-A or SCR-578-B.
AN-08-10-104	Handbook of Operation and Maintenance Instructions Radio Receiving Equipment RC-103-A, RC-103-AZ (Western Electric).
AN-08-30ART-13-2	Handbook of Maintenance Instructions for Radio Transmitting Set AN/ART-13.
AN-08-10-3	Handbook of Maintenance Instructions Reel RL-42-B and Reel Control Box BC-461.
08-10-111	Instruction Book for Operation and Maintenance of Test Equipment IE-19-A.
AN-08-30AIC2-2	Handbook of Operating Instructions for Interphone Equipment AN/AIC-2.
AN-08-10-237	Handbook of Operating Instructions for Radio Receiving Equipment AN/ARR-1.

AN-08-10-248	Handbook of Maintenance Instructions Interphone Equipments RC-34, RC-35, RC-35-Z, RC-36, RC-51.
AN-08-10-255	Handbook of Maintenance Instructions Static Discharger Assemblies AN/ASA-1, AN/ASA-1A.
08-15-1	Army Air Forces Radio Facility Charts.
08-10-175	Handbook of Maintenance Instructions for Radio Compass SCR-269-G.

TEST HISTORICAL DATA

1. Introduction.

This test was originally part of AFPOC Project No. 6-44-2-E, "Operational Suitability of the Radio and Radar Equipments in the B-29 Airplane", which was requested in letter, AAF Board, Orlando, Florida, dated 3 May 1944, to Commanding General, AFPOC, Eglin Field, Florida, subject: "Test of Operational Suitability of the B-29 Airplane". A new project (6-44-2-Ze) to cover specifically the radio equipment in the B-29 airplane was activated 6 September 1944 on verbal authority from the AAF Board, Orlando, Florida.

2. Test Activated.

The test was activated 6 September 1944.

3. Equipment Received.

The B-29 aircraft used for this test were received by this Command before the date of activation of the test.

4. Test Delays.

The test was suspended on 2 November 1944 because no flight tests had been made for two weeks due to higher priority projects. At an informal conference between the Chief, Electronics Section, Proof Division, the Project Officers, and the Test Officers on 20 November 1944, it was decided to revise the method of testing and the test was then reactivated. Prior to this time the test had been conducted in accordance with the "Standard Procedure for Operational Test of Radio and Radar in Aircraft", as issued by this Headquarters, without much progress being made because of the complexity of this procedure.

The test was delayed from 5 September to 9 September 1944 because communication facilities were being used for mass flight tests on projects E-44-40 and E-44-42.

Frequent delays of from one to five days occurred throughout the test due to low priority of the project, unsuitable weather for high altitude missions, and excessive engineering maintenance work on the planes.

5. Testing Completed.

Testing was completed 9 January 1945.

6. Report Completed.

The report was completed 20 February 1945.

7. Net Testing Time.

Flying Time: B-29 aircraft--105 hours.

B-26 test plane--3 hours.

Ground Time: 30 hours.

PROOF DEPARTMENT
ARMY AIR FORCES PROVING GROUND COMMAND
EGLIN FIELD, FLORIDA

SECRET
BY AUTHORITY OF
THE COMMANDING GENERAL
AAF PROV'G GD. COMMAND
C. A. A.

(610-I) AEH:JDR:bbb

22 January 1945

SUBJECT: Program for Test of the Operational Suitability of the Radio Equipment in the B-29 Airplane. (S. T. No. 6-44-2-Ee, AAF Board Project No. H-3916)

TO : Commanding Officer, Electronics Section, 610th AAF Base Unit I, AAF Proving Ground Command, Eglin Field, Florida.

1. GENERAL:

a. Description of Equipment.

(1) Communication facilities are provided by the AN/ARC-8 liaison set, the SCR-274-N command set, the SCR-522 VHF set, the RC-36-B interphone system, microphone T-30, headset HS-33, and emergency rescue radio set SCR-578.

(2) Navigational assistance is rendered by the radio compass SCR-269-G, localizer receiving equipment RC-103 for blind landings, the marker beacon receiving equipment RC-43, range filter FL-8-A, and the radio altimeter SCR-718.

(3) Identification to ground radar stations is provided by the SCR-695 IFF transpondor.

b. Availability of Equipment.

The radio equipment required will be that which is installed in B-29 aircraft at this station.

c. Airborne Test Facilities.

An airplane (B-26, P-61 or B-17) equipped with a SCR-729 airborne interrogator-responsor will be required for one mission of two hours duration. Several such planes are now being maintained at Auxiliary Field 9, Eglin Field, Florida, and one of these airplanes will be available when needed.

d. Ground Test Facilities.

The major testing facilities, other than aircraft, are enumerated below. All other test equipment will be standard communication maintenance test equipment.

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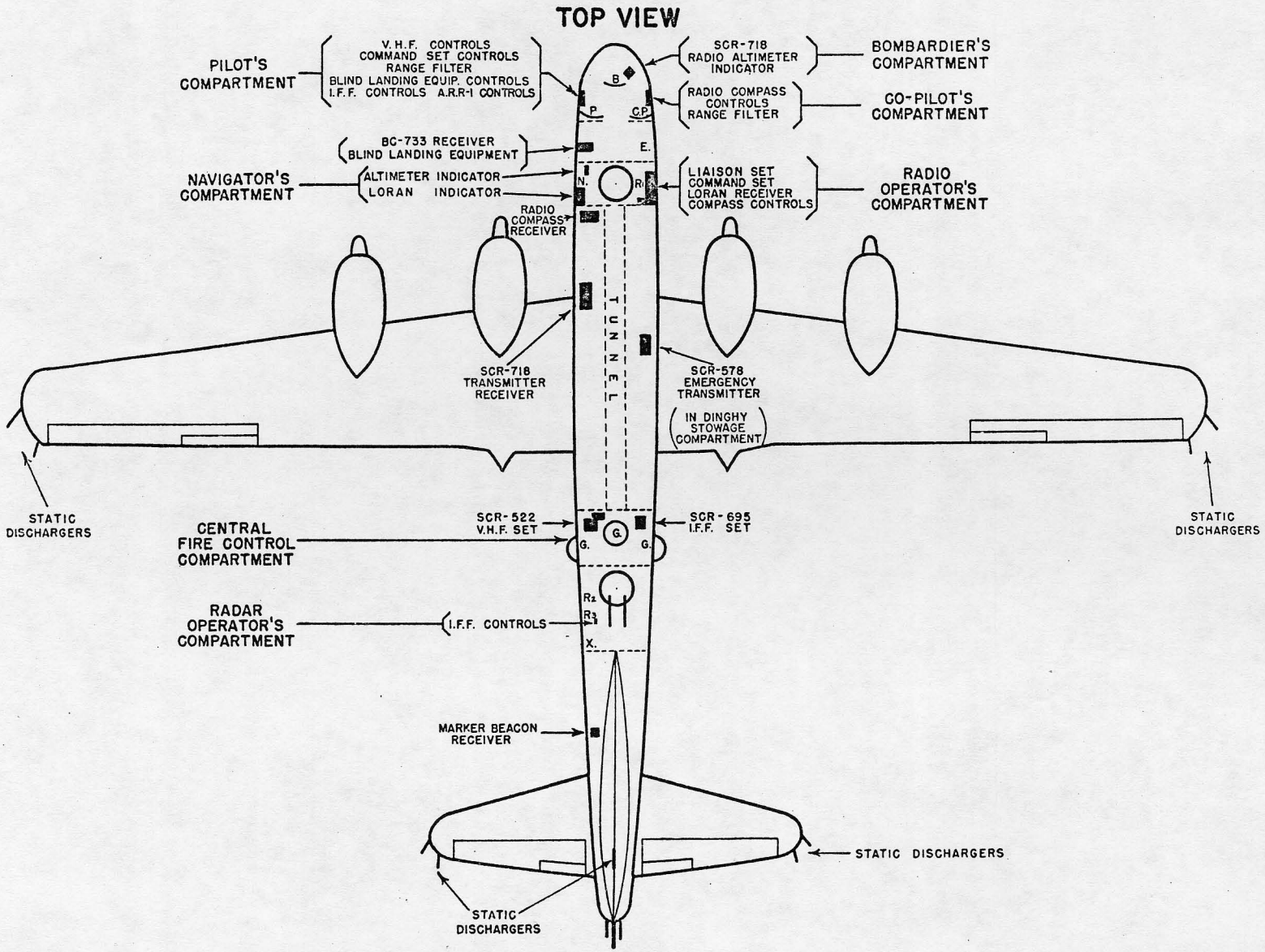
PGE-22 JAN 45 6-44-2-EE SF-423



RADIO LOCATIONS ON PLANES TESTED

FIGURE 1

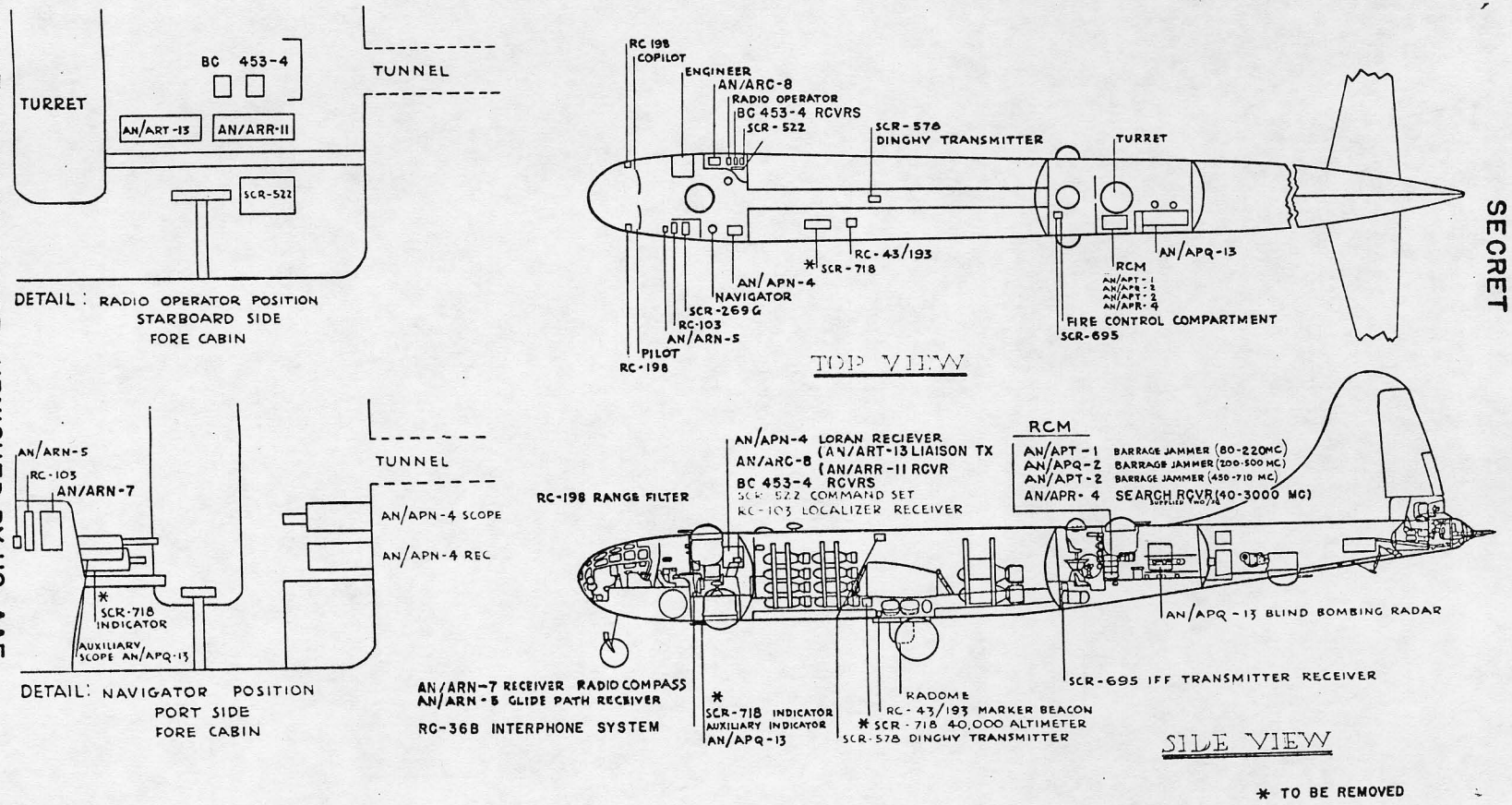
SECRET

INCLOSURE III
PAGE 2

PGE-16 JAN. 45 SF-395

SECRET

RADIO AND RADAR ON B-29



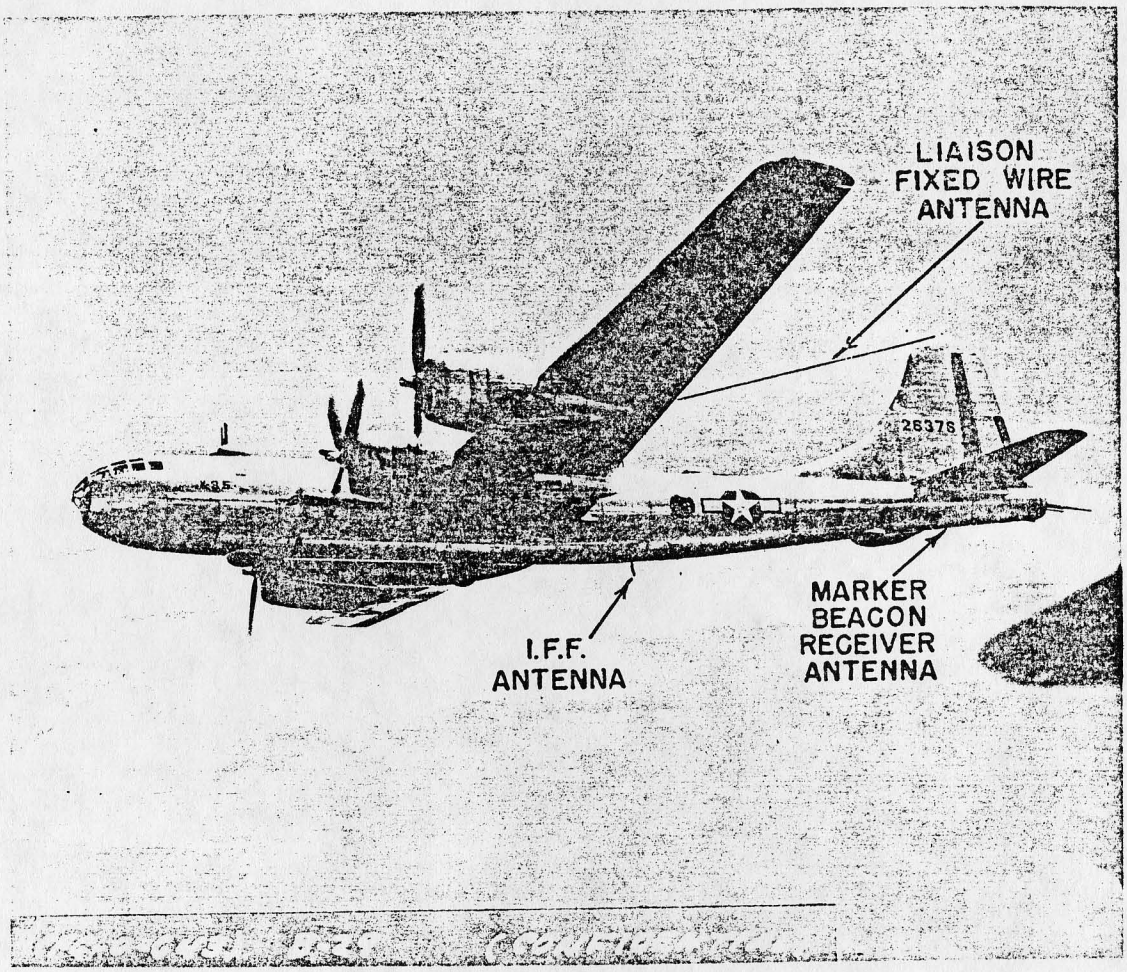
INSTALLATION CHART FURNISHED BY HQ. AAF

* TO BE REMOVED

NOVEMBER, 1944

FIGURE 2

SECRET



ANTENNA LOCATIONS

INCLOSURE III

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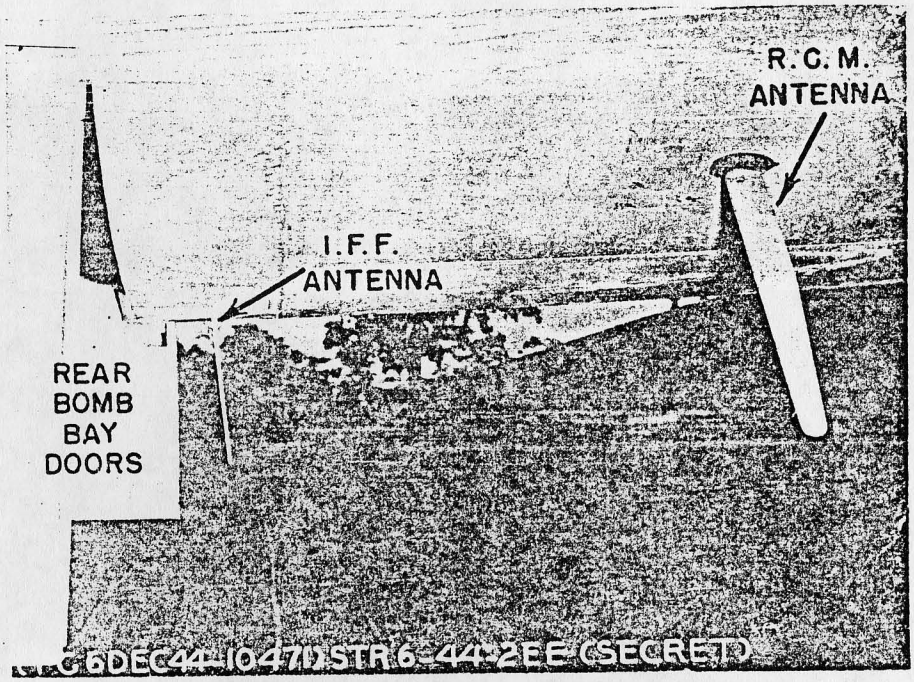
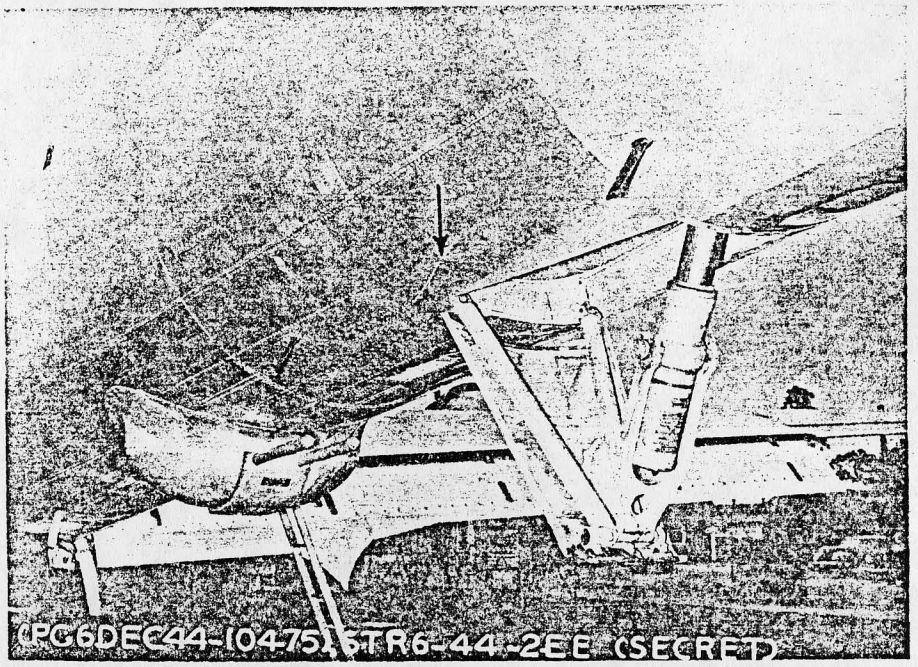
FIGURE 3

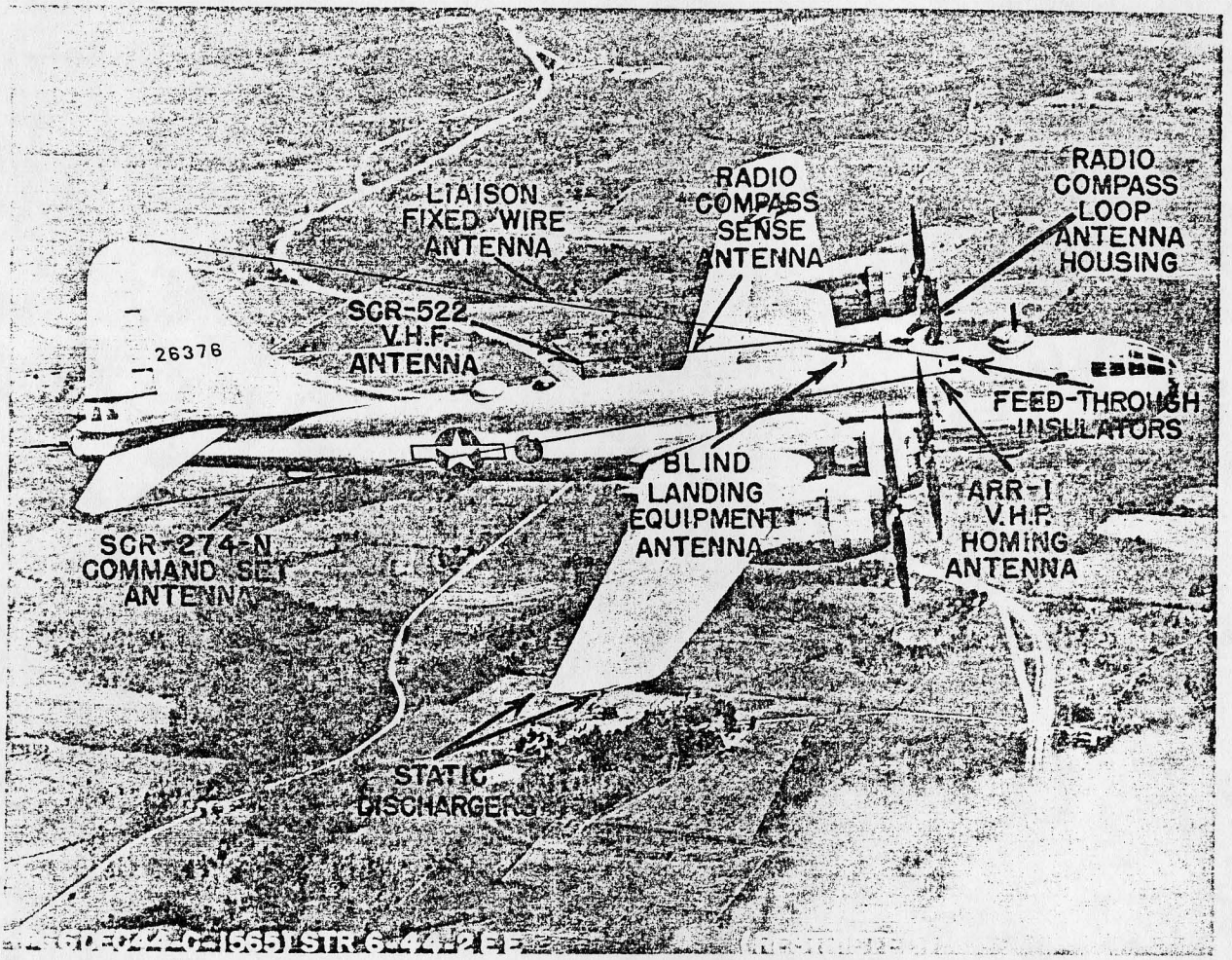


I.F.F. ANTENNA INSTALLATION



MARKER BEACON RECEIVER ANTENNA INSTALLATION

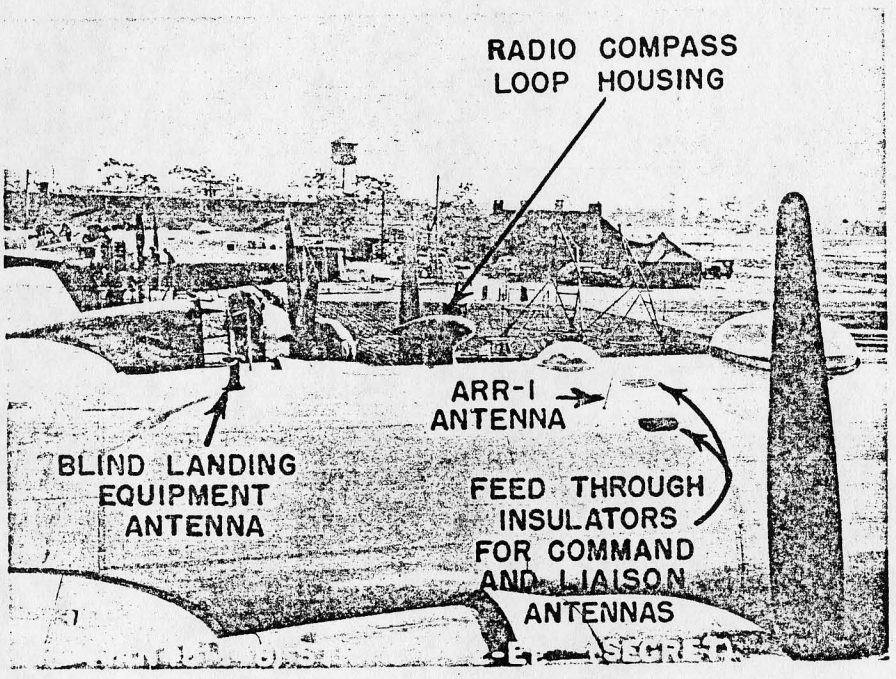
THE LEAD-IN WIRE IS SUBJECT TO FREQUENT BREAKAGE AT THE "FEED-THROUGH" INSULATOR.



ANTENNA LOCATIONS

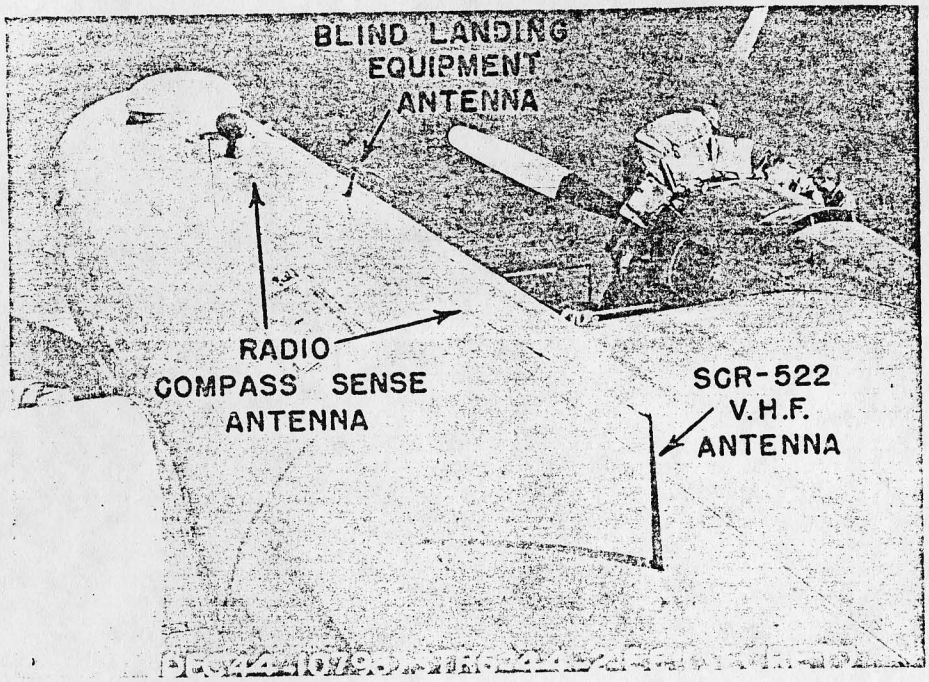
INCLOSURE III

FIGURE 6



UPPER FORWARD ANTENNA INSTALLATIONS

FIGURE 7



ANTENNA INSTALLATIONS ON TOP OF PLANE

INCLOSURE III

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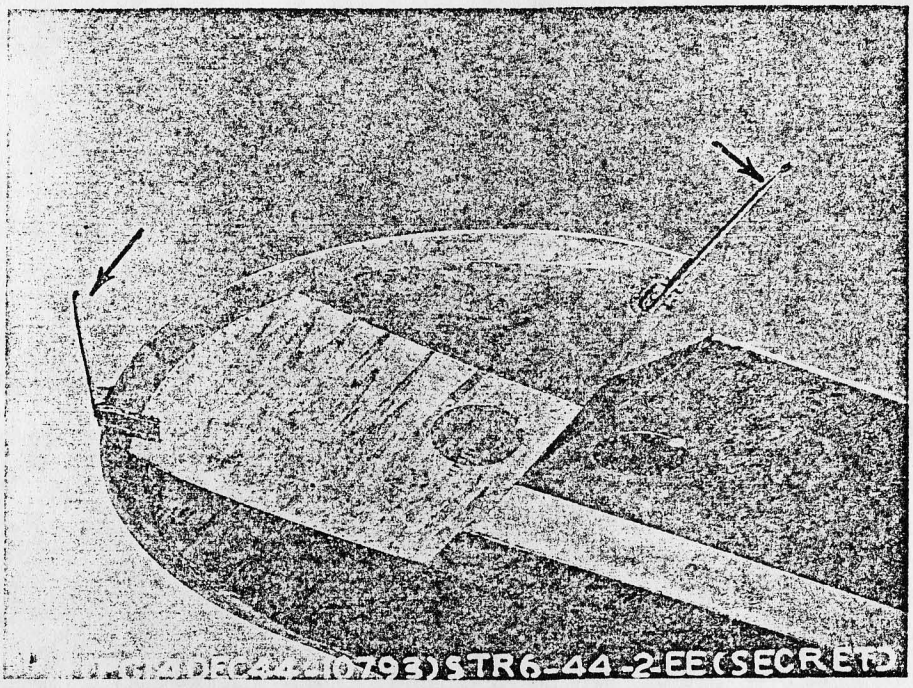
FIGURE 8



STATIC DISCHARGER INSTALLATION
ON LEFT HORIZONTAL STABILIZER

INCLOSURE III
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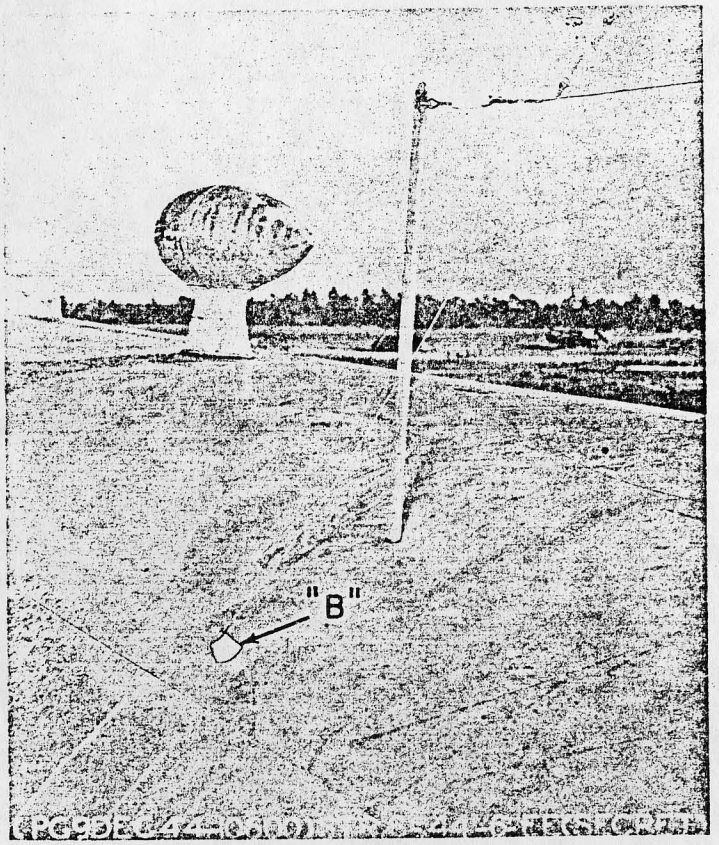
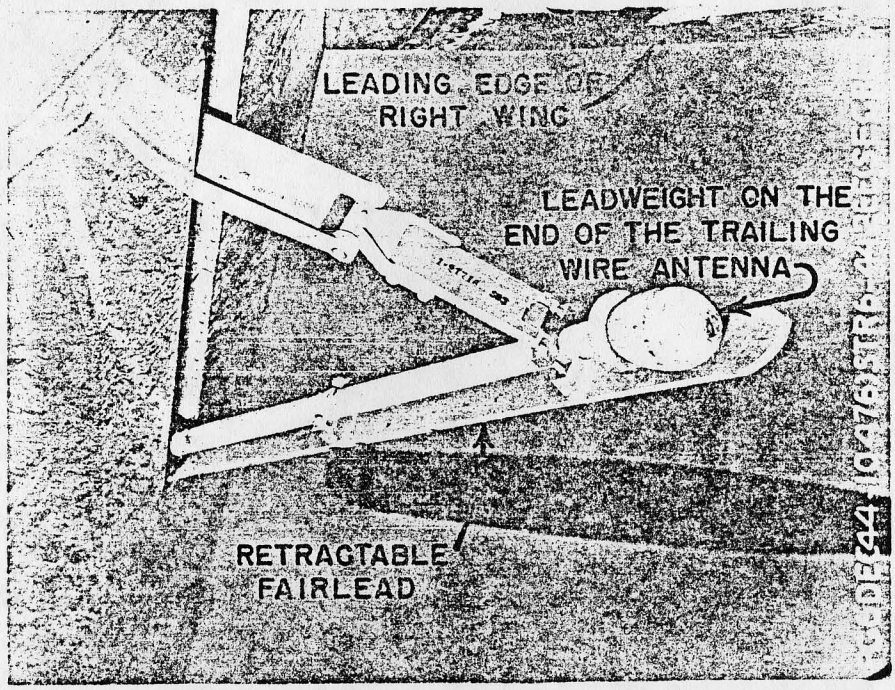
FIGURE 9



LEAD-IN FOR THE RADIO COMPASS SENSE ANTENNA

USE OF A PORCELAIN "FEED-THROUGH" INSULATOR AT POINT "B" REDUCED ANTENNA BREAKAGE AT THIS POINT AND ALSO EFFECTED A SAVING IN TIME AND MATERIALS REQUIRED TO REPLACE A BROKEN ANTENNA OR LEAD-IN WIRE. THIS WAS ESPECIALLY TRUE ON PLANES EQUIPPED WITH BOMB BAY GAS TANKS.



TRAILING WIRE ANTENNA FAIRLEAD
INSTALLATION

INCLOSURE III
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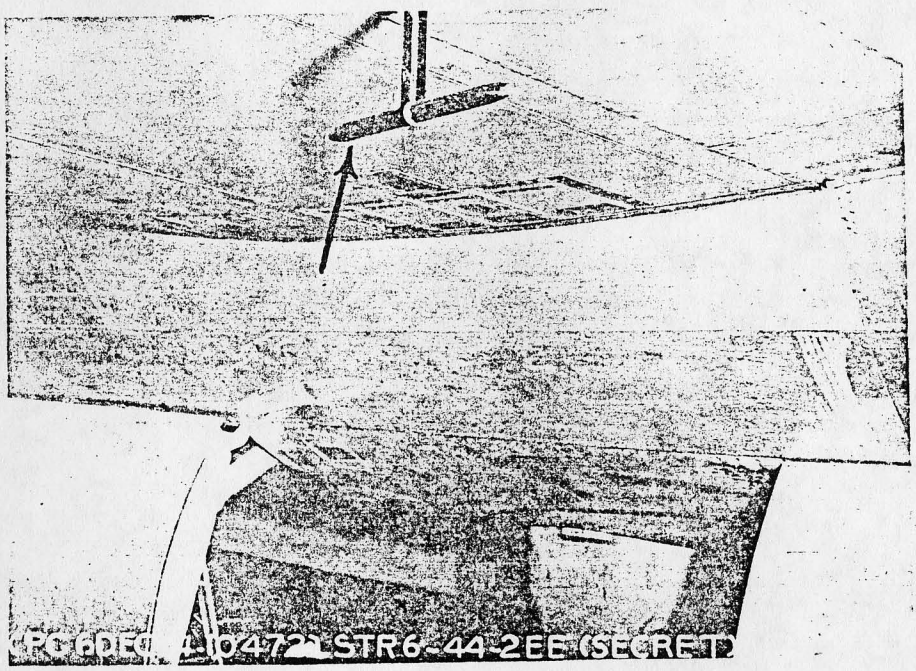
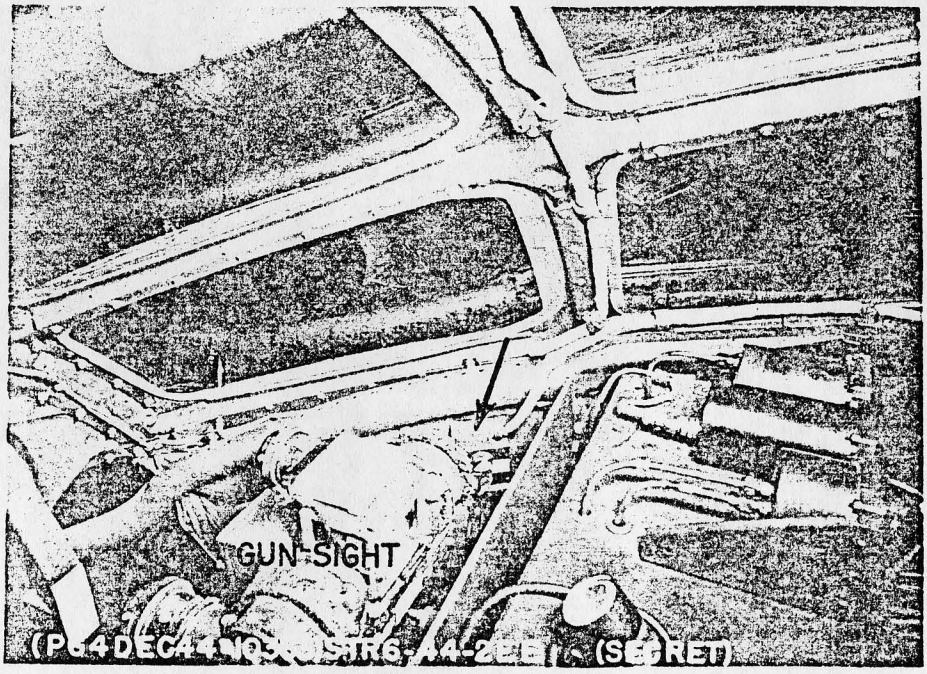
FIGURE 11



SCR-718 RADIO ALTIMETER ANTENNA INSTALLATION ON THE UNDERSIDE OF THE LEFT WING

THE COMPLETE INSTALLATION INCLUDES A DUPLICATE ANTENNA ON THE UNDERSIDE OF THE RIGHT WING IN THE CORRESPONDING POSITION.

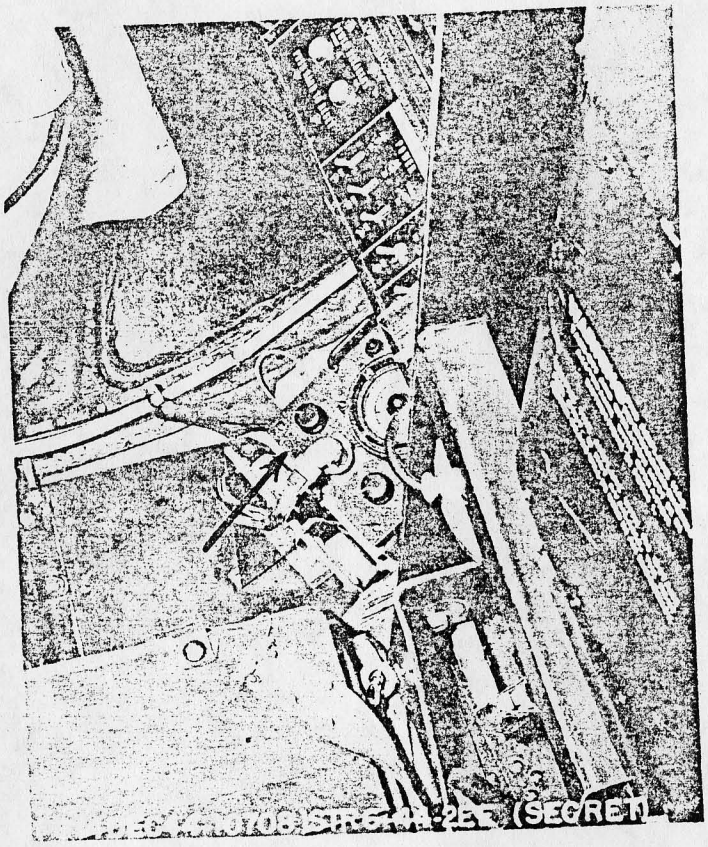


INSTALLATION OF BOMBARDIER'S
INTERPHONE JACK BOX

NOTE THE INACCESSIBLE LOCATION OF THE
JACK BOX

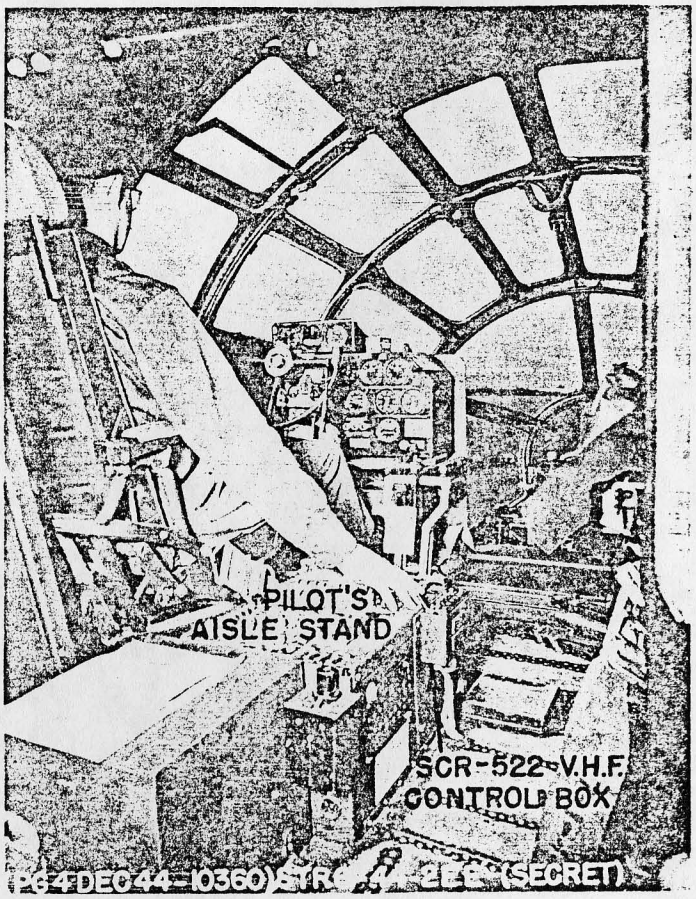
INCLOSURE III
PAGE 13 OF 37 PAGES

FIGURE 13

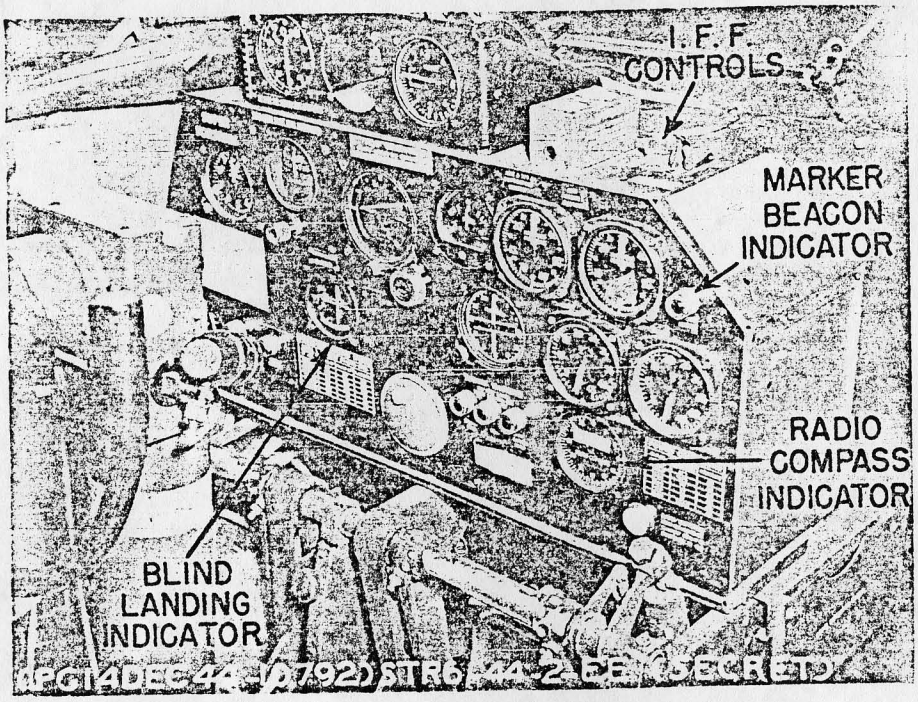


SCR-718 RADIO ALTIMETER INDICATOR
IN THE BOMBARDIER'S COMPARTMENT

FIGURE 14



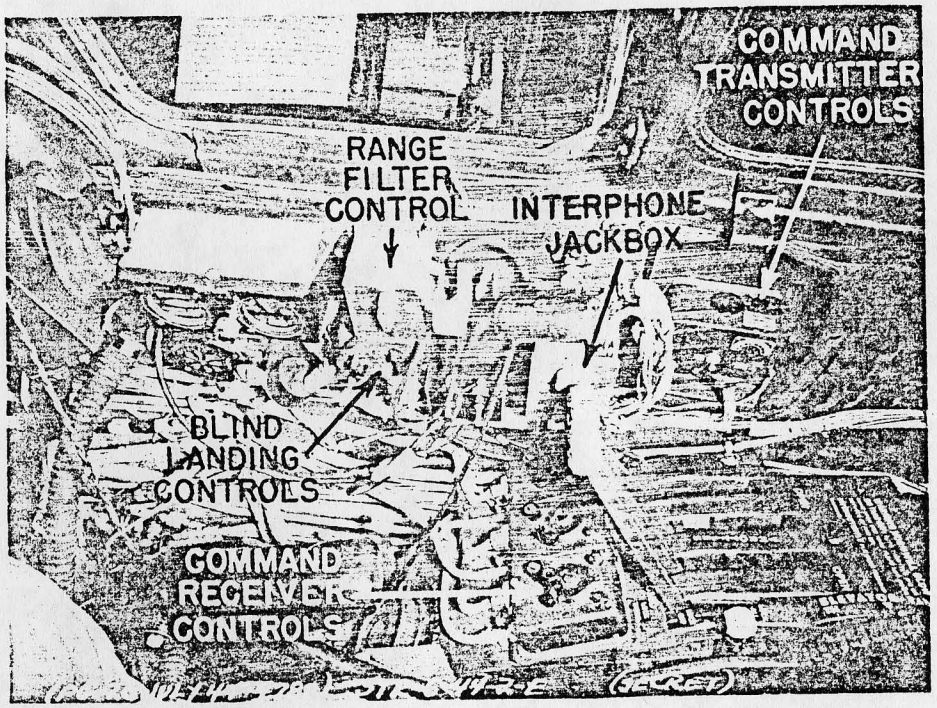
PILOT'S COMPARTMENT



PILOT'S INSTRUMENT PANEL

INCLOSURE III
PAGE 16 OF 37 PAGES

FIGURE 16



RADIO CONTROLS AT LEFT-HAND SIDE
OF PILOT'S POSITION

INCLOSURE III
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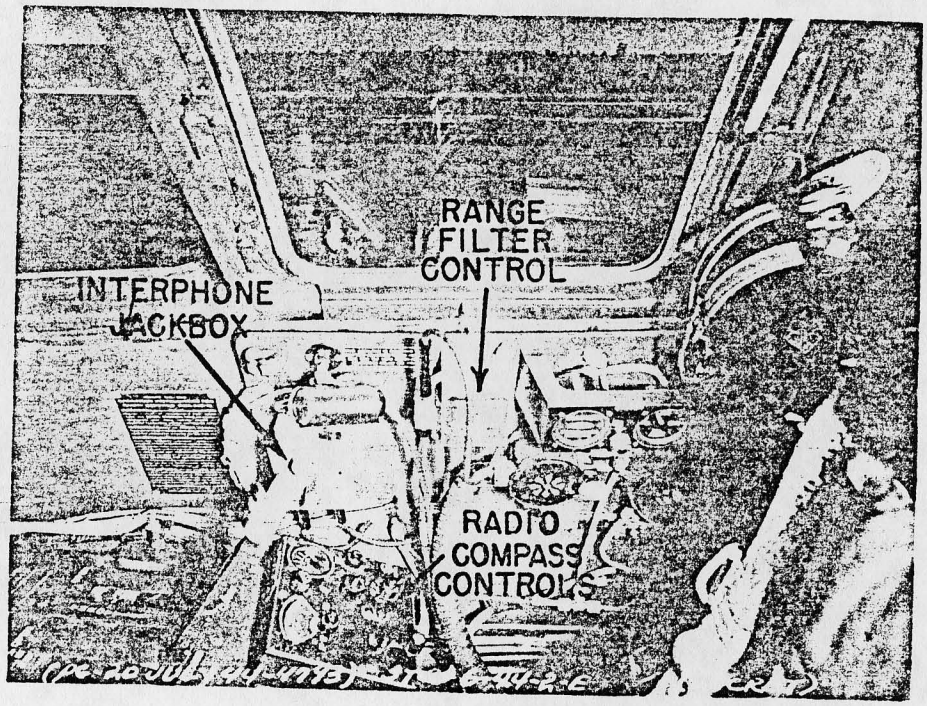
FIGURE 17



CO-PILOT'S RADIO CONTROLS

INCLOSURE III
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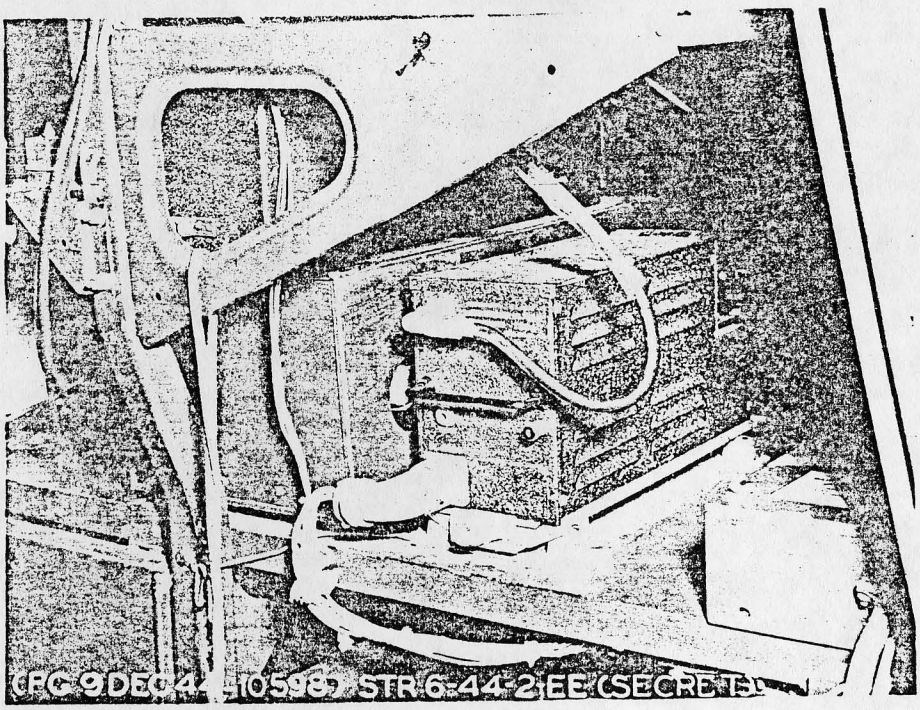
FIGURE 18



BC-733 LOCALIZER
RECEIVER INSTALLATION

INCLOSURE III
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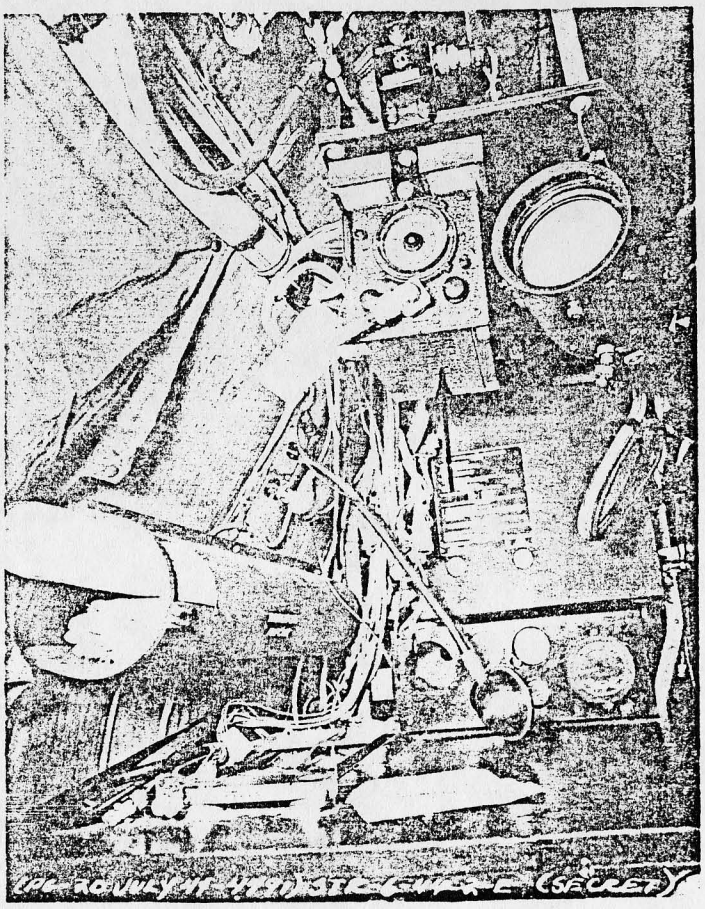
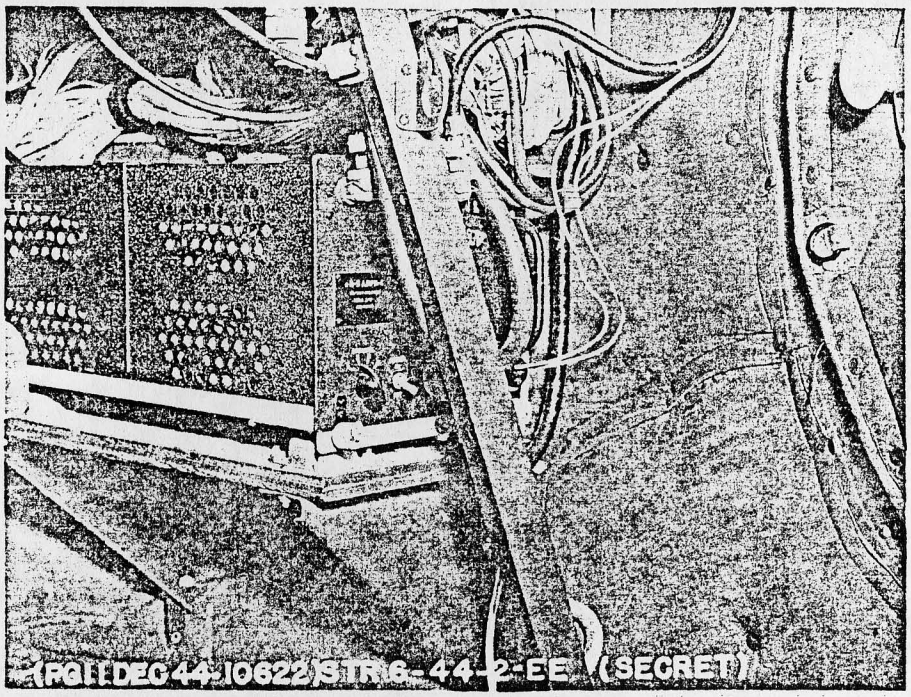
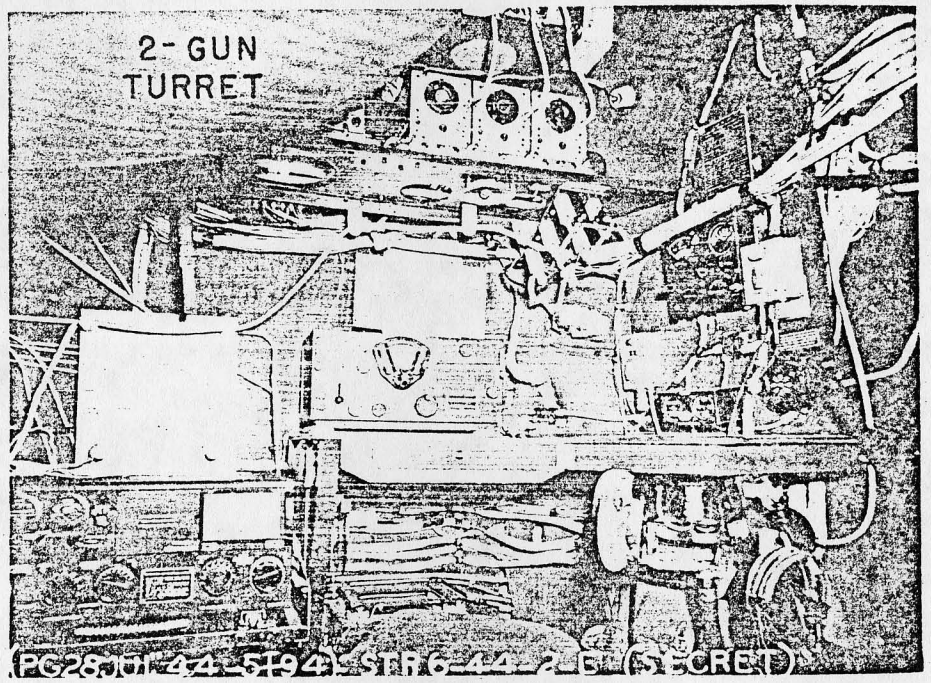
FIGURE 19



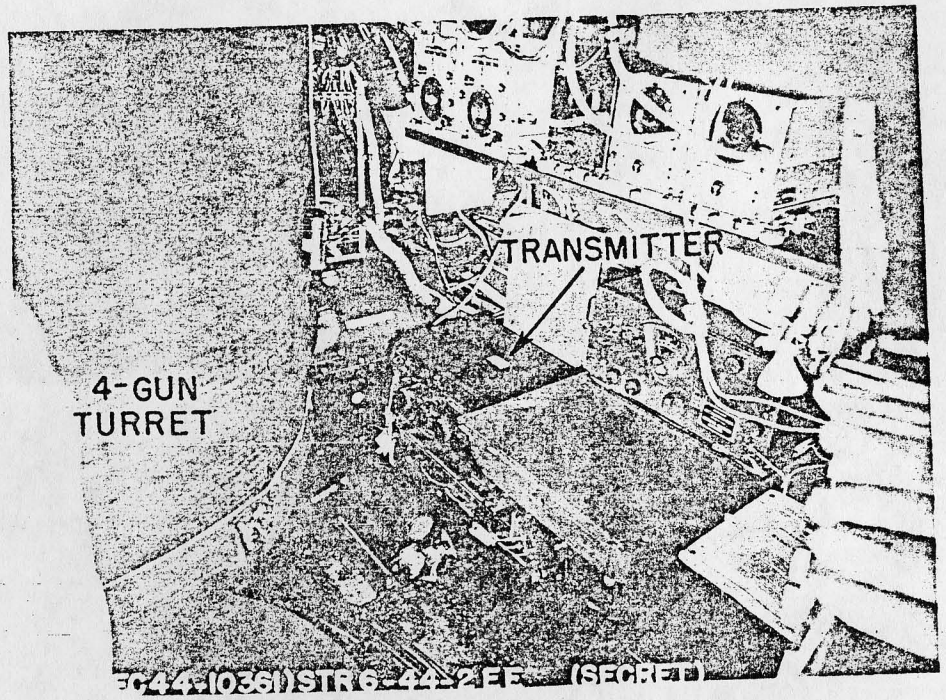
SCR-718 RADIO ALTIMETER INDICATOR
IN THE NAVIGATOR'S POSITION



R-9 A/APN-4
LORAN RECEIVER INSTALLATION UNDER
RADIO OPERATOR'S TABLE



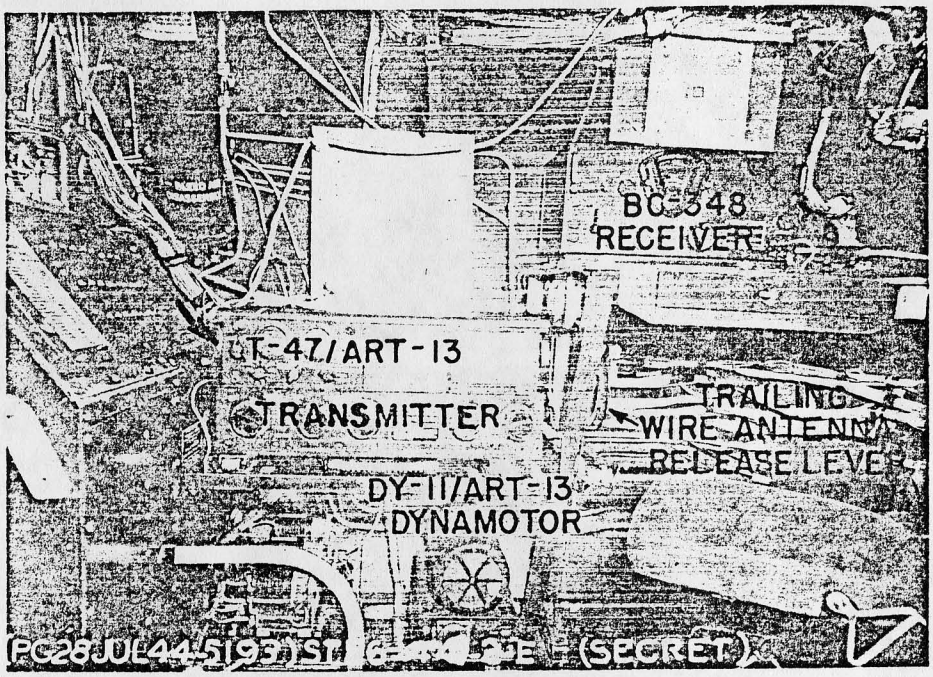
GENERAL VIEW OF THE RADIO OPERATOR'S COMPARTMENT



RADIO OPERATOR'S CRAMPED WORKING SPACE

THE T-47/ART-13 TRANSMITTER WHICH IS THE MOST DIFFICULT AND CRITICAL PIECE OF RADIO EQUIPMENT TO TUNE IS LOCATED IN THE MOST REMOTE AND INACCESSIBLE POSITION IN THE RADIO OPERATOR'S COMPARTMENT.

FIGURE 24



LIAISON SET INSTALLATION IN THE
RADIO OPERATOR'S COMPARTMENT

INCLOSURE III

FIGURE 25

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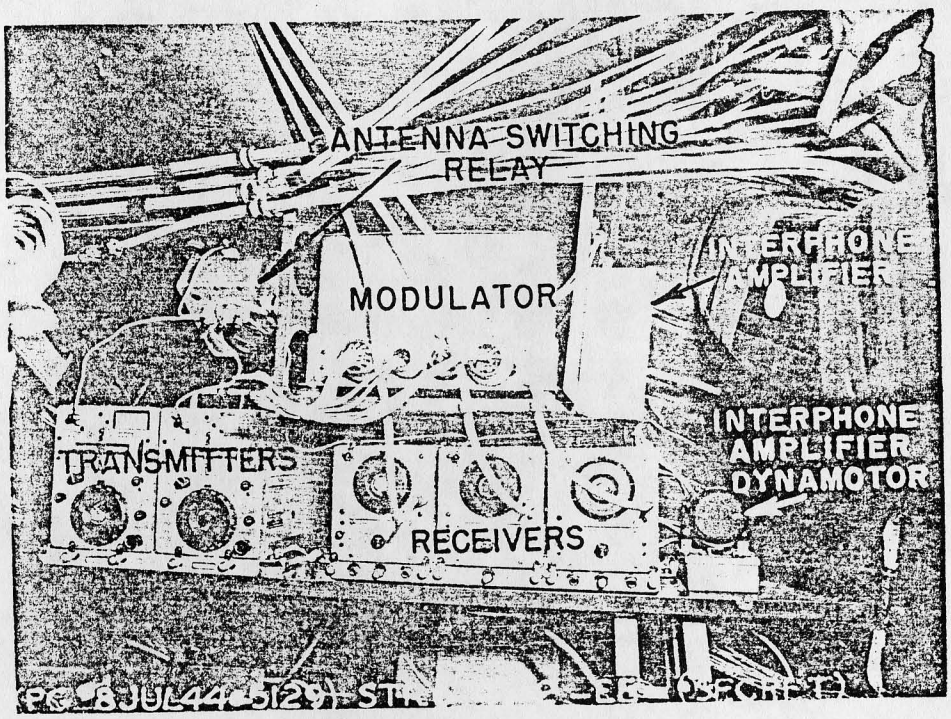
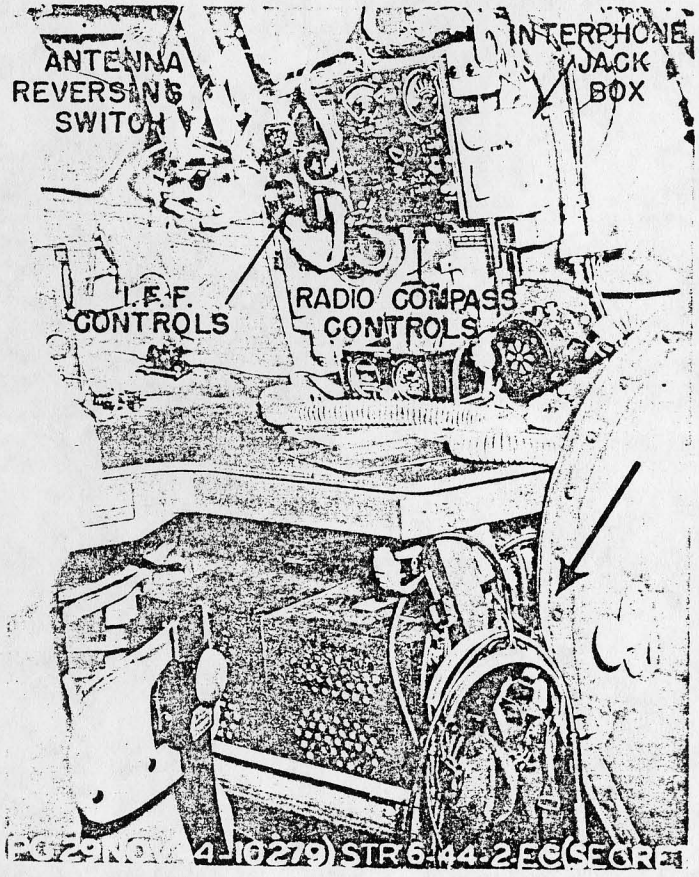


RC-36 INTERPHONE AMPLIFIER AND SCR-274-N COMMAND SET INSTALLATIONS IN THE RADIO OPERATOR'S COMPARTMENT

INCLOSURE III
PAGE 26 OF 37 PAGES

FIGURE 26

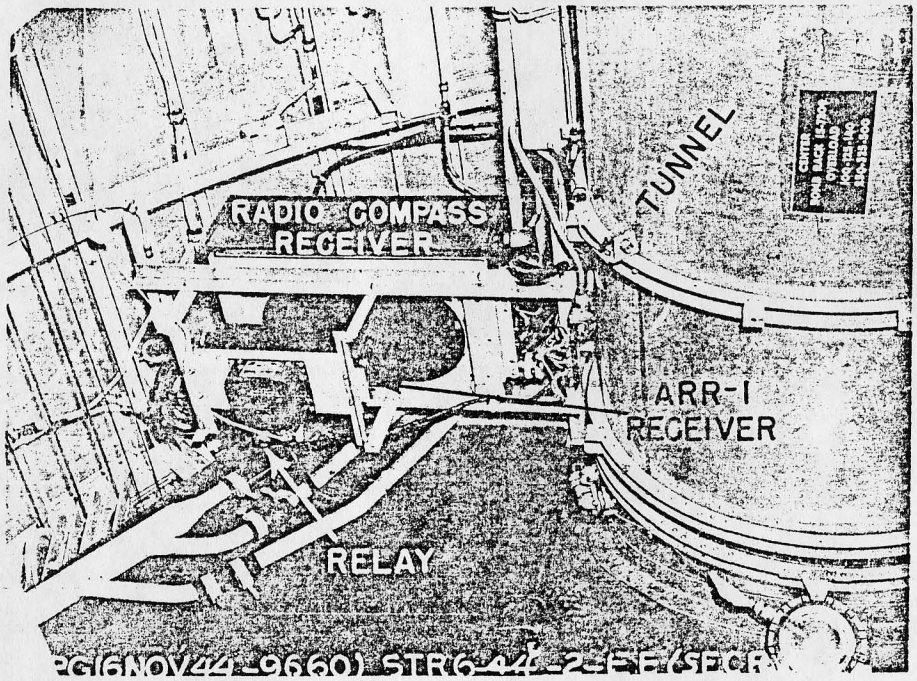


RADIO OPERATOR'S CONTROLS ON REAR BULKHEAD OF COMPARTMENT

NOTE HOW THE HEADPHONES ARE STRUCK BY THE DOOR WHEN IT IS CARELESSLY OPENED.

INCLOSURE III
PAGE 27 OF 37 PAGES

FIGURE 27

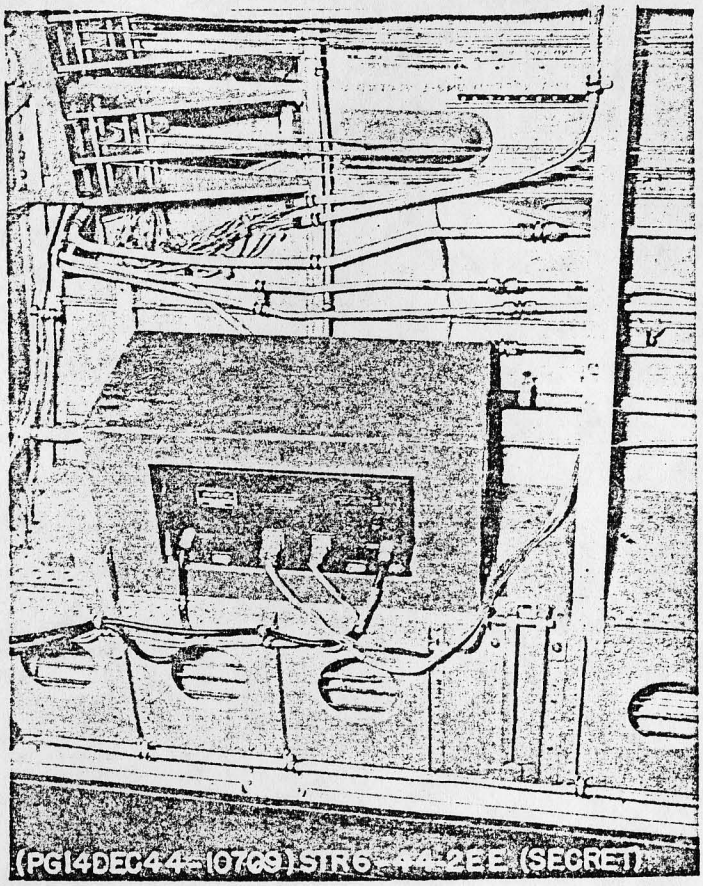


ARR-1 V. H. F. HOMING ADAPTOR AND
RADIO COMPASS RECEIVER INSTALLATION

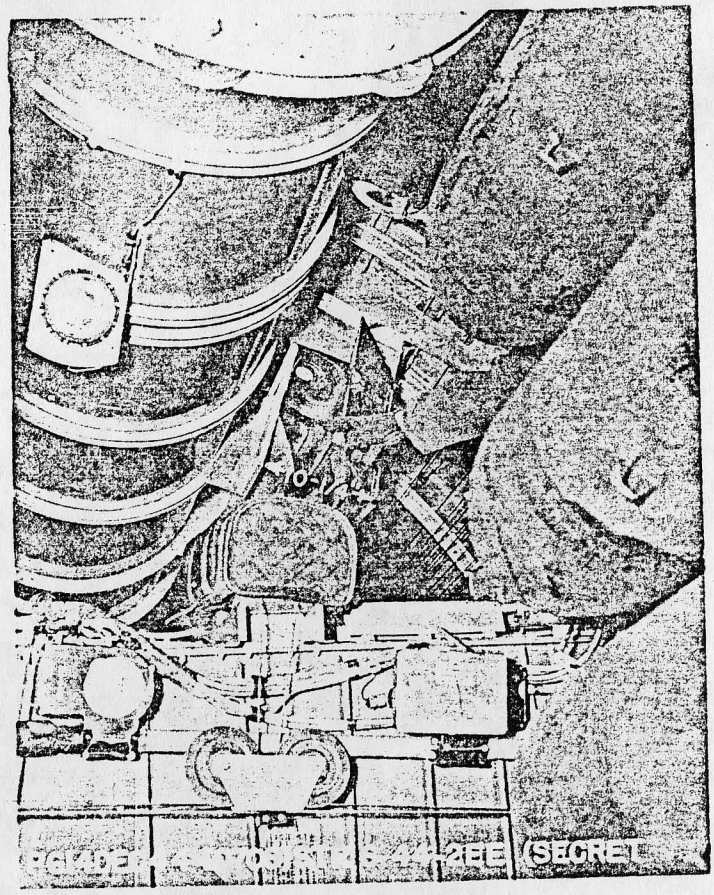
NOTE INACCESSIBLE LOCATION OF COMPASS RECEIVER

INCLOSURE III
PAGE 28 OF 37 PAGES

FIGURE 28



RADIO ALTIMETER RECEIVER-TRANSMITTER
BC-788-B INSTALLATION IN FORWARD BOMB BAY



REAR BOMB BAY LOOKING FORWARD

THE SCR-578-B WILL NOT FIT INTO THE COMPARTMENT PROVIDED.

INCLOSURE III
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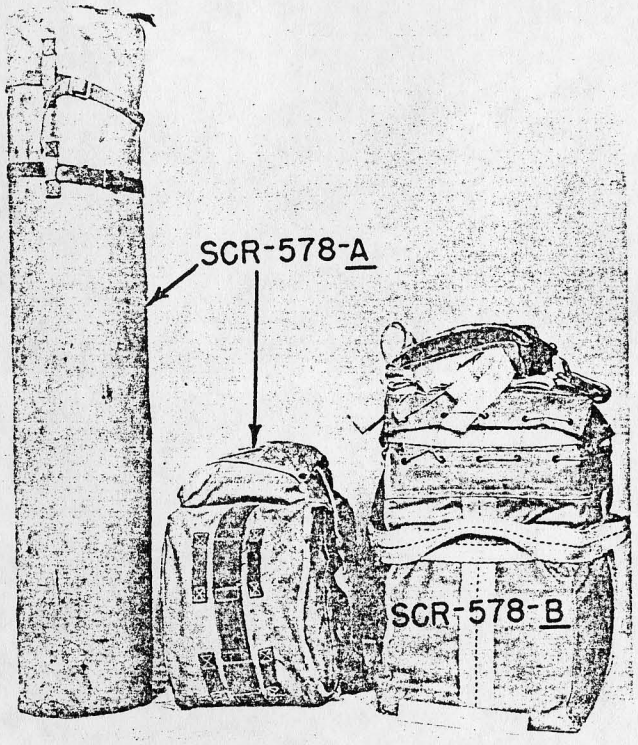
FIGURE 30



COMPARATIVE SIZE OF THE SCR-578-A
AND SCR-578-B

COMPARTMENT FOR STOWING THE LIFE-RAFT AND DINGHY EMERGENCY RADIO

THE IMPOSSIBILITY OF FITTING THE SCR-578-B INTO THE RADIO SECTION OF THIS COMPARTMENT IS ILLUSTRATED. THIS PICTURE IS USED TO SHOW THE COMPARATIVE DIMENSIONS. ACTUALLY THE COMPARTMENT IS DESIGNED FOR STOWING THE EMERGENCY RADIO FROM INSIDE THE BOMB BAY.

SEE FIGURES 30 AND 31

INCLOSURE III

FIGURE 32

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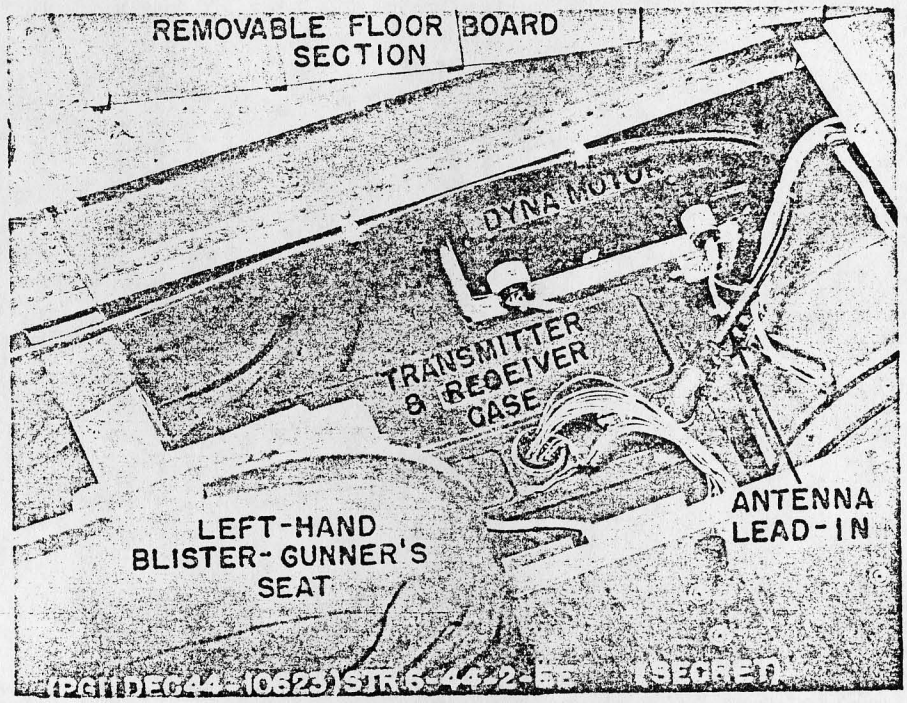

SCR-522 V.H.F. SET INSTALLATION

INCLOSURE III
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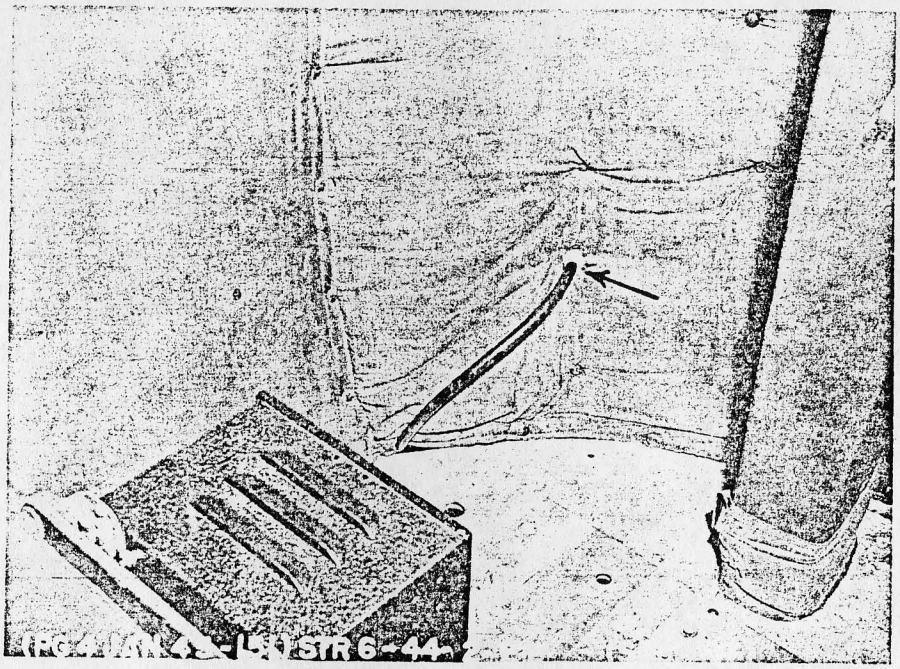
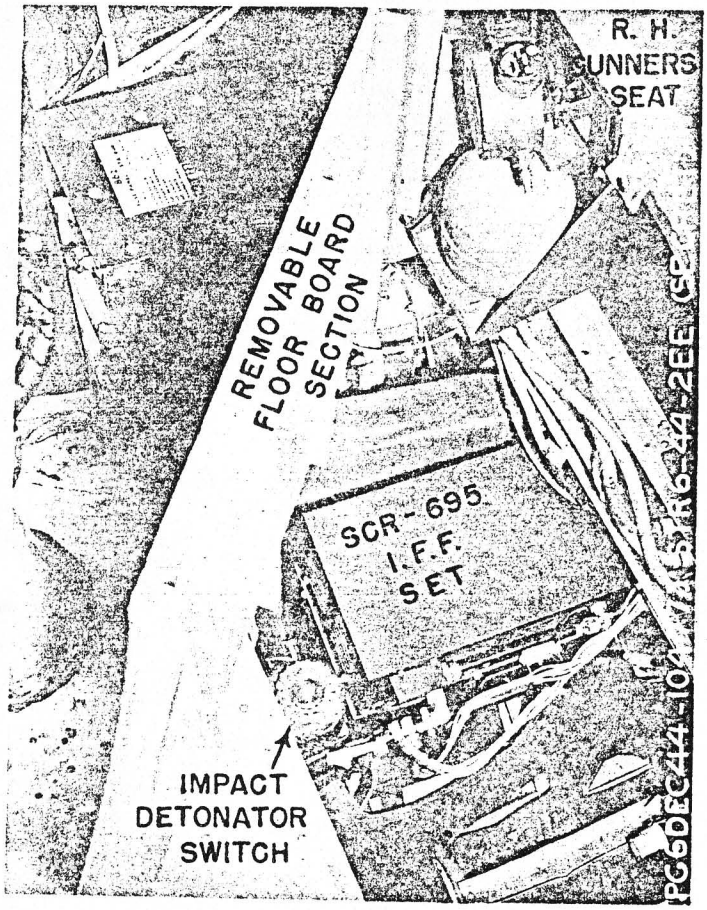
FIGURE 33

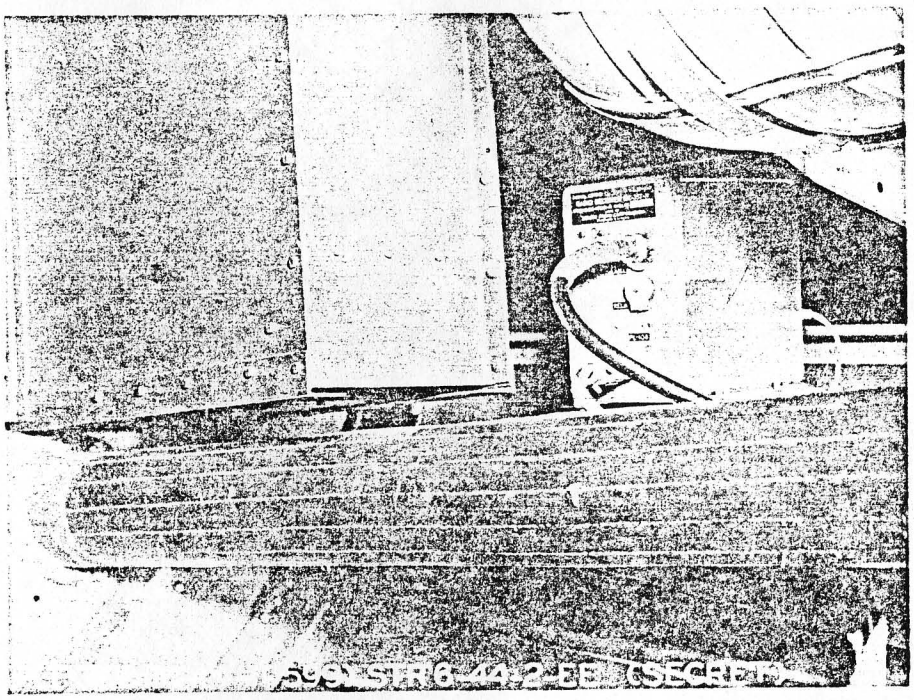


SCR-522 ANTENNA LEAD-IN

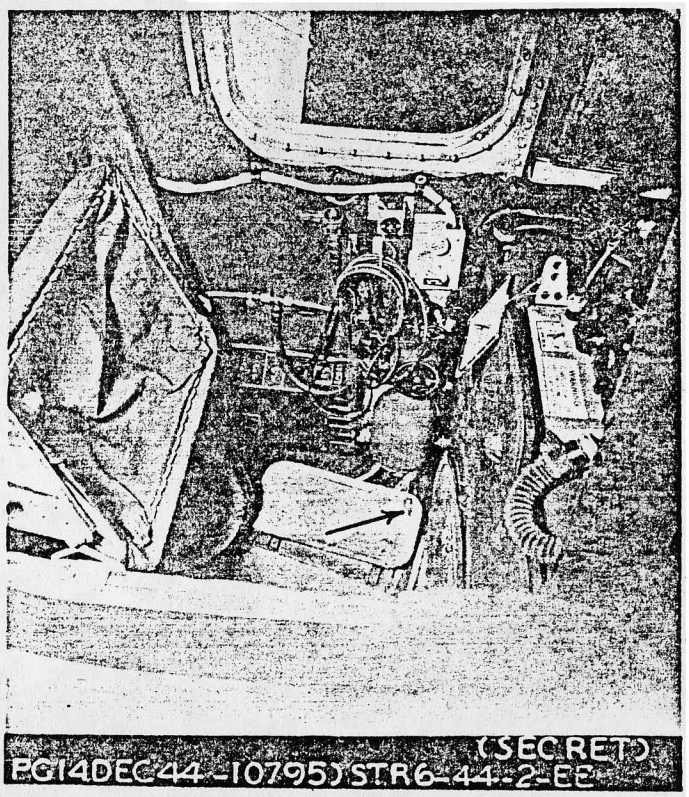
CONNECTION TO "FEED-THROUGH" INSULATOR ON FORWARD BULKHEAD OF GUNNER'S COMPARTMENT IS DAMAGED FREQUENTLY BY PARACHUTES AND OTHER EQUIPMENT THROWN IN THIS CORNER.



SCR-695 I.F.F. SET INSTALLATION

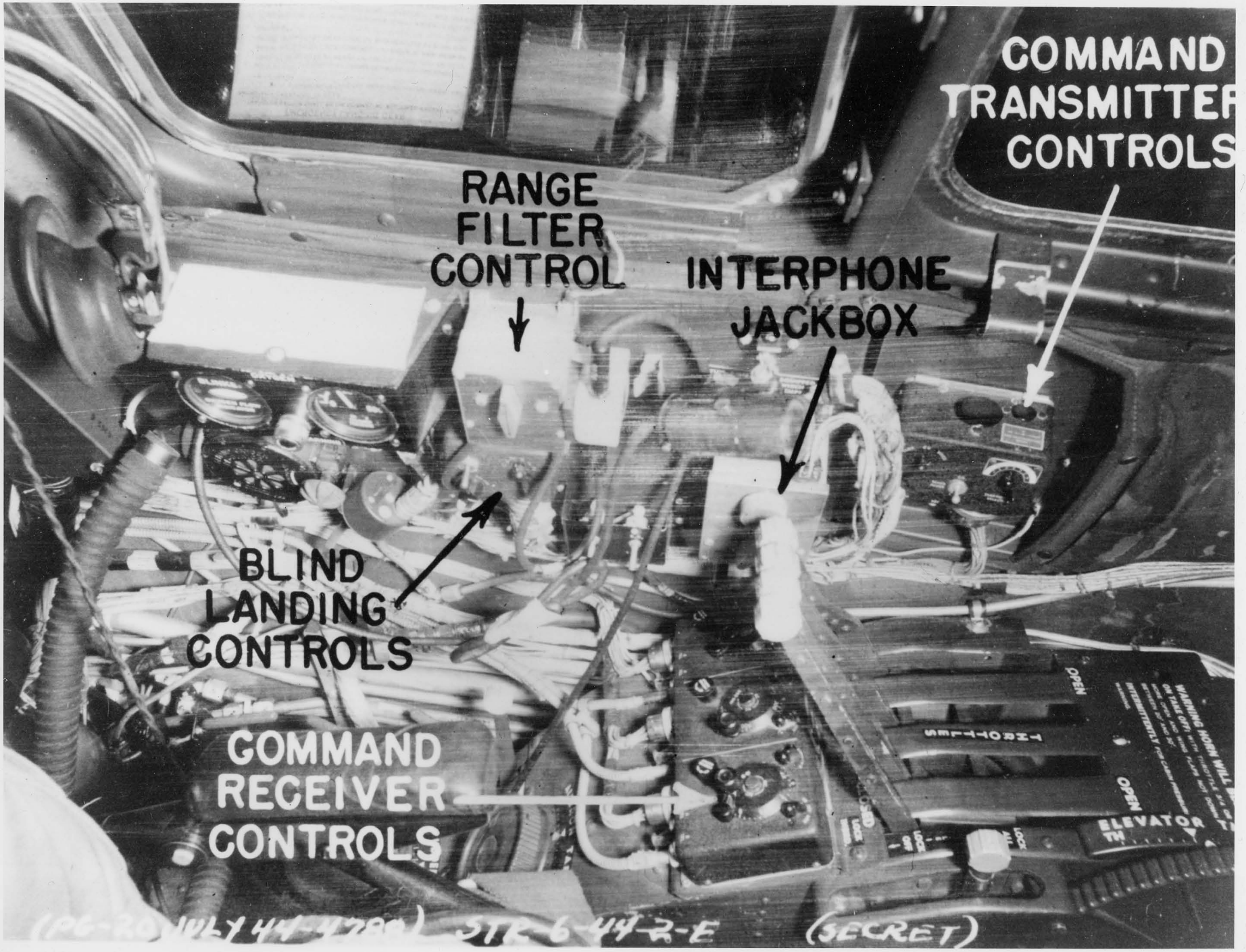


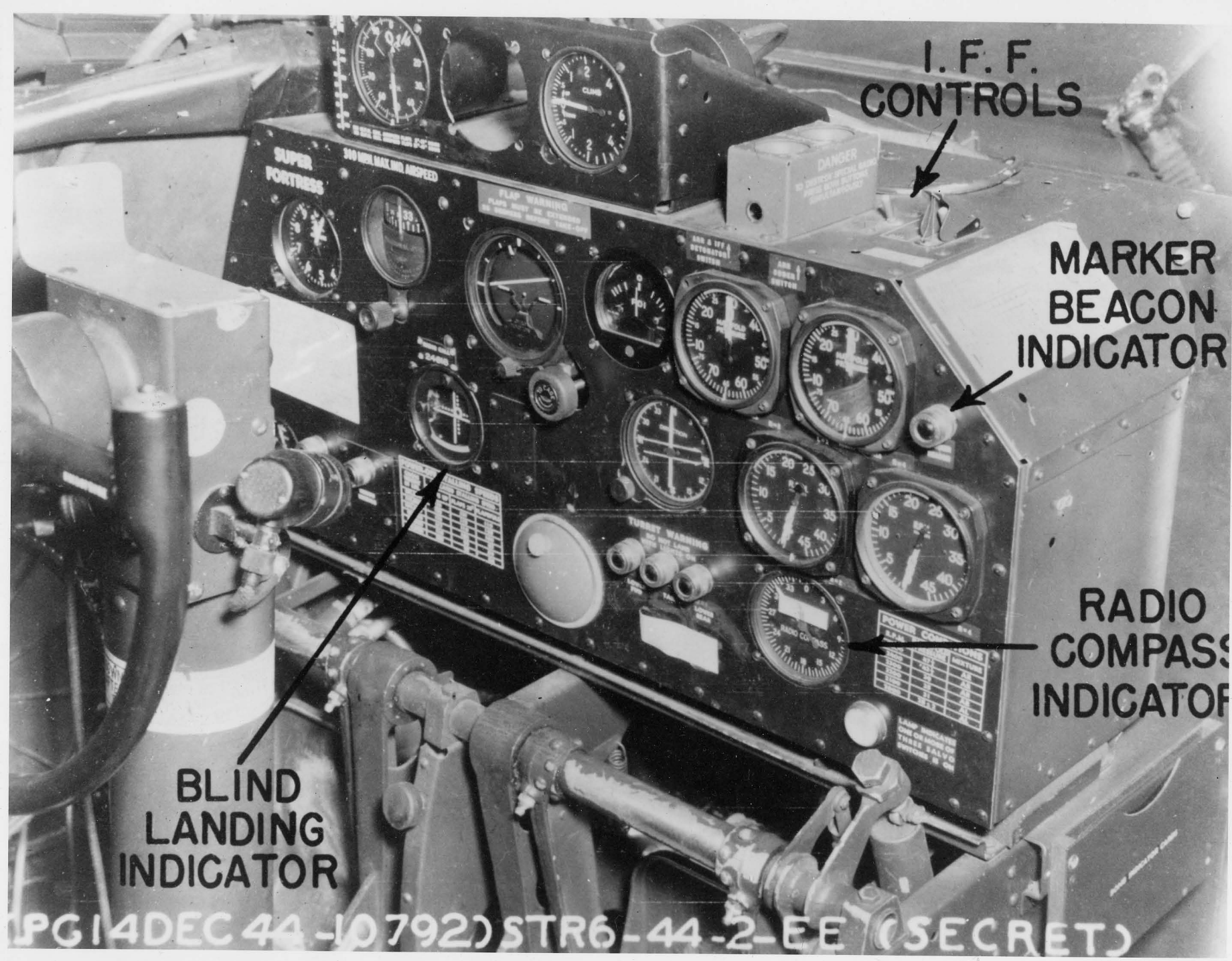
MARKER BEACON RECEIVER INSTALLATION



TAIL GUNNER'S COMPARTMENT

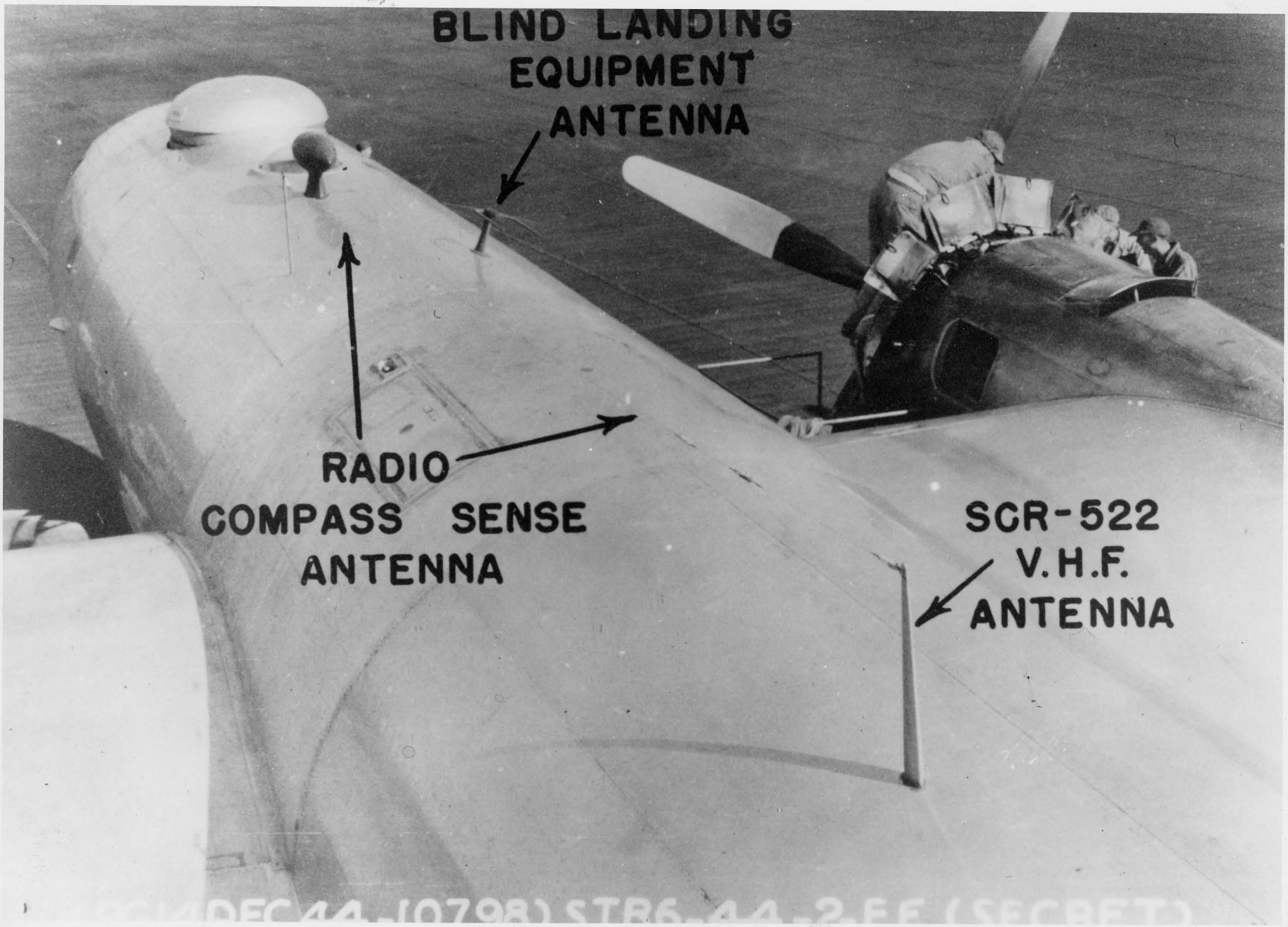
THE MICROPHONE SWITCH IS DIFFICULT TO REACH BECAUSE OF THE LOCATION OF THE PORTABLE OXYGEN BOTTLE


COMMAND TRANSMITTER CONTROLS
RANGE FILTER CONTROL
INTERPHONE JACKBOX
BLIND LANDING CONTROLS
COMMAND RECEIVER CONTROLS
OPEN
OPEN
ELEVATOR
(SECRET)

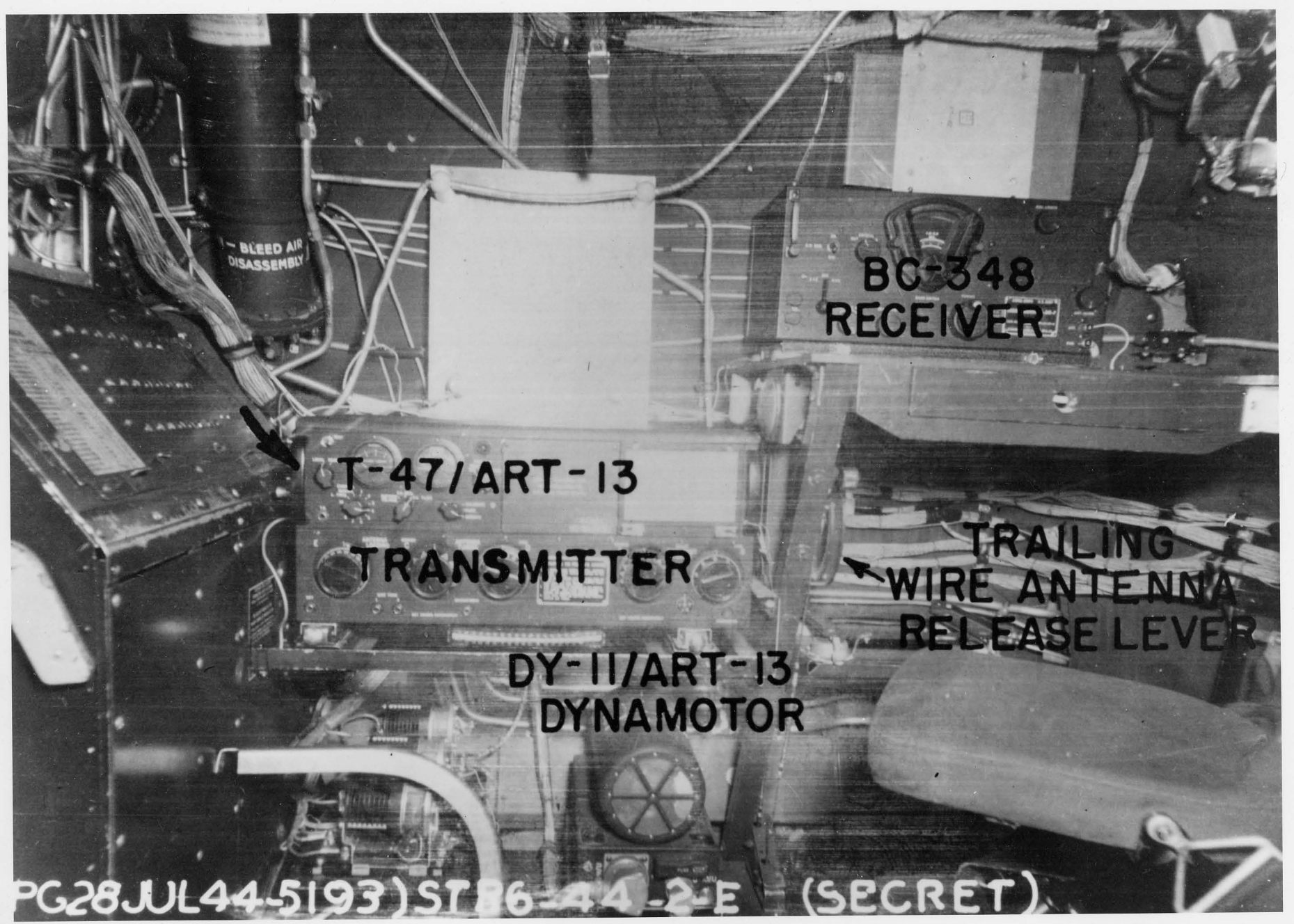


(PG 14 DEC 44 - 10792) STR6-44-2-EE (SECRET)

PG 29NOV44-10279) STR 6-44-2-EC(SECRET

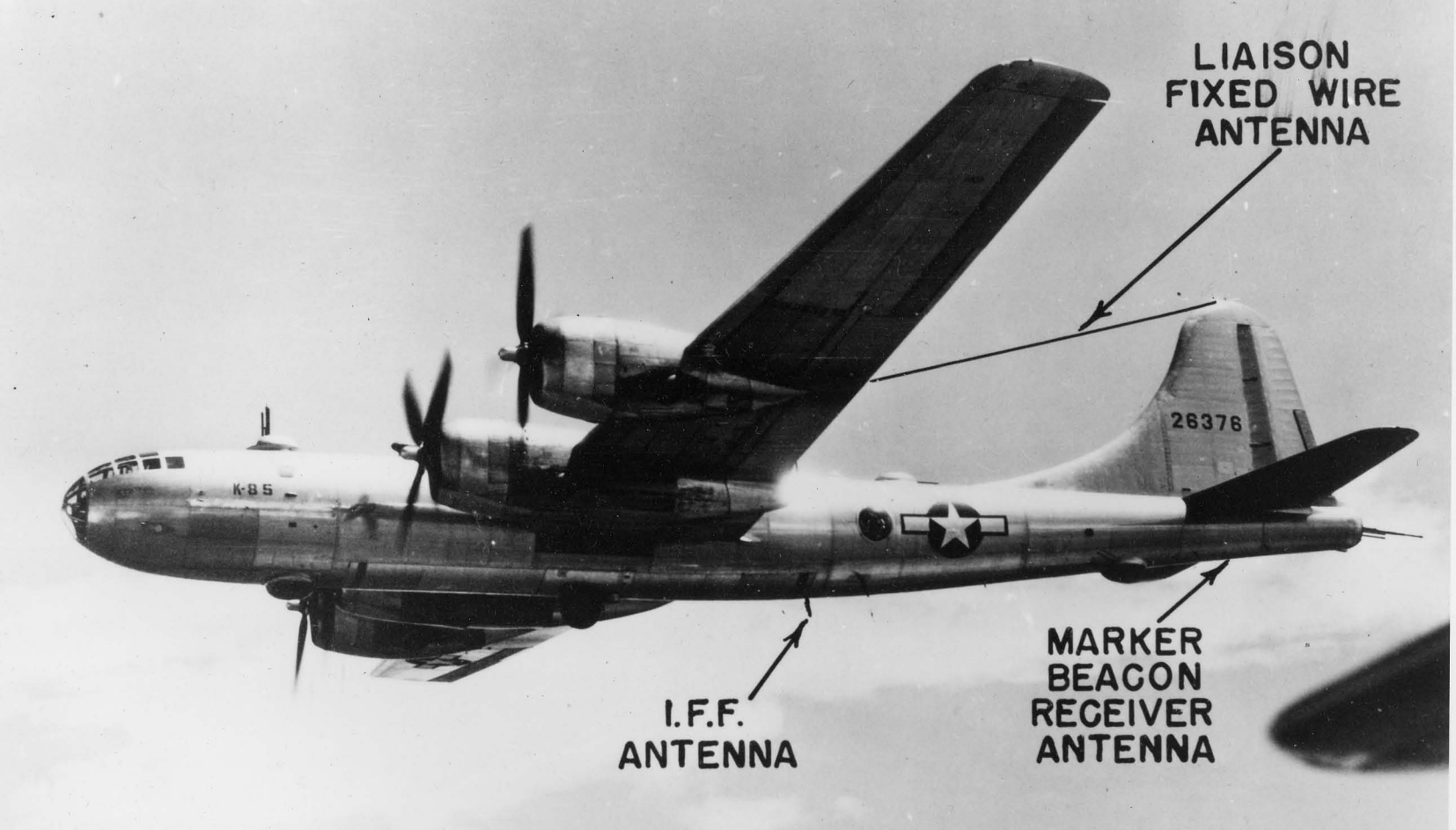


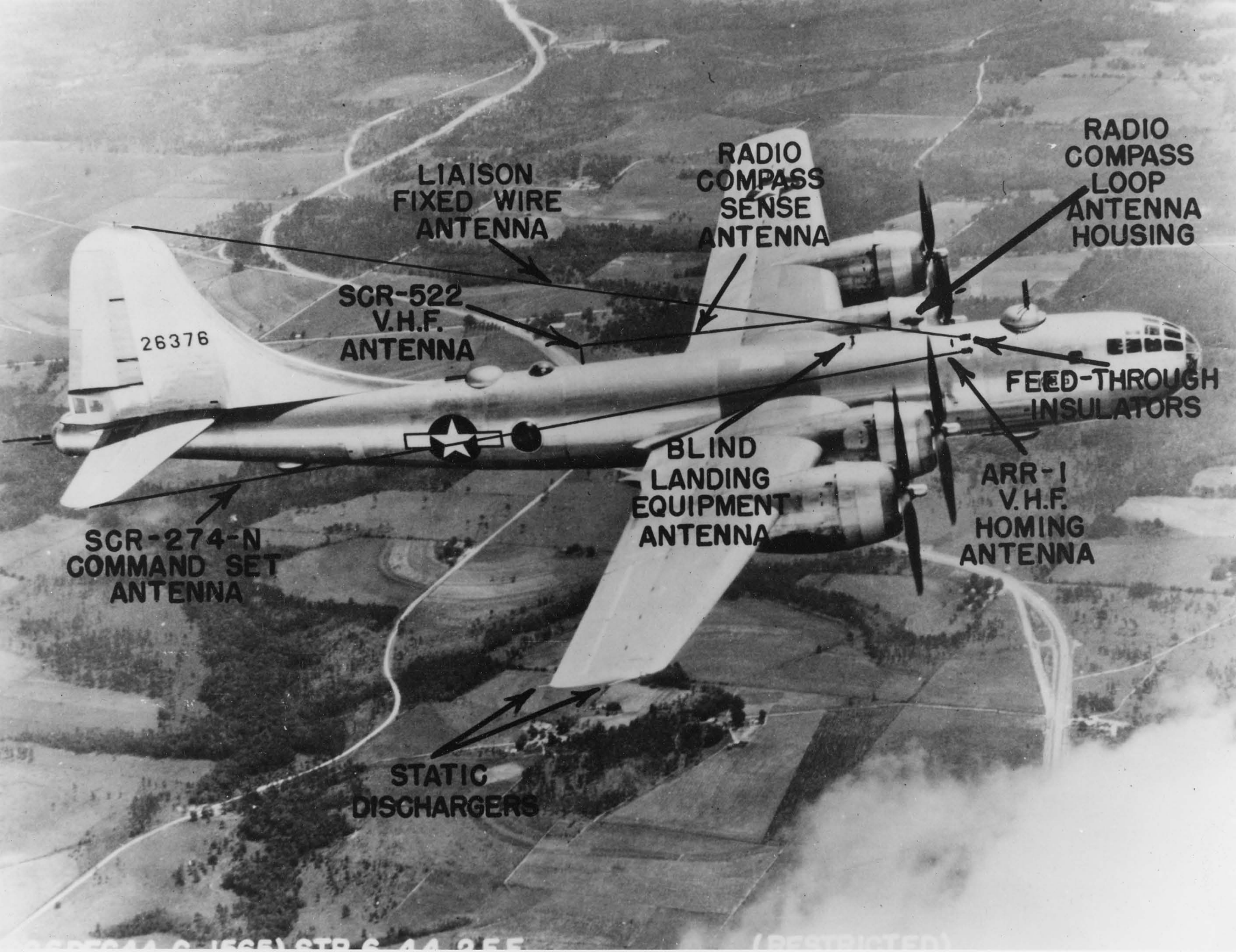
DEC 44-10798) STB6-44-2 E.E. (SECRET)



PG28JUL44-5193) ST 6-44-2-E (SECRET)


RADIO COMPASS
LOOP HOUSING
ARR-1
ANTENNA
BLIND LANDING
EQUIPMENT
ANTENNA
FEED THROUGH
INSULATORS
FOR COMMAND
AND LIAISON
ANTENNAS
584
(SECRET)


LIAISON
FIXED WIRE
ANTENNA
26376
K-85
I.F.F.
ANTENNA
MARKER
BEACON
RECEIVER
ANTENNA


LIAISON
FIXED WIRE
ANTENNA
RADIO
COMPASS
SENSE
ANTENNA
RADIO
COMPASS
LOOP
ANTENNA
HOUSING
SCR-522
V.H.F.
ANTENNA
26376
FEED-THROUGH
INSULATORS
BLIND
LANDING
EQUIPMENT
ANTENNA
ARR-1
V.H.F.
HOMING
ANTENNA
SCR-274-N
COMMAND SET
ANTENNA
STATIC
DISCHARGERS