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Front Cover

Top: WF512 (44 Squadron) at dispersal, RAF Coningsby (*Ernest Howlett*)

Lower: Nose of B-29-45-MO 44-86292 better known as *Enola Gay* on display at the Smithsonian's Udvar Hazy Center, Washington Dulles Airport, Maryland, USA. (*Chris Howlett*)

Inside Front Cover

Top: *It's Hawg Wild* at Duxford (*Chris Howlett*)

Lower: *Enola Gay* being reversed over the atomic bomb loading pit. (*USAF*)

This Page

Enola Gay photographed while being stored at Davis Monthan AFB 23 July, 1947 as part of the collection destined for preservation. The Circle R tail markings were probably added post the retirement of *Enola Gay* since *Enola Gay* and the 509th CG aircraft reverted to the Circle Arrow marking once WWII ended. Also note the 'fat man' symbols on the nose denoting pumpkin bomb missions (although one may also represent the actual atomic mission). The Smithsonian is restoring *Enola Gay* to the condition she was in on the 6 August, 1945 mission so neither these symbols nor the red tip to the tail are present on the aircraft as displayed.

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It's Hawg Wild in the American Air Museum, Duxford. (*Chris Howlett*)

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Introduction

Welcome to issue 12 of Washington Times. This issue could also be termed the ‘Reunion Special’ as it is intended to complement the reunion being held at the Imperial War Museum (IWM), Duxford, Cambridgeshire, 18 – 20 May 2007.

As I am sure you are all aware, it had been hoped that part of the reunion would be access to the interior of *It's Hawg Wild*, the B-29 preserved and displayed in the American Air Museum at Duxford. Unfortunately, such access was not possible so here, as an alternative, is a pictorial tour.

The tour is based on a set of interior photos of *Enola Gay* and the forward part of *It's Hawg Wild*. The photos of *Enola Gay* were mainly supplied by Scott Willey and Mike Hanz while those of *It's Hawg Wild* were provided by Ivor Warne and Martin Claydon. Scott Willey and Mike Hanz are volunteers at the Smithsonian's National Air and Space Museum (NASM) Udvar Hazy Center at Washington Dulles airport and are some of the many people who helped with the huge restoration project that returned *Enola Gay* to near pristine condition and put her on public display. Mike Hanz also maintains an excellent web site on USAAF radios which includes much detail and many photos of *Enola Gay's* radio and countermeasure fit (<http://aafradio.org/>). Ivor Warne is an Explainer at the IWM, Duxford and took the photos especially for this issue of Washington Times. Martin Claydon maintains a web site dedicated to Duxford (<http://www.duxford-update.info/>). Other significant contributors were Taigh Ramey who flew on *It's Hawg Wild* during her delivery flight to Duxford and now operates a vintage aircraft company in California (<http://www.twinbeech.com>) and finally Mike Vosin who maintains a web site upon which are many USAAF manuals (<http://www.aafcollection.info/index.html>).

Scott's, Mike's, Ivor's and Martin's photos are superb and illustrate the B-29 nearly as well as being in one. *It's Hawg Wild* is a standard B-29A and as such is representative of the vast majority of the RAF's Washingtons (84 of the 87 Washingtons were B-29As). Unfortunately, only the forward section of *It's Hawg Wild* has been restored and access is denied beyond this area. Consequently, the more complete set of photographs are for *Enola Gay*. However, although *Enola Gay* is almost certainly the most famous B-29 of them all (and maybe the most famous plane of all time) modifications made to her in preparation for the atomic mission mean that she is not representative of most B-29s including the RAF's Washingtons. Having said that, the differences are interesting in themselves and these are indicated with (where known) the reasons for the changes in the text that accompanies each set of photos.

I hope you enjoy this compilation and that it compensates, in part at least, for the lack of an interior tour.

Chris Howlett



Above: *It's Hawg Wild* on a test flight around Tucson, Arizona shortly after being rescued from China Lake Naval Weapons Center, China Lake, California. (**Taigh Ramey**)

Silverplate, Enola Gay and the First Atomic Mission

Silverplate was the code name for the US Army Air Force's project to modify B-29s to enable them to deliver the atomic bomb although it later also included the training and operational aspects of the program as well. Silverplate was a part of the larger Project Alberta or Project A that was responsible for developing the means to deliver the atomic bomb. This included designing the bomb shape, the radio altimeters and pressure sensors required to allow the bomb to explode at the optimum altitude, modify the bomber to be able to carry it and train the air, ground and special ordnance crews needed to support the mission when it had deployed overseas. Project Alberta was, in turn, a part of the overarching Manhattan Project that covered all work relating to the design and delivery of the atomic bomb.

Initially the USAAF had a serious problem in that they had no plane that was suitable to carry a bomb of the anticipated size and weight. The B-29, then still very much under development, showed promise but there was no clear indication that the design would work. Dr Norman Ramsey, one of the two top men in Project Alberta (the other being Captain William Parsons USN), seriously considered using Avro Lancasters since at that time these were the only allied planes with a proven ability to carry bombs of the required size and in October 1943 discussions were held in Canada between Ramsey and Roy Chadwick (the Lancaster's chief designer) on this issue. However, when Captain Parsons recommended the Lancaster to General Hap Arnold, the Commanding General, US Army Air Forces, Arnold made it quite clear that if the new super bomb being developed at such great expense by the US was to be dropped then it would be from a USAAF crewed B-29 so the Lancaster idea was dropped! Hindsight has shown this to have been a correct decision for even had the Lancaster's limited range been taken care of by staging the raid out of Iwo Jima or Okinawa, the Lancaster was both speed and altitude limited and would almost certainly not have survived the shock wave from the explosion.

The prototype Silverplate B-29 was a standard B-29, B-29-5-BW, serial 42-6259 that was delivered to Wright Field, Ohio on 2 December, 1943 where it was modified, largely by hand, to carry the dummy atomic bomb shapes then being evaluated. At that time, one of the anticipated designs for the atomic bomb was a long thin 'gun type' Plutonium (Pu-239) bomb of about 17 foot length codenamed *Thin Man*. To be able to carry this shape of bomb, extensive modifications were required to the B-29's bomb bays since the bomb, although carried in the rear bay extended into the forward one. The modifications included the removal of all four bomb bay doors and the outer fuselage section between the two bomb bays. Even with these modifications, it was a tight fit as the existence of the main wing spar between the bomb bays only allowed a 2 foot diameter bomb to be carried. Twin release points modified from glider tow and release mechanisms were fitted in the rear bomb bay to secure the bomb.

The other shape of bomb was for an implosion type device and this, largely spherical device (codenamed *Fat Man*), would fit into the forward bomb bay where it was secured to another twin set of modified glider tow and release mechanisms.

Testing of the bomb shapes started when a *Thin Man* shape was dropped on a bombing range near the US Army Air Field of Muroc, California on 6 March, 1944. On 14 March two further drops were made, both of these being of the *Fat Man* shape. All these drops were successful although in all cases the bomb failed to drop immediately which frustrated many of the calibration tests being run on the ballistic properties of the shapes. When the fourth test resulted in the test bomb (a *Thin Man* type) dropping prematurely and seriously damaging the aircraft the release mechanism was changed to the British system of using a single release mechanism for large bombs. Consequently a British Type G single point attachment and Type F release mechanism were obtained and installed in the B-29.

As the bomb development advanced, it became evident that *Thin Man* would not work. *Thin Man*'s design was based upon the fissibility of pure Pu-239 but, at that time, it was not possible to create pure Pu-239 as traces of Pu-240 kept creeping in and the increased fissibility of this mixture made it impossible to merge two pieces of Pu before fission would start which would have resulted in a fizzle. So, on 17 July, 1944, the Pu gun type weapon was dropped and work pressed on with a Uranium (U-235) gun type weapon. Due to U-235's slower fission rate the length of this gun type bomb (code named *Little Boy*) was significantly less and it too could fit wholly into the forward bomb bay, simplifying the modifications needed and leaving the rear bomb bay free for the carriage of long range fuel tanks.

With the B-29 proving to be capable of carrying the atomic bomb, in August 1944 a batch of 17 'production' Silverplate B-29s was ordered – to be taken from the production lines at Martin's production and modification centre at Omaha, Nebraska. These were delivered, essentially as standard B-29s, to Wendover AAF where the

turrets were removed and the planes used to train the crews of the newly formed 393rd Bomb Squadron of the 509th Composite Group (CG) – the crews who would eventually take the Silverplate B-29s into combat. One of the things that had to be devised was how the dropping plane could survive the explosion and this resulted in the crews practising a full power turn through 155 degrees as soon as they had dropped their bomb. Such a turn would place the plane as far from the point of explosion as possible, a necessity given the immense shock wave that the bomb was expected to generate.

The intensive training programme effectively wore out these planes and consequently a third batch of 20 Silverplate B-29s was ordered. The first 5 of these went to the test unit (216th Base Unit) for continued development work while the next 15, so called combat models, went to the 393rd Bomb Squadron with the first being delivered in April 1945. These were all modified to Silverplate standard at the Martin modification centre at Omaha (having also been built at the same facility) before being delivered to Wendover. Subsequently they were delivered to North Field Tinian by their crews arriving in theatre in June and July 1945. *Enola Gay* was one of these planes (in fact the 31st Silverplate B-29) and arrived on Tinian on 2 July, 1945.

Although the 509th CG was an independent unit, when at North Field, Tinian, it came under the resident conventional B-29 Bomb Wing (the 313th BW) for administrative purposes. Shortly after they arrived on Tinian the 509th CG planes were painted with an Arrow in a Circle tail marking to denote them as belonging to the 509th CG. However, to try and confuse the Japanese, these group markings were soon removed and replaced with markings from other B-29 units. *Enola Gay* took on the Circle R identity of the 6th BG that was also based at North Field as part of the 313th BW.



Left: North Field, Tinian (photographed from the north) with its four parallel 8,500 ft long runways was home to the 180 B-29s of the 313th BW and, later, the 15 Silverplate B-29s of the 509th CG.

In the distance West Field Tinian can just be made out. West Field supported another 180 B-29s, these being from the 58th BW.
(*Earl Johnson*)

Having arrived in theatre the crews of the 509th CG began an intensive period of training with practice bombing missions, using standard 500 and 1,000lb bombs, being carried out against the small island of Rota in the Marianas chain that was still held by Japanese forces. As the crews grew more proficient they began to range further afield to bomb other Japanese held islands. Truk was attacked on 5 July, 1945 with Marcus Island being attacked the following day. Marcus Island counted as an operational mission and became a regular destination although much to the disgust of the crews who bombed it after 20 July it had by then been reclassified as only a training mission!

On 20 July, 1945 the 509th crews finally got to bomb mainland Japan when 10 Silverplate B-29s each dropped a single 'pumpkin' bomb that simulated the size, shape and weight of the *Fat Man* type of atomic bomb but contained 5,500lb of conventional explosives. Three further missions to Japan took place on subsequent days (23, 26 and 29 July) resulting in a total of 37 pumpkin bombs being dropped. To simulate the planned atomic mission, each plane was given an individual target so only one or sometimes two planes would be above each city as it was bombed. It was hoped that the Japanese would become used to the sight of the solitary B-29s and their single bomb and they would not consider them a worthy target for interception.

Clearance for the atomic mission was given on 25 July, 1945 with a message to General Carl A. Spaatz, commander of the U.S. Strategic Air Forces in the Pacific that authorised the 509th CG to "deliver its first special bomb as soon as weather will permit visual bombing after about 3 August, 1945". On 2 August Major

General Curtis LeMay, Chief of Staff, US Strategic Air Forces Pacific, issued Special Bomb Operational Order No. 13 to the 509th CG to carry out the attack and when, on 5 August the weather forecast for the next day was suitable the mission was set for the 6th. Later that day Tibbets named his B-29 *Enola Gay* after his mother and the plane was then towed to the special bomb loading pit where the *Little Boy* bomb was lifted into the forward bomb bay. The load was completed by 16:00 that afternoon.



The crew of *Enola Gay*
Standing: Maj Porter (509th CG ground maintenance officer), Maj Van Kirk (Navigator), Maj Ferebee (Bombardier), Col Tibbets (Airplane Commander), Capt Lewis (Copilot), Lt Beser (Radar Countermeasures)
Kneeling: Sgt Stiborik (Radar Operator), S/Sgt Caron (Tail Gunner), PFC Nelson (Radio Operator), Sgt Shumard (Assistant Engineer), S/Sgt Duzenbury (Flight Engineer)
Not shown are Capt Parsons (USN) and Lt Jeppson who also flew on the mission.
(USAF)

Briefings for the special mission were held at around 11 pm then at 1:30 am on 6 August the three weather reporting planes (*Full House*, *Jabbitt III* and *Straight Flush*) took off. These would report the weather over the three potential target cities which were, in order of priority, Hiroshima, Kokura and Nagasaki. At 2.45 am the *Enola Gay* started her take off run accompanied by three other Silverplate B-29s. *The Great Artist* which would carry special instruments to assess the strength of the explosion and No 91 (later named *Necessary Evil*) which would act as the photo plane would accompany *Enola Gay* to Japan while *Top Secret* would go as far as Iwo Jima where she would wait as a reserve in case *Enola Gay* developed a fault. A special bomb loading pit, similar to the ones on Tinian, had also been built on Iwo Jima to cater for this possibility.

As history has recorded, *Enola Gay* did not develop any faults and, after *Straight Flush* radioed a coded message to confirm that the weather over Hiroshima was suitable the fate of the city was sealed.

At 9:15 am the *Little Boy* bomb dropped from *Enola Gay* 31,600 ft above Hiroshima. The instant the bomb had left the plane Tibbets began the maximum rate turn through 155 degrees that would place them as far from the point of blast as possible. The bomb fell for some 45 seconds before detonating 1,900 feet above the city. The shock wave, expanding away from the epicentre at the speed of sound, caught up with *Enola Gay* less than a minute later. Despite being an estimated 15 miles 'slant range' away at that time *Enola Gay* still suffered two sever jolts in quick succession (the direct shock wave and a reflected one), although no damage was done.

After turning back over Hiroshima to survey the damage Tibbets turned *Enola Gay* for home, landing back on Tinian at 2:58 pm – a mission of 12 hours and 13 minutes. The earlier deception seems to have worked for the three planes on the atomic mission went unchallenged by the Japanese defenders.

When this mission was followed on 9 August, 1945 by the bombing of Nagasaki (*Bockscar* dropping a *Fat Man* bomb) the Japanese surrendered on 14 August.

After the war a further 27 Silverplate B-29s were delivered bringing the total (including the prototype) to 65 nuclear capable B-29s delivered between 1943 and 1946. Given the extensive modifications required to carry and successfully drop an atomic bomb it is clear that, despite numerous claims to the contrary, no RAF Washington was capable of carrying or delivering a nuclear bomb – even had Britain possessed such a weapon at that time (although Britain detonated her first atomic device on 3 October, 1952 this was not a bomb and it was not until 11 October 1956 that the first British atomic bomb was detonated – dropped by a Valiant on the Maralinga bombing range in South Australia)!



Forward entry hatch

Top: A general view of the *Enola Gay* in the Smithsonian's Udvar Hazy Center, Washington Dulles Airport. She is perched atop 9 foot high jacks which serve two purposes. Firstly, they allow other artefacts to be placed underneath and secondly they help protect *Enola Gay* from the attention of vandals intent of protesting against the atomic missions.

Note the lack of gun turrets and faired over sighting blisters for the gunners – the most obvious outward changes made to the Silverplate B-29s. The Smithsonian is restoring *Enola Gay* to the condition she was in on the 6 August, 1945 atomic mission which accounts for the Circle R tail marking. (**Chris Howlett**)

Right: The inside of the nose wheel bay with the entry hatch to *It's Hawg Wild* – the normal means of entry for those who inhabited the forward pressurised compartment. (**Ivor Warne**)

The cylinder mounted by the ladder at upper right (rear of nose wheel bay) and a similar one barely visible at upper left are the two CO₂ fire extinguishers for the engines. These were controlled from the Flight Engineer's control panel.

The hand crank is for the emergency operation of the nose wheel. It was inserted into a gear box between the Copilot and Flight Engineer – 257 turns being needed to raise or lower it.





Bombardier Station

Top: The Norden M-9B bombsight mounted in the nose of *It's Hawg Wild*. (Ivor Warne)

Bottom: The equivalent bombsight mounted in *Enola Gay*. (Scott Willey)

The bombsights used by the Silverplate B-29s were standard models and therefore represent the bombsights in all B-29s. However, the sharp sighted amongst you may have noticed a few differences. Firstly, the rectangular box to the left of *It's Hawg Wild's* sight is missing from the one in *Enola Gay*. This is the interface to the Honeywell C-1 autopilot and should be present. It has now been fitted. Secondly, the glass item mounted just above the eyepiece (upper centre top of the lower photo). This is an X-1 reflex sight, designed and built by the W. L. Maxson Corp. of New York. This unit was installed by the Victor Adding Machine Co and became part of the overall bombsight (i.e. you did not simply remove it when you did not want to use it). Its purpose was to provide the bombardier with a greater field of vision when he first swung the sight onto the target. Because of its optics, it also gave him a better ability to see targets in darker conditions. It could be clutched in to the bombsight and engaged to the lateral cross hairs or rate system in the bombsight sighthead. Although not present on *It's Hawg Wild*, this was not Silverplate specific and at least some of the RAF's Washingtons were also fitted with these devices.

Of interest, the bombsight mounted in *Enola Gay*, Norden M-9B V-4120 built by the Victor Adding Machine Co, is the actual bombsight used in *Enola Gay* on the 6 August, 1945 atomic mission. The Victor Adding Machine Co bought back the surplus stock and, upon discovering this bombsight in their inventory, donated it to the Smithsonian so that it could be reunited with *Enola Gay* then awaiting restoration in the Smithsonian's care.

NOMENCLATURE AND OPERATION



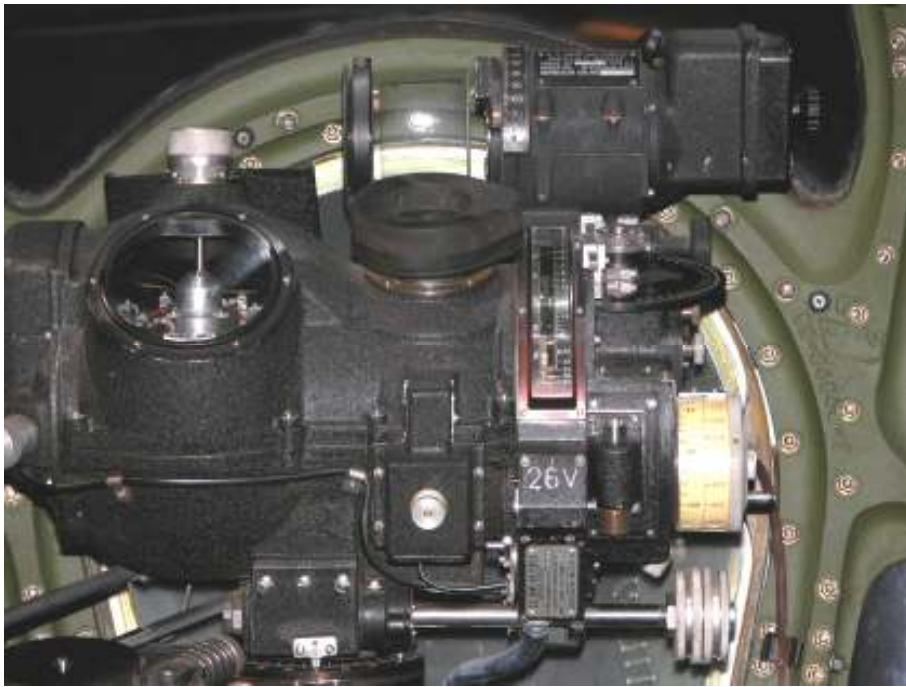
1. LEVELING KNOBS
2. CAGING KNOB
3. EYEPIECE
4. INDEX WINDOW
5. TRAIL ARM AND TRAIL PLATE
6. EXTENDED VISION KNOB
7. RATE MOTOR SWITCH
8. DISC SPEED GEAR SHIFT
9. RATE AND DISPLACEMENT KNOBS
10. MIRROR DRIVE CLUTCH
11. SEARCH KNOB
12. DISC SPEED DRUM
13. TURN AND DRIFT KNOBS

14. TACHOMETER ADAPTER
15. RELEASE LEVER
16. CROSSHAIR RHEOSTAT
17. DRIFT SCALE
18. PDI BRUSH AND COIL
19. AUTOPILOT CLUTCH ENGAGING KNOB
20. AUTOPILOT CLUTCH
21. BOMBSIGHT CLUTCH ENGAGING LEVER
22. BOMBSIGHT CLUTCH
23. BOMBSIGHT CONNECTING ROD
24. AUTOPILOT CONNECTING ROD

The bombsight has 2 main parts, sighthead and stabilizer. The sighthead pivots on the stabilizer and is locked to it by the dovetail locking pin. The sighthead is connected to the directional gyro in the stabilizer through the bombsight connecting rod and the bombsight clutch.

RESTRICTED

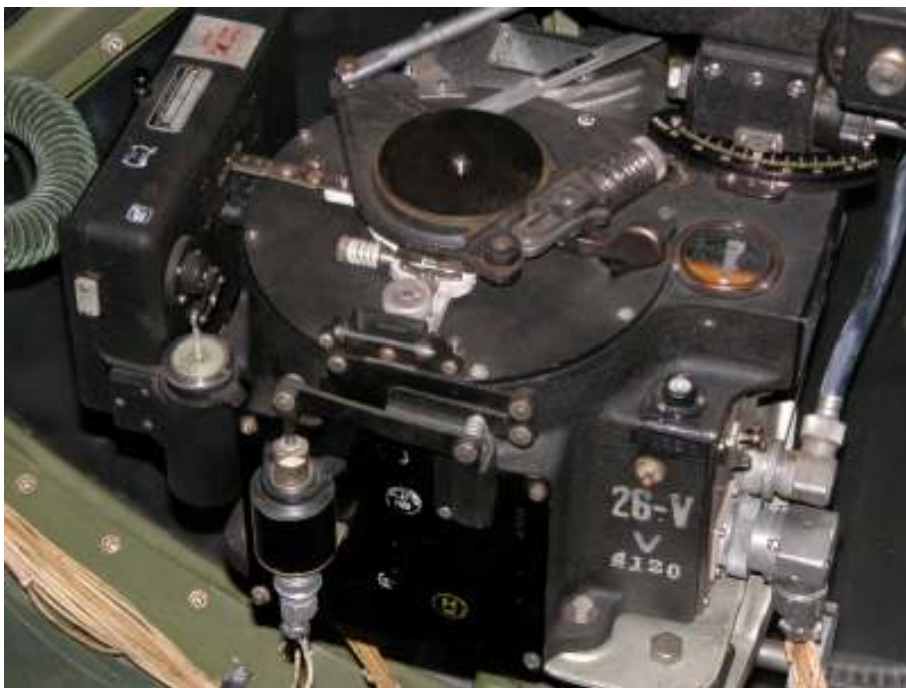
Above: An extract from the USAAF publication 'Bombardier's Information File' containing a schematic identifying the various dials and knobs of the Norden bombsight. Not identified is the rectangular box located under the row of numbers 19 – 22. This is the interface to the Honeywell C-1 autopilot. (*Mike Voisin*)



Top: The bombsight sighthead in *Enola Gay*. (*Scott Willey*)

The bombsight optics in the sighthead were stabilized in the vertical plane (for deviations in pitch and roll) by a gyro mounted under the glass window to the left of the photo. The window allowed the bombardier to see the top of the gyro mount upon which were fitted two spirit levels, one pointing fore and aft the other left to right. If both were in the centre the gyro was vertical and therefore so too were the optics.

Middle: The Stabilizer unit in *Enola Gay*. (*Scott Willey*)



The sighthead mounted onto the stabilizer unit. Both combined to make the bombsight assembly. The sighthead would not work without the stabilizer unit. The stabilizer unit contained a gyro that stabilized the bombsight in the horizontal plane (for deviations in yaw). Thus, when the sighthead was combined with the stabilizer unit the two gyros combined to fix the bombsight optics in space regardless of aircraft motion.

Honeywell C-1 Autopilot.

Unlike the sighthead that was only used while bombing, the stabiliser unit was also an integral part of the Honeywell C-1 autopilot within which it was used to sense deviations in yaw. The autopilot interface is the rectangular box mounted on the left hand side of the stabiliser unit shown in the middle photo. Because the sighthead was not part of the autopilot another gyro was required to allow the autopilot to sense deviations about the vertical axis (pitch and roll) as it was the gyro in the sighthead that did this for the bombsight assembly. This gyro was mounted on the cockpit floor just behind the central aisle stand where it was protected by a plywood box under which a heated cover kept the gyro from freezing at altitude.

Further pictures and descriptions of the autopilot are at pages 23 and 24.

Left: The protective plywood box covering the vertical flight gyro located just behind the central aisle stand in *Enola Gay*. (*Taigh Ramey*)

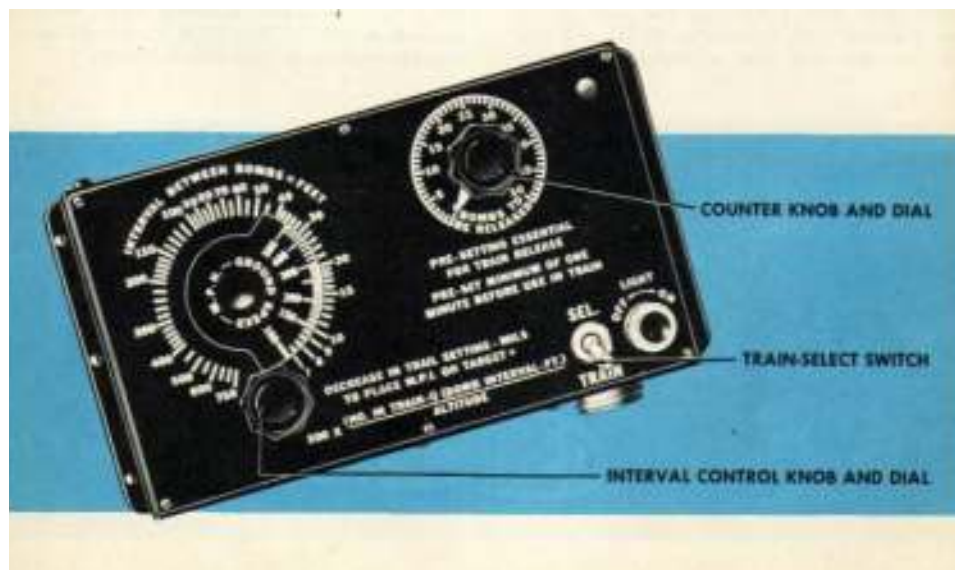


Top: The bombardier's control panel mounted on the left hand side of the nose of *It's Hawg Wild*. (*Ivor Warne*)

The top panel controlled the cameras while the bombardier's control panel (the green panel on the right) contained all the necessary switches to control the release of the bombs. Other parts of the panel contained the bomb indicator lights (black panel at lower right with 40 indicators – one light per possible bomb location), basic flight controls (large black panel at upper left) with a remote compass read out at top, an altimeter lower left and an air speed indicator lower right. Below the flight instruments is the intervalometer (diagram at **bottom**) that, when fed with details of the aircraft's altitude and speed provided a method of releasing in train (i.e. one bomb after the other rather than salvo when all were released together) a predetermined number of bombs with a predetermined space interval between successive impacts. It also controlled the drop sequence to ensure that the aircraft's centre of gravity remained within limits as the bombs drop free.

The panel in *Enola Gay* (next page – photo by *Scott Willey*) is almost identical as the Silverplate aircraft had no special modifications made to this area. Indeed, despite the modifications made to the bomb bay to carry the single heavy nuclear bomb the Silverplate planes still retained their standard bomb racks and could drop conventional bombs if required to do so.

There is one notable difference though between the planes as indicated by the substitution of a rate-of-climb indicator in *Enola Gay* where *It's Hawg Wild* has the remote compass readout. This change was a result of *Enola Gay* (and the other Silverplate B-29s) being fitted for a device known as the Glide Bombing Attachment (GBA). Not a Silverplate addition but rather a late war improvement to the bomb aiming equipment.





The GBA was an auxiliary instrument used with the M series bombsights. With it the bombardier could use the bombsight accurately in climbs and glides as well as in horizontal flight. Since the idea was to be able to vary altitude at up to 150 ft/min, the rate-of-climb indicator was more valuable than a compass.

Even before the war the Army had wanted a way to vary the altitude of a bomber during the bomb run to confuse flak. For various reasons, the ability to do this and maintain bombing accuracy took a long time to develop and even then it was only good up to 15,000 ft. Hap Arnold held off putting it out into the units until it could work up to 25,000 ft. When the GBA was finally ready in late 1944, they started going operational, but not many bombers got them before the war ended. *Enola Gay* is equipped to carry the GBA but it is not thought that the 509th aircraft ever carried the actual device or that the crews even trained with them.

Bottom: The 'High Altitude Absolute Altimeter' (SCR-718) in *Enola Gay*. (Bernie Poppert)

The SCR-718 was a high altitude absolute altimeter that had a complete radar transmitter and receiver that sent out pulses, received them and timed their return to give the height of the aircraft above the ground directly below. It was primarily an aid to navigation and high level precision bombing. It was also used by the bombardier to determine any error in the altitude delay circuit.

Since this photo was taken research, carried out by Bernie Poppert and Mike Hanz of NASM, has concluded that on the 6 August mission the SCR-718 in *Enola Gay* was mounted on the navigator's table and the SCR-718 has been moved to there. It is thought that the SCR-718 was replaced in the nose for the post war CROSSROADS mission. Standard B-29s had it located in the nose as shown here (see also pages 35 and 42).



Common Equipment

As we move through the B-29 we will come across certain items that are common to all crew stations. To avoid explaining their use many times, these and some personal items, are covered here. There were no differences between this equipment in standard B-29s or the Silverplate versions.

Interphone System

The AM-26/AIC-2 amplifier (silver box top centre of upper photo; *Mike Hanz*) is located on the Navigator's side of the forward pressurised compartment, but for logical reasons it was usually the radio operator who cared for it. It was the central component of the interphone system, the system which allowed each crewman to talk with another, and selected crewmen (like the pilot) to also talk over the various radios in the aircraft. The amplifier shown was a significant 1944 improvement over an older interphone amplifier designed in the 1930s. It included the ability to increase volume in four steps as altitude was increased – a job carried out by the radio operator. This feature was especially important in planes that were not pressurized like the B-17, less so in the B-29. To the right of and below the amplifier is a typical crewman's jack box for headphones and microphone. These can be found at all crew stations and other points where crewmembers may be expected to alight. Note the volume control at the top of the box. The switch at the bottom allowed the crewman to select between (clockwise from left) **COMP** to listen to the radio compass receiver; **VHF LIAISON** connected the crewman to the long range radio; **COMMAND** connected the crewman to the short range 'plane to plane' radio; **INTER** allowed the user to talk to any other crewmember without being transmitted outside the aircraft and **CALL** was an over-ride switch that allowed the user to be heard on any other station regardless of the setting on their jack boxes.

Earphones (**Far right**: Copilot's earphones in *Enola Gay*, *Mike Hanz*) were used for listening to the radios - the ambient noise level was simply too high to make a loudspeaker practical.





Throat microphones (**Previous page lower centre**) were generally used unless oxygen masks were donned, in which case a built-in mike in the mask was employed. Hand held microphones (**Previous page bottom centre**) were also available as an alternative.

Unfortunately, intelligibility with the throat microphone was not a strong point. A post-war analysis by the US Office of Scientific Research and Development stated, "[Throat microphones]...would probably have been a very effective instrument but for the fact that the speech signal available at the larynx is intrinsically unintelligible." While we may be amused at this stilted understatement of a serious problem, these microphones were used throughout the war years and beyond because of their "hands off" utility.

Oxygen System

Top: Oxygen distribution outlet at the Flight Engineer's station in *It's Hawg Wild*. (*Ivor Warne*)

Each crew station had an oxygen distribution outlet similar to the one shown above left. The right hand dial showed the oxygen pressure while the left hand dial (blinker) indicated that oxygen was flowing. The large hose connected to the oxygen mask while the small one was for recharging the portable oxygen bottles (an A-4 portable bottle would last for approximately 4 to 8 minutes of use between recharges). The oxygen system used 18 interconnected type C-1, low pressure, shatterproof oxygen cylinders. The entire system was filled from one filler valve located on the outside of the left fuselage just forward of the wing root. When full (400 – 450 psi) and with automix on these provided more than 10 hours' supply for 11 men flying at 15,000 ft (see graph to left). Each oxygen outlet was supplied from two separate distribution lines so the loss of one still left the station with a supply of oxygen.



Heated Flying Suits

Bottom: Power outlet for a heated flying suit. This one is mounted on the armour plate behind the Airplane Commander in *It's Hawg Wild* although all crew stations had similar outlets (*Ivor Warne*)



Bombardier's flak suit has full armor. When he pulls ripcord at suit's center, entire suit falls off.

FLAK SUITS

Flak suits consist of armored vest and apron assemblies. They are not personal issue, but they should be delivered to the plane before the flight and picked up afterward for inspection. You couldn't carry one anyway, with everything else you're lugging. Report to the pilot if you don't find a flak suit in the plane for you.

Wear the suit when you approach the target area. It's heavy but it's guaranteed that you won't notice the weight when the fight begins to get hot.

Note: Ask your Personal Equipment Officer to have a tab sewed on your flak suit for your oxygen mask hose clip.



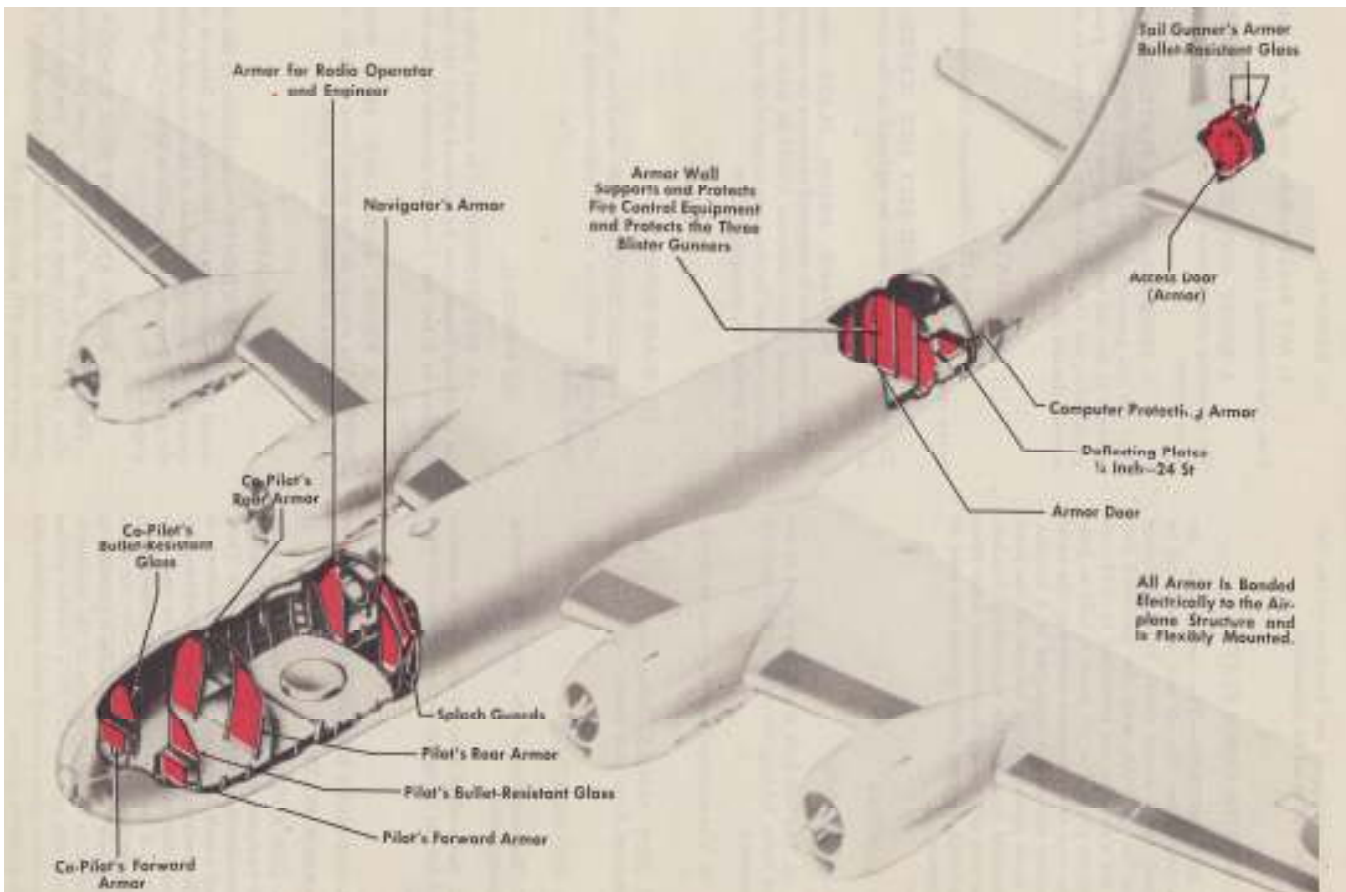
FLAK HELMETS

The flak helmet is personal issue. If you have worn both your flak suit and flak helmet on the mission, you have a good chance of returning the helmet to the supply room **personally** after the flight.

RESTRICTED

Armour Protection

Above: Extract from the USAAF publication 'Bombardier's Information File' showing what every well dressed B-29 bombardier should wear when in range of the enemy – although it is indicative of all crewmen. (*Mike Voisin*)



Above: In addition to the personal flak suits (previous page), standard B-29s carried a reasonable amount of armour (red in diagram above) to protect not only the crewmembers but also some of the vital electronic equipment. Note 'Deflecting plates' under the floor in the Radar compartment which protected the computers for the top, left, right and tail sighting stations in the CFC system. The nose sighting station computer was located immediately behind the A/C's armour plate and protected by this. In the Silverplate aircraft only the Pilot's, Copilot's and Tail Gunner's armour remained. The rest was deleted to save weight. (*Taigh Ramey*)

Smoking

Smoking was allowed in the aircraft and each crew station even had its own built in ashtray (made by the Ford Motor Car Company!)

Middle: The walls of the B-29 were seemingly completely covered with various placards. This one, on the armour plating behind the A/C's station in *It's Hawk Wild*, states when smoking was not to be allowed. (*Ivor Warne*)

Bottom: The ashtray (green/grey circle below the oxygen distributor) built into the fuselage wall at the Flight Engineer's station in *Enola Gay*. (*Scott Willey*)





Remote Control Turret System

Previous page: The nose sighting station in *It's Hawg Wild. (Ivor Warne)*. This was one of five similar sighting stations in a standard B-29. The others were for the Top Gunner, Left and Right Blister Gunners (or scanners) and the Tail Gunner. Silverplate B-29s only kept the Tail Gunner's sighting station, the others being deleted to save weight.

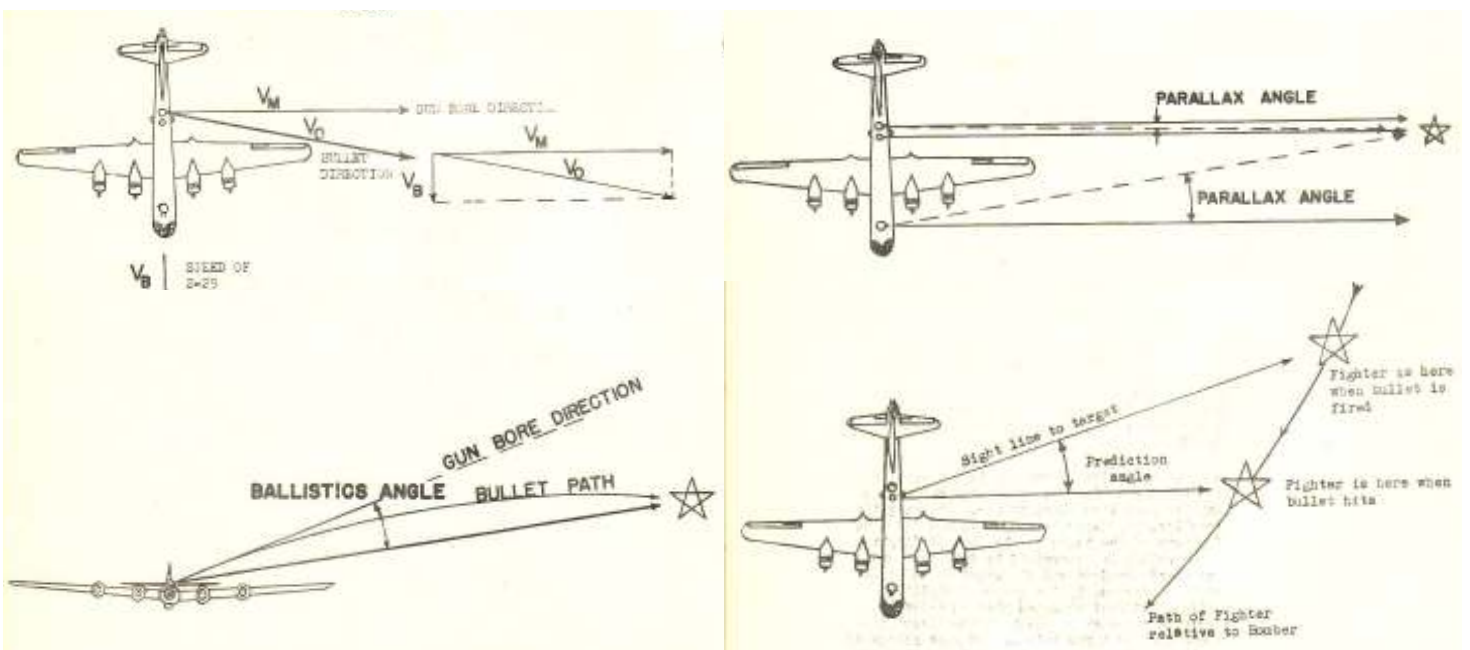
The system was called the Remote Control Turret System (RCT) or the Central Fire Control System (CFC) because the gunner did not occupy the turret. Instead he occupied a sighting station and controlled his turret remotely using a sight at his sighting station. This system allowed the gunners to remain in the heated and pressurised crew compartment which kept them more comfortable and therefore more able to perform their duties well.

The RCT was designed by General Electric and used one sighting station for each turret although, by using a set of switching boxes, and with the exception of the tail gunner who could only control his own turret, the gunner at each station could take control of other turrets should he have a better sighting angle or should that turret's gunner be incapacitated in any way (see control diagram on next page).

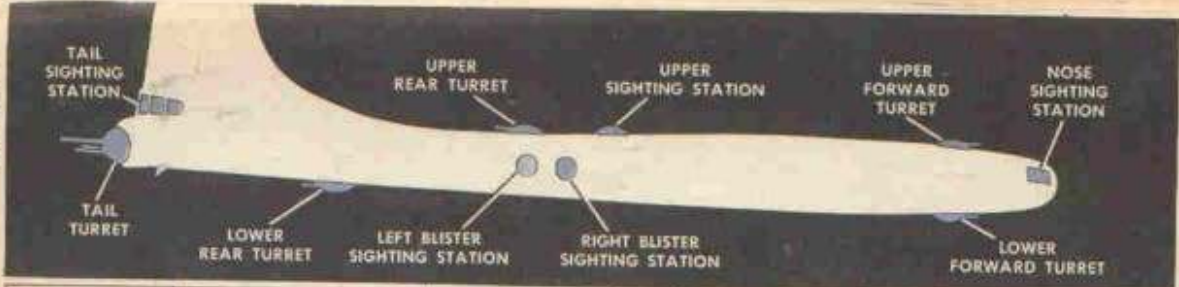
To allow the RCT to operate, the sight at each sighting station was connected to the turret or turrets that it could control via its own mechanical computer. The computer was designed so that, when the gunner sighted directly on his target, it caused the bore axes of the guns, on the turret or turrets, which the gunner was controlling, to be changed from a position parallel to the line of sight to a position which would cause the bullets to hit the target. The computer for the nose sighting station was located between the Navigator and Airplane Commander just behind the Airplane Commander's armour while the computers for the top, left, right and tail sighting stations were all located under the floor in the gunner's compartment.

To get the bullets to hit the target, the computer calculated three corrections; Parallax (to compensate for the distance along the longitudinal axis of the airplane between the turret and the sight), Ballistics (to compensate for windage and gravity) and Lead or prediction angle (to compensate for the distance the target would have travelled from the time the bullet leaves the gun until it strikes the target) – see diagrams below taken from the 1948 SAC publication 50-1 'Gunner's Reference File' (*Taigh Ramey*). The three corrections were added together and appeared as a single total correction. Two types of computers were used in the system; Type 2CH1C1 single-parallax computers were used with the nose and tail sighting stations while type 2CH1D1 double-parallax computers were used with the others. The reason for the difference was that the upper and both blister sighting stations could control two or more turrets while parallax base length was sufficiently different to require two different parallax corrections. Although the nose station could control either or both of the forward turrets, their azimuth parallax base length was approximately the same.

The inputs required by the computers to make these corrections were; azimuth and elevation gun position (obtained from sensors [selsyns] in the sights), true airspeed and air density (calculated from indicated air speed, pressure and outside air temperature as entered by the navigator at the navigator's hand set – see page 37), range to target (from a range potentiometer in the sight that was varied as the gunner adjusted his range hand wheel, or grip, to keep the reticule spanning the target – see page 59) and relative velocity of the target (from two gyros on the sight). See page 58 for a description of the various components on the sights and page 60 for the locations of the various components.



GIF 2-2

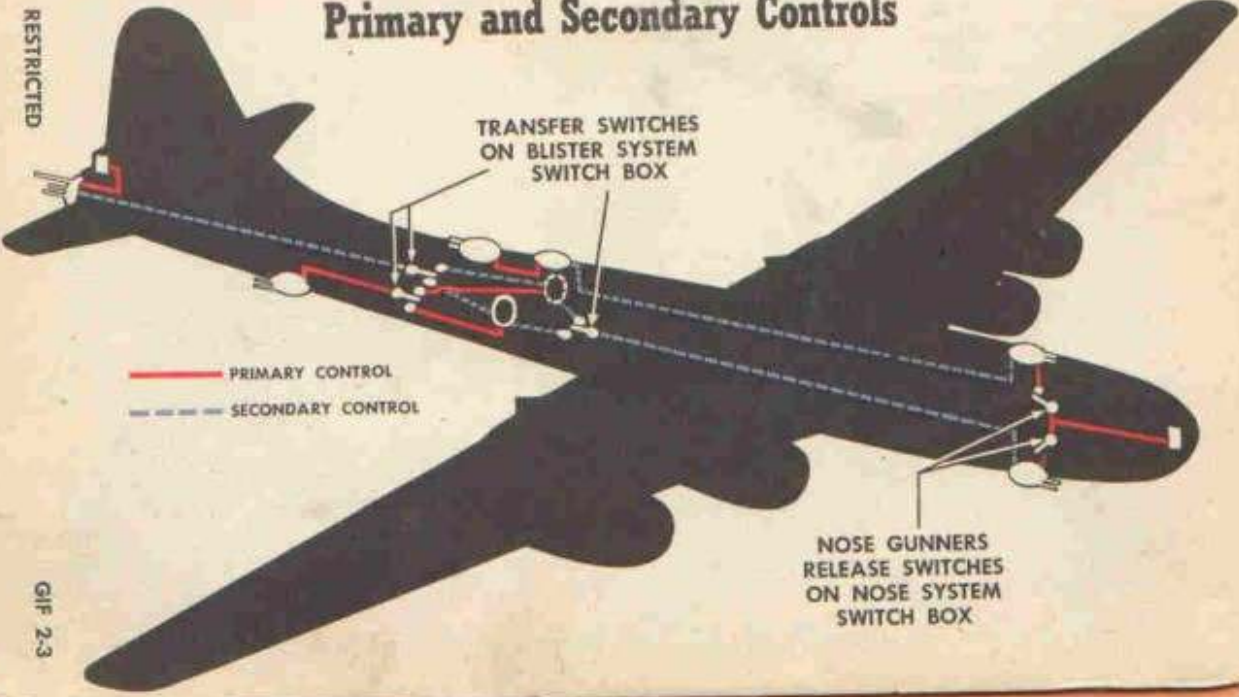


Sight and Turret Identification Chart

| If You Are at This Sight | And Want Control of This Turret | Use Control Switches on This Control Box | AND TURN SELECTOR SWITCH | |
|--------------------------|---------------------------------|--|-----------------------------------|-------------------------------|
| | | | On Blister Selector Switch Box To | On Nose Release Switch Box To |
| Upper | Upper Rear | Upper System | | |
| | Upper Forward | Upper System | | |
| Nose | Upper Forward | Upper System | | OUT |
| | Lower Forward | Nose System | | IN |
| Right Blister | Lower Forward | Nose System | RIGHT | OUT |
| | Lower Rear | Blister System | RIGHT | |
| | Tail | Tail System | RIGHT | |
| Left Blister | Lower Forward | Nose System | LEFT | OUT |
| | Lower Rear | Blister System | LEFT | |
| | Tail | Tail System | LEFT | |
| Tail | Tail | Tail System | | |

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Primary and Secondary Controls



RESTRICTED

GIF 2-3

GIF 2-3

Above: An extract from the USAAF publication 'Gunner's Information File' showing the primary and secondary turret controls and switch settings necessary to take control of a turret. (*William Royster*)

HOW TO TURN ON



THE NOSE SIGHTING STATION

FACTS AND FIGURES

Movement of the Nose Gunner's Sight

The nose gunner can swing his sight from almost straight down (-80 degrees) to almost straight up (80 degrees). To the right he can swing the sight a little more than a half circle (185 degrees), and to the left he can swing almost a half circle (140 degrees).

Turrets He Has First Call On

The nose gunner has first call—primary control—on the two forward turrets—upper and lower. Often he will need them both to shoot down a fighter attacking from the front. But he can release the upper forward turret to the top gunner, and the lower forward turret to one of the side gunners. Frequently he will release one of the turrets and keep operating the other one.

Other Turrets He Can Operate

None.

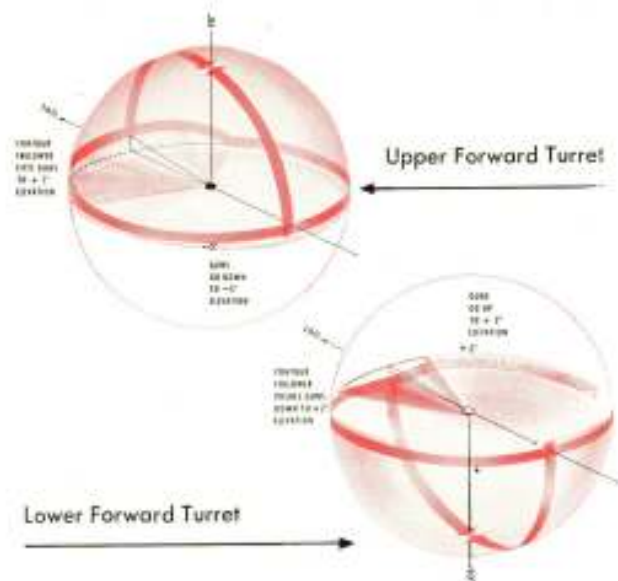
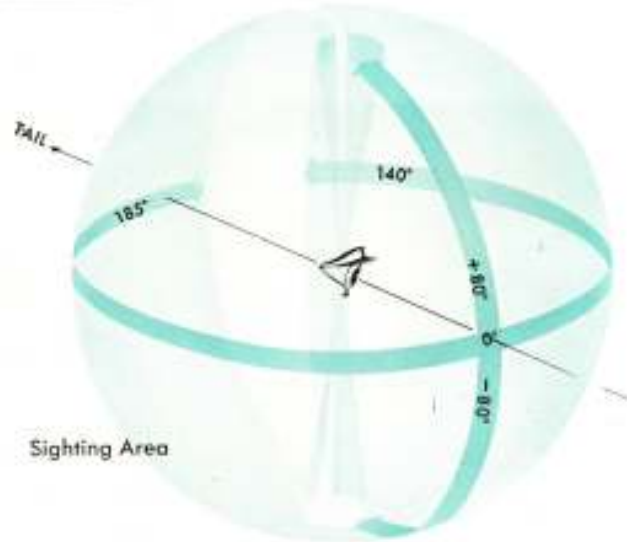
Field of fire of his turrets

The upper forward turret swings a full circle in azimuth. In elevation, it covers the entire upper surface—from a little below horizontal (-5 degrees) to straight up (90 degrees). At one point—when the guns are pointed straight back—the contour follower stops them before they go quite down to level (5 degrees).

The lower forward turret also covers a full circle in azimuth. In elevation, its guns move from a little above level (5 degrees) to straight down (-90 degrees). When the guns point aft, the contour follower keeps them from rising more than 2 degrees above horizontal.

Stowing Duties

The nose gunner is responsible for stowing the lower forward turret—with its guns pointed straight back and as near horizontal as possible.

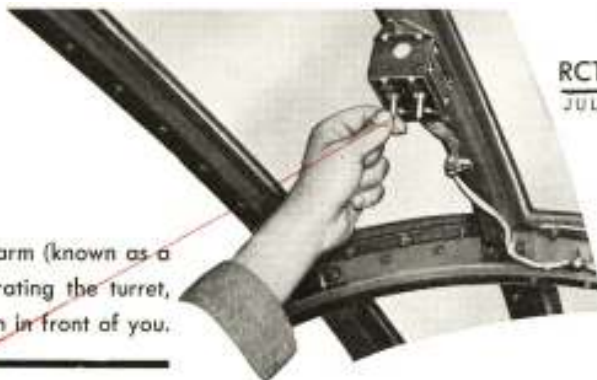


RESTRICTED

This page and next: Extract from the USAAF publication 'Air Forces Manual No. 27 Gunnery in the B-29' relating to the nose gunner's sighting station. (Taigh Ramey)

THE NOSE GUNNER'S SWITCHES

At the nose sighting station, the sight is mounted on a long arm (known as a **pantograph**) extending from the fuselage. To begin operating the turret, unsnap the latch on this arm and swing the sight into position in front of you.



Then take these steps in order:

1 Turn on the switch marked **power aux.** This will supply current to warm up the computer, start the air compressor for the gun chargers, and operate the gun firing circuit in the lower forward turret.

2 Above your head you will find a small switch box with toggles marked **upper forward** and **lower forward turret.** When these switches are turned to **in**, you have control of the two turrets; when they are turned to **out**,

the top gunner takes control of the upper forward turret, and one of the side gunners takes control of the lower forward turret. Turn these switches to the proper position—which will be determined in combat by your airplane commander or senior gunner.

3 Push the power breaker buttons to make sure the circuits are closed.

4 Turn on **power A.C.**—a main power switch.

5 Turn on the **computer** switch. This starts the computer and the gyroscopes on your sight. Now wait at least 10 seconds to avoid overloading the circuits.



6 Use the 10 seconds to check your sight, as described on page 5-7-1. Then turn on the switch marked **power turret**, which supplies current for operating the lower forward turret.

7 The last two switches can now be turned on in any order you wish. The **guns** switch is a safety switch for the firing circuit in the lower forward turret; on the ground it should be turned on just before

testing the triggers, and in the air it should be turned on just before firing test rounds and then left on for the rest of the mission. The **camera** switch supplies current for operating the gun camera.

The power, camera, and gun switches for the upper forward turret are all located in the top sighting station. You will have to depend on the top gunner to turn these switches.

You are now ready to operate the sight, as described in Section 3, and fire the guns in either or both of the two front turrets. As long as the two switches marked **upper forward turret** and **lower forward turret** are both turned to **in**, the guns in both turrets will follow your sight and will be fired by your triggers.

How the nose gunner

can transfer control of his turrets

If you want the top gunner to take over the upper forward turret, throw the **upper forward turret** switch to **out**. If you want the side gunners to take over the lower forward turret, throw the **lower forward turret** switch to **out**.

Control of your turrets will also pass on to the top and side gunners when you release your sight's action switch. (For a description of this switch, see p. 3-1-2.)



Airplane Commander's Station

Top: The A/C's window in *Enola Gay*. This, and the similar window by the Copilot's station, opens by coming in and then sliding up (in the photo the window is open). The brick red tubes are part of the demisting plumbing running along the top of the cabin. (*Scott Willey*)

Middle: A general view of the A/Cs station. (*Scott Willey*)

Mounted on the cabin wall to the A/C's right are the throttles (long handled levers with the blue ends), trim wheels (grey wheels), oxygen distribution system (black dials) and communication controls. Note the command radio channel selector switch box immediately behind the throttles. The eight red buttons (labelled A through H) hint at a late modification made to *Enola Gay*'s radio equipment when the 'standard fit' SCR-522 four channel VHF command radio was replaced during a stop on the delivery flight to Tinian with the more advanced eight channel AN/ARC-3 command radio.

Note the Boeing 'hub cap' in the control column yoke (something of a rarity for a Washington to have retained one of these!).

Bottom: A close up of the A/C's control panel this time in *It's Hawg Wild*. (*Ivor Warne*)

Note the missing Boeing hub cap!

Missing from both *Enola Gay* and *It's Hawg Wild* are the armoured glass panels that mounted above both the Airplane Commander's and Copilot's instrument panels filling the entire area between the panel and the overhead. Since the front of the instrument panel was also armoured the two pilots were relatively well protected. The Smithsonian Institute is currently fabricating replica panels at their Garber restoration facility for fitting to *Enola Gay*.



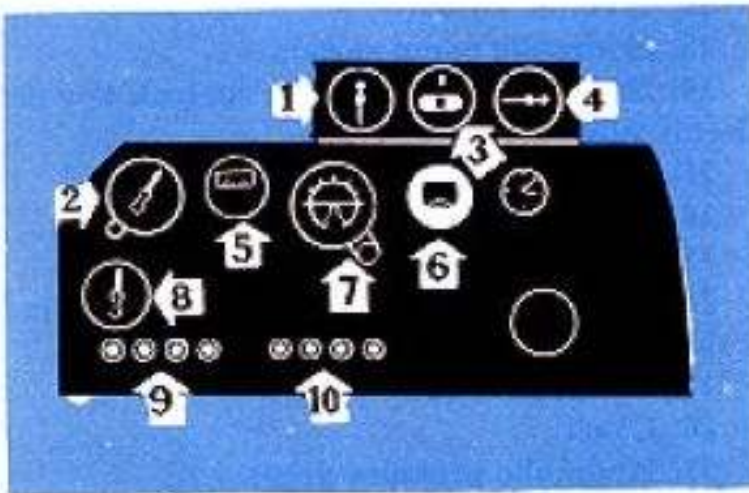
EXCEPT FOR MANIFOLD PRESSURE GAGES AND TACHOMETERS, THE INSTRUMENTS ON THE AIRPLANE COMMANDER'S PANEL ARE ALL FLIGHT INSTRUMENTS:

1. Airspeed indicator
2. Altimeter



3. Bank-and-turn indicator
4. Rate-of-climb indicator
5. Turn indicator
6. Gyro-horizon
7. Pilot direction indicator (PDI)
8. Radio compass
9. Flux gate compass
10. Manifold pressure gages
11. Tachometers
12. Blind-landing indicator
13. Clock
14. Turret warning lights
15. Bomb release indicator light
16. Vacuum warning light

THE INSTRUMENTS MOUNTED ON THE COPILOT'S INSTRUMENT PANEL ARE:



1. Airspeed indicator
2. Altimeter
3. Bank-and-turn indicator
4. Rate-of-climb indicator
5. Turn indicator
6. Magnetic compass
7. Gyro-horizon
8. Flap position indicator
9. Propeller rpm limit indicator lights
10. Landing gear indicator lights

Above: Excerpt from the USAAF publication 'The B-29 Airplane Commander Training Manual for the Superfortress AAF Manual No 50-9' identifying the dials on the Airplane Commander's and Copilot's instrument panels.

Right: General view of the A/C's and Copilot's instrument panels in *It's Hawg Wild*. (Martin Claydon)





Copilot's Station

Top: The Copilot's station in *It's Hawk Wild.* (*Ivor Warne*)

Middle: The Copilot's instrument panel in *Enola Gay.* (*Scott Willey*)

The large grey wheel to the lower right is the pitch trim control wheel. Above this and to the right is the Copilot's hydraulic instrument panel. The hydraulic system was only used for braking and an electrically driven pump kept the system at a pressure between 1,025 and 1,225 psi.

Bottom: A close up of the side wall of the Copilot's station showing the Prop Reversing button that was unique to the phase three Silverplate B-29s. The button was located on the wall just behind the throttle levers (the A/C had a similar button beside his station). (*Mike Hanz*)



The prop reversing button was relevant to the phase three Silverplate B-29s because they were fitted with reversible Curtiss-Electric reversible propellers instead of the Hamilton-Standard propellers of the normal B-29s. The reason why they were fitted with these propellers was given by Scott Willey of NASM: "Col Tibbets (C/O of 509th CG) decided to have Curtiss-Electric propellers fitted to the operational Silverplate planes because they could be reversed and not just feathered. The reasoning was that if you were in some kind of emergency situation and had to return to base heavy, in a standard B-29 you'd just go ahead and drop your bombs in the drink to get down to a safe weight. I don't think Tibbets thought it would be a great idea to plop a billion-dollar nuclear weapon in the ocean in order to lighten up the aircraft. So, if a Silverplate B-29 was coming in heavy, the reversible-pitch props gave a lot more braking to hopefully get the bird stopped on those 8,500-ft runways in the Marianas. Boeing had looked at the Curtiss props early on, but they deemed them less reliable (they were, especially in the CBI theatre on C-46s). So, although they would reduce braking distance by about 50%, Boeing stuck with the relatively reliable Hamilton-Standards."



Central Aisle Stand

Top: The central aisle stand in *Enola Gay*. (**Scott Willey**)

Bottom: The central aisle stand in *It's Hawg Wild*. (**Ivor Warne**)

The aisle stand in *Enola Gay* and *It's Hawg Wild* are essentially the same and, apart from two items, just show detail differences that reflect the different times of manufacture of the two aircraft.

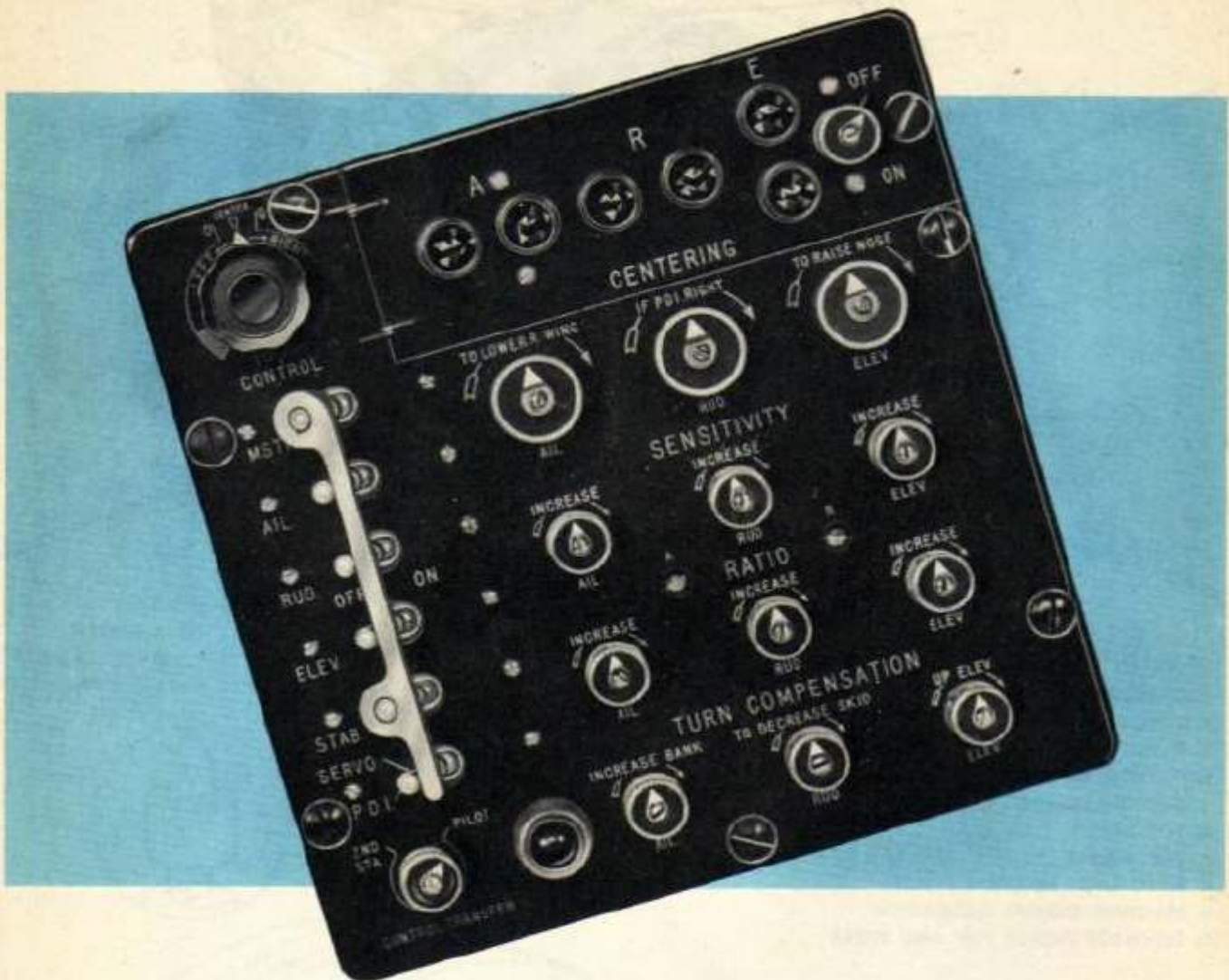
The two Silverplate differences both relate to the Curtiss-Electric propellers fitted to *Enola Gay*. The four feathering buttons of the standard B-29 (lower photo – red buttons labelled 1 - 4) are replaced by switches allowing the A/C to feather or reverse pitch each propeller. The knock on change is the additional panel to the rear of *Enola Gay's* stand that contains switches for the navigation, identification and landing lights. Standard B-29s had these switches in the main panel between the autopilot controls (square black panel to rear left of aisle stand) and the propeller feathering buttons but the need to add the controls for the Curtiss-Electric propellers necessitated their repositioning.

The white lever on the floor in the top photo is the hand pump that was used to build up pressure in the hydraulic system if the electrically driven pump did not work. The hydraulic system was only used for the brakes.

The grey item (it is supposed to be silver wrinkle finish!) toward the bottom of the lower picture is the vertical flight gyro of the C-1 autopilot. The vertical flight gyro sensed deviations in pitch and roll and sent the information to the autopilot amplifier mounted in the adjacent central aisle stand. The gyro should be protected by a plywood box. *Enola Gay's* gyro is covered by such a box (see page 8) and is also partly hidden by the panel containing the switches for the lights.

A description of the various switches on the autopilot control panel (black panel just above the gyro) is given on the next page in an extract from the USAAF publication 'Bombardier's Information File'. (**Mike Voisin**)





Autopilot Control Panel

The autopilot control panel (ACP), located in the pilot's compartment of an airplane, contains the switches, lights, and knobs used to operate and adjust the autopilot.

Tell-tale lights show when the electrical trim of the autopilot agrees with the manual trim of the airplane.

Centering knobs change the electrical trim of the autopilot to agree with the manual trim of the airplane.

Sensitivity knobs regulate the distance the airplane is allowed to deviate from straight and level flight before the servo units apply control to correct the deviation.

Ratio knobs regulate the amount the servo units move the control surfaces for any given deviation of the airplane.

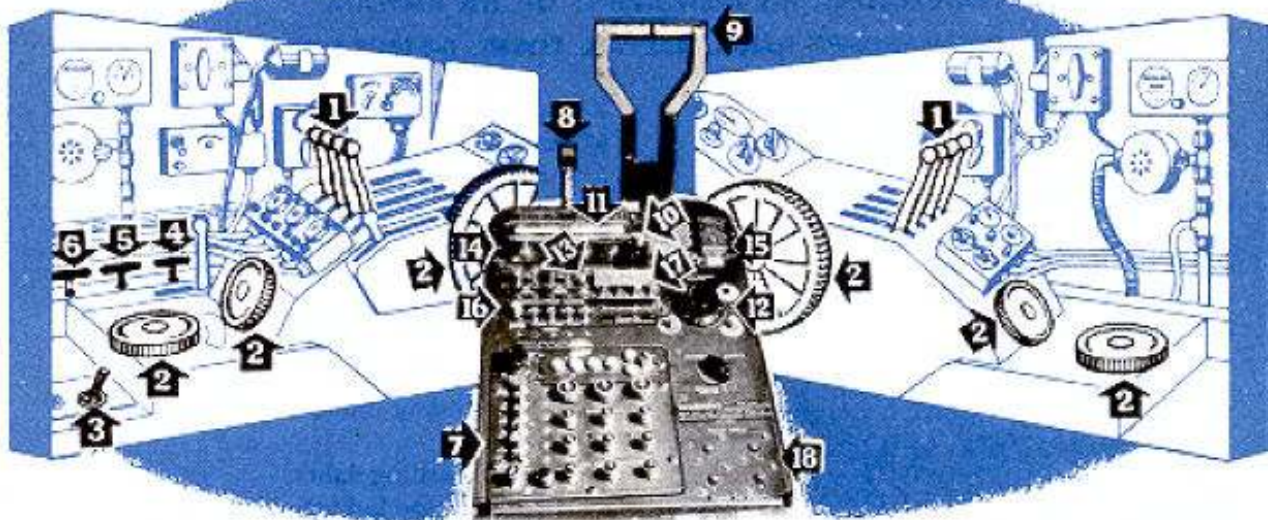
Turn compensation knobs regulate the amount of control necessary when the directional panel is used in making a coordinated turn.

Turn control enables the pilot to make coordinated turns with the autopilot.

Aileron and rudder trimmer screws regulate the amount of aileron and rudder control necessary to make a coordinated turn with the turn control.

Remote control transfer knob shifts the turn control operation to a remote turn control station in either the bombardier's or navigator's compartment.

Tell-tale light shutter knob regulates the brightness of the tell-tale lights.



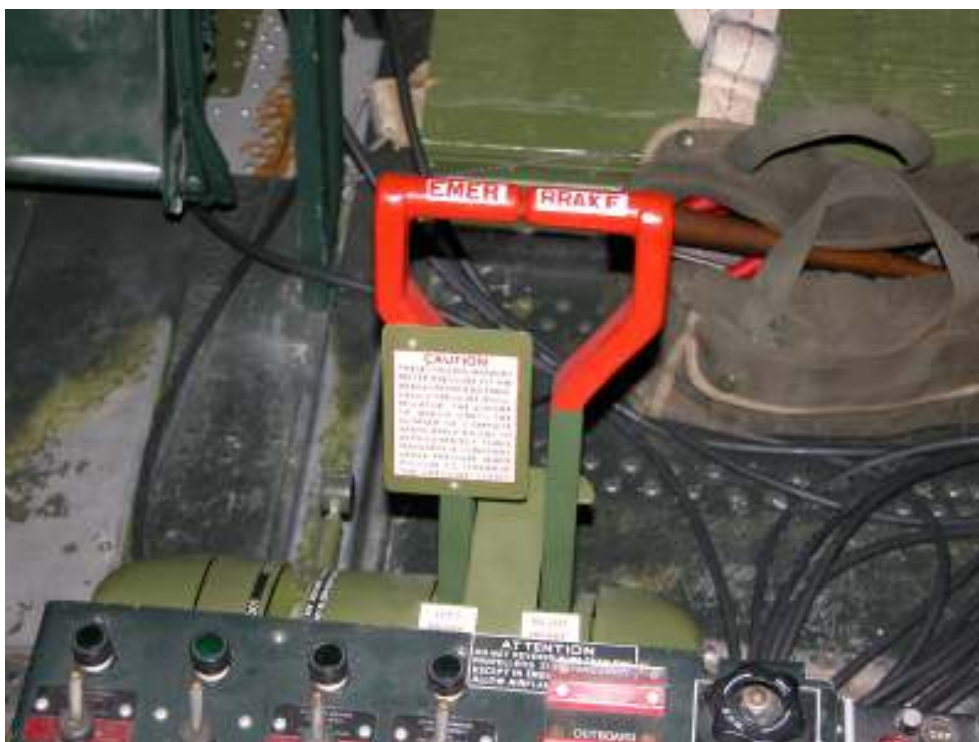
Both airplane commander and copilot have control stands on which throttles (1) and trim tab controls (2) are mounted. The landing gear transfer switch (3) and emergency cabin pressure (4) emergency bomb (5), and emergency landing gear door releases (6) are at the rear of the airplane commander's control stand.

The controls for the C-1 automatic pilot (7), the control surface lock (8), emergency brake levers (9), wing flap control switch (10), propeller feathering switches (11), turbo boost selector (12), phone-call signal light switch (13), alarm bell switch (14), landing gear switch (15), light switches (16), propeller increase and decrease rpm switches (17), and propeller pitch circuit breaker re-sets (18) are on the aisle stand to the right of the airplane commander's seat and within easy reach of the copilot.

Above and Left: Excerpt from the USAAF publication 'The B-29 Airplane Commander Training Manual for the Superfortress AAF Manual No 50-9' identifying the levers, knobs and wheels on the Airplane Commander's and Copilot's side panels and the central aisle stand.

Below: The emergency brake levers located at the front of the aisle stand in *Enola Gay* (*Scott Willey*)

The black cables littering the floor are not original but are part of the fibre optic lighting system installed in *Enola Gay* for display. Fibre optic was chosen to avoid any risk of fire although the lighting it provides also proved to be very effective as can be seen in the photo on the cover.





Top: *It's Hawk Wild's* number 4 engine and it's Hamilton Standard Propeller. (Chris Howlett)



Bottom: A close up of *Enola Gay's* number 2 engine with its Curtiss-Electric reversible propeller. (Chris Howlett)

In February 1945 it was decided that the 509th CG would get new planes to take overseas. These planes would have all the latest additions including fuel injection engines, Curtiss Electric reversible pitch propellers, pneumatic bomb bay doors, engine mounted front collector rings and other smaller mechanical improvements. It is a bit of a mystery why pneumatic bomb bay doors were included as these were fitted to standard B-29s from production blocks B-29-55-BW, B-29A-15-BN, B-29-30-BA and B-29-25-MO. The phase 3 Silverplate B-29s were later than this being block 35, 40, 45 or 50-MO aircraft.

Note the wider 'paddle' cross section and cooling cuffs of the Curtiss Electric reversible pitch propeller. Although at the time, fuel injection was a Silverplate addition, by the time the RAF received the Washingtons and when *It's Hawk Wild* operated in Korea, fuel injection was a standard feature.



Flight Engineer's Station

Above: The Flight Engineer's instrument panel in *Enola Gay*. (Scott Willey)

The Flight Engineer was primarily responsible for managing the engines and, by varying the cowl flaps, manifold pressures, fuel mixture and fuel distribution, to extract the maximum possible duration from the available fuel. Fortunately, a fully fuelled B-29 carried an impressive quantity: 1,415 gallons in each inboard wing tank, 1,320 gallons in each outboard wing tank and 1,333 (1,120 in B-29A) gallons in the centre wing tank. In addition, up to four 640 gallon auxiliary tanks could be carried in the bomb bay (2 each in the forward and rear). For the Silverplate aircraft fuel was not too much of a problem as the single 10,000 lb bomb carried in the forward bomb bay allowed a full fuel load and two of the auxiliary fuel tanks to be carried in the rear bomb bay. Standard B-29s (and B-29As) were always being pressurised into carrying a greater and greater weight of bombs at the expense of fuel, making the Flight Engineer's fuel management task that much more critical.

To complicate his task, the fuel management system fitted to the B-29 changed radically during their production run. Early planes had what was known as the Fuel Transfer System while later planes had a Manifold Fuel System.

Enola Gay had the Manifold System which allowed the fuel in any or all tanks to be directed, via a single manifold fuel line and a number of electric pumps and shut off valves, to feed any engine. The pumps and shut off valves were controlled by switches on the Flight Engineer's control stand (see pages 28 and 29). In the earlier Fuel Transfer System each engine was fed directly from its own tank and could only be fed from that tank. Fuel could however be transferred from tank to tank by two reversible pumps controlled by circuit breakers, directional control switches and tank selector valves on the Flight Engineer's control stand (see pages 32 and 33).

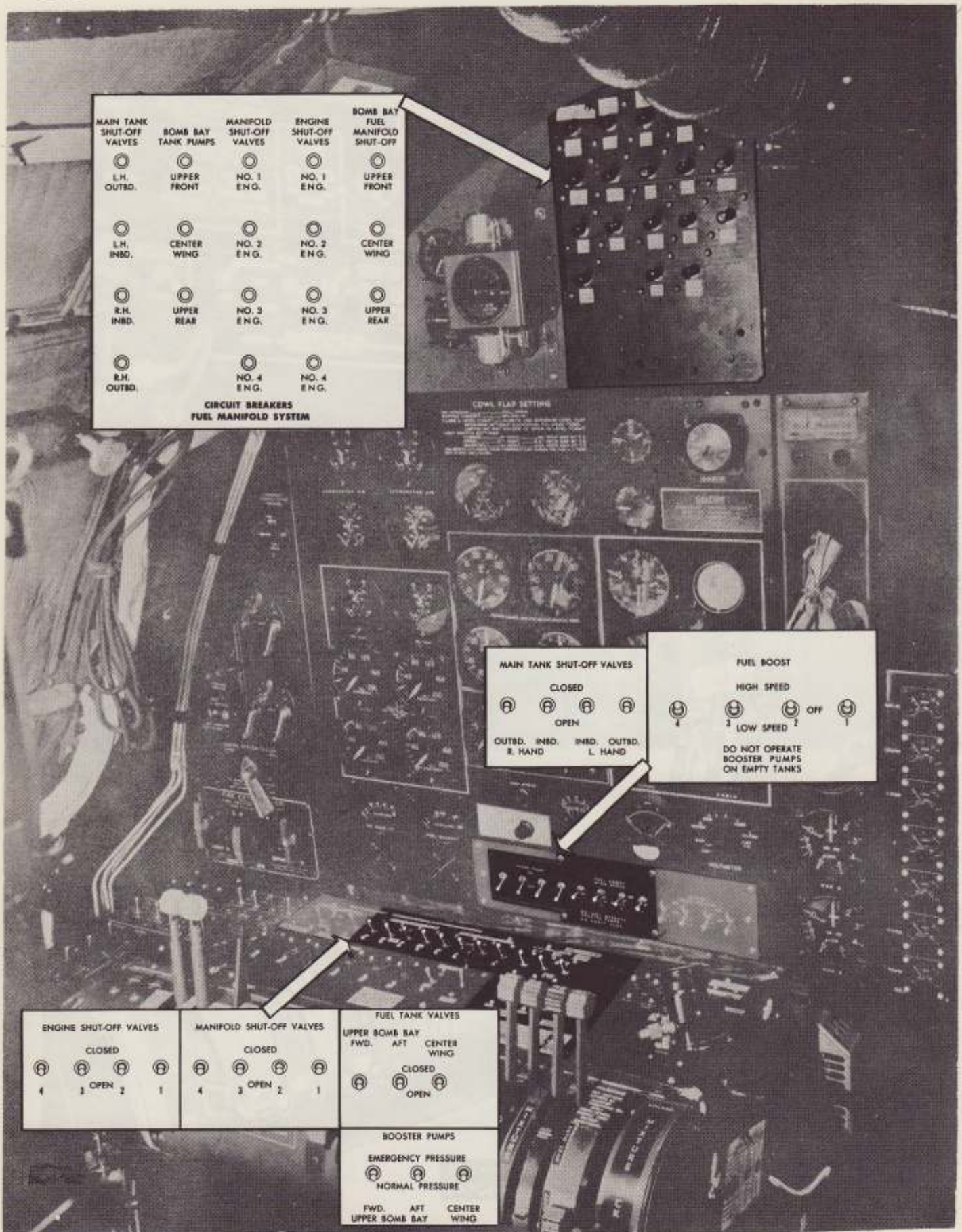


Figure 20A — Engineer's Station (Manifold Fuel System)

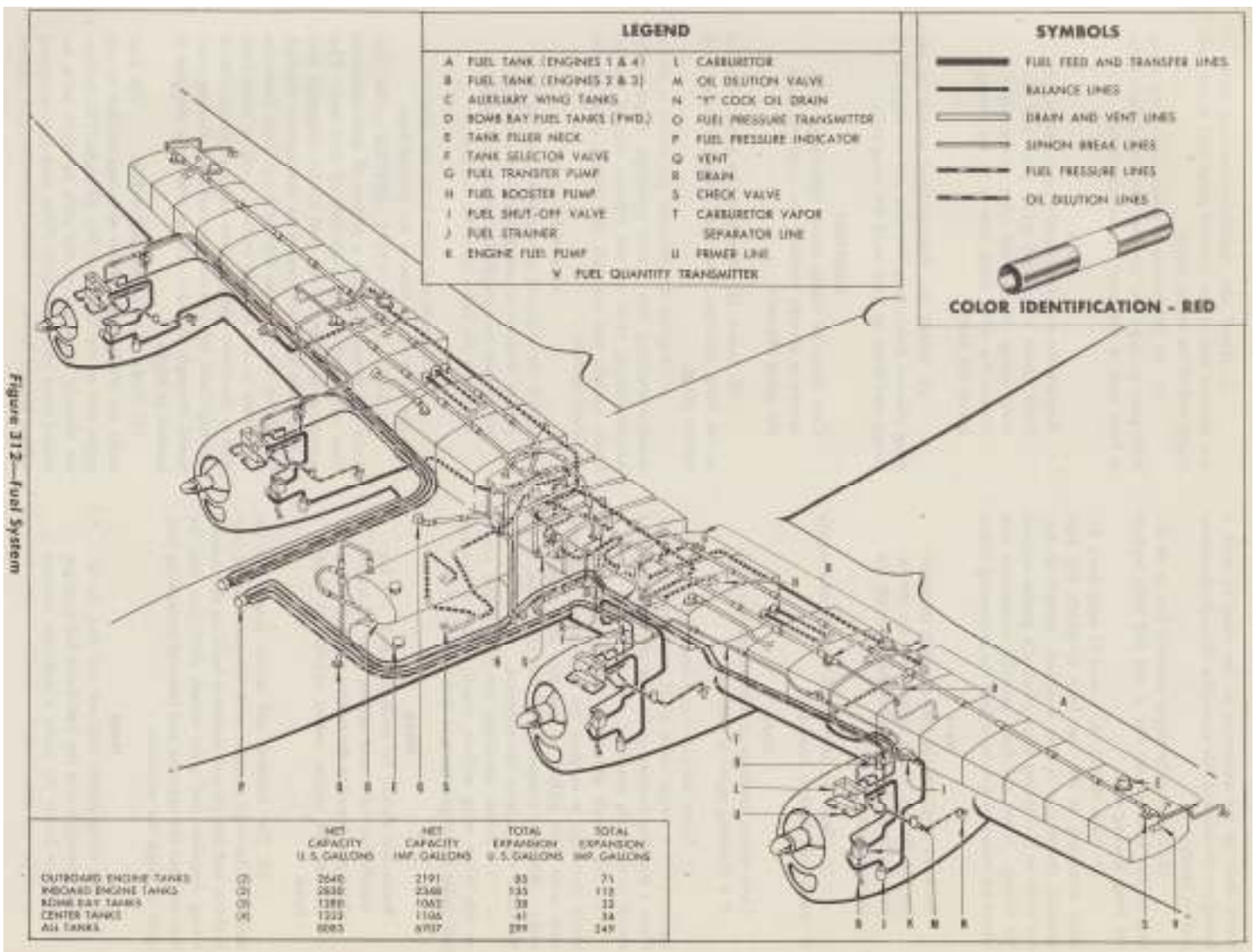
Above: A diagram from the USAF publication AN 01-20EJA-1 identifying the various switches used to control the fuel flow in those B-29s fitted with the Manifold Fuel System. (Taigh Ramey)



Above and Right: Two views of the Flight Engineer's station in *Enola Gay*. (*Scott Willey*)

The window was jettisonable although could only be used when the aircraft was on the ground as the number 3 engine's propeller was just outside and would present a serious obstacle if still running!

Below: A diagram from the publication AN 01-20EJ-2 showing the Transfer Fuel System in the B-29. (*Taigh Ramey*)



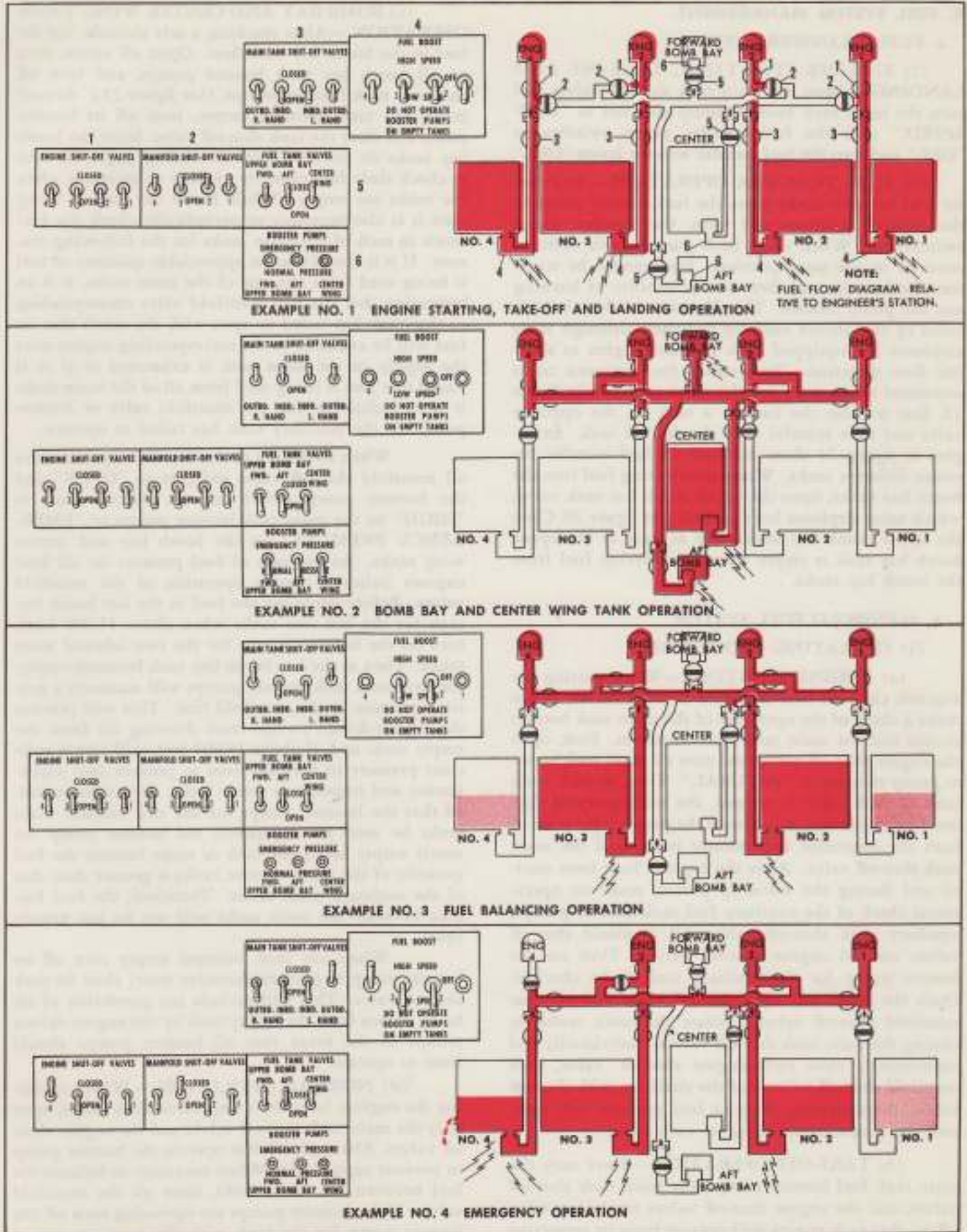
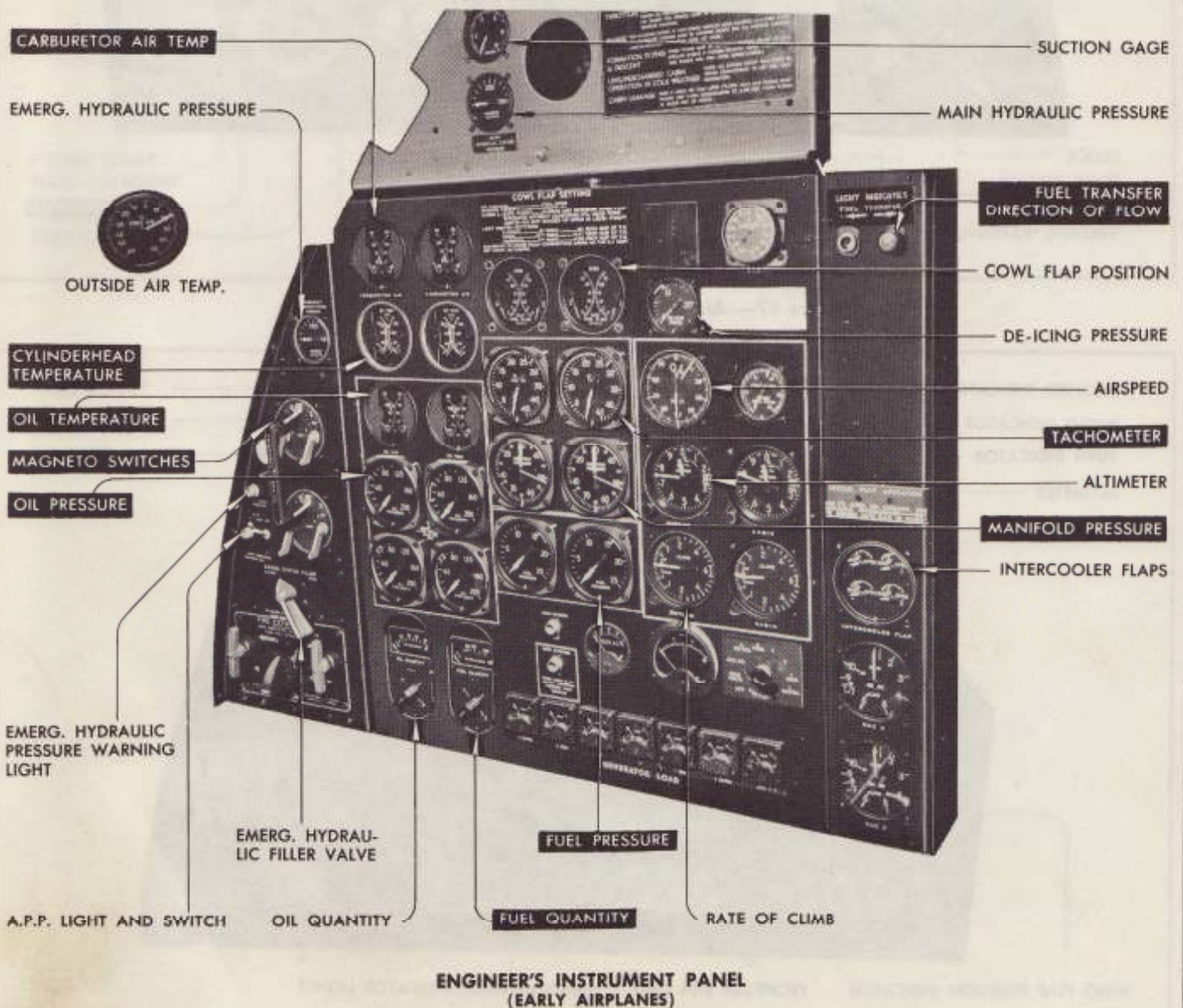


Figure 25—Manifold Fuel System Management

Above: A diagram from the USAF publication AN 01-20EJA-1 showing the switch positions and resultant fuel flow for various combinations of operations. (Taigh Ramey)



Above: The Flight Engineer's station in *It's Hawg Wild* – a B-29A fitted with the Transfer Fuel system. (*Ivor Warne*) Note the black box connected to the front of the upper forward gun turret tub. This is the servo amplifier for the lower forward gun turret. The servo amplifier for the upper forward gun turret is located in the rear gunner's compartment (see page 59).



Above: A diagram from the USAF publication AN 01-20EJA-1 detailing the various switches and dials on the Flight Engineer's instrument panel. (*Taigh Ramey*)

The diagram above shows the panel as fitted to B-29s with the Fuel Transfer System (as in *It's Hawg Wild* on previous page). Planes with the later Manifold Fuel System had a slightly different panel (see page 28) although the majority of the switches and dials are common to both. One notable change between the two panels is the displacement of the 7 DC generator load meters (one for the APU and one each for the 6 engine mounted generators) from their horizontal row at the bottom right of this panel (not annotated but at extreme bottom of panel below the Rate of Climb dial) to a new vertical column to the right of the Intercooler Flap dial. Their place on the main panel being taken by the main tank shut off valve and fuel booster pump switches.

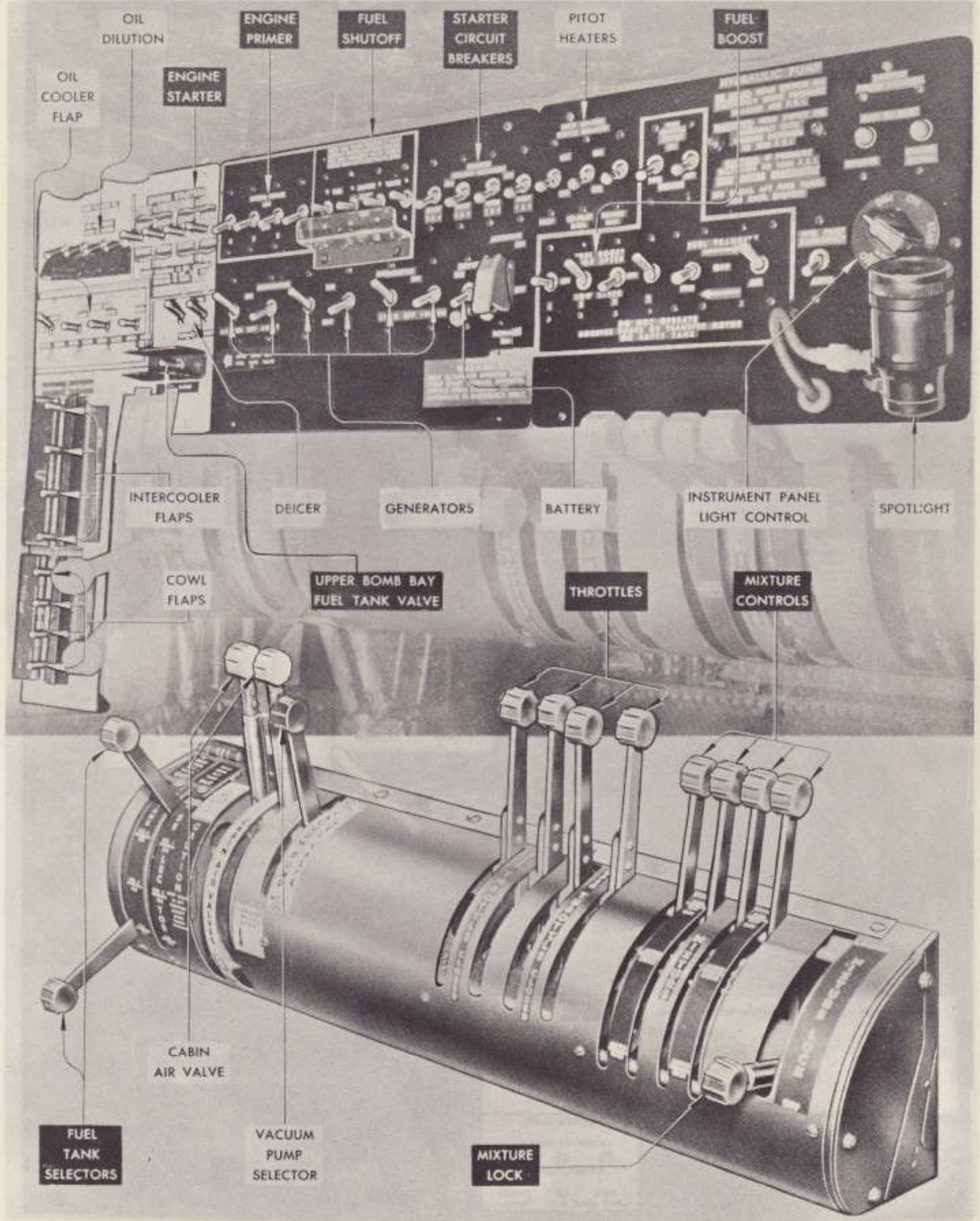


Figure 20—Engine's Controls (Transfer Fuel System)

Above: A diagram from the USAF publication AN 01-20EJA-1 showing the switches and levers on the Flight Engineer's control stand. (*Taigh Ramey*)

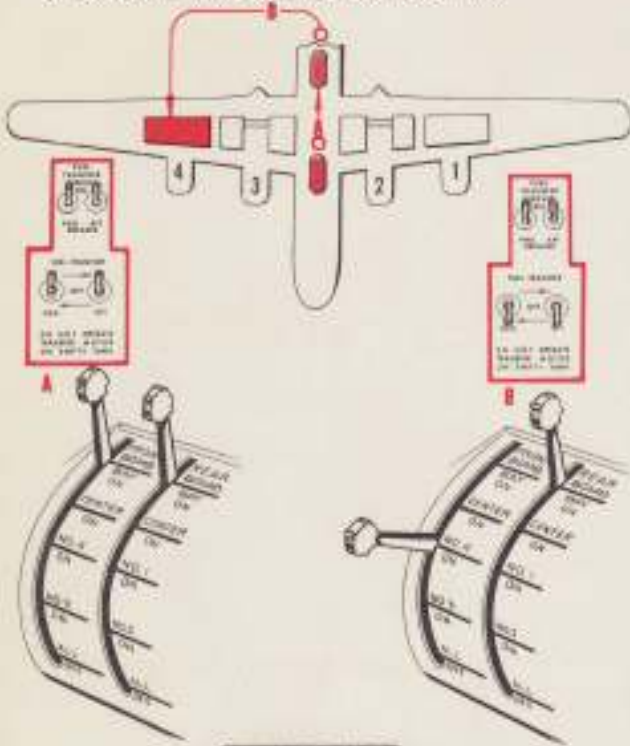
The diagram shows the controls present in those planes fitted with the Fuel Transfer System. As describe on the previous page, the controls in planes fitted with the Manifold Fuel System were largely the same although the Fuel Tank Selector levers (extreme left of stand) were deleted (although the labels and runs remain) and some of the switches repositioned to make room for the Manifold Fuel System's shut off valve and pump switches.

TYPICAL EXAMPLES OF FUEL TRANSFER COMBINATIONS.

DIRECT TRANSFER CAN BE MADE ONLY BETWEEN TANKS DESIGNATED AT OPPOSITE LEVERS.
SHOULD A TRANSFER BE DESIRED BETWEEN TWO TANKS DESIGNATED AT ONE LEVER IT IS NECESSARY TO FIRST TRANSFER THE FUEL TO ONE OF THE TANKS DESIGNATED AT THE OPPOSITE LEVER, THEN BACK TO THE DESIRED TANK.

DESIRED TRANSFER - FWD. BOMB BAY TO NO. 4 TANK

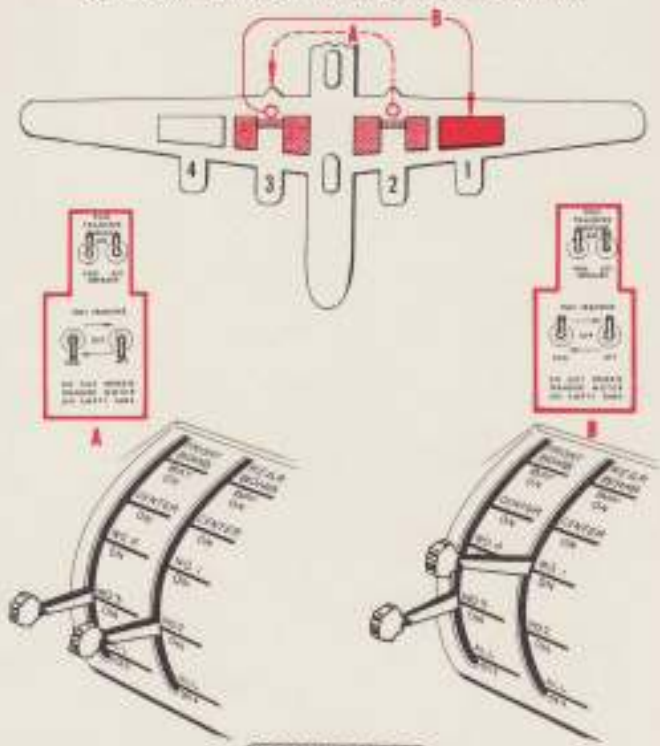
- A. FROM FWD. BOMB BAY TANKS TO AFT BOMB BAY
- B. FROM AFT BOMB BAY TO ENG. NO.4 TANK



EXAMPLE NO. 1

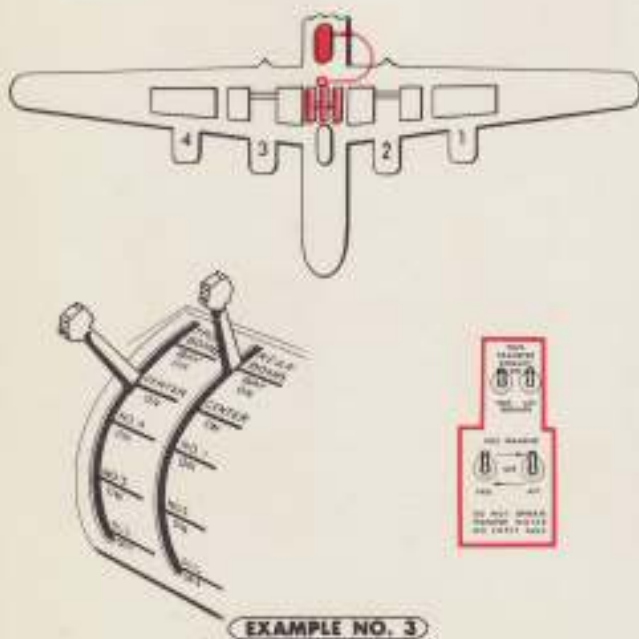
DESIRED TRANSFER - NO. 2 TANK TO NO. 1 TANK

- A. FROM ENG. NO. 2 TANK TO ENG. NO. 3 TANK
- B. FROM ENG. NO. 3 TANK TO ENG. NO. 1 TANK



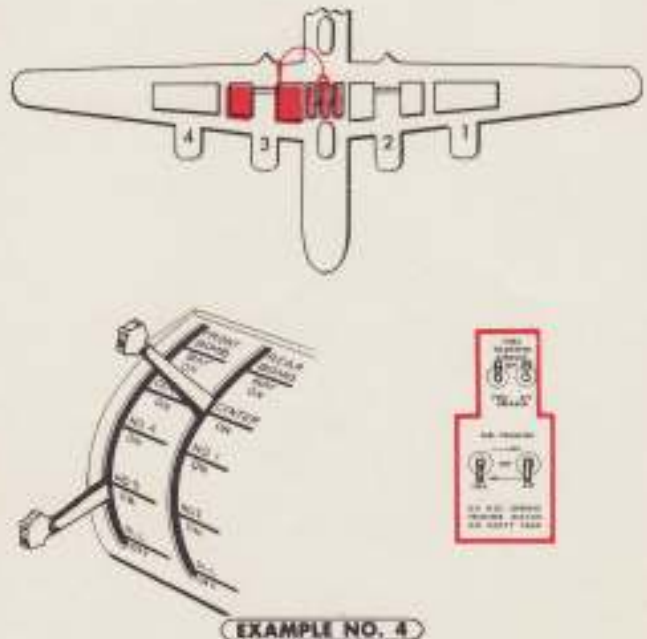
EXAMPLE NO. 2

FROM CENTER TANK TO REAR BOMB BAY
(ON CERTAIN LATE AIRPLANES)



EXAMPLE NO. 3

FROM CENTER TANK TO NO. 3 TANK



EXAMPLE NO. 4

Figure 24—Fuel Transfer System Management

Above: A diagram from the USAF publication AN 01-20EJA-1 showing the lever and switch positions for various fuel transfer combinations in planes fitted with the Fuel Transfer System. (Taigh Ramey)

Navigator's Station

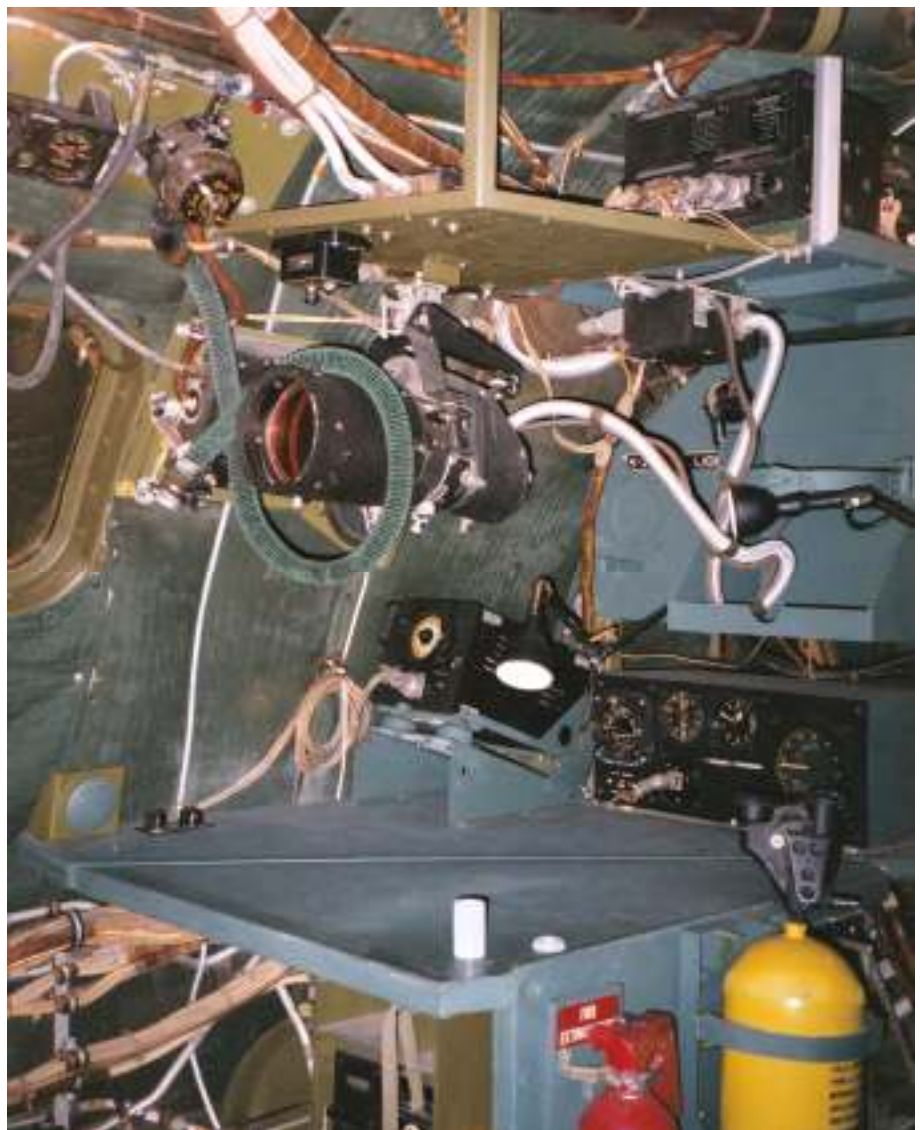
Top: The Navigator's Station in *Enola Gay* (*Mike Hanz*)

Bottom: The Navigator's Station in *Bockscar* (*US Air Force Museum via Bernie Poppert*)

The navigator's station was essentially the same in standard B-29s and the Silverplate aircraft. The repeater scope for the AN/APQ-13 radar (orange scope) is prominent with the controls and dial for the radio compass mounted on the fuselage wall to its left. Just visible above the high shelf to the top right of both photos is the amplifier for the Gyro Flux Gate Compass. Behind this are two Turbo Amplifiers, one each for number two and three engines.

One minor difference is the navigator's table. In standard B-29s this folded upwards diagonally across its middle to allow the navigator sufficient room to squeeze past the tub for the forward upper turret and access his seat. With the deletion of the turret and attendant tub the need for the fold also went and in the Silverplate aircraft the table is fixed flat. The hinges are still present but the side panel has a fire extinguisher and medium walk around oxygen bottle mounted to it.

Another noticeable difference is the deletion of the navigator's map case. This should be attached to the fuselage above the table forward of the window. In Silverplate aircraft the case was moved to the aft crew compartment near to where the aft upper turret would have been. The reason for this change was the repositioning of the SCR-718 absolute altimeter from the bombardier's station to the navigator's. When the top photo was taken the SCR-718 in *Enola Gay* was still in the nose (see page 10). The lower photo shows the location of the SCR-718 in *Bockscar* (the black box against the fuselage wall under the APQ-13 repeater scope). Why it was moved is unclear. B-29s completed before November 1944 had it located here but later B-29s had it located in the nose as per the photo on page 10. However, it does seem more sensible to have it on the Nav table where you could read the dial (bright sunlight in the nose would make it really hard to use even with an eyeshade.)





Top: The Navigator's Station in *It's Hawg Wild*. (*Ivor Warne*)

The map case (semi circular tube attached to the wall just ahead and below the window in lower photo) and the folded navigator's table are both evident as is the closeness of the tub for the forward upper turret. To the left of the photo is the side of the APN-9 LORAN receiver.

Bottom: The Drift Meter or Drift Sight in *Enola Gay*. (*Scott Willey*)

The Drift Meter allowed the navigator to assess the drift angle by rotating a grid in the sight until objects on the ground were moving along the grid lines. The angle of drift could then be read off a scale at the base of the drift meter. The Drift Meter sighted through a small glass dome located just between the lower forward gun turret and the forward bomb bay. The photo below (*Scott Willey*) shows the Drift Meter aperture on *Enola Gay* (the small bubble behind and to the right of the plate covering the opening for the removed lower forward gun turret). The hole on the other side is the flare chute.



Note the pale grey items mounted on the bulkhead behind the drift meter (and under the LORAN receiver). These are two (one normal and one emergency) Holtzer-Cabot Type MG-149F, 750 volt-ampere inverters that converted the 28 volts DC to 115 volts AC at 400 Hz for the turbo control, flux gate compass, radio compass and air position indicator. They are located in the navigator's compartment simply because there was room to 'stash' them there.



Top: A close up of the navigators flight instruments in *Enola Gay*. The dials are (from left to right) the computer for the Air Position Indicator, Airspeed indicator, Altimeter and Fluxgate compass. (*Scott Willey*)

The Air Position Indicator took heading information from the flux gate and used pitot information to give a "digital" readout of latitude and longitude. It was a very advanced instrument for its day and was used in later aircraft into the 60's. The operator set the latitude and longitude at a known location and input magnetic variation. The instrument would then give a continuous read out of the plane's latitude and longitude.

Bottom: The APN-9 LORAN receiver (mounted on the bulkhead wall behind the navigator) and the Navigator's hand set (black box on fuselage centre right) in *Enola Gay*. (*Mike Hanz*)

LORAN (Long Range Navigation) was an American modification of the British Gee system that was first put into operation during 1943. It proved to be very successful and allowed relatively accurate navigation to ranges of about 1,400 miles from the transmitting stations. The first LORAN chains were built to cover the North Atlantic during 1943 and 1944 to assist the vital convoys transporting men and material to Britain for the European war. However, once the island hopping campaign started in the Pacific, the immense distances of featureless ocean that needed to be crossed made LORAN even more vital. The LORAN transmitters were built and operated by the US Coast Guard and it was often the case that US Coast Guard engineers were some of the first people ashore on newly invaded islands should these have been designated as suitable LORAN transmitting locations. Construction would generally be started before the island had been fully secured.

LORAN continued in use long after WWII (indeed the low frequency variant known as LORAN C is still in use today) and *It's Hawg Wild* has an identical LORAN set to *Enola Gay*.

The LORAN receiver shared the antenna with the liaison set, the received signal being split by a signal splitter located on the shelf at the radio operator's station.



The Navigator's hand set was a part of the CFC gunnery system. To calculate the ballistic correction the computer needed various inputs. Many of these were derived from the sights but two, True Airspeed and Density Altitude were calculated using inputs made by the navigator at this panel. The navigator entered barometric pressure (left dial), indicated airspeed (middle dial) and outside air temperature (right dial). These were used to compute true airspeed from the indicated airspeed while density altitude was computed from the barometric pressure and temperature. In standard B-29s the data entered here was used by all five computers although in Silverplate planes only the tail turret computer remained. The Navigator's hand set is missing from *It's Hawg Wild*.



Above: The signal splitter on the shelf above the Radio Operator's station in *Enola Gay* (*Mike Hanz*)

Despite LORAN's dominance in the Pacific, Gee remained more common in Britain and Europe and the RAF's Washingtons had their LORAN receivers replaced by Gee receivers – these being located in their place.

Below: A Gee receiver (left) and indicator (right) displayed at the IWM Duxford. (*Chris Howlett*)

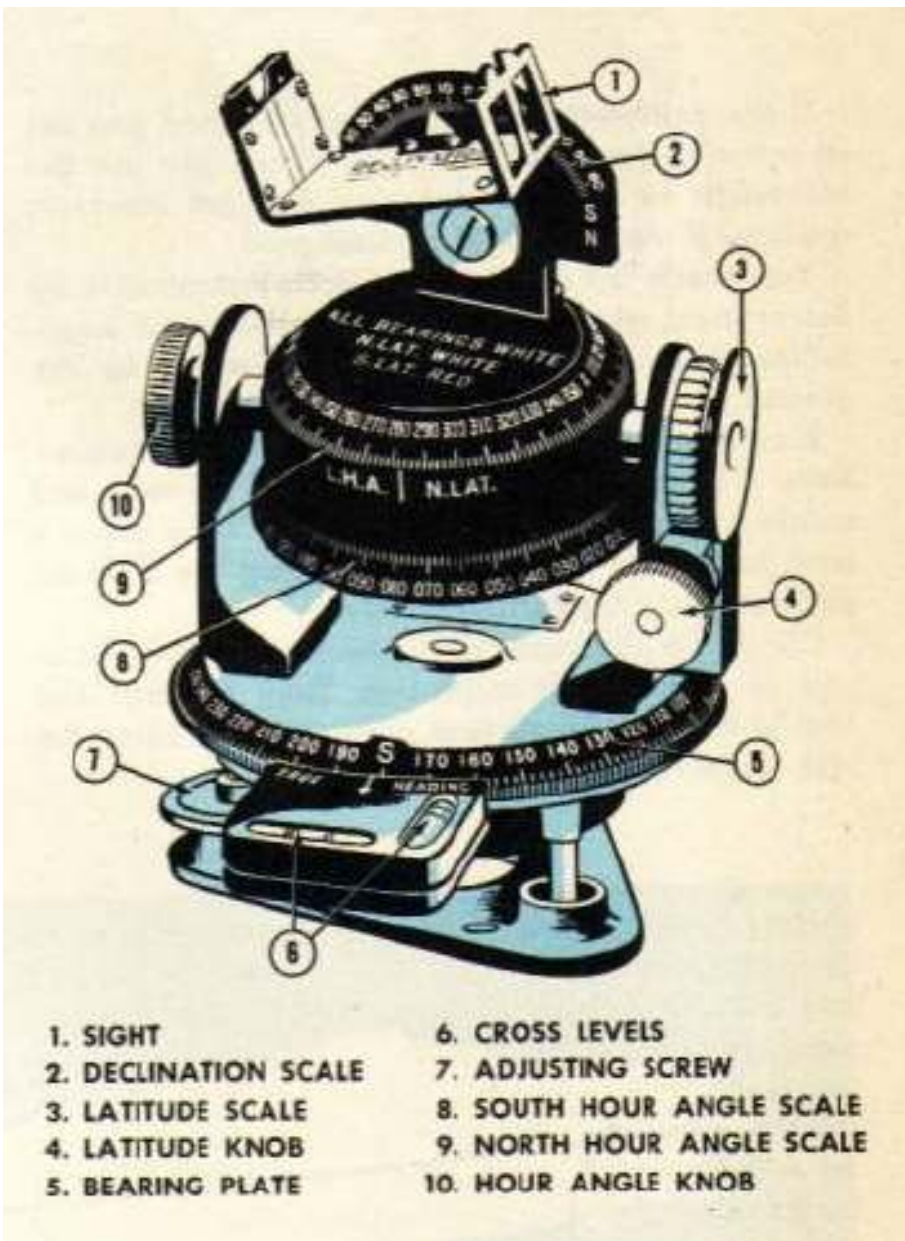


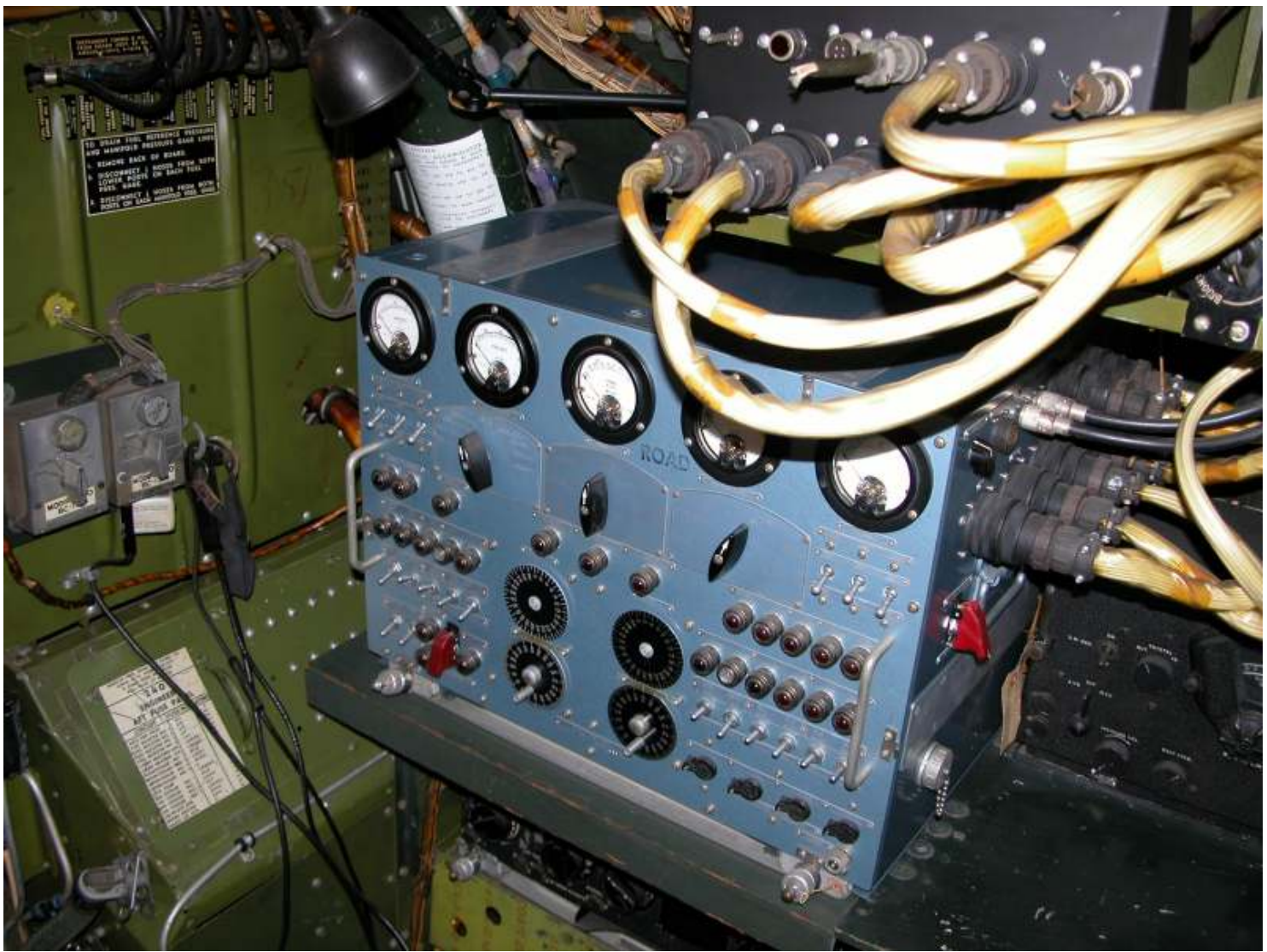
Top: The astrodome in *Enola Gay* (*Taigh Ramey*)

The navigator used the astrodome to take celestial observations (sun or stars) with either his octant or the astro-compass (the device mounted on the ring in the astrodome). To take the readings the navigator would sit in the mouth of the tunnel with his back supported by the back strap.

Bottom: An annotated diagram of the astro-compass from the Bombardier's Information File (*Mike Voisin*)

The astro-compass was used to determine the true heading of the plane although it could also be used to determine true bearing and compass deviation



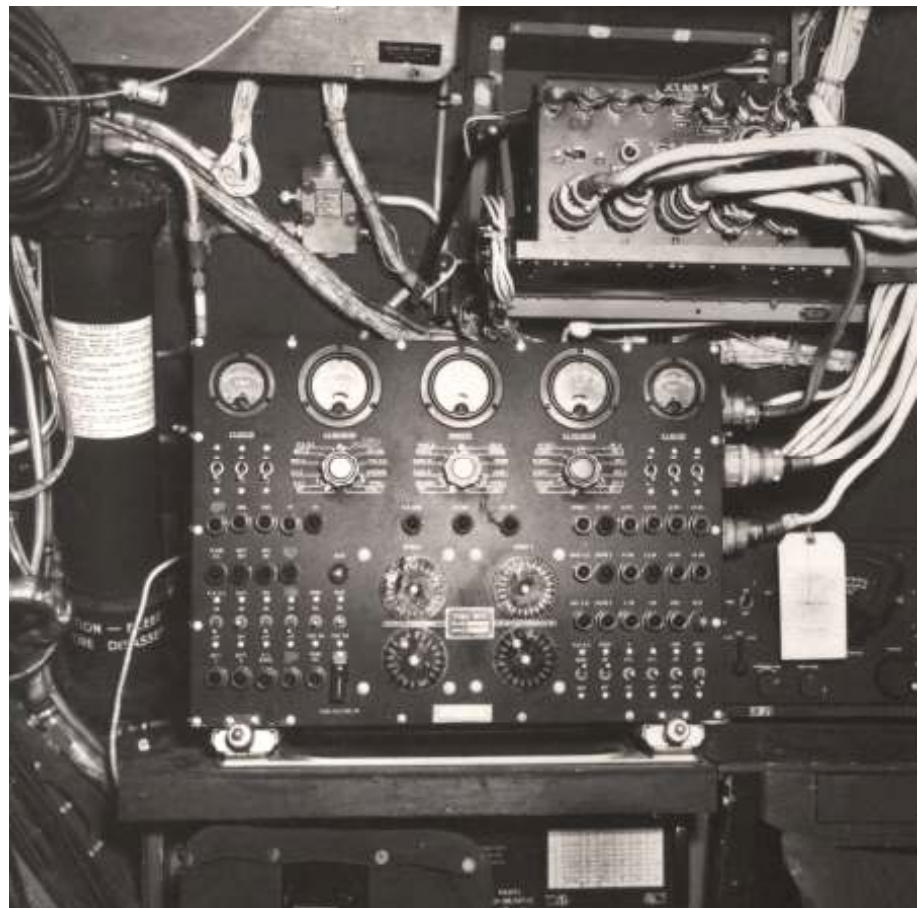


Weaponeer's Station

Above: Definitely a Silverplate only device. The Weaponeer's Flight Test Box (FTB) as fitted to *Enola Gay*. (*Scott Willey*)

The FTB for the atomic bomb was installed on what had been the forward end of the radio operator's table in standard B-29s. Cables from this box ran through the pressure bulkhead and connected to the top of the nuclear weapon. The weaponeer, a Silverplate only crewmember, could monitor the condition of the batteries and the various circuits in the bomb.

The box above is not the box that was in *Enola Gay* on 6 August 1945 but an updated one installed for the Crossroad atomic tests at Bikini Atoll in 1946. The original (pictured right – *Mike Hanz*) has disappeared, probably when the Crossroad's box was installed.



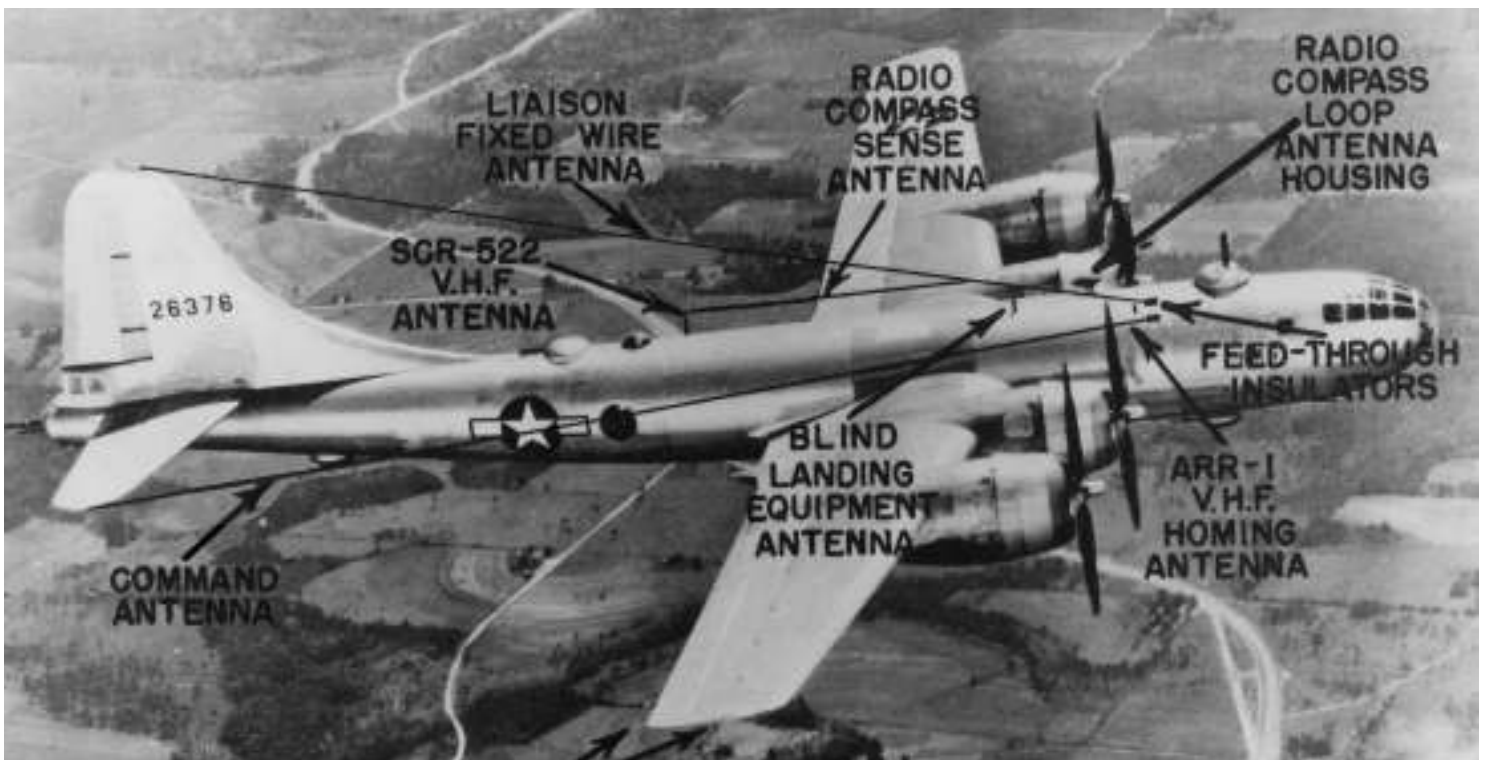


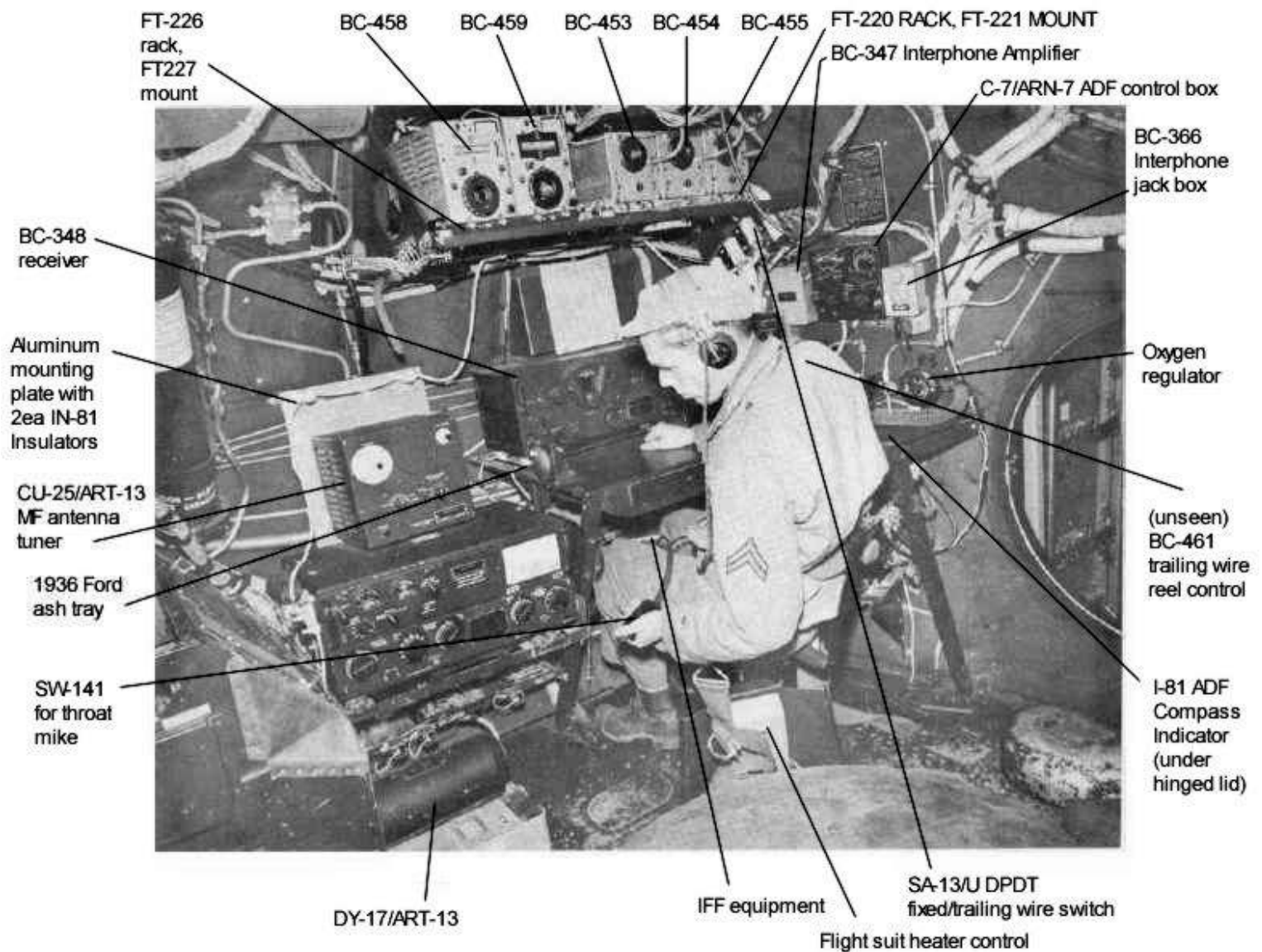
Radio Operator's Station

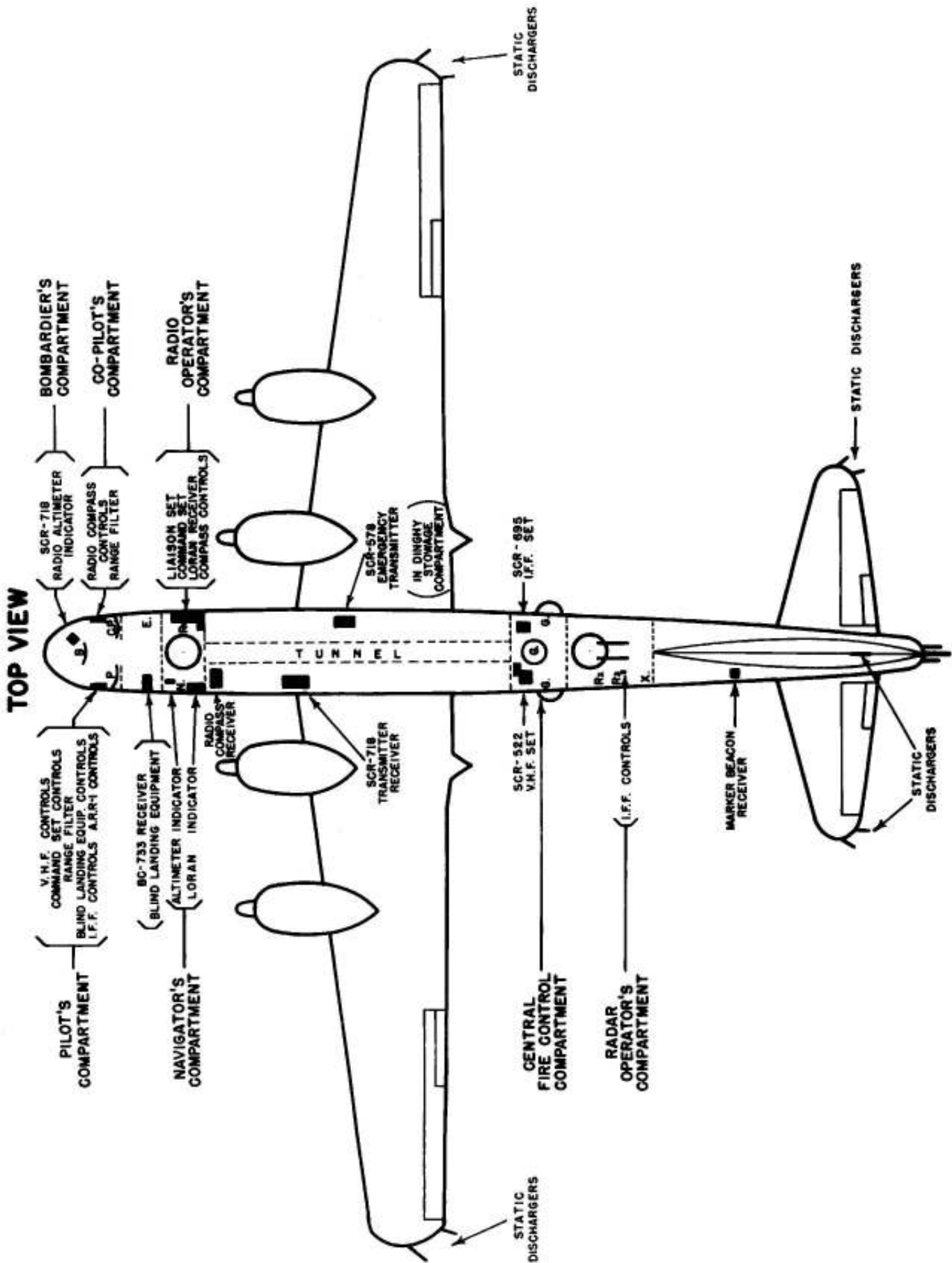
Top and Middle: The Radio Operator's station from *It's Hawg Wild*. (*Martin Claydon*).

Present is a complete liaison set consisting of: an AN/ART-13 'Collins' HF transmitter (between end of desk and turret in upper photo), a BC-348 HF receiver (on desk in upper photo), a CU25/ART-13 antenna tuner covering the 200kHz – 600kHz range (at left end of shelf in lower photo) and a DY-17 dynamotor (black tubular device on floor between turret tub and the 'Collins' in upper photo). *It's Hawg Wild* probably also carries an AN/ARC-3 VHF command radio set, the controls for which should be in the radio operator's station. The set itself would be located in the gunner's compartment, under the floor just forward of the right scanner.

Bottom and next two pages are some period photos and diagram from a report commissioned by the USAAF in 1945 into the 'Operational Suitability of the Radio Equipment in the B-29 Airplanes' showing the locations and use of the various antennae, the full and very comprehensive radio fit of an early standard B-29 and the locations of the radio equipment in a late build B-29. (*Mike Hanz*)







RADIO LOCATIONS ON PLANES TESTED



Radio Antennae Connectors

Above: The forward starboard side of *It's Hawg Wild* showing the connections for the liaison (upper) and command (lower) antennae to the fuselage. (**Chris Howlett**). Note also the Flight Engineer's window/escape hatch and the outside air temperature probe behind it.

Middle: Feed through insulators on *Enola Gay* (**Mike Hanz**). The two oval black ports (one just visible at top by navigator's astro-dome) present on *Enola Gay* are "feed through insulators" an early means of allowing the antennae to penetrate the fuselage but by mid-1945 were no longer used. Their use made antenna repairs more time consuming and the need to solder the wire coming through each of them to a taut antenna wire actually weakened the antenna, so a design change was made to use the short insulated connectors as shown. The small wire hole in the black oval insulators was simply filled with a sealer, rather than replacing them completely with aluminium patches although they had vanished in post war B-29s such as *It's Hawg Wild* and the RAF Washingtons. The other ends of the HF antennae were fastened to spring-loaded tension units. The one on the horizontal stabilizer is shown to the right (**Mike Hanz**). These tension units allowed the antenna wires to adjust to temperatures from -60 to +140 Fahrenheit (-51 to +60 degrees C) without breaking.





Top, Middle and Bottom: The Radio Operator's station in *Enola Gay*. (Mike Hanz)

In the Silverplate planes the radio operator's equipment was significantly changed to make room for the Weaponeer's panel that was located on the forward end of the radio operator's table and also to introduce a few extra items related to the special mission.

The **top photo** shows the high frequency BC-348 liaison receiver with associated Morse key to its right. This and its associated AN/ART-13 liaison transmitter (**middle photo**) are about the only items of radio equipment that remained in their original position. The AN/ART-13 transmitter, made by Collins was generally referred to as the 'Collins' rather than as the AN/ART-13.

To the right of the **top photo**, the open cover should give access to repeater dial for the radio compass but, when the photo was taken, a suitable unit was still being sought – one has since been found and fitted by Mike Hanz. The black panel to the far right (on the bulkhead between the radio compass cover and the liaison set) was unique to Silverplate B-29s. It controlled the audio for a second 'Collins' transmitter that was located under the table by the radio operator's feet (**bottom photo**) as well as the SCR-522 VHF command set that was located in the 'gunner's' compartment. As has already been mentioned, the SCR-522 in *Enola Gay* was replaced during a stop over on the flight to Tinian with the more capable AN/ARC-3 but no one changed the script on the panel!

Standard B-29s had a small radio set comprised of three receivers and two transmitters mounted on the shelf above the liaison set. This was the SCR-274N command set and is shown in the photo on page 41 with its components named (BC-458 etc). To free up space for the Weaponeer's station these were deleted on Silverplate planes, the command function being taken over by the SCR-522 or AN/ARC-3. In the empty lower forward turret there is a set of mounts for a second AN/ARC-3. The set is currently missing but it is thought that the Silverplate planes carried a spare VHF set to give redundancy although it may have been added post war. Research is continuing!

The Communication Tunnel

Top: The un-restored tunnel in *It's Hawg Wild*. (Ivor Warne)

Bottom: The tunnel and rear of the forward pressurised area in *Enola Gay* (Bernie Poppert)

Perhaps strangely, such a utilitarian item as the tunnel did have a Silverplate modification. The silver insert in the bottom of the tunnel (bottom photo) is the Silverplate addition. It is the front of the modified tunnel area above where the bomb release mechanism mounted. In order to fit a *Fat Man* type bomb into the bomb bay and still close the doors, the bomb had to be mounted high. To allow for this the tunnel had a few feet raised a few inches in order to get the bomb release shackle to a suitable height.

The raised section also incorporated a viewing window so that the shackle could be inspected. With the *Fat Man* type bomb completely filling the bomb bay there was no other way to ensure that the bomb was correctly latched.

The lower photo shows a view that would not be possible in a standard B-29. Taken from a position adjacent to the Flight Engineer's station the nose entry hatch is open with the hatch visible to the right, the edge of the flight engineer's panel is to the left. The paler green panel in the roof is the padding where the upper forward turret tub would be – the item that would make this view impossible in a standard B-29. Note also the ladder leading to the tunnel entrance. This was stowable but the one shown is not one of *Enola Gay's* originals. It was built in the Smithsonian's Garber shop from original Boeing drawings by Bernie Poppert (Deputy Chief of Restoration at NASM's Garber Facility).

The drift meter is shown just to the right of the bulkhead hatch leading to the forward bomb bay. Located above it is the AM-26/AIC-2 amplifier for the intercom system while above this is the hydraulic supply tank. This held 3 US gallons (2.5 Imp) of hydraulic fluid. The hydraulic system had one exclusive function; it transmitted force to actuate the brake mechanism. The system was divided into two; one for normal use and one for emergency use.





Above: Looking up into the forward bomb bay (*Mike Hanz*). Note the communication tunnel running along the top of the bomb bay. The raised section of the communication tunnel with its viewing window can be seen above the bomb suspension (extreme top of photo). Either side of the window are two additional ports that allowed limited access to the shackle should this be required. The yellow/green box is the wing centre section. Immediately behind this, above the catwalks in the rear bomb bay are the gear boxes that allowed the main landing gears to be raised or lowered in an emergency. The gear box on the right hand side operated the let hand gear. The gear was moved via a hand crank and required some 774 turns to raise (about 30 minutes of effort) or 387 turns to lower (about 12 minutes of effort).

Forward Bomb Bay

Top: The forward bomb bay in *Enola Gay*. (Mike Hanz)

The photo is looking up into the top of the front of the forward bomb bay. Note the H frame, connected to both sets of standard bomb racks, used to hold the single release mechanism adopted for the atomic bombs and to spread the stress of supporting the weapon across more of the airframe. Silverplate aircraft were fitted with braces for both the *Little Boy* and *Fat Man* bombs to keep the single-suspension-point bomb from moving around in the bomb bay (not a good thing with a 5-ton nuclear weapon). The outer braces near the wall are for the *Fat Man* weapon while the yellow X shaped braces were for *Little Boy*. Another, less obvious, Silverplate modification was the extension of the Interphone system into the bomb bays to allow the Weaponeer to talk with other crewmen while he was arming the weapon.

Missing are four sets of hoist motors that were part of the system. They mounted on top of the two large cross beams. NASM is currently trying to find some of these rare items to complete this part of the airplane.

The raised section of the communication tunnel with its viewing port and maintenance holes is clearly visible above the bomb suspension point.

Bottom: A drawing of the bomb mount, sway braces and bomb hoists. (Jeff Brown)

The drawing was created by Paul Mowrey, an engineer at Martin's modification center, Omaha, Nebraska and one of those responsible for designing the bomb loading and release mechanism in the Silverplate aircraft. Paul's drawing, not done until 1995 so it may contain errors, shows the four hoist motors currently missing from *Enola Gay* and the British 'block buster' single bomb attachment.

47



Top: Looking aft in the forward bomb bay in *Enola Gay*. (*Mike Hanz*)

Given the potential danger to North Field, Tinian should an atomic bomber crash on take off it was decided to only arm the weapon once the plane was safely away from the base. The wooden structure running across the bomb bay just in front of the wing spar is the work platform built for Silverplate planes to allow the bombardier and Weaponeer to arm the bomb in flight. It is not the actual platform as this has been lost. It is also only representative since restorer Bernie Poppert had no drawings to go by, and there are no descriptive sources that give a clue as to actual size and shape.

Bottom: A view into the restored forward bomb bay of *It's Hawg Wild*. (*Martin Claydon*)

Note the deflectors on the rear edges of the bomb bay doors (both *Enola Gay* and *It's Hawg Wild*). These were present on both the forward and rear sets of doors and helped the doors open quickly once the airflow caught them. This was of particular use when the emergency door release was activated as this would simply unlatch the doors and thus the deflectors helped them open and then kept them in the open position.



Rear Bomb Bay

Top, Middle and Bottom: Three views of the rear bomb bay in *Enola Gay*. (top *Mike Hanz*, middle and bottom *Scott Willey*)

The rear bomb bay was essentially unmodified in the Silverplate B-29s so again is representative of standard B-29s.

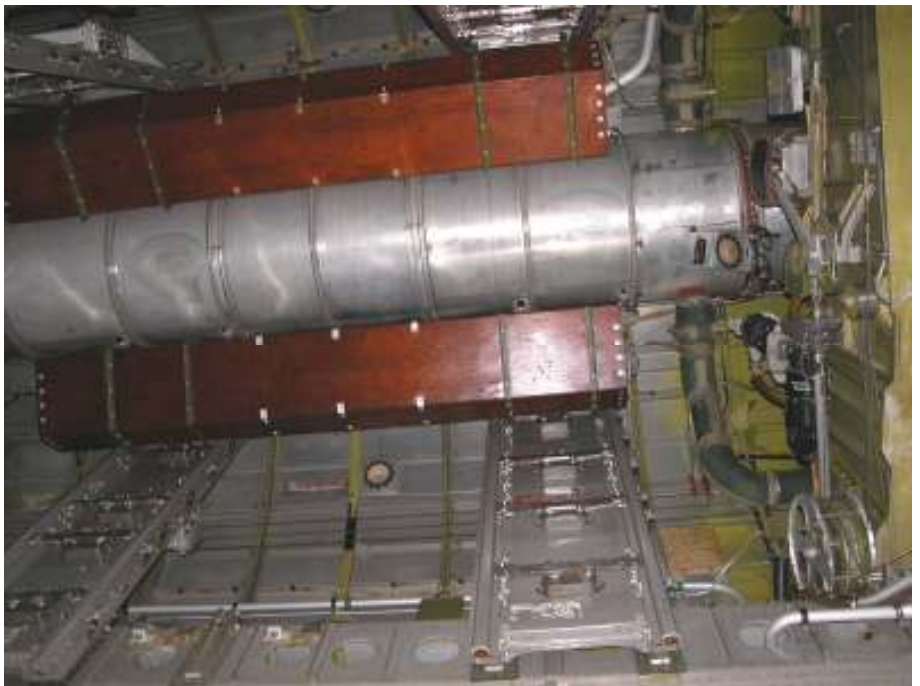
The top photo is looking forward and shows two of the 18 type C-1 low-pressure (400 - 425psi), shatterproof oxygen cylinders used by the oxygen system. When fully charged these provided about 10 hours of oxygen for an 11 man crew at 15,000 ft altitude.

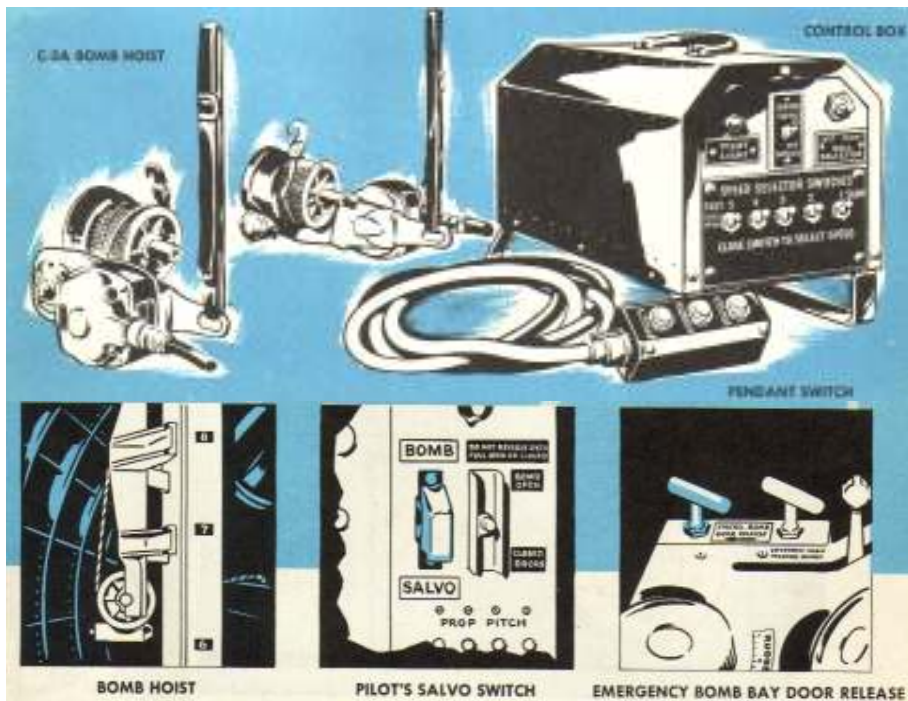
Note the actuating rods for the bomb bay doors. These were fitted to the forward end of both the forward and rear bomb bay doors. The phase three Silverplate B-29s were fitted with pneumatic actuators for their bomb bay doors. These allowed the doors to open or close in less than a second and could be linked to the bomb release mechanism so they opened automatically when the bombs were to be released. This development was not a Silverplate only addition as pneumatic bomb bay doors were introduced into B-29As fairly early and all standard B-29s had them fitted in the factory by early 1945.

One non standard item is the wooden boxes mounted either side of the tunnel (middle photo). These were cargo rack assemblies used for transporting as yet undetermined material.

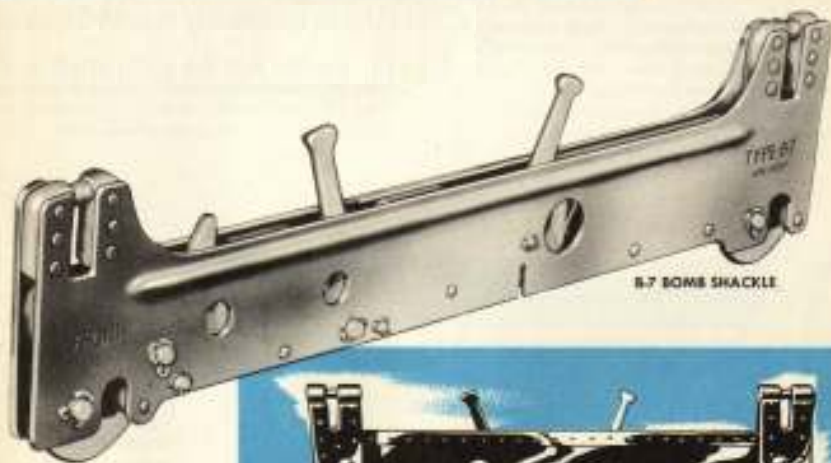
The bottom photo is looking rearward and if this were a standard B-29 the Central Fire Controller's swivel chair would be visible through the opening. However, as this is a Silverplate B-29 the chair is missing as is the CFC's sighting blister – the blanking plate covering the blister's opening can be seen.

Also missing from the photo are two 640 US Gallon (533 imperial Gallon) auxiliary bomb bay tanks that were carried on the August 6 mission primarily to counter the weight of the bomb and so better balance the plane. The NASM is looking for two such tanks to fit to *Enola Gay* as currently preserved.





ALL-ELECTRICAL BOMB RACK CONTROL SYSTEM



Bomb Hoist, Bomb Release Mechanisms and Bomb Shackles

Left: A compilation of diagrams from the Bombardier's Information File (*Mike Voisin*)

The C-3A bomb hoist assembly (**left top**) consisted of two separate hoists which operated together. It hoisted the bomb into position and rolled it slightly to assist the attachment of the shackle to the bomb rack.

The hoist could be operated either manually or electrically and was able to hoist bombs weighing up to 2,000lb. Two C-3A hoists working together were needed to lift bombs of 4,000lb. It was part of the standard bombing equipment of the B-29.

The bomb release mechanism was an electrically operated mechanical device designed to cause the bomb shackle to release and arm the bomb. The B-29 was fitted with the A-4 bomb release (**left centre**). If needed, the A-4 release could be operated manually by turning the trip screw (marked TRIP) on the front of the A-4 in the direction indicated. This affected the rotary solenoid like an electrical impulse tripping both the release and arming levers.

The bomb shackle (**left bottom**) carried, armed and released the bomb. They attached to the shackle suspension hooks on the bomb rack so that the arming lever and release lever were positioned in the bomb release mechanism.

The type of shackle varied depending upon the weight of bomb to be carried: the B-7 carried bombs from 100lb to 1,100lb; the B-10 could carry bombs up to 1,600lb while the D-6 carried 2,000lb or 4,000lb bombs.

Note that, like the release mechanism, the shackle had to be positioned the right way round. In the B-29 the bomb racks were symmetrical and special care was needed to avoid fitting them backwards.

The bomb arming controls provided selective arming of the bombs. They were attached to the edges of the bomb racks where they were operated by an arming switch at the bombardier's station and allowed bombs to be salvoed either armed or safe.

Two arming wires were used, one for the nose fuse and one for the tail fuse. The nose fuse arming wire loop was placed in a catch on the arming control. The tail fuse arming wire loop was inserted in the bomb shackle. The tail fuse was always armed by the bomb shackle for selective and train releases and made safe for salvo release.

When the arming switch was set to SAFE and the bombs salvoed the nose fuse arming wire was allowed to pull free from the arming control and the bomb would drop safe. If the arming switch was set to ARMED the wire would be held and arm the bomb as it dropped. In both cases, when salvoing bombs, the tail fuse remained safe.



A-2 BOMB ARMING CONTROL



Above: The A-2 Bomb Arming Control.. Diagram from the Bombardier's Information File (*Mike Voisin*)

Below: A page from the Bombardier's Information File showing the various types of standard bombs carried by US B-29s. (*Mike Voisin*)

Left: Bomb Arming Controls fitted to the forward edge of a bomb rack in the rear bomb bay of *Enola Gay*. Each bomb rack had a similar arrangement. (*Scott Willey*)

AERIAL BOMBS

| CLASSIFICATION | WEIGHT | NOMEN-CLATURE | COLOR MARKINGS | | HE WEIGHT | FUZES | | SHACK-LES | MINIMUM SAFE BA | TARGETS AND REMARKS | | |
|------------------------|-----------|---------------|----------------|---------------------------------------|------------|---------------------------------------|---------------------|---|---|--|---|---|
| | | | BODY | BANDS | | NOSE | TAIL | | | | | |
| GENERAL PURPOSE | 100 | AN-M30 | LUSTERLESS | (1") YELLOW BAND AROUND NOSE AND TAIL | 54 | AN-M103 | AN-M100A2 or M112A1 | B-7 or B-10 | 1500 | Railroad equipment, trackage, small buildings, ammunition dumps, planes on ground, hangars | | |
| | 250 | AN-M57 | | | 123 | | M118 | | AN-M101A2 or M113A1 | 2000 | Railroad equipment, trackage, RR terminals, ammunition dumps, destroyers, subs, transports | |
| | 500 | AN-M64 | | | 262 | or M119 | AN-M102A2 or M114A1 | 2500 | Steel railroad bridges, subways, concrete docks, light cruisers | | | |
| | 1000 | AN-M65 | | | 530 | | 3000 | Reinforced concrete bridges, steel RR bridges, piers, approach spans, medium cruisers | | | | |
| | 2000 | AN-M66 | | | 1061 | AN-M103 | AN-M102A2 | 3000 | Massive reinforced concrete and suspension bridges, heavy cruisers, battleships, dams | | | |
| LIGHT CASE | 4000 | AN-M56 | | | OLIVE DRAB | (1") YELLOW BAND AROUND NOSE AND TAIL | 3245 | AN-M103 | AN-M102A2 | D-6 | 3000 | Raze areas equal to a city block or more |
| SEMI-ARMOR-PIERCING | 500 | AN-M58A1 | | | | | 145 | STEEL PLUG | AN-M101A2 | B-7 or B-10 | | Armor plate, lightly armored vessels, reinforced concrete |
| | 1000 | AN-M59 | | | | | 303 | NONE | AN-Mk228 | | | Heavily armored naval vessels |
| ARMOR-PIERCING | 1000 | AN-Mk33 | | | | | 144 | NONE | AN-Mk224 (LATERAL) | B-7 or B-10 | | Submarines and surface craft |
| | 1600 | AN-Mk1 | | | | | 215 | | | | | |
| DEPTH | 350 | AN-Mk47 | 252 | AN-Mk219 or AN-M103 | | | | | | | | |
| | 650 | AN-Mk29 | 464 | | | | | | | | | |
| FRAG. | PARACHUTE | 23 | AN-M40 | 2.7 | | | AN-M120A1 | NONE | N-3 | 80 | Personnel—If detonated at proper angle, almost 100% casualties over 120 ft. radius | |
| | FIN | 20 | AN-M41 | 2.7 | | | AN-M110A1 | | | 800 | Tanks—Running gear, 60-90 ft.; light tank, direct hit | |
| | CLUSTER | 500 | M26 | | | | M111A2 | | | | Planes—Motor, 60 ft.; wings and tanks perforated, 200 ft.; structural damage, 3-4 ft. Telephone wires—100 ft., some cut by side spray | |
| CHEMICAL MULTI-PURPOSE | 100 | M47A2 | GRAY | *See Below | 68 | M10B | BURSTER M4 | B-7 or B-10 | | Irritating physiological effect on personnel, neutralize areas, contaminate material | | |
| | 115 | M70 | | | 64 | AN-M110A1 | BURSTER M10 | | WP produces irritating physiological effect | | | |
| INCENDIARY | 4 | AN-M50A1 | | 1 PURPLE | 1.8 | NONE | STRIKER UNIT | | Usually in 5 bomb clusters; includes 1 AN-M50XA1 (150 gr. BP burster charge) | | | |
| PRACTICE | 100 | M38A2 | BLUE | | 2.6 | NONE | MIA1 | | Training—22 gage, light sheet metal body, filled with about 80 lbs. of dry sand. Actual weight, 98 lbs. | | | |
| FLARES (PARACHUTE) | 44 | M24 | GRAY | BLUE | | NONE | FRICTION IGNITER | 2500-3000 | Target lighting; dropping rate, 11.6 ft./sec.; burns 3-3.5 min.; yellowish tint, 1,000,000 candle power | | | |
| | 53 | AN-M26 | | | | M111A2 | | 4000-25,000 | Target lighting; dropping rate, 11.6 ft./sec.; burns 3-3.5 min.; 800,000 candle power | | | |
| | 16 | M8A1 | | | | NONE | | | Emergency landings; can be used for bombing. Burns 3 min.; soft yellow, 400,000 candle power | | | |
| TORPEDO | 2100 | Mk13-2 | | | 600 | EXPLODER MECHANISM | NONE | | Effective range, 6000 yds.; speed about 40 mph; has 93-98 hp steam and gas turbine engine | | | |

*BANDS: (NOSE, TAIL AND CENTER) 1 GREEN, NON-PERSISTENT; 2 GREEN, PERSISTENT; 1 PURPLE, INCENDIARY; 1 YELLOW, SMOKE; 1 RED, IRRITANT SMOKE (Vomiting Gas)



Gunner's Compartment

Top: The left scanner's position in *Enola Gay* with its blanked off sighting blister. (*Scott Willey*)

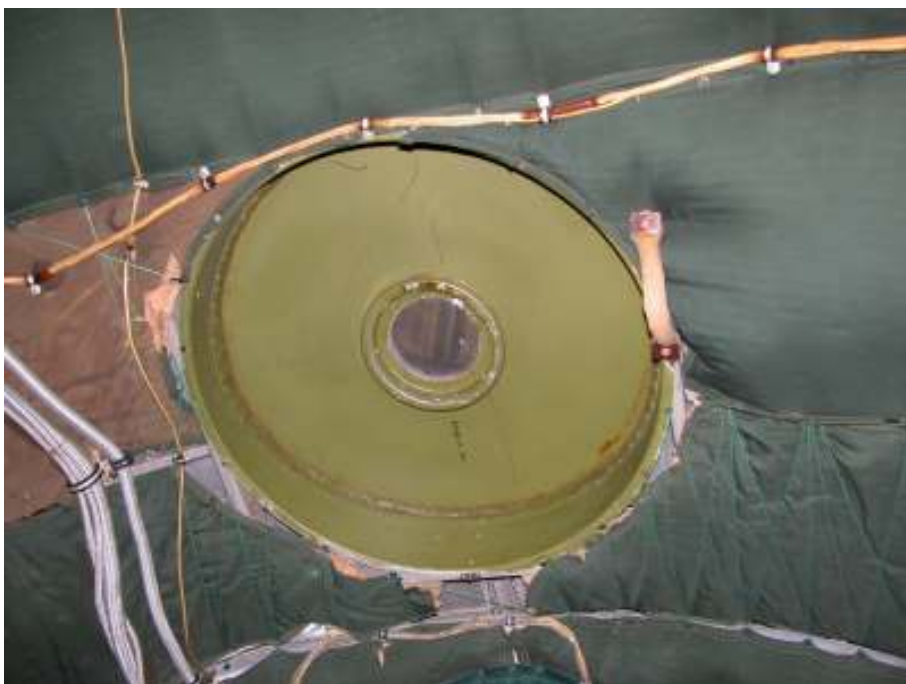
In a standard B-29 the grill in the floor (just visible at bottom left corner of photo) was to cool the computers for the CFC system, four of which were located under the floor in this compartment (one each for the top, left, right and tail sighting stations). With the deletion of most of the guns in the Silverplate planes, only the tail gunner's computer remained.

Middle: Tankers anchored off Tinian taken from *Enola Gay*'s left scanner window. (*Kenneth Eidnes*)



The central gunner's compartment in the Silverplate B-29s was effectively gutted as all the guns, turrets and controlling equipment had been removed. The scanners were still necessary to monitor the flaps as they were extended or retracted and the engines but the scanning had to be done through the small windows set into the blanking panels rather than through the large blisters as found on standard B-29s. The small windows were still effective though as is shown by the photo to the left, taken from the left scanner window of *Enola Gay* while flying from Tinian sometime shortly after the Japanese surrender. The vessels anchored are reportedly tankers bringing aviation fuel to the island and the number well illustrates the logistical problems associated with maintaining and operating some 400 B-29s so far from home (the 20th Air Force also had around 400 B-29s on Guam and 200 on Saipan compounding the problem!).

Bottom: The blanked off Central Fire Controller's astrodome in *Enola Gay*. (*Scott Willey*)



Top: A general view of the gunner's compartment in *FiFi*, the B-29 preserved by the Commemorative Air Force. Although more representative than *Enola Gay's*, the compartment is still missing a lot of the equipment that would have been found in operational B-29s. (**Frank Farrell**)

Note the small black and silver item on the pillar against the bulkhead to the right of the CFC chair. This is one of two cabin pressurization regulators (the other is hidden by the open bulkhead door). The pressurization system started at an altitude of 8,000 ft. From there to 30,000 ft, the system maintained a cabin altitude of 8,000 ft. Above that, a pressure differential of 6.55 psi was maintained so at 33,000 ft it felt like 10,000 ft inside. At 40,000 ft, the cabin was still at a relatively comfortable 12,500 ft. The Flight Engineer controlled the cabin pressurization and monitored it with an internal altimeter. Any excess air provided by the pressurizing superchargers was vented overboard by these regulators.

Middle: The right scanner's seat in *Enola Gay*. (**Scott Willey**)

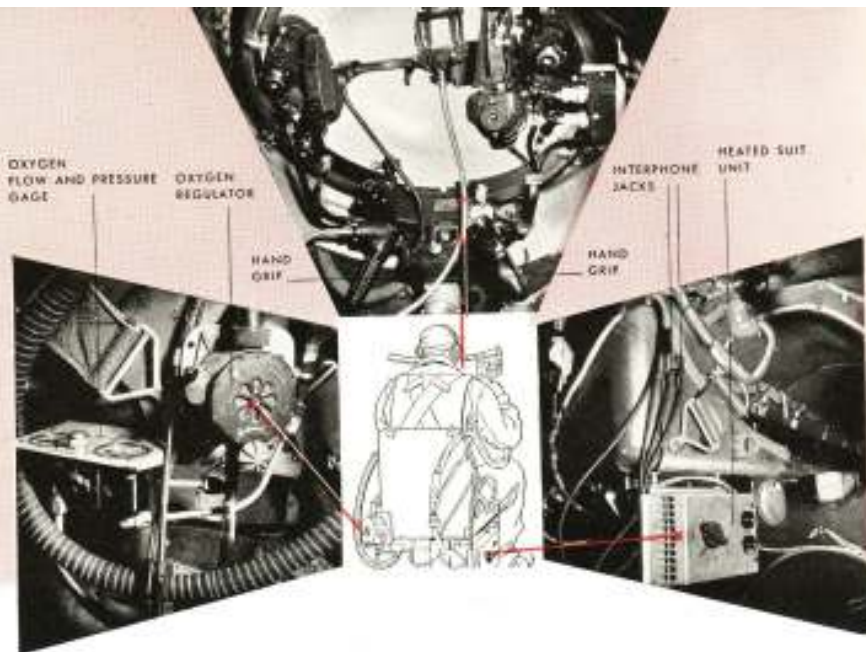
The bright green item behind the seat is a walk around oxygen bottle. The small wooden box behind the seat is a cover allowing access to the AN/ARC-3 command radio while the controls mounted on the right hand end of this box (just behind the oxygen bottle) are for salvaging the bomb load if the bomber was hit and caught fire—it reduced the chances of blowing up immediately!

Bottom: The floor of *Enola Gay's* gunner compartment. (**Mike Hanz**)

The floor of the compartment was made of ¼ inch varnished plywood panels screwed to aluminium stringers. The panels lifted out to give access to equipment or antennae locations underneath. Illustrated is a hatch (this particular one is actually in the Countermeasure officer's area) giving access to the ARR-5 antenna port. The antenna was so long it had to be deployed after take off and recovered prior to landing (see page 61). The plug shown blanked the port to retain cabin pressurisation should the antenna not be used.



HOW TO TURN ON THE TOP SIGHTING STATION



FACTS AND FIGURES

Movement of the Top Gunner's Sight

The top gunner can swing his sight in a full circle horizontally. In elevation, he can sight from just below horizontal (-5 degrees) to straight up (90 degrees).

Turret He Has First Call On

The top gunner has sole charge—primary control—of the upper aft turret. This turret is always under his control, and he cannot give control to anyone else.

Other Turrets He Can Operate

The upper forward turret comes under his control at all times when the nose gunner is not using it. All switches for turning on this turret are on the top gunner's control box, and he must always help the nose gunner by keeping the switches in proper position.

Field of Fire of His Turrets

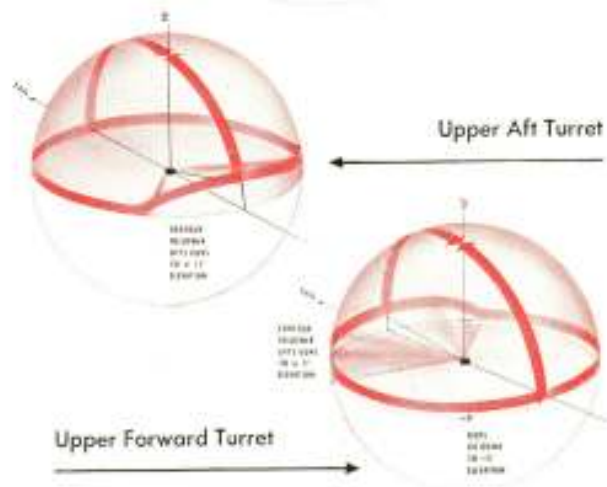
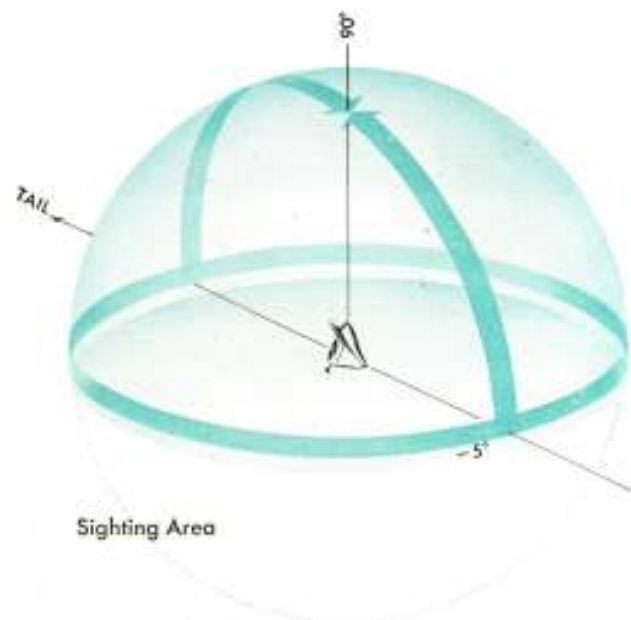
The upper aft turret swings a full circle in azimuth. In elevation, it covers the entire top surface—from horizontal to straight up. The only exception is when the guns are pointed forward; then the contour follower keeps them at least 11 degrees above horizontal.

The upper forward turret swings a full circle in azimuth. In elevation it travels from a little below horizontal (-5 degrees) to straight up.

Stowing Duties

The top gunner is responsible for stowing the upper aft turret—with its guns pointed forward and as near horizontal as the contour follower permits.

Since he has all of the switches for the upper forward turret, he is also responsible for stowing this turret—also with the guns pointed forward and horizontal.



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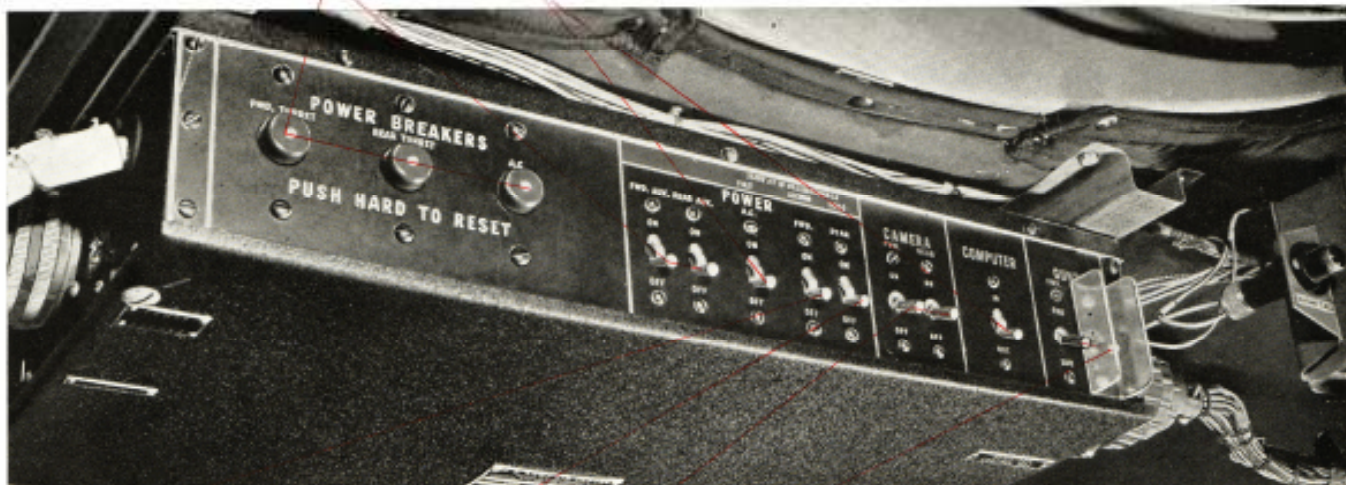
Above and next three pages: Four pages from the USAF publication 'Air Forces Manual No. 27 Gunnery in the B-29' relating to the top and side gunner's switches. (Taigh Ramey)

THE TOP GUNNER'S SWITCHES

In the top sighting station you will sit in a swivel chair, in front of the only ring-mounted sight in the B-29. When you take your seat at this station, be careful not to damage the sight mounting—use the support handles, not the mounting, to pull yourself into the seat.

Once you are seated, take these steps in order:

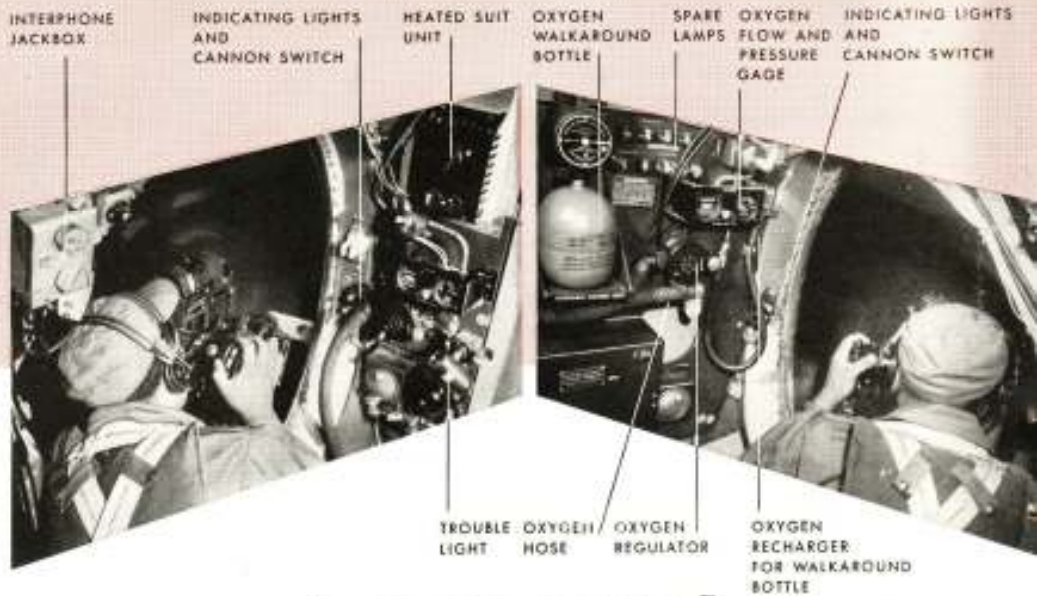
- 1 Turn on the two switches marked **power fwd. aux.** and **power rear aux.** This will supply current in both upper turrets to warm up the computers, start the air compressors for the gun chargers, and operate the gun circuits.
- 2 Press all the power breaker buttons at the left end of the control box to make sure the circuits are closed.
- 3 Turn on the **power A.C.** switch—a main power switch.
- 4 Turn on the **computer** switch. This will start your computer and the gyroscopes on your sight. Now wait at least 10 seconds to avoid overloading the circuits. Use the 10 seconds to make sure the right is working properly as described on page 5-7-1.



- 5 Turn on the switch marked **power fwd.** This supplies current for operating the upper forward turret—be sure to notify the nose gunner, who has first call on using this turret, before turning it on.
- 6 After another 10-second wait, turn on the switch marked **power rear.** This supplies current for operating the upper aft turret.
- 7 The other switches can now be turned on in any order you find convenient. The **guns** switches are safety switches for the trigger circuits; on the ground they should be turned on just before testing the triggers, and in the air they should be turned on just before firing test rounds and then left on. The **camera** switches supply current to operate the gun cameras.

You are now ready to operate the sight and guns, as described in Section 3. As you move your sight, the guns in the upper aft turret will follow, and your trigger will fire the guns. If the nose gunner is not using the upper forward turret, you will also be aiming and firing the front guns.

HOW TO TURN ON THE RIGHT OR LEFT SIGHTING STATION



RIGHT GUNNER · LEFT GUNNER

FACTS AND FIGURES

Movement of the Side Gunners' Sights

The left gunner can swing his sight horizontally to cover the entire left side of the plane; the movement covers slightly more than a half circle. In elevation, he can sight from straight down (-90 degrees) to two-thirds of the way up (60 degrees). The right gunner covers the same area on the right side of the plane.

Turret They Have First Call On

The two side gunners share sole control—primary control—of the lower aft turret. They can transfer control of this turret back and forth by turning a switch placed between them. No other gunner can operate this turret.

Other Turrets They Can Operate

The two side gunners take over control of the lower forward turret when the nose gunner is not using it. They also take over the tail mount when the tail gunner is not using it.

Field of Fire of Their Turrets

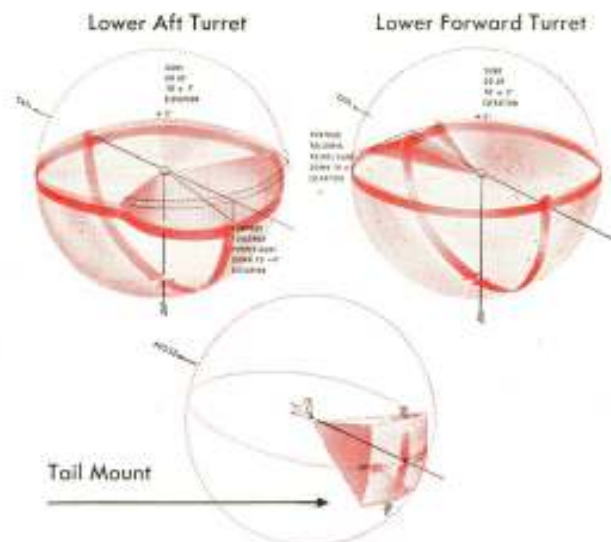
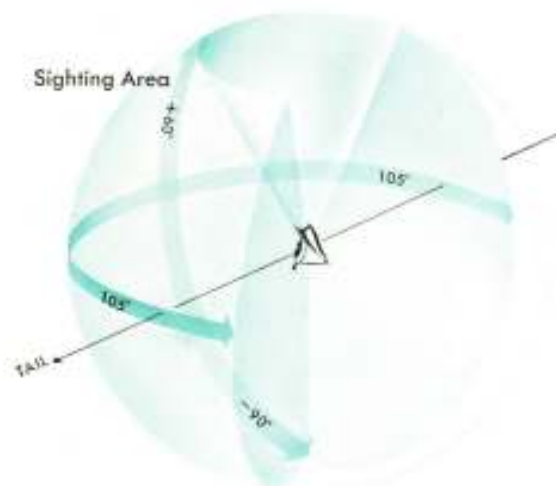
The lower aft turret swings a full circle in azimuth. In elevation, the guns move from a little above horizontal (5 degrees) to straight down (-90 degrees). But when the guns are pointed forward, the contour follower keeps them a little below horizontal (-9 degrees).

The lower forward turret swings a full circle in azimuth, and in elevation its guns move from a little above horizontal (5 degrees at most points) to straight down. The tail mount guns move a third of the way (30 degrees) up, down, and toward either side.

Stowing Duties

The side gunners are responsible for stowing the lower aft turret—pointing aft and at $+5$ degrees elevation.

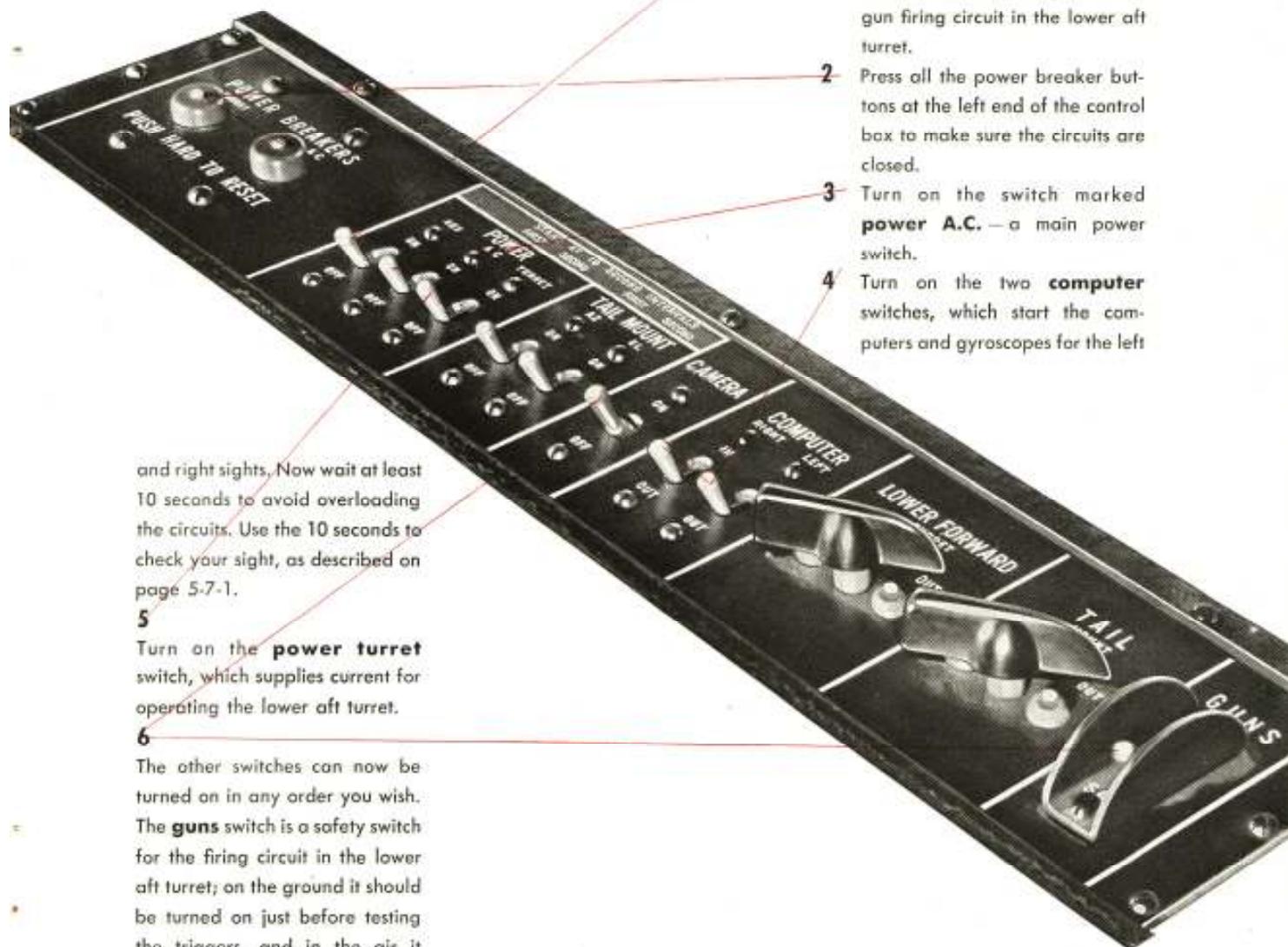
They sit across from one another, facing rear of bomber.



THE SIDE GUNNERS' SWITCHES

At the side stations, the two gunners share a single control box. To start operating the station, take the following steps in order:

- 1 Turn on the switch marked **power aux.** This will supply current to warm up the computers, turn on the air compressor for the gun chargers, and operate the gun firing circuit in the lower aft turret.
- 2 Press all the power breaker buttons at the left end of the control box to make sure the circuits are closed.
- 3 Turn on the switch marked **power A.C.**—a main power switch.
- 4 Turn on the two **computer** switches, which start the computers and gyroscopes for the left



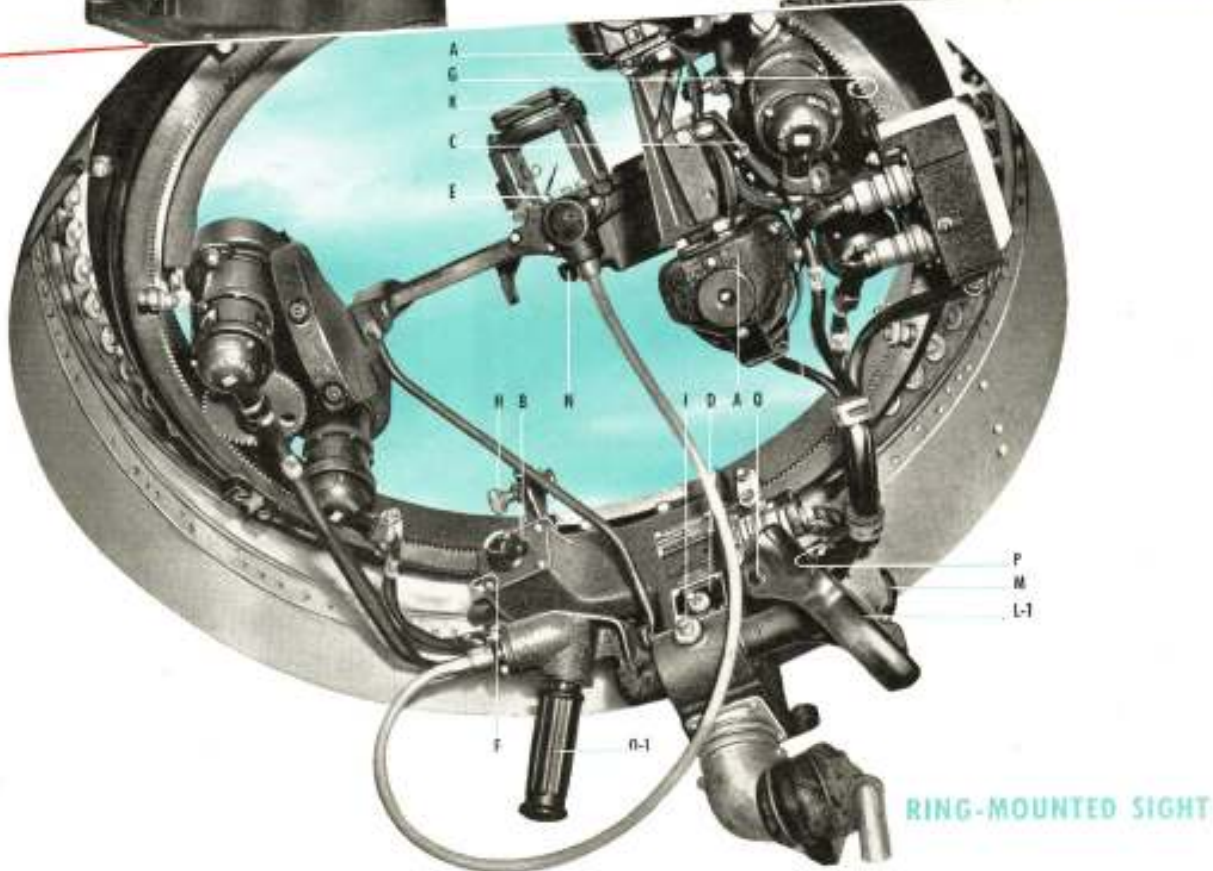
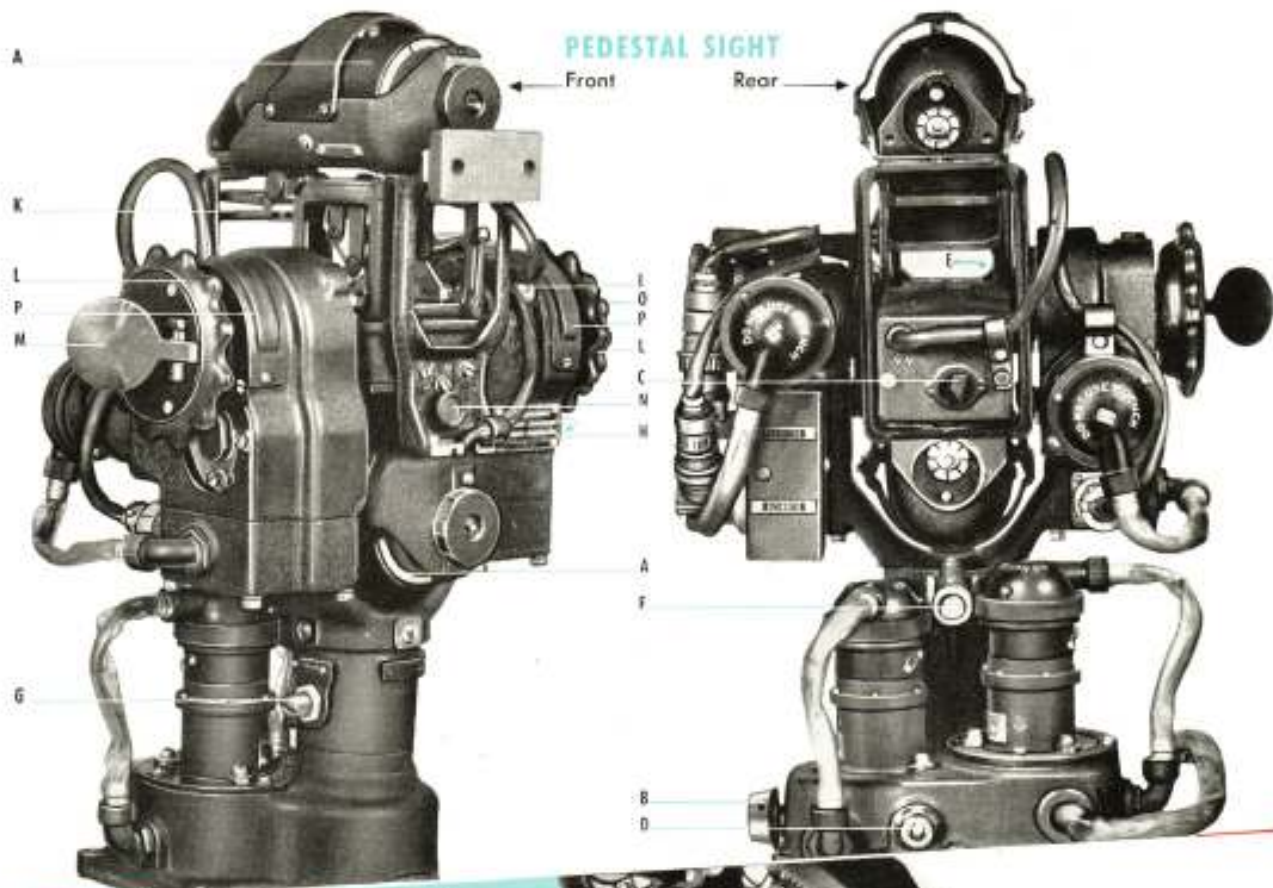
and right sights. Now wait at least 10 seconds to avoid overloading the circuits. Use the 10 seconds to check your sight, as described on page 5-7-1.

- 5 Turn on the **power turret** switch, which supplies current for operating the lower aft turret.

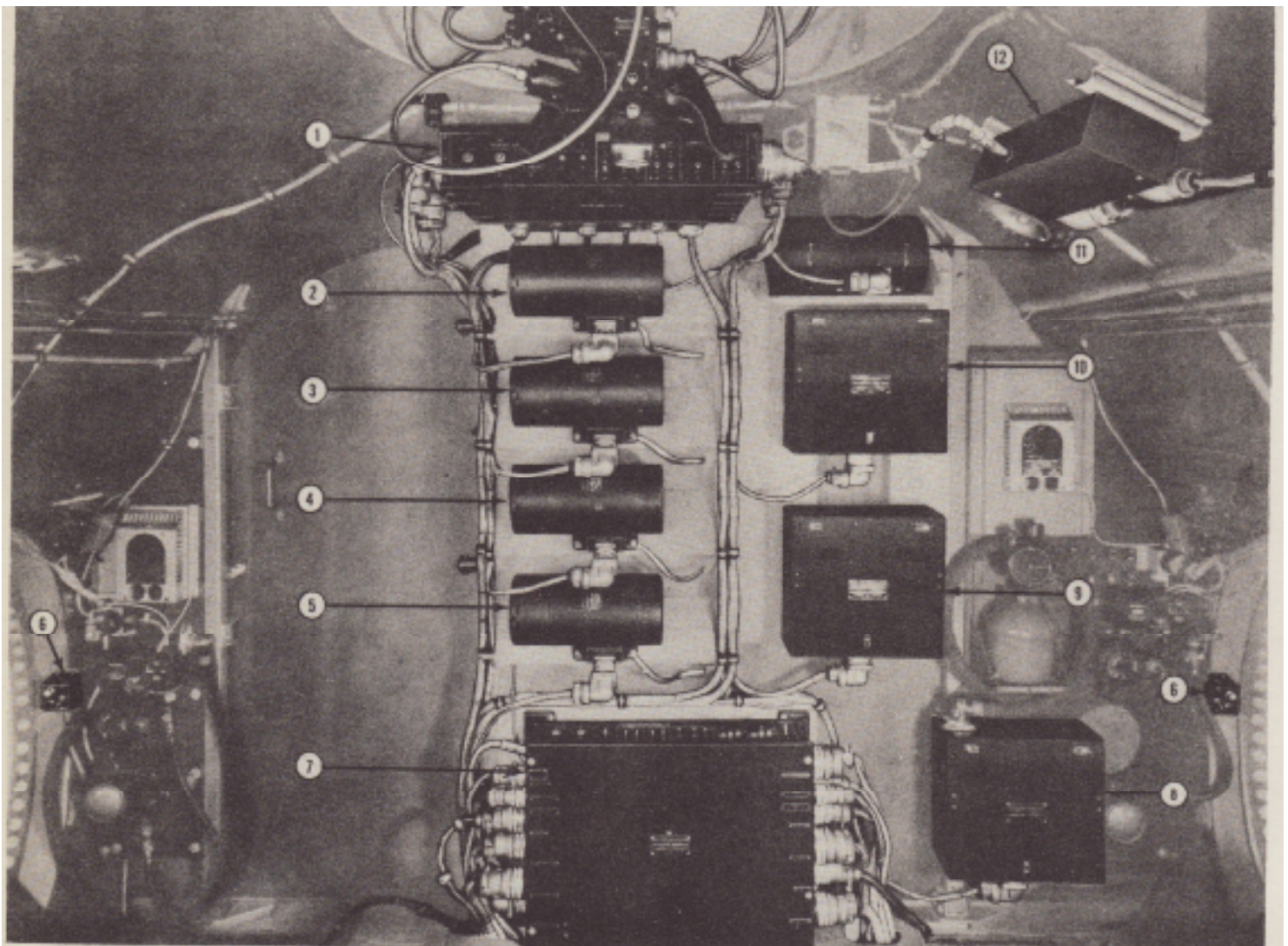
- 6 The other switches can now be turned on in any order you wish. The **guns** switch is a safety switch for the firing circuit in the lower aft turret; on the ground it should be turned on just before testing the triggers, and in the air it should be turned on just before firing test rounds and then left on for the rest of the mission. The **camera** switch supplies power for operating the gun camera. The switches marked **tail mount az.** and **tail mount el.**, for supplying power to run the tail mount in azimuth and elevation, need not be turned on at all except in emergencies—for the tail gunner has the same set of switches and will be using them.

The other two switches on the control box have a special purpose. The one marked **lower forward turret** is used to accept or refuse to operate that turret when the nose gunner is not using it. If the switch is turned to **in**, the side gunners will take over the turret as soon as the nose gunner gives it up. If the switch is **out**, the side gunners have no control over the turret no matter what the nose gunner does.

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Above: The B-29 pedestal and ring sights from 'Air Forces Manual No. 27 Gunnery in the B-29'. (*Taigh Ramey*)
A Gyroscope, **B** Rheostat, **C** Filament Switch, **D** Computer Standby Switch, **E** Warning Light, **F** Azimuth Stowing Pin, **G** Azimuth Friction Adjustment, **H** Elevation Stowing Pin, **I** Elevation Friction Adjustment, **K** Sky Filters, **L** Hand Wheel, **L-1** Handle, **M** Action Switch, **N** Target Size Knob, **O** Range Wheel, **O-1** Range Grip, **P** Trigger, **Q** Push-to-Talk Button

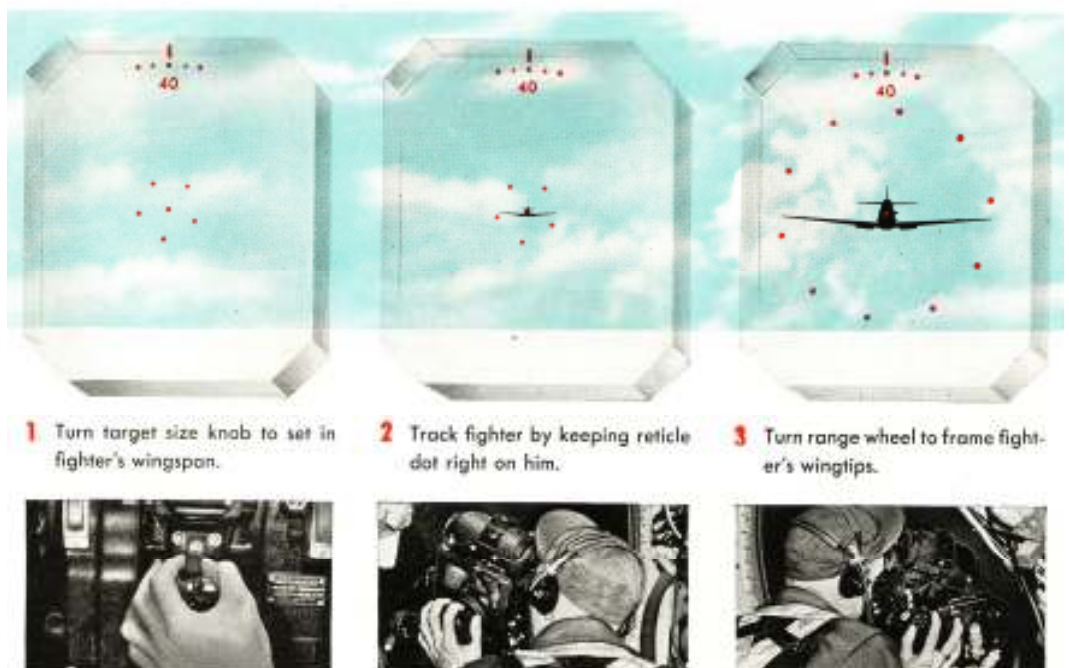


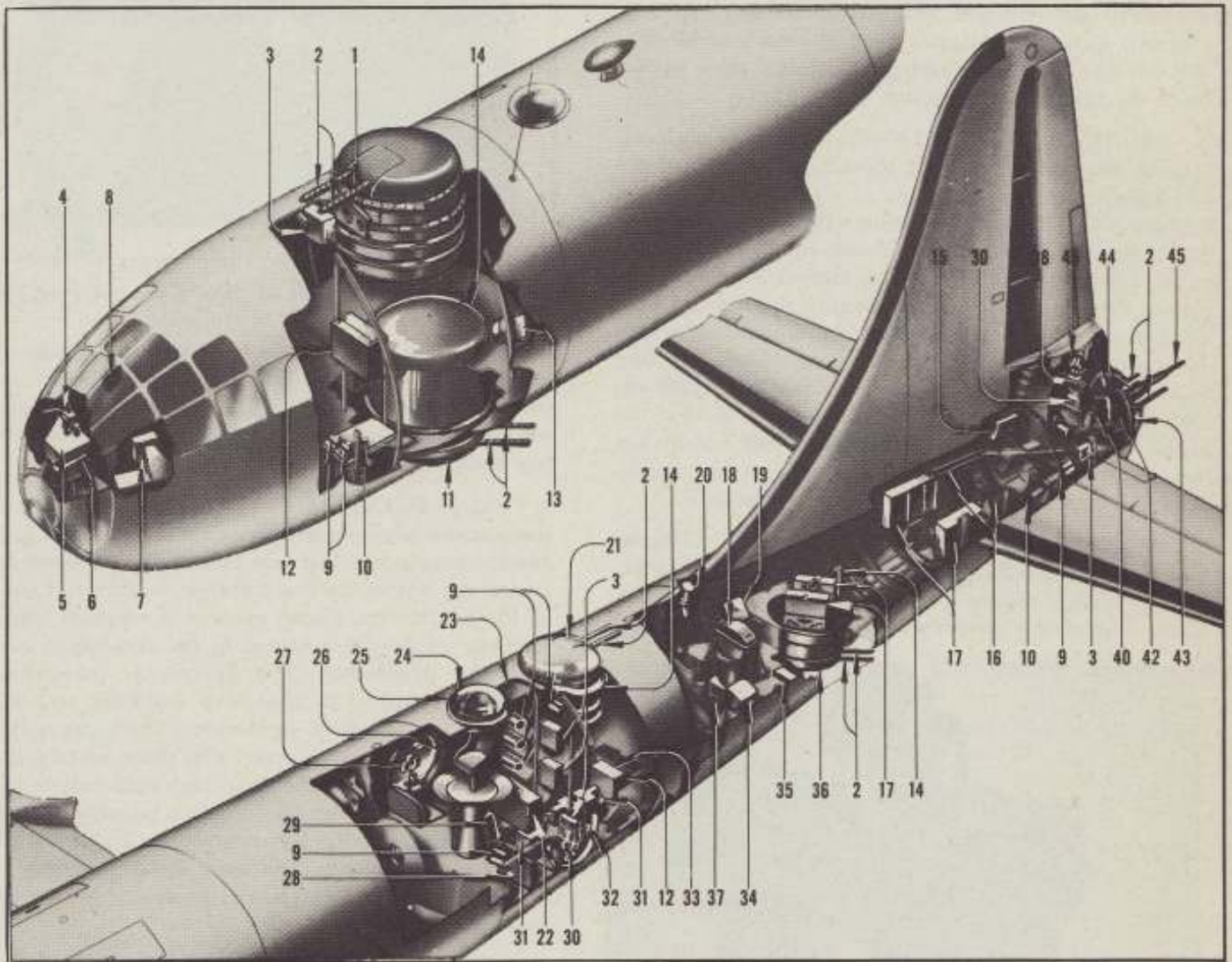
Above: The rear of the gunner's compartment. (*Taigh Ramey*)

1 Top Gunner's Switch box, **2** Upper forward turret azimuth amplidyne, **3** Upper rear turret elevation amplidyne, **4** Upper rear turret azimuth amplidyne, **5** Lower rear turret azimuth amplidyne, **6** side gunner stations' auxiliary control box, **7** Side Gunner's Switch Box, **8** lower rear turret servo amplifier, **9** upper forward turret servo amplifier, **10** upper rear turret servo amplifier, **11** Upper forward turret elevation amplidyne, **12** upper sighting station auxiliary control box.

Right: An extract from 'Air Forces Manual No. 27 Gunnery in the B-29' showing the operation of the sighting reticule. (*Taigh Ramey*)

The sights have a small glass plate onto which the sight projected a small ring of orange dots with another in the centre. The gunner first entered the target's wingspan via the target size knob. He then tracked the target by keeping the centre dot right on it while rotating the range wheel so as to keep the ring of orange dots framing the targets wingtips which allowed the computer to calculate the range to the target.



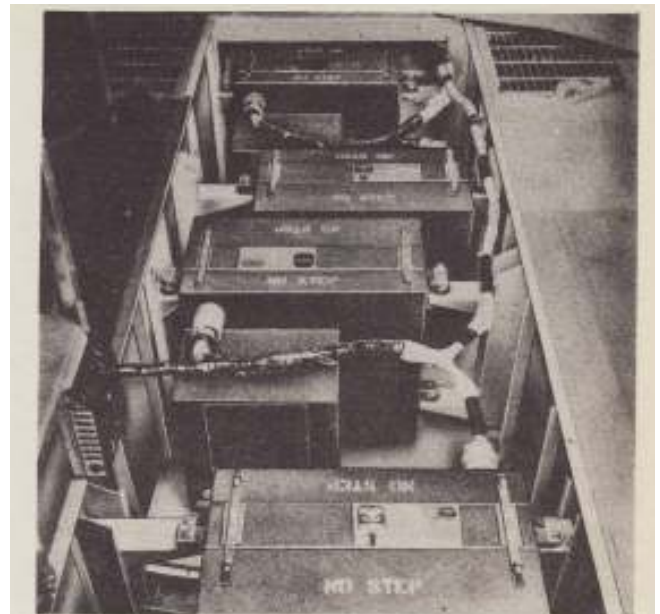


- | | | |
|--------------------------------------|-----------------------------------|-----------------------------------|
| 1. Gun Sight Aiming Point Camera. | 16. Caliber .50 Ammunition Track. | 32. Auxiliary Control Switch Box. |
| 2. Caliber .50 Machine Gun. | 17. Caliber .50 Ammunition Boxes. | 33. Computer Armor Plate. |
| 3. Servo Amplifier. | 18. Vertical Camera. | 34. Left Hand Oblique Camera. |
| 4. Nose Gun Sight. | 19. Right Hand Oblique Camera. | 35. Camera Junction Box. |
| 5. Bombardier's Table. | 20. Type K-20 Camera. | 36. Lower Rear Turret. |
| 6. Lower Forward Turret Control Box. | 21. Upper Rear Turret. | 37. Camera Shut-Off Valve Box. |
| 7. Camera Intervalometer. | 22. Blister Station Control Box. | 38. Azimuth Drive Motor. |
| 8. Nose System Switch Box. | 23. Upper Control Box. | 39. Elevation Drive Motor. |
| 9. Amplidyne. | 24. Upper Sighting Blister. | 40. 20 mm Feed Chute Assembly. |
| 10. Dynamotor. | 25. Upper Gunner's Sight. | 41. 20 mm Gun Switch. |
| 11. Lower Forward Turret. | 26. Auxiliary Control Switch Box. | 42. 20 mm Ammunition Box. |
| 12. Single Parallax Computer. | 27. Right Blister Gunner's Sight. | 43. Tail Turret. |
| 13. Altitude and Airspeed Handset. | 28. Computer Voltage Regulator. | 44. Gun Camera. |
| 14. Turret Safety Switches. | 29. Switch Box Blister. | 45. 20 mm Cannon. |
| 15. Selector Panel. | 30. Left Blister Gunner's Sight. | 46. Tail Gunner's Sight. |
| | 31. Double Parallax Computer. | |

Figure 592—Gun and Camera Equipment Location Diagram

Above and right: A diagram and photo from AN 01-20EJ-2, 'Parts Catalogue for USAF series B-29, KB-29M, KB-29P and WB-29 Aircraft revised 15 November 1951' showing the gun and camera locations (above) and the computers under the floor in the rear pressurised compartment (right) (*Taigh Ramey*)

The photo (right) is looking forward in the radar operator's compartment. The AN/APQ-13 equipment rack (see next page) is just visible at the extreme lower left. From bottom to top (rear to forward) the computers are; tail sighting station (type 2CH1C1 - single parallax computer); left blister sighting station, right blister sighting station, top sighting station (type 2CH1D1 - double parallax computers). In standard B-29s the computers were protected by armour plate (see page 14) but this and all but the tail sighting station computer were deleted in the Silverplate planes. See also page 16.



Radars and Countermeasure Operators' Stations

Top: The rear of the gunner's compartment in *Enola Gay* looking through the 'door' to the Radar and Countermeasure Stations. (*Scott Willey*)

The curtain door and canvas 'walls' to the right are another Silverplate addition since standard B-29s had a wall made of armour plate (see pages 14 and 59). The deletion of this was part of the weight savings of the Silverplate modifications. The canvas 'door' can be closed to keep light out of the compartment while the radar and countermeasures operators were working their scopes. Note the medical kit on the wall in front of the large water flask. The vertical green board next to the medical kit should hold one of the three fire extinguishers carried inside the aircraft. The other two should be mounted adjacent to the Flight Engineer's panel and next to the rear entry hatch.

Bottom: A general view of the Radar and Countermeasure station room. (*Scott Willey*)

The circular hatch at the back gives access to the rear unpressurised section and, ultimately, the tail gunner's compartment.

The Radar operator occupied the seat on the right hand side of the picture (left side of plane) with the radar equipment being mounted on the wall in front of him and in the green rack to the right of the picture. The radar equipment shown here was a standard B-29 fit and is representative of all standard B-29s including the RAF's Washingtons. The countermeasure equipment is located behind the canvas wall and only just visible in the extreme lower right of this photo.

Note the control cables running along the wall to the left (a similar set run along the wall to the right, behind the radar equipment). Also, one of the two air pressurisation ducts going to the tail gunner's compartment can be seen running vertically to the left of the open bulkhead hatch. The other duct is hidden behind the radar equipment.





The prototype and very earliest B-29s (maybe only the YB-29s) had no Radar or countermeasures suite fitted and this compartment contained crew rest bunks. Oddly, many references mention these bunks and imply that they were a standard feature on most, if not all, B-29s. This is not so and bunks played only an infinitesimally small part in the B-29 story.

The Radar, the AN/APQ-13, was a US development of the British H2S and almost all operational B-29s had this fitted as standard although the B-29B was fitted with the more advanced AN/APQ-7 'Eagle' Radar instead. The addition of countermeasure equipment came later. Initially flight crews protested against the carriage of this new fangled technology that did not seem to do anything as it meant they could carry fewer bullets for their guns. However, once it became clear that it was effective (especially against gun laying Radar) attitudes changed and everyone wanted the countermeasures equipment.

Top: Radar Operator's table. (*Scott Willey*)

The black box with the white central section mounted on the wall in the centre of the photo is the Computer Box. This was designed to determine range and altitude accurately for the solution of the bombing problem.

Below the Computer Box are the Radar Operator's instruments, the four dials being (from left to right) airspeed, flux gate compass, altitude and a voltmeter.

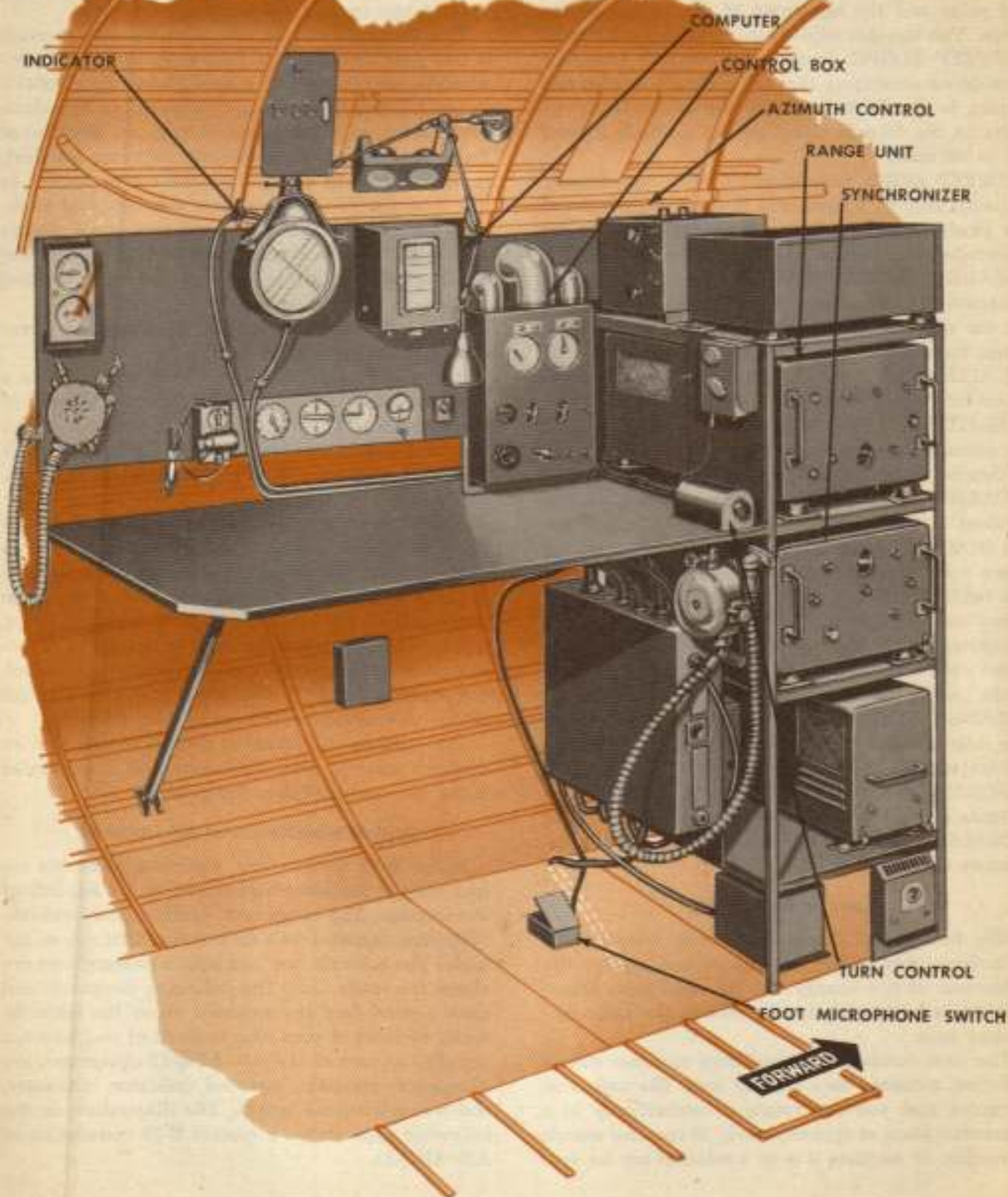
Bottom: The AN/APQ-13 electronics rack. (*Scott Willey*)

The top box (only half shown) is the Range Unit that is the heart of the AN/APQ-13. The unit controls the timing of the sweep and the bomb release pulse circuits.

Below this is the Synchroniser Unit. This synchronised the sweep and the received signals which made it possible to determine range and azimuth.

Note the Elsan toilet, colloquially known as the 'Tokyo Bombsight', tucked away behind the electronics rack.





B-29 INSTALLATION OF AN/APQ-13

What's in a name? The AN/APQ-13 was so called because it followed what was known as the Army Navy nomenclature system (AN). For complete pieces of equipment the major title of the equipment came after a slant bar after the letters AN and consisted of three or four letters and a number;

First letter (installation): A – airborne (i.e. fitted in a plane), C – air transportable, U – general utility

Second letter (equipment type): G – Telegraph or teletype (wire), I – interphone and public address, N – sound, P – Radar, R – radio, T – telephone, V – Visual and light, X – facsimile or television

Third letter (purpose): C – communication, receiving and transmitting, D – direction finding, G – gun laying, M – maintenance and test, N – navigation, Q – special, R – receiving, S – search and/or detecting, T – transmitting, W – remote control, X – identification and recognition.

The number was simply a sequential number so the AN/APQ-13 was the 13th airborne radar special named in the system. If the equipment was specifically designated for training a T was added as a fourth letter e.g. AN/APQT-13.

Components used the same three letter descriptors and numbers as complete pieces of equipment but replaced the initial AN with a descriptive code. There are too many to list all here but a few examples are: AM – amplifier, CU – coupling unit (special impedance matching or coupling device), DY – dynamotor unit and PP – power pack (e.g. AM-26/AIC on page 11).



Previous page: A page from the USAAF publication 'Radar Observer's Bombardment Information File' showing the layout of the Radar installation in a B-29. (*Mike Voisin*)

Top: A close up of the Radar Operator's desk. (*Scott Willey*)

The Plan Position Indicator (PPI) with its light shade is the black tube hanging from the roof. A slave display is mounted in the Navigator's station in the forward pressurised area.

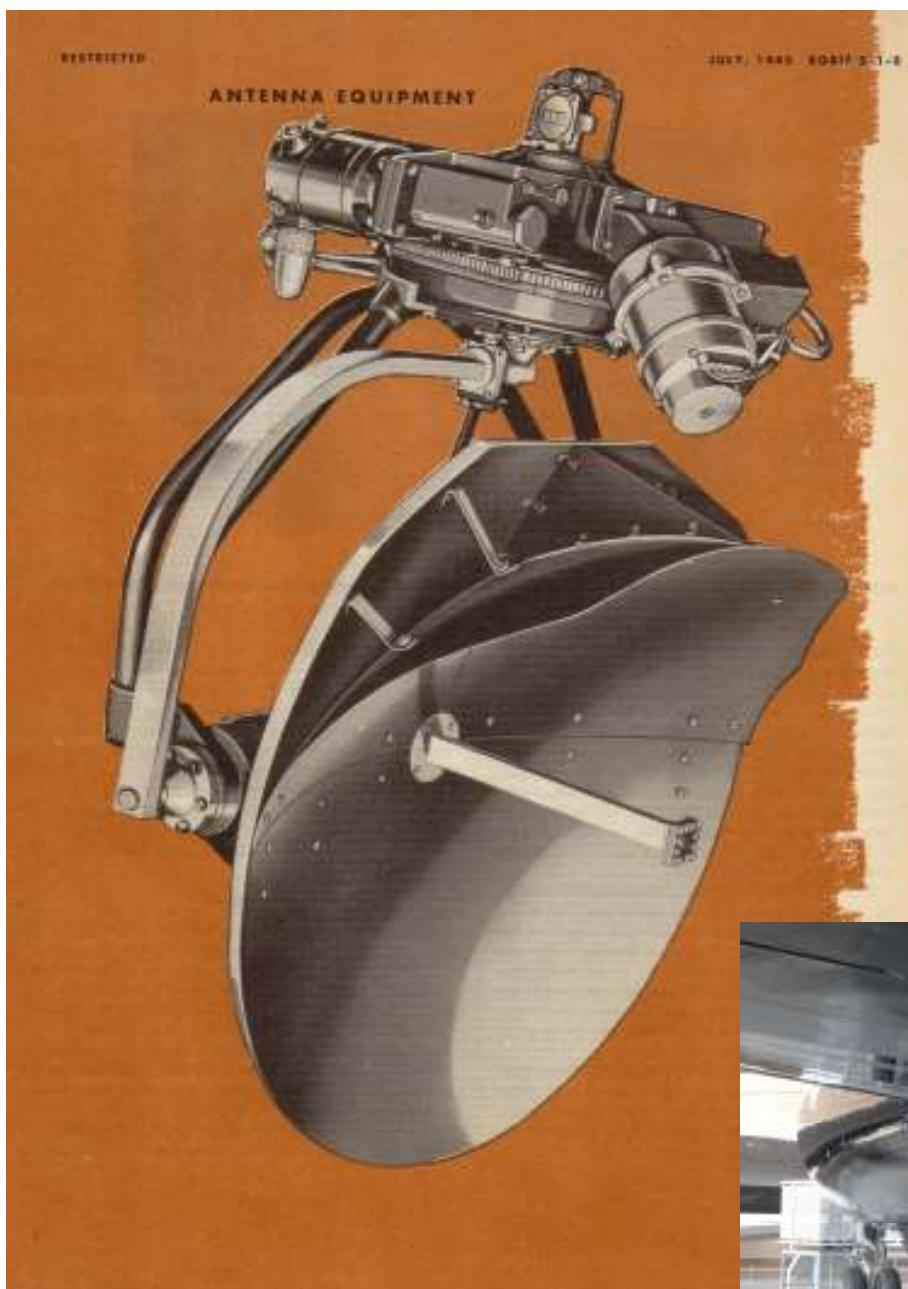
The large black panel to the right of the PPI and partly hidden by the angle poise lamp is the Main Control Box for the AN/APQ-13 set. This box contained the switches which governed the operation of the system. The left hand of the two meters indicated the various operating currents and voltages while the right hand meter indicated the elevation tilt of the antenna (ranging from -10 to + 65 degrees).

Below Left: An excerpt from the USAAF publication 'Radar Observer's Bombardment Information File' showing the antenna equipment. (*Mike Voisin*)

The unit was mounted between the two bomb bays with the antenna protruding below the fuselage and protected by a streamlined fairing.

Below: The AN/APQ-13 antenna fairing on *It's Hawg Wild*. (*Chris Howlett*)

Note one of the two single dipole antennae (upper centre) for the SCR-718 (protected by a Perspex cover on the museum plane). The other is under the other wing. These antennae and the APQ-13 fairing on *Enola Gay* are almost identical.



Countermeasure Officer's Station

The role of the countermeasure officer (also known as the Raven officer) in a standard B-29 was to identify and counter radars that may be illuminating their plane for gun laying or searchlight direction. To do this, the countermeasure station normally consisted of a single rack of equipment crammed in between the fuselage wall and the tub containing the ammunition for the rear upper turret (upper photo). Shown is an AN/APA-6 pulse analyser (top) with an AN/APR-4 frequency monitor (under). The empty racks below could carry up to two jammers such as the APT-1.

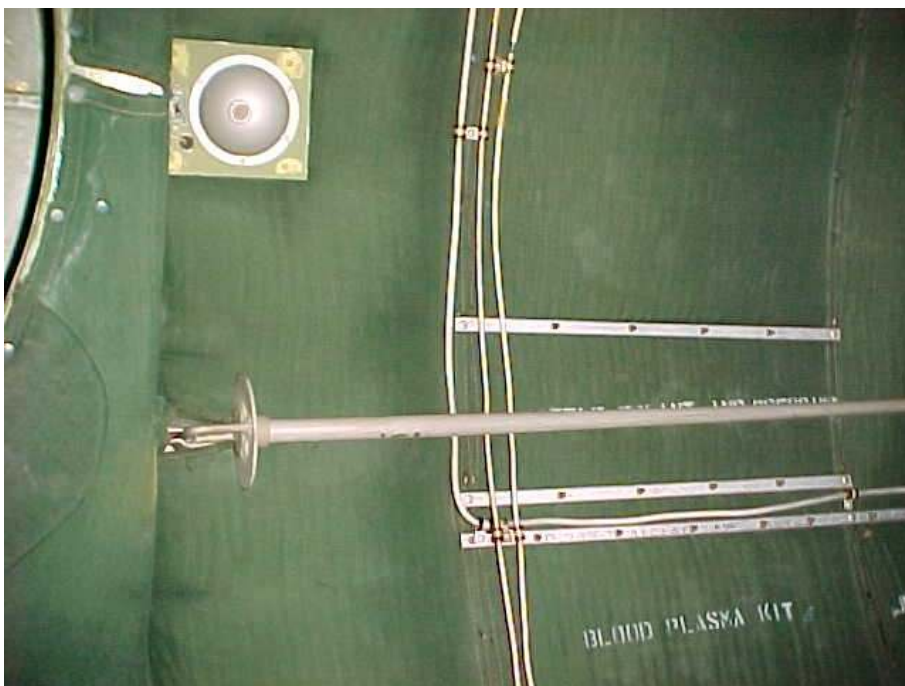
In the Silverplate aircraft, with the deletion of the upper rear turret the extra space allowed more racks to be fitted. These were used to carry additional frequency scanners as well as a number of special monitoring devices. Although all Silverplate planes carried the frequency scanners, only the designated instrumentation plane carried the special monitoring devices leaving *Enola Gay's* racks looking somewhat empty. Also, although not confirmed, it seems that *Enola Gay* carried no jamming equipment on 6 August leaving even more space on the racks! The lower photo shows *Enola Gay's* Raven equipment in arbitrary locations as the actual locations or even fit has not yet been fully established. The equipment has also not been wired up.

The equipment fitted in *Enola Gay* is; an AN/APA-11 pulse analyzer (left on top row) - specialized instrument that permitted detailed characterization of electronic radar signatures, an AN/APA-10 panoramic adapter (middle of top row) - visually displayed a continuous band of frequencies to the left and right of the frequency actually being listened to on any of the three frequency monitors in this bay of equipment, an AN/ARR-7 (right on top row) 0.55 – 42Mc, an AN/ARR-5 (right on middle row) 27.3 – 143Mc, and an AN/APR-4 (bottom row) 40 – 3,400Mc. It is not certain that the ARR-7 was carried on 6 August 1945 and research is continuing. Finally, a PP-32/AR power supply (left on middle row) provided power to both the AN/ARR-5 and the AN/ARR-7.



Top: An early countermeasures fit in a standard B-29. (Mike Hanz)

Bottom: The Countermeasure Equipment in *Enola Gay*. (Scott Willey)



Top: The AN/ARR-5 special instrumentation antenna deployed through the lower rear fuselage of *Enola Gay* with the blade antenna for the AN/APR-4 to its right. (Mike Hanz)

Bottom: The AN/ARR-5 special instrumentation antenna stowed on the roof of the countermeasure compartment. The plate covering the hole left by the deleted upper rear turret is just visible to the upper left. (Mike Hanz)

One of the reasons for the additional scanners in the Silverplate aircraft was that, in addition to his normal duties, the Silverplate Raven officer had to carefully monitor the frequencies between 390Mc and 430Mc. This was because the primary fuse in the atomic bomb was a radar altimeter based upon the APS-13 tail warning radar (410 – 420Mc). The fuse system used four such units, known as ‘Archies’, and the bomb would only detonate when any two of these agreed that they had dropped through the critical altitude. Each ‘Archie’ was slightly off-tuned from a central frequency but it was still theoretically possible that stray or deliberate radio waves at just the correct frequencies could get two of the Archies to think they had reached the desired altitude and detonate the bomb as soon as it left the bomb bay – which would not have been good! If any potentially dangerous emissions were detected the countermeasure operator would inform the Weaponer who could alter the frequency of the fuse (there were two choices) or disable them completely and rely on the secondary, barometric, fuse. A third, contact fuse, was always enabled in case all others failed.

The primary instrument for detecting these potentially dangerous emissions was the AN/APR-4. This was normally configured to automatically scan back and forth across a preset range of frequencies which prevented the Raven officer having to constantly kneel on the floor to tend it! The antenna for the AN/APR-4 was a small blade antenna located on the lower right of the rear fuselage (see upper right of top photo).

In addition to the equipment on *Enola Gay* the instrumentation aircraft carried three AN/ARR-5 receivers to monitor the emissions from the three air dropped canisters (dropped by the instrumentation plane at the same time as the bomb) in the vicinity of 50MHz, as well as three AN/ANQ-1 wire recorders to record the overpressure signatures provided by the canister microphones. From this information, approximate yields could be calculated. The somewhat lengthy antenna for the AN/ARR-5 is shown deployed in the top photo and stowed on the roof of the radar/countermeasures compartment for take off/landing below.

The Rear Unpressurised Area

Top: Looking aft from the pressure bulkhead. (*Scott Willey*)

In the foreground to the right of the photo is the Auxiliary Power Unit or 'Putt Putt' as it was universally known.

The raised area is where the lower rear gun turret would have been located. In standard B-29s the ammunition boxes and motor mechanism would have presented an obstacle to movement aft but in the Silverplate B-29s it was covered by a simple cover plate.

Beyond the remnants of the lower rear turret are more oxygen bottles and, in the distance, the rear gunner's compartment.

Note the control cables running along both sides and the green pressurisation ducts leading to the tail gunner's compartment. Also, the green upright metal frames in the extreme foreground (bottom of photo) are the racks for the vertical reconnaissance camera.

Cameras were interchangeable and a variety of different cameras could be carried. Records show that Enola Gay carried a K-18 camera on the 6 August mission.

Middle: A close up of the 'Putt Putt'. (*Scott Willey*)

The 'Putt Putt' was a 2 cylinder, 4 stroke, 7 Horse Power engine that drove a 200-amp, 28.5 volt DC generator. The tail gunner had the job of firing this up before engine start. After the engines were running, their six Type R-1 (300 Amp) generators (two on each outboard and one on each inboard engine) supplied the electrical needs of the plane although the 'Putt Putt' was left on until after take off in case an engine failure resulted in a generator failure. After take off the Putt-Putt was shut down and was not used again until the tail gunner started it again before landing.

Bottom: The aircraft battery; Type G-1, 34 ampere hour, 24 volt. (*Scott Willey*)

Note the air pressurisation duct going to the tail gunner's compartment (green tube) behind the battery.





Above The rear entry door of *It's Hawg Wild* from the outside. (Chris Howlett)

Left: The rear entry door of *Enola Gay* from the inside (Scott Willey)

The rear entry door, located on the right hand side of the rear fuselage was common between the Silverplate and standard B-29s. A fire extinguisher should be fitted to the vertical panel just visible to the extreme right of the photo.

Bottom: The camera bay. (Scott Willey)

Located immediately adjacent to the Putt Putt, the racks at the top of the photo either side of the dark green aperture doors held a vertical camera. This was controlled by the panel at the very top of the bombardier's control panel and allowed post strike photos to be taken. On the 6 August mission *Enola Gay* carried a K-18 camera although several types were available. The K-18 was a low light camera and why this was installed for the mission is unclear. In the event it was not used so its specifications were irrelevant. Note the plywood walk boards that prevented the aircrew (or ground crew) from damaging the thin fuselage skin. Also, the green item at the bottom of the photo is a hatch brace, carried to reinforce the bulkhead hatches in the event of a ditching. Additional braces were carried in the rear pressurised area, strapped to the bulkhead beside the hatch leading to the rear bomb bay.



Top: The blanked off lower rear turret. (*Scott Willey*)

In standard B-29s, the motor mechanism and ammunition tubs that were located here would have presented a significant hindrance to further movement aft.

Middle: Approaching the rear gunner's compartment. (*Scott Willey*)

Once past the remains of the lower rear turret there are no more Silverplate modifications and *Enola Gay* becomes representative of all standard B-29s.

The oxygen bottles seen in the distance in the photo at page 67 above are now in the foreground. Behind these are the rectangular boxes that contain the ammunition for the tail guns while the tail skid mechanism is on the floor between them. In this photo the tail skid is extended, when the plane was in flight it would be retracted and the mechanism would project higher into the space.

Bottom: A photo taken directly under the horizontal stabiliser torque box and between the ammunition boxes for the tail turret. (*Scott Willey*)

The photo is looking rearward through the open pressure bulkhead door into the tail gunner's compartment. The ladder does not belong here. It is the ladder for the rear entry door and should be secured in brackets against the right hand side of the roof near the Putt Putt. Note the pulleys and control arms for the elevators either side of the bulkhead hatch (close up below – *Scott Willey*). The silver item at the bottom is the ammunition track for the tail turret. A similar track is located on the other side.



Tail Gunner's Station

Top: The view greeting the tail gunner as he crawled into his compartment. (*Scott Willey*)

The silver tube is one of two that carry the ammunition tracks the ammunition boxes in the rear unpressurised compartment through to the tail guns. A similar tube is located on the opposite side of the compartment.

The cylindrical item above the tube is one of the two Amplidyne motor generators for the tail turret. These took 28 volts DC and turned it into 0 to 60 volts DC power used for the turret drive motors.

Middle: The tail gunner's seat in its stowed position. (*Scott Willey*)

The photo is looking vertically up at the stowed tail gunner's seat from the entry hatch. Once the tail gunner had entered and closed the hatch the seat was lowered down the rails seen in the photo before being used.

Bottom Left: The left hand side of the tail gunner's compartment (right hand side of the plane) (*Scott Willey*).

The black box at the bottom left is the tail gunner's control box. The hose for the oxygen mask is prominent while the silver grey box (middle right) is an interphone control box.

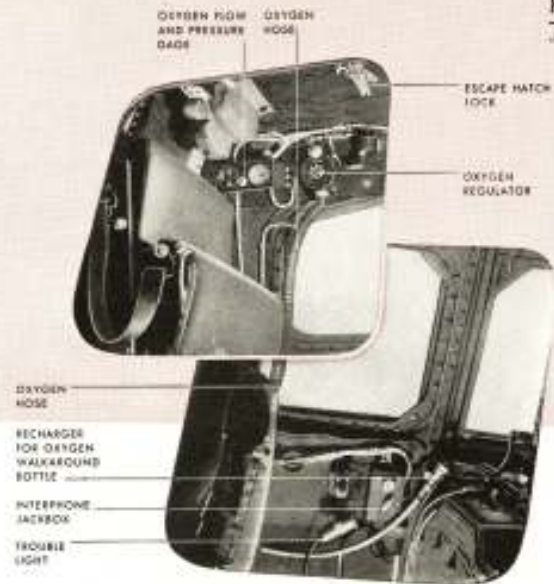
Bottom Right: The right hand side of the tail gunner's compartment (left hand side of plane). (*Scott Willey*)

The window is part of a jettisonable panel that is the tail gunner's escape hatch. The black box at the bottom of the photo is the servo amplifier for the tail turret.

Note the darker green circular panel embedded in the padding (lower left, above the servo amplifier). This is the tail gunner's ash tray (made by the Ford motor car company) – similar devices can be seen at all other crew positions.



HOW TO TURN ON THE TAIL SIGHTING STATION



Upper photo: Seat as seen looking toward ceiling;
Lower photo: Seat as seen looking down.

FACTS AND FIGURES

Movement of the Tail Gunner's Sight

The tail gunner can turn his sight more than half way back toward either side (105 degrees from the center-line in either direction). In elevation, he can sight all the way from straight down (-90 degrees) to two-thirds of the way up (60 degrees). This is much farther than his guns can follow.

Turret He Has First Call On

The tail gunner has first call—primary control—on the tail mount. When he is not using it, control passes to one of the side gunners.

Other Turrets He Can Operate

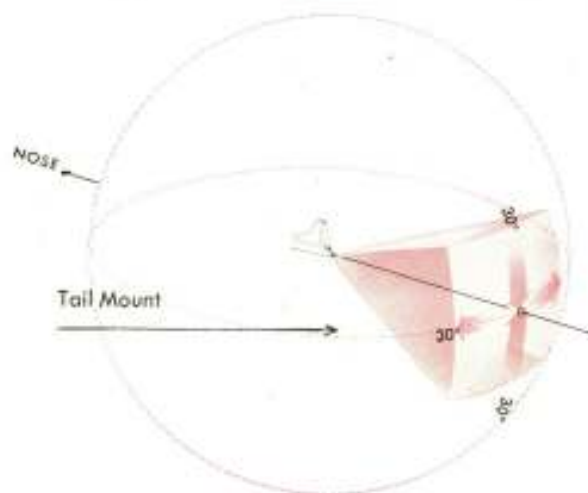
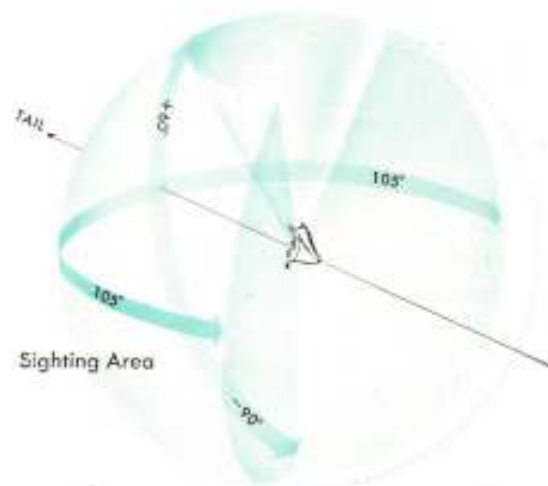
None.

Field of Fire of His Turret

The tail mount guns move a third of the way up (30 degrees), a third of the way down, and a third of the way toward either side.

Stowing Duties

The tail gunner stows his tail mount with its guns pointing back and a little above horizontal.



RESTRICTED

This page and next: Two pages from the USAAF publication 'Air Forces Manual No. 27 Gunnery in the B-29' relating to the tail gunner's sighting station and switches. (Taigh Ramey)

THE TAIL GUNNER'S SWITCHES

The tail gunner's control box is located just to the left of the seat. To start operating the tail mount, take the following steps in order:



- 1 Turn on the switch marked **power aux.** This will supply current to warm up the computer, start the air compressor for the gun chargers, and operate the firing circuits in the tail mount.
- 2 Push all the power breaker buttons at the left end of the control box to make sure the circuits are closed.
- 3 Turn on the switch marked **power A.C.** — a main power switch.
- 4 Turn on the **computer** switch, which starts the computer and the gyroscopes on your sight. Now wait at least 10 seconds to avoid overloading the circuits. Use the 10 seconds to check your sight, as described on page 5-7-1.
- 5 Next turn on the switch marked **power az.**—which supplies current for moving the turret in azimuth.
- 6 After another 10-second wait, turn on the switch marked **power el.** — which supplies power for moving the guns up and down. (The equipment for moving the tail mount requires so much electricity that two switches are provided to avoid a sudden drain on the power system.)
- 7 The other switches can be turned on in any order you wish.

The **guns** switch is a safety switch for the firing circuit in the tail mount; on the ground it should be turned on just before testing the triggers, and in the air it should be turned on just before firing test rounds and then left on for the rest of the mission. The **camera** switch provides power for operating the tail gun camera. (If your sighting station has a **manual charge** switch, ignore it unless you receive special instructions—the equipment it operated has been removed from most B-29s.)

You are now ready to operate the sight and guns, as described in Section 3. The tail guns will follow your sight and fire when you press your triggers. You can fire the 20 mm cannon along with the caliber .50s by turning on a small toggle switch mounted near the sight. (For instructions on when to use the 20 mm, see page 4-4-1.)

As soon as you let go of the action switch on your sight (described on page 3-1-2), control of your guns will pass to one of the side gunners.



Top: Looking down to the left of the tail gunner's seat (right hand side of the aircraft). (*Scott Willey*)

The turret dynamotor that turned the airplane's 28 volts DC into 115 Volt 400 cycle AC is under the wooden cover by Scott Willey's foot. Below this is the ammunition tube while above the dynamotor and partly covered by the insulation padding is the tail gunner's control box.

A walk around oxygen bottle is also just visible under the oxygen hose. The smaller hose that ends at the centre top of the photo is for recharging the walk around oxygen bottle. The thin black wires are not original but are again parts of the fibre optic lighting system installed by the Smithsonian to show off their exhibit.



Middle: A close up of the tail gunner's control box in *Enola Gay*. (*Taigh Ramey*)

Bottom: The roof panel with the tail gunner's heated flying suit connector. (*Scott Willey*)

The top of the gun sight is at the very bottom while the gunner's heated flying suit connector is the black panel attached to the roof.

Unlike the gunners at the other sighting stations, the tail gunner could only control the guns in his own turret. However, this was simply because the field of view afforded the tail gunner was insufficient to allow him to sensibly take charge of any other turret. His sighting system still operated in exactly the same way as the others and hence, even though he was seated adjacent to his guns, his turret was still remotely controlled. The computer for the tail sighting station was located with those for the top and both blister sighting stations under the floor in the rear pressurised compartment (see also page 60).



Top: The tail gunner's pedestal gun sight. (*Scott Willey*)

A standard B-29 has four of these sights and one variation that fitted to a ring mount in the Central Fire Controller's blister. The Silverplate aircraft had just the one in the tail. The sighting window is at the top. The gunner's two hands gripped the wheels on the side. As he moved the sight in both elevation and azimuth; electrical and gyro components gave the General Electric computer both direction and rate of motion information. By turning the right wheel, the gunner adjusted the reticule to enclose the attacker's wingspan. This provided range information to the computer. The device sticking out from the left wheel is the dead-man's switch. It had to be depressed for the sight to work. If the gunner's hand left the wheel, the sight shut down. A diagrammatic representation of the sight is at page 58.

Middle: A close up of the sight. (*Scott Willey*)

The trigger is the rectangular button just inside the range wheel (knurled wheel to the right of the sight). There is a second trigger on the other side.

The interphone button is the circular button below and to the left of the trigger while the sight's data plate is below this. You can see from the data plate that this is a General Electric sighting station manufactured by the International Business Machine Corporation at Endicott N.Y.

Bottom: The twin 0.5 inch machine guns in *Enola Gay's* tail turret. (*Chris Howlett*)

Note the discharge chute for the spent links and shell cases under the guns. The small circle above the tail gunner's rear window is the bombing light. Under the discharge chute is the formation light. Also visible is the escape hatch.

Back cover: The nose art of *Enola Gay* and *It's Hawg Wild* (*Chris Howlett*)



