Chapter 4 ATTACK SYSTEM

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Introduction

1. The attack system of this aircraft comprises two complementary systems, the search and fire control radar (ARI 5930) and the strike sight system. A brief functional description of these systems is contained in this Chapter; for further details, reference should be made to A.P.114P-0100-1AB, A.P.114P-0100-1 (Supplement) and A.P.112E-0402-1. Location and wiring routeing diagrams, and a detailed list of the components comprising the installation, are in Sect.9 of the SDM. The List of Components serves as a key to location and includes Part No., identification and access details, and references to associated Air Publications.

Modification standard

2. This Chapter includes Mod 898, 993, 1069, 1077, 1190A, 1240, 1272, 1338, 1342, 1361, 1437, 1441, 1446, 1585, 1669, 1671, 1746B and 5223, 5356, and STI/Bucc/341. Pre-Mod standard information is described in Appendixes to this Chapter.

SEARCH AND FIRE CONTROL RADAR

General

3. The search and fire control radar enables the aircraft to search for, locate and home on to a target which may be visible to radar, or invisible to radar but of known range and bearing from a radar or optically-visible point. The equipment comprises the following units:-

Radar set
Azimuth range indicator
Radar set control
Indicator control

Function

4. The equipment is a forward-looking pulse-modulated primary radar, working on the monopulse principle in which the aerial pattern takes the form of four main lobes, all of which are energized by each transmitter pulse. The return echoes from the four lobes are compared to give directional information about the target or land or sea surface. Information is supplied with the radar functioning in the normal, radar ranging or terrain warning role. With the radar set transmitting, suppression pulses are fed to the wide-band homer installation (*Chap.5, this Section*) irrespective of S band or X band selection, to cut off video and audio interference at the radar set p.r.f. On post-Mod 1441 aircraft, with the radar set transmitting, suppression pulses are fed to the passive warning system (*Chap.7, this Section*) to cut off video and audio interference at the radar set p.r.f.

Normal role

5. In the normal role the radar provides the information to enable the aircrew to locate a surface target within a range of 240 nautical miles, approach under the radar horizon, relocate and attack the target, either blind or visual. This is achieved in three consecutive phases of search, acquisition and track, and is implemented by selection of the phase change switch on the observer's radar set control.

6. *Search.* When the radar is operating in the search mode the aerial beam is swept continuously in azimuth 50 deg either side of ahead and controlled in elevation from the scanner elevation controls on the radar set control (*para* 25), while pitch and roll stabilization is introduced from the MRG (*Sect. 7, Chap. 8, this Cover*). In synchronism with the aerial sweep a PPI sector or B scan display (depending on range selection) is presented on the azimuth range indicator (*para* 21). When a target echo is obtained, the observer aligns a bearing marker and a range marker about the displayed echo to determine the target range and bearing relative to the aircraft.

7. *Acquisition.* The selection of the acquisition phase reduces the azimuth sweep to a rapid 10 deg either side of the marked target while the elevation control remains unchanged, unless automatic depression is selected on the radar set control which then determines, according to the range in use, a fixed scanner depression of 1 deg or 2½ deg. The scan display now presents to the observer a higher rate of information about a selected target and allows an easier and more accurate marking of the target.

8. *Track.* When within 30 nautical miles of the target and having successfully 'marked' the echo, the observer selects the track mode on the phase change switch. If the target echo is of sufficient amplitude the radar will lock on and will automatically follow the target, simultaneously providing the strike sight system with continuous range and bearing information for eventual presentation on the display symbols of the pilot's display unit (*para* 43).

Radar ranging role

9. The radar ranging role is used when a visual attack is being performed on a non-discrete radar target, i.e. a target not giving an echo individually distinct in a group of echoes. The pilot then navigates the aircraft to align the aerial boresight axis with the target by maintaining the aiming spot on the display unit over the actual target. In this role, therefore, the radar provides only slant range to the target pull-up and release computations.

Terrain warning role

10. The terrain warning role is used to warn the pilot when a terrain obstruction appears in his flight path within a certain range. The scanner is maintained in the dead ahead position in azimuth and given a fixed depression angle of 1 deg. When a signal is detected in the upper aerial lobes and the obstruction is within two nautical miles of the aircraft, the terrain warning circuit is actuated. A red lamp C-CW, marked TERRAIN WARNING, is then illuminated warning the pilot of terrain prox-

imity; the lamp incorporates a press-to-test facility and is mounted at the port side of the pilot's display unit.

Note...
The terrain warning role is not cleared for use and must not be selected in flight.

Description

Radar set

11. The radar set, N-BR, is the main unit of the installation and comprises the aerial system, transmitter, receiver, target marker computer and all the major electronic circuits. The set is carried in a pressurized pod consisting of a canister and the nose radome. All external connections to the set are made by two 91-pole plugs and sockets which connect with four plugs and five sockets at the rear of the canister.

12. The set is cooled by circulating air within the pod through a heat exchanger as described in A.P.101B-1202-1A, Cover 2, Sect. 3, Chap. 8. Two blower motors on the set are connected to the heat exchanger at the aft end of the canister by flexible pipes.

Note...
With STI/Bucc/341 embodied radar sets of any modification state may be installed in the attack system.

13. *Aerial system.* The aerial system propogates the transmitter pulses and, from the returning echoes, derives signals from which the range and direction of echo sources may be determined. It is controlled by servo mechanisms and is space stabilized in pitch and roll by outputs from the MRG (*Sect.* 7, *Chap.* 8, *this Cover*). The aerial head consists of a scanner and a central, four-channel, waveguide feed arranged to produce a dual-plane monopulse angle sensing system from which the azimuth difference, elevation difference and sum signals are derived and fed to the receiver.

14. The sum signal consists of the vector addition of all four waveguide signals unchanged in relative phase. It is at its maximum on the boresight and provides range information. It also provides a phase reference for the difference signals in the angle sensing role.

15. The azimuth difference signals are derived from the amplitude comparison of the four waveguide signals which are in phase for a target in the azimuth plane. They have an amplitude proportional to the angular displacement of the target in azimuth, the sense of the displacement being determined by their phase relative to the sum signal.

16. The elevation difference signals are derived from the phase comparison of the four waveguide signals and have an amplitude proportional to the target displacement in elevation. The sense of the displacement is determined by their phase relative to the sum signal.

17. *Transmitter.* The transmitter incorporates a modulator, main e.h.t. transformer, heater transformer and magnetron, together with other components and circuitry. The transmitter generates the r.f. pulses for transmission and provides initiation pulses for the azimuth range indicator timebase and automatic ranging circuits. A nominal r.f. output of 170 kW is produced at a p.r.f. of 316 pulses per second at a transmitter frequency in the range 8925 MHz to 8995 MHz.

18. *Receiver.* The receiving system of the radar set incorporates a logarithmic i.f. amplifier, a linear three-channel i.f. amplifier and a linear error amplifier. The output of either the logarithmic amplifier, or the linear error amplifier (when MRE IN is selected on the azimuth range indicator (*para* 24)) is fed to the range indicator to provide intensity modulation.

19. In the track phase the linear i.f. amplifier is supplied with the sum, elevation difference and azimuth difference signals. The difference signals in each plane are compared with the sum signal to give the angular misalignment of the aerial boresight axis with respect to the target. The sum signal is used for automatic ranging while the azimuth and elevation error signals cause the aerial servo systems to align the aerial with the target, thus providing automatic tracking in these planes.

20. *Target marker computer.* This unit is a dead-reckoning navigational computer of the analogue type and is mounted on the port side of the front face of the radar set sub-assembly. Its main function is to provide bearing and range information to the azimuth range indicator (when in other than the radar lock mode) to position the target marker. The following inputs are provided at the computer for processing:—

(a) Ground speed and drift angle from the Doppler navigation system (*Chap.* 3, *this Section*).

(b) Heading information from the heading servo repeater unit in the IFIS installation (*Sect.* 7, *Chap.* 8, *this Cover*) via the control and release computer in the attack system (*para* 29).

(c) Target marker datum setting from the along heading and across heading rate controls at the radar set control (*para* 25).

The inputs to the computer are used in ground

stabilizing the target marker at the position set by the observer. Range and bearing determined by the target marker are then fed to the strike sight control and release computer, where they are used in the generation of the range circle and deflection of the target circle respectively on the pilot's display unit (*para* 43).

Azimuth range indicator

21. This unit, C-CB, is the observer's radar display and shows the location of echoes relative to the aircraft on a PPI sector or B scan display. A target marker appears on the c.r.t. as a radial bearing marker crossed by a single marker pip at target range, which may be positioned about the target by an output from the target marker computer (*para* 20) or the radar tracking system. The target marker computer positions the marker automatically or to the demands of the observer's radar set control.

22. The radar tracking system controls the marker in the track phase in which the aerial does not scan and the marker takes the form of a radial line, indicating the target bearing with respect to the aircraft heading, while a bright dot indicates the target range. A radar lock, amber lamp, positioned on the upper front face of the unit, is illuminated during this phase.

23. The track marker, which is controlled by the target marker computer, may be substituted for the target marker by selection of the track marker push-switch on the radar set control (*para* 25). Information may then be obtained regarding the track of the aircraft relative to aircraft heading. Controls on the lower face of the indicator provide range scale selection, display signal level and brightness, range and bearing marker brightness, MRE selection and sharpness, with finally target marker pip blackout.

24. With MRE (monopulse resolution enhancement) selected IN on the indicator, a narrower azimuth r.f. beam is simulated by reducing the echo smear on the display during the search mode, while the picture sharpness may be adjusted by a rotary control at the extreme right of the indicator. A blue indicating lamp to the right of the radar lock lamp is illuminated on failure of the pod pressurization system.

Radar set control

25. The radar set control, C-CD, is a movable pistol grip assembly positioned forward of the observer's right hand. The unit incorporates the radar main on-off switch, the along heading and across heading rate controls, the phase change switch, track marker and scanner elevation switches. A fore and aft movement of the grip controls the along heading rate, while a lateral movement controls the across heading rate. The phase change switch is incorporated in the grip handle while the remaining switches and controls are positioned on the side mounting of the assembly.

Indicator control

26. The indicator control, C-CC, located directly forward of the observer, provides control of the search and fire control radar and strike sight system, via the following control and switching arrangements:–

(1) *Search and fire control radar*

(a) LONG RANGE–SHORT RANGE and associated thumbwheel selectors 0-240 NM and 0-30 NM

(b) O – O+D – N – IP (target marker computer input selector: offsets, offsets plus Doppler, normal and identification point)

(c) BEARING (two off, offset bearing rotary controls)

(d) C – N (scanner cage)

(e) HT RESET

(f) RR – N – TW (radar ranging, normal and terrain warning)

(g) DTM – RR (discrete target marker and radar ranging)

(2) *Strike sight system*

(a) TARGET SPEED, 0 – 60 knots

(b) TARGET COURSE, 0 – 360 deg

(c) WIND SPEED, 0 – 60 knots

(d) WIND DIRECTION, 0 – 360 deg

(e) HGT ABOVE BURST, -5–0–+5 and an associated switch marked x 10^2 – x 10^3

(f) AM DEPRESSION, 0 – -10 deg DSL or + 2½ – -2½ deg DT (aiming mark depression)

(g) MRG, OUT – IN – TVC – LAG (master reference gyro, target velocity compensation and lead angle generation selector)

(h) DTPU, 8–11 sec (dive toss pull-up)

(j) ST SIG, OUT–IN (steering signals)

(k) COMP, OUT–IN (control and release computer)

27. The above controls enable the observer to set in offsets, wind and target velocities, height-above-burst and aiming mark depression selections together with the target marker computer modes of operation. Offsets are used in an attack against a target which is not visible to radar but of known range and bearing from a radar or optically visible point.

STRIKE SIGHT SYSTEM

General

28. Strike sight is a sighting and computing system which permits the delivery

of a primary store in the long toss bombing mode and the delivery of conventional stores in the medium toss or dive attack modes. It provides the pilot with visual signals to enable him to steer the aircraft from initial location on to a target collision course and to perform the delivery manoeuvre. The system comprises the following items of equipment:—

Control and release computer
Gyro unit
Display waveform generator
Pilot's display unit
Junction box
Ballistic plugs (7 off)

The type of weapon and the method of delivery are selected as described in Cover 3, Sect. 10; except where otherwise stated the following description applies to the delivery of a primary store by the long toss method.

Description

Control and release computer

29. The primary functions of the control and release computer, N-BS, are to compute the start of pull-up, instant of store release and to control the state of the pilot's display. It is mounted on the forward face of the cockpit front pressure bulkhead and consists basically of release computation and azimuth control circuits, display and gyro drive circuits and triggering, switching and power circuits.

30. Pull-up and release computations are effected by four servo mechanisms, the shaft positions of which represent the four variables of elevation, speed, horizontal distance to the target and height relative to the required burst height. Basic position inputs to the servos are rate of climb, ground speed, range, height above burst, estimated wind and target speed, the latter three items being set in by the observer on the indicator control. The basic inputs are processed to set up the variables before pull-up.

31. The servos continually store the information until pull-up, when they are switched by relays in the computer from servos with position inputs into integrators with rate inputs. In this way, correction terms which modify the stored information are obtained by integrating the outputs of the vertical and longitudinal accelerometers contained in the gyro unit.

32. The outputs of the release servos are fed to the trigger circuits which detect the satisfaction of the pull-up and release equations and transmit signals to this effect to the appropriate user equipments. From the operations involved in computing the pull-up point, the trigger circuits generate a 3-second warning signal of the imminence of pull-up. The signal is routed to the waveform generator and processed to produce the upper event marker for display in the pilot's display unit (*para* 43). At the pull-up instant, a pull-up rate demand signal is fed, via the gyro unit and waveform generator (*para* 40 *and* 45 *respectively*), to the display to precess the target circle upwards. When the release equation is solved a signal is transmitted to the firing relays in the armament installation (*Cover* 3, *Sect.* 10, *Chap.* 3) for subsequent store release.

33. The other basic computing operation is that concerned with the control of the aircraft in azimuth before pull-up and it is required that the aircraft shall fly a target collision course prior to pull-up.

34. The azimuth control circuit consists mainly of a bank servo and a heading servo, the inputs to which are derived from the MRG and the heading servo repeater unit respectively (*Sect.* 7, *Chap.* 8, *this Cover*). The bank and heading inputs may be switched out on the indicator control if the information is suspect, in which case they are replaced by simulated zero bank and true north inputs. Resolvers on the heading servo shaft have inputs of northings and eastings of target and wind speed which are resolved into along and across heading components.

35. The total across heading component is resolved with bank angle and fed to the gyro drive circuits which, via the gyro unit and the waveform generator, offset the aiming spot during approach so that a collision course is flown.

36. With the aircraft operating in the long toss or medium toss attacks, the radar locked on, and the indicator control (*para* 26) selected to LAG or TVC, a facility is provided in the control and release computer for automatic compensation for wind and target velocities. This obviates the necessity for selecting wind and target speeds on the control indicator.

37. The computer incorporates ballistics for 600 lb bombs only, while the ballistics for conventional stores are provided for by the fitment, prior to flight, of two ballistic plugs to a junction box (*para* 38). The configuration of the control and release computer is arranged to suit the required mode of attack by changing the switching inputs according to the settings of the weapon and attack selector switches (*Cover* 3, *Sect.* 10, *Chap.* 2); with no input applied, the long toss mode is selected. In the medium toss and dive toss bombing modes, a resistance

analogue in the bomb distributor (*Cover* 3, *Sect.* 10, *Chap.* 3) modifies the release equation so that the stick of bombs straddles the target. In the auto DSL (depressed sight line) mode the resistance analogue in the distributor is not used, the weapon selector switch may be selected to either BOMBS A or BOMBS B and a 'double accept' technique described in Cover 3, Sect. 10, Chap. 3 must be employed. Except for these differences the auto DSL mode of release is similar in electrical operation to the medium toss mode. For lay-down, varitoss, manual DSL (depressed sight line) and manual RR (radar ranging) attacks, additional inputs routed via the attack selector switch inhibit the computer release circuits, with the strike sight system providing only the required sighting.

Junction box

38. Junction box N-CM, in the nose compartment, provides for the interconnection of various units of the installation, some of these interconnections being routed directly through the box, while others are routed via plug and socket connectors and components within the box. Mounted on top of the junction box are two 10-pole sockets, marked BOMBS, A–B respectively, which accept the various ballistic plugs (*Para* 39) fitted according to the type of conventional stores carried by the aircraft; two changeover relays, K and M, a transformer L, and a terminal block N, form part of the associated control circuit which is interconnected with the control and release computer.

Ballistic plugs

39. Seven ballistic plugs are provided to enable the release equations for medium toss and dive toss attacks to be adjusted to suit the differing ballistics of the various types of conventional bombs which can be carried. The junction box (*Para* 38) provides for the installation of any two plugs for a given flight, and these are fitted according to the conventional stores being carried (*Cover* 3, *Sect* 10, *Chap* 3). The plugs, each of which has a resistance network representing the ballistics of the particular bomb are as follows:-

YEU-73-1	1 000 lb bomb
YEU-74-1	500 lb bomb (free fall)
YEU-77-1	500 lb bomb (ejected)
YEU-78-1	540 lb bomb (free fall)
YEU-79-1	540 lb bomb (ejected)
YEU-75-1	28 lb bomb (free fall)
YEU-102-1	28 lb bomb (ejected) (post-Mod 5356)
YEU-76-1	25 lb bomb (free fall) (pre-Mod 5356)

Note...

(1) Any mode of release applicable to bombs can be performed when operating with practice bombs

(2) The installation of ballistic plugs in junction box N-CM is described in AP 101B-1202-1A, Cover 1, Sect 2, Chap 5A. Wiring diagrams of the plugs, junction box and associated circuits are in Sect 9 of AP 101B-1202-10A.

Gyro unit

40. The gyro unit, N-BT, mounted adjacent to the control and release computer on the forward face of the cockpit front pressure bulkhead, contains an aiming spot gyro, a target circle gyro, a vertical accelerometer and a longitudinal accelerometer. The gyros are twin axis rate gyros which cause deflections of the display according to signals from the computer and, in addition, provide smoothing for the display symbols against aircraft short term oscillations. The accelerometer outputs of vertical and horizontal acceleration are used during pull-up to provide information on the angle pulled through and on the variation in aircraft velocity for the release computation.

41. The deflection of the gyros is a function of the positional demand and the rates of yaw and pitch of the aircraft. Their sensitivity is adjusted according to the particular phase of an attack by the gyro drive circuits which are, in turn, controlled by the trigger circuits.

42. During the approach both gyros have the same low rate sensitivity which, at the instant of pull-up, is reduced for 1/2 sec in order to centralize the gyros and hence the aiming spot and target circle. During pull-up, the sensitivity of the aiming spot gyro is restored to its approach value but that of the target circle is made high in order to demand a 7 deg/sec pull-up rate.

Pilot's display unit

43. The pilot's display, C-CA, consists basically of a cathode ray tube, an optical system and an e.h.t. unit. The display appears on the face of the c.r.t. as a pattern of green lines and is reflected by a mirror on to a partial reflector in the pilot's line of sight. The optical system is collimated such that the display, which is superimposed on a view of the outside world as seen through the partial reflector, appears to originate at infinity. The e.h.t. unit functions solely to provide power for the c.r.t.

44. The display is made up of two groups of symbols, the target circle and roll bar forming one group and the aiming spot, range circle, speed scale, event marks, pull out range indicator and range quadrantal marks forming the other. To correlate the display, all the symbols of a group are made to move together although the groups move independently of each other.

Display waveform generator

45. The display waveform generator, N-BV, located on the port side of the aircraft beneath the observer's cockpit floor,

produces the waveforms required for the presentation of the symbols on the pilot's display. Circular symbols are derived from sine waves passed through resolving networks and linear symbols from triangular waveforms.

46. Aiming spot and target circle deflection signals from the gyros are added to the display waveforms of their respective groups of symbols to offset them as required. A bank input from the computer is used to revolve the roll bar about the target circle and a range input to indicate range to the target by the progressive shortening in a counter clockwise direction of the line which forms the range circle.

47. A bright-up waveform applied to the control grid of the c.r.t. permits only the presentation of those parts of a symbol that are required, i.e. the roll bar which would otherwise be a continuous straight line, and regulates the combination of symbols displayed at any time. Occulting signals from the computer control the bright-up waveform and hence the display state. The speed scale pointer is positioned by an input of true airspeed from the air data system (*Sect.*7, *Chap.*8, *this Cover*).

Note...
Eight preset potentiometers on the external case of the waveform generator allow harmonisation of the display symbols on the pilot's display unit during the alignment procedure (*para* 50).

Power supplies

48. 200-V, 3-phase, 400-Hz a.c. and 28-V d.c. supplies for the attack system are routed via the contacts of two relays, H (panel N-E) and E (panel N-F) respectively. Selecting the ON–OFF switch on the radar set control (*para* 25) to ON energizes both relays and a.c. is routed from fuses on panel A-D via relay H contacts and thence via sub fuses to the equipment. Simultaneously, d.c. is fed from fuses on panel C-Q via relay E contacts to the attack system and also to the IFIS navigation display (*Sect.*7, *Chap.*8, *this Cover*). A further d.c. supply from panel C-Q is fed directly to the terrain warning lamp (*para* 10) for test purposes.

SERVICING

Strike sight

Reflector and lens assembly

49. The reflector and lens assembly must only be cleaned using alcohol BS 1595 and lens tissue.

Strike sight alignment jig

General

50. The jig, Part No. YB3-88-5335, illustrated in fig 1, facilitates initial alignment, and subsequent alignment when a unit is changed, of the strike sight system pilot's display unit (PDU) and gyro unit to the aircraft horizontal datum. A working datum is derived from the horizontal datum by relation to the nose fold latch pins to which the jig is attached.

Note...
Refer to note following para 47 for harmonization of the display symbols on the pilot's display unit during strike sight alignment procedure.

50A. Alignment procedure also involves use of the strike sight alignment telescope and test set Type 1 and is detailed in A.P. 112E-0402-1, Cover 2, Sect. 1, Chap. 4.

Description

51. The jig is a welded tubular mild steel structure and carries two steel brackets, on each of which a collimator unit may be accurately located. The upper bracket has a suitably-machined area on which the upper collimator base plate is mounted and the lower bracket is welded to the aft face of the jig vertical member and is machined to accept the lower collimator base plate. Both collimator base plates are located by dowels and secured by nuts and bolts.

52. The jig is attached to the aircraft at the three male nose fold latch pins on the forward face of frame 68. Taper cup fittings on the jig engage with the latch pins and are retained by captive locking pins. With the jig in position on an aircraft, the upper collimator unit falls within the pilot's line of sight and is used solely for calibration of the alignment telescope. The lower collimator is used in conjunction with a permanently-attached mirror on the gyro unit datum face to check the alignment of the gyro unit relative to the aircraft horizontal datum. The collimator units are permanently

dowelled and bolted to their base plates. The units, complete with base plates, are peculiar to their associated jig and, although removable, are not interchangeable.

53. On the upper forward face of the jig is bolted an I-shaped platform which is machined and shimmed to within 0 deg 5 min of the aircraft pitch and roll axes. The platform is used as a base for a clinometer to verify that the jig is aligned to within 0 deg 30 min of the MRG in the pitch and roll axes.

54. The 28-V d.c. supply required to illuminate the collimator graticules is obtained from the strike sight test set Type 1 and is routed to the collimators via a junction box mounted on the jig.

55. Before attaching the jig to the aircraft the nose must be folded and secured with the jury strut provided.

Function tests

56. Function tests on ARI 5930 and the strike sight system are in A.P.101B-1202-4A3(R).

REMOVAL AND INSTALLATION

Radar set (fig 2)

General

57. The removal and installation of the search and fire control radar set is effected using the gantry, Ref No. 26NA/95341, and Minilift hoist illustrated in fig 2.

Note...

(1) *With STI/Bucc/341 embodied radar sets of any modification state may be installed in the attack system.*

(2) *If the aircraft is to be flown with the radar set removed and it is desired to maintain the same flying characteristics as would be achieved with the radar set fitted, the appropriate weight of ballast must be fitted to the radar set mounting as described in A.P.101B-1202-1A, Cover 1, Sect.2, Chap.2 and 3.*

Gantry

58. The gantry consists of an I-section alloy beam supported at both ends by an alloy plate frame assembly. A trolley, designed to carry a Minilift hoist secured by webbing straps, is free to move along the beam on rollers unless secured at the forward end by a quick-release pin which passes through the web of the beam. The forward end frame is pivoted about the end of the beam and locked in position by a tubular steel stay. The stay is secured by a quick-release pin to a lug on the underside of the beam. When folded for stowage, the frame is pinned to the lug and the stay is pinned to the trolley.

Attachment of gantry to aircraft

59. The gantry aft end frame is located at the port engine air intake safety guard upper strap securing pin and the forward end frame is secured to the aft frame of the folding nose by a pin-locked swivel bracket.

Removal procedure

60. (1) Remove the radome (*A.P.* 101B-1202-1A, *Cover* 2, *Sect.* 3, *Chap.* 1A).

(2) Open the folding nose and secure with the jury strut provided.

(3) Open the gantry forward support stay and lock in position with the quick-release pin.

(4) Secure the Minilift hoist to the gantry trolley.

(5) Release the port engine air-intake safety guard upper securing pin.

(6) Lift and secure the gantry into position between the nacelle and the aft face of the folding nose. Using the quick-release pin provided, lock the swivel bracket on the forward end frame assembly in position over the spigot on frame 65-8.

(7) Disconnect the two 91-pole plug and socket breaks at the radar set.

(8) Secure the hoisting adapter to the upper horizontal lifting bar and attach both upper and lower bars to the radar set with wing bolts.

(9) Secure the front handling frame to the lifting bars with the four knurled nuts.

Note...

The hoisting adapter, lifting bars and handling frame are described in A.P. 114P-0100-1C.

(10) Engage the Minilift hook with the hoisting adapter and take up the slack on the cable.

(11) Locate the two captive bolts securing the radar set to the aft face of the radar pod (*detail* B). Remove the locking plate (starboard) and locking wire (port) and unscrew both bolts.

(12) Remove the two bolts securing the radar set upper mounting on the forward frame of the folding nose section (*detail* A). Rotate the scanner aerial to its upper extremity, retain it in that position to avoid causing damage to the radar equipment and remove the two bolts from the lower mounting.

(13) Take the weight of the radar set on the Minilift hoist, slide carefully out and lower to a position four feet from the ground.

(14) Attach the rear handling frame to the horizontal lifting bars with four knurled nuts and tighten the two locating screws at either side of the frame.

(15) Lower the equipment on to a suitable trolley or take the weight at the four lifting handles on the handling frame and disengage the Minilift hook from the hoisting adapter.

(16) Refit the two pairs of mounting bolts for safe keeping.

Note...
If the aircraft is to be flown with the radar set removed, reference must be made to A.P.101B-1202-1A, Cover 1, Sect. 2, Chap. 2 for ballast fitting and pressure sealing procedures.

Installation procedure

61. (1) Remove the radome (*A.P.*101B-1202-1A, *Cover* 2, *Sect.* 3, *Chap.* 1A), open the folding nose and secure with the jury strut provided. Remove any ballast or seals, if fitted, by reversing the procedures detailed in A.P.101B-1202-1A, Cover 1, Sect. 2, Chap. 2 or, remove the two pairs of bolts fitted at the upper and lower mounting points. Position the radar set, complete with handling frame and hoisting adapter attached, beneath the Minilift hoist and engage the lifting hook.

(2) Take the weight of the radar set on the Minilift hoist and remove the rear handling frame by releasing the two locating screws at the rear of the frame and the four knurled nuts.

(3) Raise the radar set to a level such that the nylon blocks on the set are aligned with the mating channel in the pod.

(4) Slide the radar set carefully into the pod, locate it on the mounting spigots and tighten the two captive bolts on the rear face of the pod into the radar set aft mountings. Secure the two bolts in the upper forward mounting, rotate to and retain the scanner at its upper extremity and secure the two bolts in the lower forward mounting. Fit the locking plate to the starboard captive bolt head, wire-lock the port captive bolt (aft mountings) (*detail* B) and wire-lock the two pairs of bolts in the forward mountings (*detail* A).

(5) Disengage the Minilift hook, remove the front handling frame and both lifting bars and connect the two 91-pole plug and socket breaks.

(6) Remove the gantry from the aircraft and screw down the locating pin on the port engine nacelle.

(7) Ensure that the scanner has unrestricted movement before closing and locking the nose and replacing the radome.

(8) Remove the Minilift hoist from the gantry trolley before folding the gantry for stowage.

Strike sight display unit

62. The pilot's display unit can be removed, without disturbing the instrument panel shrouds, as follows:-

(1) Unscrew the three quick-release fasteners and disengage them from the slotted lugs on the sides of the unit.

(2) Disconnect, from the starboard front end of the unit, the cable loom quick-release socket.

(3) Use a screwdriver to release the spring-loaded captive bolt on each side of the unit.

(4) At the port side of the unit remove the $\frac{3}{8}$ in. UNF bolt and cup washer which secure the body of the unit to the dependent support strut.

(5) Gently ease the display unit rearwards and away from its mountings.

Strike sight display waveform generator

63. Removal of the strike sight display waveform generator, from its mounting cradle, is a straightforward operation and needs no explanation, but certain precautions must be observed during installation. The cylindrical canister of this unit is pressurized to approximately 5 p.s.i. in excess of atmospheric pressure and careless tightening of the retaining straps can distort the canister to the extent that internal pressure is lost. Extreme care should, therefore, be exercised when tightening the retaining straps and, during the process, it is desirable to frequently move the straps from side-to-side to ensure the correct 'lay'.

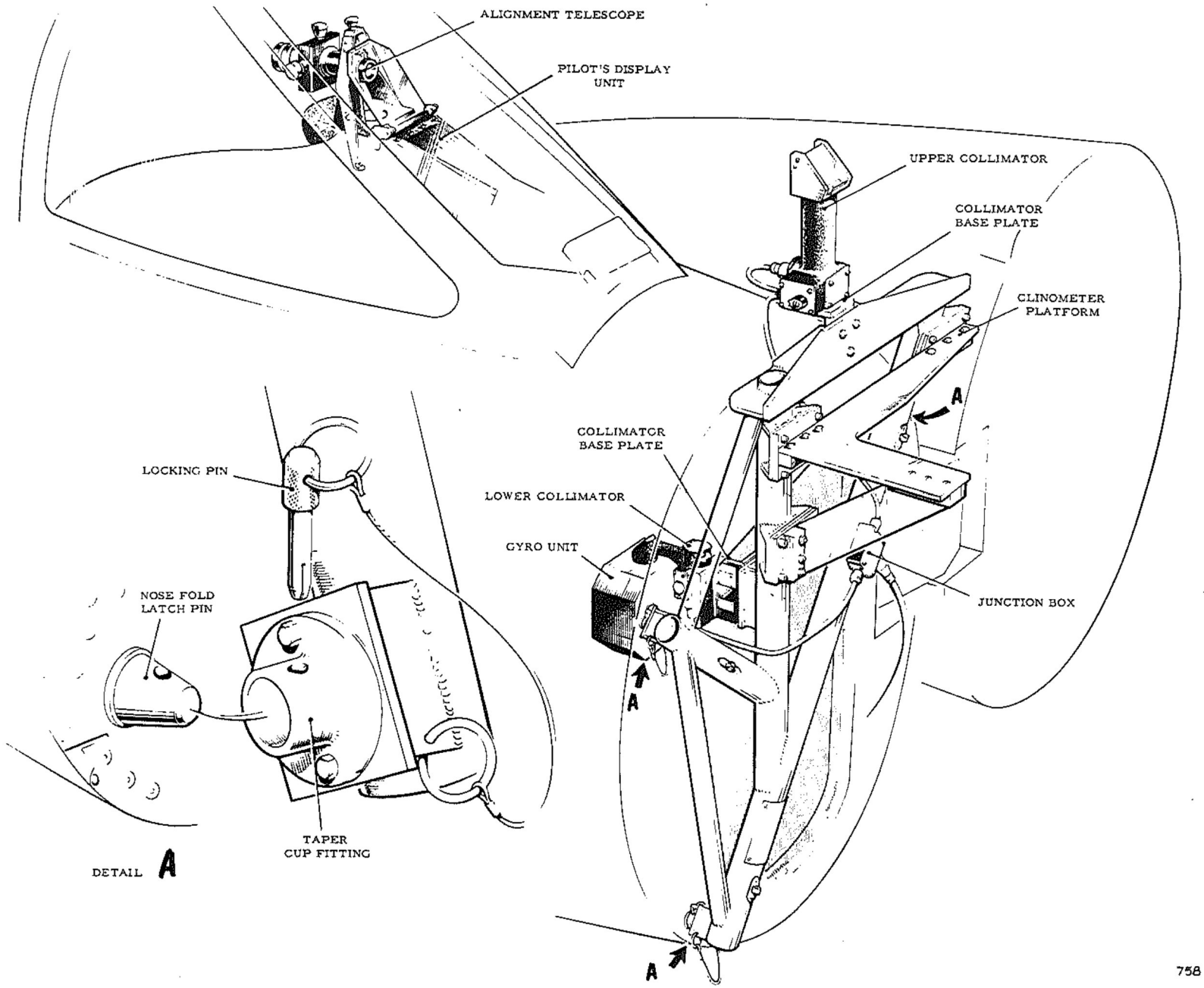

Fig.1 Strike sight alignment jig

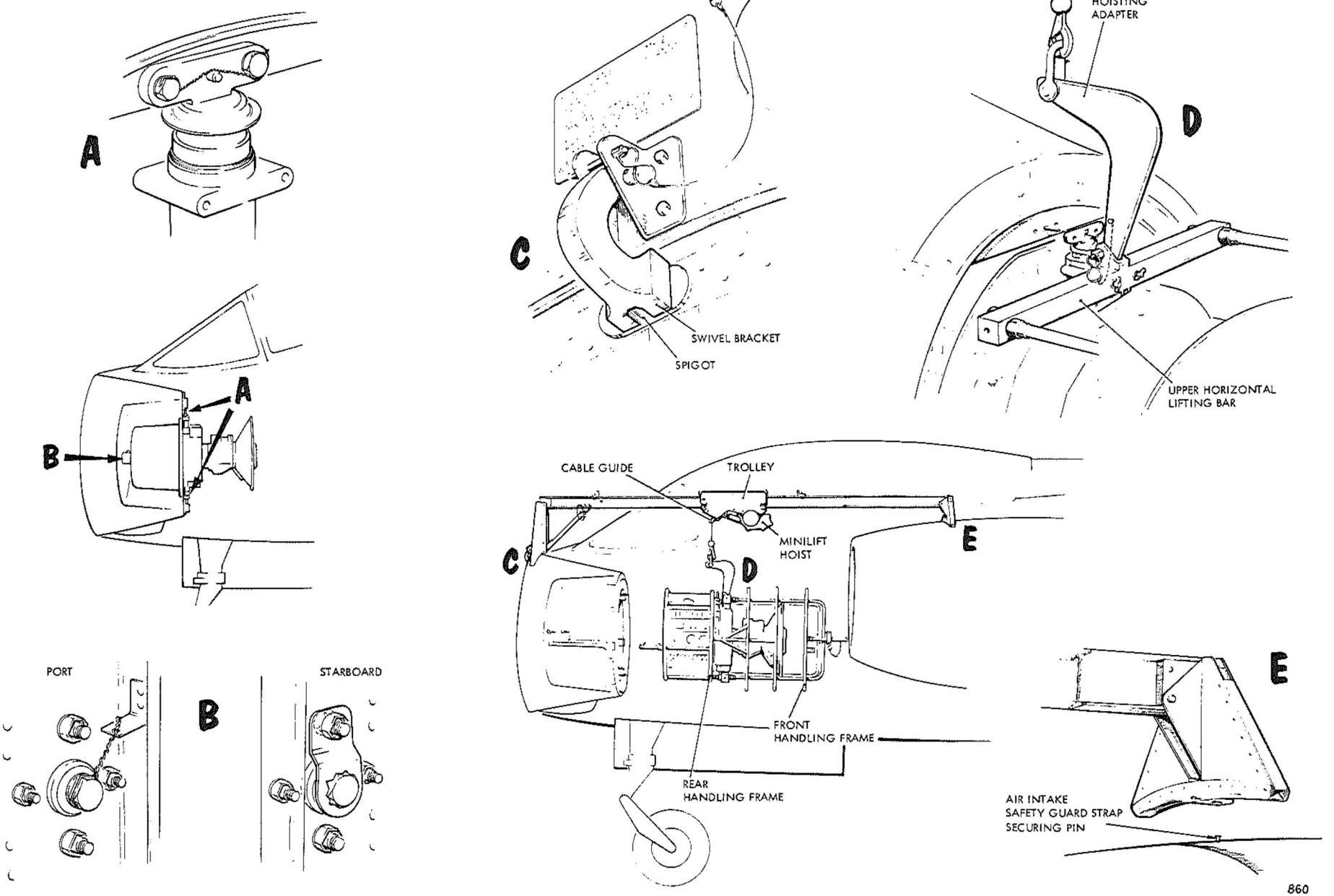

Fig.2 Radar set — removal and installation

LIST OF APPENDIXES

Appendix 2 ATTACK SYSTEM (pre-Mod 1342)

ILLUSTRATION

1. Prior to Mod 1342 the wiring of junction box N-CM is as shown in fig 1. The wiring from pin F of both BOMBS A and BOMBS B sockets is routed directly to terminal 1 of T.B.N. With the exception of these wiring differences the circuitry and function of the junction box remains as described in the basic Chapter.

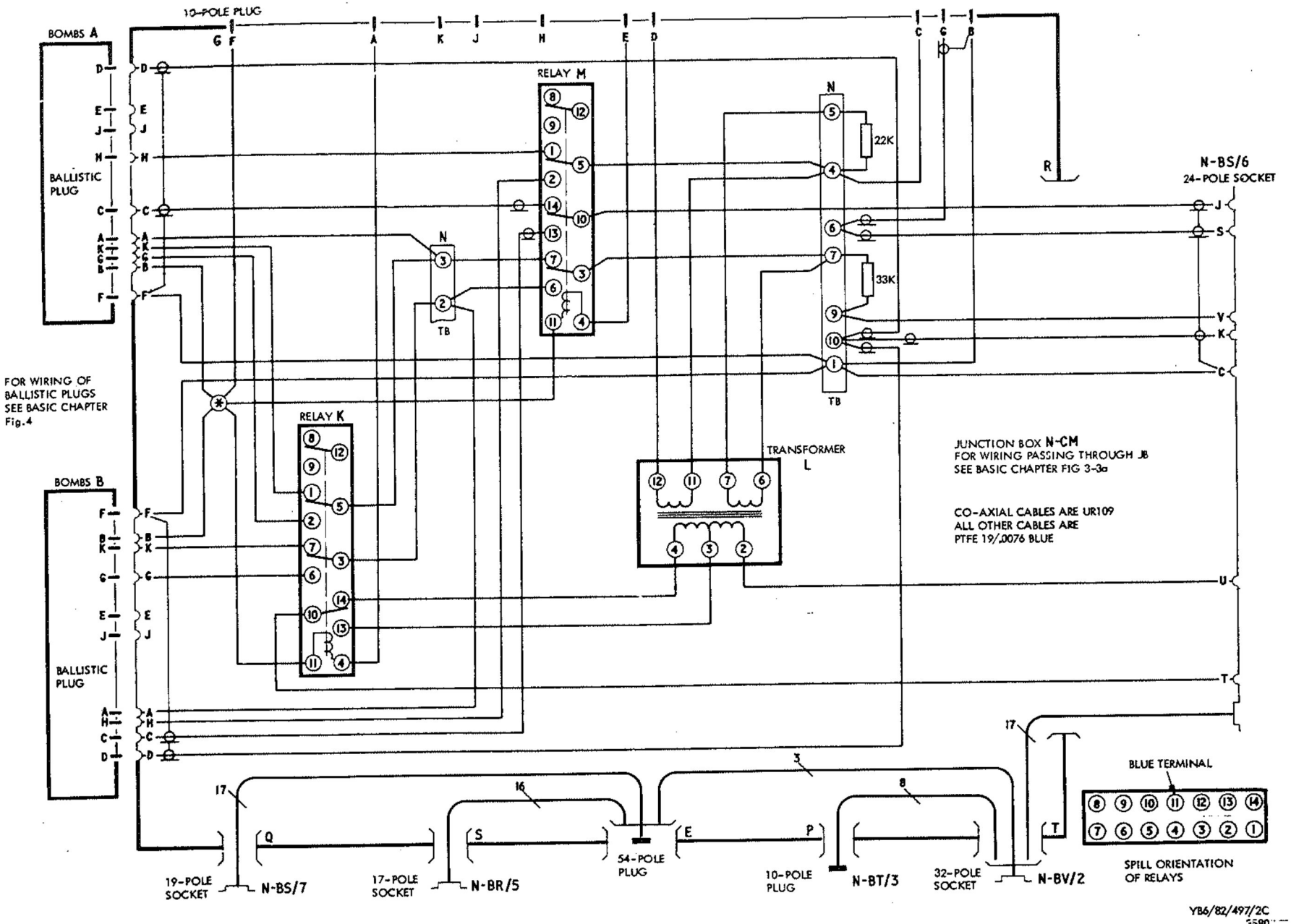

Fig. 1. Junction box N-CM
(Cross-reference amendments)

Appendix 3 ATTACK SYSTEM (pre-Mod 1585)

LIST OF CONTENTS

Introduction

1. Prior to the embodiment of Mod 1585, the attack system indicator control and azimuth range indicator are of a different type to those described in the basic Chapter. Associated wiring differences in the control wiring are shown in the corresponding appendix in the SDM. With the exception of the difference in the facilities available via the indicator control and azimuth range indicator, the installation function remains as described in the basic Chapter.

Indicator control

2. The indicator control provides control of the search and fire control radar and strike sight system via the control and switching arrangements detailed as follows:–

(1) *Search and fire control radar*

(a) RANGE OFFSET, 0-50 – 0-250

(b) O – O+D – N – SEARCH – IP – M (target marker computer input)

(c) RANGE (offset)

(d) BEARING, 0–9 (offset)

(e) C – N (scanner edge)

(f) RR – N – TW (radar ranging, normal and terrain warning)

(g) DTM – RR (discrete target marker and radar ranging)

(h) HT RESET

(2) *Strike sight*

(a) TARGET SPEED, 0–60 knots

(b) TARGET COURSE, 0–360 deg

(c) WIND SPEED, 0–60 knots

(d) WIND DIRECTION, 0–360 deg

(e) HEIGHT ABOVE BURST, -5 – 0 – +5 and an associated switch marked X100 – X1000

(f) AM DEPRESSION, 0 – 10 (aiming mark depression)

(g) MRG, OUT – IN (master reference gyro)

(h) DTPU, 8 – 11 secs (dive toss pull-up)

(j) ST SIG, OUT – IN (steering signals)

(k) COMP, OUT – IN (control and release computer)

3. The above controls enable the observer to set in offsets, wind and target velocities, height-above-burst and aiming mark depression selections together with the target computer modes of operation. Offsets are used in an attack against a target which is not visible to radar but of known range and bearing from a radar or optically-visible point.

4. The indicator control, Ref No. 5841-99-195-3692, is compatible with either pre- or post-Mod 1585 radar set wiring installations.

Azimuth range indicator

5. The indicator is similar to the unit described in the basic Chapter and performs the same basic functions; the control and switching arrangements are as follows:-

(1) Amber indicating lamp (radar lock)

(2) Blue indicating lamp (pod pressurization warning)

(3) Range selector control marked ¼M – ½M – 1M – 3M – 60 -240 – EXP

(4) EXP.SW, 1 – 2 – 3 (expansion switch, together with the range selector controls range scales and determines the type of display)

(5) SENS.MAX (varies the amplitude of signals applied to the video amplifier circuits in the indicator)

(6) DIFF, LONG – SHORT – OUT (lessens the effect of long or short duration clutter, selected to OUT the circuit is inoperative.

(7) BRILL. (adjusts the brightness of the c.r.t. display)

6. A target marker appears on the c.r.t. as a radial line broken by two arcuate lines which may be positioned about the target by an output of the target marker computer or the radar tracking system. The tracking system controls the marker in the track phase in which the aerial does not scan and the marker takes the form of a radial line broken by two bright dots which mark the target.

7. The azimuth range indicator Ref No. 5841-99-956-3653 or 5841-99-107-8120, is compatible with either pre or post-Mod 1585 radar set wiring installations.

Appendix 4 ATTACK SYSTEM (pre-Mod 1446)

LIST OF CONTENTS

Introduction

1. On pre-Mod 1446 aircraft a weapons system recorder provides a photographic record of the series of events during an attack as seen by the pilot on his display. With the exception of the differences described in this Appendix and the wiring differences shown in the corresponding Appendix in Sect.9 of the SDM, the system is as described in the basic Chapter.

Weapon system recorder

2. The recorder, N-BU, is in the underside of the folding nose between station 42.06 and station 65.8 and is protected by a fairing. The unit incorporates a 16 mm cine camera driven by an electric motor, a cathode ray tube and an optical system. The camera has two taking lenses, one looking forward through an aperture in the fairing to present a view of the outside world while the other gives an equivalent view of the monitor c.r.t. which receives the same waveforms as the pilot's display and hence provides an identical presentation.

3. The recorder motor runs continuously with power connected to the installation, but on pre-Mod 1338 aircraft, or with the camera control switch (*para* 6) selected to AUTO no pictures are taken until the first symbol additional to the airspeed scale appears on the pilot's display. At this point the camera commences taking pictures at the slow framing rate – one frame per fifteen seconds – in response to a signal from the display waveform generator. This rate is continued until the appearance of the accept mark on the display, when, on receipt of a further signal from the waveform generator, the fast framing rate of fifteen frames per second is initiated. At the instant of weapon release, filming is discontinued, but if either the target reject push-switch or the weapons release trigger switch (*Cover* 3, *Sect.*10, *Chap.*2) is operated previously, the camera will revert to the slow framing rate.

4. With FAST selected on the camera control switch, the camera operates as described in para 6. Throughout the operation the camera motor runs at a constant speed, irrespective of the framing rate, the changes in filming speed being achieved by an electro-mechanical pulsing unit incorporated in the recorder drive mechanism.

Weapons system recorder display supply and control unit

5. This unit, N-CZ, is in the folding nose adjacent to the weapons system recorder. It derives the weapons system recorder c.r.t. power supplies from the aircraft 200-V, 400-Hz supply and carries six c.r.t. display preset potentiometer adjustment controls on an external face.

Camera control switch

6. On aircraft with Mod 1338 embodied a switch, C-KA, marked W.S.R. CAMERA, AUTO–FAST, at the port side of the observer's cockpit, provides control of the framing rate of the weapons system recorder. With power on the search and fire control radar and the switch selected to AUTO, the recorder camera is controlled by signals received from the display waveform generator during the attack phase. With the switch selected to FAST, the camera will take pictures at the fast framing rate irrespective of the attack phase until the moment of weapon release when filming is discontinued.