2-1. FUNCTIONS OF THE AN/ASG-15
FIRE CONTROL SYSTEM

2-2. GENERAL

2-3. This manual comprises operational check and maintenance instructions for the AN/ASG-15 Fire Control System which is installed on B-52G aircraft AF57-6468 and on. The armament equipment of the fire control system together with the search and track radar form a system of defensive armament on the B-52G aircraft.

2-4. The system is operated by a gunner who is seated in the 41 section of the aircraft. At the gunner's position are located the controls necessary to turn on the fire control system and to place it in its different modes of operation. Search and track radar information is displayed on the radar indicator which is located in front of the gunner. A line of sight indicator gives the position of the line of sight servos.

2-5. In its search function, the system makes use of the search radar which is viewed on the radar indicator. The gunner is able to scan a substantial part of the rear hemisphere. If an enemy fighter is detected in the search mode, the gunner enters acquisition mode and attempts to lock on the target with the track radar. When the track radar locks on the target, the system will receive inputs of target position and range from the radar equipment which, along with airspeed, air pressure, and air temperature information, make up the necessary inputs for the system to compute the correct gun line angle of the gun turret. See Figure 2-1 for a cabling diagram and Figure 2-2 for equipment location of the FCS.

2-6. SEARCH

2-7. A functional system data flow diagram of the normal radar track mode is shown in figure 2-3. The search radar antenna is a continuously scanning device which is used for both transmission and reception of radar signals. High voltage pulses generated in the search modulator are fed into a magnetron where it causes the magnetron to oscillate at the radar frequency for the duration of the high voltage pulse. Through duplexing waveguides, the high frequency pulse is fed to the search antenna. The antenna radiates the pulses generated by the search transmitter circuits in a helical scanning pattern and also receives the returned echoes of pulses which are reflected by a target. The pulse repetition rate is governed by a multivibrator in the target position computer. Through the duplexing waveguides, the received pulses are fed into the search radar receiver section where the signals are mixed with the local oscillator frequency. The mixed frequencies are thereby converted into a 30 mhz intermediate frequency which is then amplified in intermediate-frequency amplifiers in the search frequency converter transmitter and pulse sweep generator. The pulse sweep generator contains the circuits for converting the RF pulses and antenna position voltages into signals for the B and C scope presentations of the search system.

2-8. TRACK

2-9. The purpose of the track radar is to supply tracking and range information to the turret loop and computer. The radar tracking function will take place after a target has been detected during search operation and locked on to in range by the track system. The track radar makes use of a dual antenna through which one single pulse will furnish complete deflection and elevation information of the target position. The transmission of pulses is accomplished as in the search radar and is triggered by the target position computer multivibrator in intervals so that there is no interference between the received echo pulses of the two radar systems. A sum and a difference signal is derived from the echo pulses by the use of magic tee waveguides. These signals are fed into the target position computer where they are converted into error signals and range information. The range information is supplied to the radar indicator for visual range indication on the scope and to the range servo in the computer. The output voltage of the range servo is used in the sensitivity squaring servo for computation of the modified time of flight. The sensitivity, the output of the sensitivity squaring servo, is fed to the ballistics computer as are the outputs of the azimuth and elevation data servos, the relative density servo, and the true airspeed servo. The ballistics circuits derive the ballistics corrections used in the calculation of the prediction angles in the prediction computer. The prediction angles are the horizontal and vertical angles by which the guns must lead the track antennas. These angles are corrected for the aircraft motion by inputs from the cross-roll gyro and the azimuth and elevation gyros. The output of the prediction computer controls the government of the antenna servos, and the prediction rate generated in the antenna servos is fed to the rate amplifiers which are part of the azimuth and elevation gyro circuits. The azimuth and elevation gyros also receive tracking rate information from the aided rate servos which receive the azimuth and elevation error signals from the phase discriminator chassis in the target position computer.
2-10. Turret rate signals, the output of the gyro circuits, drive the torque motors in the azimuth and elevation gyros in the turret. The position of the gyro torque motor shaft determines the voltage output of a microsyn generator. This voltage (turret rate) is amplified in the turret servo amplifiers and is then used to energize the control solenoids of the hydraulic valves in the turret hydraulic transmission.

2-11. The above operating phases or modes of the system are but a few of the many modes of operation. In addition to the normal modes of operation, there are several emergency and auxiliary modes which permit various emergency methods of operation using part of the system or auxiliary capabilities of the system. A detailed analysis of the system modes and circuits involved will be given in system modes description.

2-12. DESCRIPTION OF THE SERVO SYSTEM COMPONENTS

2-13. AZIMUTH, ELEVATION, AND RANGE INDICATOR

2-14. The azimuth, elevation, and range indicator (figure 2-4) is mounted on the FCS operator's panel which contains all the operating controls for the system. The indicator scope is a dual-gun cathode-ray tube. Two-thirds of the screen area is used for B-type display (range and azimuth) and the remaining area for C-type display (azimuth and elevation). A high-voltage supply, B-video and C-video amplifiers, and a B-sweep amplifier are also included in this unit. An etched, clear-plastic overlay scale covers the face of the scope.

Figure 2-4. Azimuth, Elevation, and Range Indicator

Figure 2-5. Control Panel
2-15. A LIMIT INDICATOR lamp mounted to the left of the scope face lights when the turret is against the limit stops. A TARGET WARNING indicator lamp mounted to the right of the scope blinks when a target appears on the scope within the C sector. Controls for the proper adjustment of presentations are arranged below the screen.

2-16. An external automatic noise level control is installed on the edge-lighted panel to the right of the indicator tube. A cursor intensity control is also installed on the edge-lighted panel to the left of the indicator tube.

2-17. CONTROL PANEL

2-18. The control panel (figure 2-5) contains the switches and indicator lights necessary to turn on the search radar and to prepare the system for operation. The panel is located to the right of the operator to permit easy access to switches.

2-19. LINE OF SIGHT, RANGE, AND WINGSSPAN INDICATOR

2-20. The line of sight, range, and wingspan indicator (figure 2-6) gives the operator the quadrant and the coordinates of line of sight. This is done by positioning a spot of light on a calibrated grid showing azimuth and elevation angles. Behind the indicator grid, a plastic plate supports and illuminates two film strips which are located between the indicator grid and the plastic plate. These film strips travel in horizontal and vertical directions. Each strip is opaqued, except for a clear line across the strip.

As these films are superimposed one on the other, light from the plastic plate will pass through to the operator only where the two clear areas cross. The plastic plate is illuminated by four edge lighting lamps, and therefore can transmit light information through the aperture created by the intersection of the two clear lines. The resulting spot clearly shows the operator which quadrant of aft hemisphere in which the line of sight is pointing.

2-21. CONTROL HANDLES

2-22. The control handles (figure 2-7) are mounted to the panel containing the operating controls. The control handle unit contains the azimuth and elevation hand control units; the manual ranging unit; and the various switches required for Searching, acquiring, and tracking targets.

2-23. The gunner's movable control unit may be extended manually by squeezing a handle located below the control unit. The handle releases a lock mechanism and the control unit, which is mounted on an extendable panel, may then be moved to the desired position by pushing or pulling. When the desired position has been reached, the handle must be released to reengage the lock mechanism. The control unit may be stowed by pulling the unit forward slightly as the handle is squeezed and then pushing the unit forward all the way.

Successful operation of the gunner's ejection seat arming lever and subsequent ejection of the gunner is dependent on the control unit being easily movable since the unit must be stowed by the arming lever during ejection.

2-24. ABSOLUTE PRESSURE PICKUP

2-25. The absolute pressure pickup (figure 2-8) contains a pressure-sensitive bellows linked to a variable resistance unit which constitutes one leg of a Wheatstone bridge. The voltage across this bridge is transmitted to the relative density servo in the computer central.