AC NO: AC 20-76
DATE: 21 Oct 71

ADVISORY CIRCULAR

MAINTENANCE INSPECTION NOTES FOR BOEING B-707/720 SERIES AIRCRAFT

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

AC NO: 20-76

DATE: 21 Oct 71

ADVISORY CIRCULAR

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

SUBJECT: MAINTENANCE INSPECTION NOTES FOR BOEING B 707/720 SERIES AIRCRAFT

1. PURPOSE. This handbook provides maintenance inspection notes which can be used for the maintenance support program for certain structural parts of the B-707/720 series aircraft.

2. DESCRIPTION. Maintenance inspection matters on the wing and fuselage are reviewed with a view toward supplementing information currently available.

3. HOW TO GET THIS PUBLICATION.

   a. Order additional copies of this publication from:

      Department of Transportation
      Federal Aviation Administration
      Distribution Unit, TAD-484.3
      Washington, D.C. 20591

   b. Identify this publication as: Advisory Circular 20-76
      Maintenance Inspection Notes for Boeing B-707/720 Series Aircraft

James F. Rudolph

Director
Flight Standards Service

Initiated by: FS-320

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

APPENDICES

1. INTRODUCTION. This advisory circular provides maintenance information which can be used, but is not required to be used, by mechanics, repair agencies, owners, and operators in developing maintenance programs, making improvements in existing programs, and conducting inspection and repairs on certain structural parts of Boeing B-707/720 airplanes. The material is based, in part, upon information made available through discussions with personnel who have maintained these types of airplanes for thousands of hours of time in service. The intent of the circular is to impart some of this knowledge to other interested persons so that it is not lost.

2. DESCRIPTION. This circular contains guidance material for performing maintenance on wing, fuselage, and empennage structure. The information has been derived from service experience. It does not comprise a full and complete maintenance program for the subject aircraft but should be considered as supplemental maintenance data. Included in the circular are diagrammatic sketches of the control cabin windows and passenger cabin windows. In addition, there is a listing of selected maintenance difficulties which have been reported since 1964.

3. BACKGROUND.

   a. Older Aircraft. The administrator has realized that several different types of transport aircraft are being phased out of service by some airlines because of the availability of newer equipment. Such older aircraft are being purchased by other operators who may not be familiar with the scope of required maintenance and the means which have been used to keep the aircraft in a safe condition.

   b. Maintenance "Know How." Since maintenance "know how" is not transferred with the aircraft, the new operator generally goes through a learning cycle before he is able to rapidly pinpoint the important/critical problem areas of the aircraft. In this respect, identification of known areas where structural problems have been experienced will help in the preparation of an initial maintenance program by a new operator. It also can serve as a guide to other operators who have not accumulated sufficient service experience to have knowledge of all the problem areas of the aircraft.

4. GENERAL DISCUSSION OF STRUCTURE SURVEILLANCE.

   a. Manufacturer's Service Bulletins. The manufacturer has published service bulletins containing its recommendations concerning the inspection, repair, and modification of aircraft. Most of these bulletins cover known areas; however, some are predictive in nature and have been issued even though no fatigue damage has been identified in the fleet. Because of differences in structural configuration, most service bulletins apply only to certain aircraft. Effectivity is shown in each bulletin. Additional bulletins may be published by the manufacturer, and a service bulletin is available from the

manufacturer and is updated periodically. (Note: Although service bulletins may be referred to in Airworthiness Directives (ADs) issued by the FAA, the bulletins do not supersede any of the requirements of the ADs.)

b. Other Documentation. Further, the manufacturer has published the following documents to aid in maintaining the aircraft in serviceable condition:

Maintenance Planning Data Document,
Maintenance Manual,
Overhaul Manual,
Structural Repair Manual,
Non-Destructive Test Document.

This documentation is updated from time to time by the manufacturer.

Structural Item Interim Advisories are published by the manufacturer to notify operators of newly found problems which may be of fleet-wide significance and may or may not be followed by service bulletins.

c. Maintenance Action. For adequate maintenance of the 707 and 720 structure, every operator should have in his possession and be conversant with the above documentation, including service bulletins applicable to his particular aircraft. He should also obtain complete service records from previous owners and become familiar with the structural history of his aircraft, including information on maintenance procedures followed, major repairs made, and preventive modifications and/or repair work incorporated per service bulletins. This is essential to carry out the follow-up procedures required, and to avoid unnecessary work where corrective action has already been taken.

(1) The new operator should contact the manufacturer regarding any areas requiring clarification.

(2) The operator should keep himself informed of new developments and arrange to be supplied with revised and new documentation by the manufacturer. Consultation with the manufacturer and/or more experienced operators should take place from time to time as necessary, to establish which service bulletins have structural significance and when they would best be incorporated.

(3) The maintenance program established by the new operator should reflect changes in environment and usage of the aircraft (e.g., shorter flights, intermittent use, etc.).

d. Problem Areas. Areas with known or predicted problems are presently covered by service bulletins. These areas should remain airworthy with the documented maintenance, inspection, preventive modification and repair procedures. There are other areas that may become critical where predictive methods have not been usable. These are of concern because of the difficulty to observe them regularly, rather than because they are considered suspect and damage-prone. Potential problems involve fatigue or corrosion. These areas are further discussed in Section 8.

5. CABIN WINDOWS. During operation at altitude, the B-707/720 series aircraft passengers and control cabin spaces will be pressurized. In the event either a passenger or control cabin window "blows out" while pressurized, the aircraft will experience an "explosive" or sudden decompression. This occurrence could result in a catastrophic accident and underscores the importance of adequate maintenance inspection program for the aircraft cabin windows. This discussion on cabin windows will briefly highlight maintenance inspections. However, there are other windows such as inspection windows, toilet windows, etc. The manufacturers' maintenance manual should be consulted for applicable details.

a. Control Cabin Windows (5). The control cabin windows (1 through 5) consist of a thick transparent vinyl plastic core sandwiched between an inner and outer tempered glass layer. On the inboard face of Number 4 window, there is an additional vinyl core and a layer of acrylic sheet. Sliding windows are in Number 2 window position. The other windows are stationary and bolted to the airframe. (See Figure 1).

(1) Inspection. Examine each window for:

(a) Scratches, cracks, delaminations, discoloration of panes, and chipping.

(b) Binding of sliding windows, positive locking and locking mechanism release, seal deterioration, wear of bushings and guides.

(c) Loose or missing window frame fasteners.

(d) Rain repellency of windows.

(2) Scratched Windows.

(a) Inner pane scratched. Inner pane scratches may contribute to a window failure under cabin pressure and heat.

(b) Outer pane scratched. Scratches on the outer pane reduces pane strength under normal cabin pressurization conditions. Any scratch causes stress concentration.

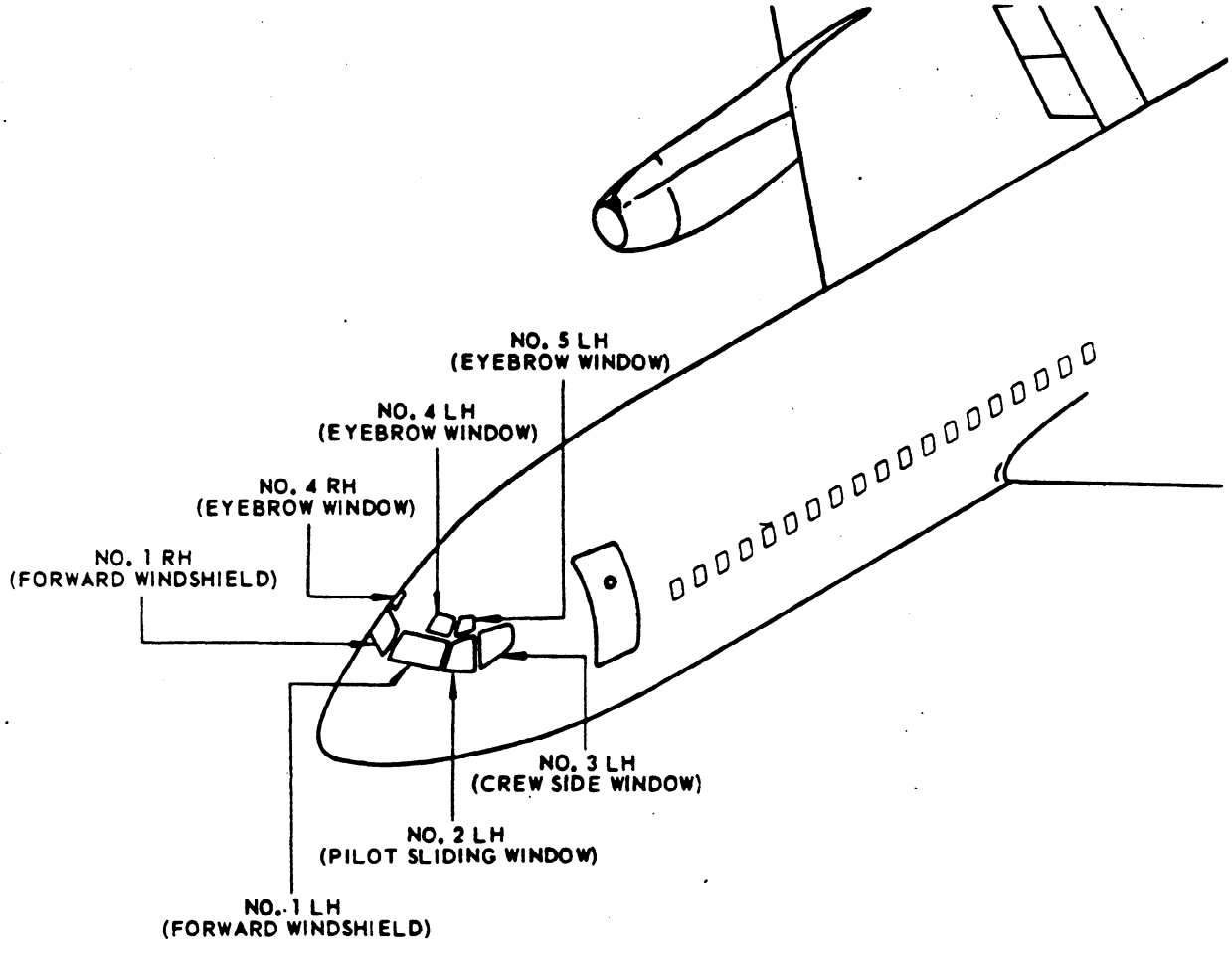

FIGURE 1. CONTROL CABIN WINDOW LOCATIONS

(3) Cracked panes. Any window with a cracked pane should be replaced.

(a) Inner pane cracked. This pane takes pressurization load and the airplane should not be pressurized if this pane is cracked.

(b) Outer pane cracked. Cracks that extend toward the center of the pane or span the pane usually become progressively worse and the pane should be replaced at the first opportunity.

(c) Cracking of vinyl usually occurs in the upper aft corner of the No. 1 windshields. It is a fail-safe, bird-proof core. The window should be replaced at the first opportunity.

(4) Delamination. A delamination is the separation of either pane of glass from the vinyl core. When minor delamination occurs between the inner or outer pane and the vinyl core, the airplane could be flown pressurized. An electrically heated window need not be replaced due to delaminations unless the visibility is restricted or lack of window heating, or the pane is scorched.

(5) Chipping. Chips on the laminated surface of the glass are layers or flakes of glass broken from a surface by excessive stresses. Presence of glass chips on laminated surface should be reason enough for window replacement if airplane is to be pressurized.

(6) Arcing. Arcing will produce hot spots with possible eventual result of a cracked pane.

b. Passenger Cabin Windows. These windows are located between the fuselage frames in the areas where passenger seating is provided. Passenger cabin windows consist of outer, center, and inner panes. The outer and inner panes are each capable of taking the full cabin pressurization load. The inner pane is nonstructural. All three panes are acrylic. The emergency exit hatch passenger window installations are very similar to those for the outer and center panes of the other passenger windows. (See Figure 2).

(1) Inspection/checks of passenger cabin windows. Examine the window for:

(a) Scratches, cracks, and crazing of acrylic panes.

(b) Deterioration of seals.

(c) Marks, Scratches, and dents.

(d) Loose or missing fasteners at window retaining brackets.

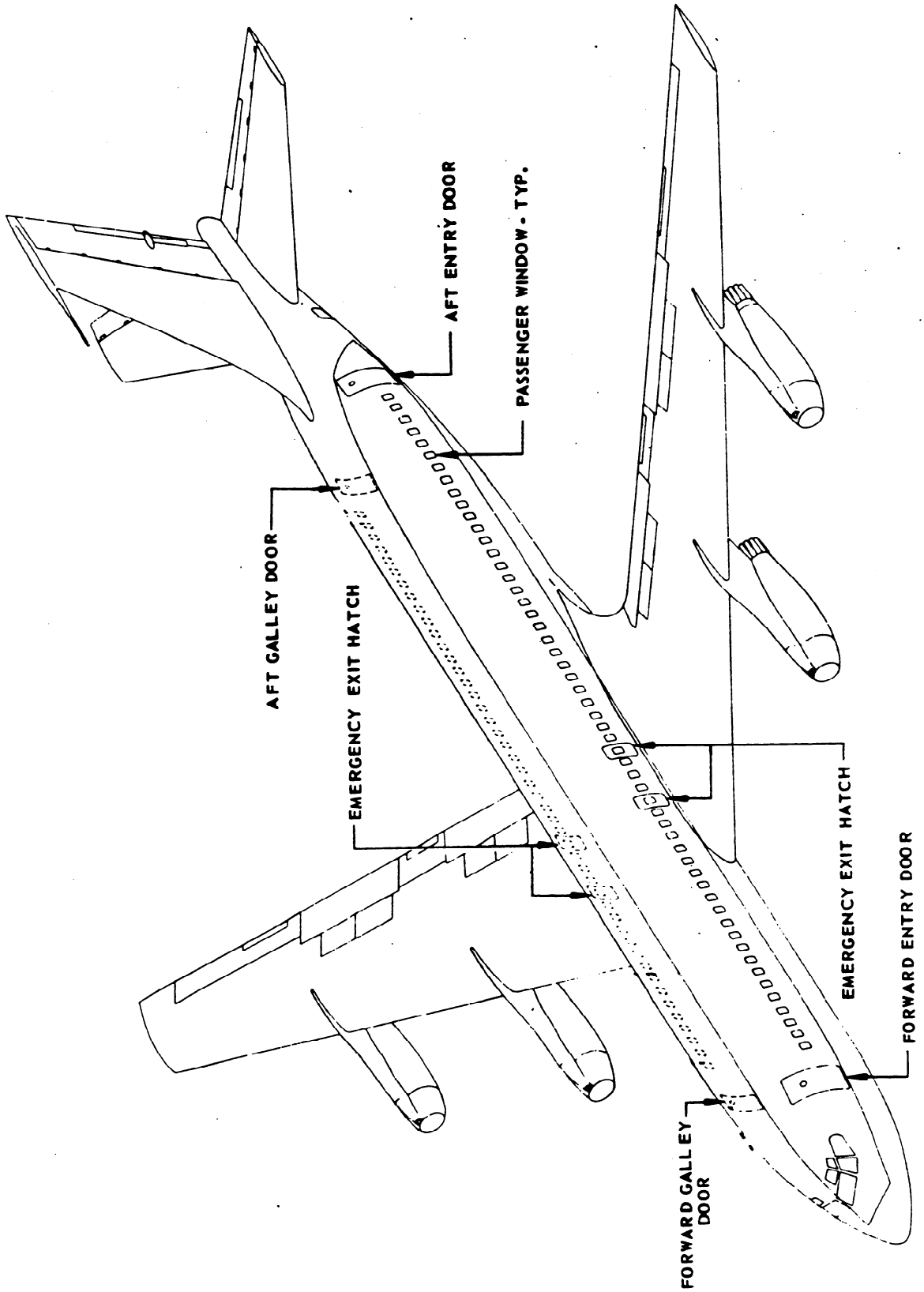

FIGURE 2. PASSENGER CABIN WINDOW LOCATIONS

c. Criteria for Window Inspections.

(1) Optical and visibility criterion should be established by the operator.

(2) A crack is a fissure perpendicular to the surface which extends completely through the pane. Airplane should not be pressurized with a cracked pane.

(3) Crazing is a series of small fissures perpendicular to the surface but not extending through pane. Crazing can be caused by improper pane installation or exposure to certain liquids.

(a) Surface crazing is permissible within certain limits if not a routed edge.

(b) Routed radius crazing of a pane is more serious than in the overall surface. Since routed crazing requires pane removal to monitor the extent of crazing, the pane may as well be replaced.

(4) Delamination is a separation of adjacent layers of laminate parallel to pane surface. Manufacturer's maintenance manuals provide recommended delamination limits and should be consulted.

(5) Scratches in routed radius will be impossible to see, unless window pane is removed.

(a) Scratches are most likely found on the exterior surface of the pane which is exposed to weather and washing and accompanying foreign bodies which inevitably get on that surface.

(b) Scratches are easily detected by visual examination and are critical if they exceed certain limits. Manufacturer's maintenance manuals provide recommended limits on scratch, depth and length and should be consulted. (Figures 1 & 2)

6. VERSIONS OF THE B-707/720 SERIES AIRCRAFT. The basic versions of the B-707/720 series aircraft follow. For a detailed description of each version which includes weight, loadings, performance, intermixing of engines, etc. the applicable FAA aircraft type certificate data sheet as indicated should be consulted. Further, the data sheet describes the type design and sets forth the operating limitations, and other limitations and information found necessary for type certification of a particular model aircraft as prescribed by the FARs.

a. B-707-100 long body. The FAA type certificate approval was issued on September 18, 1958. This aircraft was the first production version and was intended for continental flights but also had capability of over-water operation. This aircraft is powered by four Pratt and Whitney JT3C-6 turbojet engines. (See Type Certificate Data Sheet No. 4A21.)

b. B-707-100B long body. The FAA type certificate approval was issued on March 1, 1961. The aircraft was a further development of the basic B-707-100 with four Pratt & Whitney JT3D-1 turbofan engines with similar changes incorporated in the B-720. Included were a new inboard wing leading edge and additional segments (four) of the leading edge flaps. (See Type Certificate Data Sheet No. 4A21.)

c. Model B-707-100B short body. FAA type certificate approval issued July 25, 1961. Same as B-707-100B long body, except for shorter fuselage, wing changes, and other associated changes and limitations. Aircraft is powered by four Pratt & Whitney JT3D-1, or JT3D-IMC6 or JT3D-IMC7 turbofan engines. (See Type Certificate Data Sheet No. 4A21.)

d. B-707-200. FAA type certificate approval was issued on November 5, 1959. This aircraft is identical to the B-707-100 long body but is powered by four Pratt & Whitney JT4A-3 engines. (See Type Certificate Data Sheet No. 4A21.)

e. B-707-300 Intercontinental. FAA type ceritificate approval was issued on July 15, 1959. This aircraft is an over-water long range version featuring an increase in wing span and longer fuselage. This aircraft is powered by four Pratt & Whitney JT4A-5 engines, JT4A-3 engines JT4A-9 engines or JT-4A-11 engines. (See Type Certificate Data Sheet No. 4A26.)

f. B-707-300B Intercontinental. FAA type certificate approval issued on May 31, 1962. This aircraft was a further development of the B-707-300 and powered by four Pratt & Whitney JT3D-3 or JT3D-3B turbofan engines. The design changes included new leading and trailing edge flaps plus low-drag wing tips. (See Type Certificate Data Sheet No. 4A26.)

g. B-707-300C Intercontinental. FAA type certificate approval was issued on April 30, 1963. This aircraft features a cargo or mixed cargo passenger version of the B-707-300B with a forward cargo door (94 inches x 134 inches) and a cargo loading system using pallets and containers. The cargo space includes the full upper deck and the two lower deck holds. This aircraft is powered by four Pratt & Whitney JT3D-7 engines. (See Type Certificate Data Sheet 4A26.)

h. B-707-400 Intercontinental. FAA type certificate approval was issued February 12, 1960. This aircraft is identical to the B-707-300 but powered by Rolls Royce Conway MK508 turbofan engines. (See Type Certificate Data Sheet No. 4A26.)

i. B-720 Series Aircraft. The B-720 is essentially identical to the B-707-100 in external outline, main dimension, aerodynamic design and control systems although the B-720 is completely different from a weight and structural strength design standpoint. However, most B-720 aircraft parts and repairs are interchangeable with the B-707/720 aircraft. The B-720 aircraft features a wing leading edge change resulting in an aerodynamic variance which improved the aircraft performance. (These aforementioned changes were incorporated in the B-707-100B version.) The B-720-720B series aircraft have several different models due to different installations of equipment, interiors, airplane flight manuals, etc.

(1) B-720. FAA type certificate approval was issued on June 30, 1960. The basic aircraft is powered by four Pratt & Whitney JT3C-7 turbojet engines or JT3C-12 engines. (See Type Certificate Data Sheet No. 4A28.)

(2) B-720B. FAA type certificate approval was issued on March 3, 1961. This aircraft is powered by four Pratt & Whitney JT3D-1 or JT-3D-3 turbofan engines. (See Type Certificate Data Sheet No. 4A28.)

7. AIRCRAFT STATION DIAGRAMS. The Manufacturers Structural Repair Manual should be consulted for aircraft station diagrams.

8. MAINTENANCE INFORMATION. The requirements for structural surveillance of older airplanes vary greatly.

a. Factors that should be considered include:

(1) Basic structural differences of the various models.

(2) Production changes made to correct structural problems.

(3) Production changes made for weight reduction.

(4) Preventive modifications made per service bulletins.

(5) Repairs made per service bulletins.

(6) Repairs made per Structural Repair Manual.

(7) Incorporation of special repairs, correcting structural problems.

(8) Minor repairs made to cover external damage.

(9) Major repairs made as a result of accident.

(10) Airplane usage (past, present and future), e.g., duration of flights.

(11) Environmental factors.

(12) Intended service life.

b. Operators may find that their several aircraft require a variety of maintenance procedures because of differences in original delivery date, prior usage, service bulletin applicability and incorporation, and prior maintenance.

c. Following is a summary of potential or actual problem areas. This information should be useful in identifying types of details, as well as typical locations, for structural inspections. Because of structural differences some of these items do not apply to all airplanes.

d. Corrosion Control. For corrosion control, certain parts of the aircraft require additional attention as the airplane gets older. If utilization is reduced or spasmodic, there may be greater accumulation of moisture inside the aircraft and more atmospheric corrosion elements on the exterior of the aircraft. A critical area review has been made to define possible corrosion sensitive locations:

(1) The interior moisture sensitive areas are the crown and bottom of the fuselage.

(2) The structure below the cargo deck and areas below galley and toilet facilities may require more attention than identified in maintenance planning for newer airplanes.

(3) A wet insulation blanket is a clear alert signal that the blanket should be removed to inspect for corrosion.

(4) The moisture-trap low areas in the wing may require attention if the fuel replenishing is irregular.

(5) Inspect the above areas and the exterior of the aircraft for evidence of corrosion after washing. (Early identification of fatigue damage may also be revealed during these inspections.)

e. Potentially Fatigue - Critical Areas. The following areas with difficult access merit special attention:

(1) Fuselage frames and stringers behind rarely disturbed electrical, navigational and air-conditioning equipment. The greatest concentration of these components is in the sidewalls and below the floor of the cockpit. Close exterior inspection, and inspection of the interior when and where accessible, can be used to evaluate the condition of the structure. (Note: Several service bulletins have been directed to this area.)

(2) Wing hidden or blind areas are as follows:

(a) Upper and lower splice plates at the Wing Station 360 joint.

(b) Upper and lower surface skins under the external rib chords and form part of the landing gear support.

(c) Lower surface skin in the center section, particularly between the BBL 12.78 lower beams and under the outboard wing to center section splice plates.

(d) Portions of the production break forgings at Wing Station 733 that are sandwiched between the skin and stiffeners.

(e) Doublers under the rib chords at the dry bays at Wing Station 360 and 501.

(f) Front and rear spar chords under various fittings.

f. In addition to the inspection recommended by the Manufacturer's Maintenance Planning Data (D6-7552), some of these areas may receive eddy current inspection during incorporation of a number of service bulletins.

g. Sampling inspections, utilizing eddy current with selective fastener removal, general X-ray and rigorous visual techniques can be used in selected areas to supplement the documented inspection requirements.

h. General Inspection of Known Problem Areas.

(1) Fuselage.

(a) Stringer and frame flanges - check for cracks at intersections, upper and lower lobes.

(b) Skin cracks at spotwelds attaching doublers, stiffeners, and fail safe straps.

(c) Skin cracks at upper row of countersunk rivets in .040 exterior skin at longitudinal lap joints.

(d) Frames and skins around cutouts.

(e) Stress corrosion of forged fittings at floor beams below sill of upper deck cargo door, doorstops at entry, service and lower cargo doors, bulkhead at attachment of wing rear spar to body, floor beams supporting main landing gear side struts, and supports of stabilizer jackscrew and hinges.

(f) Fin front and rear spar attachment fittings and the local bulkhead structure near these fittings.

(2) Wing.

(a) Skins - Around cutouts, joints, stiffener terminations, and areas of attachment of other components such as spars, nacelle, flaps, and spoilers.

(b) Stiffeners - At joints (including lower surface spanwise skin splices at S-4 and S-8) and in the wing center section upper surface at intersection with fuselage floor beams.

(c) Inspar rib webs from Wing Station 387 to Wing Station 752 and at the WBL 315 rib aft of the inboard nacelle.

(d) The ribs, spar, fittings, and structure adjacent to the main landing gear support.

(3) Empennage.

(a) Stress corrosion in stabilizer center section lugs that attach outboard stabilizer and in rib chord adjacent to those lugs.

(b) Stress corrosion of aluminum lug around stabilizer hinge fittings.

(c) Fatigue in center section skins by fasteners attaching jackscrew nut support fittings.

(4) Nacelle Struts.

(a) Nacelle strut skins.

(b) Nacelle front spar chord at attachment of spar fitting and the spar fitting.

i. Maintenance Reports. The following is a listing of selected maintenance difficulties experienced, representing examples of reports submitted by air carrier operators. It should be noted that this is a partial list only, and only a portion of time in the history of 707 and 720 aircraft is covered.

(1) Fuselage.

(a) During inspection found station 360 bulkhead (aft end nosewheel well) lower chord cracked at left outboard air lock fastener. Total aircraft time (TAT) 29,515 hours.

(b) During scheduled inspection found support fitting P/N 65-27187-1 under sill of upper main cargo door cracked. Support fitting directly beneath second fitting from forward end of sill. Replaced fitting. TAT 9,955 hours (B-707-300 series).

(c) Found two cracks in floorbeam BS880 in lower flange from bolthole at LBL and RBL 7.29 inches. Crack progressed outboard from LH and RH bolthole approximately 1.4 inches. Crack on LH side of airplane progressed inboard approximately 1.5 inches to the next fastener hole. Crack on RH side of airplane progressed inboard approximately 2.6 inches to second fastener hole. Repaired per manufacturer's instructions. TAT 11,832 hours.

(d) Visual inspection revealed a crack in the right fuselage terminal fitting. Boeing P/N 65-1903-2. Crack appeared to start at the forward lower fastener hole common to stringer 18A and progressed up the heavy flange, approximately 6.5 inches and down around fillet radius 1.5 inches. TAT 24,244 hours.

(e) During visual inspection found 15-inch long crack forward side of aft cargo door frame in radii. Repair made per manufacturer's instructions.