Boeing Commercial Airplane Group
P.O. Box 3707
Seattle, WA 98124-2207

February 22, 1996
B-XK01-15543-ASI

Mr. Greg Phillips, AS-40
National Transportation Safety Board
490 L'Enfant Plaza SW
Washington D.C. 20594

BOEING

Subject: Recommended Maintenance Intervals - USAir 737-300 Accident N513AU near Pittsburgh, September 8, 1994

Reference: Your fax to Rick Howes, February 13, 1996

Dear Mr. Phillips:

As requested in the reference correspondence, the following provides the documentation and an explanation for the Boeing recommended maintenance interval history for the 737 Rudder and Standby Rudder Power Control Units since original certification in 1967.

The original FAA Maintenance Review Board (MRB) in 1967 approved a hard time operational life of 12,000 flight hours before overhaul. In the MRB report, Appendix A, the "System and Component Operating Performance Evaluation" (SCOPE) program was introduced. This program specified that certain components could go to Conditional Monitoring (CM), as long as the operator had a reliability program with internal leakage checks (Enclosure A, page 6). The Rudder and Standby Rudder Power Control Units were so designated. Revision 2 dated August , 1971 of the MRB report (Enclosure A, page 9) did not reflect any changes in this area.

The current 737-300 Maintenance Planning Document (MPD) interval for the Rudder and Standby Rudder Power Control Units are On Condition (O/C) with an internal leak check performed at Airplane Maintenance Check Interval 3C or 9600 flight hours. (For comparison, the 757/767/777 have MRB internal leakage intervals of 12,000 flight hours, and the 747-400 has a gross internal leak check of 25,000 flight hours.) O/C vs CM is explained in enclosure B, page 8.0-2.

Sometime before December, 1977, the 737 Rudder and Standby Rudder Power Control Units, and approximately 12 other hydraulic components were changed to O/C, in the MPD only, based on results of gross internal leakage checks. This was applied to all models (707/727/737/747) at the time. The MRB's for 707/727/737 were not subjected to revisions at that time. Generally the MPD's superseded MRB's which were then considered "inactive" documents. Earlier, MRB's had served as guidelines for initial operators, but the MPD unofficially became the "guide". Essentially, the MPD assumed the role of the MRB report.

The MPD intervals are our recommendations to the airlines. Through their FAA Principal Maintenance Inspector, the airlines can change these intervals to accommodate their in-service experience and/or reliability programs.

For operators reporting, our trend records show that the Mean Time Between Scheduled Removal is 15,932 flight hours for the Rudder Power Control Unit, and 47,435 flight hours for the Standby Rudder Power Control Unit.

BOEING

If you have any questions, please contact me.

Very truly yours,

FLIGHT TEST

[redacted]

John W. Purvis
Director, Air Safety Investigation
Org. B-XK01, Mail Stop 14-HM
Telex 32-9430, STA DIR PURVIS
[redacted]

Enclosures:
A. FAA MRB Report, Revision 2, August, 1971, pages 6, 9, and Appendix A
B. Boeing 737 Maintenance Planning Document, D6-38278, pages 6.1-83, 8.0-2, and 8.27-1, Revision W, November 15, 1995

cc: Mr. Thomas Haueter, AS-10

16. Procedures for the maintenance of the "Advance 737" versions of this airplane shall contain provisions for the inspection and maintenance of the various performance improving devices unique to this airplane.

These consist of:

(1) High lift system flaps and slats
(2) Trailing edge flap seals
(3) Anti-skid system (auto-braking)

- NOTE 1:

The units having Note 1 specified in the "Other" column may be maintained under a FAA Approved reliability program written to comply with AC 120-17. If a reliability program is utilized, the operators specifications will show an acyronym, asterisk or other identifier in the overhaul column. In addition, the program shall have internal leakage rates as the primary performance standard and require an internal leakage flow check to be performed at each "D" interval. The component initial internal leakage rate standard will be established by the manufacturer.

OPERATIONS SPECIFICATIONS
AIRCRAFT MAINTENANCE
BOEING 737

	Overhaul Period	Inspection & Check Period	Other
Flight Controls, Chapter 27, Cont'd.			
Flight Control Cables	O.C.	C	Tension Check @ D
Ground Spoiler Control Valve	12,000	C	Note 1
Ground Spoiler Shutoff Valve Assembly	O.C.	C	F/C @ D
Trailing Edge Flap Transmission Assemblies RH and LH	12,000	C,D	
Leading Edge Device Alternate Extension Shutoff Valve Assembly	O.C.	C	OP/C @ C
Leading Edge Device Control Valve Assembly	12,000	C	Note 1
Leading Edge Flap Actuator	12,000	C	Note 1
Leading Edge Slat Actuator	12,000	C	Note 1
Leading Edge Standby Fuse	12,000	D	
Rudder and Elevator Feel Computer	9,000	2C	
Rudder Feel Actuator	12,000	C	Note 1
• Rudder Power Control Unit	12,000	C	Note 1
Spoiler Mixer Assembly	12,000	C	
Stabilizer Trim Brake Installation (Aisle Stand)	O.C.	C,D	OP/C @ C
Stabilizer Jackscrew & Gearbox Assembly (Ballnut & Jackscrew, Gimbal Assembly, Cable Drum & Gearbox consisting of Gearing & Brakes)	9,000	C,D	
Stabilizer Trim Electric Actuator (3-Phase Induction Motor, 2-Electromegnetic Clutches & Output Shaft)	9,000	C,D	
Stabilizer Trim Autopilot Actuator (3-Phase, Reversible, 2-Speed Induction Servo Motor, Electromagnetic Clutch with Gear Reduction & Output Shaft)	9,000	C,D	
• Standby Rudder Power Control Unit	12,000	2C,D	Note 1
Standby Rudder Shutoff Valve Assembly	O.C.	C,D	OP/C @ C
Trailing Edge Flap Bypass Valve Assembly	O.C.	C,D	OP/C @ C
Trailing Edge Flap Control Valve Assembly	12,000	C	Note 1
Trailing Edge Flap Flow Limiting Valve Assembly	O.C.	C,D	F/C @ 3000
Trailing Edge Flap Hydraulic Motor Assembly	12,000	2C,D	
Ground Spoiler Actuator Assembly	12,000	C	Note 1

Effective date _____

BOEING 737 MAINTENANCE REVIEW BOARD REPORT

APPENDIX A

1. PURPOSE. This Appendix has been provided for operators who desire to adopt "System and Component Operating Performance Evaluation" (SCOPE) program for a limited number of components incorporated in the Boeing 737 aircraft in lieu of specific overhaul times.

   The SCOPE program as set forth in this Appendix contains the basic elements of a reliability program as specified in Advisory Circular No. 120-17.

2. The SCOPE Concept

   The SCOPE program considers the functional importance of systems and components and their operating performance to determine appropriate time limitations or alternative standards for controlling reliability. The program operates without initial overhaul time limitations. The SCOPE program and system uses the initial operating period of components that normally have had overhaul times assigned to establish performance standards before their time overhauls normally would occur.

   Techniques for determining the expected number and the expected variability of future events from observations of past events are normal tools of the statistical analyst. In the case of unit performance evaluation, these techniques can be used to indicate if a removal rate experienced during some period was within the range of ones expectation based on past experience. In other words, if the past experience represents some performance standard, samples from subsequent experience can be compared with it to see whether they "meet the standard".

   Because of the usual variability of data taken even from a stable environment, the average experience can not be used as the standard. If it were, subsequent samples would exceed the standard about 50% of the time. Therefore, some increased value based on the historic variability of the data is necessary. This value can be established so that, ideally, the risk of false alarms is constant, irrespective of the value of the standard. In the SCOPE program these standards are called "Reliability Standards".

   These Reliability Standards are 2 standard deviations above and below the average removal rate experienced during the initial 2 years of operations. (The standard deviation is a statistical parameter that senses the variability of data about its average value.) The expectation of false alarms with this standard is very small.

The sample values used to evaluate performance are removal rates. The periods for which these rates are calculated are varied with the number of operating aircraft so that the operating experience represented by a period, for different operators, does not vary greatly.

If experience (removal rate) during any period exceeds the upper control limit, the operator must give evidence of corrective action within 90 days. For example, the action may be:

a. Set an appropriate overhaul time limit
b. Make appropriate modifications
c. Revise the maintenance process
d. Revise the operating environment.

If removal rate trends indicate improved reliability (below the lower control limits), the cause should be investigated and the Reliability Standards may be re-computed.

3. Establishment of the Reliability Standard

The program for SCOPE units uses an initial experience period of 2 years called the "Standard Setting Period". This is based on expectations that all 737 operators will operate more than 2 years before their oldest airplane requires its first "D" check. Even for a two-airplane operator, this period would be expected to include at least 9,000 unit hours for each SCOPE unit. Several performance readings (removal rates) are required for this period to establish the characteristic variability for each unit.

An increase in the number of operating aircraft will distort this variability unless the numbers of flight hours experience for each reading is about equal. The number of hour's experience for each reading must be about the same as the number of flight hours in the first Performance Evaluation Period after the Reliability Standard has been established.

The Performance Evaluation Periods are based on the number of operating aircraft at the end of the 2 year Standard Setting Period in accord with the following table:

Number of Operating Aircraft	Performance Evaluation Period
1 - 5	6 Months
6 - 10	3 Months
11 - 15	2 Months
Over 15	1 Month

For example, if an operator expected to fly 4,530 hours in the first Performance Evaluation Period and he operated 32,174 hours during the Standard Setting Period, he should take 7 performance readings with about 4,600 hours experience for each. It is not necessary to define these sub-periods closer than to the nearest month. Figure 1 pictures this process.

NOTE: An operator may at any time elect to assign an overhaul time or select an appropriate "On Condition" overhaul, or another "reliability program" for any SCOPE unit subject to approval by his FAA local district office.

The Reliability Standard is based on the removal rate during the Standard Setting Period. Figure 2 is a suggested form for calculation of these standards.

The first step is calculation of the removal rates during the Standard Setting Period. The mean rate during the Standard Setting Period is calculated first. The removal rates for the sub-periods of the Standard Setting Period must then be calculated. From these removal rates a variability measure, the Standard Deviation, is then calculated for each unit. Two times the standard deviation is added to and subtracted from the mean removal rate to obtain the "Reliability Standard" control limits.

Before the end of the first Performance Evaluation Period following the Standard Setting Period, each operator must furnish a complete report to the assigned FAA inspector indicating the reliability standard for each SCOPE item contained in the program.

4. Summary

A summary of the reliability standards for all SCOPE units shall be maintained. Figure 3 is a suggested form for this summary.

5. Periodic Reports

During the initial 2 years of SCOPE program operation, quarterly removal rates are required to show the characteristic variability for each component included in the program. The assigned FAA inspector must be provided with copies of the quarterly performance summary within 30 days following the end of the quarter.

Within 30 days after the end of each Performance Evaluation Period, the FAA assigned inspector will be provided with a Performance Evaluation Exception Report in a form similar to Figure 4. This report focuses on exceptions rather than reporting details. It serves to highlight instances of unreliability shown above the standard limit and improved maintenance techniques or reliability below the standard limit.

6. Displays

A time series record of SCOPE unit performance is required in a form similar to Figure 5. This chart is an "exception report" and is based on Figure 4. It is superior to a conventional chart of program performance because it highlights instances of unreliability above standard and shows trends without resulting in a large number of charts or reports. Copies of such reports will be forwarded to the assigned FAA inspector.

7. Implementation

Each air carrier wishing to utilize the SCOPE program outlined above must prepare their entire program into a comprehensive document which when approved becomes a part of that carrier's Operations Specifications - Maintenance. This report will contain, in detail, as follows:

a. The system of data collection.

b. Identification of information sources with a description of the flow of information from source through analysis.

c. The methods of data analysis and the application to the maintenance controls employed.

d. The methods utilized for the reliability portion of the program and instructions for amendments, including an identification of areas which require approval by the FAA.

e. The procedures used in the establishment of performance standards and the revision of these standards based on reliability experience.

f. Program status displays used by the program to summarize operating experience and the details of corrective action taken or planned as a result of failure to meet established performance standards.

g. Definitions of significant terms used in the program.

h. A procedure for development of initial performance standards for the components controlled by the program. This would be the expected removal rate standard for each SCOPE component to be used until the performance standard has been established in accordance with the procedures as outlined in Paragraph 3.

i. Operators who adopt the SCOPE program for eligible components will specify on the Aircraft Maintenance Specifications, FAA Form 1014, O.C. (On Condition) in the Overhaul column and SCOPE in the Other inspection column for each component involved. The inspection and check periods listed for the conventional or hard time program will be applicable to SCOPE items, and will be listed as such.

8. Provision for Review and Updating the "SCOPE" Program

Due to the many gems of knowledge that may be revealed from experience gained after implementation of the SCOPE program, it is suggested that airline participants establish some form of service experience exchange. It appears that after such a pooling of intelligence and operation of the individual airline programs through the "Reliability Standard Setting Period", the participating airlines could be in a position to substantiate worthwhile revisions to the basic "SCOPE" program.

Listed below are components considered appropriate for inclusion into the "SCOPE" program:

System 21 - Air Conditioning

Air Cycle Machine
Air Mix Valve
Air Mix Valve Position Indicator
Cabin Altimeter and Differential Pressure Indicator
Cabin and Duct Temperature Indicator
Cabin Rate-of Climb Indicator
Cabin Temperature Selector
Gasper Fan
Heat Exchanger
Outflow Valve
Outflow Valve Position Indicator
Pack Valve
Pressure Control Panel
Pressure Controller
Ram Air Actuator
Supply Duct Check Valves
Turbo Fan
Turbo Fan Valve
Water Separator 35°F Control Valve

System 22 - Autoflight

Auto Pilot Accessory Box
Auto Pilot Control Panel - White Lighted
Auto Pilot Pitch Control Channel
Automatic Stabilizer Trim Potentiometer and Position and Trim Sensors
Auto Pilot Stabilizer Trim Servo
Auto Pilot Switching Accessory Box
Control Wheel Steering Force Transducer and Limiters
Mach Trim Coupler
Mach Trim Actuator
Roll Control Channel
Yaw Damper Coupler

System 23 - Communications

Audio Accessory Box
Passenger Address Amplifier
Selcal Chime
Selcal Decoder (Dual)
VHF Control Panel
VHF Transceiver

System 24 - Electrical Power

AC Ammeter
AC Voltmeter
Battery Charger
Boost and Metering Current Transformer Assembly
Bus Protection Panel
CSD Oil Temperature Indicator
DC Ammeter
DC Voltmeter
Engine Differential Current Transformer
External Power Contactor
Frequency Meter
Load Bus Different. Current Transformer
Relay Modules (3)
Static Inverter
Transformer - Rectifier 60 AMP
Test Module

System 25 - Equipment and Furnishings

Airflow Detector
Automatic Flow Control Valve
Electronic Cooling Blower

System 26 - Fire Protection

Engine and APU Fire Detection Module

System 27 - Flight Controls

Aileron Power Control Unit
Elevator Feel Actuator
Elevator Power Control Unit
Flap Position Indicator
Flap Position Transmitter
Flight Spoiler Actuators
Leading Edge Flap Actuator
Leading Edge Flap Slat Position Indicating Module
Leading Edge Slat Actuator
Rudder and Elevator Feel Computer

System 27 - Flight Controls, Continued

Rudder Feel Actuator
• Rudder Power Control Unit
Rudder Trim Actuator
Trailing Edge Flap Flow Limiting Valve Assembly
Trailing Edge Flap Hydraulic Motor Assembly
Ground Spoiler Actuator Assembly

System 28 - Fuel

APU Fuel Check Valve
Fuel Boost Pump
Boost Pump By-Pass Valve
Fuel Boost Pump Low Pressure Switch
Fuel Boost Pump Vent Check Valve
Fuel Quantity Compensator Unit
Fuel Quantity Indicators (lbs)
Tank Unit, Fuel Quantity
Fuel Temperature Bulb
Fuel Temperature Indicator
Fueling Shutoff Valve
Volumetric Top-Off Compensator Unit
Volumetric Top-Off Unit and Bussing Plug Assembly

System 29 - Hydraulic Power

Engine Driven Hydraulic Pump Assembly - System A
Hydraulic Pressure Indicator - Systems "A" and "B"
Hydraulic Pressure Transmitter - Systems "A" and "B"
Motor Driven Hydraulic Pump Assembly System "B"

System 30 - Ice and Rain Protection

Rain Repellant Pressure Gage
Rain Repellant Shutoff Valve
Rain Repellant Solenoid Valve
Window Heat Module
Windshield Wiper Motor Converter
Wing Anti-Ice Shutoff Valve

System 31 - Instruments

Aural Warning Devices Box
Clock (Chronometer)
Flight Recorder Test Module

System 32 - Landing Gear

Antiskid Control Unit (Shield)
Antiskid Wheel Speed Transducer
Brake Accumulator Pressure Gage (Direct Reading)
Brake Antiskid Valve
Brake Pressure Indicator
Landing Gear Indicating Module
Main Gear Priority Valve (in Main Gear Module)
Nose Gear Priority Valves (in Nose Gear Module)
Nose Gear Steering Actuators
Nose Gear Steering Metering Valve
Parking Brake Shutoff Valve
Wheel Well Seal System Motor Driven Shutoff Valve
Wheel Well Seal System Pressure Regulator
Wheel Well Seal System Shutoff Valves

System 33 - Lights

Outboard Landing Light
Rotating Beacons
Position Lights

System 34 - Navigation

ADF Loop Antenna
ADF Receiver
ADF Sense Antenna Coupler
Air Data Computer
Altimeter
Angle of Airflow Sensor
ATC Antenna
ATC Transponder
Comparator Warning Unit
Control Column Shaker
Course Deviation Indicator
Directional Gyro
DME Indicator
DME Interrogator
DME Antenna
Flight Director System
Flight Instrument Amplifier Unit
Flux Valve
Glide Slope Antenna
Horizon Direction Indicator
Instantaneous Vertical Speed/Rate of Climb Indicator
Low Range Radio Altimeter Receiver/Transmitter
Mach Airspeed Indicator
Magnetic Standby Compass
Marker Beacon Antenna

System 34 - Navigation

Marker Beacon Receiver
Pitot Tube Probe
Radio Altimeter Antenna
Radio Altimeter Indicator
Radio Magnetic Indicator
Stall Warning Module
Standby Artificial Horizon Indicator
Static Selector Valve
TAS/Static Air Temperature Indicator
Total Air Temperature Indicator
Total Air Temperature Probe
Turn and Slip Indicator
Vertical Gyro
VOR Antenna Assembly
VOR/GS Navigation Unit
Weather Radar Antenna
Weather Radar Indicator
Weather Radar Receiver - Transmitter

System 35 - Oxygen

Crew Oxygen Demand Regulator
Crew Oxygen System Pressure Transducer
Oxygen System Pressure Indicator

System 36 - Pneumatics

APU Check Valve
Dual Pneumatic Manifold Pressure Gauge
Isolation Valve
Pneumatic Manifold Pressure Transmitter

System 38 - Water and Waste

Water and Waste System Components

System 49 - Airborne Auxiliary Power

Bleed Air Regulating and Shutoff Valve - APU
Exhaust Gas Temperature Indicator - APU
Inlet Door Actuator - APU

System 52 - Doors

Aft Airstair Power Unit
Aft Airstair Drive Transmission Unit Fwd and Aft
Aft Airstair Gear Box
Aft Airstair Drive Governor
Forward Airstair Actuator
Forward Airstair Actuator Motor
Forward Airstair Actuator Motor-Standby
Forward Airstair Door Actuator
Forward Airstair Door Actuator Motor-Norm
Forward Airstair Door Actuator Motor-Standby
Solid State Switching Module

System 73 - Engine Fuel and Control

Fuel Flow Indicator
Fuel Flow Power Supply Unit

System 74 - Ignition

Ignition Exciter Unit

System 76 - Engine Controls

Autothrottle Clutch and Cam Assembly

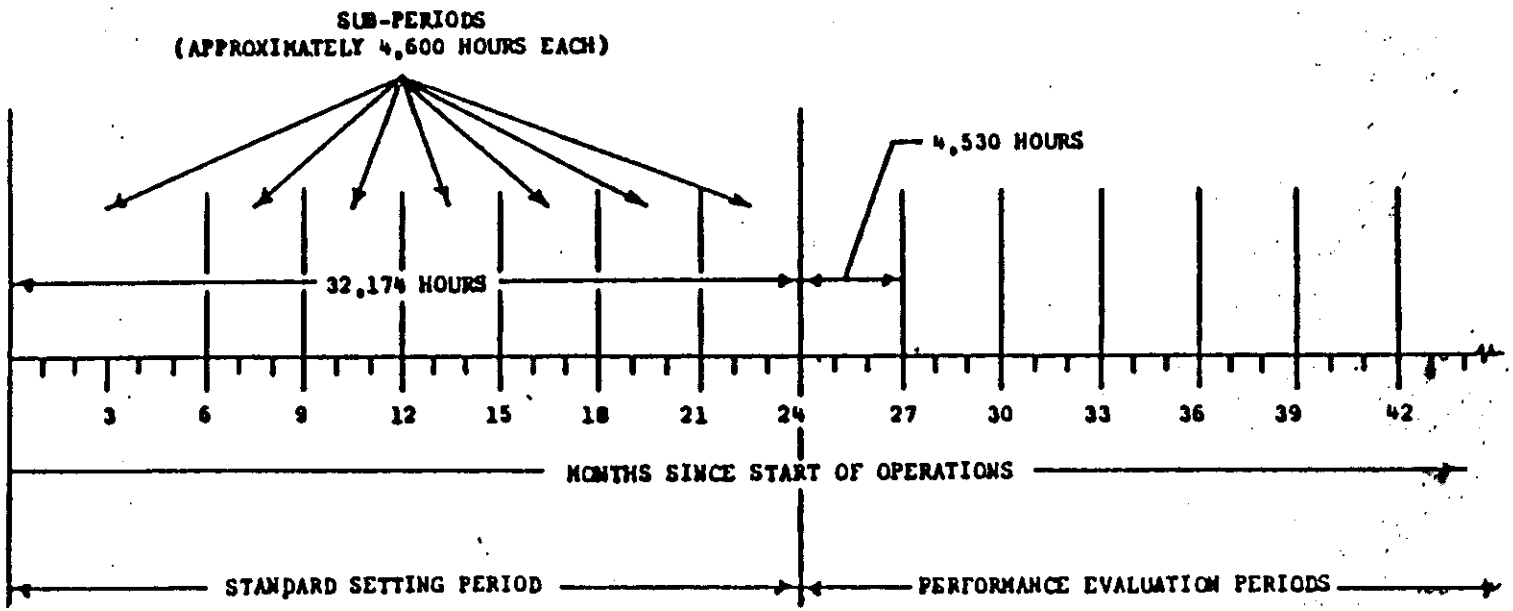
System 77 - Engine Indicating

Engine Accessory Module
Engine Pressure Ratio Indicator
Engine Pressure Ratio Transmitter
Engine Vibration Indicator-Amplifier
Exhaust Gas Temperature Indicator
Tachometer Indicators, N_1 and N_2

System 79 - Oil

Engine Oil Pressure Indicator
Engine Oil Quantity Indicator
Engine Oil Temperature Indicator

THE STANDARD SETTING PERIOD AND ITS SUB-PERIODS



GIVEN: 6 AIRPLANES AT END OF STANDARD SETTING PERIOD
32,174 FLYING HOURS AT END OF STANDARD SETTING PERIOD
4,530 FLYING HOURS EXPECTED IN FIRST PERFORMANCE EVALUATION PERIOD

Figure 1.

SCOPE
RELIABILITY STANDARD

USER _____ DATE _____ BY _____

	A YEAR	B MONTH	C MONTHLY FLYING HOURS	D SUB-PERIOD FLYING HOURS	E UNITS PER PLANE	F REMOVALS	G (RR) F x 1000 / D x E	H (RR)^2 G x G
START OF OPERATION →	1968	J	110					
		F	205					
		M	560					
		A	925					
		M	1206					
		J	1504	4510	1	3	.67	.45
		J	1501					
		A	1526					
		S	1543	4570	1	2	.44	.19
		O	1523					
		N	1518					
		D	1520	4561	1	4	.88	.77
	1969	J	1500					
		F	1529					
		M	1521	4550	1	3	.66	.44
		A	1523					
		M	1558					
		J	1562	4703	1	2	.43	.19
		J	1593					
		A	1499					
		S	1578	4670	1	4	.86	.74
		O	1577					
		N	1502					
		D	1571	4610	1	2	.43	.19
TOTALS (Σ)				32174	1	20	4.37	2.95

NUMBER OF SUB-PERIODS = N = 7

MEAN RR = $\bar{G}$ = (ΣG)/N = 4.37/7 = .62

STANDARD DEVIATION = SD = $\sqrt{\frac{\Sigma H - (\Sigma G \times \Sigma G)/N}{N-1}}$ = $\sqrt{\frac{2.75 - (4.37 \times 4.37)/7}{7-1}}$ = .19

RELIABILITY STANDARD = $\bar{G}$ + (2 x SD) = .62 + (2 x .19) = 1.00

Figure 2.

SCOPE
RELIABILITY STANDARD SUMMARY

UNIT	RELIABILITY STANDARD

Figure 3.

SCOPE
PERFORMANCE EVALUATION EXCEPTION REPORT

PERIOD_____

UNIT	RELIABILITY STANDARD	PERFORMANCE RR)	CORRECTIVE ACTION

Figure 4.

SCOPE UNIT PERFORMANCE

(UNITS HAVING PERFORMANCE POORER THAN RELIABILITY STANDARD)

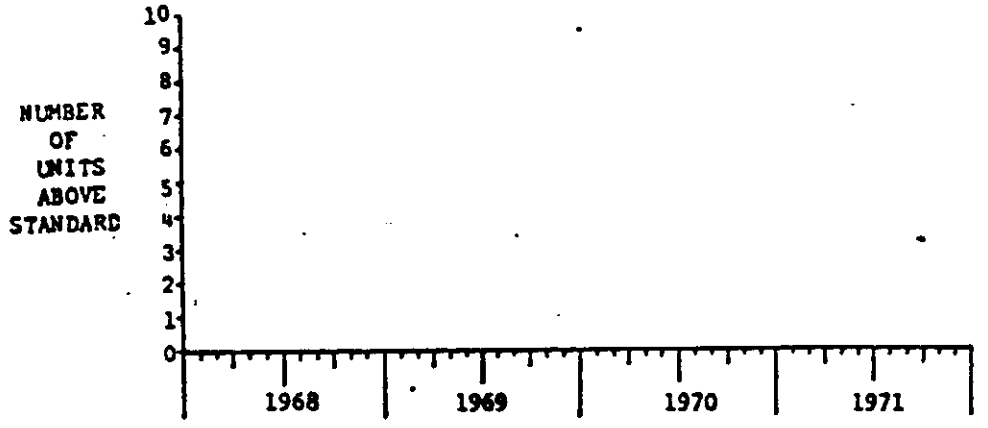


Figure 5.

NOTE: REPORTING FREQUENCY IS BASED ON NUMBER OF OPERATING AIRCRAFT AT END OF "STANDARD SETTING PERIOD".

APPENDIX B

This Appendix lists a number of components which have been deleted from the basic Maintenance Review Board Document. The components were individually considered by the Maintenance Review Board and it was determined that there are no specific overhaul periods or special check requirements above those inspections that are required to maintain this system on an On Condition basis. Inspection of these components will be performed at the same intervals as established for the individual aircraft system and in accordance with the provisions of the limitations for On Condition as stated on Page 2, Paragraph 2 of this document.

System 21 - Air Conditioning

Air Mix Valve
Air Mix Valve Position Indicator
Cabin Altimeter & Differential Pressure Indicator
Cabin & Duct Temperature Indicator
Cabin Rate-of-Climb Indicator
Cabin Temperature Selector
Ground Service Conditioned Air Connection Check Valve
Heat Exchanger
Outflow Valve Position Indicator
Pressure Control Panel
Safety Relief Valve
Supply Duct Check Valves
Water Separator
Water Separator 35°F Control Valve
High Pressure Modulation Valve
Pressure Regulator

System 22 - Auto Pilot

Auto Pilot Control Panel - White Lighted
Automatic Stabilizer Trim Potentiometer & Position & Trim Sensors
Control Wheel Steering Force Transducer & Limiters

System 23 - Communications

Voice Recorder

System 24 - Electrical System

AC Ammeter
AC Voltmeter
Battery
Battery Charger
Boost & Metering Current Transformer Assembly
Bus Protection Panel
CSD Oil Temperature Indicator
Constant Speed Drive Oil Cooler
DC Ammeter
DC Voltmeter
Engine Differential Current Transformer
External Power Contactor
Frequency Meter
Bus Transfer Relay
Generator Control Unit
Load Bus Different. Current Transformer
Static Inverter
Transformer - Rectifier 50 AMP
Test Module

System 25 - Equipment and Furnishings

Airflow Detector
Automatic Flow Control Valve
Blower Check Valve
Electronic Cooling Blower

System 26 - Fire Protection

Engine & APU Fire Detection Module
Compartment Overheat Control Module
Fire Detector Control Module - Engine & APU
Detector, APU Fire
Detectors, Engine Fire
Fire Protection System Module
Fire Extinguisher Directional Valve
Wheel Well Overheat Sensing Element
Wing & Lower Aft Body Overheat Sensing Elements

System 27 - Flight Controls

Alternate L.E. Extension Flow Limiting Valve Assembly
Control Column Assembly
Elevator Tab Lock Actuator
Flap Position Indicator
Flap Position Transmitter
Flap Control Hydraulic Pressure Switch Assy. - System "A" & System "B"
L.E. Flap Slat Position Indicating Module
Rudder Trim Actuator

System 28 - Fuel

C.G. Baffle Check Valves (Wing Tanks)
Boost Pump By-Pass Valve
Fuel Boost Pump Low Pressure Switch
Fuel Quantity Compensator Unit
Fuel Quantity Indicators (Lbs)
Tank Unit, Fuel Quantity
Fuel Temperature Bulb
Fuel Temperature Indicator
Fueling Shutoff Valve
Volumetric Top-Off Compensator Unit
Volumetric Top-Off Unit & Bussing Plug Assembly

System 29 - Hydraulic System

Hydraulic Pressure Indicator - Systems "A" & "B"
Hydraulic Pressure Transmitter - Systems "A" & "B"
Quantity Low Level Switch - Systems "B" & Standby
Reservoir assemblies
Switch assembly - Cartridge Systems "A", "B" & Standby
System "A" Hydraulic Quantity Indicator
System "A" Hydraulic Quantity Transmitter
System "B" Overheat Sensing Switch

System 30 - Ice and Rain Protection

Rain Repellant Pressure Gage
Rain Repellant Shutoff Valve
Rain Repellant Solenoid Valve
Window Heat Module
Windshield Wiper Motor Converter
Wing Anti-Ice Ground Overheat Thermal Switch
Wing Anti-Ice Shutoff Valve

System 31 - Instruments

Aural Warning Devices Box
Clock (Chronometer)
Flight Recorder Test Module

System 32 - Landing Gear

Anti-skid Control Unit (Shield)
Anti-skid Wheel Speed Transducer
Auto-Braking Module
Auto-Braking S.O. Valve
Brake
Brake Accumulator
Brake Accumulator Pressure Gage (Direct Reading)
Brake Pressure Indicator
Landing Gear Indicating Module
Main Landing Gear Torsion Link Damper
Wheel Well Seals

System 33 - Lights

Outboard Landing Light
Rotating Beacons
Position Lights
Emergency Lighting

System 34 - Navigation

Stall Warning Module
Stick Shaker
Angle of Attack Sensor

System 35 - Oxygen

Crew Oxygen System Pressure Reducer
Crew Oxygen System Pressure Transducer
Oxygen System Pressure Indicator
Passenger Oxygen System Latch, Valve & Manifold Assembly

System 36 - Pneumatic

APU Check Valve
Dual Pneumatic Manifold Pressure Gage
Engine Bleed Precooler
Engine Bleed Shutoff Valve
Engine Bleed Thermostat

System 36 - Pneumatics, continued

Ground Pneumatic Connection
Isolation Valve
Pneumatic Manifold Pressure Transmitter
Precooler Modulating Valve

System 38 - Water and Waste

Water & Waste System Components

System 49 - Airborne Auxiliary Power

Exhaust Gas Temperature Indicator - APU

System 52 - Doors

Cabin Cargo Door Lift Actuator
Cabin Cargo Door Latch Actuator
Cabin Cargo Door Control Valve
Cabin Cargo Door S.O. Valve
Solid State Switching Module

System 71 - Powerplant

Vibration Isolator Assembly

System 73 - Engine Fuel and Control

Fuel Flow Indicator
Fuel Flow Power Supply Unit

System 74 - Ignition

Ignition Exciter Unit
Igniter Plugs, Champion Continuous Duty
Igniter Plugs, Champion Intermittent Duty

System 75 - Air

Nose Cowl Thermostatic Valve

System 76 - Engine Controls

Engine Fire Emergency Shutdown Switch

System 77 - Engine Indicating

Engine Pressure Ratio Indicator
Engine Pressure Ratio Transmitter
Engine Vibration Indicator - Amplifier
Engine Vibration Pickup, Inlet Fwd., Turbine Aft
Exhaust Gas Temperature Indicator
Exhaust Gas Temperature Probes
Engine Accessory Module
Tachometer Indicators, N_1 & N_2
Tachometer Generator

System 78 - Exhaust

Accumulator
Deflector Door Unlock Actuator
Deflector Door Operation Actuator
Hyd. Press. Accum. Switch
Thrust Reverser Isolation Valve
Thrust Reverser Control Valve
Directional Valve
Thrust Reverser Actuator (Pneumatic)
Thrust Reverser Assembly
Thrust Reverser Lock Assembly
Thrust Reverser Sequence Valve

System 79 - Oil

Engine Oil Filter By-Pass Switch
Engine Oil Low Pressure Switch
Engine Oil Pressure Indicator
Engine Oil Pressure Transmitter
Engine Oil Quantity Indicator
Engine Oil Quantity Compensator & Tank Unit
Engine Oil Temperature Bulb
Engine Oil Temperature Indicator
Oil Tank & Stick Quantity Indicator
Oil Strainer

A. GENERAL

This section contains general information on selected airframe and engine components considered to be maintenance significant. The aircraft component selection was originally developed by Boeing, customer airlines and the FAA 737 Maintenance Review Board.

FAA regulations permit three maintenance control processes to be applicable to the 737 maintenance program. They are "Condition Monitoring," "On Condition" and "Hard Time". Each of these processes is defined by the following descriptions. To properly place each component in the appropriate maintenance category, each component has been subjected to the decision logic process developed through joint efforts of the Air Transport Association, the manufacturer, and the FAA. Results of the application of the decision logic placed a majority of the components in the "Condition Monitoring" category.

(1) Adoption of "Condition Monitoring" (CM) as the maintenance control process for a component removes any time limit or fixed overhaul period. No specific maintenance tasks are required in order to use the "Condition Monitoring" process for a component. However, certain tasks may be called out for CM components during the scheduled checks to accomplish servicing, operational checks or establish physical security.
(2) "On Condition" (OC) was selected as the maintenance control process for those components for which a check or test can be performed on the airplane which will give reasonable assurance of the probability of continued airworthiness until the next specified check. Each item listed as OC includes the maintenance planning document reference defining the applicable OC check or test.
(3) A component was placed in the "Hard Time" maintenance category and given a fixed removal period if statistical data revealed an economic advantage to the scheduled removal of a component, or if the failure of that component would have a direct adverse affect upon flight safety.

For those operators who do not adopt a "Condition Monitoring" program, an alternate "Hard Time" is listed. Those items for which only CM appears in the "Maintenance Frequency" column, an alternate "Hard Time" of 22,400 hours is suggested. In those cases in which an alternate "Hard Time" of less than 22,400 hours is advisable, the alternate "Hard Time" will appear in the "Maintenance Frequency" column along with the CM recommendation. (Operators having a CM Program should ignore the alternate hard times listed.)

Where "Hard Times" are shown, it is recommended that the component be removed for overhaul when it accumulates the flight hours specified. However, if a MPD Reference and/or note is provided, that component should be removed for a shop visit or other action as specified.

MPD ITEM NUMBER	MRB	INTERVAL	ZONE	ACCESS	APPLICABILITY APL	APPLICABILITY ENG	MAN HOURS	TASK DESCRIPTION
B29-00-00-6A		3C	101 102 216 701	3701	ALL	ALL	03.0	FUNCTIONALLY CHECK THE HYDRAULICS SYSTEMS "A", "B", AND STANDBY FOR INTERNAL LEAKAGE.
B29-09-11-2A	#	1C	217		ALL	ALL	00.2	CLEAN THE HYDRAULIC RESERVOIR PRESSURIZATION MODULE FILTER.
B29-15-00-A	#	1C	216		ALL	ALL	---	VISUALLY CHECK THE FOLLOWING LEFT WHEELWELL SYSTEM "A" HYDRAULIC COMPONENTS AND ASSOCIATED PLUMBING FOR CONDITION AND SECURITY OF INSTALLATION. 1. MODULAR UNITS, 2. HYDRAULIC PRESSURE TRANSMITTER (MM 29-31-12). 3. ELECTRIC MOTOR DRIVEN HYDRAULIC PUMP AND ACOUSTIC FILTER, 4. HYDRAULIC FLUID OVERHEAT WARNING SWITCH (MM 29-32-12), 5. HYDRAULIC LINES, BRACKETS AND FITTINGS. SEE TASK CARD Z53-216-01.
B29-15-00-A	#	1C	217		ALL	ALL	---	VISUALLY CHECK THE FOLLOWING RIGHT WHEELWELL SYSTEM "B" HYDRAULIC COMPONENTS AND ASSOCIATED PLUMBING FOR CONDITION AND SECURITY OF INSTALLATION. 1. MODULAR UNITS, 2. HYDRAULIC PRESSURE TRANSMITTER (MM 29-31-12), 3. ELECTRIC MOTOR DRIVEN HYDRAULIC PUMP AND ACOUSTIC FILTER, 4. HYDRAULIC FLUID OVERHEAT WARNING SWITCH (MM 29-32-12), 5. HYDRAULIC RESERVOIR PRESSURIZATION MODULE, DEPRESSURIZATION VALVE AND PRESSURE GAGES (# MRB ITEM) (MM 29-09-311), 6. HYDRAULIC QUANTITY INDICATING TRANSMITTERS AND SWITCHES (# MRB ITEM), 7. EDP PRESSURE SWITCH (MM 29-22-41), 8. HYDRAULIC LINES, BRACKETS AND FITTINGS. SEE TASK CARD Z53-217-01.

COMPONENT MAINTENANCE INFORMATION ATA NO. 27

CHAPTER	FLIGHT CONTROLS DESCRIPTION COMPONENTS COMMON TO 737-300/400/500		QTY PER ACFT	REFERENCE MAINT MANUAL	MAINT FREQUENCY	LOCATION ZONE AND AREA	ACCESS DOOR NUMBER	TIME HOURS & TENTHS REMOVE AND REPLACE ELAPSED	MAN HRS
8-27-01	FLIGHT CONTROL SHUTOFF VALVE ASSEMBLY SYSTEM A AND B		2	27-09-31	CM	2-16 2-17	NA	.25	.25
8-27-02	FLIGHT SPOILER SHUTOFF VALVE ASSEMBLY SYSTEM A AND B		2	27-09-41	CM	2-16 2-17	NA	.25	.25
8-27-03	AILERON TRIM SWITCH	#	2	27-11-00	CM	1-1	1-2		.20
8-27-04	AILERON TRANSFER MECHANISM		1	27-11-61	CM	2-2	1103	1.75	2.75
8-27-05	AILERON POWER CONTROL UNIT	#	2	27-11-71	O/C MPD B29-00-00-6A	2-16	NA	1.00	1.00
8-27-06	AILERON ARTIFICIAL FEEL, CENTERING & TRIM MECHANISM	#	1	27-11-81	CM	2-16		1.00	1.00
8-27-07	AILERON TRIM ACTUATOR	#	1	27-11-54	CM	2-16		1.00	1.00
8-27-08	RUDDER TRIM INDICATOR	#	1	27-21-00	CM	1-1	1-2		.20
8-27-09	RUDDER TRIM CONTROL SWITCH ASSEMBLY	#	1	27-21-00	CM	1-1 1-2		.20	.20
8-27-10	RUDDER TRIM CENTERING UNIT ASSEMBLY (ALSO CALLED RUDDER FEEL & CENTERING UNIT ASSEMBLY)	#	1	27-21-82	CM	7-6		.30	.30
• 8-27-11	RUDDER POWER CONTROL UNIT		1	27-21-91	O/C MPD B29-00-00-6A	7-6	9512 9514	1.50	1.50
8-27-12	RUDDER TRIM ACTUATOR	#	1	27-21-87	CM	7-6	9509	1.00	1.00
8-27-13	STANDBY RUDDER ACTUATOR SHUTOFF VALVE ASSEMBLY		1	27-21-94	CM	2-16	NA	.25	.25
• 8-27-14	STANDBY RUDDER ACTUATOR (POWER CONTROL UNIT)		1	27-21-24	O/C MPD B29-00-00-6A	7-6	9515	1.00	1.00
8-27-15	ELEVATOR POWER CONTROL UNIT	#	2	27-31-14	O/C MPD B29-00-00-6A	7-4	3802	1.00	1.00
8-27-16	DELETED - B737-100/-200 ONLY								
8-27-17	ELEVATOR FEEL COMPUTER	#	1	27-31-37	O/C MPD B27-31-17-2B	7-4	3701	1.00	1.00
8-27-18	ELEVATOR FEEL AND CENTERING UNIT	#	1	27-31-64	CM	7-4	3701	1.00	1.00