FAILURE MODES EFFECTS ANALYSIS (FMEA) – CRITICAL HARDWARE
NUMBER: 03-2F-111110 -X

SUBSYSTEM NAME: FORWARD REACTION CONTROL SYSTEM (RCS)
REVISION: 3 10/18/94

		PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	:	TANK ASSEMBLY, PROPELLANT MARTIN MARIETTA	MC282-0061-0601 855C3320000-029
LRU	:	TANK ASSEMBLY, PROPELLANT MARTIN MARIETTA	MC282-0061-0602 855C3320000-030

PART DATA

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
TANK ASSEMBLY, PROPELLANT, INCLUDING ACQUISITION DEVICE

QUANTITY OF LIKE ITEMS: 2
ONE REQUIRED PER PROPELLANT

FUNCTION:
TO STORE/SUPPLY PROPELLANT FOR REACTION CONTROL THRUSTERS. ACQUISITION DEVICE RETAINS PROPELLANTS FOR ADEQUATE FEED DURING 1"G", 0"G" AND HIGH "G" CONDITIONS. REGULATED HELIUM IS SUPPLIED TO THE ULLAGE TO FORCE PROPELLANT TO THE THRUSTERS AS REQUIRED. (243 + OR -4 PSIA) (17.95 CUBIC FEET). ACQUISITION DEVICE CONSISTS OF UPPER AND LOWER COMPARTMENT CHANNELS, SCREENS, FEEDOUT TUBE, PLENUM, BULKHEAD, BARRIER AND COLLECTOR.

FAILURE MODES EFFECTS ANALYSIS (FMEA) – CRITICAL FAILURE MODE
NUMBER: 03-2F-111110 - 01

REVISION# 3 10/14/94

SUBSYSTEM NAME: FORWARD REACTION CONTROL SYSTEM (RCS)
LRU: TANK ASSEMBLY, PROPELLANT
ITEM NAME: TANK ASSEMBLY, PROPELLANT
CRITICALITY OF THIS FAILURE MODE: 1/1

FAILURE MODE:
EXTERNAL LEAK, STRUCTURAL FAILURE - TANK WALL CRACK OR RUPTURE WHICH PROPAGATES AROUND TANK

MISSION PHASE:

PL	PRELAUNCH
LO	LIFT-OFF
OO	ON-ORBIT
DO	DE-ORBIT
LS	LANDING SAFING

VEHICLE/PAYLOAD/KIT EFFECTIVITY: 102 COLUMBIA
103 DISCOVERY
104 ATLANTIS

CAUSE:
MECH SHOCK, FATIGUE/VIB, OVERPRESS, STRESS CORROS, IMPROPER PROP PURITY OR TEST FLUID, STRESS RISER, WELD OR MATERIAL DEFECT, INCORRECT OR DAMAGED SEAL.

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

REDUNDANCY SCREEN A) N/A
B) N/A
C) N/A

PASS/FAIL RATIONALE:
A)

B)

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:
LOSS OF PROPELLANT SUPPLY FOR MODULE THRUSTERS.

(B) INTERFACING SUBSYSTEM(S):
POTENTIAL FIRE/EXPLOSION AND CERTAIN CONTAMINATION OF SUBSYSTEMS IN RCS COMPARTMENT.

FAILURE MODES EFFECTS ANALYSIS (FMEA) – CRITICAL FAILURE MODE
NUMBER: 03-2F-111110 - 01

(C) MISSION:
EARLY MISSION MODIFICATION.

(D) CREW, VEHICLE, AND ELEMENT(S):
POTENTIAL LOSS OF CREW/VEHICLE IF FAILURE IS BEFORE ET SEPARATION. LOSS OF MODULE/VEHICLE DUE TO OVERPRESSURIZATION. LOSS OF PROPELLANT.

(E) FUNCTIONAL CRITICALITY EFFECTS:

-DISPOSITION RATIONALE-

(A) DESIGN:
DESIGN FACTOR OF SAFETY IS 1.5 FOR BURST AND 1.34 FOR PROOF. DEVELOPMENT TESTS INCLUDE WELD CYCLE LIFE (800 CYCLES), FRACTURE MECHANICS, AND FORGING EVALUATION. ALL MATERIALS USED IN THE FABRICATION OF THE TANK ARE COMPATIBLE WITH PROPELLANTS.

(B) TEST:
THE QUALIFICATION TEST PROGRAM INCLUDES EXPULSION CYCLES (166,000 FLOW TRANSIENTS OVER 200 EXPULSION CYCLES), PRESSURE CYCLES (800 CYCLES), BOOST RANDOM VIBRATION (4.6 MIN/AXIS), ACCELERATION, EXTERNAL PRESSURE, PROPELLANT EXPOSURE, PRESSURE HOLD CREEP, BURST (525 PSIG), FUNCTIONAL TEST, HANDLING SHOCK, SHIPPING CONTAINER SHOCK, 100 MISSION LIFT-OFF VIBRATION.

THE TANK ALSO QUALIFIED AS PART OF THE POD IN THE VIBRO-ACOUSTIC TEST AT JSC (131 EQUIVALENT MISSIONS) AND THE HOT FIRE TEST AT WSTF (24 EQUIVALENT MISSION DUTY CYCLES AND APPROX 7 YEARS OF PROPELLANT EXPOSURE).

THE ACCEPTANCE TEST PROGRAM INCLUDES SUBASSEMBLY BUBBLE POINT VERIFICATION, PAD SUBASSEMBLY VISUAL INSPECTION, RADIOGRAPH AND DYE PENETRANT INSPECTION, PROOF PRESSURE (470 PSIG), BUBBLE POINT RETENTION, OUTFLOW DELTA PRESSURE PERFORMANCE, INTERNAL CLEANLINESS, HOT N2 PURGE WITH SAMPLES FOR IPA.

OMRSD PERFORMS THE FOLLOWING: STATIC AIR SAMPLING EVERY FLIGHT AND ON A CONTINGENCY BASIS. PROPELLANT SAMPLING ON FLIGHT #2 WHEN PROPELLANT MANIFOLDS ARE DRAINED. THEN ON A CONTINGENCY WHEN SUSPECTED CONTAMINATION (FLIGHT DATA INDICATES FLOW RESTRICTION), OR PROPELLANT OFF-LOAD EXCEPT AT LAUNCH PAD. PROPELLANT LOADING FOR EVERY FLIGHT. TOXIC VAPOR LEAK CHECK OF THE PROPELLANT TANK FIRST FLIGHT AND ON CONTINGENCY. AN EXTERNAL LEAKAGE VERIFICATION OF THE SYSTEM FOR THE FIRST FLIGHT AND ON A CONTINGENCY BASIS. SUBSYSTEM INSPECTION THE FIFTH FLIGHT AND EVERY FIVE FLIGHT THEREAFTER AND ON A CONTINGENCY BASIS. ALSO, A CONTINGENCY EXISTS IF STRUCTURAL AND COMPONENT EXTERNAL DEGRADATION IS SUSPECTED OR WHENEVER THE POD/MODULE IS REMOVED, THIS INSPECTION SHALL BE PERFORMED. CONTROL OF N204 SPECIFICATION.

(C) INSPECTION:
RECEIVING INSPECTION

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL FAILURE MODE
NUMBER: 03-2F-111110 - 01

CHEMICAL AND PHYSICAL PROPERTIES TESTS REPORTS ARE VERIFIED BY INSPECTION.

CONTAMINATION CONTROL
HEMISPHERE CLEANLINESS IS VERIFIED BY INSPECTION PRIOR TO WELDING. GIRTH WELDS PENETRANT AND RADIOGRAPHICALLY INSPECTED. SCREEN MATERIAL CLEANLINESS IS VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION
TANK HEMISPHERES ARE DIMENSIONALLY INSPECTED.

NONDESTRUCTIVE EVALUATION
FORGINGS ARE ULTRASONICALLY INSPECTED. AFT TANK GIRTH WELDS ARE ULTRASONICALLY INSPECTED IN THE COLLECTOR DOME AREA. WELD START AND STOP POINTS ARE INSPECTED WITH FIBER OPTICS.

CRITICAL PROCESSES
WELDING IS VERIFIED BY INSPECTION.

TESTING
ATP IS WITNESSED AND VERIFIED BY INSPECTION.

HANDLING/PACKAGING
PACKAGING FOR SHIPMENT IS VERIFIED BY INSPECTION.

(D) FAILURE HISTORY:
NONE

(E) OPERATIONAL USE:
IF LEAK RATE SUPPORTS, PERFORM NOMINAL ET SEP, OTHERWISE, ATTEMPT NO FWD JET SEP. REDLINE ADDITIONAL AFT RCS PROPELLANT FOR TAIL ONLY ATTITUDE CONTROL-MAY RESULT IN EARLY MISSION TERMINATION. IF LEAK RATE SUPPORTS, DUMP PROPELLANT ON-ORBIT TO MINIMIZE FIRE HAZARD.

- APPROVALS -

EDITORIALLY APPROVED	: RI	:
EDITORIALLY APPROVED	: JSC	: 5/17/95
TECHNICAL APPROVAL	: VIA CR	:S502598