SUBSYSTEM: SEPARATION

ITEM NAME: Fwd Booster Separation Motor (BSM)

PART NO.: 10317-0001-805, -806

FM CODE: A07

ITEM CODE: 30-01-06

REVISION: Basic

CRITICALITY CATEGORY: 1R

REACTION TIME: Immediate

NO. REQUIRED: 4 Forward

DATE: March 1, 2002

CRITICAL PHASES: Boost

SUPERCEDES: March 31, 2000

CN 044

FMEA PAGE NO.: B-20A

ANALYST: T. Burke/S. Parvathaneni

SHEET 1 OF 4

APPROVED: S. Parvathaneni

FAILURE MODE AND CAUSES: Premature ignition of the igniter, main grain or BKNO3 (two BSMs) caused by:

- o High temperature
- o Shock
- o Vibration
- o Increased sensitivity due to contamination
- o Electrostatic discharge
- o Acoustics

FAILURE EFFECT SUMMARY: Loss of separation thrust results in loss of mission, vehicle and crew.

REDUNDANCY SCREENS AND MEASUREMENTS:

1. N/A
2. Fail - Loss of redundancy not detectable by flight or ground crew.
3. Pass

RATIONALE FOR RETENTION:

A. DESIGN

Design Specification is USA SRBE 10SPC-0067.

o High temperature

- BKNO3, booster charge, shall not ignite when subjected to a temperature of 400^{O}F for 15 minutes or 210^{O}F for six hours.

CN 044

- Propellant - Predicted high temperature of BSM motor propellant including igniter grain will not exceed 106^{O}F .

- BSM propellant is qualified to 120^{o}F per Test Report CSD 5180-79-109 and CSD-5596-88-3.

o Shock - Fwd BSM does not experience an ordnance shock environment. The Aft BSM was subject to ordnance shock as reported in CSD 5180-79-109 and CSD-5596-88-3.

o Electrostatic discharge/Lighting Effects - Propellant is encased in aluminum which is hard mounted to primary structure. The mounting surface of the BSM shall be free of resistive film and contamination so as to produce a 2.5 milliohm maximum electrical bonding.

o Vibration - Vibration performed on eight motors per qual test report CSD 5180-79-109. Vibration performed on four motors per qual test report CSD-5596-88-3. Acoustic environment is included in vibration test criteria.

o Delta Qualification Tests

- The FWD BSM was qualified per qual test reports CSD-5180-79-109 and CSD-5596-88-3.

- CSD 5597-93-2 delta qualification tests for BSM configuration 10317-0001-805. Delta qualification on two units subjected to environmental and functional tests.

B. TESTING

o None

C. INSPECTION

o All listed vendor related inspections are conducted 100% by vendor (or sub-tier vendor) QA personnel. Where no designated QA organization exists at a vendor, inspections are witnessed/monitored by CSD QA personnel or inspection records are evaluated for compliance with quality system requirements by CSD QA personnel.

o All listed KSC related inspections are conducted 100% by USA SRBE or SPC QA personnel.

VENDOR RELATED INSPECTIONS

Propellant Constituents Inspections

Hydroxyl Terminated Poly-Butadiene

- Chemical/physical properties of the following constituents are verified by test and data evaluation.
  - Hydroxyl value
  - Water
  - Iron
  - Peroxide
  - Antioxidant
  - Viscosity @30^{o} C
  - Insolubles

- Infrared spectra analysis performed to identify material Isophorone Diisocyanate
- Chemical/physical properties of the following constituents are verified by test and data evaluation.
  - NCO equivalent weight
  - Dimer
  - Density @20^{o} C
  - Hydrolyzable chloride
  - Water

- Infrared spectra analysis performed to identify material

Di-octyl Adipate
- Chemical/physical properties of the following constituents are verified by test and data evaluation.
  - Ester content
  - Specific gravity at 25 ^{O}C
  - Acidity, as acetic acid

Stabilizer
- Melting point is verified by test and data evaluation

Bonding Agent
- Chemical/physical properties of the following constituents are verified by test and data evaluation.
  - Imine equivalent weight
  - Hydrolyzable chloride
  - Moisture (weight percent)
- Infrared spectra analysis performed to identify material

Aluminum
- Chemical/physical properties of the following constituents are verified by test and data evaluation.
  - Free aluminum metal
  - Volatiles
  - Ether Extractables
  - Particle size distribution

Ferric Oxide
- Chemical/physical properties of the following constituents are verified by test and data evaluation.
  - Ferric oxide, assay
  - Loss on ignition
  - Water content
  - pH, water suspension
  - Particle size distribution

Ammonium Perchlorate (Standard)
- Chemical/physical properties of the following constituents are verified by test and data evaluation.
  - Ammonium perchlorate assay
  - Tricalcium Phosphate
  - Total water
  - pH of water solution
  - Sulfated ash
  - Particle size

Ammonium Perchlorate (90 micron)
- Chemical/physical properties of the following constituents are verified by test and data evaluation.
  - Ammonium perchlorate assay
  - Tricalcium Phosphate
  - Total water
  - pH of water solution
  - Sulfated ash
  - Particle size

o Igniter/Motor Moisture/Contamination

- A 100% inspection is performed on the interior of the motor just prior to installation of the nozzle assembly and taping weather seal on nozzle.

- Installation of security bag and lead seal verified.

- BKN03 velostat bag is processed in a nitrogen box and purged with nitrogen until it reaches a specified relative humidity. Relative humidity is verified and BKNO3 bag welds are vacuum tested and verified.

KSC RELATED INSPECTIONS

o Receiving Inspection (All Failure Causes)

- Verify for each BSM received there is no evidence of damage, corrosion, misalignment or moisture per OMRSD File V, Vol. I, requirement number B000FL.005.

o FWD BSM Installation Inspections per 10REQ-0021. (Electrostatic Discharge)

- Electrical bonding resistance check between SRB Structure ground and BSM verified per para. 1.2.1.2.6.

- Electrical bonding resistance check between BSM and Frustum verified per para. 1.2.1.2.6.

- Aerosheat Shield (AHS) cover seal integrity is tested by verifying no visual leakage for forward BSM AHS per para. 1.1.3. (Contamination)

D. FAILURE HISTORY:

Failure histories may be obtained from the PRACA database.

E. OPERATIONAL USE

o Not applicable to this failure mode.