STS-98 (BI105)
SPECIAL PRCB

January 15, 2001

Solid Rocket Booster

Cable Investigation

United Space Alliance

STS-97 IFA CABLE INVESTIGATION

Presenter:
Robert Wright
Organization/Date:
USA-SRB/1-15-01

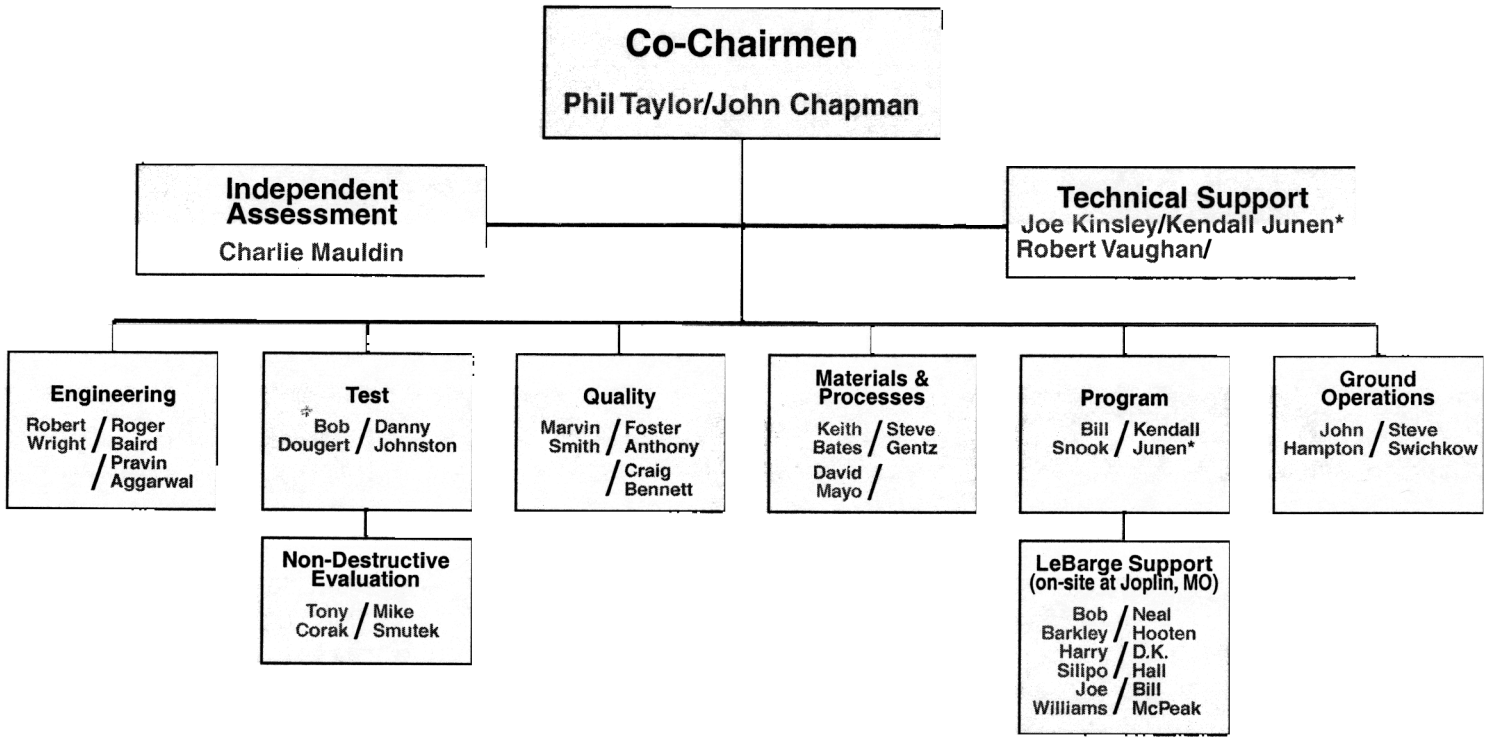
Team Charter:

1. Develop detailed understanding of SRB cable problems
2. Develop corrective action to enable flight rationale for near-term flights
3. Develop long-term cable strategy

STS-97 IFA CABLE INVESTIGATION

Presenter: Robert Wright

Organization/Date: USA-SRB/1-15-01



Discipline Expert Consultants
- Robert Schwinghamer
- Lockheed Martin (Titan)
- USAF Reliability Lab (WPAFB)
  George Slenski

Ad Hoc Team Members
- RSRM
- Level II

*Dual Assignment

AGENDA

Presenter:
Robert Wright

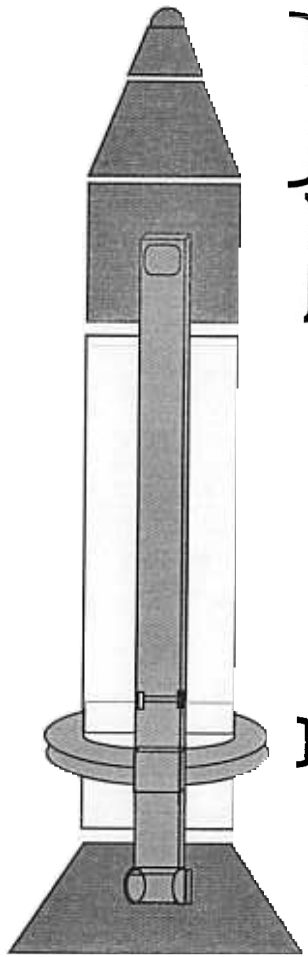
Organization/Date:
USA-SRB/1-15-01

- STS-97 IFA
  - Anomaly definition
  - Applicability to STS-98
  - Work performed on STS-98
- Systems Tunnel Cable Anomaly
  - Anomaly definition
  - Applicability to STS-98
- Flight Rationale for SRB cables

SRB CABLE INVESTIGATION

Presenter: Robert Wright

Organization/Date: USA-SRB/1-15-01



Nose Cap / Frustum
Throw-Away - 22

Forward Skirt
Throw-Away - 8
Non-Water Tight Reusable - 82

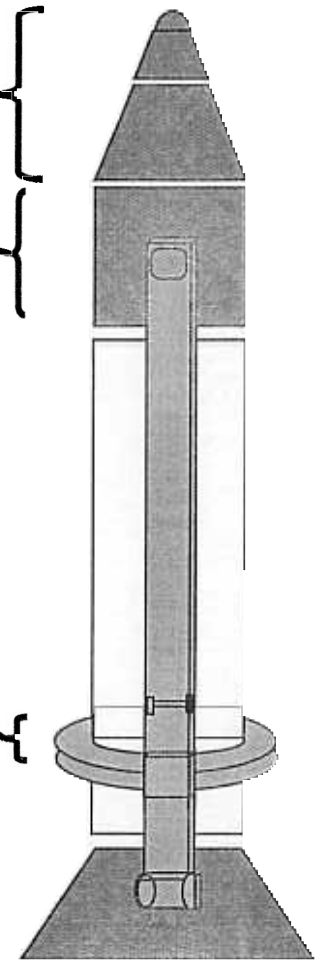
Forward Systems Tunnel
Throw-Away - 2
Water Tight Reusable - 16

ET Attach Ring
Throw-Away - 26
Water Tight Reusable - 10

Aft Systems Tunnel
Water Tight Reusable - 22

Aft Skirt
Throw-Away - 22

Totals
Water Tight Reusable - 48
Non-Water Tight Reusable - 82
Throw-Away- 80
Flight Set Total - 210



LH - 105 Total

RH - 105 Total

STS-98

United Space Alliance

STS-97 IFA CABLE INVESTIGATION

Presenter:
Robert Wright
Organization/Date:
USA-SRB/1-15-01

NSI Pressure Cartridge Failed to Fire

Problem

- System "A" NSI Pressure Cartridge in LH aft lower strut did not fire
  - Criticality 1R failure of SRB separation system

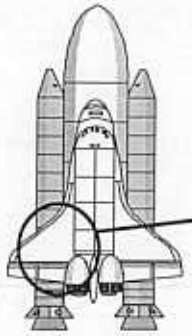
Discussion

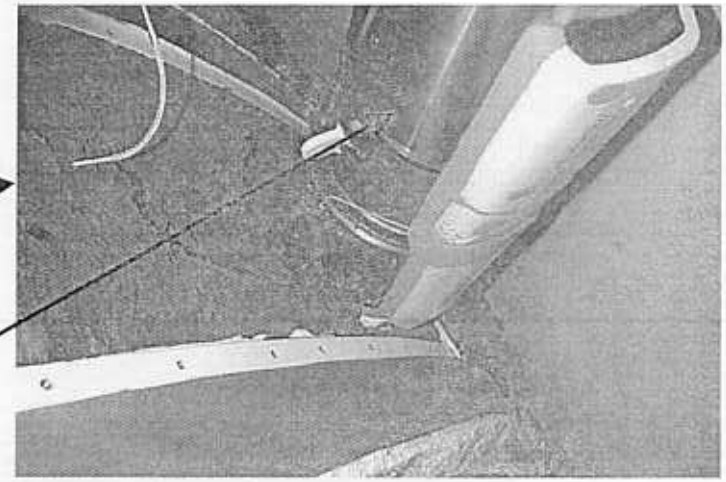
- Technician discovered an unfired NSI Pressure Cartridge at aft separation bolt during normal disassembly procedure
- Anomaly Resolution Team (ART) formed to investigate
- Plan developed to investigate anomaly, pyrotechnic or electrical system
- Fault tree analysis plan developed

STS-97 IFA CABLE INVESTIGATION

Presenter:
Robert Wright

Organization/Date:
USA-SRB/1-15-01

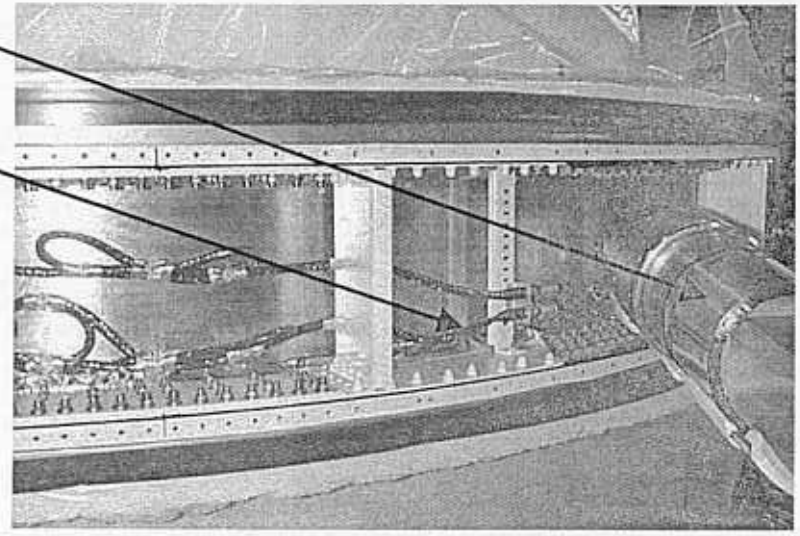




Diagonal Strut

Lower Strut

STS-97 Failed cable



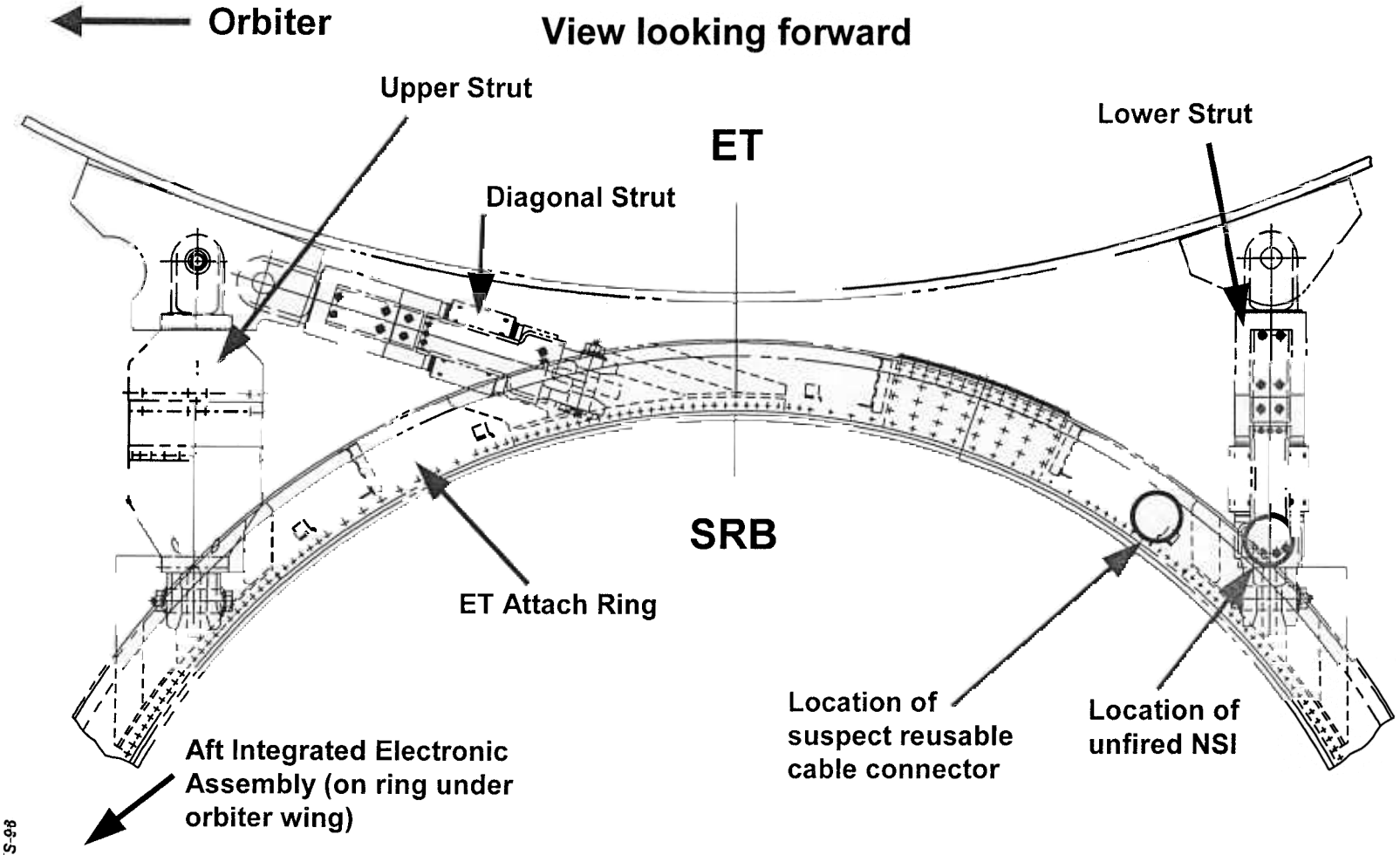
STS-98

United Space Alliance

STS-97 IFA CABLE INVESTIGATION

Presenter: Robert Wright

Organization/Date: USA-SRB/1-15-01



STS-98

United Space Alliance

STS-97 IFA CABLE INVESTIGATION

Presenter:
Robert Wright
Organization/Date:
USA-SRB/1-15-01

Discussion (cont.)

- Pyrotechnic
  - NSI bridge wire found intact and NSI fired nominally in subsequent test
  - Pyrotechnic fault tree closed
- Electrical
  - MECs
    - Verified both Orbiter Master Events Controllers (MECs) issued separation commands to both System "A" (SRB side) and "B" (ET side)
      - All other System "A" pyrotechnic components performed nominally during mission; System "B" LH lower strut performed nominally
  - Integrated Electronics Assembly (IEA)
    - Visual internal inspection of aft IEA found no anomalies
    - Tested separation system six times with no anomalies noted
    - Successfully completed normal refurbishment testing including ambient, functional thermal and vibration tests
    - IEA fault tree closed

STS-97 IFA CABLE INVESTIGATION

Presenter:
Robert Wright
Organization/Date:
USA-SRB/1-15-01

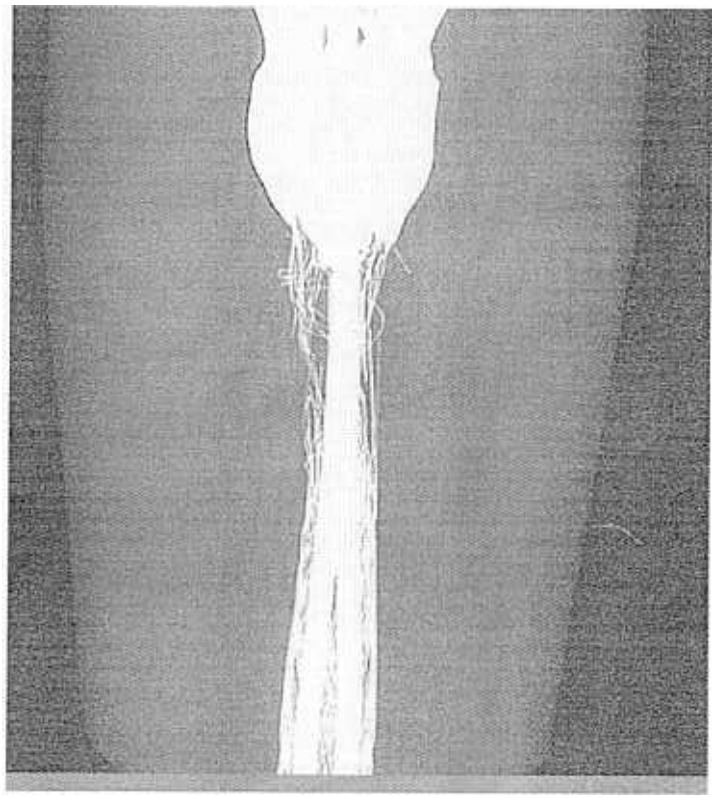
Discussion (cont.)

- Electrical - SRB cables
  - Electrical testing found open circuit in both conductors and shield of ET Attach Ring (ETAR) watertight reusable (WTR) ordnance cable
    - Cable manufactured in 1985
    - Flown on nine previous missions
    - Cable passed all pre-flight electrical tests
  - X-ray photos and failure analysis verified completely broken shield in reusable watertight ordnance cable
  - Failure analysis of cable verified conductors were broken at crimp connection of pins
  - Most probable cause of failure determined to be handling damage caused by unique handling process during lifecycle of ETAR WTR ordnance cables

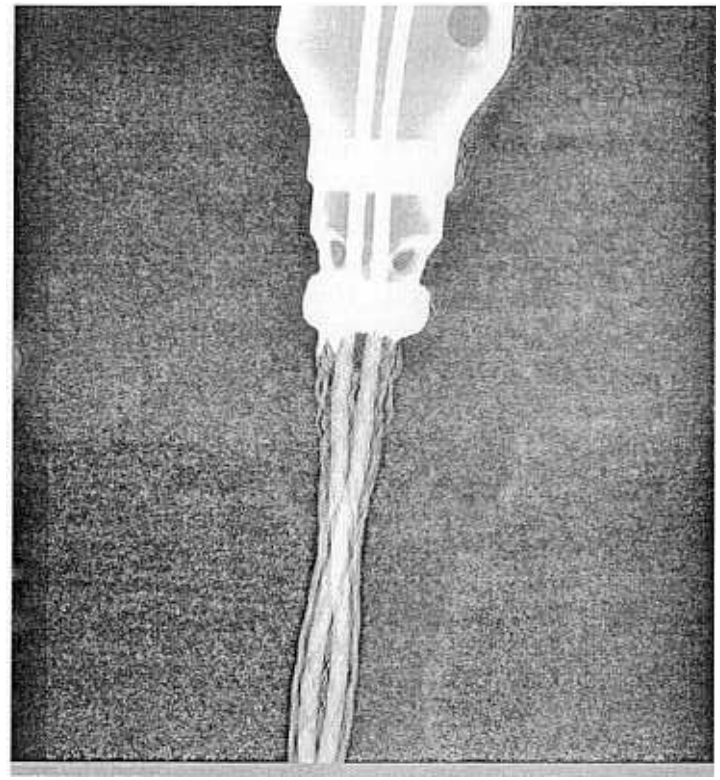
STS-97 IFA CABLE INVESTIGATION

Presenter:
Robert Wright
Organization/Date:
USA-SRB/1-15-01

Discussion (cont.)



STS-97 IFA Cable



Good Cable

STS-97 IFA CABLE INVESTIGATION

Presenter:
Robert Wright
Organization/Date:
USA-SRB/1-15-01

Discussion (cont.)

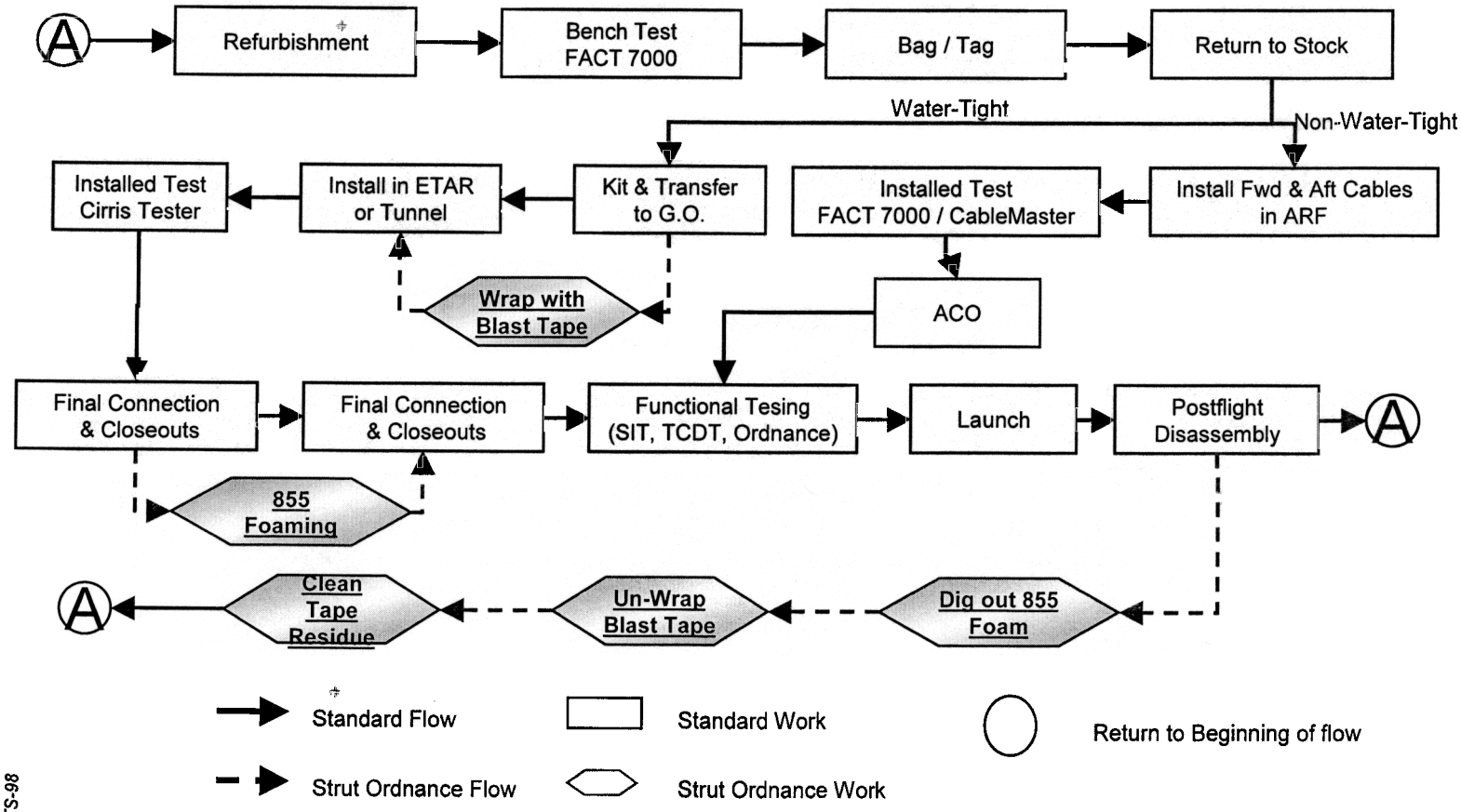
- Handling of ETAR WTR ordnance cables is unique
  - Bench test
  - Kit for transfer
  - ***Wrap with two layers of thermal tape***
  - ***Wrap with Mylar tape over blast tape***
  - Route and install in ETAR
  - ***Foam in place with PR 855 foam***
  - Flight environment
  - ***Remove from foam***
  - ***Remove all three layers of tape***
  - ***Remove tape residue from cable jacket***
  - Bench test
  - Bag & tag
  - Return to stock

STS-97 IFA CABLE INVESTIGATION

Presenter: Robert Wright

Organization/Date: USA-SRB/1-15-01

SRB Reusable Cable Processing flow



STS-98

United Space Alliance