ISS Hardware Certification Process and Challenges

Mark Weyland
Lockheed Martin at NASA/Johnson Space Center

Disclaimer

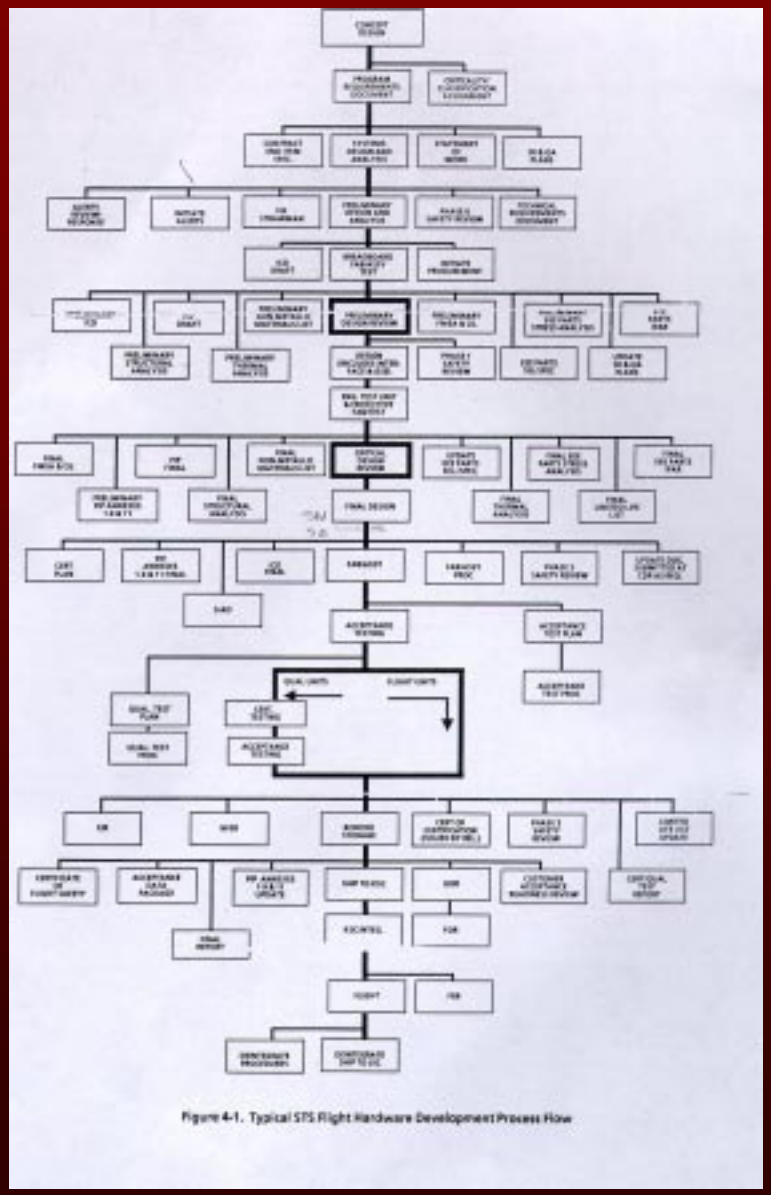
The material presented here are the thoughts and opinions of the author, and may not represent the views of Lockheed Martin or NASA.

Purpose

Familiarize international user community with Johnson Space Center (JSC) flight hardware certification processes, approximate timelines/costs, and potential pitfalls.

Certification Process

- Before, during, and after ISO-9000 and switch to the Engineering Directorate



EV-CPDS

EV-CPDS

- Very complex instrument developed from ground up
- Over 5 years from start to finish
- Development and certification during transition to ISO-9000
  - » Significant difference being the amount of paperwork required to perform tasks
    - Final weight of EV-CPDS instrument = 72 lbs.
    - Final weight of paperwork = 75 lbs.

Example: Removing 5 screws to check interior of instrument

Before

»Engineer writes and opens TPS

»Technician removes screws

»Technician repairs broken insert with new one from project controlled storage

Total Time = 30 minutes

After

»Engineer writes TPS

»Takes to QA to open (leaves it in inbox)

»Calls and checks back repeatedly trying to get it open

»QA puts several MIP steps on TPS and opens it

»Wait for QA to arrive to begin taking screws out

»Technician removes screws

»QA writes a DR on the broken insert

»Must go to Bond room to retrieve new insert (they're closed for the day)

»Get new insert next morning but can't proceed due to QA overseeing another project

»QA shows up and new insert is installed

Total Time = 1.5 days

EV-CPDS

Example of mid-project labor expenditures:

» Over 200 people charging to project, which was running around 10 EPs per year during this phase

	% of effort
Admin.	4.0
Stress and Matl.	2.5
Design and Drafting	13.3
Documentation	9.4
Engineering	9.1
Software	15.0
Technician	24.4
Project Mgt.	6.5
Machine Shop	5.9
SR & QA	9.9

New Process for COTS and MOTS

- Officially same process
- Unofficially, and in practice, Commercial Off-The-Shelf (COTS) and Military Off-The-Shelf (MOTS) hardware is being processed much faster
- Previously unacceptable documentation is now considered acceptable

HRD

High Rate Dosimeter (HRD)

- Biggest challenge has been getting the project started
- Identified very well documented MOTS hardware over 1 year ago
- Approval from appropriate boards/panels/committees over 9 months ago
- Funding stuck at contracting officer for more than 6 months
- Integration contractor to begin work this month (personnel)
- Forecast delivery date is May 2001 (9 months)

Passive Dosimeter

Passive Dosimeter Modification

- Slight modification to existing certified hardware
- New unit was essentially a subset of previous unit – smaller, weighs less, no problem, right???
- Wrong…
  - » smaller can mean sharper, work around sharp edge concerns
  - » Instead of tape we switched to nylon screws… EMU (EVA suit) concerns: nylon is flammable in 100% O2
  - » EVA concerned about new smaller unit drifting out of the pocket
  - » Many documents to update/rewrite, many boards/panels etc. to present to
    - Inside EMU… materials cert.
    - Labels… drawing updates

Example Hardware Summary

Custom, Complex (EVPDS)	Well Documented COTS/MOTS	Small Modification to Certified Hardware
> 5 years	9 months – 1 year	~ 4 months
Avg. 8 EP/year + Material and Travel	3 EP full time + Material	2 people part time + Material (if any)

Conclusions

- Certifying hardware at the Johnson Space Center (JSC) for flight on the Space Shuttle or the International Space Station (ISS) is complex and expensive
- Recent changes including, but not limited to, the adoption of ISO-9000 have only made things worse
- Good News: ISS Program management recognizes problem and some steps have been taken to expedite the processes
- Bad News: Remains to be seen if these new initiatives will improve situation