

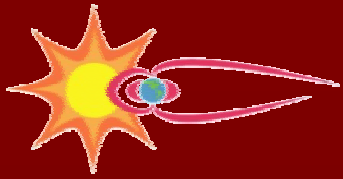
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ISS Hardware Certification Process and Challenges

Mark Weyland
Lockheed Martin at NASA/Johnson Space Center



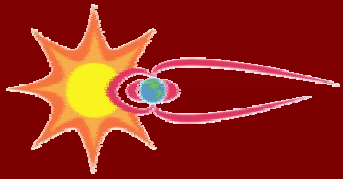
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Disclaimer



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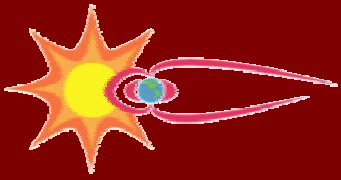
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Purpose



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



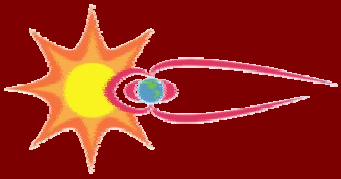
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EV-CPDS



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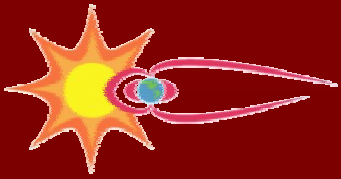
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EV-CPDS



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- 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

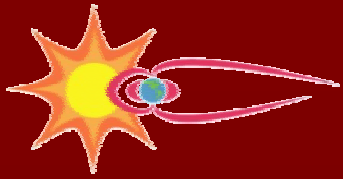
- » Engineer writes and opens TPS
- » Technician removes screws
- » Technician repairs broken insert with new one from project controlled storage

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



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EV-CPDS

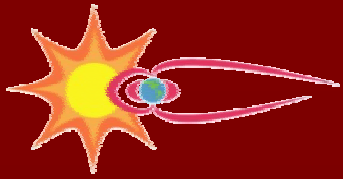


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Example of mid-project labor expenditures:

- » 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



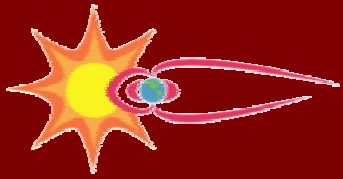
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New Process for COTS and MOTS



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- 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



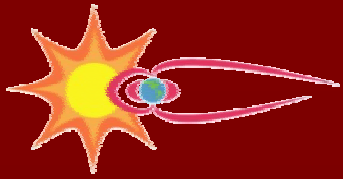
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HRD



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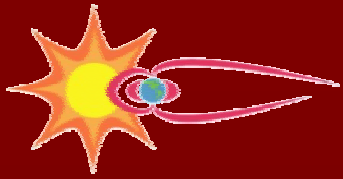
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High Rate Dosimeter (HRD)



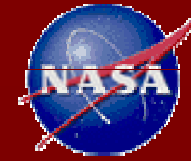
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- Biggest challenge has been getting the project started
- Identified very well documented MOTS hardware over 1 year ago
- Approval from appropriate boards/panels/committees over 9 months ago
- Funding stuck at contracting officer for more than 6 months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



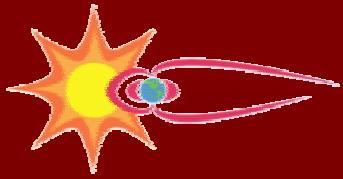
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Passive Dosimeter



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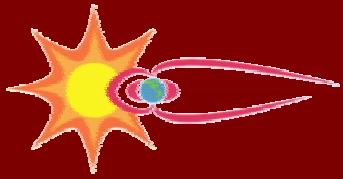




Passive Dosimeter Modification



- 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



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Example Hardware Summary



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Custom, Complex
(EVPDS)

Well Documented
COTS/MOTS

Small Modification
to Certified Hardware

> 5 years

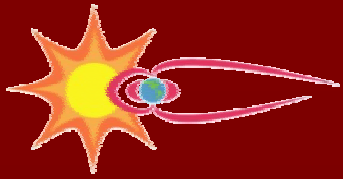
9 months – 1 year

~ 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