



COS
Monthly Status Review

February 27, 2002

Holiday Inn, Cocoa Beach, FL



COS
Monthly Status Review



Agenda

Progress Summary Since Last Monthly	J. Andrews
Optics Development Status	J. Andrews
Ground Calibration Planning	J. Andrews
UCB FUV Detector Programmatic Status	J. Andrews
UCB FUV Detector Technical Status	O. Siegmund
CU Software Activities Status	J. Andrews
Schedules	J. Andrews
Descope Report	J. Andrews
Upcoming Events/Activities	J. Andrews
CU Issues & Resolution Plan	J. Andrews
STScI Presentation	STScI
BATC Presentation	R. Higgins
Financial Splinter	GSFC/Ball/CU



Progress Summary Since Last Monthly (2/6/02)

- Continued rework of FUV detector door mechanism
 - Tested revised assembly successfully in vacuum
 - ETU vibed at LMMS
 - Completed post vibe TV testing of ETU
- Began reassembly of door mechanism on FUV-01 unit at CU.



Optics Development Status

- All FUV gratings are completed, coated, mounted, tested and meet/exceed specifications.
- All NUV flight gratings are fabricated, coated, tested and delivered to Ball. All meet/exceed CEI throughput specification.
- Two gratings utilize bare Al coatings - we have discussed this with John Mangus and Richard Harms and they agree the coatings will be fine.
- **AS REPORTED LAST MONTH, THE NUV “PROBLEM” IS CLOSED.**

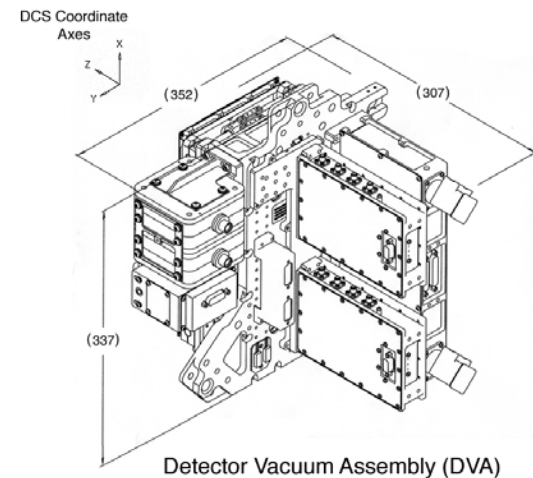
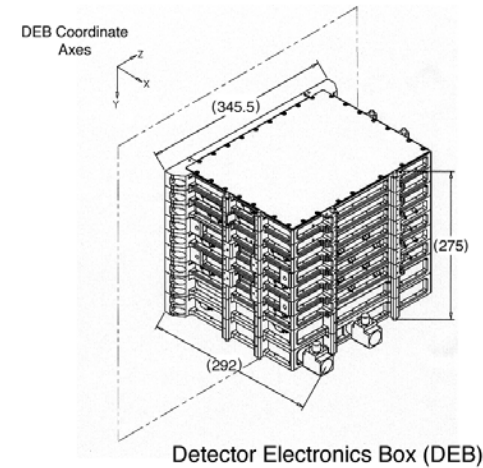


Ground Calibration Planning

- COS ground calibration to be done at Ball in NASA-4.
- GROVER is now available for refurbishment into the COS aberrated optical simulator (CAOS).
- The COS PI is now preparing a COS Ground Calibration Plan that will be used to establish requirements on calibration procedures and test set-ups.

Overview of FUV Detector Assemblies

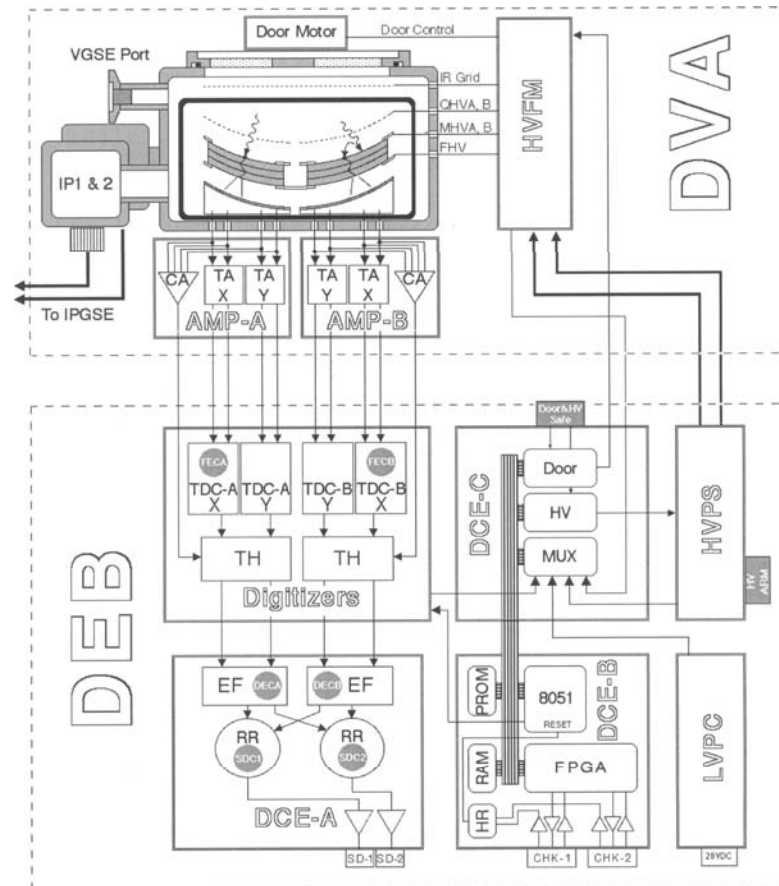
- **DEB - (Detector Electronics Box)**
 - DCE (Detector Control Electronics)
 - TDCs (Time-to-Digital Converters)
 - HVPS (High Voltage Power Supply)
 - LVPC (Low Voltage Power Converter)
- **DVA - (Detector Vacuum Assembly)**
 - VHA (Vacuum Housing Assembly)
 - Detector Door Mechanism
 - Ion Pump Assembly
 - DBA (Detector Backplate Assembly)
 - Amplifiers
 - HVFM (High Voltage Filter Module)





FUV Detector Subsystem Block Diagram

- UCB is under contract to deliver 1 flight FUV detector subsystem (FUV-01) and 1 flight-spare detector subsystem (FUV-02).



TA - Timing Amplifier
 CA - Charge Amplifier
 TDC - Time-to-Digital Converter
 TH - Threshold Ckt
 EF - Event Formatter
 RR - Round Robin Arbitrator

FEC - Front End Counter
 PRC - Preamp Reset Counter
 DEC - Digitized Event Counter
 SDC - Science Data Counter
 HR - Hardware Reset Ckt

GG 11/99



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FUV Detector Verification Testing Summary

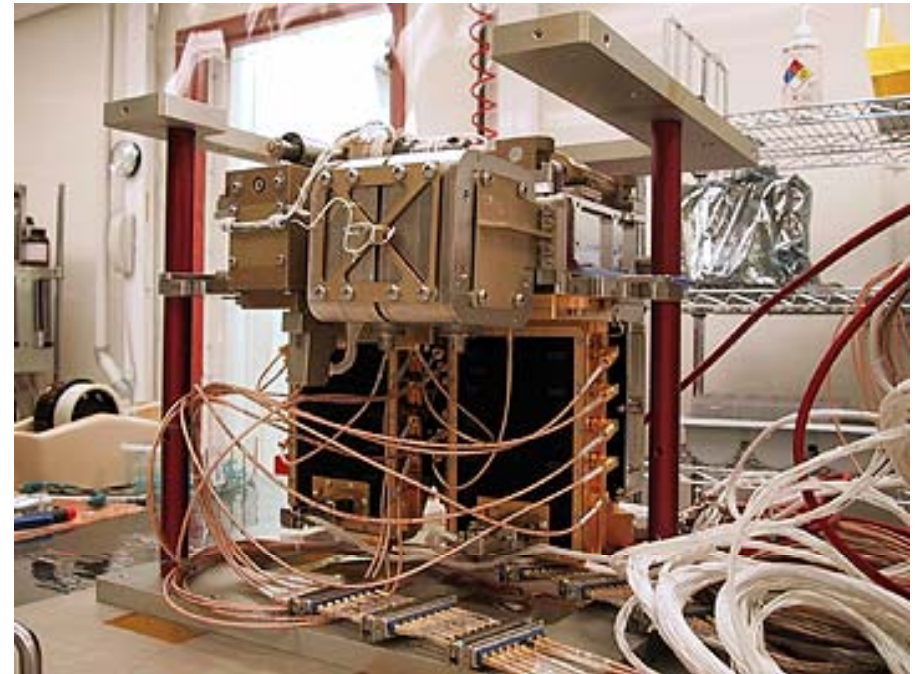
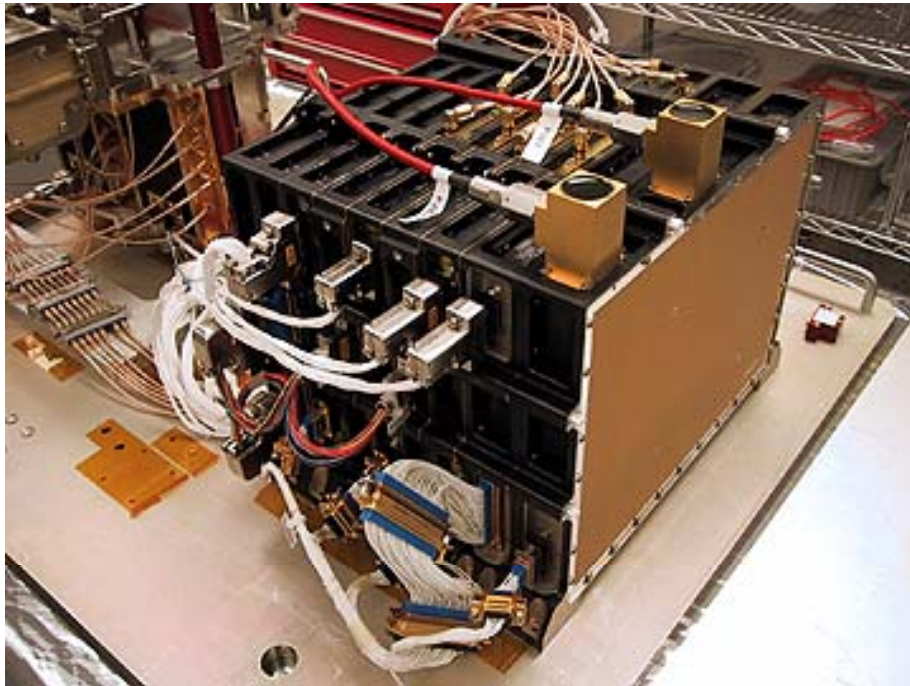
Unit	Functional Testing	Performance Testing	EMI/EMC	Sine Burst	Random Vibe	Thermal-Vac	Contamination Certification
FUV-01 DVA	C	C	@SS	A - C	A - C	@SS	@SS
FUV-01 DEB	C	C	@SS	Q - C	Q - C	@SS	@SS
FUV-01 SS	C	C	C	@Comp	@Comp	6-cycles	C
FUV-02 DVA	C	C	N/R	Q - P	Q - P	@SS	@SS
FUV-02 DEB	C	C	N/R	Q - P	Q - P	@SS	@SS
FUV-02 SS	P	P	N/R	@Comp	@Comp	8-cycles	P
DVA Surrogate (1)	C	N/R	N/R	C	C	N/R	N/R
DVA Surrogate (2)	P	N/R	N/R	P	P	P	N/R

- C Complete
- @SS At Subsystem
- A Acceptance Levels
- Q Qualification Levels
- N/R Not Required
- P Planned
- (1) Old Door Mechanism
- (2) New Door Mechanism

- FUV-01 DVA has now seen acceptance level vibe 2x.
- A single-axis workmanship vibe on FUV-01 DVA is planned after the door mechanism is repaired.

COS FUV Detector Systems

- Detector DEB
- Detector Head



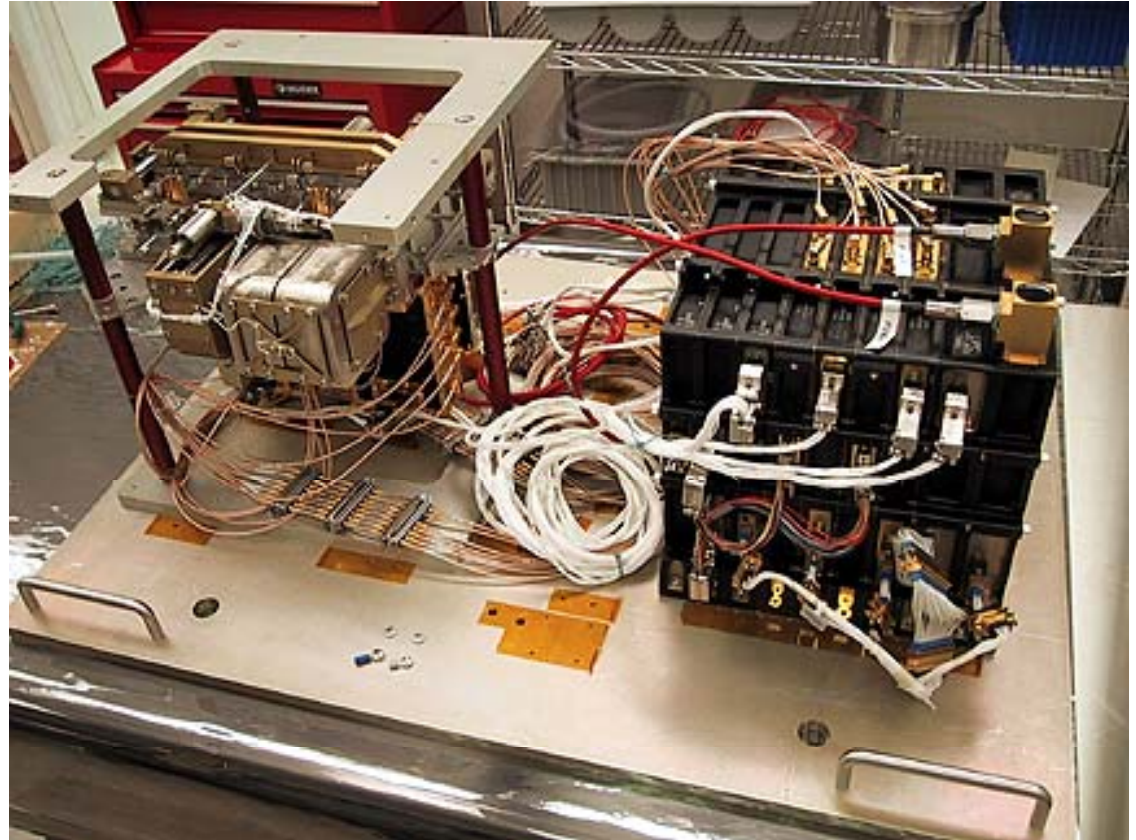
Flight FUV01 Detector System

Detector upper door & mechanism re-worked at UCB.

Door reassembled and tested successfully at CU then vibrated at Ball.

Had door problem in CU vacuum tank post-vibration due to clamshell /shaft tolerancing.

Door motor and HOP subassy at UCB being reworked in collaboration with Swales, CU & GSFC





FUV Door Redundant Mechanism Problem - Design Changes Summary

Hard mount pillar, make one piece block with bearing

Put upper & lower flats on rail, change carriage bearings to allow lateral movement.

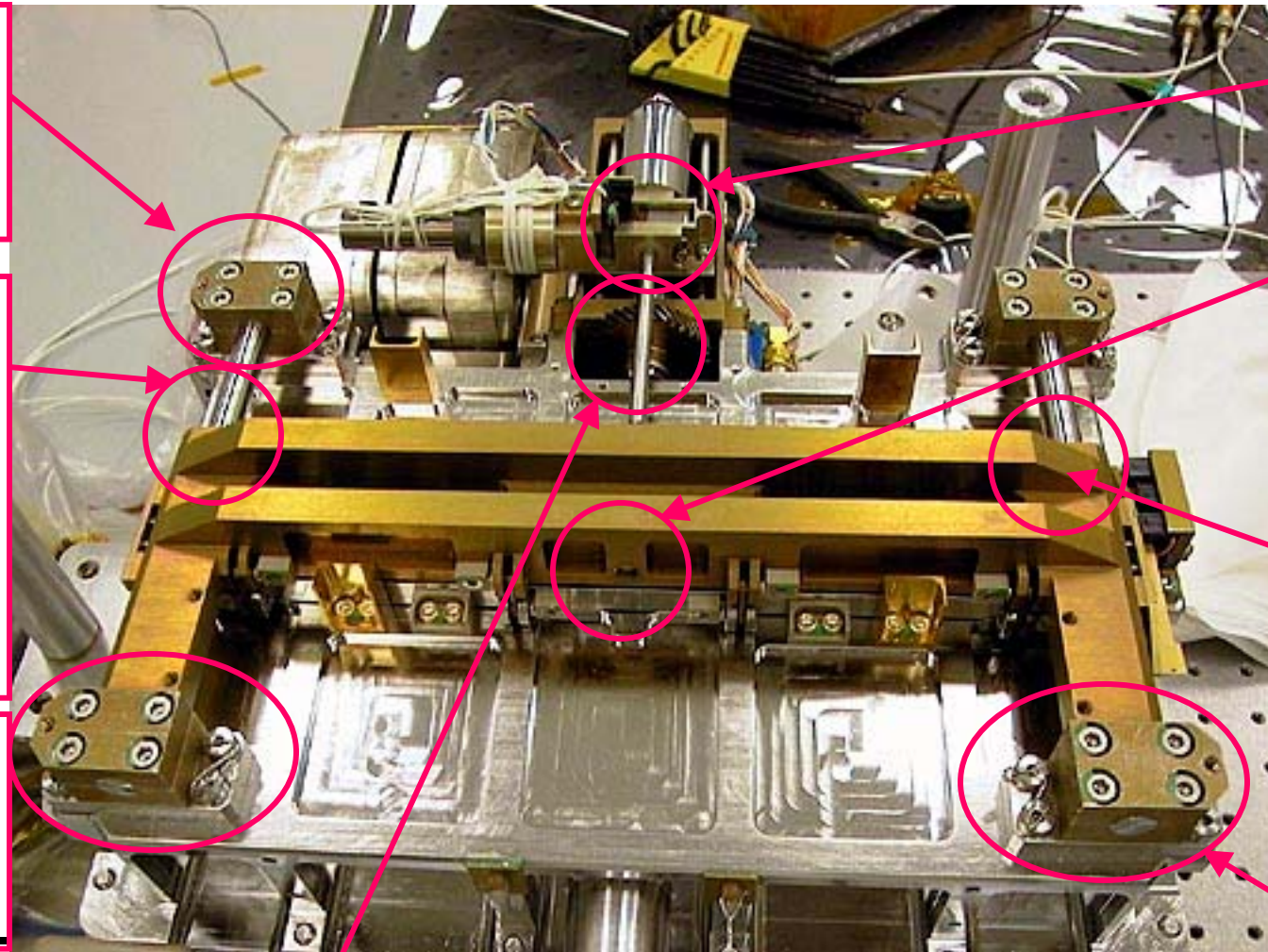
Hard mount pillar, make one piece blocks and pin rail

New PEEK/PTFE bushings with greater tolerance

Widen bore and install uniball

Pin rail to carriage, and extend rails, grease rails

Hard mount pillars, make one piece blocks and install bearings



Thin shaft to allow flexure



FUV Door Problem Recap - Early February Monthly

- Qual testing of door design on ETU VHA was completed successfully
 - 25 operation cycles, -done with no problems
 - vacuum test, hot (+40°C) and cold (0°C) with HOP actuation, -done OK
 - vibration at qualification levels (with notching), -completed at Lockheed
 - vacuum test, ambient, hot (+40°C) & cold (0°C) with HOP actuation -no problems
- FUV01 Door Reassembled and Tested
 - Re-assembled FUV01 door assembly at CU but pushrod shaft bent
 - Made new pushrod shaft (in Boulder) on 1 day turnaround
 - Installed VHA & vacuum tested door motor and HOP at ambient temp - OK
 - Vibrated FUV01 door assembly & VHA to acceptance levels at Ball - OK
 - Returned FUV01 to CU tank to complete thermal vacuum testing
 - Initial HOP door open test OK, but had problems with re-latching door shaft
 - Problem identified with tolerancing of the door driveshaft slots and clamshells

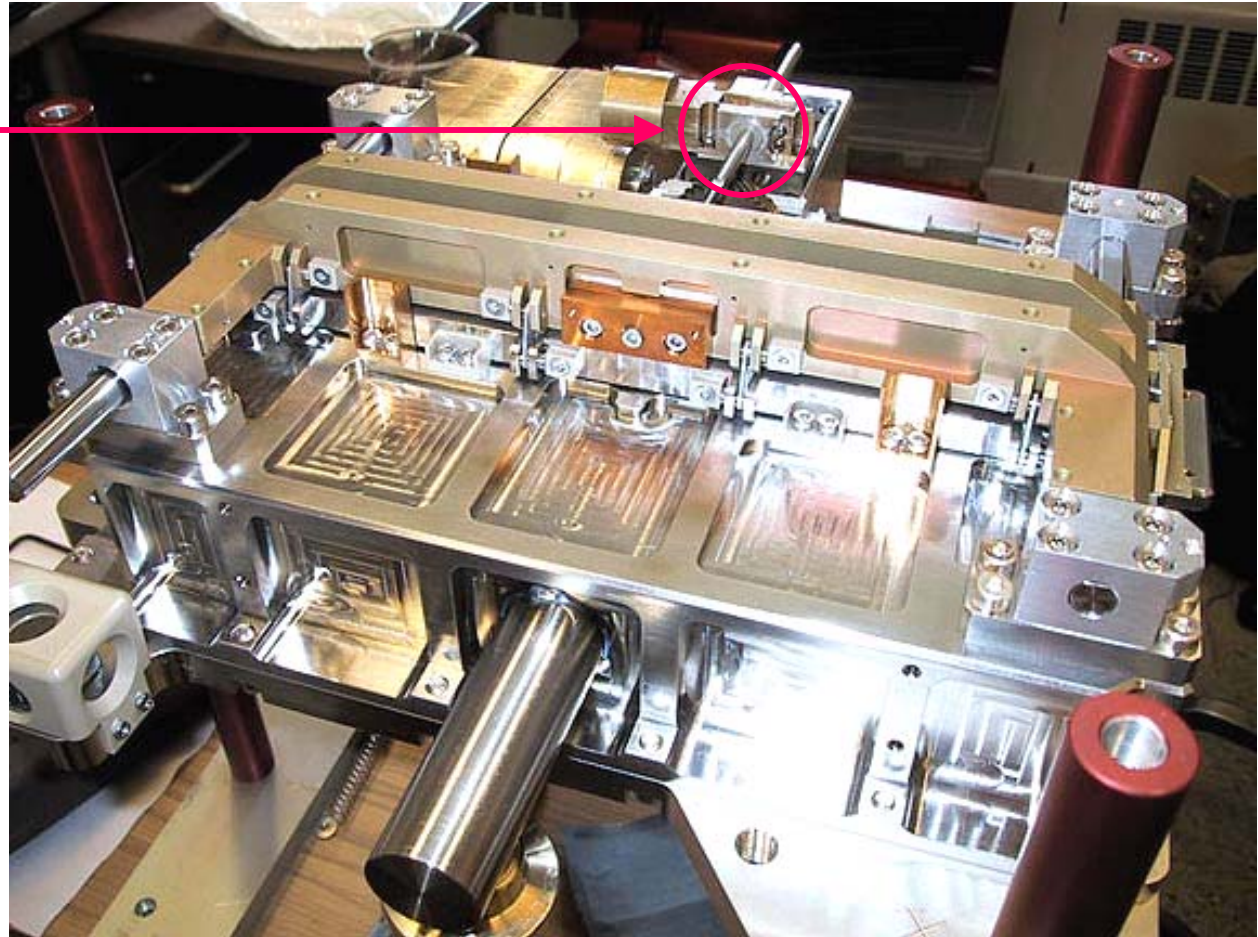


FUV Door - New Assembly on ETU VHA

Problem area,
clamshells &
shaft slots.

Reworked, and
now through
most tests.

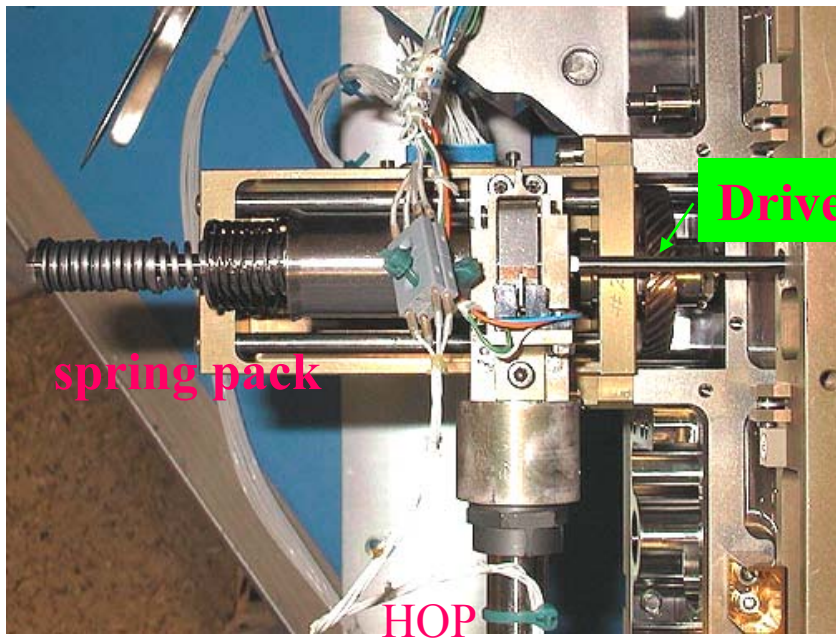
All other new
door components
have worked
very well.



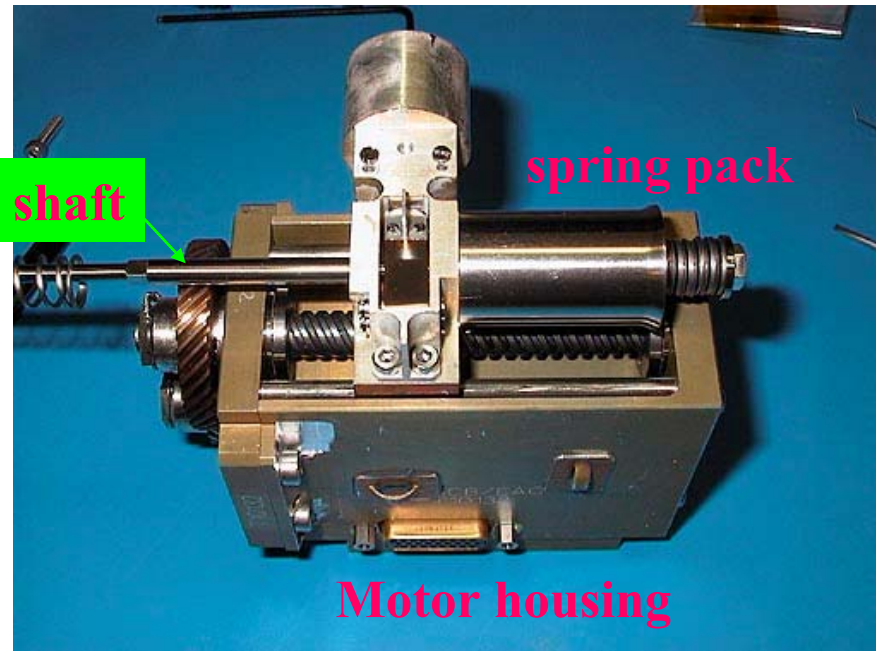
FUV Door Problem - Motor subassembly

- Tried to re-engage door with motor after HOP firing - **NO LATCH INDICATION**
- Noticed top clamshell was not engaging the driveshaft & flag not depressed
- Assessment was clamshell/pushrod/housing tolerancing issue
- Produced list of recommendations that have since been implemented

HOP carrier and shaft/spring pack



Door motor subassembly

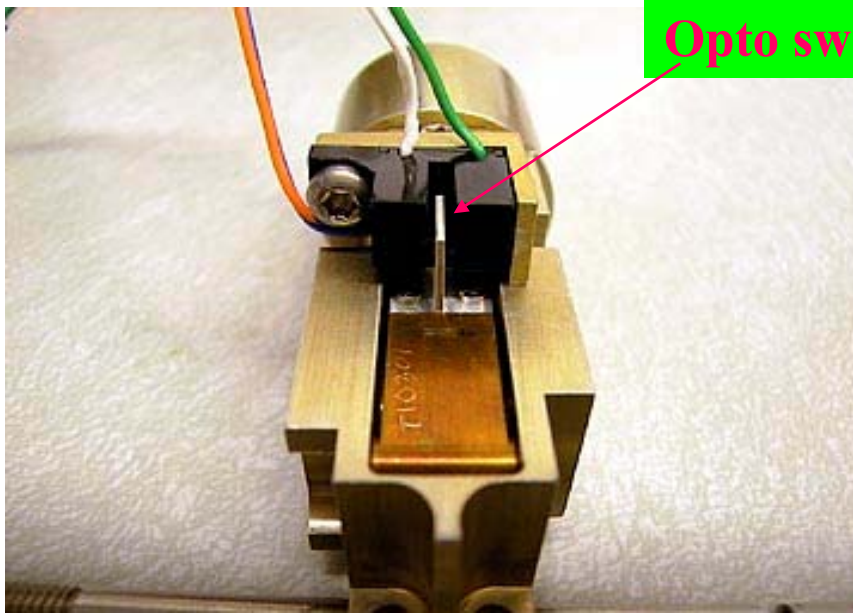




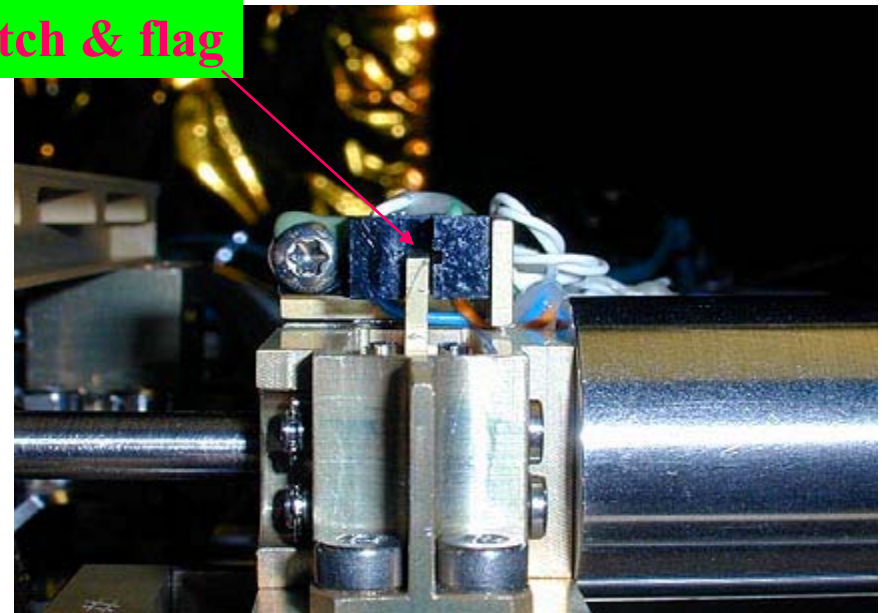
FUV Door Problem - Motor subassembly

- FUV01 clamshell flag/opto switch clearance increased
 - Flag thinned from 1.5mm to 0.5mm
 - More tolerance for flag rotation and side to side movement of clamshells

Flag configuration after change



FUV01 before change



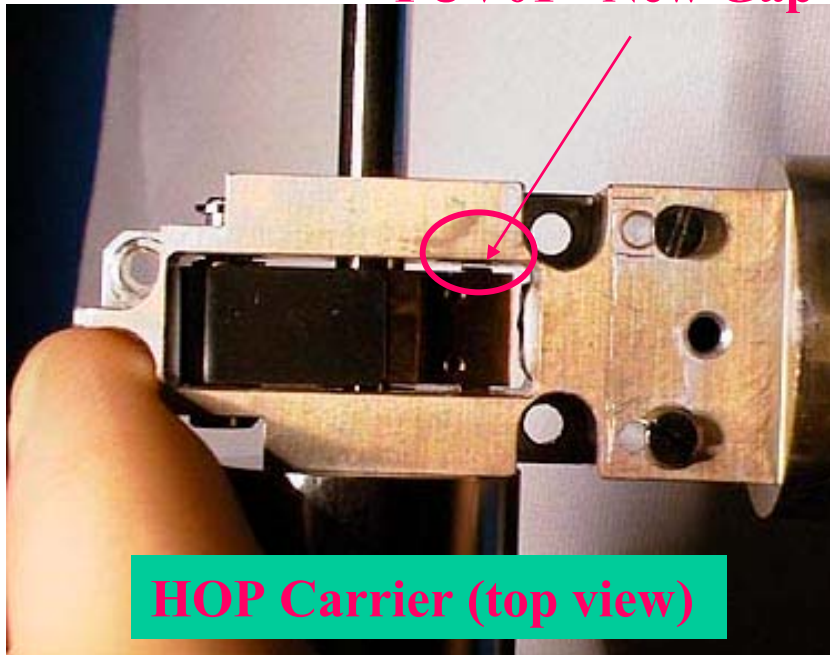


FUV Door Problem - Motor subassembly

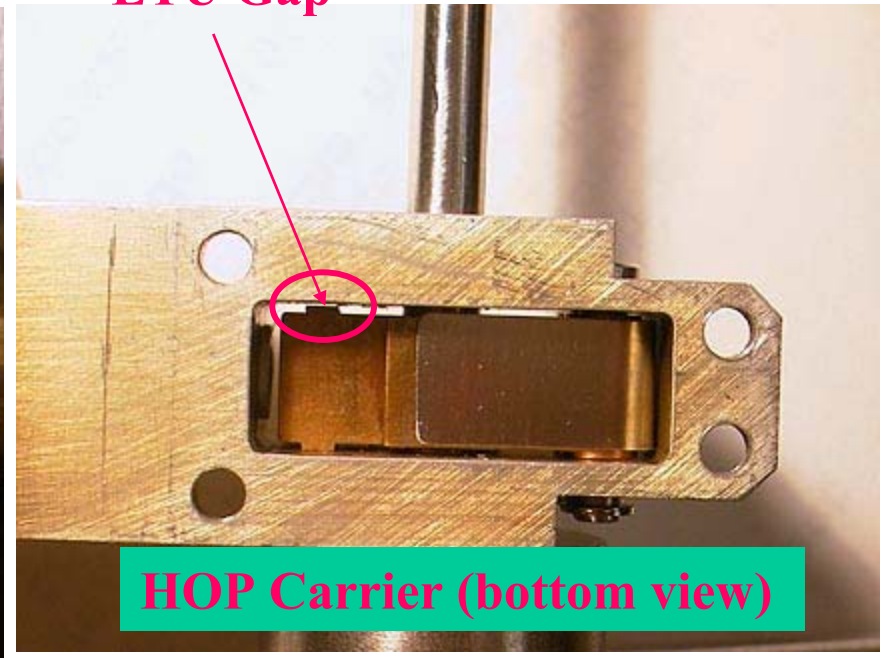
• Motor Assembly Clamshell Tolerancing

- FUV01 clamshell/housing spacing was too tight (0.002")
- ETU clamshells have ~0.006" gap,
- FUV01 clamshells remade - **narrowed the clamshells by 0.010"**
- FUV01 clamshells now have adequate tolerances, - **no friction problems**

FUV01 - New Gap



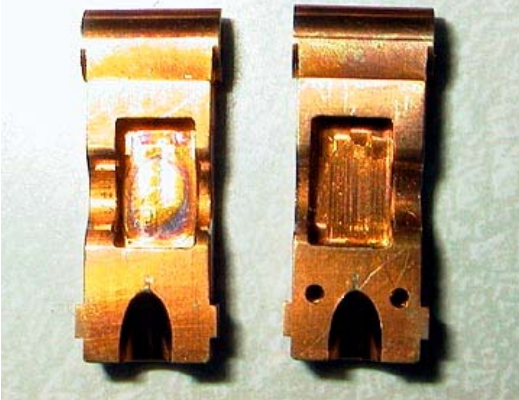
ETU Gap



Clamshells



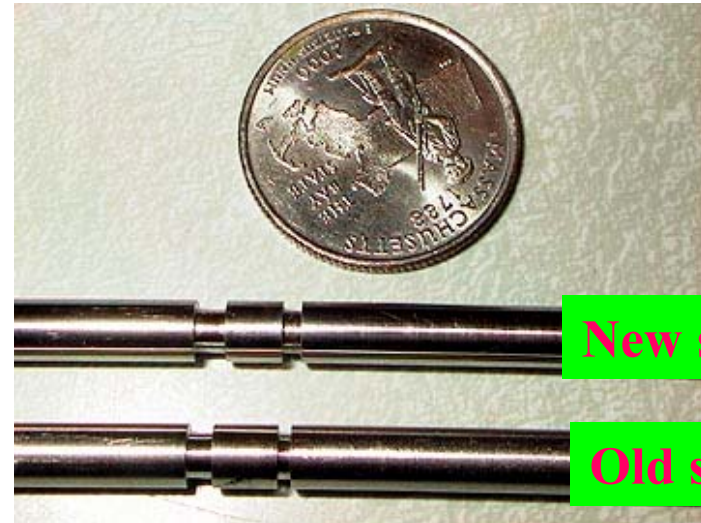
New clamshells and shaft slots



FUV Door Problem - Motor subassembly

• Clamshells and pushrod dimensions

- FUV01 clamshells had about 0.001" slop inside the pushrod shaft notches
- This is too tight - **opened out notches by 0.020"**.
- Modified the clamshell teeth to ensure engagement on the large teeth surfaces.



FUV Door Problem - Motor subassembly

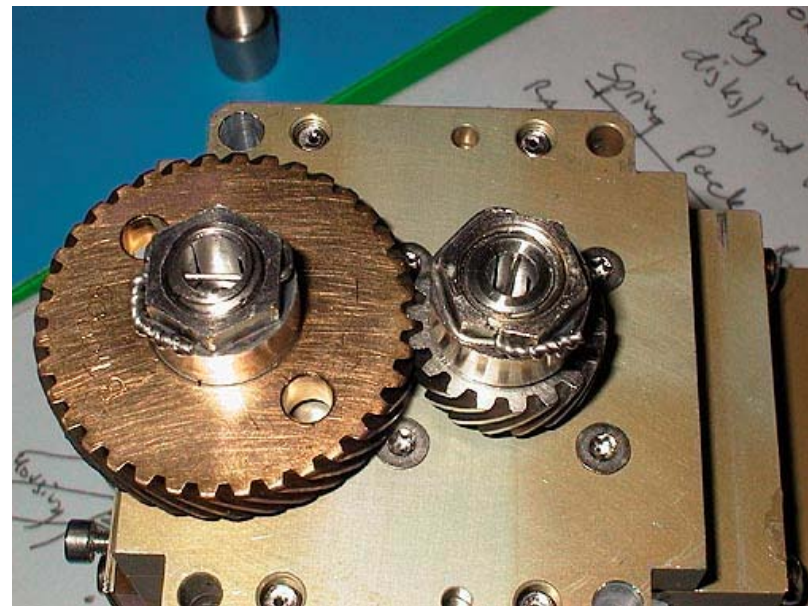
FUV01 Door motor

- Driveshaft on motor cog showed signs of slippage/chafing/debris.
- Made tool to ensure correct torque on Trantorque installation - 125in/lb
- Rebuilt FUV01 motor with new shaft and bearing
- Installed wire locks on shaft nuts

Before Rework



After Rework



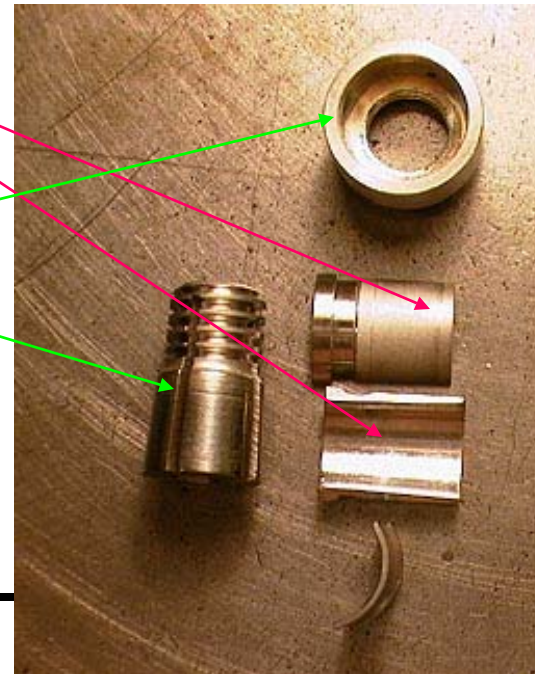
FUV Door Problem - Motor subassembly

•Trantorque adaptor

- Checked slip limit for motor cogs/shafts when installed to 125in-lbs
 - 70in-lbs/motor, 170in-lbs/driveshaft,
 - both sufficient per Casey's model

•Roughed motor shaft,
 & outside of spreaders and
 polished the inside of spreaders

•Also wired nuts to inner
 sleeves



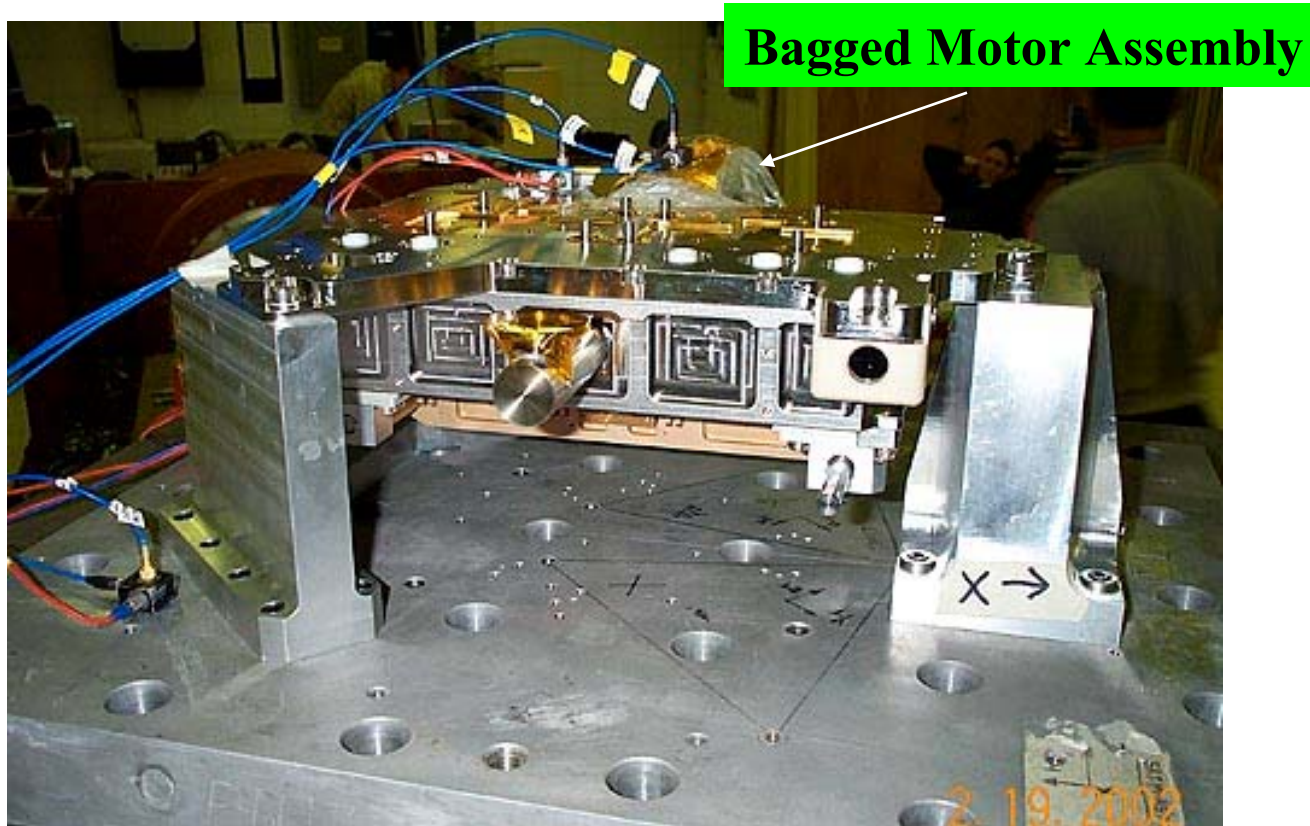


FUV01 Progress and Actions

- Motor Assembly Modifications
 - FUV01 shafts, flags, cogs, clamshells, motor are done, subassembly rebuilt
 - Installed FUV01 motor sub assembly onto ETU DVA
 - Bench tested, door open/close with motor, HOP firing, relatch, - OK
 - Installed in thermal vac tank and tested
 - door open/close with motor, HOP firing, relatch, at ambient/cold/hot -OK
 - Vibrated to qualification levels at Lockheed
 - no ion pumps, no vacuum, levels controlled to produce correct vibration levels at motor assy
 - 2 anomalies,
 - Metal debris found on vibration fixture - does not seem to come from DVA
 - Lower door slid to one side by 1mm
 - door pressure is 100 lb less without vacuum
 - Polished steel door seal surface with greased “o” ring – slides,
 - Seal was not broken even with movement, some latitude to move around
 - Door is constrained by blocks and does not lose vacuum integrity
 - Door has never moved before when shaken with DVA under vacuum

FUV Door - Motor Subassembly Shake on ETU DVA

- **Vibration of FUV01 reworked motor assembly on ETU DVA at Lockheed**
- No ion pumps, no vacuum, qual level to produce correct vibration at motor assy

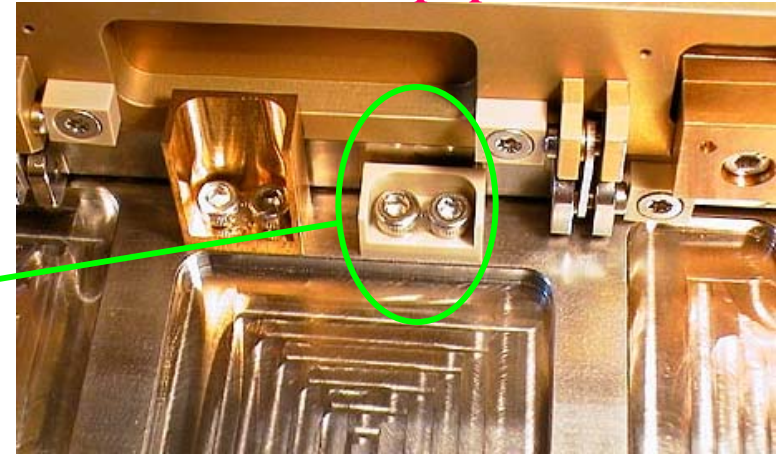
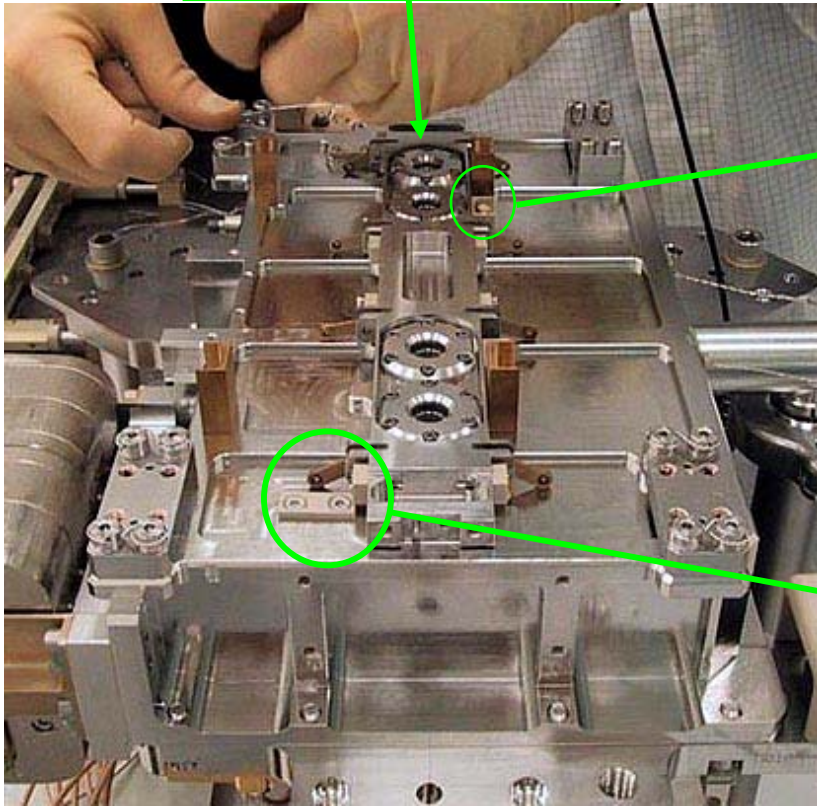




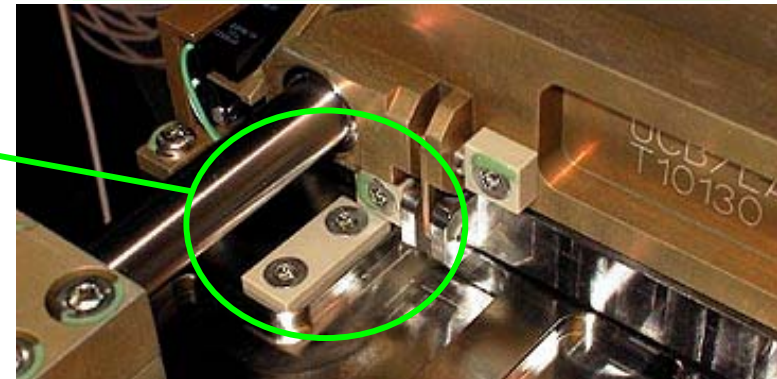
FUV Door - Motor Subassembly Shake on ETU DVA

ETU lower door stop -post vibration

FUV01 lower door



FUV01 lower door limit block





FUV01 Progress and Actions

- **FUV01 Operations**

- Bench tested, door open/close with motor, HOP firing, relatch, **-OK!**
- Installed back into thermal vacuum tank for final test sequence
 - door open/close with motor, HOP firing, relatch, at ambient/cold/hot **-OK**

- **Next actions**

- Remove FUV01 motor assy and return to CU, install on FUV01
- Vacuum test door operation
- Vibrate one TBD axis to acceptance at Ball
- Return to CU and verify door operation
- Complete 2 cycles of thermal vacuum and hot/cold soak.
- Final delivery to Ball



UCB FUV02, Flight Backup Detector, Status

- **DEB Electronics Boards**
 - All boards have been cleaned, coated, staked, and vacuum baked.
- **Harnesses**
 - Cleaned and vacuum baked/certified.
- **Detector Backplate Assembly**
 - Built up and integrated with VHA, at UCB.
- **Vacuum Housing Assembly**
 - Successfully completed alignment tests at Ball.
 - Door assembly at UCB awaiting re-assembly with modified parts
- **Brazed Body Assembly**
 - Photocathodes deposited successfully and detector QDEs measured.
 - BBA currently in safe vacuum storage awaiting final FUV02 buildup.
- **ETU DEB**
 - ETU DEB delivered to Ball mid August.



FUV02 Plan

- Complete FUV02 assembly and test sequence
- Complete FUV02 door pre-assembly preparations at UCB
- Re-assemble FUV02 door assembly at UCB and test
- Proceed with final FUV02 buildup, test, & scrub.
- FUV02 environmental testing (vibration and thermal vacuum).



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FUV-01 DVA Recovery Schedule

ID	Task Name	% Complete	2002								
			December	January	February	March	April	May	June		
1	Qualification of new FUV#1 door motor design with ETU	97%									
2	Design & fabricate new clam shells, push rods and trantorque ada	100%		1/15	2/6						
3	Assemble & test new FUV#1 door mechanism on ETU VHA in air	100%			2/7	2/9					
4	Vacuum test new door in T-V chamber	100%			2/10	2/11					
5	Hot & cold thermal cycle test of door****	100%			2/12	2/13					
6	Prepare/pack ETU VHA for vibration test at Lockheed	100%			2/14	2/15					
7	VHA+door qualification vibration test at Lockheed	100%			2/18	2/21					
8	Install ETU in T-V chamber at SSL	100%			2/22	2/22					
9	Post shake tests of surrogate VHA/door at SSL****	100%			2/23	2/26					
10	New door mechanism verified	0%				2/26					
11	Ship FUV#1door motor assembly to CASA	0%				2/27	2/27				
12	RETRO-FIT & TEST OF FUV#01 Door on Flight VHA#1	0%									
13	Assemble & test new FUV01 door motor ass'y on VHA at Uco	0%				2/28	3/1				
14	Install FUV#01 in T-V chamber and initial test	0%				3/2	3/2				
15	Vacuum test of new door motor mechanism at CASA	0%				3/3	3/4				
16	Ship and stake for vibe test	0%				3/5	3/5				
17	Vibration test of FUV01 DVA at BATC	0%				3/6	3/7				
18	Post vibe test functional tests of FUV01 DVA at CU	0%				3/8	3/8				
19	Thermal-vac cycle final tests of FUV01 *****	0%				3/9	3/12				
20	System cleanliness cert check	0%				3/13	3/13				
21	Remove system from chamber and pack	0%				3/14	3/14				
22	FUV01 ready for flight integration and test at BATC	0%					3/14				



COS MSR: CU Software/Operations Efforts

- No change in status since 2/6/02 MSR.



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COS Schedule for CU/UCB

Task	Status
G140L – Blazed Grating Testing	Canceled
CALCOS Software Development	On-going
NUV Gratings (JY)	Complete
Cal/FF SS Optical Integration	March – May '02
FUV-01 Rework Activities	Feb. – March '02
Deliver FUV-01 to Ball	March 14 '02
Complete FUV-02	By 6/1/02



COS Descope Issues (No Changes Since Last MSR)

- The COS IDT has been asked to develop and track a descope plan which, if implemented, can be used to control future cost growth and/or schedule difficulties.
- At the beginning of the COS development effort, late CY97 and early CY98, we prepared and presented several descope options. At that time we descope the following:
 - Reduced the MEB SRAM buffer memory
 - Fewer NUV/FVU optics/grating spares
 - No parallel technology path for NUV gratings
 - Reduced I&T/calibration effort
 - Baselined environmentals at GSFC



COS Descope Tracking List

Candidate De-Scope	Trigger Date	Resource Saved*	Impacts
Eliminate FUV Detector detailed resolution tests	Implemented	2 weeks	Knowledge of detector
Eliminate FUV Detector detailed QE tests	Implemented	2 weeks	Knowledge of detector
Eliminate FUV Detector deep FF tests	Implemented	3 weeks	Knowledge of detector
Make DCE Op Code non-uploadable	Too late	---	Higher risk, Ops
Early transition of FSW to Code 582	Too late	\$	Ops
Remove Redundant Cal/FF Elements	Too late	\$,t	Higher risk, Ops
Remove/reduce memory	Too late	---	Ops
Remove NUV gratings from OSM2	Too late	\$,t	Degraded science
Drop NUV channel	TBD	\$\$\$,tt	Degraded science
Remove NCM3 optics	Too late	\$,t	Degraded science, Ops
Eliminate Aperture Mechanism	TBD	\$,t	Ops, Obs. Efficiency, higher risk
Drop all Accum mode processing w/ Doppler	Too late	\$,t	Degraded science
Drop spare FUV detector	Too late	\$,t	Higher risk
Drop OSM1 capability (don't cover λ gap)	Too late	---	Degraded science
Reduce S/N requirement to 30 (no FF lamp)	TBD	\$,t	Degraded science
Relax NUV resolution requirements below 20k	Too late	\$,t	Degraded science
Remove on-orbit change-out capability	Too late	\$,t	Higher risk
Drop dispersed light TA	Too late	\$,t	Ops
No Ion Gauge	TBD	\$,t	Higher risk, Ops
No external shutter	Too late	\$,t	Ops
Change MSRs to QSRs	TBD	\$	Save trees
Eliminate Mechanism Lifetime tests	TBD	\$\$	Higher risk
Reduce CDRLs	TBD	\$	Unknown
Drop G140L blazed effort	Implemented	\$,t	Missed opportunity for improved science
Reduce G160M image testing	Too late	\$,t	Higher risk

*The IPT has not yet done a detailed analysis to quantify actual \$ or time to be saved.



Upcoming Events/Activities

- Deliver FUV-01 detector system to Ball.
- Start Cal/FF subsystem I&T.
- Commence detail ground calibration planning.



Issues

- None