

Exit Presentation

Christan Ross Summer 2012

Agenda

- Background
- Current Project
  - Master Equipment List Update
  - Comparison of Design Model and Physical Vehicle
- Experiences
- Future Plans

Background

- Born in Clearlake, Texas
- Moved to Pearland, Texas
  - -Graduated from Pearland HS
- University of Texas at Arlington
  - -Mechanical Engineering Major
- USRP Internship at NASA in EA3

Current Project

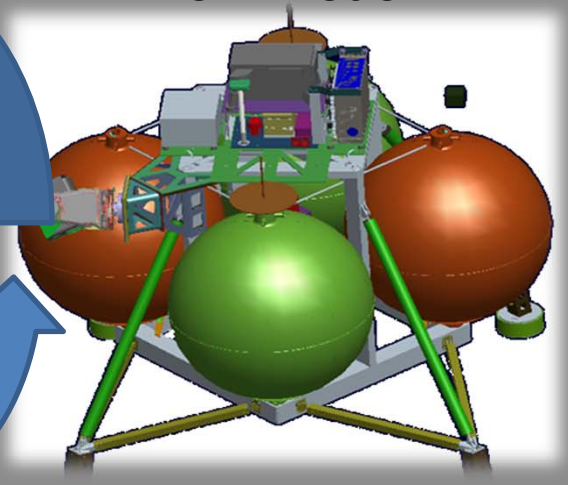
- Project Morpheus
  - Vertical Take-Off/ Vertical Landing vehicle that tested for navigation and landing technologies
- Autonomous Landing and Hazard Avoidance Technology (ALHAT)
  - Autonomous precision landing and hazard avoidance system
- Purpose
  - Demonstrate the advancement of precise navigation with secure landing capabilities by using a non-toxic energy source. Allowing contact with new sites that were once recognized as difficult to access.

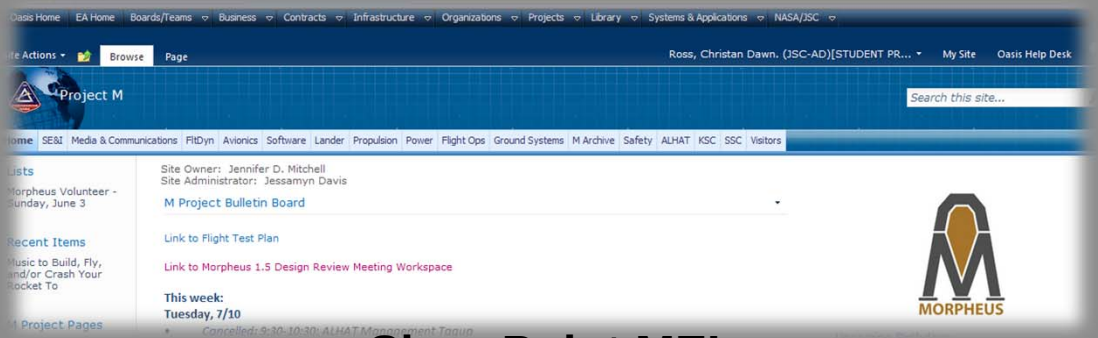
Current Project

Physical Vehicle



Pro-E Model





SharePoint MEL

Current Project

- Purpose of Morpheus MEL
  - Account of all equipment and hardware used on or for the vehicle
  - Track progress and ensure required equipment and systems are on record
  - Ability to track all risks, discrepancies and design changes
  - Database information including Subsystem, Component, Sub-Component, Configuration ID, Pro E Part Name, mass properties and Point of Contact

Current Project

- Problems with the Original MEL
  - Out of Date
    - Missing important vehicle hardware
    - Updates and Additions
  - Unused excessive columns and subjects
  - Unable to utilize its initial purpose
    - Account for risks and discrepancies

Original MEL

Subsystem **Component** **Sub-Component** **Configuration ID**

	Phase	Element	Subsystem	Component	Sub-Component	Config ID
198	2;#3	Vehicle	Vehicle	EPS changes	DH Chassis	
199	2;#3	Vehicle	Vehicle	Flight Batter		V.EPS.BATTERIES
200	2;#3	Vehicle	Vehicle Power	Wiring & Connectors		V.EPS.WIRING
201	1;#2;#	Vehicle	Vehicle Propulsion	Propellant tanks inc boss baffles		V.PROP.TANKS
202	3	Vehicle	Vehicle Propulsion	RCS engine system		V.PROP.RCSENG
203	1;#2;#	Vehicle	Vehicle Propulsion	GHe in ullage		V.PROP.GHEULLAGE
204	3	Vehicle	Vehicle Propulsion	GHe tank		V.PROP.GHETANK
205	1;#2;#	Vehicle	Vehicle Propulsion	Main engine		V.PROP.ENGINE.HD3
206	1;#2;#	Vehicle	Vehicle Propulsion	Gimbal ring		V.PROP.GIMBALRING
207	1;#2;#	Vehicle	Vehicle Propulsion	Gimbal adaptor		V.PROP.GIMBALADPTR
208	1;#2;#	Vehicle	Vehicle Propulsion	G1 (Gimbal actuator)		V.PROP.GIMBAL1
209	1;#2;#	Vehicle	Vehicle Propulsion	G2 (Gimbal actuator)		V.PROP.GIMBAL2
210	1;#2;#	Vehicle	Vehicle Propulsion	SV-101 jefferson 1390 (Solenoid valve for roll thruster - includes port and wire)		V.PROP.SV101
211	1;#2;#	Vehicle	Vehicle Propulsion	SV-102 (Solenoid valve for roll thruster - Includes port and wire.)		V.PROP.SV102
212	1;#2;#	Vehicle	Vehicle Propulsion	SV-301 (Solenoid valve for roll thruster - Includes port and wire.)		V.PROP.SV301
213	1;#2;#	Vehicle	Vehicle Propulsion	SV-302 (Solenoid valve for roll thruster - Includes port and wire.)		V.PROP.SV302
214	1;#2;#	Vehicle	Vehicle Propulsion	SV-103 (Solenoid valve for ignition - Includes port and wire.)		V.PROP.SV103
215	1;#2;#	Vehicle	Vehicle Propulsion	SV-104 (Solenoid valve for propellant vent - Includes port and wire.)		V.PROP.SV104
216	1;#2;#	Vehicle	Vehicle Propulsion	SV-303 (Solenoid valve for ignition - Includes port and wire.)		V.PROP.SV303
217	1;#2;#	Vehicle	Vehicle Propulsion	SV-304 (Solenoid valve for propellant vent - Includes port and wire.)		V.PROP.SV304
218	1;#2;#	Vehicle	Vehicle Propulsion	SV-503 (Solenoid valve for GHe purge - Includes port and wire.)		V.PROP.SV503
219	1;#2;#	Vehicle	Vehicle Propulsion	MV-301 (Motorized valve for fuel cutoff)		V.PROP.MV301
220	1;#2;#	Vehicle	Vehicle Propulsion	MV-302 (Redundant Motorized valve for fuel cutoff)		V.PROP.MV302
221	3	Vehicle	Vehicle Propulsion	MV-501 (Motorized valve for GHe)		V.PROP.MV501
222	1;#2;#	Vehicle	Vehicle Propulsion	TV-101 (Lox Throttle valve actuator)		V.PROP.TV101
223	1;#2;#	Vehicle	Vehicle Propulsion	TV-301 (Fuel Throttle valve actuator)		V.PROP.TV301
224	1;#2;#	Vehicle	Vehicle Propulsion	HV-101 (Hand valve)		V.PROP.HV101
225	1;#2;#	Vehicle	Vehicle Propulsion	HV-301 (Hand valve)		V.PROP.HV301
226	3	Vehicle	Vehicle Propulsion	HV-501 (Hand valve)		V.PROP.HV501
227	1;#2;#	Vehicle	Vehicle Propulsion	CV-501 (Check valve)		V.PROP.CV501
228	1;#2;#	Vehicle	Vehicle Propulsion	CV-551 (Check valve)		V.PROP.CV551
229	1;#2;#	Vehicle	Vehicle Propulsion	CV-502 (Check valve)		V.PROP.CV502
230	1;#2;#	Vehicle	Vehicle Propulsion	QD-501 (Quick Disconnect)		V.PROP.QD501
231	1;#2;#	Vehicle	Vehicle Propulsion	QD-101 (Quick Disconnect) carter coupling		V.PROP.QD101
232	1;#2;#	Vehicle	Vehicle Propulsion	QD-301 (Quick Disconnect)		V.PROP.QD301
233	1;#2;#	Vehicle	Vehicle Propulsion	RV-301 (Relief valve)		V.PROP.RV301

ProE Dump | OLD OASIS MEL | ProE-MEL Crosswalk | Xwalk 2 | Prop | Power | Camera | C&DH

Original MEL

Excessive Columns

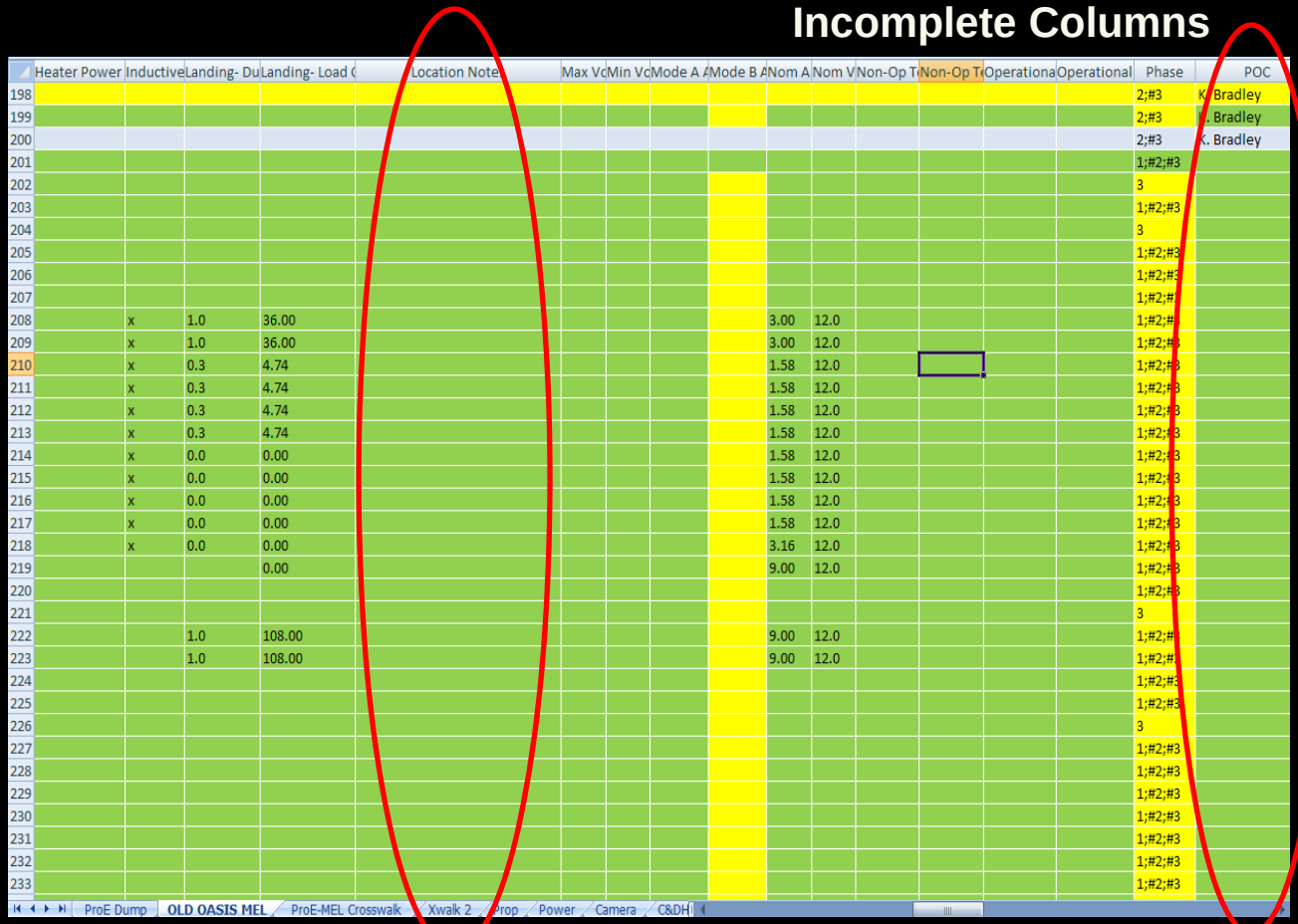
	Box Weight	Qty Bo	Total Box W	Unit Length	Unit Width	Unit Heig	Unit Volu	Actual We	Esitmated U	Box Weight w	Bus type	Capacitive	Component Description	Content Ty	Cost	Ground
198	0.6	1	0.6				0		0.3	0.2734				Item		
199	9.152	1	9.152	10.04	1.97	1.14	22.5478		1.76	4.150432				Item		
200	2.6	33	85.8				0		2	1.1791				Item		
201	675.68	1	675.68				0		164	306.42088				Item		
202	36	1	36				0		30	16.326				Item		
203	48.48	1	48.48				0		48	21.98568				Item		
204	26.7225		0				0		25.45	12.11865375				Item		
205	52.5		0				0		50	23.80875				Item		
206	15.75		0				0		15	7.142625				Item		
207	21		0				0		20	9.5235				Item		
208	2.1		0				0		2	0.95235	12V			Item		
209	2.1		0				0		2	0.95235	12V			Item		
210	1.9285		0				0		1.9	0.87457475	12V			Item		
211	1.9285		0				0		1.9	0.87457475	12V			Item		
212	1.9285		0				0		1.9	0.87457475	12V			Item		
213	1.9285		0				0		1.9	0.87457475	12V			Item		
214	1.5225		0				0		1.5	0.69045375	12V			Item		
215	1.5225		0				0		1.5	0.69045375	12V			Item		
216	1.5225		0				0		1.5	0.69045375	12V			Item		
217	1.5225		0				0		1.5	0.69045375	12V			Item		
218	1.9285		0				0		1.9	0.87457475	12V			Item		
219	4.06		0				0		4	1.84121	12V			Item		
220	4.06		0				0		4	1.84121				Item		
221	5.075		0				0		5	2.3015125				Item		
222	4.06		0				0		4	1.84121	12V	x		Item		
223	4.06		0				0		4	1.84121	12V	x		Item		
224	1.624		0				0		1.6	0.736484				Item		
225	1.624		0				0		1.6	0.736484				Item		
226	1.624		0				0		1.6	0.736484				Item		
227	0.25375		0				0		0.25	0.115075625				Item		
228	0.25375		0				0		0.25	0.115075625				Item		
229	0.25375		0				0		0.25	0.115075625				Item		
230	0.406		0				0		0.4	0.184121				Item		
231	0.406		0				0		0.4	0.184121				Item		
232	0.406		0				0		0.4	0.184121				Item		
233	0.13195		0				0		0.13	0.059839325				Item		

ProE Dump | OLD OASIS MEL | ProE-MEL Crosswalk | Xwalk 2 | Prop | Power | Camera | C&DH

Application

Original MEL

Incomplete Columns



	Heater Power	Inductive	Landing- Du	Landing- Load (	Location Note	Max Vc	Min Vc	Mode A A	Mode B A	Nom A	Nom V	Non-Op T	Non-Op T	Operationa	Operational	Phase	POC
198																2;#3	K Bradley
199																2;#3	. Bradley
200																2;#3	K. Bradley
201																1;#2;#3	
202																3	
203																1;#2;#3	
204																3	
205																1;#2;#3	
206																1;#2;#3	
207																1;#2;#	
208		x	1.0	36.00						3.00	12.0					1;#2;#	
209		x	1.0	36.00						3.00	12.0					1;#2;#3	
210		x	0.3	4.74						1.58	12.0					1;#2;#3	
211		x	0.3	4.74						1.58	12.0					1;#2;#3	
212		x	0.3	4.74						1.58	12.0					1;#2;#3	
213		x	0.3	4.74						1.58	12.0					1;#2;#3	
214		x	0.0	0.00						1.58	12.0					1;#2;#3	
215		x	0.0	0.00						1.58	12.0					1;#2;#3	
216		x	0.0	0.00						1.58	12.0					1;#2;#3	
217		x	0.0	0.00						1.58	12.0					1;#2;#3	
218		x	0.0	0.00						3.16	12.0					1;#2;#3	
219				0.00						9.00	12.0					1;#2;#3	
220																1;#2;#3	
221																3	
222			1.0	108.00						9.00	12.0					1;#2;#	
223			1.0	108.00						9.00	12.0					1;#2;#	
224																1;#2;#3	
225																1;#2;#3	
226																3	
227																1;#2;#3	
228																1;#2;#3	
229																1;#2;#3	
230																1;#2;#3	
231																1;#2;#3	
232																1;#2;#3	
233																1;#2;#3	

ProE Dump | OLD OASIS MEL | ProE-MEL Crosswalk | Xwalk 2 | Prop | Power | Camera | C&DH

Unused Columns

Progression of Original MEL

Pro-E Assembly Tree

Subsystem

Component

Lv	Lv	Lvl 4	Subsy	Component	Sub-Compone
RR2_WELDMENT_ASSY.ASM			Vehicle	cture	
	Pattern 1 of RR2_5X5_125_1.PRT		Vehicle S	e	5X5_125_1
	Pattern 2 of RR2_VER_BEAM_CON4.PRT		Vehicle Structure		VER_BEAM_CON4
	Pattern 3 of RR2_HOR_BEAM_1_CON4.PRT		Vehicle Structure		HOR_BEAM_1_CON4
	RR2_VER_BEAM_2_CON4.PRT		Vehicle Structure		VER_BEAM_2_CON4
	Pattern 4 of RR2_VER_BEAM_3_CON4.PRT		Vehicle Structure		VER_BEAM_3_CON4
	Pattern 5 of RR2_ENGINE_MOUNT_BEAM_CON4.PRT		Vehicle Structure		ENGINE_MOUNT_BEAM_CON4
	Pattern 6 of RR2_ENGINE_MOUNT.PRT		Vehicle Structure		ENGINE_MOUNT
	Pattern 14 of LIFT_INTERFACE.PRT		Vehicle Structure		LIFT_INTERFACE
	Pattern 19 of GHE_BEAM.PRT		Vehicle Structure		GHE_BEAM
	Pattern 20 of AA_BRACKET_UNISTRUT_3230T22.PRT		Vehicle Structure		AA_BRACKET_UNISTRUT_3230T22
	Pattern 26 of AK46005.ASM (Hoist Ring)		Vehicle Structure		AK46005 (Hoist Ring)
	Group GUSSET		Vehicle Structure		GUSSET
	Pattern 3 of TANK_STRUT_ASSY.ASM		Vehicle Structure		Top Tank Struts
	RR2_GEAR_ASSY_MIN_WELD.ASM		Vehicle Structure		Landing Gear
PROPULSION_TOP_LEVEL_ASSY.ASM			Vehicle Propulsion		
	RR2_TANK_ASSY_AA.ASM		Vehicle Propulsion		Propellant tank inc boss baffles
	RCS engine system		Vehicle Propulsion		RCS engine system
	GHe in ullage		Vehicle Propulsion		GHe in ullage
	GHe tank		Vehicle Propulsion		GHe tank
	Main engine		Vehicle Propulsion		Main engine
	Gimbal ring		Vehicle Propulsion		Gimbal ring
	Gimbal adaptor		Vehicle Propulsion		Gimbal adaptor
	G1 (Gimbal actuator)		Vehicle Propulsion		G1 (Gimbal actuator)
	G2 (Gimbal actuator)		Vehicle Propulsion		G2 (Gimbal actuator)
	BD-101 (Burst disc)		Vehicle Propulsion		BD-101 (Burst disc)
	BD-301 (Burst disc)		Vehicle Propulsion		BD-301 (Burst disc)
	BD-501 (Burst disc)		Vehicle Propulsion		BD-501 (Burst disc)
	CV-101 (Check valve)		Vehicle Propulsion		CV-101 (Check valve)
	CV-102 (Check valve)		Vehicle Propulsion		CV-102 (Check valve)
	CV-301 (Check valve)		Vehicle Propulsion		CV-301 (Check valve)
	CV-302 (Check valve)		Vehicle Propulsion		CV-302 (Check valve)
	CV-501 (Check valve)		Vehicle Propulsion		CV-501 (Check valve)
	CV-502 (Check valve)		Vehicle Propulsion		CV-502 (Check valve)
	CV-551 (Check valve)		Vehicle Propulsion		CV-551 (Check valve)

E Dump | OLD OASIS MEL | ProE-MEL Crosswalk | Xwalk 2 | Prop | Power | Camera | C&DH

Progression of Original MEL

Propulsion Subsystem

Additions

Renamed Cells

Component	Sub-Component	Config ID	ProE Name			Legend:
BD-101 Burst disc		V.PROP.BD101				Expand item.
BD-301 Burst disc		V.PROP.BD301				Rename to cell value
BD-501 Burst disc		V.PROP.BD501	Phase 3?			New
CV-101 Check valve		V.PROP.CV101				
CV-102 Check valve		V.PROP.CV102				
CV-103 Check valve		V.PROP.CV103				
CV-301 Check valve		V.PROP.CV301				
CV-302 Check valve		V.PROP.CV302				
CV-303 Check valve		V.PROP.CV303				
CV-502 Check valve		V.PROP.CV502				
CV-503 Check valve		V.PROP.CV503				
CV-552 Check valve		V.PROP.CV552				
CV-553 Check valve		V.PROP.CV553				
CV-554 Check valve		V.PROP.CV554				
E-101 Evaporator		V.PROP.E101	???			
E-301 Evaporator		V.PROP.E301	???			
F-102 Filter		V.PROP.F102				
F-302 Filter		V.PROP.F302				
FH-103 Flex hose		V.PROP.FH103				
FH-303 Flex hose		V.PROP.FH303				
FH-502 Flex hose		V.PROP.FH502				
FH-552 Flex hose		V.PROP.FH552				
FM-101 Flow meter		V.PROP.FM101				
FM-301 Flow meter		V.PROP.FM301				
GHe in ullage		V.PROP.GHEULLAGE				
GHe tank		V.PROP.TANK.GHE	Phase 3?			
HV-101 Hand valve		V.PROP.HV101				
HV-102 Hand valve		V.PROP.HV102				
HV-103 Hand valve		V.PROP.HV103				
HV-301 Hand valve		V.PROP.HV301				
HV-302 Hand valve		V.PROP.HV302				
HV-303 Hand valve		V.PROP.HV303				
LOX propellant level sensor gauge		V.PROP.GAUGE.LOX				

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Progression of Original MEL

GN&C Subsystem

Subsystem	Component	Sub-Component	Config ID	ProE Name		Legend:
Vehicle GNC	Altimeter - Acuity		V.GNC.ALT.ACUITY	ALTIMETER_NEW_DRF.PRT		Expand item.
Vehicle GNC	Altimeter - FT4		V.GNC.ALT.FT4	LASER_ALTIMETER_SEPT.PRT		Rename to cell value
Vehicle GNC	GNC Camera		V.GNC.CAM	???		New
Vehicle GNC	GNC Plate		V.GNC.PLATE	GNC_PLATE_ASSEMBLY_1-5.ASM		
Vehicle GNC	IMU SIGI		V.GNC.IMU.SIGI			
Vehicle GNC	Javad GPS Antenna		V.GNC.GPSANT			
Vehicle GNC	Javad GPS Mast		V.GNC.GPSMAST			
Vehicle GNC	Javad GPS Receiver		V.GNC.GPS.JAVAD			
Vehicle GNC	LN200 Backup IMU		V.GNC.IMU.LN200			
Vehicle GNC	LN200 Interface Box		V.GNC.IMU.LN200IF			
Vehicle GNC	Velocimeter Electronics		V.GNC.VELOC.ELECT	???		
Vehicle GNC	Velocimeter Optical Head		V.GNC.VELOC.OPT	???		

ALHAT Subsystem

ALHAT Crosswalk		New MEL			Existing MEL	
Pro/E Name	Subsystem	Component	Sub-Compone	Config ID	Component	Sub-Component
	ALHAT					
~~DL_LA_ASSEMBLY.ASM~~ALHAT_NAV_SENSORS.ASM	ALHAT					
DL_LA_STRUCTURE.ASM	ALHAT	DA_LA Brackets and Cabling		PYLD.ALHAT.NAV.DL_LA_INSTAL		
ALHAT_FT4_TELESCOPE_2_ASM.ASM	ALHAT	Doppler Lidar Optical Head		PYLD.ALHAT.NAV.DLIDAR.OPTICS		
DOPPLER_CHASSIS_SOLID.PRT	ALHAT	Doppler Lidar Electronics Box		PYLD.ALHAT.NAV.DLIDAR.ELECT		
LASER_ALTIMETER.PRT	ALHAT	Laser Altimeter Sensor		PYLD.ALHAT.NAV.LASER_ALT		
ALHAT_HDS.ASM	ALHAT					
HDS_FLASH_LIDAR_STRUCTURE.ASM	ALHAT	HDS Flash Lidar Structure		PYLD.ALHAT.HDS.FLIDAR.STRUCT	Hazard Detection System	Sensor Mount
HDS_GIMBAL.PRT	ALHAT	HDS Flash Lidar Gimbal		PYLD.ALHAT.HDS.FLIDAR.GIMBAL	Flash Lidar	Gimbal Assembly
HDS_SENSOR.PRT	ALHAT	HDS Flash Lidar Optical Head		PYLD.ALHAT.HDS.FLIDAR.OPTICS	Flash Lidar	Lidar
HDSELECTRONICSBOX.ASM	ALHAT	HDS Flash Lidar Electronics Box		PYLD.ALHAT.HDS.FLIDAR.ELEC_BOX	Hazard Detection System	Processor
HDS_TRANSMIT_LASER	ALHAT	HDS Flash Lidar Transmit Laser		PYLD.ALHAT.HDS.FLIDAR.LASER		
ALHAT_CE_BOX.ASM	ALHAT	HDS Compute Element		PYLD.ALHAT.HDS.FLIDAR.COMP_ELEM		
CE_SHELF.PRT	ALHAT	HDS Compute Element Shelf		PYLD.ALHAT.HDS.FLIDAR.COMP_ELEM_SHELF		
ALHAT_PDU_BOX_ENV_A1.ASM	ALHAT	HDS Power Distribution Unit		PYLD.ALHAT.HDS.PDU	Hazard Detection System	Power Distribution
ALHAT_BATTERY_BOX_ENV_A1.ASM	ALHAT	HDS Battery Box		PYLD.ALHAT.HDS.BATT_BOX		Power Source: Battery Box
HDS_IMU_LN200	ALHAT	HDS IMU LN-200		PYLD.ALHAT.HDS.IMU_LN200		IMU LN-200

Legend:
Expand item.
Rename to cell value
New

Recommendations

- After the final MEL is complete and uploaded into SharePoint
  - Team members will have the ability to insert in any modifications through SharePoint
  - Automatic emails will be sent to the designer allowing changes to the design model
- Effects:
  - Smoother execution of the design process
  - More organized accountability for new hardware and material



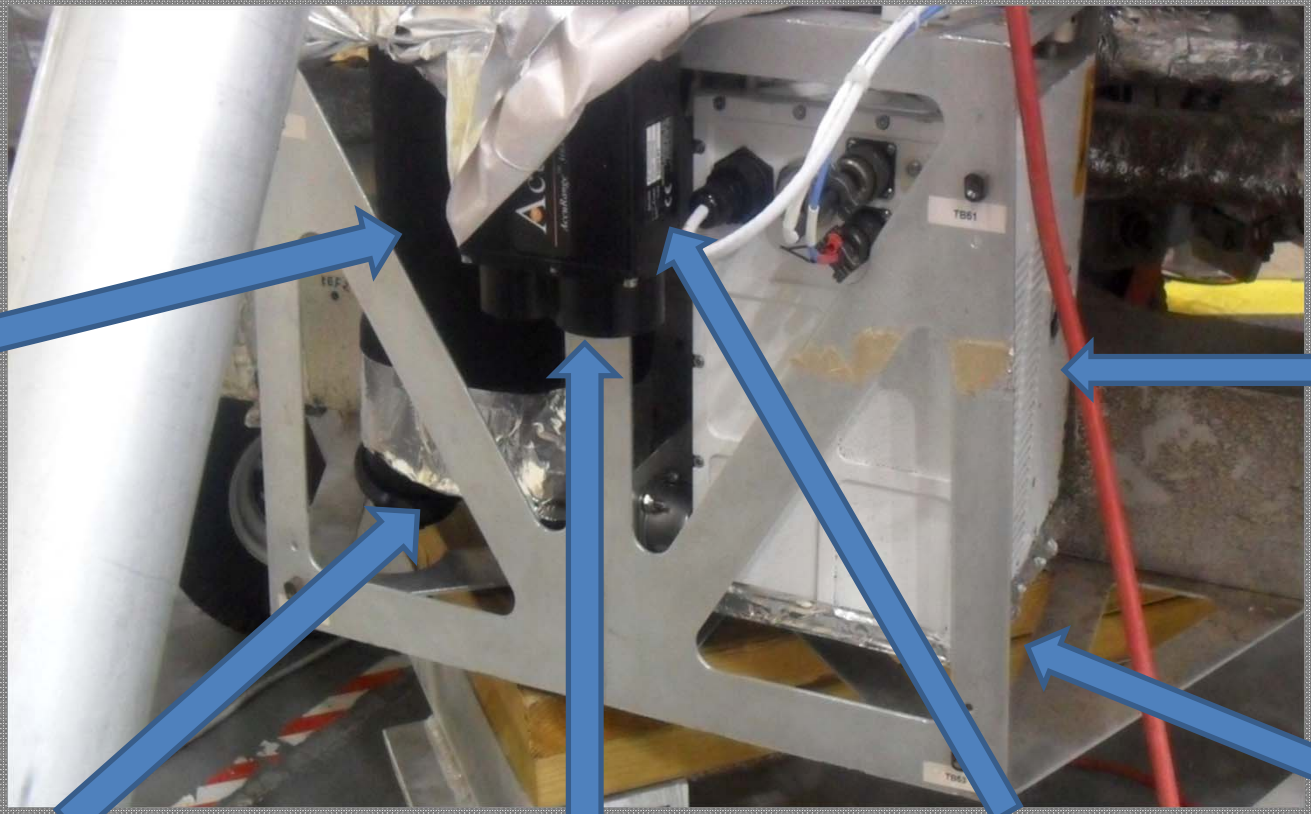
Current Project



- Syncing the CAD, design model, of Morpheus to the physical vehicle
  - Recognizing dissimilarities from the model to the present existing vehicle.
  - Noting all differences including the movement of systems, alterations to design structures and additions to the vehicle

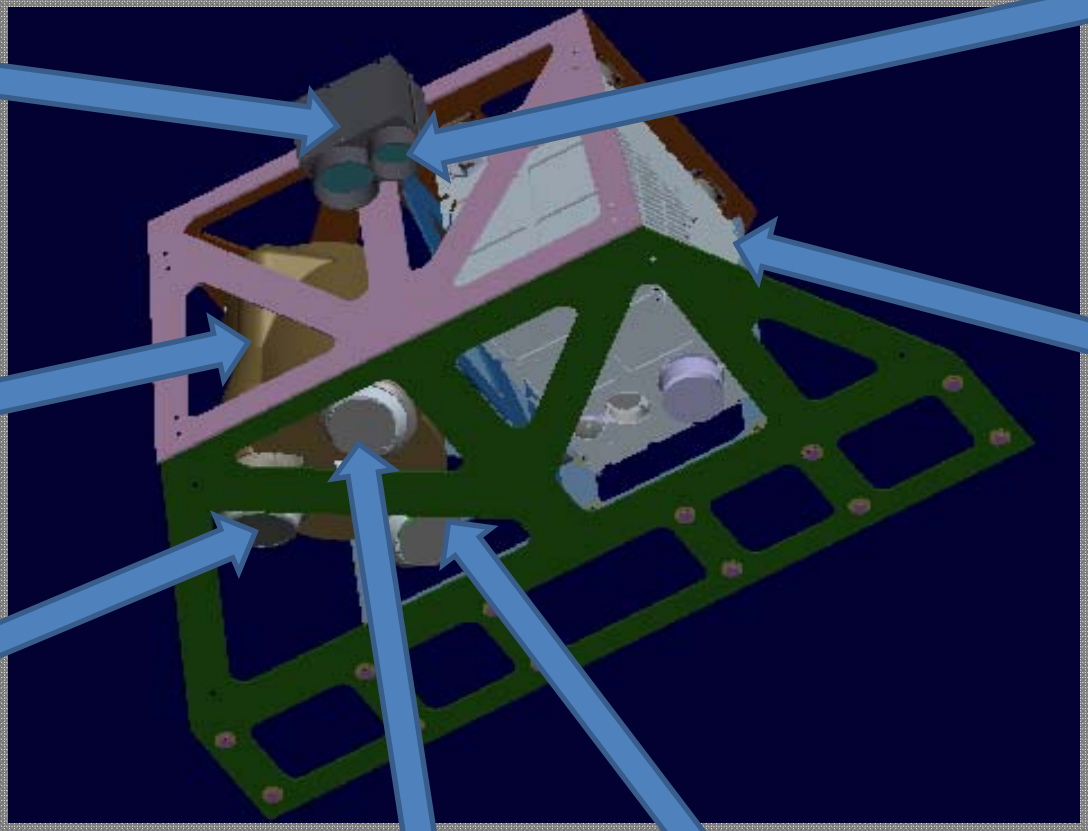
Comparisons

Doppler LiDAR and Laser Altimeter



Comparisons

Doppler LiDAR and Laser Altimeter



ALTIMETER_
NEW_DRF

Group LENS

LASER_
ALTIMETER_SEPT.

ALHAT_FT4_
TELESCOPE_2_ASM

ALHAT_FT4_
TELESCOPE_ASM.ASM

*ALHAT_FT4_
TELESCOPE_
AFO_ASM.ASM
(located within the
ALHAT telescope)

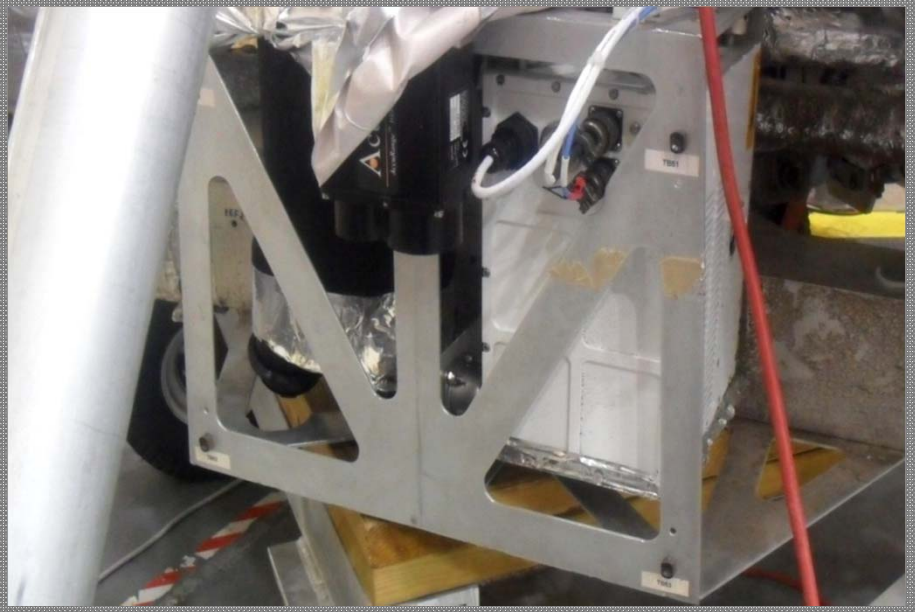
ALHAT_FT4_TELESCOPE_ASM.ASM

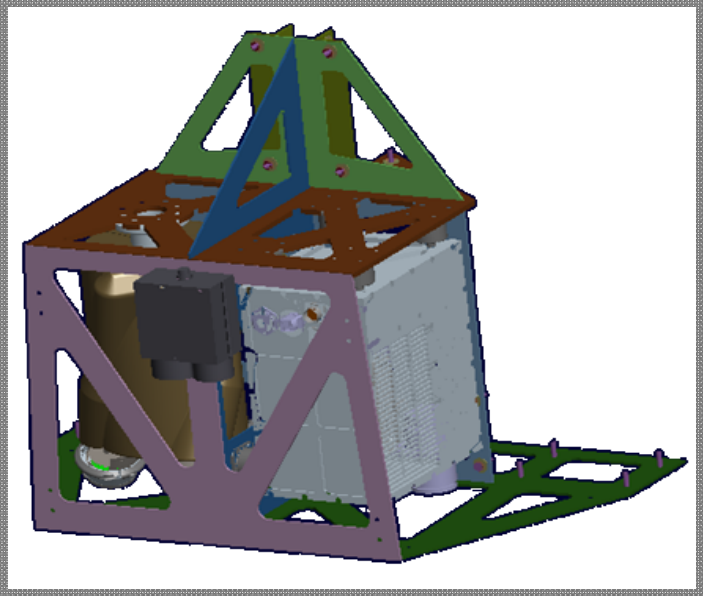
ALHAT_FT4_TELESCOPE.ASM

Comparisons

Differences

- There are no major or minor differences between the physical vehicle and the design model

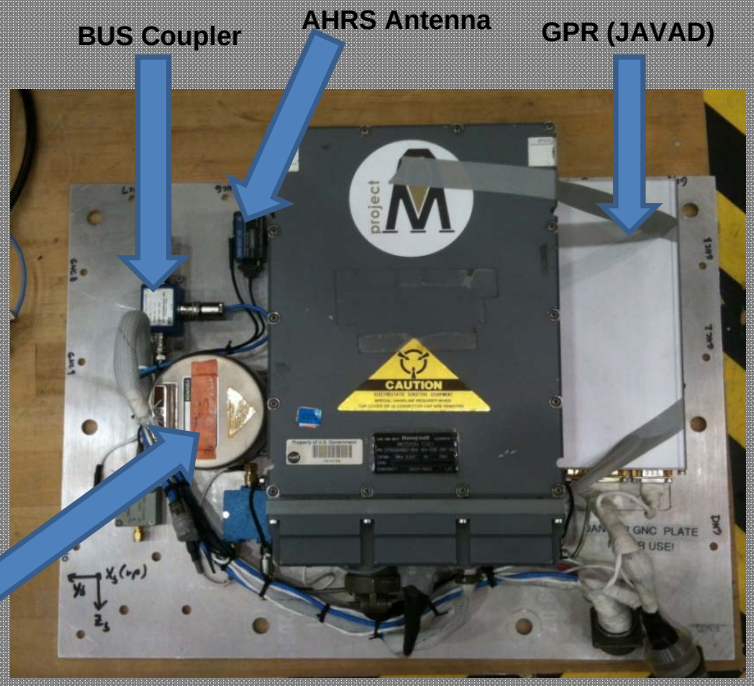




Comparisons

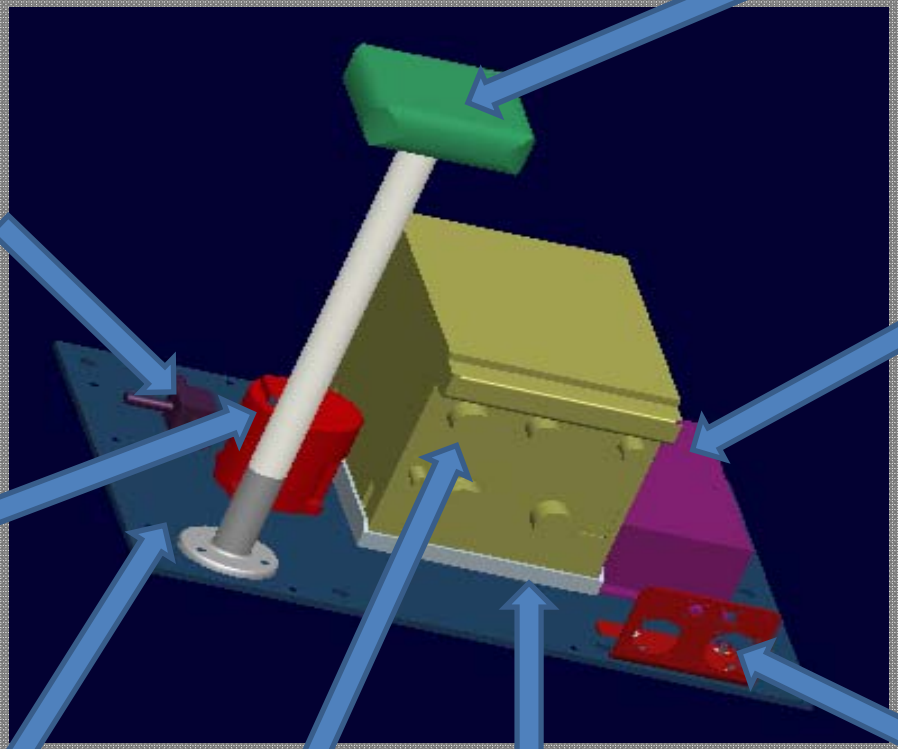
GN&C Plate





Comparisons

GN&C Plate

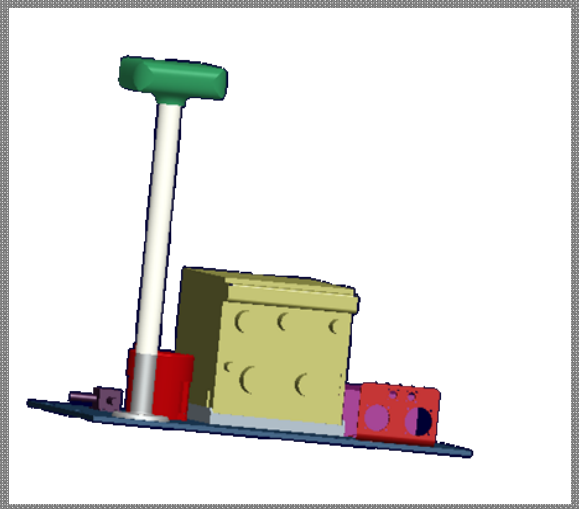


Comparisons

Differences

- GPS Antenna Assembly is located on the top of the HDS CE Shelf in order to obtain accurate navigation readings
- In the design model there is not an account for the Alignment Laser that is located on top of the SIGI.
- AHRS antenna not located in the design model







Recommendations



- Keep an up to date file of changes, additions, replacements and removals
  - Therefore avoiding repetitive mistakes or mishaps
  - File should consist of photos, detailed descriptions including purpose of change, who approved the change and what are the expectations with this change implemented



Summary



- Overall Difference:
  - Current Physical Vehicle Dry Mass (approximate): 2238lbs.
  - Current Design Vehicle Mass: 2149.69lbs.
  - Approximately 88.31 lbs dissimilarity
- Remaining Work:
  - Continue to meet with subsystem leads to finalize any uncertainties within the MEL
  - Add wiring and other details to design model, so that all weight and mass measurements can be as accurate as possible.

Experiences at JSC

- Morpheus Tests
  - Access Control
- Shuttlebration
- EA3 All Hands
- JSC Academic Scholarship







Future Plans



- Back to the DFW area
- Return to University of Texas at Arlington
  - Fall 2012
- Morpheus Free Flight Kennedy Space Center
- Back to JSC
  - Hopefully Summer 2013



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The Morpheus Team

All of EA3



What a Ride it's Been!
by Brian Basset