



# JAMES WEBB SPACE TELESCOPE (JWST) TEST ASSESSMENT TASK (TAT)

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***Briefing to the NASA Science Mission Directorate***

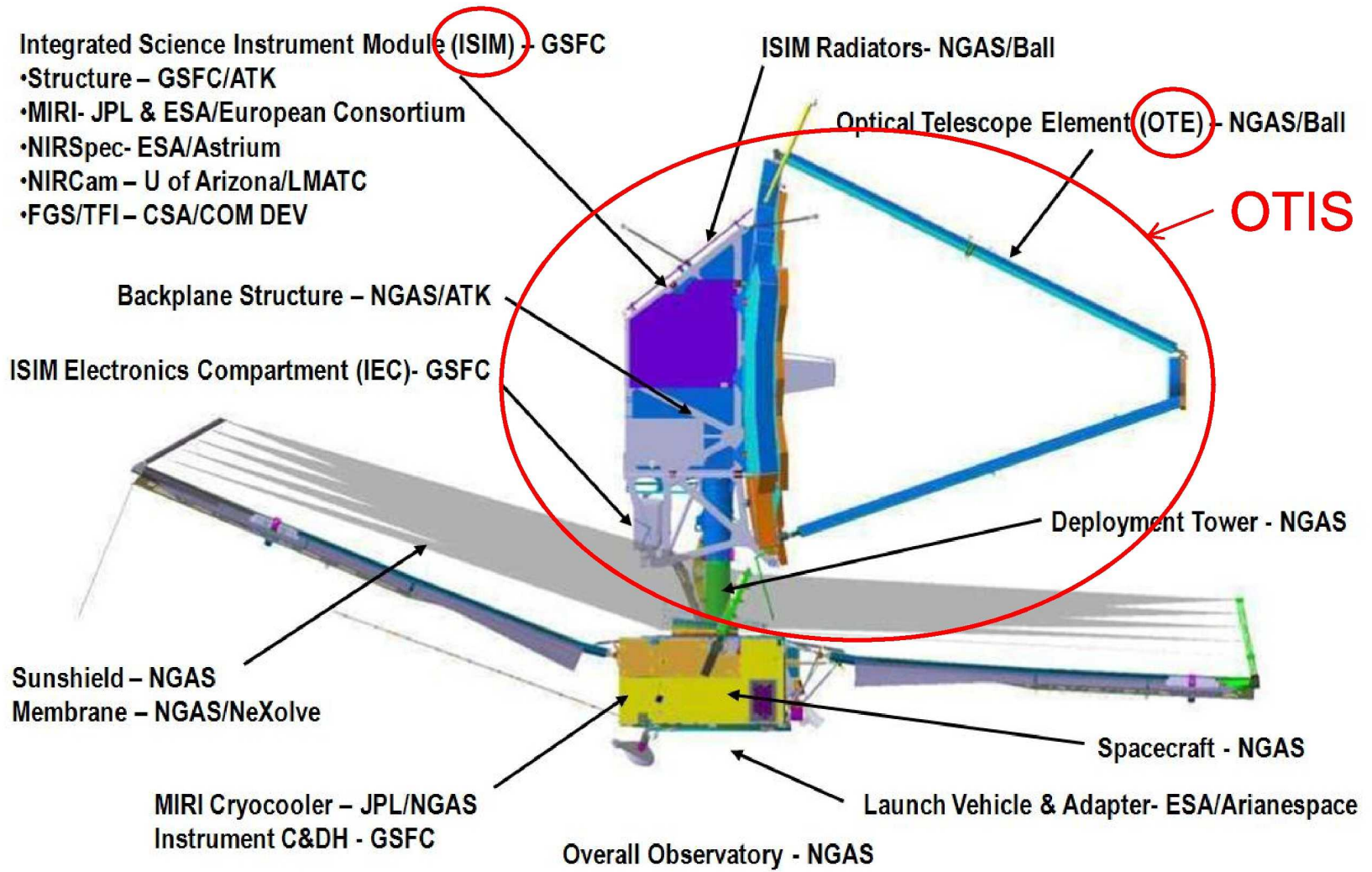
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## **JWST Testing Assessment Task**

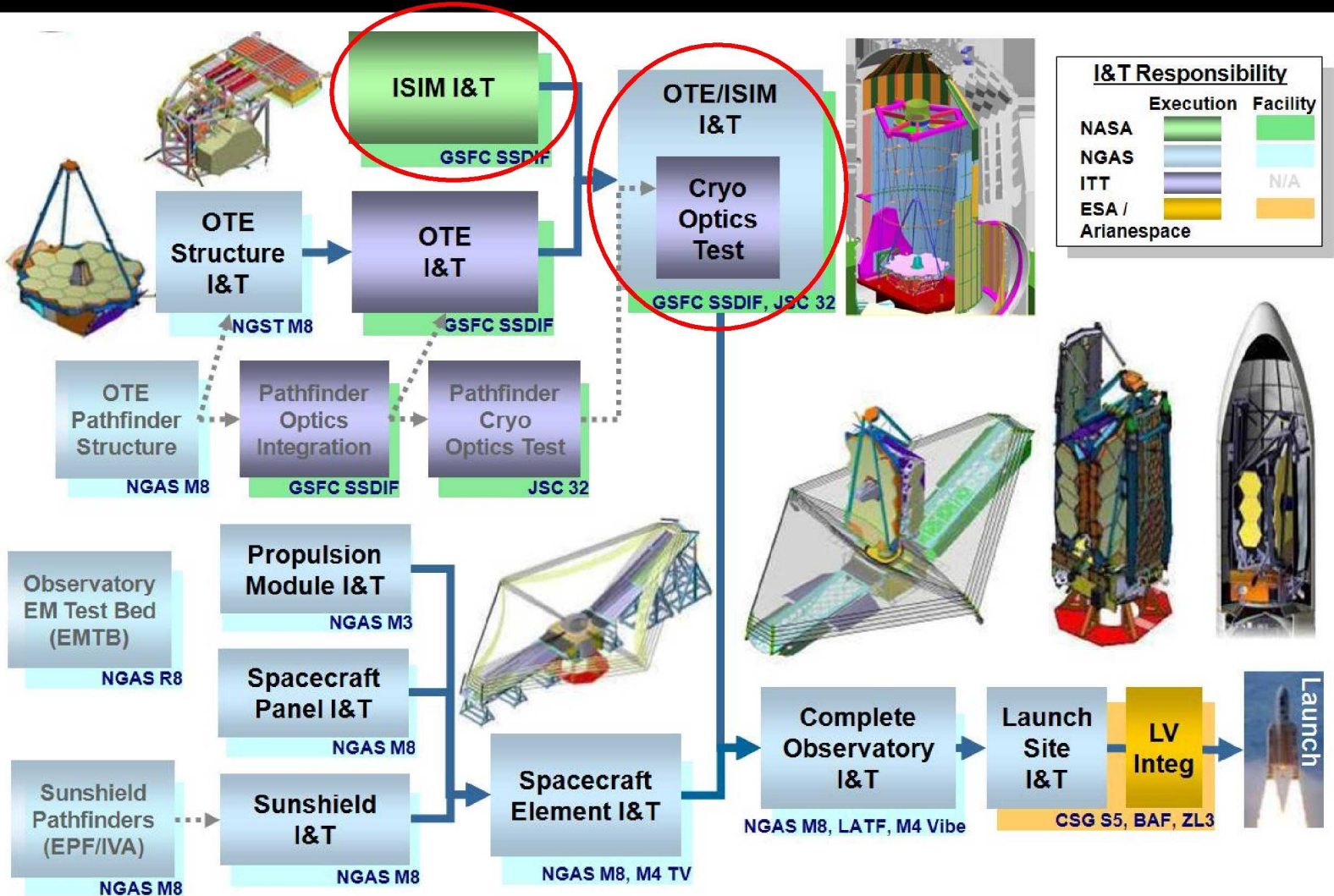
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NASA Headquarters  
August 20, 2010

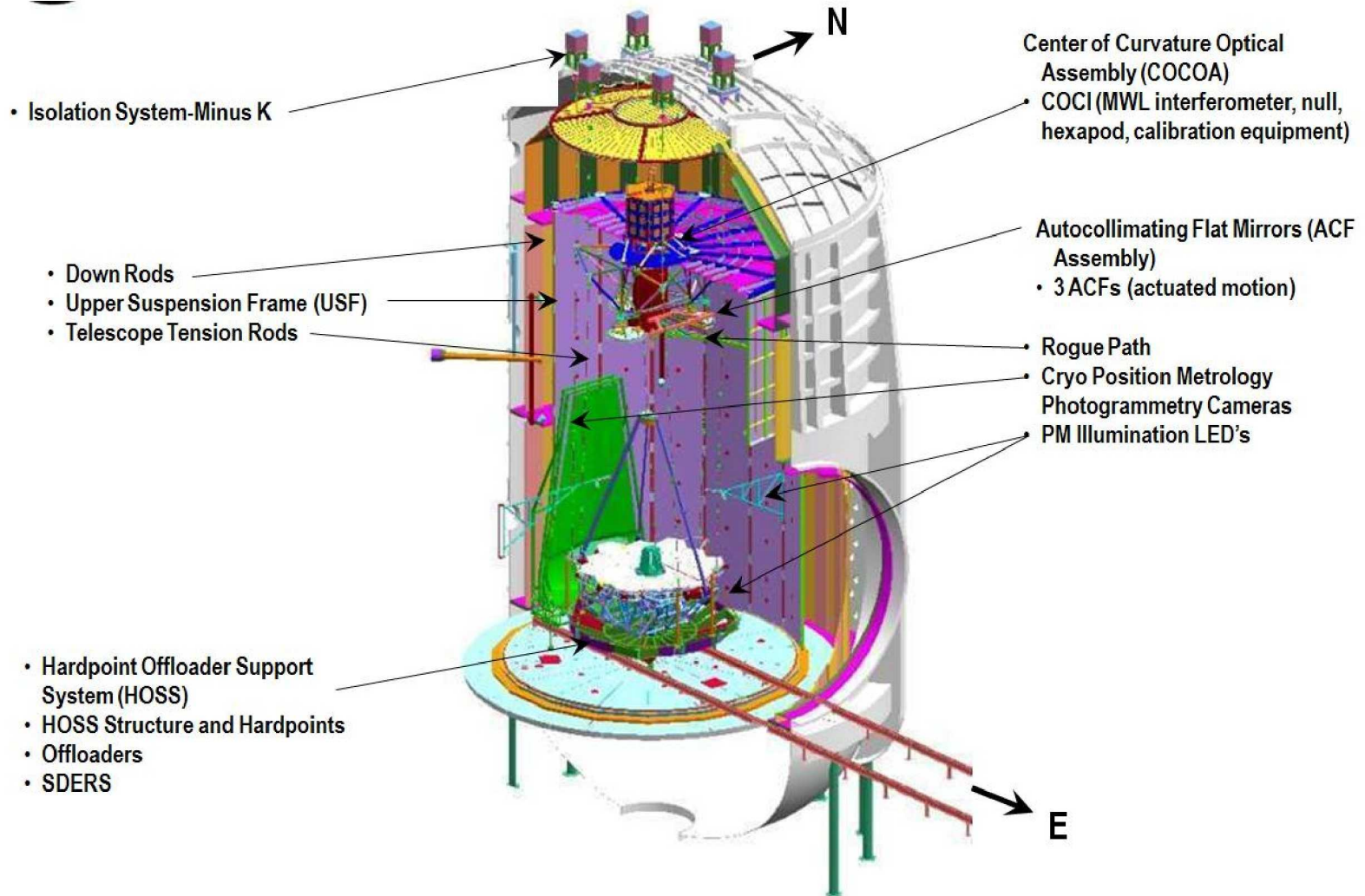
# ISIM + OTE = OTIS



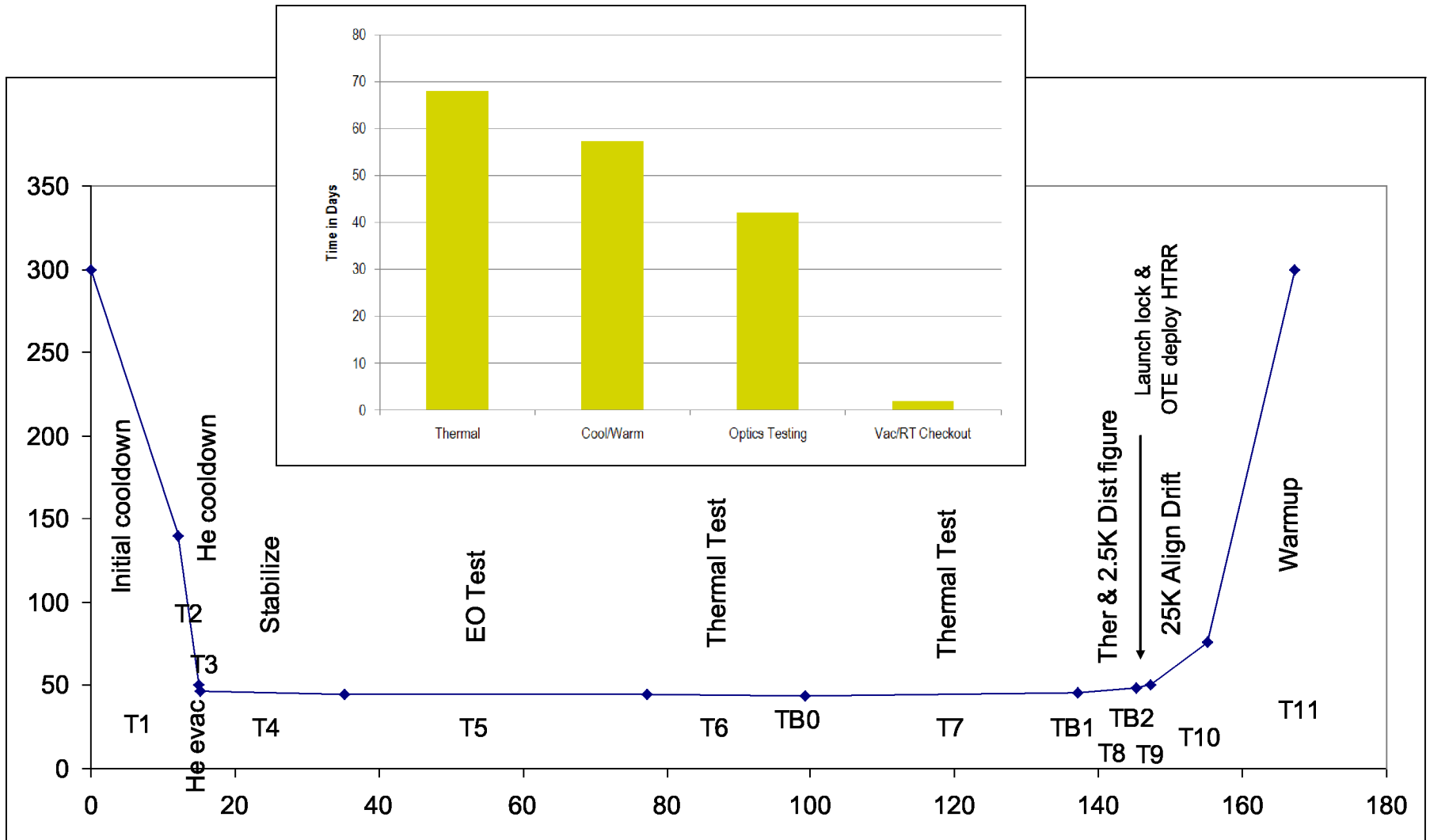
# TAT Scope



# Test Complexity at JSC



# OTIS Cryo Test Timeline



# Backup

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# Thermal Verification Overview

○ Orange (O) Provides demonstration/risk reduction and supporting data for model validation  
○ Yellow (Y) Provides direct test data for partial model correlation and performance verification.  
○ Green (G) Provides direct measurement/model correlation in flight like thermal environment and as flown configuration.

		2009 → 2013													Flight	
		A	B	C	D	E	G	H	I	J	K	L	M	Final Verification T- Test A - Analysis	Notes	
		Engineering Full Scale Core	Engineering 1/3 Scale SS	Engineering Layer 5 Lidar	Flight IEC Baffle	Flight SI TV/TB	Flight IEC	Flight Heat Straps	Flight ISIM Radiators	Flight ISIM SES	Flight OTIS JSC	Flight SS Core	Flight Bus			
		Description														
1	OTE Temperature	function of several architecture thermal features	O	Y	Y	Y						G	Y	A	via analysis. OTE temperature is a function of several architecture	
2	Core Isolation Performance	critical to overall temperature of OTE and ISIM	O								G	G		T/A		
3	IEC Isolation Performance	critical to overall temperature of OTE and ISIM	O					Y			G			T/A		
4	IEC/Core SS Backscatter	critical to overall temperature of OTE and ISIM		O	Y	Y								A	via analysis. Only Lidar and baffle test provide	
5	Radiator Performance	dictates total load capability of passive cooling system								G				T		
6	Heat Strap Performance	dictates total load capability of passive cooling system						G						T		
7	Radiator/Strap end to end	radiator to strap interface is									G			T		
8	Cooler - ISIM Loads	ISIM contributor to total load on cryocooler					Y				G			T/A		
9	Cooler - Line Loads	Observatory contributor to total load on cryocooler	O								G			T/A		
10	Harness Radiator Performance	major mitigator of IEC to ISIM harness loads									Y	Y		A	final performance is via analysis. Only lidar and baffle test provide	
<b>Radiator Load Breakdown</b>																
QT	<b>Total Load (253) mW, FGS Ex.</b>	<b>Description</b>												A	total load is verified via analysis. Strong function of OTE temperature	
Q1	Mounts - C (42)	radiator supports to OTE									G			T/A		
Q2	Ext Backload - R (88)			O	Y	Y								A	final performance is via analysis. Only lidar and baffle test provide test data.	
Q3	Int Backload - R (0)										G			T/A		
Q4	<b>Strap Load - C (123)</b>	total load thru strap									Y	G		T/A	OTE generated heat loads are via analysis only	
Q4A	Supports - C (0)	strap supports to ISIM/OTE									Y	G		T/A		
Q4B	Radiation - R (0)	OTE ISIM cavity									Y	G		T/A		
Q4C	<b>Instrument - C (123)</b>	Load thru instrument									Y	G		T/A		
Q4C1	Mounts - C (13)	Bench to Instrument Mounts					Y				Y	G		T/A		
Q4C2	Radiation - R (25)	OTE ISIM cavity					Y				Y	G		T/A		
Q4C3	<b>Instrument Load (85)</b>	Instrument Generated									G			T		
Q4C3A	Dissipation (55)						G							T		
Q4C3B	<b>Harness (30)</b>	Harness Total									G			T	assumes harness radiator performs as specified.	
Q4C3B1	IRSU(5)	IRSU to Instrument									G			T		
Q4C3B2	Instrument (25)	FPE/ICE to Instrument									G			T		

# Optical Verification Overview

	OTE Subsystem Level	SI Level	ISIM	JSC	Notes
<b>WFE/Figure Performance</b>					
PM Low Freq/PMSA-PMSA Alignment	Y	N/A	N/A	G (critical)	Backplane SES test at Subsystem Level; Integrated structure/PMSA alignment measured using acuator range for phasing at JSC
PM Mid Freq	G	N/A	N/A	O	
PM High Freq	G	N/A	N/A	N/A	
PMSA Astigmatism	G	N/A	N/A	Y	
PM RoC	Y	N/A	N/A	G	
PM Conic	G	N/A	N/A	Y	
SM WFE	G	N/A	N/A	O	
SM RoC	G	N/A	N/A	O	
SM Conic	G	N/A	N/A	O	
TM WFE	G	N/A	N/A	O	
TM RoC	G	N/A	N/A	O	
TM Conic	G	N/A	N/A	O	
FSM Figure	G	N/A	N/A	O	
SI WFE	N/A	Y	G	O	
<b>Alignments</b>					
PM to AOS Alignment	Y	N/A	N/A	G (critical)	Backplane SES test at Subsystem Level
SM to AOS Alignment / SM Actuator Range	Y	N/A	N/A	G (critical)	Backplane SES Test, SMSS ambient testing including deployment repeatability measured at Subsystem Level
Internal AOS Alignment (TM, FSM, Mask, Aperture)	G	N/A	N/A	O	
ISIM to AOS Alignment	Y	N/A	Y	G (critical)	Backplane piece measured during Backplane testing in SES; ISIM piece including KM strut adjustments measured using OSIM
SI to ISIM Pupil Shear	N/A	Y	G	O	Internal SI Shear measured at SI level
SI to ISIM Focus	N/A	Y	G	O	Internal SI Focus measured at SI level
<b>Other</b>					
Thermal Distortion – PM WFE & RoC Change	O	N/A	N/A	Y	BSTA testing
Thermal Distortion – OTE Alignment Change	O	N/A	N/A	Y	Full Strut CTE test at Subsystem Level
PM Collection Area	G	N/A	N/A	O	
Rogue Path	N/A	N/A	N/A	O	AOS mask alignment measured at Subsystem Level - captured under "Alignments" above
PM to FSM Mask Alignment / Truant Path	O	N/A	N/A	O	Frill test at JSC
Plate Scale	N/A	Y	Y	G	OTE alignments that impact plate scale are captured under "Alignments" above
WFS&C Algorithms/Process	G	O	O	O	Full SW Verification w/ ITM at Subsystem Level; End-to-End WFSC Demo at JSC
WFS&C Influence Functions	O	N/A	N/A	Y	TBT validation at Subsystem level
WF Control Signal Path (PMSA, SMA motion control sign check test)	N/A	N/A	N/A	G	Mirrors see flight electronics for first time at JSC
WF Control - Hexapod performance	G	N/A	N/A	O	
Fine Guidance Loop	Y	N/A	O	O	DITCE/ADU/FSM test at BATC; JSC uses ADU EDU

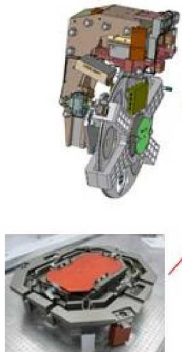
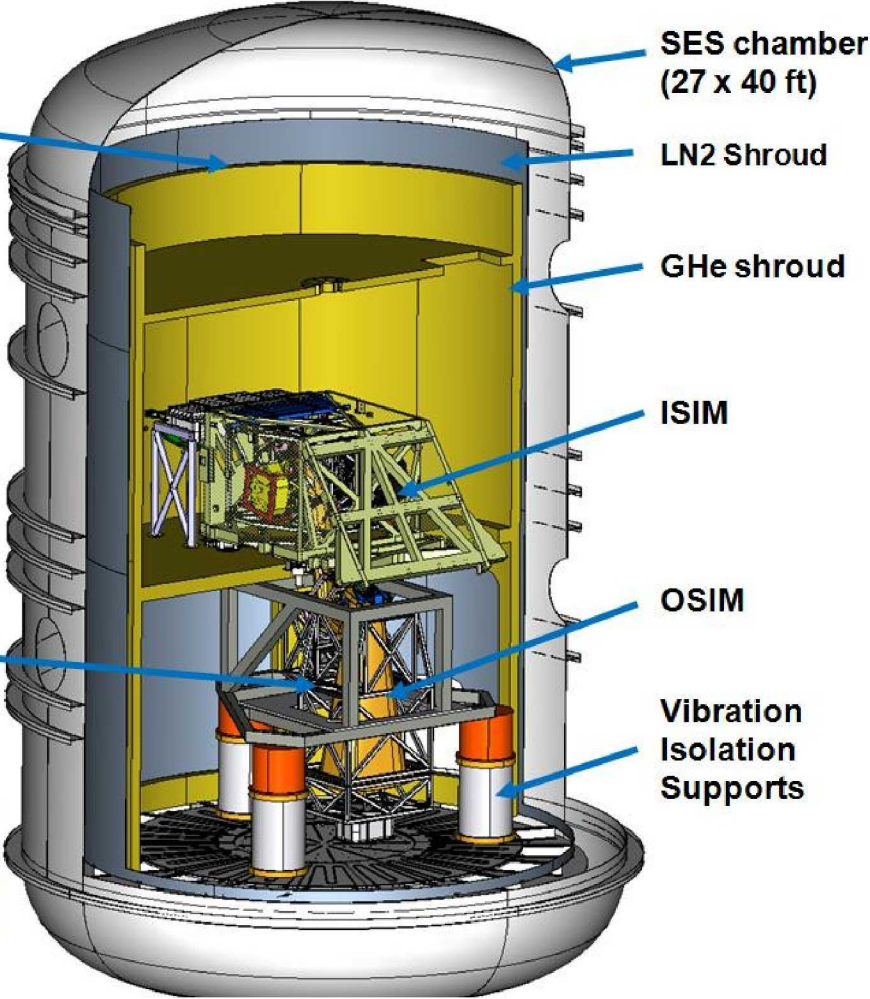
Orange	Risk redn/demo/blunder
Yellow	Test data for partial model validation/performance verification
Green	Provides flight like test data
NOTE: All Low frequency terms and PMSA astigmatism factor into actuator range	



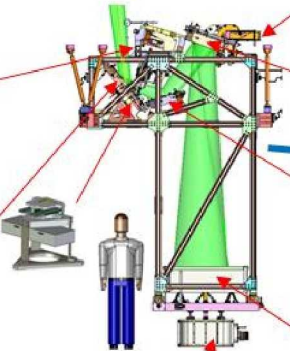
# ISIM Cryo Test Configuration at GSFC



GHe shroud installation and test completed July 09



Fold Mirror 3 Tip/Tilt Gimbal Assembly

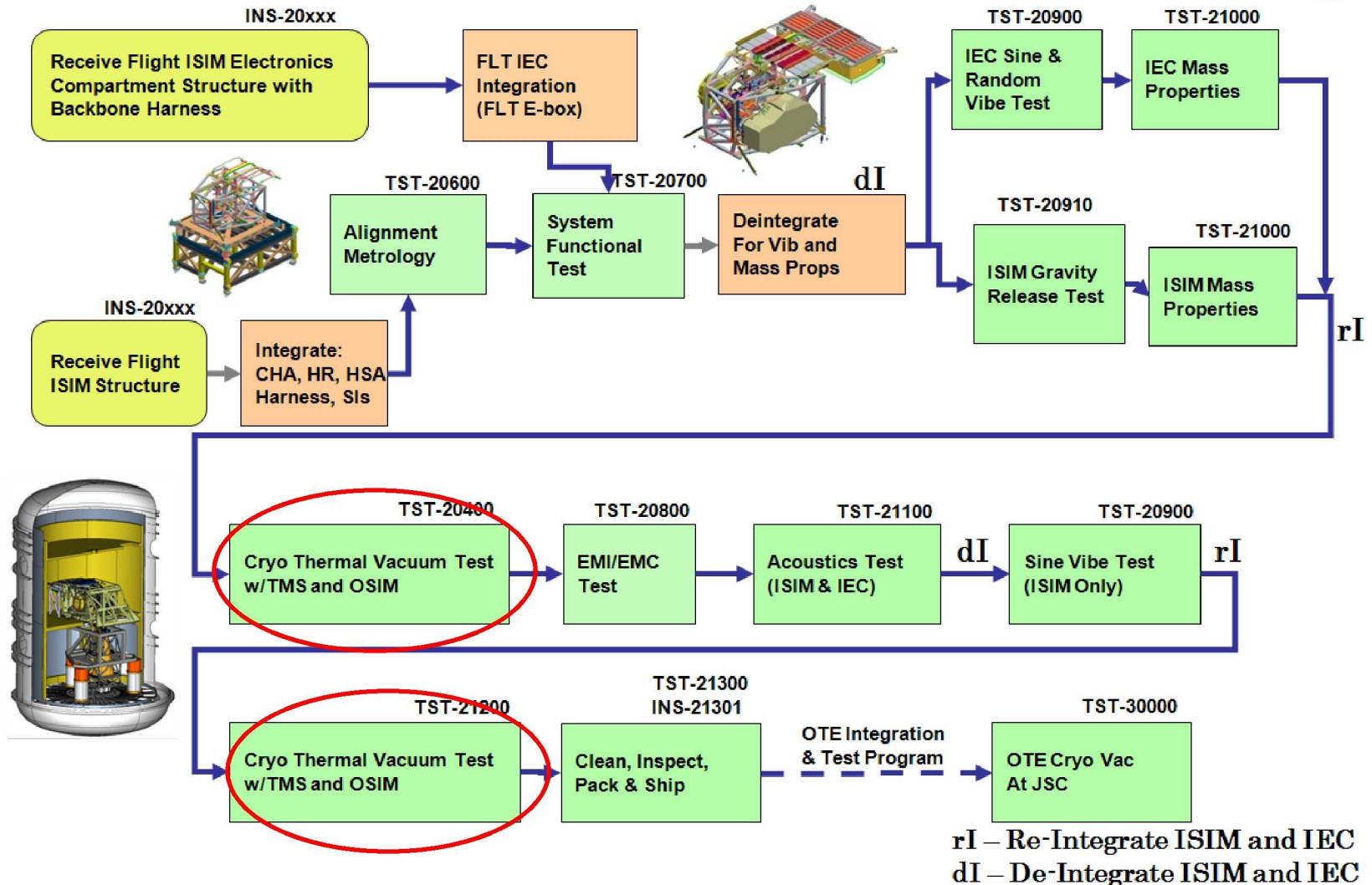


Alignment Diagnostic Module

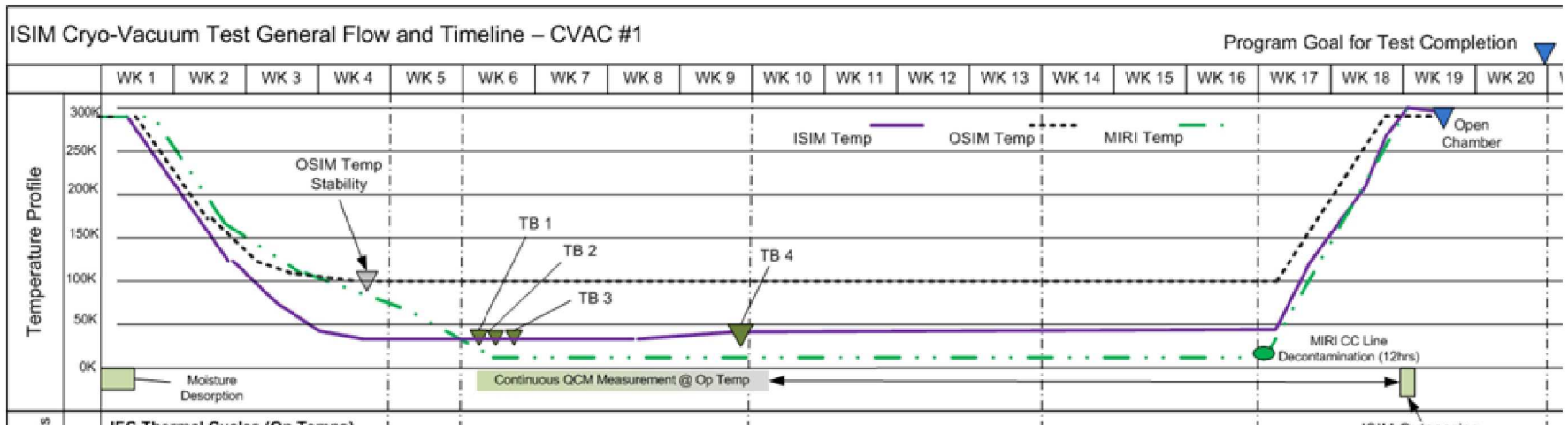


OSIM Primary Mirror

# ISIM I&T Flow



# ISIM Cryo Test Timeline



# JSC Activities Flow

