



Managing the Ares I-X First Stage IPT “Life on the Critical Path”



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Agenda



◆ Introduction to First Stage

- Hardware
- Mission
- Organization

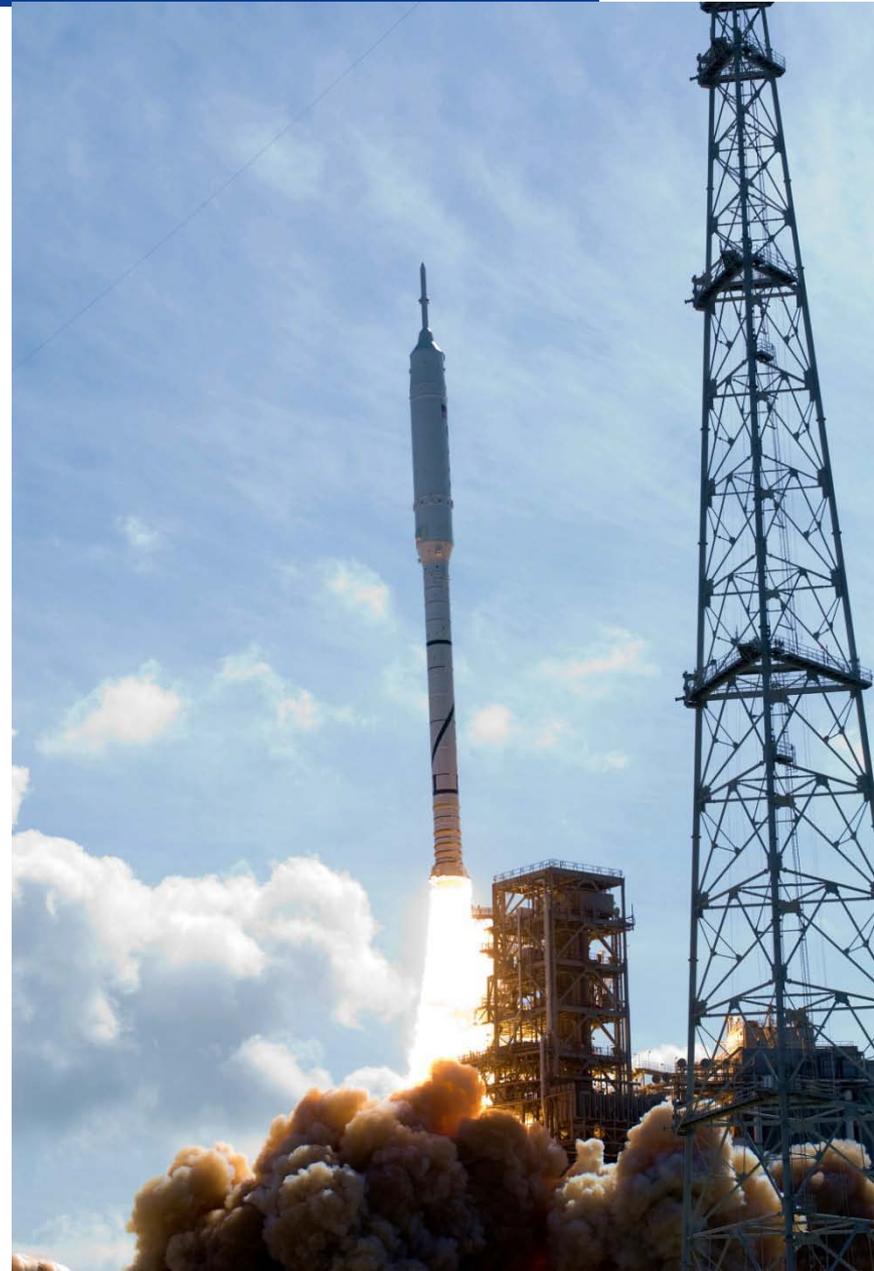
◆ Ares I-X Life-Cycle

- Significant Events
- Top Level Schedule
- Additional Pressure Points

◆ Dealing with the Pressure

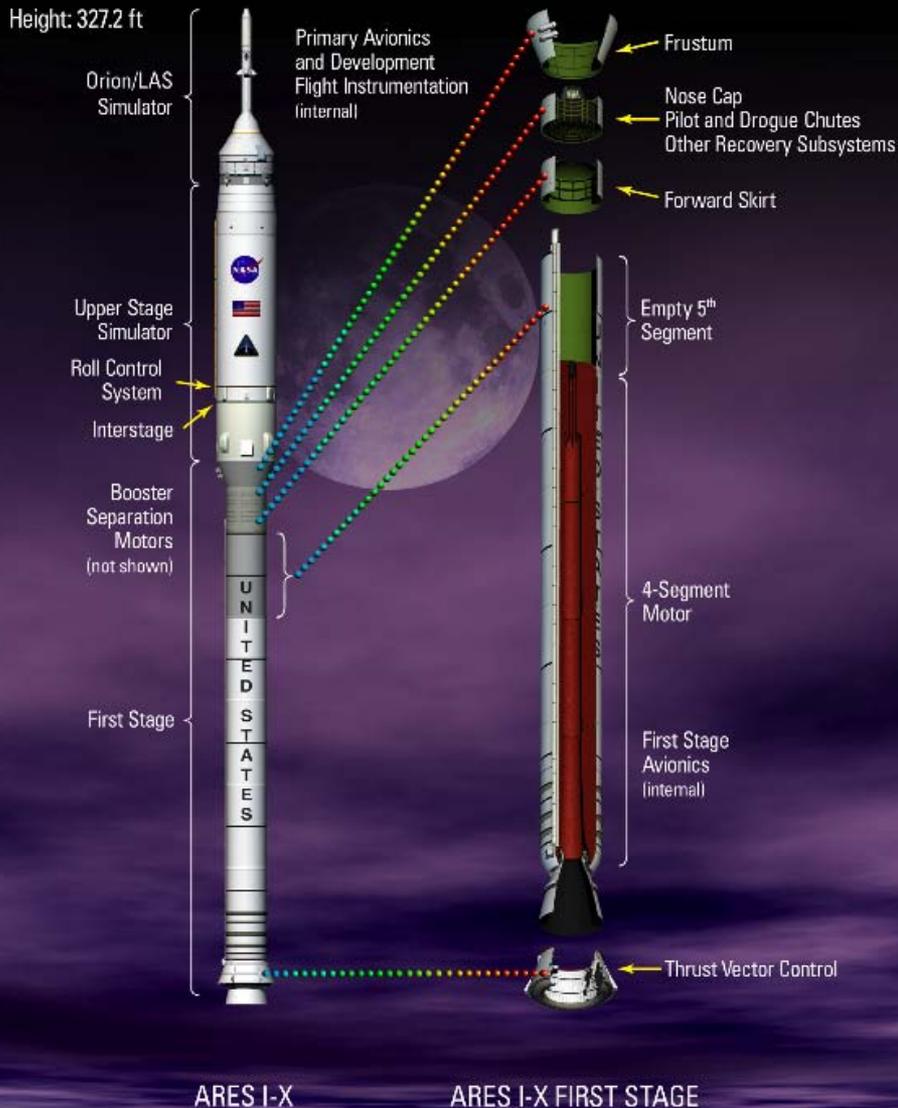
- Putting the Team Together
- Key Decisions Made
- Tools Implemented

◆ Conclusions and Lessons Learned





First Stage Technical Overview



◆ Heritage Hardware

- 4 Segment Reusable Solid Rocket Motor (RSRM) w/Nozzle
- Thrust Vector Control (TVC)
- Flight Termination System (FTS)
- Nose Cap w/Thrusters
- Booster Separation Motors (BSMs)

◆ Modified Heritage

- 1st Stage Provided Avionics (Shuttle Derived Avionics) (ISC, RCU, and APUC)
- Aft Skirt
- T-0

◆ New Developments Specifically for AIX

- Fifth Segment Simulator (5SS)
- Forward Skirt (FS)
- Forward Skirt Extension (FSE)
- Main Parachute Support Structure (MPSS)
- Frustum

◆ Ares I Designs

- Parachutes
- FTS Extension to Aft Segment



Ares I-X First Stage Major Hardware



Finished Stage will also include:

Development Flight Instrumentation Installed
Systems Tunnel Cables & Covers Installed
Complete Cable & Instrumentation Interfaces

*Insulated and Cast
Forward Segment with
Igniter Installed*

*Insulated and Cast
Forward Center Segment*

*Insulated and Cast
Aft Center Segment*

*Insulated and Cast
Aft Segment with Forward
Nozzle Assembly Installed*

Modified Systems Tunnel for FTS LSC

Aft Exit Cone Assembly

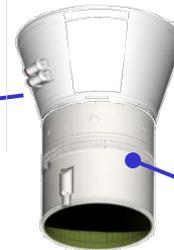
Four Segment Motor



Forward Assembly

Fifth Segment Simulator

Aft Skirt Assembly



Upper Stage Interface

Separation and Deceleration
System Installed

Pad Stabilization Connection Point



Avionics Pallet Installed
(all except flight computer & two RRGUs)

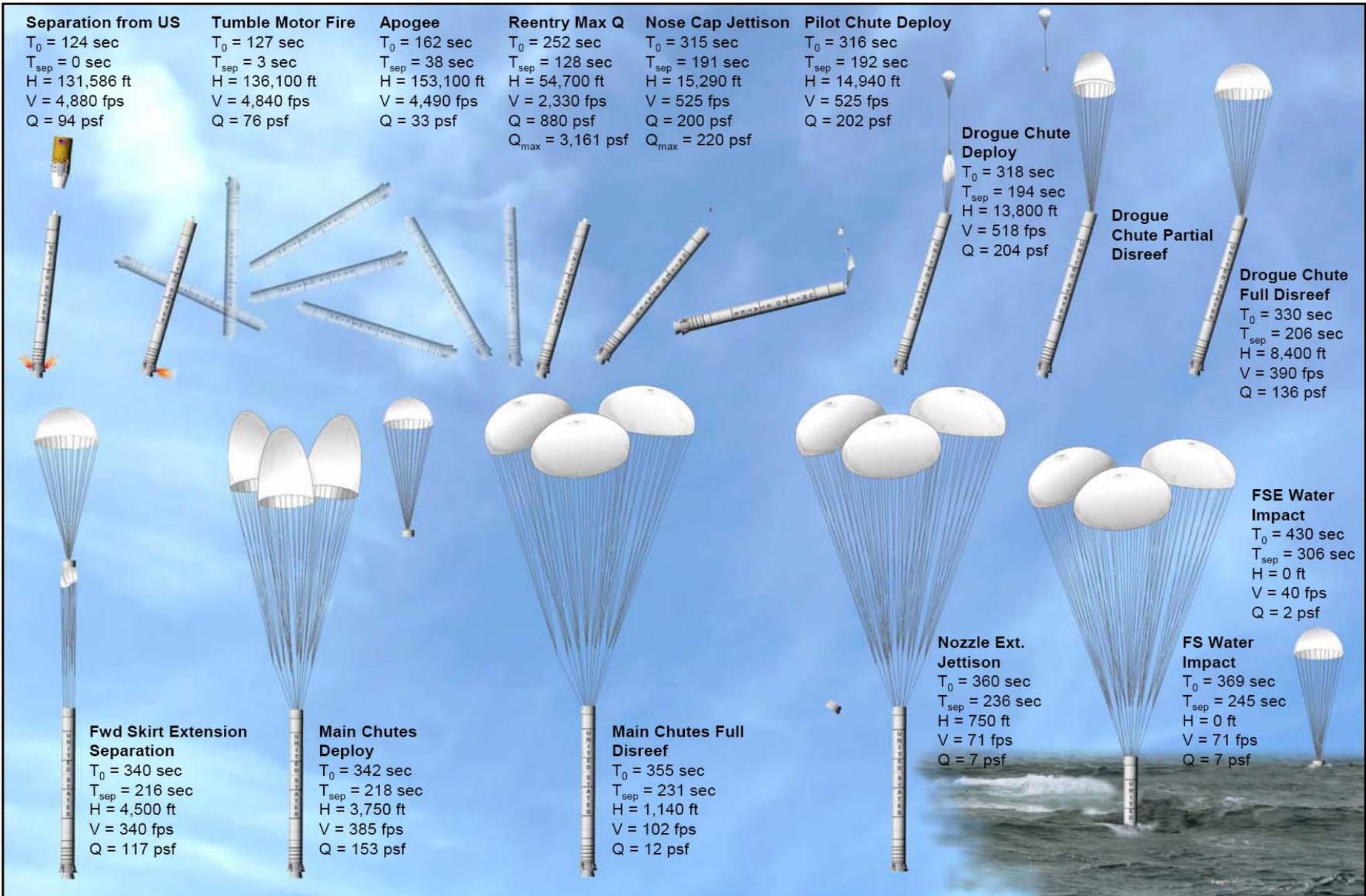


12 GFP BTMs/BDMs Installed
TVC System (incl. APUC) Installed
RRGU Installed
Only T-0 Electrical Interface



Ares I-X First Stage Recovery Sequence

Re-entry Mass Properties with BDMs, BTMs, and 3654-lb ballast on Aft Skirt

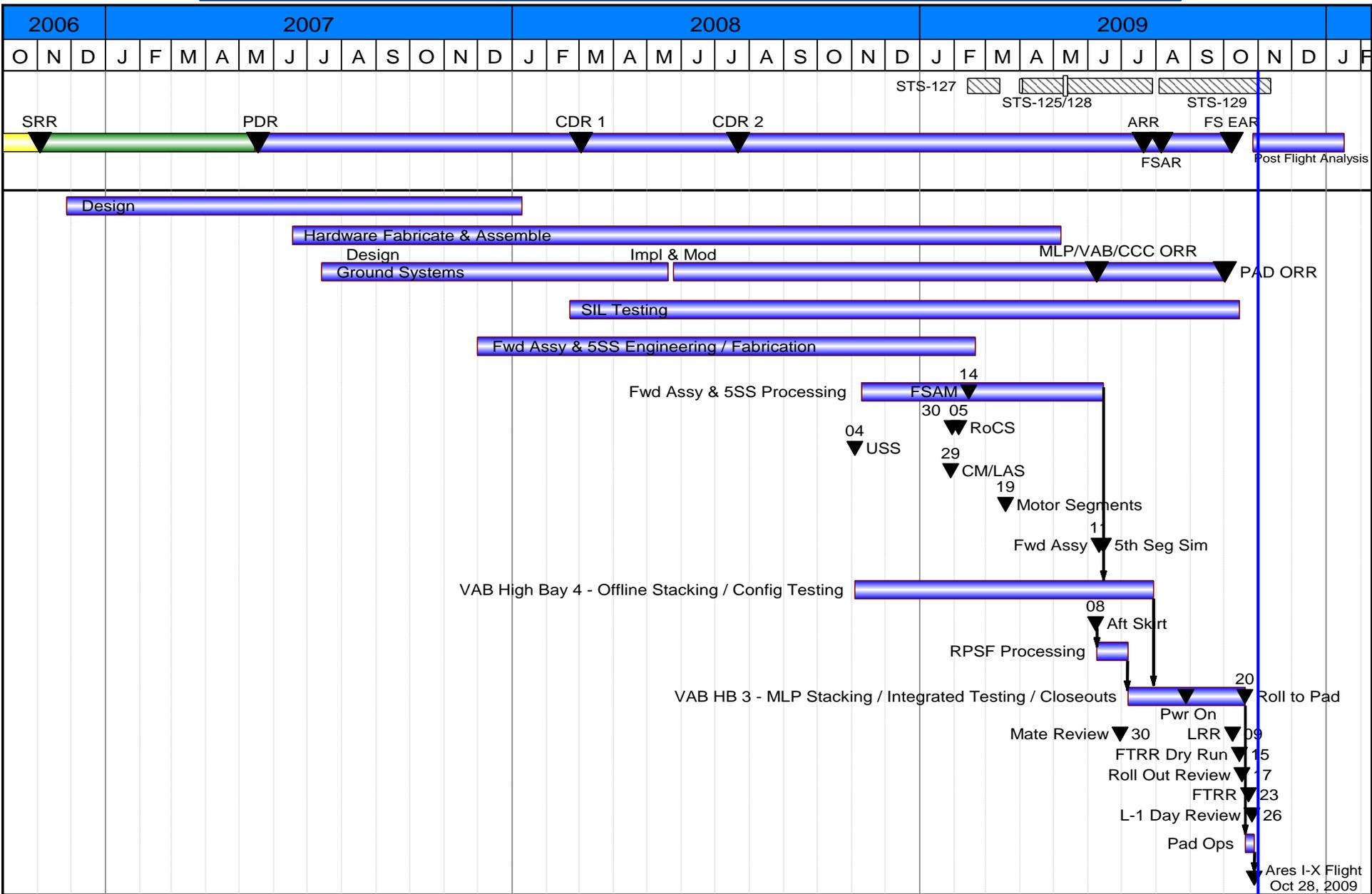


All events are based on predicted nominal performance, unless otherwise noted

11/28/07

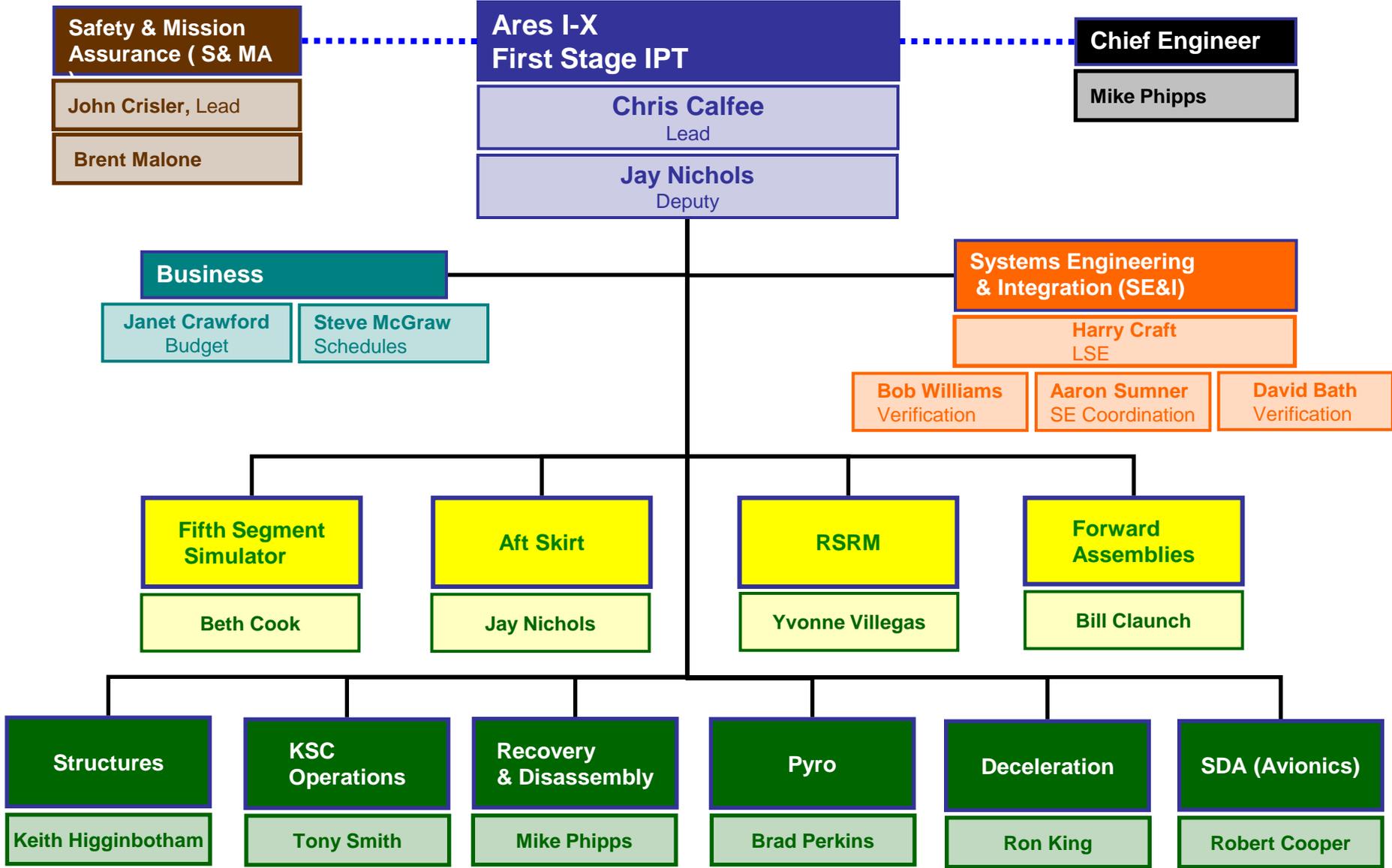


Ares I-X Executive Summary





Ares I-X First Stage IPT (MSFC)





Significant Events During the Life Cycle



- ◆ **ATP May 2006 (April 15, 2009 Launch)**
 - Motor Delivery 8/8/2008
 - Forward Assembly/5SS Delivery 1/30/2009
 - Aft Skirt Delivery 12/12/2008
- ◆ **750 DFI Sensors on Vehicle, 325 on First Stage**
- ◆ **April 2007 -1st Lean Event and Project Re-Organization**
- ◆ **August 2007 - Separation Plane Change**
 - Moved Separation Plane from Top of Interstage to Bottom of Frustum
 - Moved Separation and Tumble Motors to Aft Skirt
 - Aft Skirt Moved to Critical Path Along with Forward Assemblies
- ◆ **Summer of Lean**
- ◆ **PDR and CDR “Slippages”**
 - 4-10 Months
 - No Change to Launch Date



The “Leaning” of First Stage Delivery Dates



	Original Delivery Dates	Evolved Dates
Motor	8/8/08	7/17/08
Forward Assembly	1/30/09	12/1/08
5SS	1/30/09	12/15/08
Aft Skirt	12/12/08	11/19/08

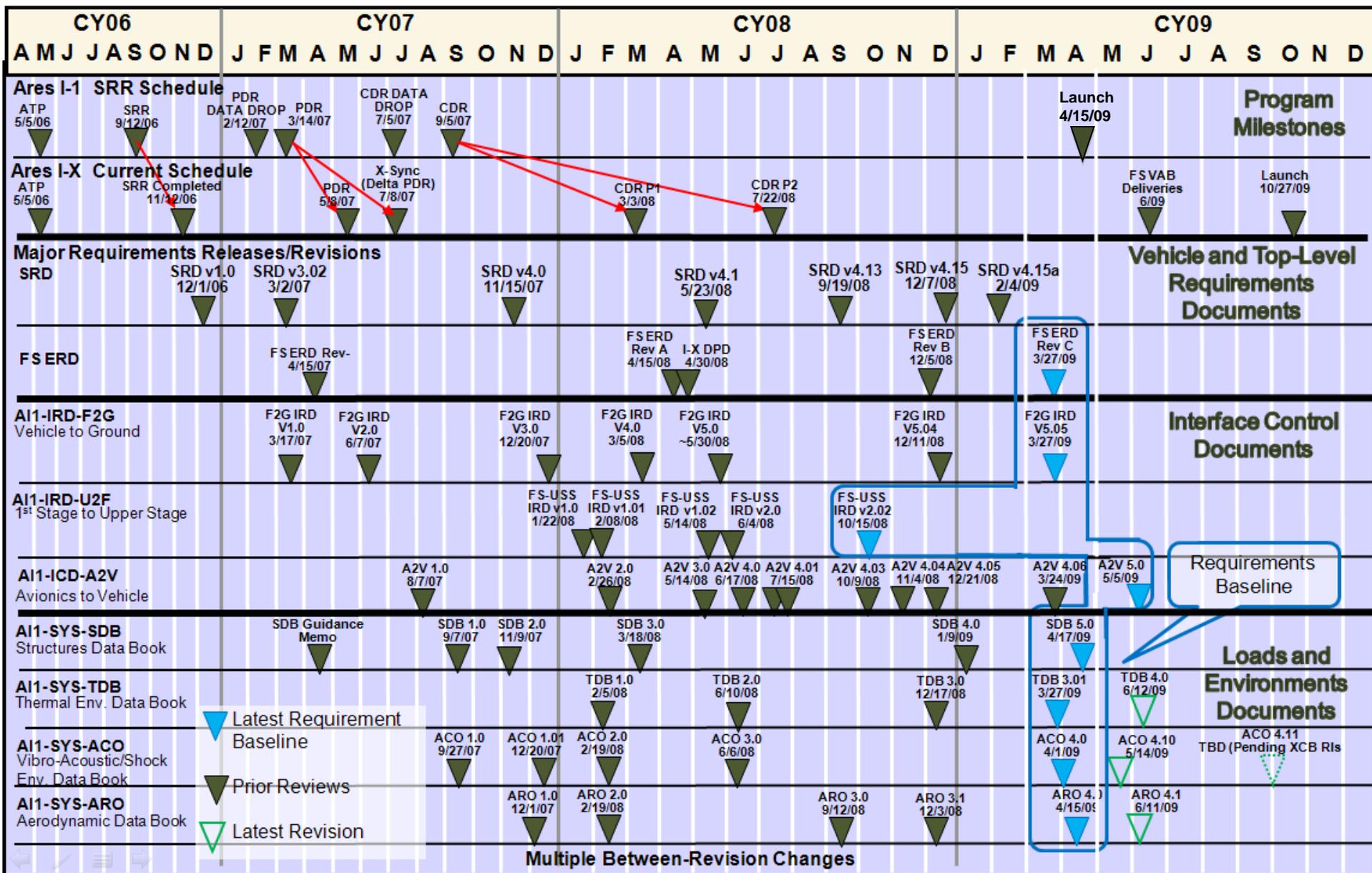
Assumptions:

4/15/09 Launch Date

May 2006 ATP



Ares I-X Major Milestones



Multiple Between-Revision Changes



Other Interesting Events



- ◆ **Forward Assembly and Fifth Segment Simulator Fabrication**
 - “Small” Shop in Indianapolis, Major Tool & Machine
 - Centralized Location for All Major FS Fab
 - Six Major Pieces of Structure
 - 3 Aluminum
 - 3 Steel
 - Shortage of Welders
 - Lack of Experience with “Flight Hardware”

- ◆ **Motor Shipment**
 - Pressure was Applied to Ship the Motor to KSC Before it was Ready
 - KSC Had No Plan in Place to Complete Instrumentation
 - First Stage Refused

- ◆ **Forward Assembly Processing**
 - KSC Didn’t Approve FA/5SS of Astrotech Processing, Wanted it Done at KSC

- ◆ **Harness Issues**
 - Availability
 - Testing
 - Aluminum Tape

- ◆ **ATK-USA Contract Squabbles**

- ◆ **Safety Violations**



Adding to the Pressure



◆ Interactions with MMO

- MMO Wanted Schedule Updates from ATK/USA Simultaneously to First Stage Receiving
 - Didn't Allow FS to "Manage" the Schedule
- Margin Controlled by Mission Manager
 - Gave the IPTs Limited Flexibility in Managing Schedule

◆ Interactions with Prime Contractor

- Schedule Management was a Significant Weakness Early in Life Cycle
- ATK Understood the Pressure the First Stage IPT was Under
- Difficult at First
 - ATK Continually Submitted Updated Schedules with Slippages to Delivery Dates
 - Multiple Reports Coming from Different Groups



Dealing with the Pressure



◆ Team Makeup

- Good Mix of “Greybeards” and “Greenies”
- Selection of the “Right” Personality
- Worked and Played Well Together

◆ Actions Taken

- Re-Org of First Stage Team
- On the Floor Presence
- Ship FA/5SS Structures Directly to KSC for DFI Installation
- Stop the Mass Distribution of Schedule Updates/Data

◆ Tools Implemented

- “One Pagers”
- Daily Tracker
- Milestone Tracking Status





AI-X First Stage Tracking Milestones

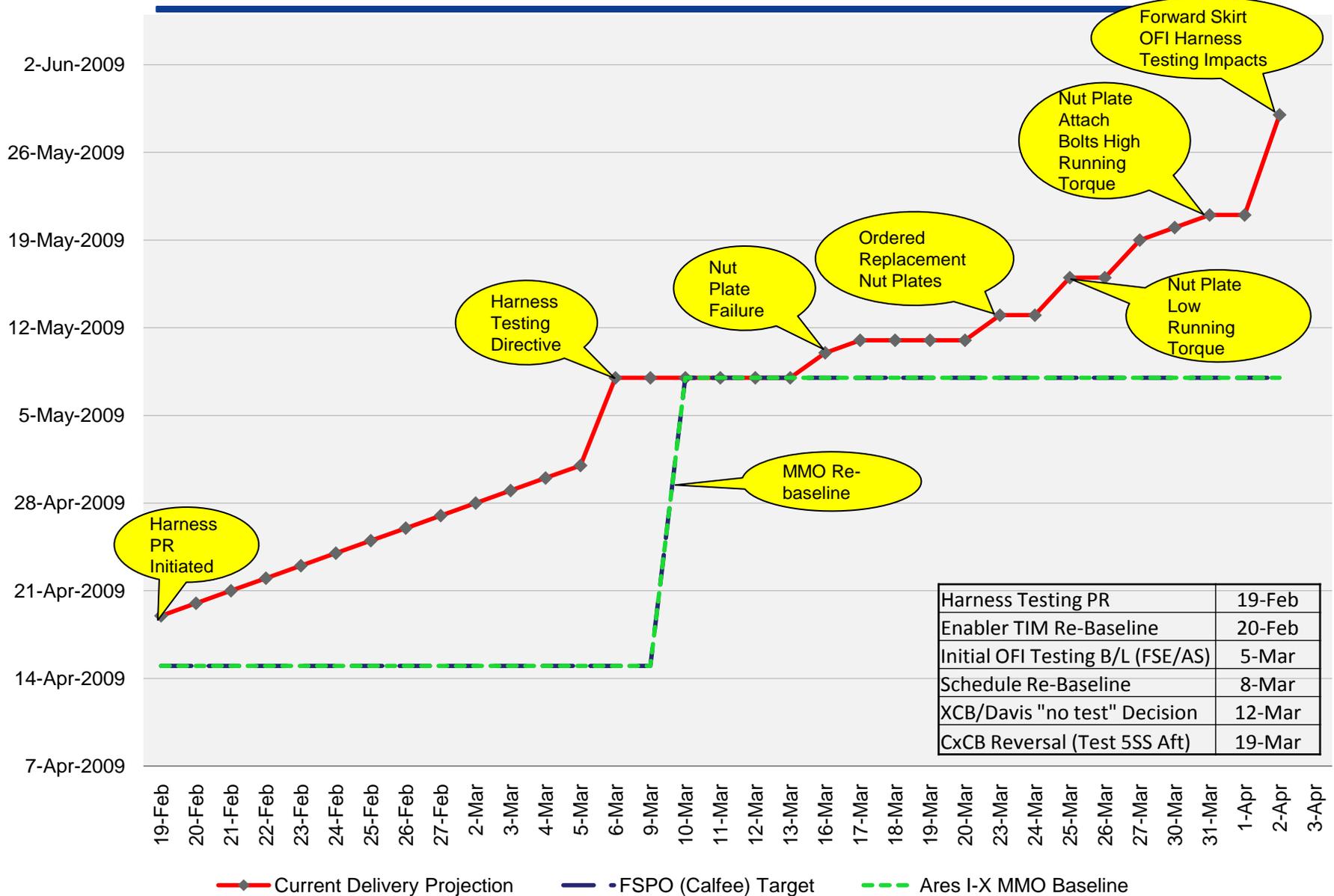
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Milestone	Milestone Completion Date	Status	Last % Complete	Current % Complete	Threats
FORWARD ASSEMBLY					
Frustum O/D at ARF	2/20	G	100%	100%	
Main Chute Install Complete	3/13	G	100%	100%	
OFI Cable Testing Complete	3/17	G	100%	100%	
Fwd Skirt DFI Sensor Install Complete	3/26	G	85%	100%	Last 2 Accels Installed 4/2
Fwd Skirt Ready to Mate	4/3	R	82%	85%	Projection: 4/20 (4/24) OFI Harness Testing (6 Harnesses, 34 connectors) Return 2 Pyro cables to LMCO for rework
Frustum DFI Sensor Install	3/31	R	40%	75%	Projection: 4/11 Peeling Paint inside Frustum
FSE Ready for Mate	4/8	R	85%	90%	Projection: 4/20
Frustum Ready for Mate	4/8	R	65%	75%	Projection: 4/22
FSE/FS Mate	4/13	R	0	0	Projection: 4/26 (4/30)
Frustum/FSE Mate	4/20	R	0	0	Projection: 4/30 (5/6)
Transfer to GO	5/8	R	0	0	Projection: 522 (5/29)

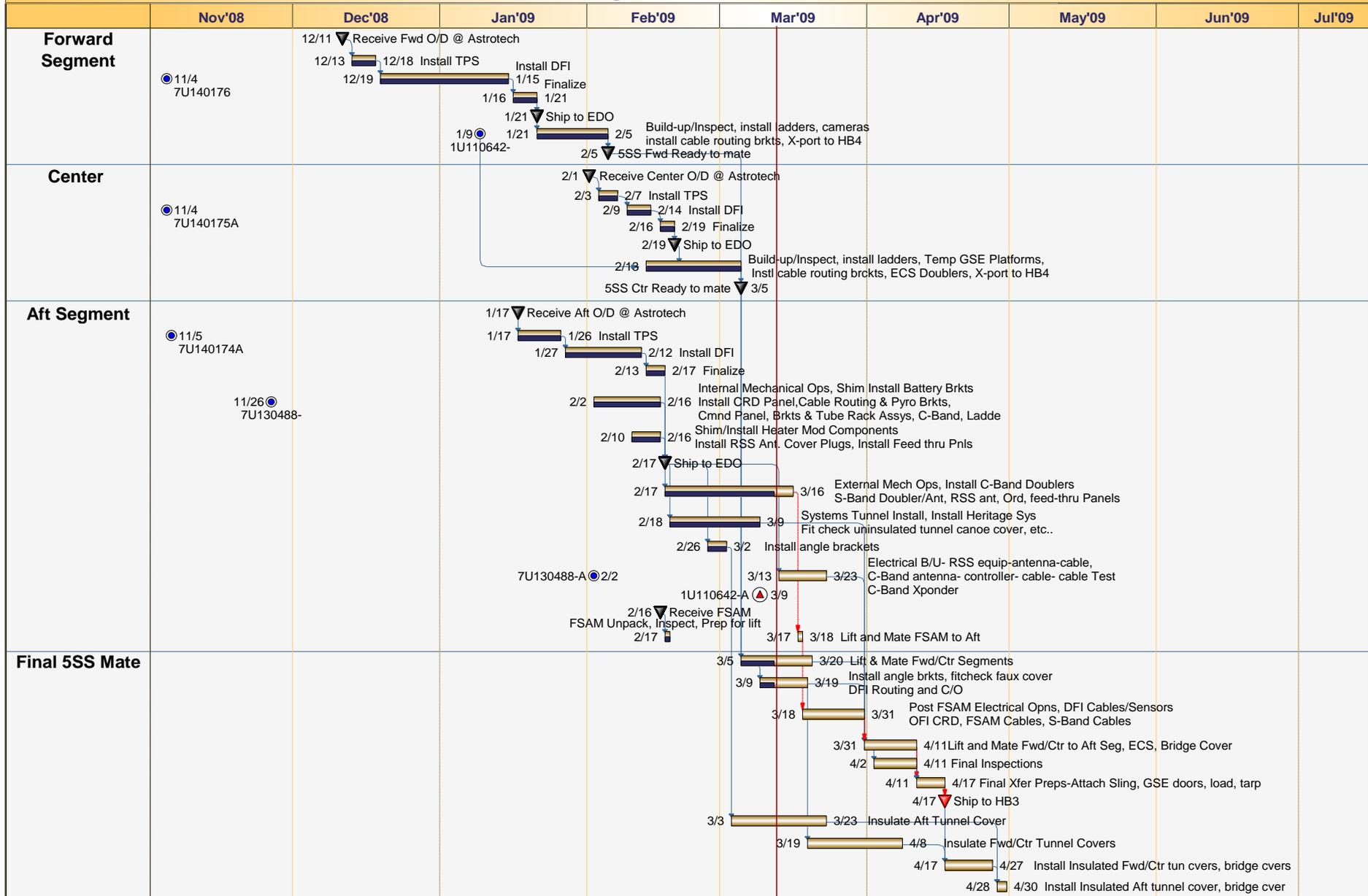


Forward Assembly Delivery to VAB



First Stage Ares IX 5SS Flow

As of 3/12/09





Summary & Lessons Learned



- ◆ Coming together is a beginning. Keeping together is progress. Working together is success. ~Henry Ford
- ◆ Individual commitment to a group effort - that is what makes a team work, a company work, a society work, a civilization work. ~Vince Lombardi
- ◆ Respect your fellow human being, treat them fairly, disagree with them honestly, enjoy their friendship, explore your thoughts about one another candidly, work together for a common goal and help one another achieve it. ~Bill Bradley
- ◆ Never doubt that a small group of thoughtful, committed people can change the world. Indeed, it is the only thing that ever has. ~Margaret Meade
- ◆ Teamwork is the ability to work together toward a common vision. The ability to direct individual accomplishment toward organizational objectives. It is the fuel that allows common people to attain uncommon results. ~Andrew Carnegie
- ◆ If you want to build a ship, don't drum up people together to collect wood and don't assign them tasks and work, but rather teach them to long for the endless immensity of the sea. ~Antoine de Saint-Exupery
- ◆ None of us is as smart as all of us. ~Ken Blanchard



