08-476

PRIMAVERA 25th ANNUAL CONFERENCE

2008 WORLD CHAMPIONSHIP PROJECTS AND PORTFOLIOS

CENTERED ON CUSTOMER SUCCESS

Multi-Element Integrated Project Planning at Kennedy Space Center

Bob Mullon
Project Manager – Integrated Scheduling Lead
ASRC Aerospace

PRIMAVERA

Introduction:

- Bob Mullon, Project Manager – Integrated Scheduling Lead
  - Currently supporting NASA with developing and maintaining an integrated critical path schedule for the design, construction and validation of Ground Systems and Elements for the new Constellation Program at Kennedy Space Center
  - Utilizing Primavera 6.0 and P6 Web Access.
  - Using Primavera products since 1987.
  - Project planner/scheduler for construction or modification of five launch pads for four different launch vehicles both for NASA and commercial construction contractors.

Multi-Element Integrated Project Planning at Kennedy Space Center

- Introduction
- Disclaimer
- What is Constellation?
- Space Shuttle to Constellation Transition at KSC
- Constellation Program at KSC
  - Elements
  - Other Projects
- Element Schedule Development in P6
- Integration of Multiple Elements in P6
- Integrated Critical Path Analysis and Reporting
- Communicating Project Status via P6 Web
- Questions

Introduction:

- ASRC Aerospace
  - ASRC Aerospace Corporation is a subsidiary of Arctic Slope Regional Corporation (ASRC) out of Anchorage, Alaska.
  - An Alaska Native Corporation headquartered in Greenbelt, Maryland, ASRC Aerospace is providing technical design support and project planning to the Constellation Ground Operations Project Office and the Engineering Directorate at Kennedy Space Center.
  - Winner of NASA's George M. Low Award - 2008

Disclaimer:

- Schedule information contained in this presentation is not representative of any current NASA launch manifests or program schedules. All dates and status are for display purposes only and do not portray any current NASA commitments or obligations.

Multi-Element Integrated Project Planning at Kennedy Space Center

- Overview
  - NASA consists of several centers and facilities spread across 10 different states from the east coast to the west coast and the Gulf of Mexico to Cleveland, Ohio.
  - The work force consists of civil servants (NASA employees) and numerous support contractors and contractor personnel. It also involves a large number of independent suppliers and contractors providing materials and services to keep up with current program needs.
  - Acronyms and abbreviations are a key part of day to day operations at the Kennedy Space Center. There is not a key center, facility, building, system, process or meeting that can be referred to without the use of an acronym or abbreviation. Kennedy Space Center, more commonly known as KSC, is just one example. NASA is another. There are many more to follow.
  - Kennedy Space Center (KSC) is located on the east coast of Florida and is the designated launch site for all of NASA's manned space flights.

Map of Constellation content across NASA

Ames
- Lead Thermal Protection System ADP
- Aero-Aerothermal database
- Ares Abort simulations
- Software and GN&C support

Glenn
- Lead Service Module and Spacecraft Adapter integration
- Flight Test Article "Pathfinder" fabrication
- Ares I-1 upper stage simulator lead
- Ares power, TVC and sensors lead
- J-2X altitude/inspace testing
- SE&I Support

Goddard
- Communications Support

Dryden
- Lead Abort Flight Test Integration/Operations
- Abort Test Booster procurement
- Flight Test Article Development/ Integration

Langley
- Lead Launch Abort System integration
- Lead landing system ADP
- Ares I-1 vehicle integration
- Ares aerodynamics lead
- SE&I Support

JPL
- Thermal Protection System support

Kennedy
- Home for Ground Ops Project
- Ground processing
- Launch operations

Johnson
- Home for Program
- Home for Projects: Orion, Mission Ops, EVA, Lunar Lander
- Lead Crew Module integration
- Orion Spacecraft Integration
- GFE projects management
- Flight Test Program

Stennis
- Rocket Propulsion Testing for Ares

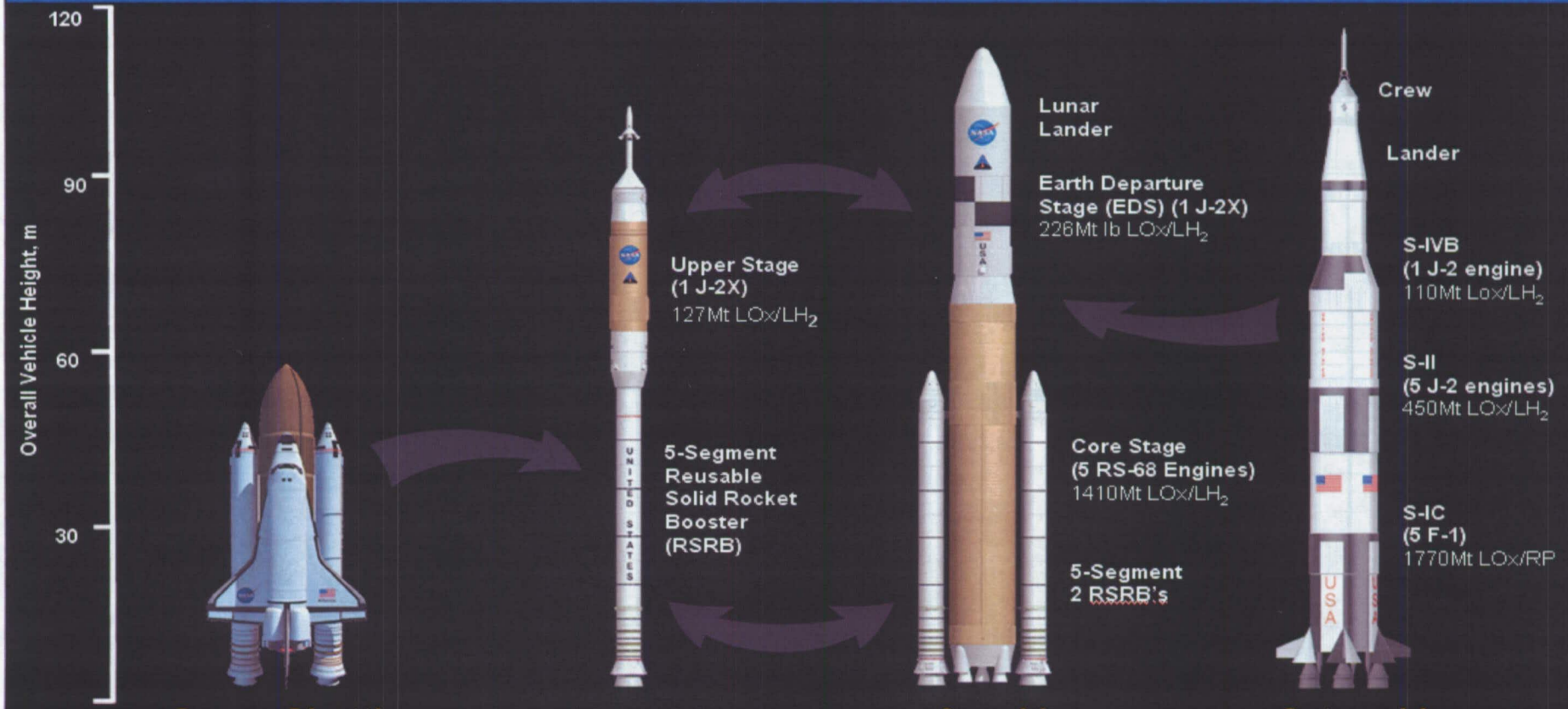
Marshall
- Home for Ares Project
- Ares I and V development and integration lead
- LAS and SM SE&I Support

Constellation:

- What is Constellation?
  - Constellation represents the next phase of manned space flight for NASA and the USA
    - Involves the design and development of the Ares I and Ares V launch vehicles, the Orion Crew Module and Lunar Lander. These vehicles will provide service to the International Space Station and continue manned space exploration to the moon, Mars and beyond
    - Involves the design, development and construction of new hardware and infrastructure to process, launch and recover these launch vehicles
    - Involves the transition of existing facilities and infrastructure at Kennedy Space Center (KSC) from current Space Shuttle configurations to the new Ares I and V configurations

Building on a Foundation of Proven Technologies

- Launch Vehicle Comparisons -



Space Shuttle

Height: 56m
Gross Liftoff Mass: 2040Mt

25Mt to LEO

Ares I

Height: 98m
Gross Liftoff Mass: 910Mt

22Mt to LEO

Ares V

Height: 109m
Gross Liftoff Mass: 3310Mt

53Mt to TLI
65Mt to TLI in Dual-Launch Mode with Ares I
131Mt to LEO

Saturn V

Height: 111m
Gross Liftoff Mass: 2950Mt

45Mt to TLI
119Mt to LEO

Transition:

- Space Shuttle to Constellation Transition at KSC
  - KSC is currently scheduled to process and launch Space Shuttles through 2010
  - Constellation will use the same launch complexes (LC-39A and LC-39B) and many of the same systems and facilities that are used for the Space Shuttle
  - LC-39B will be the first launch complex to be modified for Constellation. Following the launch of the Hubble Space Telescope Repair mission, LC-39B will begin modifications for the first test flight of the new launch vehicle configuration
  - The first Constellation test flight, Ares I-X, will launch from LC-39B in early to mid 2009
  - LC-39A is scheduled to begin modifications for the Constellation cargo vehicle, Ares V-Y, following the last Shuttle flight in 2010
  - The first manned flight for Constellation is scheduled for 2015

Constellation Program at Kennedy Space Center (KSC):

- Constellation Program at KSC - EPS/WBS
  - Involves the Ground Operations node of the Constellation Program EPS/WBS
  - Within this node is the Ground Systems Development and Sustaining node which contains the Ground Systems and Elements that will process, launch and recover the new launch vehicle and spacecraft, Ares and Orion
  - Ground Systems Development is the primary WBS for the Constellation schedules to be discussed today
  - Within that node we will focus on the development of the project schedules and critical path to Ground Systems Initial Operational Capability (IOC) for the launch of the first "full stack" of the Ares Launch Vehicle – Ares I-Y

Constellation Ground Operations EPS/WBS:

NASAIP	NASA Interlink Projects	NASAIP
292360	Ground Operations	292360
STS	STS Summary	292360
292360.L3	Ground Operations Level III	292360.L3M
292360.01	Project Management	292360.01
292360.02	Systems Engineering & Integration	292360.02
292360.03	Safety & Mission Assurance	292360.03
292360.05	Future Elements Development & Operatio	292360.05
292360.06	Orion Dev Support & Ground Operations	292360.06
292360.07	KSC Integrated Operations	292360.07
292360.08	Launch Vehicle Dev Support & Operations	292360.08
292360.09	Ground Systems Development & Sustaining	292360.09
292360.09 INT	Ground Systems Integration	292360.09
292360.09.20	Ground Systems CLV	292360.09.20
292360.09.20.01	VAB HB#3 CLV	292360.09.20.01
292360.09.20.02	KSC-Mobile Launcher CLV	292360.09.20.02
292360.09.20.03	Pad B CLV	292360.09.20.03
292360.09.20.04	LCC CLV	292360.09.20.04
292360.09.20.05	KSC-Hangar AF CLV	292360.09.20.05
292360.09.21	KSC-Ground Sys Spacecraft Process & Pay	292360.09.21
292360.09.22	KSC-Ground Systems CaLV	292360.09
292360.09.24	Ground Systems Common Support Sys	292360.09
292360.09.24.04	Launch Equipment Test Facility	292360.09
292360.09.25	KSC-Command, Control and Communications	292360.09.25
292360.09.30	Ares I-X Development	292360.09.30

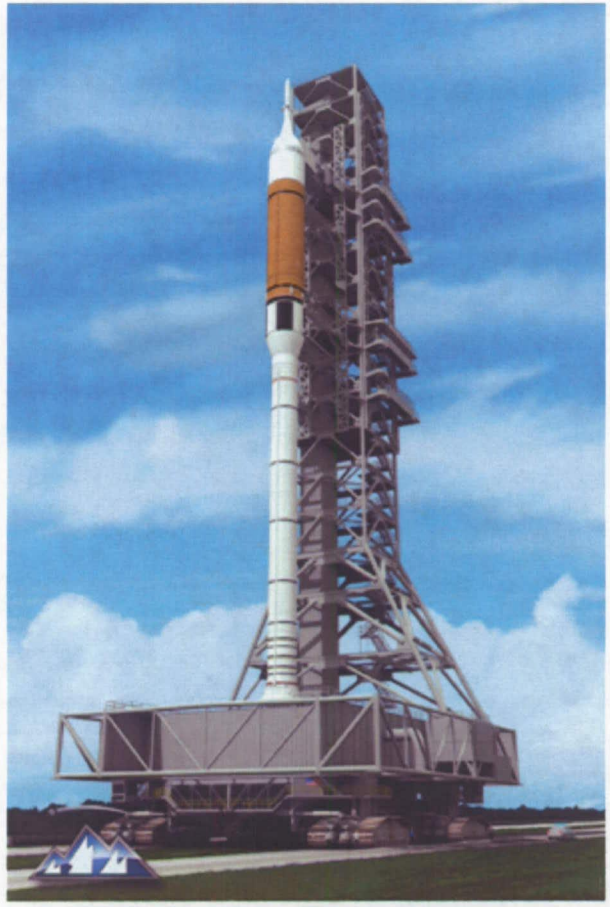
Constellation Program at KSC:

- Ares I-Y Ground Systems Development Elements
  - Mobile Launcher Element (MLE)
  - Launch Pad Element (LPE)
  - Vertical Integration Element (VIE)
  - Solid Rocket Processing Element (SRPE)
  - Spacecraft Processing Element (SPE)
  - Command, Control and Communications Element (CCCE)
- Other Projects
  - Ares I-X Test Flight
  - Launch Equipment Test Facility (LETF)

Ground Systems Development Elements:

- Mobile Launcher Element (MLE)
  - New mobile launcher compatible with LC 39B and existing capacity transporter & crawlerway
  - Consists of Mobile Launcher Base (MLB), Tower (MLT) and facility systems along with launch accessories and spacecraft related fluid, gas, electrical, communication, imagery and launch control systems to service the Ares launch vehicle and Orion spacecraft
  - 385' tall and approximately 12,000,000 lbs

- Mobile Launcher with Ares I-Y



Ground Systems Development Elements

- Launch Pad Element (LPE)
  - Both launch pads are currently operational and used by the Space Shuttle program. LC-39B will be used to launch Ares I, LC-39A will be used to launch Ares V
  - LC-39B project consists of modifying existing systems to interface with the new Mobile Launcher, installing new instrumentation, lightning protection, emergency egress system and demolition of the existing Fixed and Rotating Service Structures

- Launch Complex 39B - Current

- Launch Complex 39B - Future

Ground Systems Development Elements:

- Vertical Integration Element (VIE)
  - The Vehicle Assembly Building (VAB) will be used to assemble and integrate launch vehicles and spacecraft in vertical mode.
  - The Ares I VAB project will rework High Bay #3 for Ares I stacking with a new platform concept allowing 360°access to the Ares and Orion spacecraft
  - Project consists primarily of installing new platforms, modifying existing systems and installing new Ground Support Equipment (GSE) to interface with the new Mobile Launcher and spacecraft

- Vehicle Assembly Building (VAB)

Ground Systems Development Elements:

- Solid Rocket Processing Element (SRPE)
  - The Solid Rocket Processing Element is composed of the facilities and systems necessary to process solid rocket components (boosters).
  - Consists of the existing Assembly Refurbishment Facility (ARF), existing Rotation Processing Surge Facility (RPSF), construction of new Rotation Processing Surge Facility (RPSF) and modifications to existing Hangar AF Complex.
  - Modifications to the Hangar AF Complex for the Ares I-X test flight in 2009 are currently under way.

Ground Systems Development Elements:

- Spacecraft Processing Element (SPE)
  - The Spacecraft Processing Element (SPE) is composed of the facilities, systems and Ground Support Equipment (GSE) necessary to transport, service, fuel and integrate the Orion Crew Module with the Ares launch vehicle and other Elements in preparation for launch.
  - Consists of design, procurement, fabrication, installation and validation of above GSE along with Multi-Payload Processing Facility (MPPF) modifications, Multi-Mission Support Equipment (MMSE), Prime Mover for Launch Abort System (LAS) and all systems and support equipment for the Lunar Lander (future missions).

- Orion Crew Module – Short Stack

Ground Systems Development Elements

- Command, Control and Communications Element (CCCE)
  - The Command, Control and Communications Element is composed of two parts
    - Command and Control or Launch Control System (LCS), consists of computer hardware and software used for operation of ground systems and launch vehicles in support of launch processing and launch
    - Communications consists of providing infrastructure for voice, imagery (video and film), and data to support launch processing along with leveraging existing communications systems for all Constellation Support throughout the development efforts of Command and Control as well as the other Ground Systems Elements

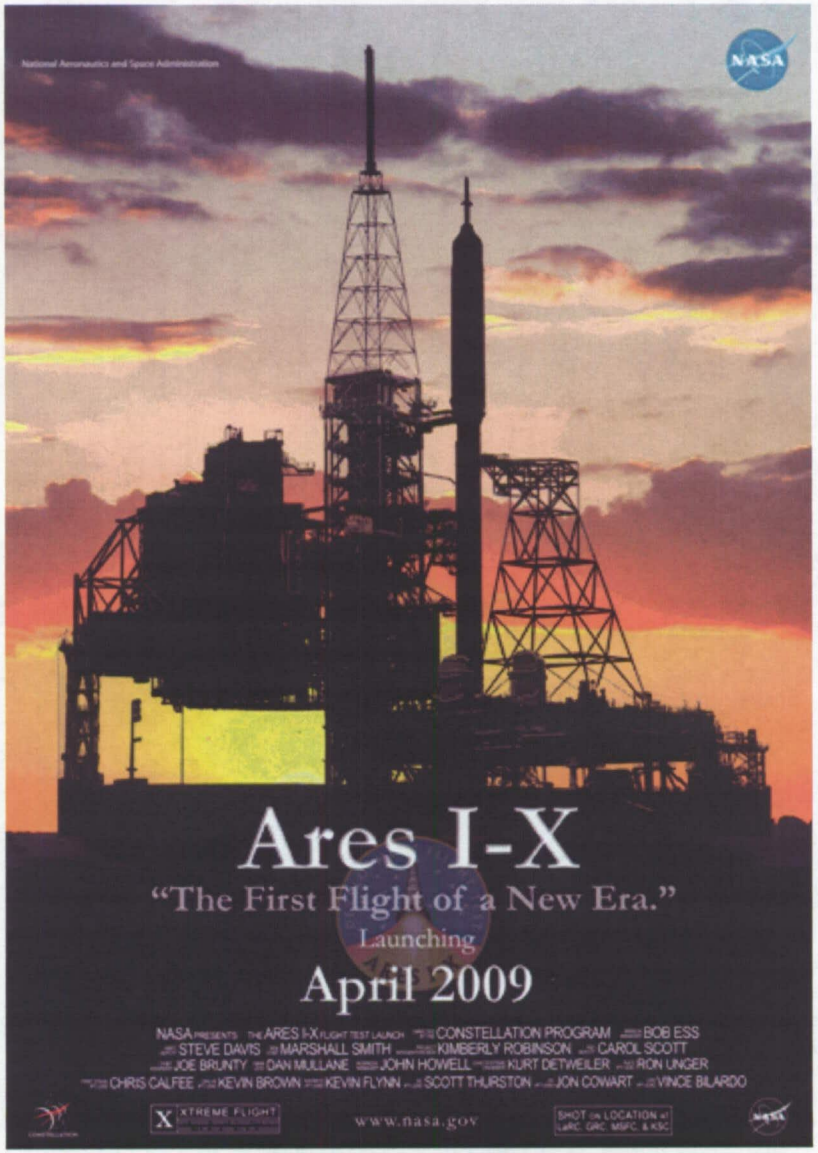
Other Projects:

- Launch Equipment Test Facility (LETF)
  - The LETF will be used to provide prototype Ground Support Equipment (GSE) and element development, testing and qualification for mechanical, umbilical systems, fluids, electrical GSE systems and components.

Other Projects:

- Ares I-X
  - Ares I-X is the initial demonstration flight of the Ares launch vehicle configuration. Ares I-X demonstration flight ground systems will utilize existing infrastructure, modifying only what is necessary to support the mission. All modifications will be done on a non-interference basis and will allow the Space Shuttle Program (SSP) to preserve Launch On Need capability for the Hubble Space Telescope mission.

- Ares I-X


National Aeronautics and Space Administration
NASA
Ares I-X
"The First Flight of a New Era."
Launching
April 2009
NASA PRESENTS THE ARES I-X FLIGHT TEST LAUNCH CONSTELLATION PROGRAM BOB ESS
STEVE DAVIS MARSHALL SMITH KIMBERLY ROBINSON CAROL SCOTT
JOE BRUNTY DAN MULLANE JOHN HOWELL KURT DETWEILER RON UNGER
CHRIS CALFEE KEVIN BROWN KEVIN FLYNN SCOTT THURSTON JON COWART VINCE BILARDO
XTREME FLIGHT
www.nasa.gov
SHOT ON LOCATION AT LaRC, GRC, MSFC, & KSC

Ground Systems Development Elements:

- Schedule Development in P6
  - Constellation program office made the decision to use Primavera Project Management software as its scheduling tool 2 – 3 years ago
  - Element and Other Project schedules were required to be completed and managed as stand alone projects with "control" milestones established for reporting to upper levels of the program
  - Schedules were also required to establish "sound" logic defining inter-project dependencies as well as external dependencies (ie. Program deliverables)

Ground Systems Development Elements:

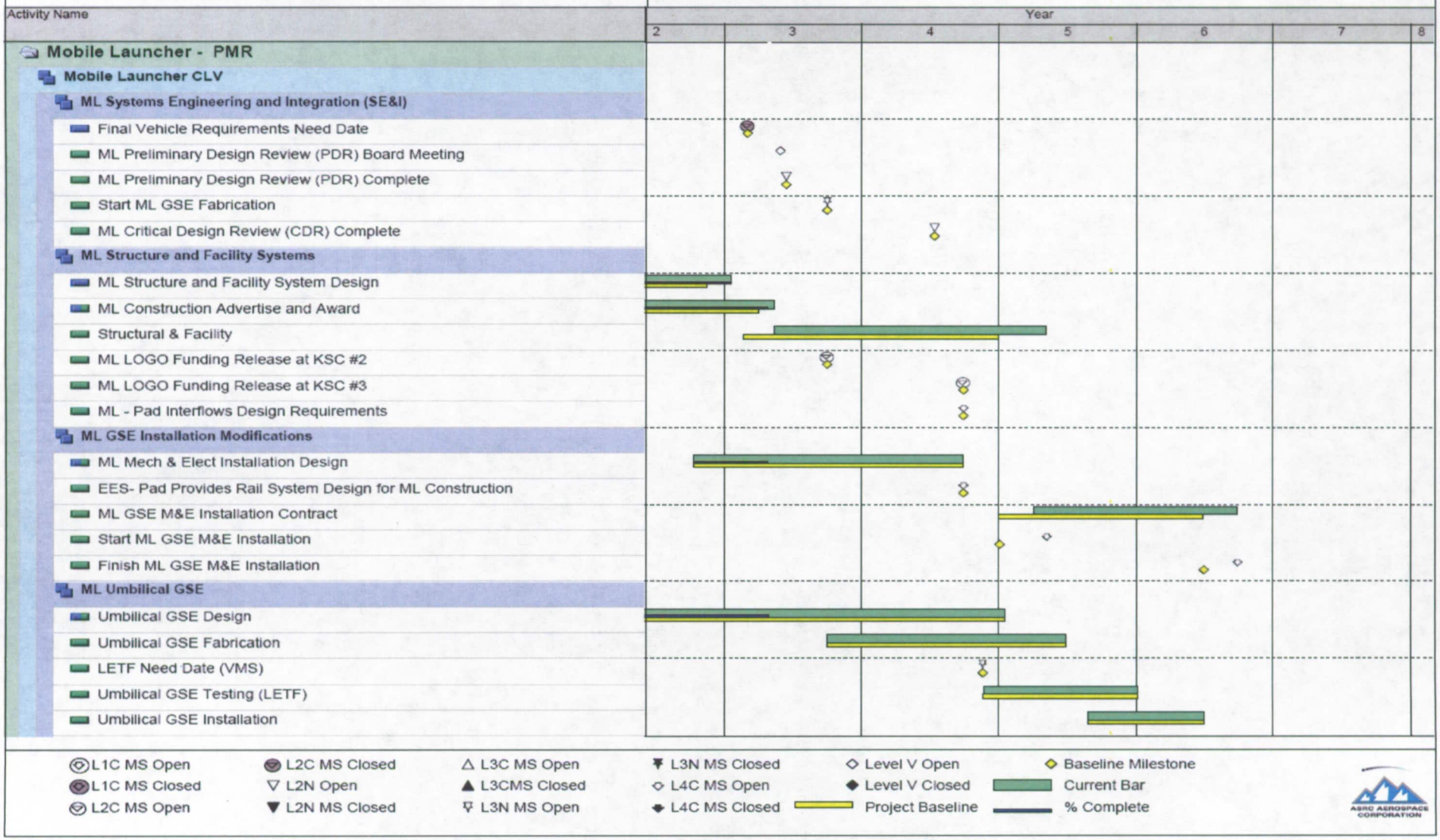
- Schedule Development in P6
  - The Constellation database and Primavera software exists at Marshall Space Flight Center in Huntsville, AL.
  - The system operates on the NASA Citrix Access Platform in the NASA secure Integrated Collaborative Environment (ICE)

Elements and Other Projects within EPS/WBS:

292360.09	Ground Systems Development & Sustaining	292360.09
292360.09 INT	Ground Systems Integration	292360.09
GE Rqmts-29	Ground Elements Integration	TS Cx Ground Operations
W06.292360.09.99-1	Ground Systems Project - Ares 1-Y ORD	IS 0089
292360.09.20	Ground Systems CLV	292360.09.20
292360.09.20.01	VAB HB#3 CLV	292360.09.20.01
W06.VAB-1	VAB HB-3 - PMR	IS 0089
292360.09.20.02	KSC-Mobile Launcher CLV	292360.09.20.02
W06.292360.09.20.02-1	Mobile Launcher - PMR	IS 0089
292360.09.20.03	Pad B CLV	292360.09.20.03
W06.292360.09.20.03-1	CLV Pad B - PMR	IS 0089
292360.09.20.04	LCC CLV	292360.09.20.04
W06.LCC-1	LCC CLV - PMR	IS 0089
292360.09.20.05	KSC-Hangar AF CLV	292360.09.20.05
W06.HAF-1	Hangar AF CLV - PMR	IS 0089
292360.09.21	KSC-Ground Sys Spacecraft Process & Pay	292360.09.21
W06.SPE 09-1	Spacecraft Processing - PMR	IS 0089
W06.SPE MPPF 09-1	Spacecraft Processing MPPF - PMR	IS 0089
292360.09.22	KSC-Ground Systems CaLV	292360.09
GS CaLV 09-3	Ground Systems CaLV	292360.09
292360.09.24	Ground Systems Common Support Sys	292360.09
292360.09.24.04	Launch Equipment Test Facility	292360.09
W06.LETF-2	LETF CxP Program Support - PMR	IS 0089
292360.09.25	KSC-Command, Control and Communications	292360.09.25
W06.292360.09.25.01-1	Command and Control - PMR	IS 0089
W0608.COMM-1	Communications - PMR	IS 0089
292360.09.30	Ares I-X Development	292360.09.30
W06.292360.09.30-1	Ares I-X GS Development - PMR	IS 0089

LC 39B, Mobile Launcher and VAB High Bay #3
Level IV Summary w/ Milestones
Current Project Schedule through ORD

Date: 00/00/00
Page 1 of 6
Data Date: 00/00/00



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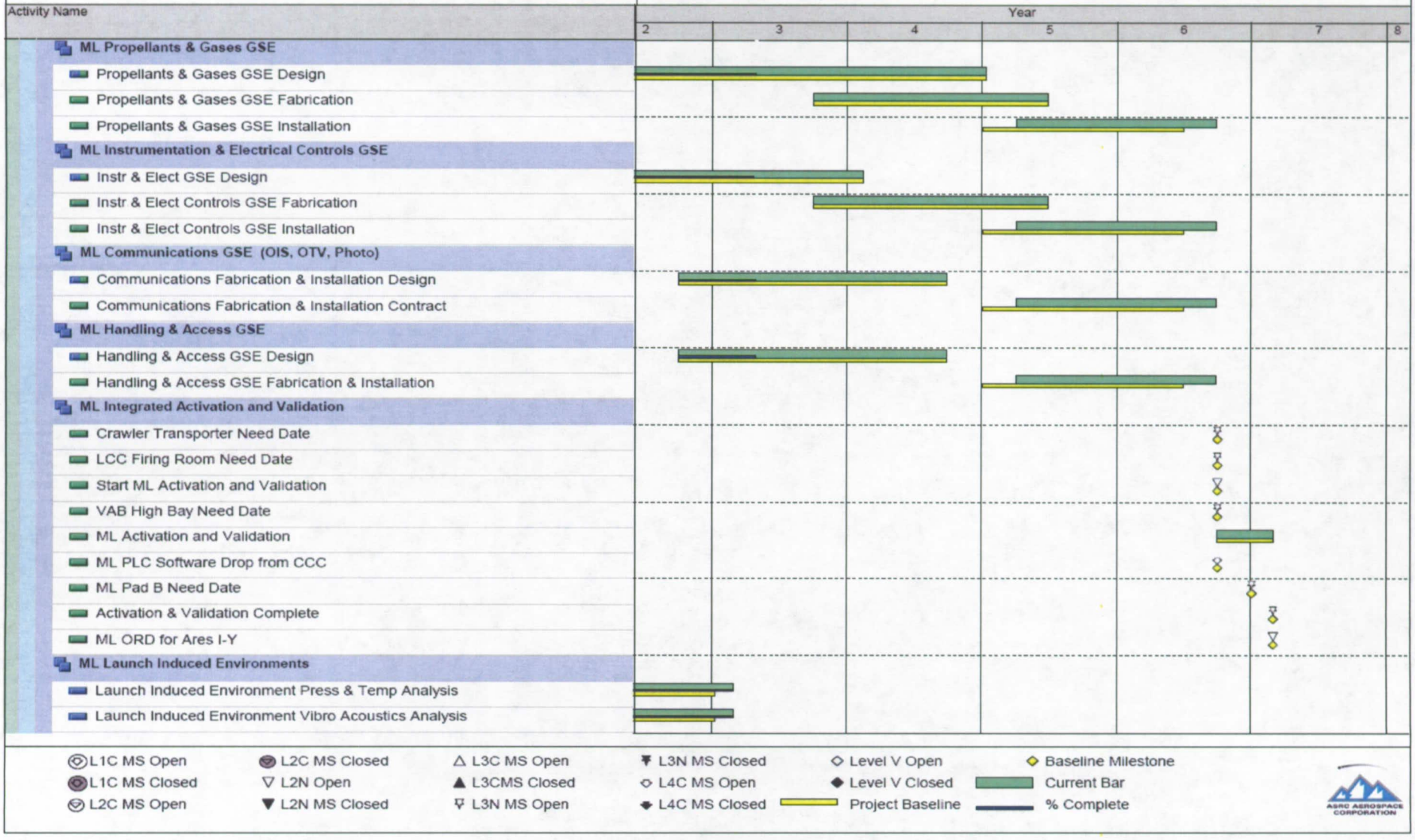
LC 39B, Mobile Launcher and VAB High Bay #3
Level IV Summary w/ Milestones
Current Project Schedule through ORD

Date: 00/00/00
Page 2 of 6
Data Date: 00/00/00



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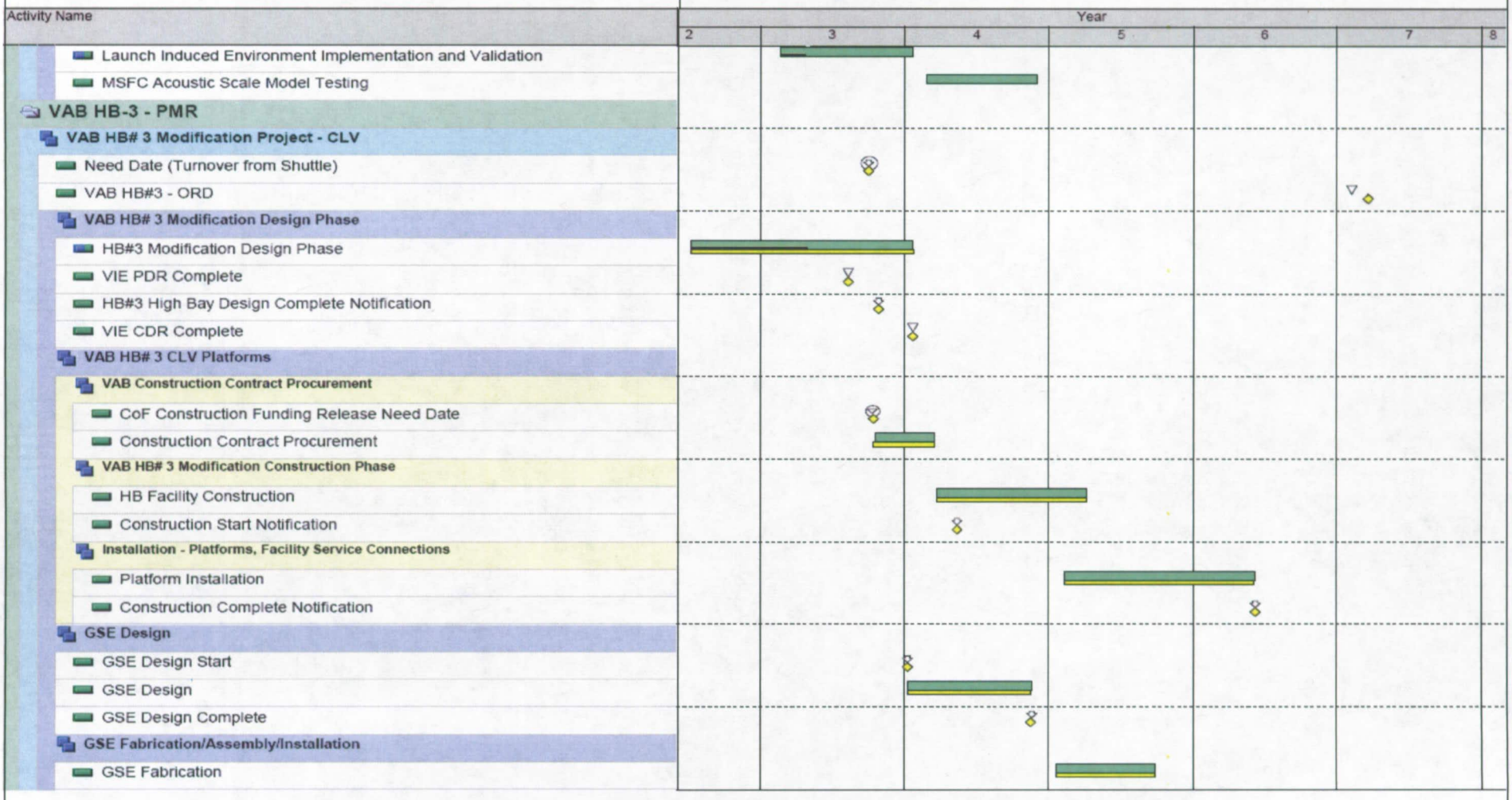


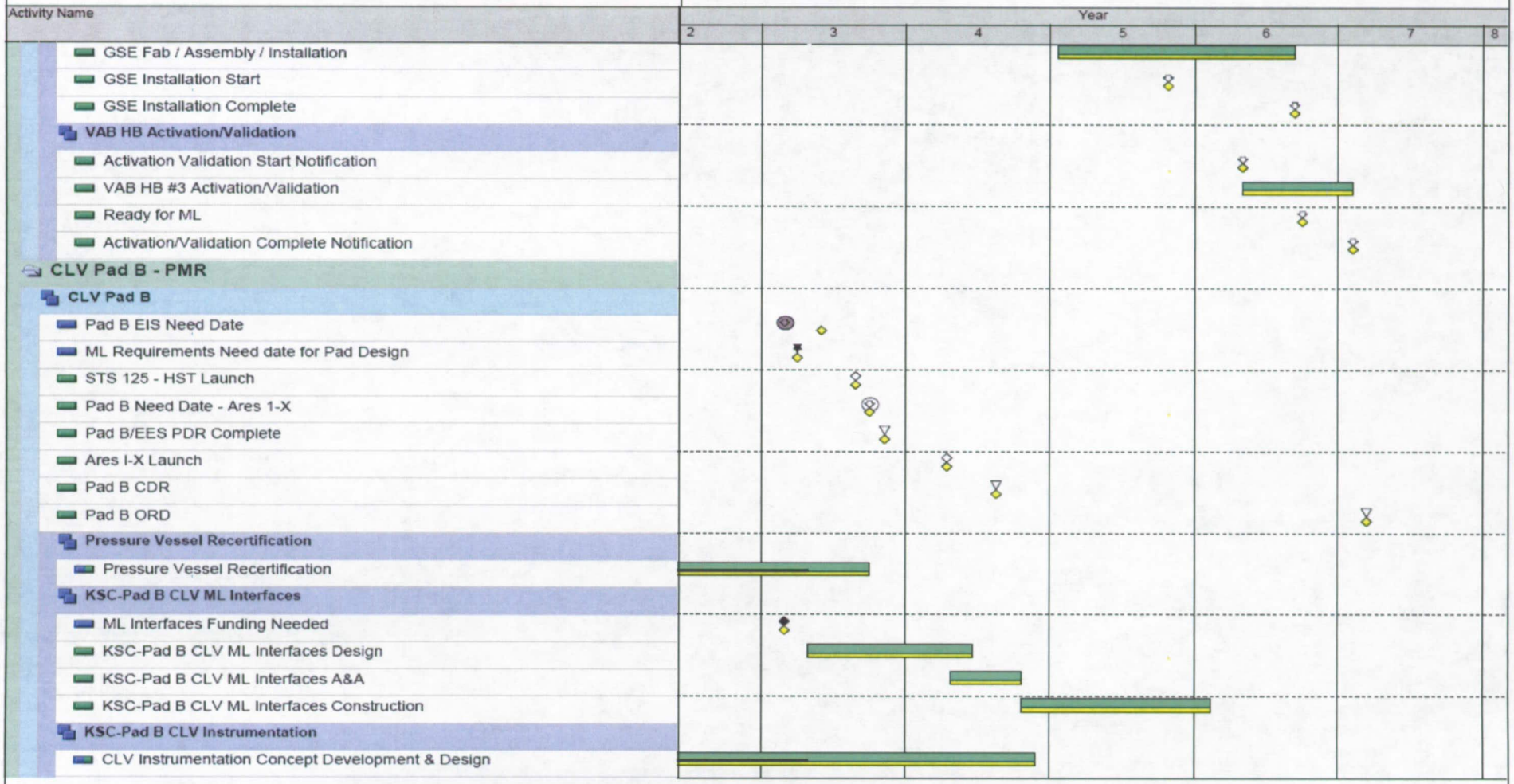
L1C MS Open
L1C MS Closed
L2C MS Open
L2C MS Closed
L2N Open
L2N MS Closed
L3C MS Open
L3CMS Closed
L3N MS Open
L3N MS Closed
L4C MS Open
L4C MS Closed
Level V Open
Level V Closed
Project Baseline
Baseline Milestone
Current Bar
% Complete

ASRC AEROSPACE CORPORATION

LC 39B, Mobile Launcher and VAB High Bay #3
Level IV Summary w/ Milestones
Current Project Schedule through ORD

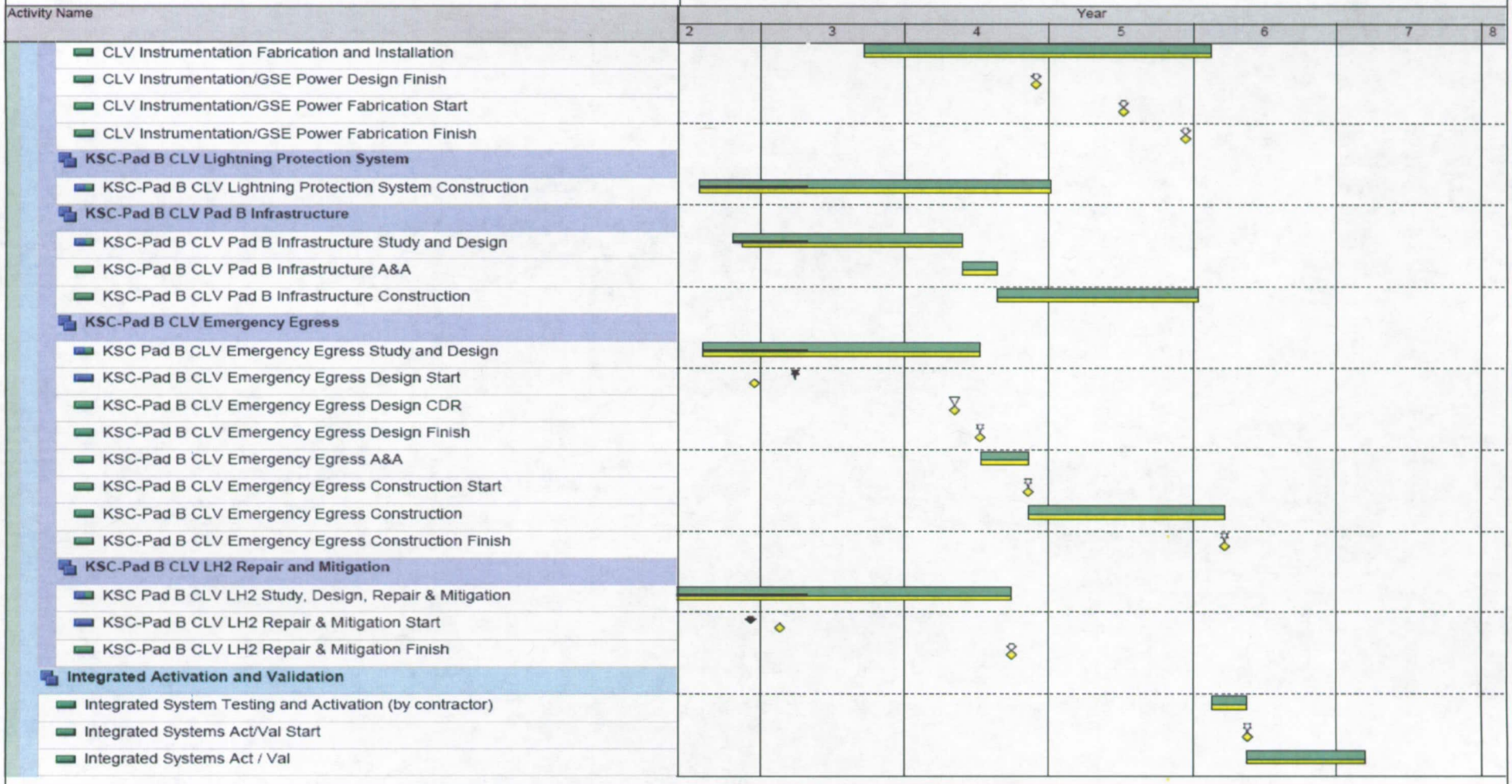
Date: 00/00/00

Data Date: 00/00/00



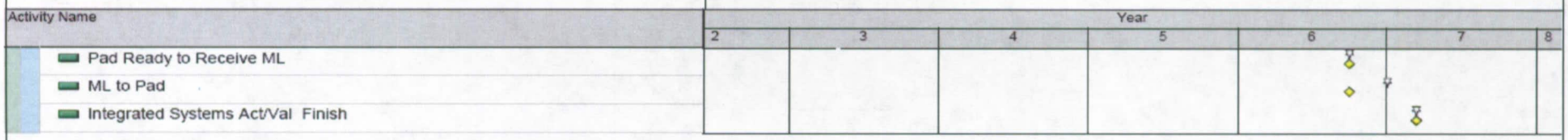
LC 39B, Mobile Launcher and VAB High Bay #3
Level IV Summary w/ Milestones
Current Project Schedule through ORD

Date: 00/00/00
Page 5 of 6
Data Date: 00/00/00



LC 39B, Mobile Launcher and VAB High Bay #3
Level IV Summary w/ Milestones
Current Project Schedule through ORD

Date: 00/00/00
Page 6 of 6
Data Date: 00/00/00



L1C MS Open
L1C MS Closed
L2C MS Open
L2C MS Closed
L2N Open
L2N MS Closed
L3C MS Open
L3CMS Closed
L3N MS Open
L3N MS Closed
L4C MS Open
L4C MS Closed
Level V Open
Level V Closed
Project Baseline
Baseline Milestone
Current Bar
% Complete

ASRC AEROSPACE CORPORATION

Ground Systems Development Elements:

- Integration of Multiple Elements
  - P6 allows for easy analysis of multiple schedules in order to identify and assign relationships between projects
  - User-defined text fields allows you to define relationships and give explanations in regards to direction and purpose of these relationships along with filtering data based on these fields
  - Although unique, intelligent activity ID's are preferred, having separate projects allows you use non-unique ID's across different projects within your Master Schedule

Ground Systems Development Elements:

- Integration of Multiple Elements
  - Initiated weekly schedulers meetings
  - Prepared scheduling standards and work instructions
    - Standardize levels of detail
    - Set baseline standards
    - Standardize layouts, naming conventions, coding, etc.
  - Completed Local Admin training and obtained privileges
  - Integration of Multiple Elements requires integration at all levels inside and outside of Primavera

Ground Systems Development Elements:

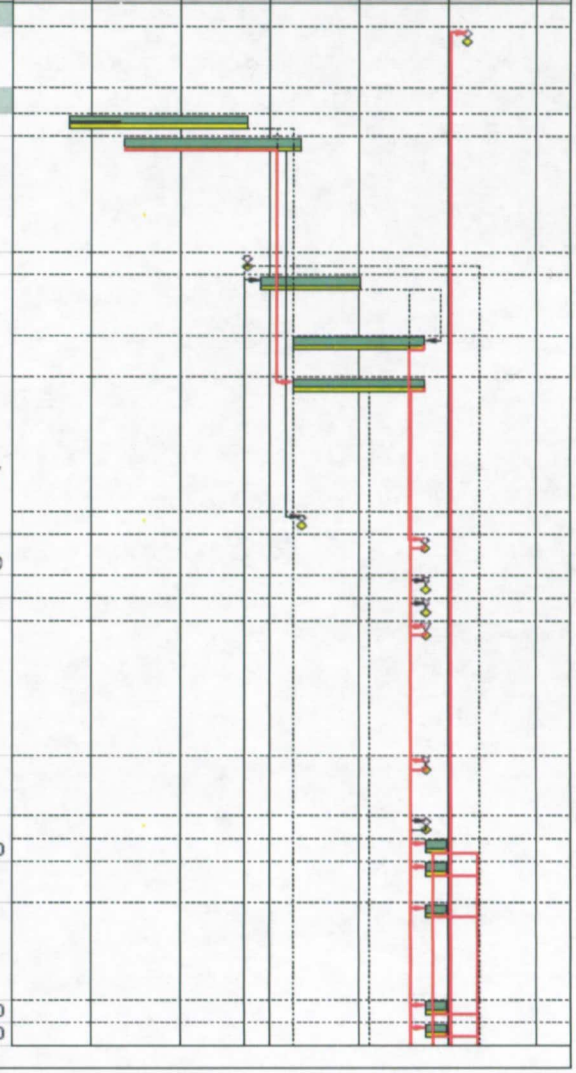
- Integration of Multiple Elements
  - Created an Integrated "ORD" project to allow critical path to be calculated through one ORD as opposed to each project ORD
  - Adjust Must Finish by dates for each project to on, or after, the Must Finish By Date for the integrated ORD project
  - Change all Mandatory and Start/Finish On constraints in all projects to soft constraints (Start/Finish on or after)
  - Change or remove On or Before constraints except for the Ares I-Y ORD Milestone in the integrated ORD project
  - Tag all interproject ties with user defined text field with "To Project/From Project" designator
  - Make sure all projects are updated properly through current data date and all data dates are the same
  - See the following layout

Ground Systems Project
Integrated Master Schedule
Inter-Project Relationships

Date: 00/00/00

Data Date: 00/00/00

Activity ID	Activity Name	From/To	Predecessors	Successors
Ground Systems Project - Ares 1-Y ORD				
GS9000	Ground Systems Projects ORD	To GO Ares 1-Y GORR	A2350, MLA1960, A10500, SP10680, SP4220, CC10590	A1990
Mobile Launcher - PMR				
MLC1580	Communications Fabrication & Installation De...	To Comm	MLE10330	MLC1730, A16180
MLF1400	Structural & Facility	To GSE Install	MLF1380, MLM2600, MLF1382	ML10480, ML10480, MLM2120, MLC1730, MLU1700, MLF1405, MLF1405, MLG1710, MLI1720, MLH1740
MLF2590	ML - Pad Interflows Design Requirements	TBD	MLF2010	MLA1960, MLU1505
MLU1505	Umbilical GSE Testing (LETF)	From LETF ORD	MLU1500, MLU1490, MLU1450, MLF2590, LE1290	MLU2250, MLU1705, MLM2125
MLM2125	ML GSE M&E Installation Contract	To ML Act/Val	MLU1505, MLM1681	MLM2130, MLM2126, MLM2126
MLC1730	Communications Fabrication & Installation Contract	To Comm	MLC1580, MLE1410, MLF1400	ML10490, ML10490, MLC1860, MLC1870, MLC1880, MLA10430, MLC1735, MLC1735, A9580, A9590, A9600, A9620, A9630, A9660, A9670, A9640, A9650
MLM2120	Start ML GSE M&E Installation	To Comm ML Install	MLF1400	
MLM2130	Finish ML GSE M&E Installation	To ML Act/Val	MLM2125	MLA10430, MLA10400, MLA1780, MLA1770, MLI1760
MLA10400	Crawler Transporter Need Date	No CT Data	MLM2130	
MLA1780	LCC Firing Room Need Date	No LCC Data	MLM2130	
MLA10430	Start ML Activation and Validation	From VAB	MLH1740, MLC1730, MLG1710, MLM2130, MLU1700, A2310, MLA2520	MLA2149, ML10500, MLG1810, MLG1820, MLG1830, MLG1840, MLG1850, MLI2240, MLC1860, MLC1870, MLC1880, MLU2250, GSML1000
MLA1770	VAB High Bay Need Date	To ML VAB Testing	MLE1410, MLM2130	MLG1810, MLG1820, MLG1830, MLG1840, MLG1850
MLI1760	GSE PLC Software Drop Need Date	To ML A/V	MLM2130	MLI2240
MLG1850	Coolants Connect, Leak and Flow Tests	To ML to Pad	MLA1770, MLA10430	MLA2150, MLA10410, A10650
MLG1840	SRB Hydraulics Connect, Leak and Flow Tests	To ML to Pad	MLA1770, MLA10430	MLA2150, MLG1920, MLA10410, A10650
MLG1810	ECS Flow and Balance Test - VAB	To ML to Pad	MLA1770, MLA10430	MLA2150, MLG1890, MLG1805, MLG1804, MLA10410, A10650, GSML1000
MLG1820	Gaseous Nitrogen Connect, Leak and Flow T...	To ML to Pad	MLA1770, MLA10430	MLA2150, MLA10410, A10650
MLG1830	Gaseous Helium Connect, Leak and Flow Tests	To ML to Pad	MLA1770, MLA10430	MLA2150, MLA10410, A10650

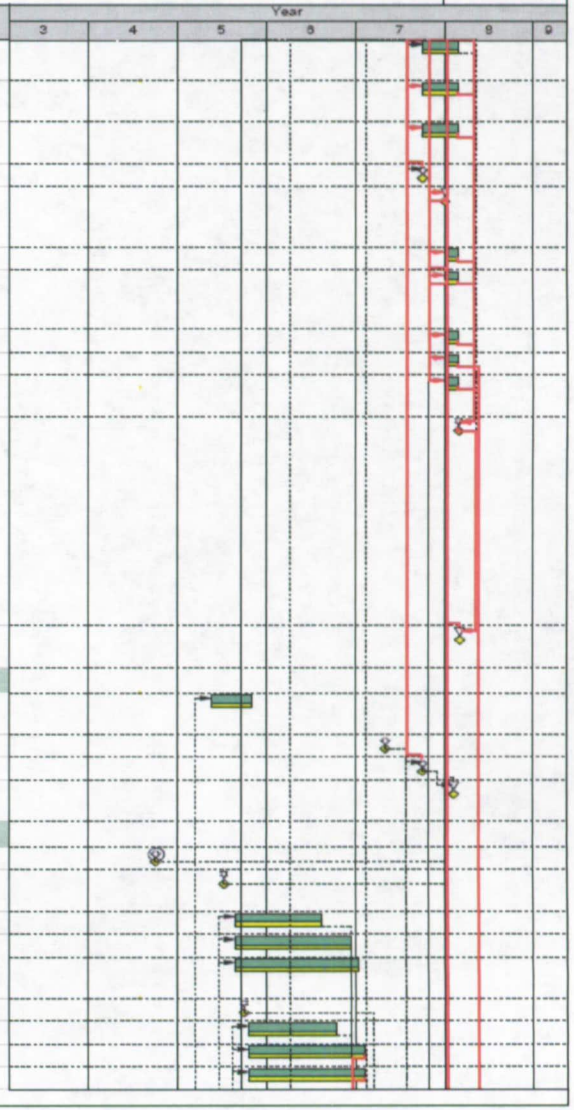


Ground Systems Project
Integrated Master Schedule
Inter-Project Relationships

Date: 00/00/00

Data Date: 00/00/00

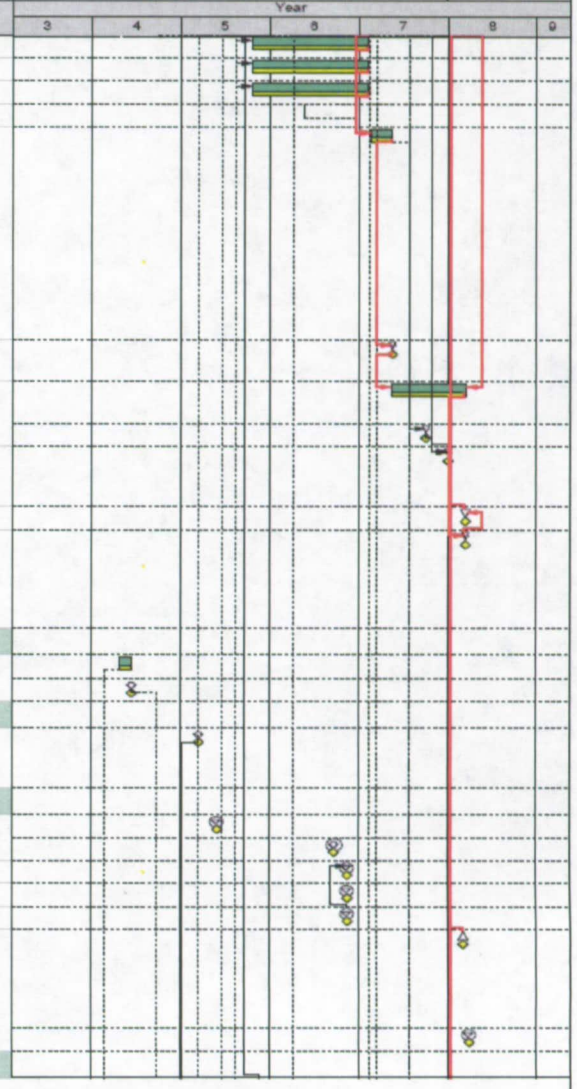
Activity ID	Activity Name	From/To	Predecessors	Successors
MLI2240	Instr & Elect Controls Activation / Validation	From ML Start A/V, C&C	MLI1720, MLI1760, MLA10430	MLA2150, MLI2245, MLI2245
MLA2149	ML Activation and Validation	From ML Start A/V	MLA10430, CC24960	MLA2150, MLA2155, MLA2155
MLU2250	Umbillical Activation / Validation	From ML Start A/V	MLU1700, MLU1505, MLA10430	MLA2150, MLU2255, MLU2255
MLA2520	ML PLC Software Drop from CCC	From C&C	CC10580	MLA10430
MLA10410	ML Pad B Need Date	To Pad B A/V	MLG1810, MLG1820, MLG1830, MLG1840, MLG1850	MLA1900, MLG1890
MLA1950	CEV Emergency Egress Test	From Pad B	MLG1890, A3270	MLA2150
MLG1890	ECS Flow and Balance Test - Pad	A/V Comp	MLG1810, A10650, MLA10410	MLG1900, MLG1910, MLA1940, MLA1950, MLA2150
MLG1900	Liquid Oxygen Cold Flow - Pad	A/V Comp	MLG1890, A10650	MLA2150
MLG1910	Liquid Hydrogen Cold Flow - Pad	A/V Comp	MLG1890, A10650	MLA2150, A2840
MLG1920	Hypergolic Propellants Connect, Leak and Flow Tests	A/V Comp	MLG1840, A10650	MLA2150, MLG1805, MLG1804, A2840
MLA2150	Activation & Validation Complete	To ML ORD	MLG1890, MLG1900, MLG1910, MLG1920, MLC1860, MLC1870, MLA2149, MLU2250, MLG1810, MLG1820, MLG1830, MLG1840, MLG1850, MLI2240, MLA1940, MLA1950, MLC1880, MLG1804	MLA1960, ML10500, MLA1900, GSML1010
MLA1960	ML ORD for Ares I-Y	To Ares 1-Y ORD	MLF2590, MLS2165, MLA2150	GS9000
VAB HB-3 - PMR				
A2090	HB Demolition	From Ares 1-X	A2050, A1950, AIX9200, A1940, A1960	A2130, A3170
A2410	Activation Validation Start Notification	From C&C	A2210	A2290, A3900, A2310
A2310	Ready for ML	To ML Start A/V	A2410, A2220	A2350, MLA10430
A2350	VAB HB#3 - ORD	To Ares 1-Y ORD	A2310, A2830, A1210, A2290, A3900, A2220	GS9000
CLV Pad B - PMR				
A10510	Pad B Need Date - Ares 1-X	To Ares 1-X	A2480	A10720, AIX1200
A3250	KSC-Pad B CLV Emergency Egress Design Finish	To MLP	A2580	A10720, A10950, MLM2600
A2690	IOP Connections Construction	From Ares 1-X	A2680, AIX1010	A10860, A10860, A2830
A2770	Breathing Air Construction	From Ares 1-X	A2760, AIX1010	A10860, A10860, A2830
A2820	KSC-Pad B CLV Pad B Infrastructure Construction	From Ares 1-X	A2810, AIX1010	A10860, A10860, A2830
A10670	Communication need date for LPS (KICS)	From C&C	A2480	A10710, A2510
A1450	KSC-Pad B CLV Hypergols Construction	From Ares 1-X	A1440, AIX1010	A10860, A10860, A2830
A1200	ECS Construction	From Ares 1-X	A1190, AIX1010	A10860, A10860, A2830
A1250	GN2/GHe Construction	From Ares 1-X	A1240, AIX1010	A3140, A3140, A2830



Ground Systems Project
Integrated Master Schedule
Inter-Project Relationships

Date: 00/00/00
Page 3 of 4
Data Date: 00/00/00

Activity ID	Activity Name	From/To	Predecessors	Successors
A1330	Power Construction	From Ares 1-X	A1320, AIX1010	A3140, A3140, A2830
A1370	Compressed Air Construction	From Ares 1-X	A1360, AIX1010	A3140, A3140, A2830
A1410	Chilled Water Construction	From Ares 1-X	A1400, AIX1010	A3140, A3140, A2830
A1660	Special Power for GSE Installation	From Ares 1-X	A1650	A3170, A3170, A2830
A2830	Integrated System Testing and Activation (by contractor)	To A/V	A2770, A1200, A1450, A1580, A2510, A2820, A2600, A10910, A2690, A2480, A2480, A1660, A1740, A1820, A1900, A2060, A2140, A2220, A2300, A2460, A1250, A1410, A1370, A1330, A1290	A10710, A10830
A10710	Integrated Systems Act/Val Start	From C&C	A2480, A2830, A10670, CC10580	A2840
A2840	Integrated Systems Act / Val	From Pad SS's/ML	A10710, MLG1920, MLG1910	A10880, A10880, A10720, GSPB1020, GSPB1020
A10830	Pad Ready to Receive ML	To ML to Pad	A2480, A2830	A10650
A10650	ML to Pad	To ML A/V @ Pad	A10830, MLG1810, MLG1820, MLG1830, MLG1840, MLG1850	MLG1890, MLG1900, MLG1910, MLG1920, GSML1010
A10500	Pad B ORD	To Ares 1-Y ORD	A10720	GS9000
A10720	Integrated Systems Act/Val Finish	To Pad B ORD	A2840, A10770, A10680, A10760, A10730, A3250, A2390, A10510, A2470, A10490, A10640, A1040	A10500
LCC CLV - PMR				
A2430	LCC FR-1 CCC Joint Occupacy	To Ares 1-X	A2480	A10640, AIX1050
A10500	LCC FR-1 Modification Project ORD	To Ares 1-X	A2995	AIX1050
Hangar AF CLV - PMR				
A1190	Hangar AF ORD	To Ares 1-X	A2510, A2500, A1205, HAF1900, HAF1310, HAF2030	AIX9730
Spacecraft Processing - PMR				
SP1250	Quick Disconnects (LM) Need Date	TBD	SP1700, SP1960	SP1750, SP2010
SP4190	Spacecraft Transporter Need Date	TBD	SP3470	
SP1270	ECLSS (LM) Need Date	TBD	SP1260	SP2370
SP1280	Orion Electrical GSE (LM) Need Date	From C&C	SP1030	SP2510
SP1260	Misc GSE (LM) Need Date	TBD	SP1030	SP1270, SP2230
SP4220	ORD Orion GSE	To Ares 1-Y ORD	SP1600, SP1860, SP2120, SP2400, SP2260, SP2540, SP1640, SP1900, SP2160, SP2440, SP2580, SP2300	GS9000
SP4150	LL Electrical GSE Need Date (LM)	TBD		SP4030, SP3900
LETF CxP Program Support - PMR				

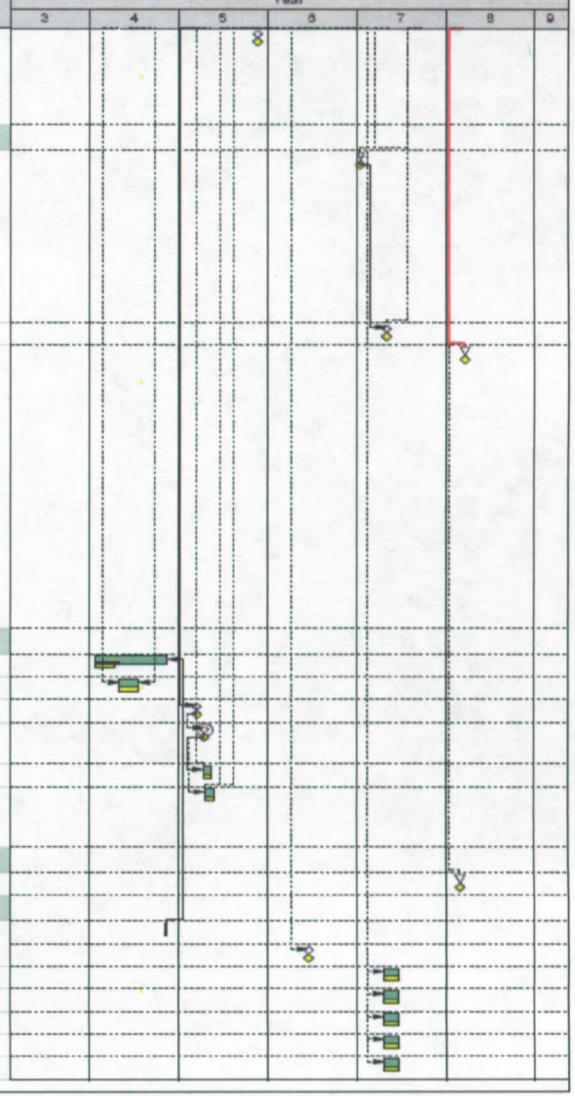


Ground Systems Project
Integrated Master Schedule
Inter-Project Relationships

Date: 00/00/00

Data Date: 00/00/00

Activity ID	Activity Name	From/To	Predecessors	Successors
LE1290	LETF ORD	To ML LETF Testing	LE2360, LE2320, LE3030, LE1240, LE2040, LE1770, LE1600, LE1510, LE1420, LE2330	MLU1505
Command and Control - PMR				
CC10580	ML/PAD Act/Val - Release 1	To ML, Pad A/V	CC22690, CC90212, CC90219, CC90226, CC90233, CC90240, CC90247, CC90254, CC90261, CC90268, CC90275, A2200, A2270, A2340	CC24960, GSCC10580, A10710, MLA2520
CC24960	LCS-GSE ORD	To ML & VAB A/V	CC10580	CC15000, A2290, MLA2149
CC10590	LCS-CEV/CLV ORD	To Ares 1-Y ORD	CC17080, CC1720, CC10720, CC15000, CC1330, CC1350, CC21740, CC16940, CC17340, CC3130, CC14450, CC14590, CC14610, CC14650, CC14750, CC14770, CC14810, CC14830, CC19650, CC20090, CC20150, CC31200, CC31000	CC14340, GSCC31200, GS9000
Ares I-X GS Development - PMR				
AIX9690	Comm Implementation	From Comm	AIX9680, A31220	AIX9910, AIX9910, AIX10110
AIX1050	CCC FR Outfitting	From LCC	AIX9770, A2430, A10500	AIX1640
AIX9730	Hangar AF ORD (reference)	From HAF	AIX9750, A1190	AIX9840
AIX9840	Ares I-X Launch	To Pad	AIX9730, AIX9810, AIX10270, AIX10340	AIX1010, AIX9200
AIX9200	VAB HB-3 Post Launch Reconfiguration	To VAB	AIX9840, AIX10150	A2090
AIX1010	Pad B Post Launch Reconfiguration	To Pad B	AIX9840	A1200, A1250, A1290, A1330, A1370, A1410, A1450, A2770, A2820, A3260, A2690
Spacecraft Processing MPPF - PMR				
SP10680	MPPF ORD	To Ares 1-Y ORD	SP10740, SP10650	GS9000
Communications - PMR				
A31220	Activation/Verification Testing	To Ares 1-X	A31210, A32000	AIX9690
A16180	Engineering Design Package Data Drop	From ML	A5750, MLC1580	A16190
A9580	KSC Networks Installation	From ML	MLC1730	A16120
A9600	Operational Intercomm System	From ML	MLC1730	
A9630	Kennedy Integrated Transmissions System	From ML	MLC1730	
A9660	Paging and Area Warning System	From ML	MLC1730	
A9670	Radio System	From ML	MLC1730	A9610, A9640, A9650



Ground Systems Development Elements:

- Integrated Critical Path Analysis and Reporting
  - P6 allows for easy analysis of multiple float paths even through different calendars across multiple projects
  - Basic principals of critical path analysis apply to each project as well as to all projects
  - Verify above requirements have been implemented
  - Open all schedules involved with the Integrated Master Schedule
  - Calculate the schedules making sure interproject relationships are considered
  - See following layouts

Ground Systems Project
Integrated Master Schedule
IMS Critical Paths by Project, Total Float & Start

Date: 00/00/00

Data Date: 00/00/00

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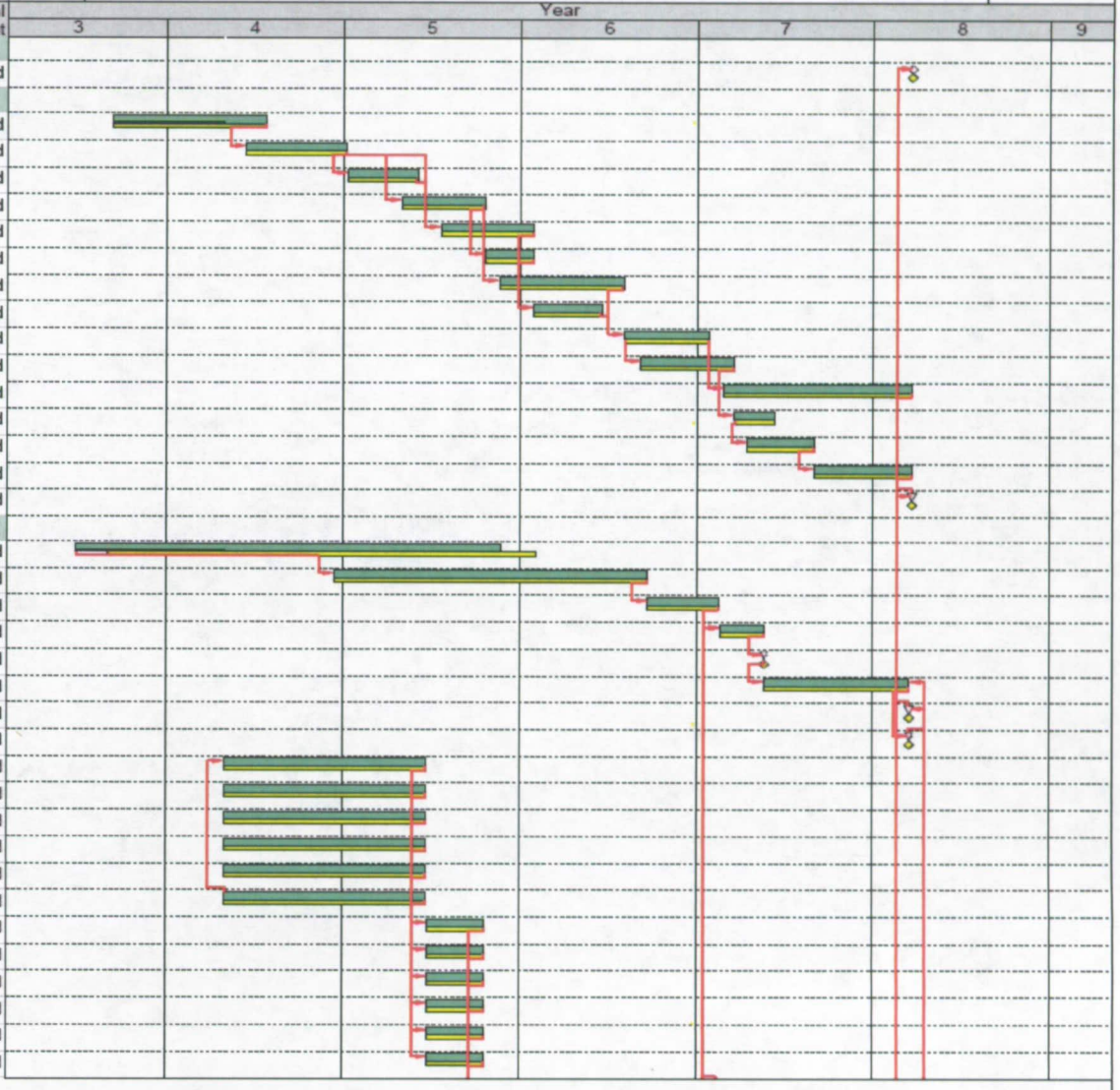
Activity ID	Activity Name	Total Float
Ground Systems Project - Ares 1-Y ORD		
GS9000	Ground Systems Projects ORD	0.0d
Command and Control - PMR		
CC21680	System Design Development Drop 2	0.0d
CC21690	System Design Verification Drop 1	0.0d
A4320	Design/Implementation for Verification Drop 1	0.0d
CC21700	System Design Verification Drop 2	0.0d
CC24610	Formal Test Verification Drop 1	0.0d
A4330	Design/Implementation for Verification Drop 2	0.0d
CC11090	Design/Implementation for Release 1	0.0d
CC24630	Formal Test Verification Drop 2	0.0d
CC24620	Formal Test Release 1	0.0d
CC1070	Implementation Release 1.1	0.0d
CC31000	Validation Testing Release 1	0.0d
CC1080	Informal Test Release 1.1	0.0d
CC11010	Formal Test Release 1.1	0.0d
CC31200	Validation Testing Release 1.1	0.0d
CC10590	LCS-CEV/CLV ORD	0.0d
CLV Pad B - PMR		
A1720	Kennedy Ground Control System (KGCS) Design	6.0d
A1730	Kennedy Ground Control System (KGCS) Fabrication	6.0d
A1740	Kennedy Ground Control System (KGCS) Installation	6.0d
A2830	Integrated System Testing and Activation (by contract...	6.0d
A10710	Integrated Systems Act/Val Start	6.0d
A2840	Integrated Systems Act / Val	6.0d
A10500	Pad B ORD	6.0d
A10720	Integrated Systems Act/Val Finish	6.0d
A1180	ECS Design	11.0d
A1230	GN2/GHe Design	11.0d
A1270	Potable Water/.Sewer/Firex Design	11.0d
A1310	Power Design	11.0d
A1350	Compressed Air Design	11.0d
A1390	Chilled Water Design	11.0d
A1190	ECS A&A	11.0d
A1240	GN2/GHe A&A	11.0d
A1280	Potable Water/.Sewer/Firex A&A	11.0d
A1320	Power A&A	11.0d
A1360	Compressed Air A&A	11.0d
A1400	Chilled Water A&A	11.0d



Ground Systems Project
Integrated Master Schedule
IMS Critical Paths by Project, Total Float & Start

Date: 00/00/00
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Data Date: 00/00/00

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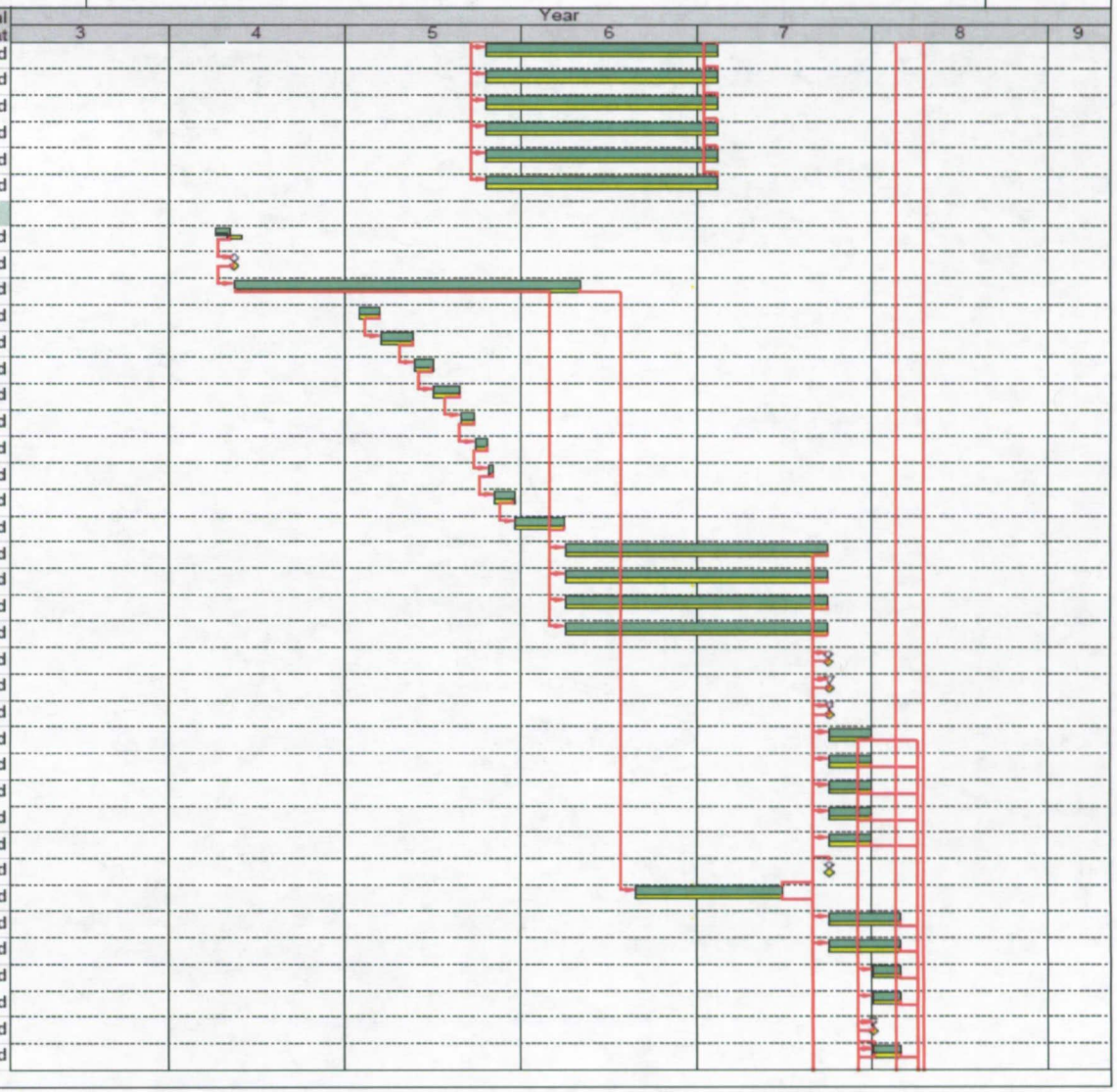
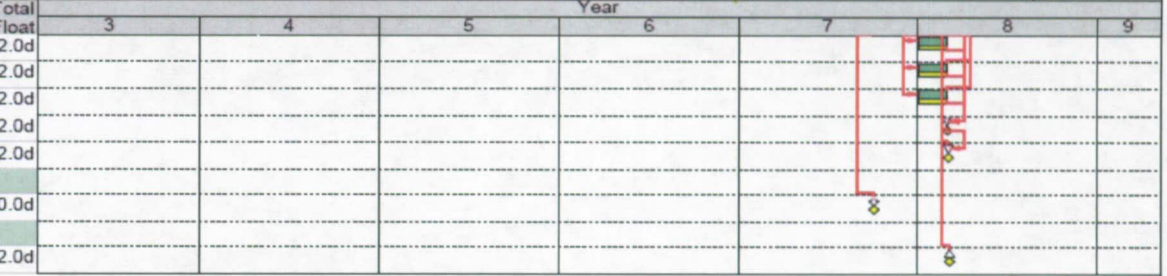
Activity ID	Activity Name	Total Float
A1200	ECS Construction	11.0d
A1250	GN2/GHe Construction	11.0d
A1290	Potable Water/.Sewer/Firex Construction	11.0d
A1330	Power Construction	11.0d
A1370	Compressed Air Construction	11.0d
A1410	Chilled Water Construction	11.0d
Mobile Launcher - PMR		
MLF1370	TCRMSF PDQ	9.0d
MLF1380	ARNTPDQ	9.0d
MLF1400	Structural & Facility	9.0d
MLM1610	M&E Install Contr Draft Solicitation Release	9.0d
MLM1620	M&E Install Contr Final Solicitation	9.0d
MLM1630	Receive M&E Install Contr Offers	9.0d
MLM1640	Evaluate M&E Install Contr Offers	9.0d
MLM1650	Competitive Range Determination	9.0d
MLM1660	Conduct M&E Install Contr Discussions	9.0d
MLM1670	Receive Final Proposal Revisions	9.0d
MLM1680	M&E Installation Contract Award	9.0d
MLM1681	Limited Notice to Preceed	9.0d
MLH1740	Handling & Access GSE Fabrication & Installation	9.0d
MLM2125	ML GSE M&E Installation Contract	9.0d
MLG1710	Propellants & Gases GSE Installation	9.0d
MLC1730	Communications Fabrication & Installation Contract	9.0d
MLM2130	Finish ML GSE M&E Installation	9.0d
MLA10430	Start ML Activation and Validation	9.0d
MLA1770	VAB High Bay Need Date	9.0d
MLG1850	Coolants Connect, Leak and Flow Tests	9.0d
MLG1840	SRB Hydraulics Connect, Leak and Flow Tests	9.0d
MLG1810	ECS Flow and Balance Test - VAB	9.0d
MLG1820	Gaseous Nitrogen Connect, Leak and Flow Tests	9.0d
MLG1830	Gaseous Helium Connect, Leak and Flow Tests	9.0d
MLA2520	ML PLC Software Drop from CCC	10.0d
MLU1700	Umbilical GSE Installation	10.0d
MLA2149	ML Activation and Validation	12.0d
MLU2250	Umbillical Activation / Validation	12.0d
MLA1940	ML Water Tests (SRB IOP, Firex, deck quench, towe...	12.0d
MLA1950	CEV Emergency Egress Test	12.0d
MLA10410	ML Pad B Need Date	12.0d
MLG1890	ECS Flow and Balance Test - Pad	12.0d



Ground Systems Project
Integrated Master Schedule
IMS Critical Paths by Project, Total Float & Start

ASRC AEROSPACE CORPORATION

Activity ID	Activity Name	Total Float
MLG1900	Liquid Oxygen Cold Flow - Pad	12.0d
MLG1910	Liquid Hydrogen Cold Flow - Pad	12.0d
MLG1920	Hypergolic Propellants Connect, Leak and Flow Tests	12.0d
MLA2150	Activation & Validation Complete	12.0d
MLA1960	ML ORD for Ares I-Y	12.0d
VAB HB-3 - PMR		
A2310	Ready for ML	10.0d
Spacecraft Processing - PMR		
SP4220	ORD Orion GSE	12.0d



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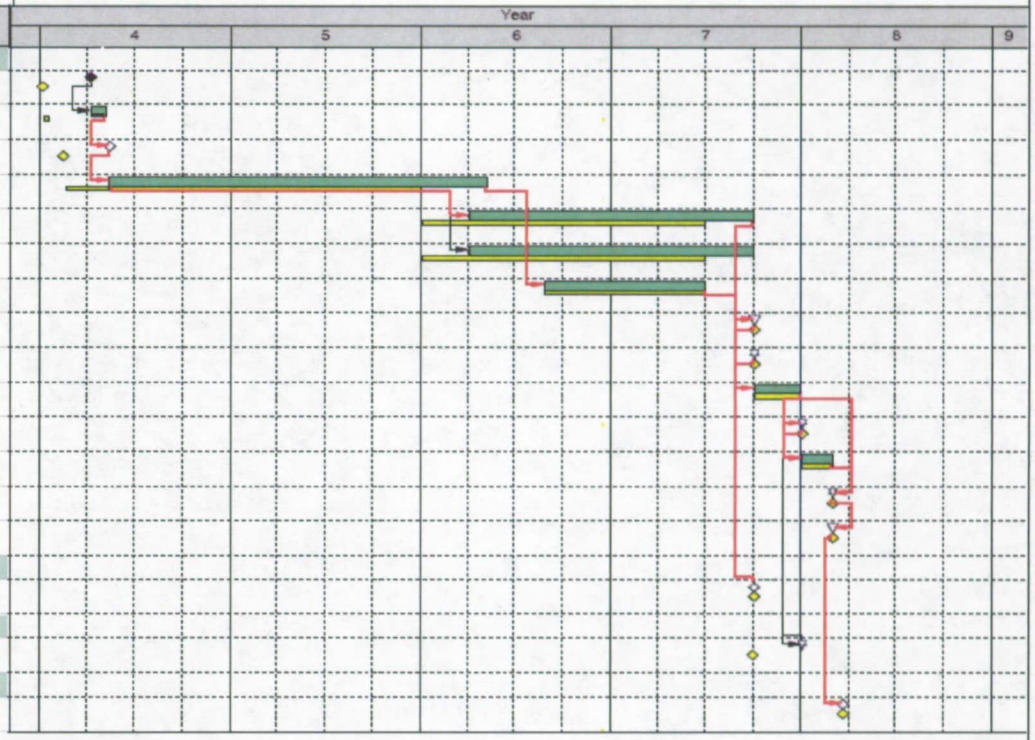
Ground Systems Project
Integrated Master Schedule Critical Paths
Tertiary - VAB HB #3/ML/Pad B - TF > 8 < 13 work days

Date: 00/00/00
Page 1 of 1
Data Date: 00/00/00

Activity ID	Activity Name
Mobile Launcher - PMR	
MLF1360	FMLPF FP
MLF1370	TCRMSF PDQ
MLF1380	ARNTPDQ
MLF1400	Structural & Facility
MLG1710	Propellants & Gases GSE Installation
MLI1720	Instr & Elect Controls GSE Installation
MLU1700	Umbilical GSE Installation
MLA10430	Start ML Activation and Validation
MLA1770	VAB High Bay Need Date
MLG1810	ECS Flow and Balance Test - VAB
MLA10410	ML Pad B Need Date
MLG1890	ECS Flow and Balance Test - Pad
MLA2150	Activation & Validation Complete
MLA1960	ML ORD for Ares I-Y
VAB HB-3 - PMR	
A2310	Ready for ML
CLV Pad B - PMR	
A10650	ML to Pad
Ground Systems Project - Ares 1-Y ORD	
GS9000	Ground Systems Projects ORD



L1C MS Open
L2C MS Open
L2C MS Closed
L2N Open
L2N MS Closed
L3C MS Open
L3CMS Closed
L3N MS Open
L3N MS Closed
L4C MS Open
L4C MS Closed
Level V Open
Level V Closed
Baseline Milestone
Current Bar Labels
Project Baseline
% Complete

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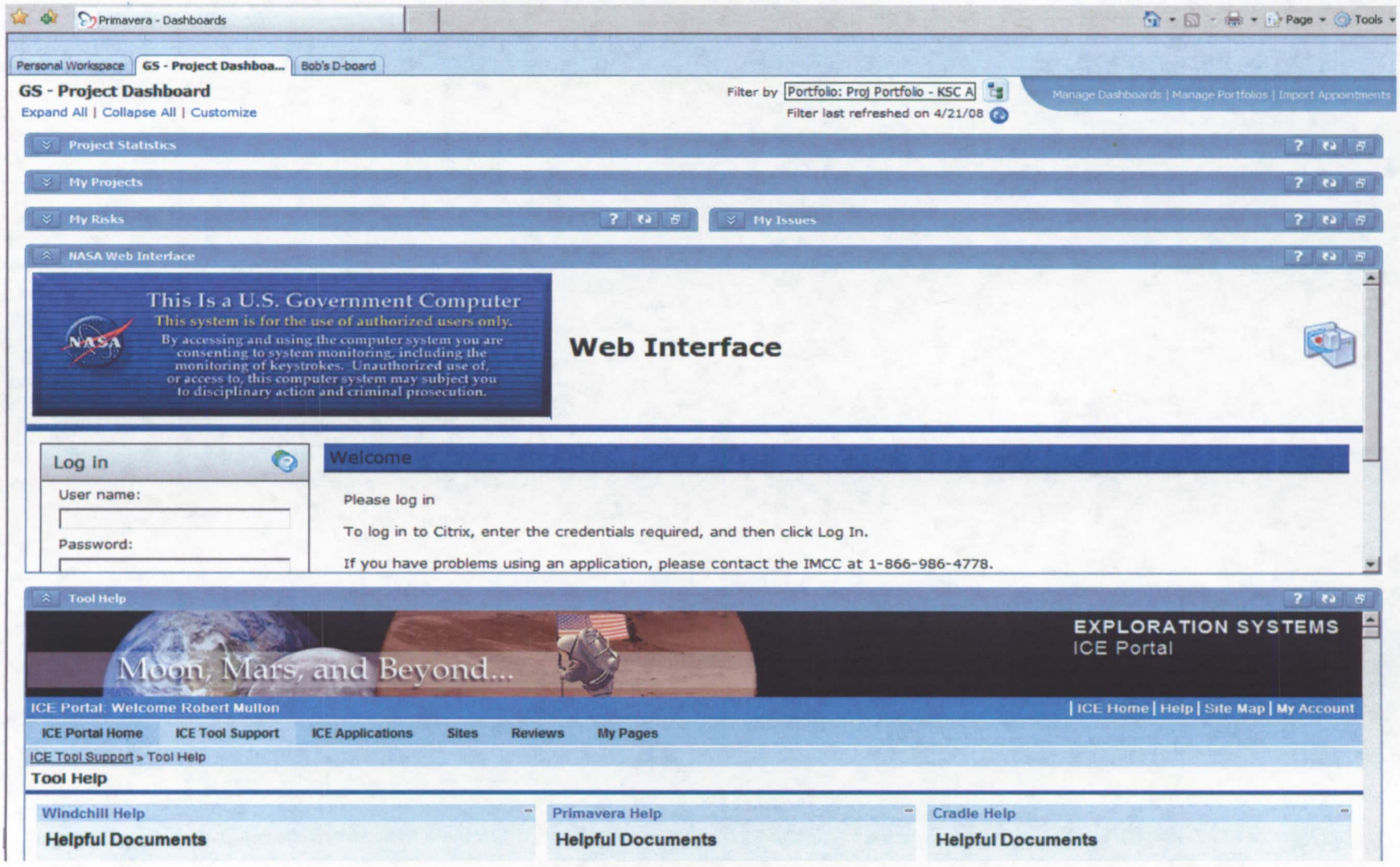
Communicating Project status via P6 Web / MyPrimavera

- Purpose:
  - P6 Web / MyPrimavera was rolled out to give NASA Project Managers 24x7 visibility into their project schedules and minimize the need for the scheduler to run ad-hoc schedule reports
  - Also gives the responsible manager the ability to run their own what-if analysis via P6 Web
- Implementation:
  - ASRC scheduler is given access to responsible manager's individual sandbox
  - ASRC scheduler sets up portfolios and basic dashboards so responsible manager only sees what he needs/wants to see
  - Current and working (what if) schedules are placed in the responsible managers individual sandbox
  - Layouts and filters are set up so that schedule views are what the responsible manager is used to seeing
  - Responsible manager can view project and schedule information and modify schedules and views with minimal training and appropriate security clearance

P6 Web Customized Dashboard:



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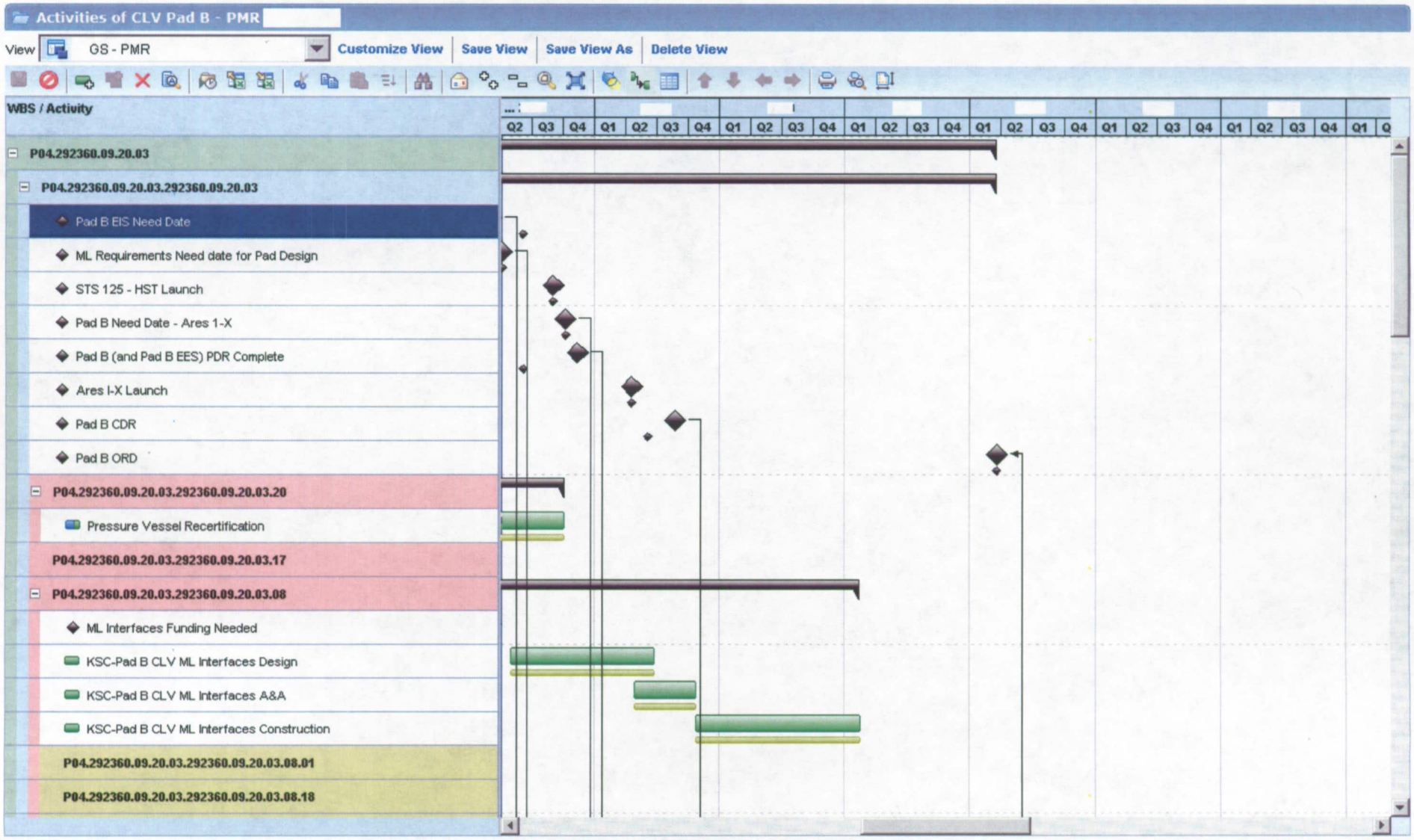
P6 Web Customized View:



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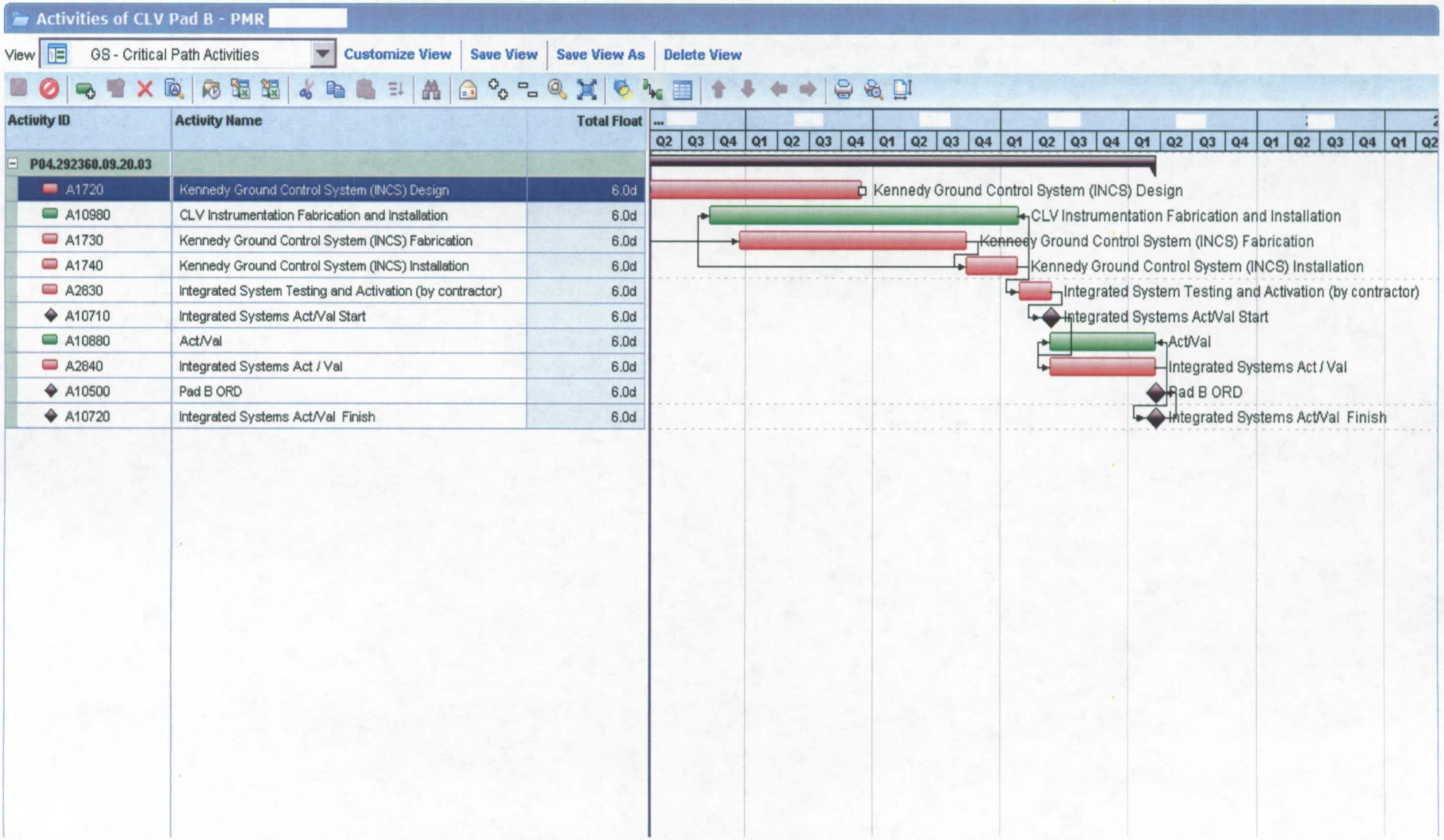
P6 Web Customized View:



Multi-Element Integrated Project Planning at Kennedy Space Center

- Questions?

08-476

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
	presentation	November 16-19, 2008

4. TITLE AND SUBTITLE
Multi-Element Integrated Project Planning at Kennedy Space Center

5a. CONTRACT NUMBER
NAS10-03006

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
Robert Mullon, ASRC Aerospace

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
ASRC Aerospace
ASRC-50
Kennedy Space Center, FL 32899

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
National Aeronautics and Space Administration
Engineering Directorate (LX)
Kennedy Space Center, FL 32899

10. SPONSORING/MONITOR'S ACRONYM(S)
NASA/KSC

11. SPONSORING/MONITORING REPORT NUMBER

12. DISTRIBUTION/AVAILABILITY STATEMENT

13. SUPPLEMENTARY NOTES

14. ABSTRACT

This presentation demonstrates how the ASRC Scheduling team developed working practices to support multiple NASA and ASRC Project Managers using the enterprise capabilities of Primavera P6 and P6 Web Access. This work has proceeded as part of Kennedy Ground Systems' preparation for its transition from the Shuttle Program to the Constellation Program. The presenters will cover Primavera's enterprise-class capabilities for schedule development, integrated critical path analysis, and reporting, as well as advanced Primavera P6 Web Access tools and techniques for communicating project status.

15. SUBJECT TERMS
Primavera, integrated critical path, multiple element integration

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19b. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Robert Mullon
				1	19b. TELEPHONE NUMBER *(Include area code)* (321) 867-9903