

The logo for Space Systems Command is a yellow triangle with a dark blue background. Inside the triangle, there is a white satellite dish, a red curved arrow pointing upwards, and a blue satellite in orbit. The text "SPACE" is written in yellow at the top, and "SYSTEMS COMMAND" is written in yellow at the bottom.

Digital Transformation in Program Office Environment

Maj. William Deavor - United States Space Force
Giorgio Gaputan - ManTech International Corporation
Madison Galvin - The Aerospace Corporation

NDIA Systems and Mission Engineering Conference - 18 Oct 2023



Agenda

- Assured Access To Space (AATS) and Launch Programs Overview
- AATS Enterprise Data Structure
- Pre-Acquisition Support: Requirements Development
 - Requirements Traceability
 - Requirements Document Generation
- Execution Support
 - Contract Deliverables (CDRL)
 - Automated Analysis
 - Data Leakage Prevention
- Conclusion



Assured Access to Space

SPACE ACCESS

Boulder, CO

AATS Inherent Activities

LTRS - Range Sustainment; Materiel and Services	Operate Vandenberg SFB, Patrick SFB, Cape Canaveral SFS, Eastern and Western Ranges	Procurements; NSSL, RSLP; Multi-Mission Manifesting
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Orbital/Sub-Orbital Launches; Storage, Surveillance, and Refurbishment of Decommissioned ICBM Motors

End-to-End Mission Assurance & Fleetwide Surveillance

National Federation of Spaceports

	<u>USG and State Spaceport Collaborations</u>	
Commercial Range Ops & Business Models	Multi-Use Range Facilities; Complex Allocation	Next-Gen Range Services

Mission Lifecycle Management

SV Processing Management; Building Capacity	AATS-Level Ops Centers for Monitoring Hardware Movements and Assets
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OPERATIONS INTEGRATION


Spaceports/Launch/Satellite Ops

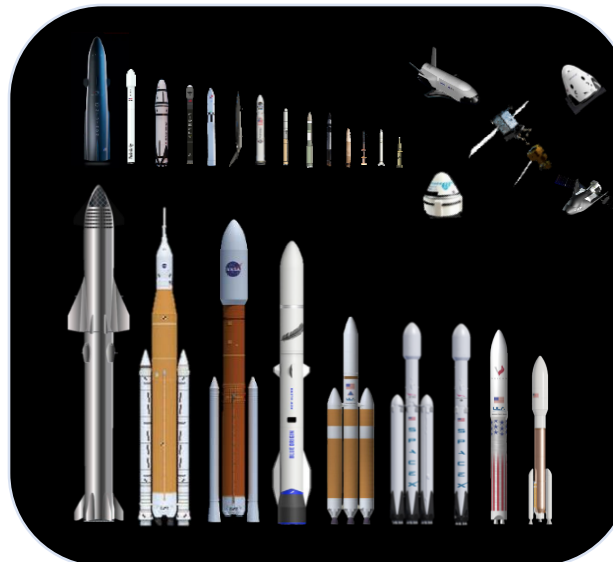
SSC/S3

SSC Spaceflight Worthiness Certification

AATS AA3/5/8

AATS Policy, Requirements & Funding
COCOM Space Effects Integrator
DoD Mission Manifesting
AATS Program Incubator





RAPID DELIVERY

Sub-Orbital/Orbital Rapid Strategic Mobility

Rocket Cargo
AFRL Vanguard Program;
Point-to-Point Rapid Global Mobility

On-Orbit Storage and Delivery in and from Space



ORBITAL RESILIENCY

Tactically Responsive Space

Provide responsive launch for TacRS on-demand delivery of space capabilities to the warfighter through all phases of conflict



On-Orbit Servicing, Maneuver, & Debris Removal

Orbital Servicing
Remove/Replace Payloads On-Orbit;
Drive Common Standards;
Commercial Refueling Capability



Orbital Maneuver
Leverage commercial industry for on-orbit maneuvers;
Small-launch to LEO, use on-orbit stages to higher altitudes



Debris Removal
Engage and Energize Industry Solutions



The Future of Assured Access to Space

Delivering On-Demand Orbital and Sub-Orbital Services, Materiel, and Capabilities to the Warfighter



Launch Programs Overview

USSF launches the most critical National Security Space satellites



Nation's Eyes & Ears

Secure Comms



Positioning, Navigation & Timing



Space Domain Awareness

98 Successful NSSL Launches



Atlas V
(2 On Contract)
Next: Silent Barker
(29 Aug 23)

Delta IV Heavy
(1 on Contract)
Next: NROL-70
(01 Mar 24)

Falcon 9
(11 On Contract)
Next: USSF-124
(29 Sep 23)

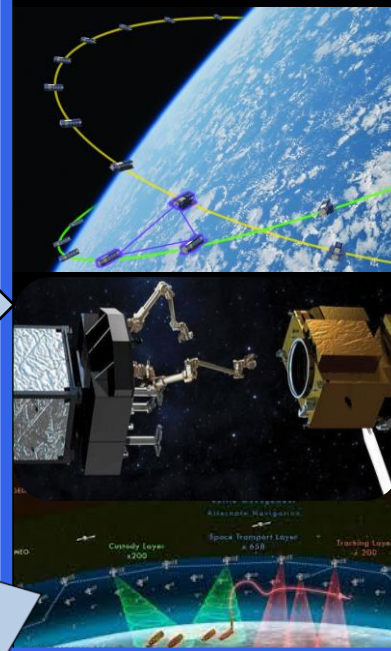
Falcon Heavy
(1 On Contract)
Next: USSF-52
(01 Sep 23)

Vulcan
(14 On Contract)
Next: USSF-106
(30 Jan 24)

Maximize On-Orbit Capability

>\$84B in On-Orbit Capability

Enables Resilient Space Order of Battle



Govt Mission Assurance = 100% Mission Success

Multi-Mission Manifesting

Minotaur
Next: Mk21A-2
Late 2023

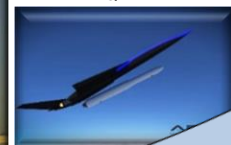
Rocket 4
Next: STP-29B
3Q FY25

RS-1
Next: STP-AR1
Late 2024

Alpha
Next: TacRS-3
NET Jul 23



Ravn X
Next: ASLON-45
4Q FY24



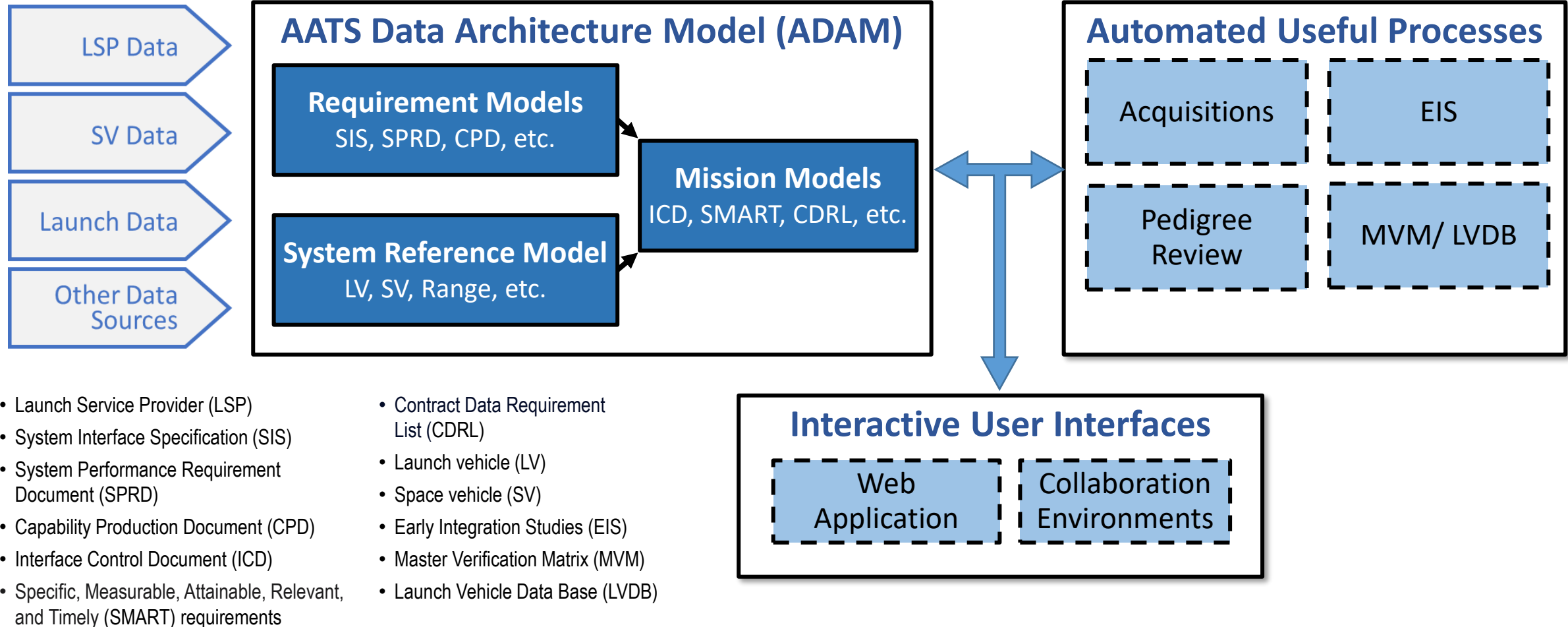
23 of 25 Successful RSLP Launches since 2015

Maximize Responsiveness

100% Launch Success is Vital to Countering the Pacing Challenge



Concept: AATS Enterprise Data Structure



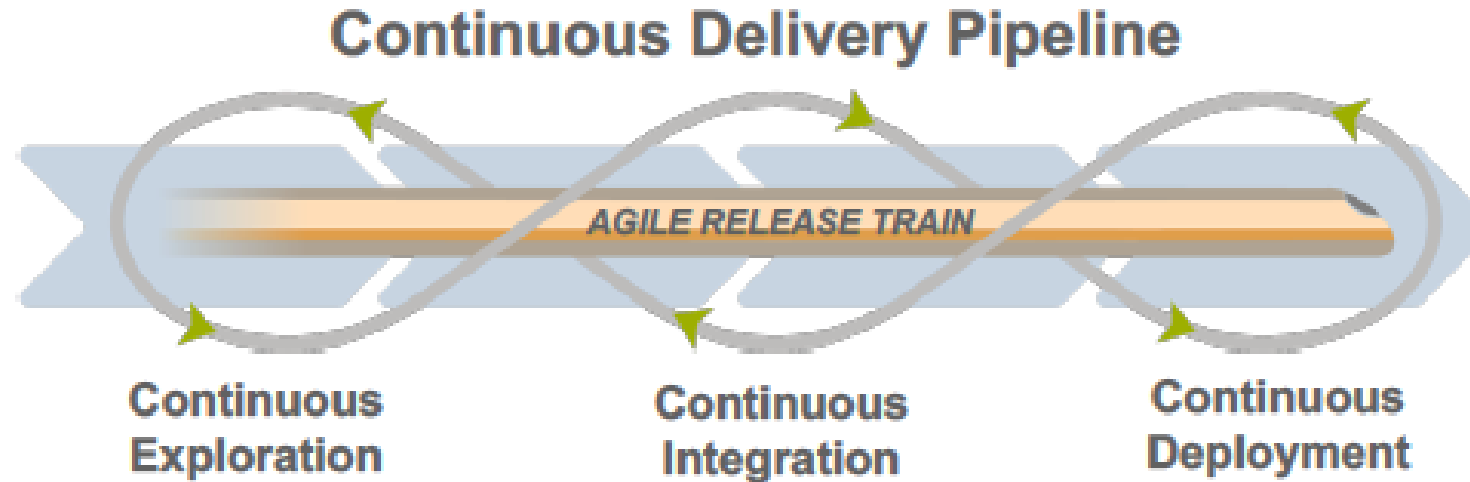
- Launch Service Provider (LSP)
- System Interface Specification (SIS)
- System Performance Requirement Document (SPRD)
- Capability Production Document (CPD)
- Interface Control Document (ICD)
- Specific, Measurable, Attainable, Relevant, and Timely (SMART) requirements

- Contract Data Requirement List (CDRL)
- Launch vehicle (LV)
- Space vehicle (SV)
- Early Integration Studies (EIS)
- Master Verification Matrix (MVM)
- Launch Vehicle Data Base (LVDB)

Goal: Integrate information to enable data driven decisions



Pre-Acquisition Support: Requirements Development

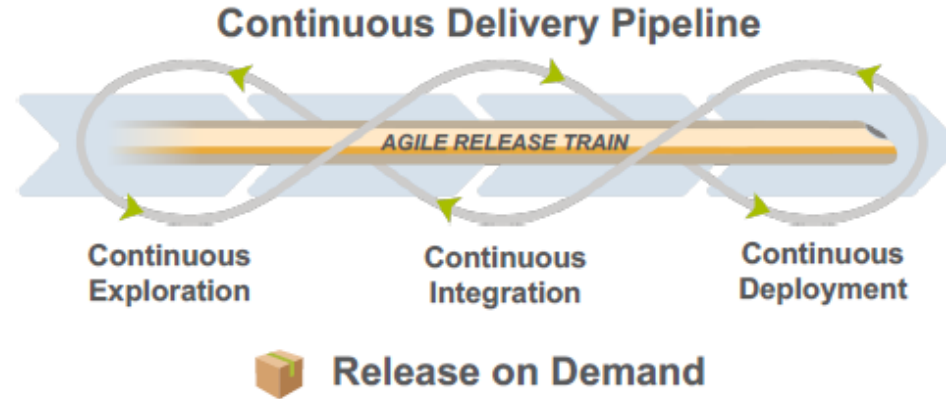
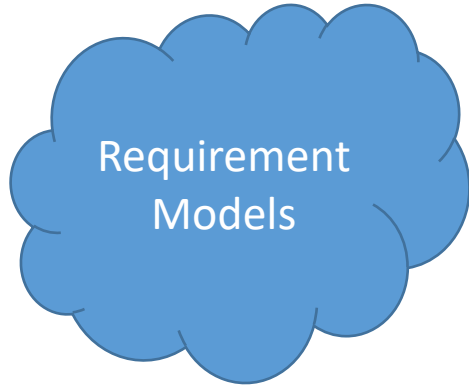


Release on Demand

- **Capability Production Document (CPD)** -Requirements for Spacelift Systems and related government activities that form a Spacelift Enterprise to provide Spacelift Capability.
- **System Performance Requirement Document (SPRD)** – Performance and Functional Requirements for the National Security Space Launch (NSSL) Systems
- **System Interface Specification (SIS)** – Standard Payload (PL) interface between the NSSL Payload and the NSSL System in accordance with the NSSL System Performance Requirements Document (SPRD)
- **Performance Work Statement (PWS)** – The Launch Services (LS), Mission Integration (MI), Mission-Unique (MU), Early Integration Studies (EIS), Fleet Surveillance (FS) tasks, and Level of Effort (LOE) work the Contractor will perform for National Security Space (NSS) missions



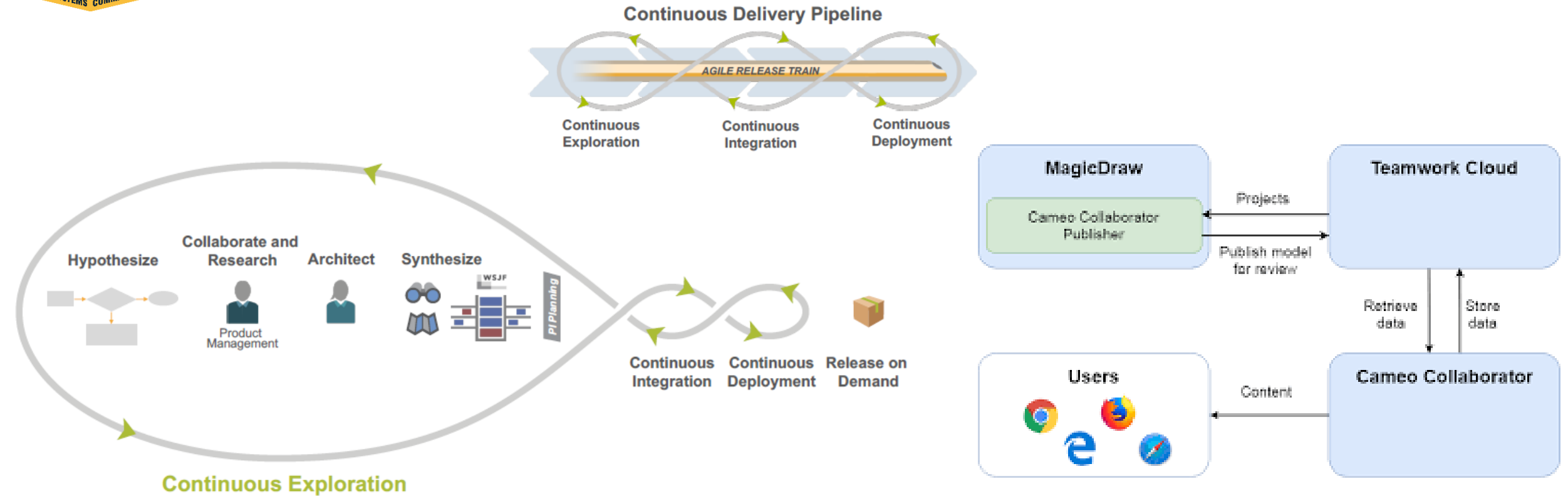
Requirements Development: Traceability



CPD	SPRD	PWS
<p>5.3.3.1 KSA-13 Flight Data</p>	<ul style="list-style-type: none"> R 3.5.0-1 Telemetry (Trajectory) R 3.5.0-3 Telemetry Requirements (LV malfunctions and failures) R 3.5.0-5 Telemetry Requirements (PL environments) R 3.5.0-6 Telemetry Requirements (PL health and status) R 3.5.0-4 Telemetry Requirements (PL malfunctions and failures) R 3.5.0-7 Telemetry Requirements (PL separation status) R 3.5.0-9 Telemetry Requirements (state vector and attitude data - auxiliary PL) R 3.5.0-8 Telemetry Requirements (state vector and attitude data - primary PL) R 3.5.0-2 Telemetry Requirements (System and Subsystem Performance) 	<p>3.9.2.1.0-1 EIS: Preliminary Mission Design Trajectory</p>



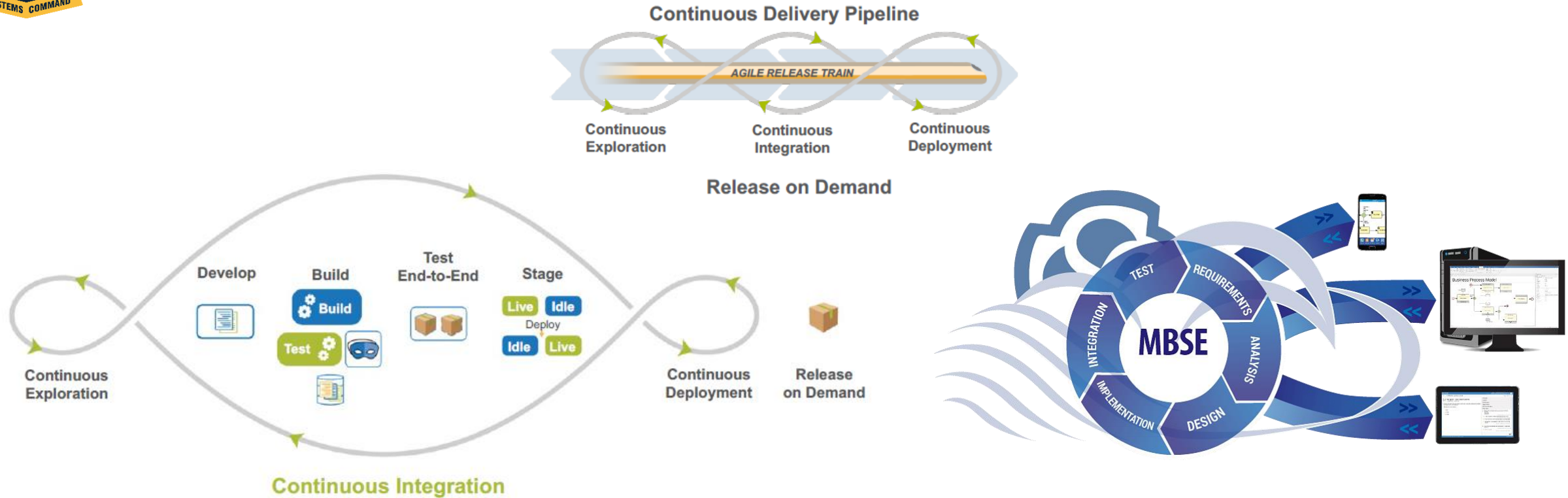
Requirements Development: Continuous Exploration



Collaborate between the **Government Stakeholders, SE&I Stakeholders,** and **MS&A Stakeholders** to further explore the launch mission need and identify mission unique items



Requirements Development: Continuous Integration

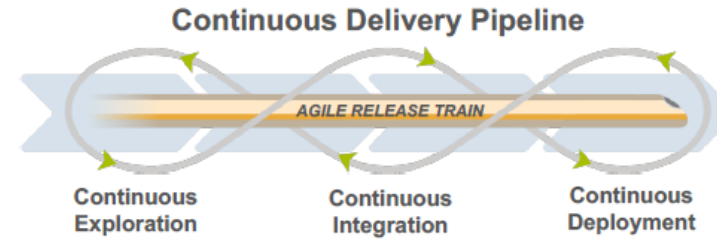


Updates are continuously integrated into MBSE Models.

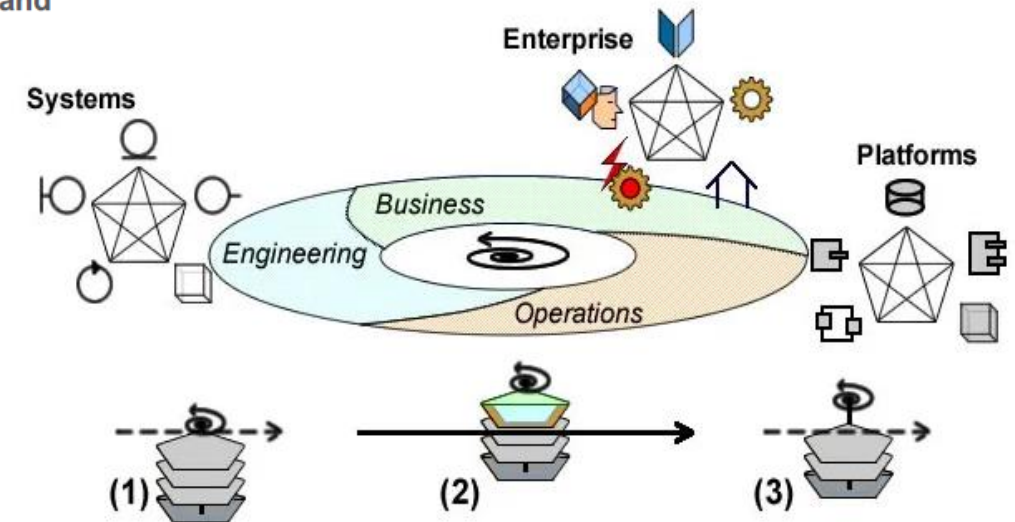
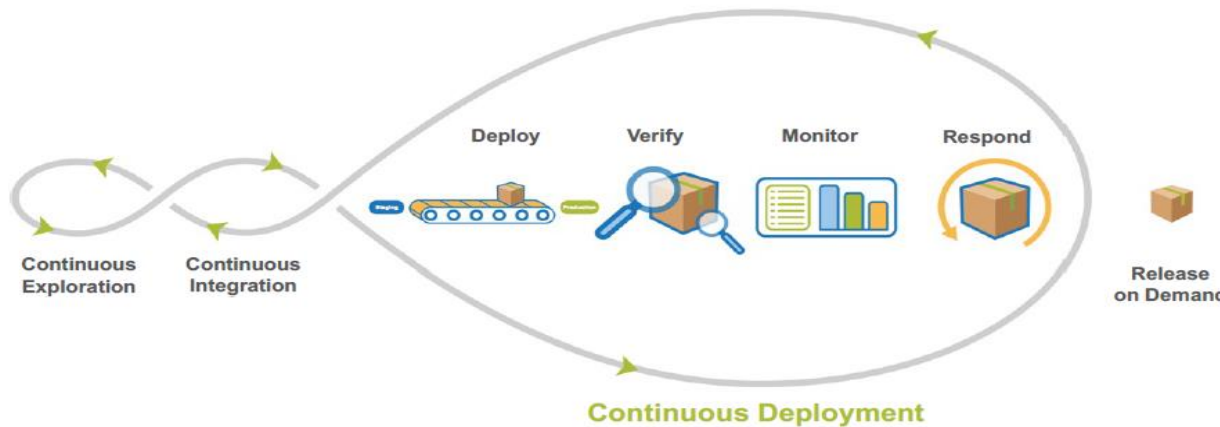
Documents can be generated within staging areas for formatting edits.



Requirements Development: Continuous Deployment



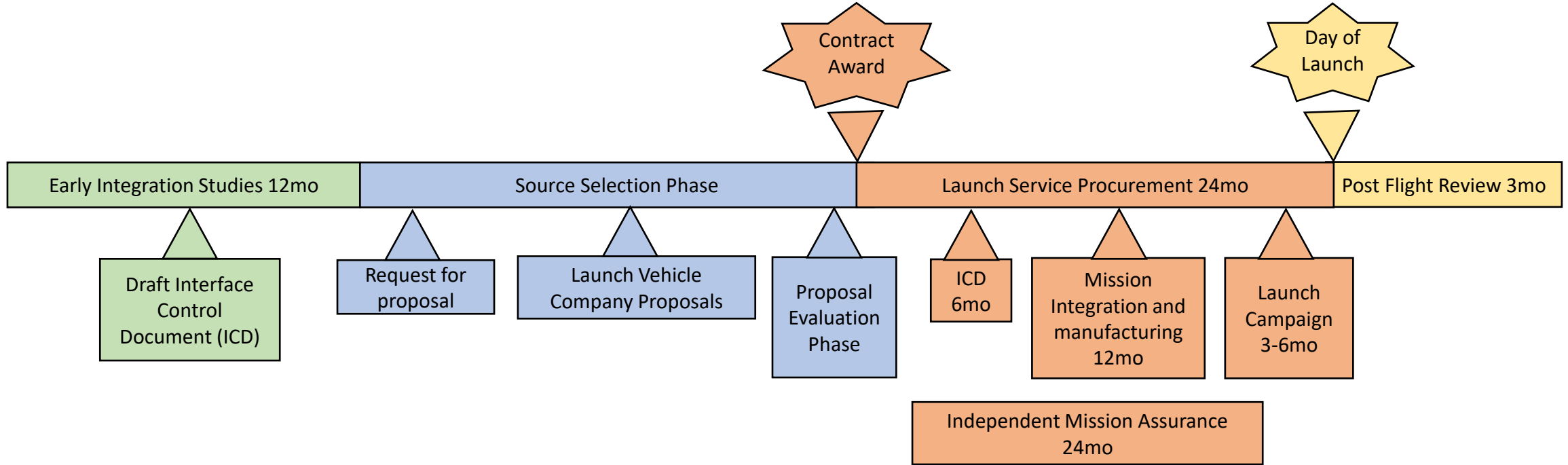
Release on Demand



Can be released to the program offices on demand

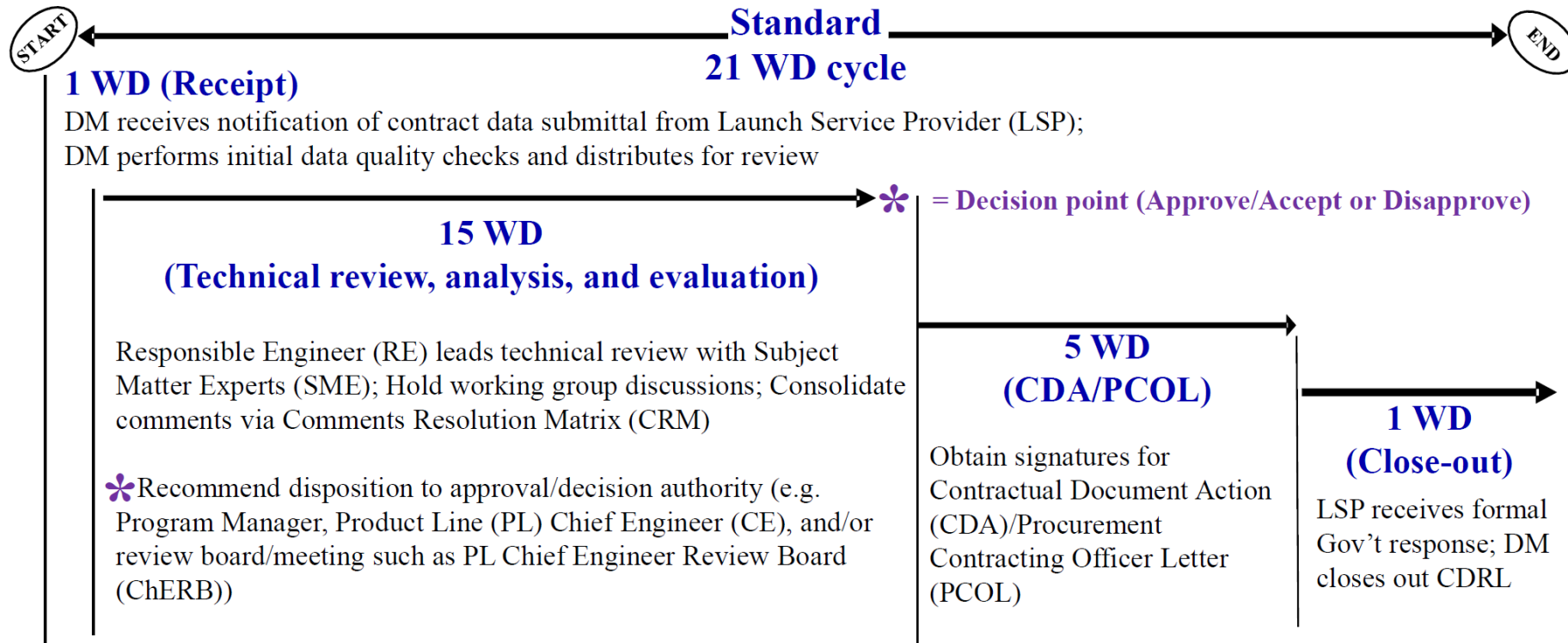


Execution Support: Launch Timeline





Execution Support: Contract Deliverables (CDRL)



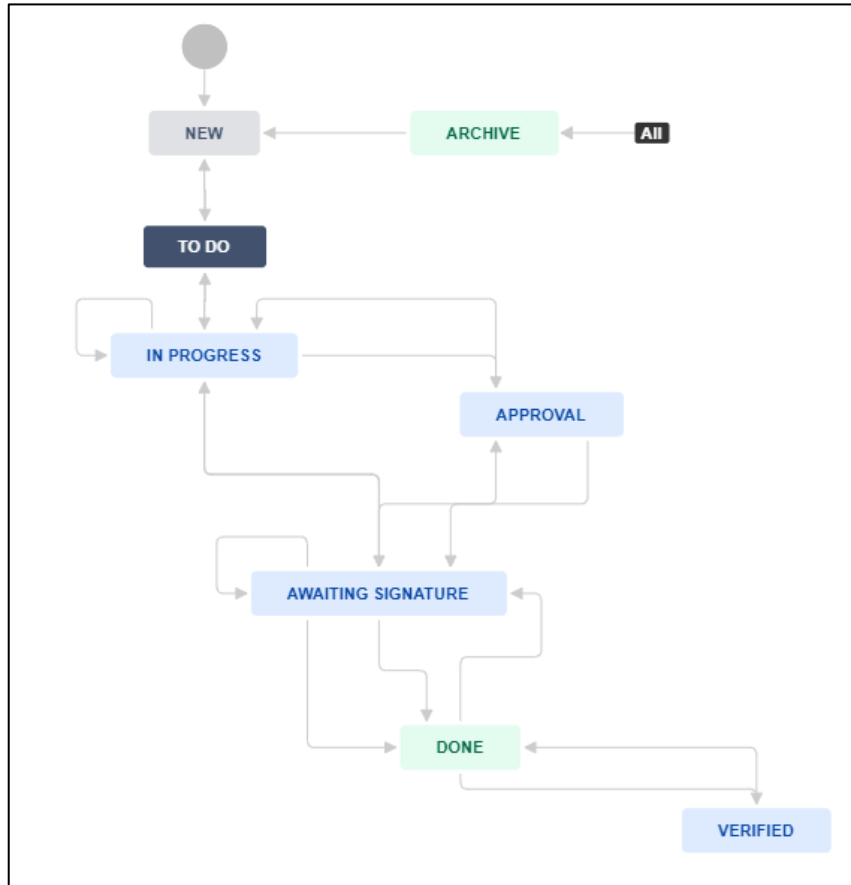
All contract deliverable management and correspondence relies on email, using Livelink for file management

Note 1: A 30 calendar day (CD) cycle equates to a 21 working day (WD) cycle

Note 2: Reviewers do not have the full 21WD to review due to activities before and after the review



CDRL Use Case: JIRA Customization



CDRL Date Completion ENABLED

Rule details

Audit log

When: Value changes for Due Date

If: Project equals CDRL Weekly Status Pilot (CDRLWS)

And: Issue Type equals Contract Deliverable

Then: Edit issue fields Actual Delivery Date

And: Edit issue fields Suspense Date

And: Add comment to issue Updating the Actual Delivery Date to `{{issue.dueDate.plusBusinessDays(-6)}}` and the suspense date to

Phase 2 OY4 CDRL Status SDA T1TL-B, SDA T1TL-C, SDA T1TL-D

For Program Personnel Reference, 00-Phase 2-CDRL StatusOY4-NSSL SDA T1TL-B-SDA T1TL-C-SDA T1TL-D

[SDA T1TL-B](#) [SDA T1TL-C](#) [SDA T1TL-D](#) [SDA T1TL-E](#) [SDA T1TR-C](#) [USSF-31](#) [SDA T1TL-B](#)
[SDA T1TL-E Curr-Comp Milestone](#) [SDA T1TR-C Curr-Comp Milestone](#) [USSF-31-Curr-Comp Mi](#)

SDA T1TL-B CDRL Status as of 25 August 2023

CDRL sequence	#- Document Subtitle	Title	Appr	Gov't POC	Task Order	CLIN#	Aero	Received Date

All status of Contract Deliverables on this page are written manually. Submitted automation will have this written live with data from Jira



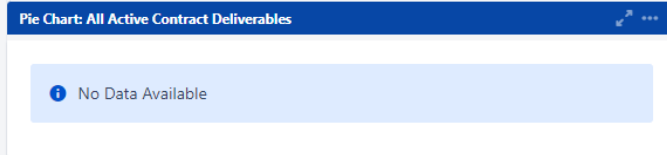
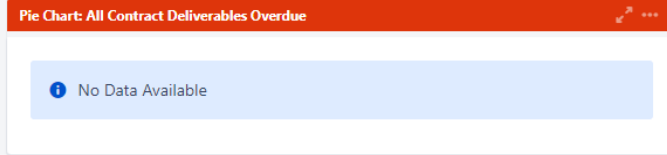
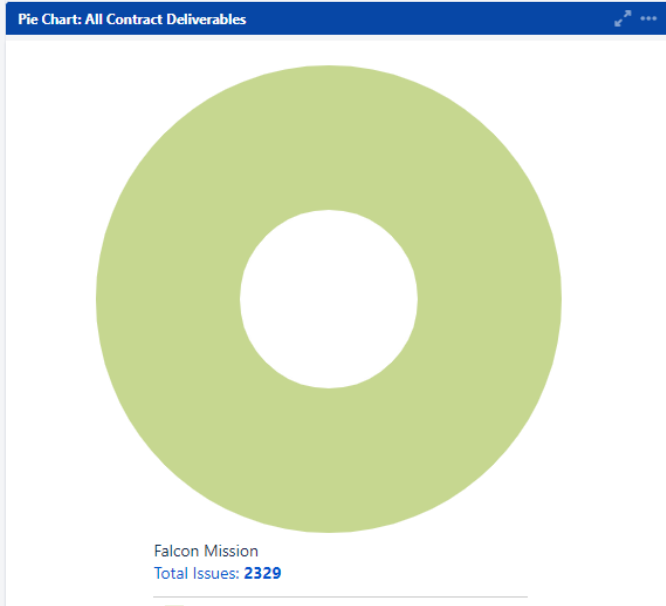
CDRL Use Case: JIRA Metric Dashboards

CDRL Metrics Dashboard

Two Dimensional Filter Statistics: All Contract Deliverables

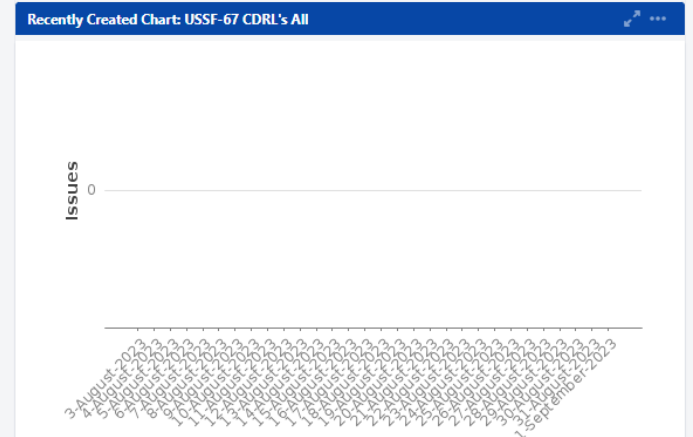
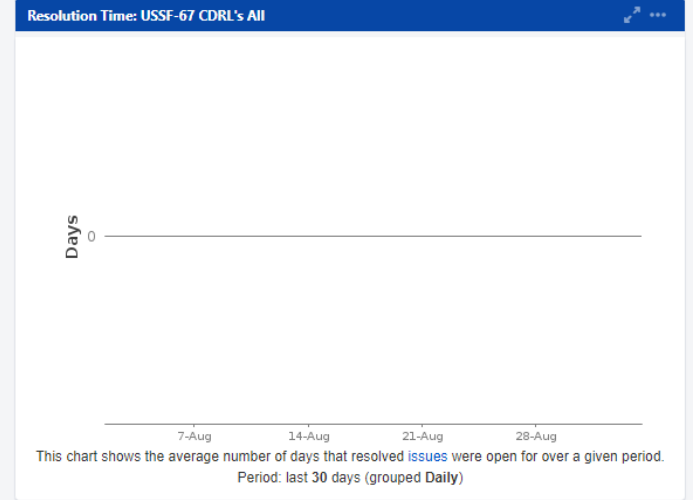
Status	None	T:
TO DO	114	114
VERIFIED	550	550
NEW	1665	1665
Total Unique Issues:	2329	2329

Grouped by: Falcon Mission Showing 3 of 3 statistics.



Two Dimensional Filter Statistics: USSF-67 CDRL's All

No matching issues found.



Automation of metrics and key performance parameters allows the team to attack problems before they get too big.



CDRL Use Case: Confluence Customization

Phase 2 OY4 CDRL Status SDA T1TL-B, SDA T1TL-C, SDA T1TL-D, SDA T1TL-E, SDA T1TR-C, and USSF-31

For Program Personnel Reference, 00-Phase 2-CDRL StatusOY4-NSSL SDA T1TL-B-SDA T1TL-C-SDA T1TL-D-SDA T1TL-E- SDA T1TR-C and USSF-31_06-23-2023.xlsx (on Livelink)

[SDA T1TL-B](#)
[SDA T1TL-C](#)
[SDA T1TL-D](#)
[SDA T1TL-E](#)
[SDA T1TR-C](#)
[USSF-31](#)
[SDA T1TL-B Curr-Comp Milestone](#)
[SDA T1TL-C Curr-Comp Milestone](#)
[SDA T1TL-D Curr-Comp Milestone](#)
[SDA T1TL-E Curr-Comp Milestone](#)
[SDA T1TR-C Curr-Comp Milestone](#)
[USSF-31-Curr-Comp Milestone](#)

SDA T1TL-B CDRL Status as of 25 August 2023										REVIEW DUE DATE LEGEND				
										Past Due	Due in 2 weeks or further in future			
										Headsup due next week	CDA signed and sent			
CDRL # - sequence	Document Title - Subtitle	Appr	Gov't POC	Task Order	CLIN#	Aero	Received Date	Status	Review Due Date	Disposition Due Date (30 days)	Action	JIRA SITE	NOTES	

This automation reviews the current CDRLs in Jira based on a custom filter. It then writes to the reporting tables in Confluence as it updates.



Execution Support: Automated Analysis

for the GMIM/AMIM/SMIM and executive leader

An online visual dashboard enabling data driven decision

Goal:

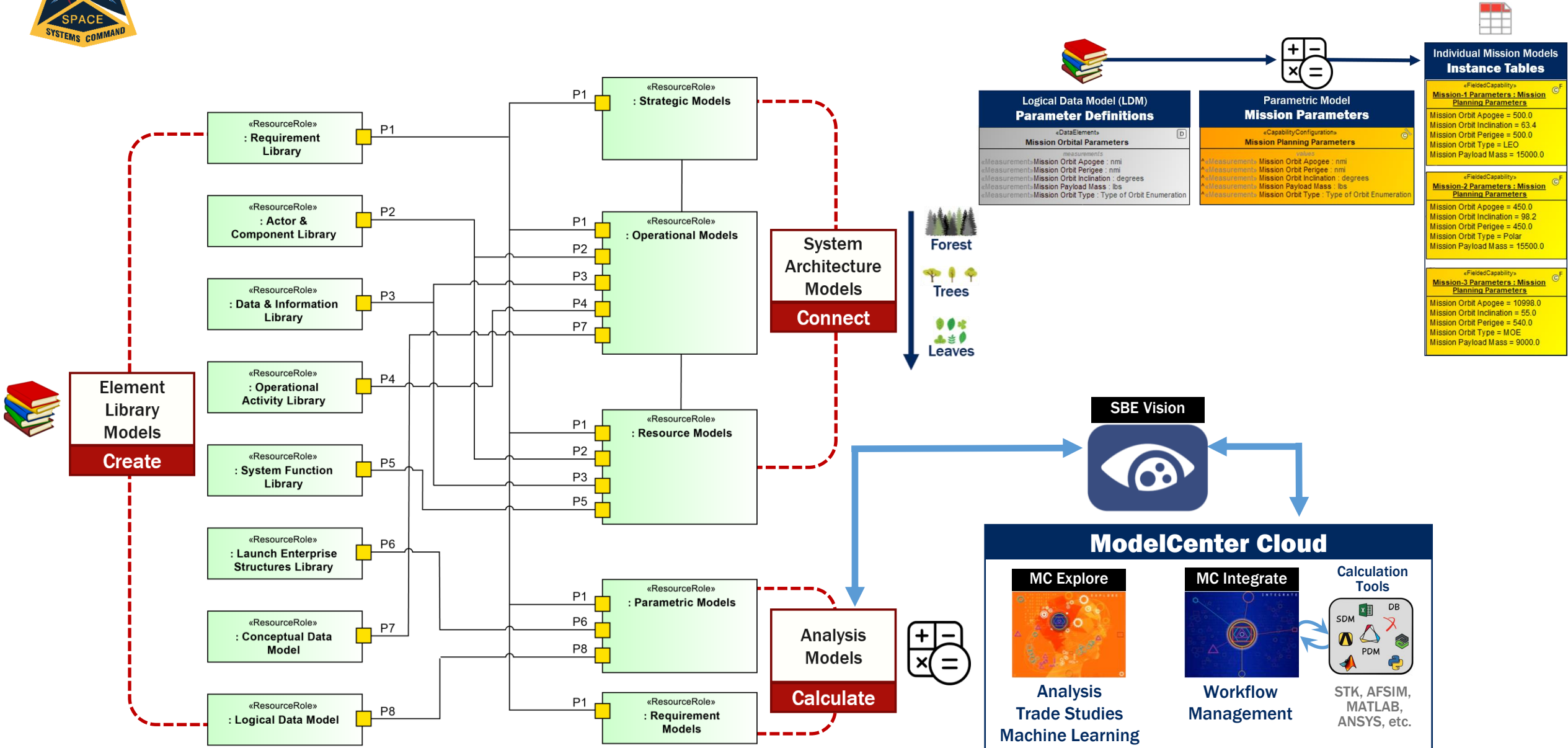
- **Enable** rapid assessment of launch vehicle and satellite compatibility
- **Reduce** the 12-month EIS process to a fraction of the time and cost
- **Eliminate** repetitive analyses and peer-to-peer data exchanges

Current Early Integration Study (EIS) Prototype:

- **Integrates** a two-way connection with the Cameo database of
 - requirements (SPRD, CPD, SIS, etc.) and
 - system reference models (LSP, SV, Ground Station, etc.)
- **Automates digital workflows** from the MIM perspective with simple parametric analyses and simulations (trajectory, loads, acoustics, etc.)



Execution Support: Automated Analysis



Logical Data Model (LDM) Parameter Definitions

«DataElement»	Mission Orbital Parameters
«Measurements»	Mission Orbit Apogee : nmi
«Measurements»	Mission Orbit Perigee : nmi
«Measurements»	Mission Orbit Inclination : degrees
«Measurements»	Mission Payload Mass : lbs
«Measurements»	Mission Orbit Type : Type of Orbit Enumeration

Parametric Model Mission Parameters

«Capability/Configurations»	Mission Planning Parameters
«Values»	Mission Orbit Apogee : nmi
«Values»	Mission Orbit Perigee : nmi
«Values»	Mission Orbit Inclination : degrees
«Values»	Mission Payload Mass : lbs
«Values»	Mission Orbit Type : Type of Orbit Enumeration

Individual Mission Models Instance Tables

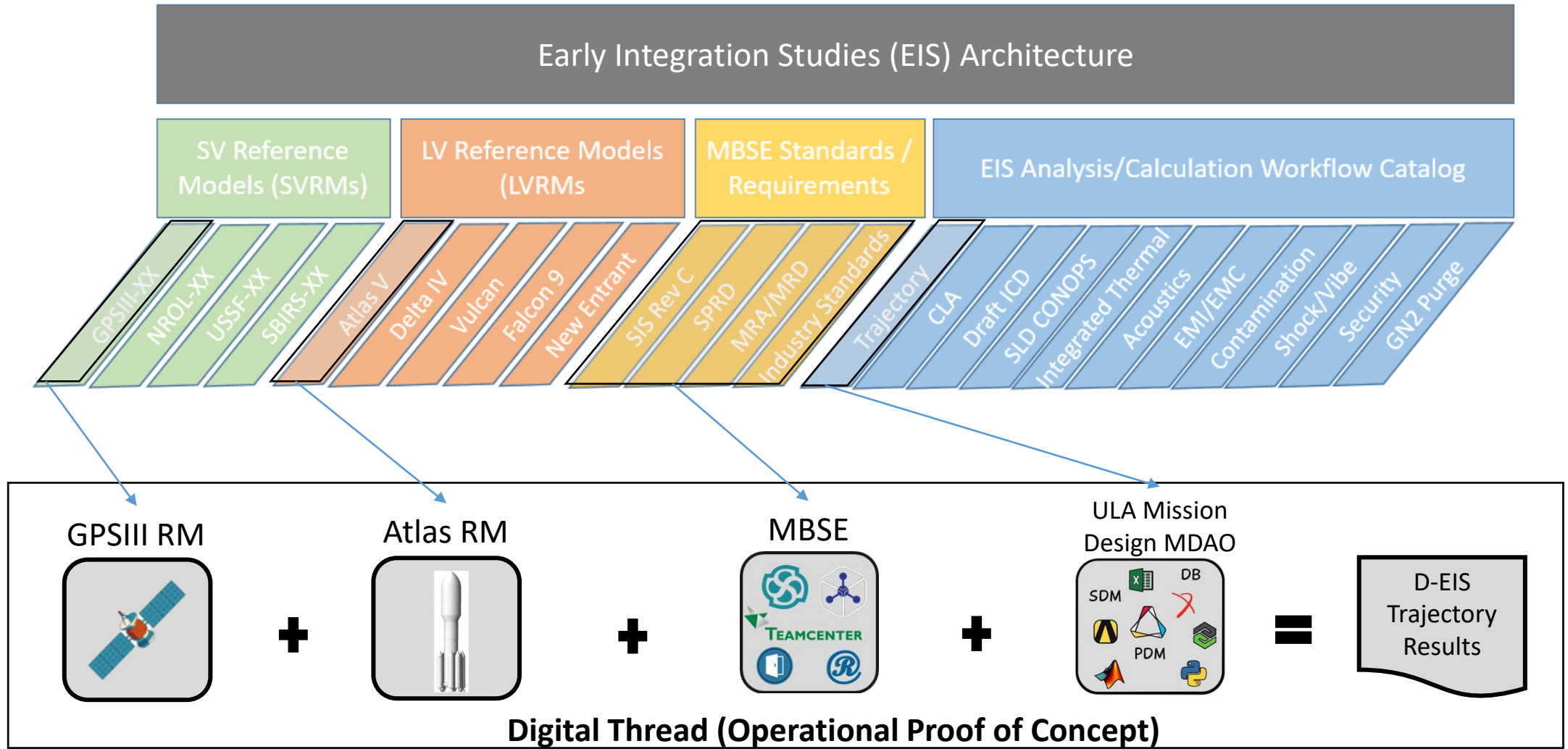
«Fields/Capability»	Mission-1 Parameters : Mission Planning Parameters
	Mission Orbit Apogee = 500.0
	Mission Orbit Inclination = 63.4
	Mission Orbit Perigee = 500.0
	Mission Orbit Type = LEO
	Mission Payload Mass = 15000.0

«Fields/Capability»	Mission-2 Parameters : Mission Planning Parameters
	Mission Orbit Apogee = 450.0
	Mission Orbit Inclination = 98.2
	Mission Orbit Perigee = 450.0
	Mission Orbit Type = Polar
	Mission Payload Mass = 15500.0

«Fields/Capability»	Mission-3 Parameters : Mission Planning Parameters
	Mission Orbit Apogee = 10998.0
	Mission Orbit Inclination = 55.0
	Mission Orbit Perigee = 540.0
	Mission Orbit Type = MOE
	Mission Payload Mass = 9000.0



Automated Analysis Use Case: EIS Prototype



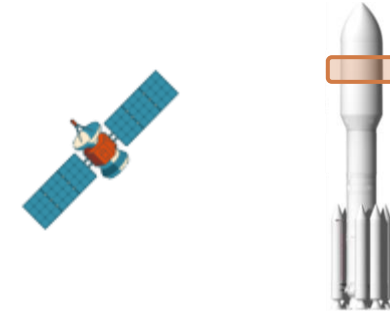
RM - Reference Model
MBSE- Model-based Systems Engineering
MDAO - Multidisciplinary Analysis and Optimization



Automated Analysis Use Case: EIS Prototype

Transition:

- complex tests → highly automated and easily repeatable workflows
- document supported → model based
- decentralized information → network centric



End state:

- uncomplicated viewable results

Results Overview			
	Loads	Acoustics	Flight Design
Mission #123. SIS Category 1, LV A:	●	●	●
Mission #122. SIS Category 2, LV A:	●	●	●

Download Results

Simple EIS <ul style="list-style-type: none">• Trajectory & Mission Design Analysis• Coupled-Loads Analysis	Standard EIS <ul style="list-style-type: none">• Draft ICD• Launch Site CONOPS
Complex EIS <ul style="list-style-type: none">• Integrated Thermal Analysis• Acoustic Analysis• EMI/EMC Analysis	<ul style="list-style-type: none">• Contamination Analysis• LV/PL Interface Analysis
Additional EIS Tasks <ul style="list-style-type: none">• Vibration/Shock Analysis• Security Analysis• GN2 Purge Analysis	Other Special Studies <ul style="list-style-type: none">• Government Reviews• Anomaly Resolution• Mission Assurance Activities



Execution Support: Data Leakage Prevention



Department of Defense (DoD)

Defense Advanced Research Project Agency (DARPA)

Space Development Agency (SDA)

Foreign Allies



Data Leakage Prevention Use Case: Web-Based Tool

The image displays two screenshots of a web-based data leakage prevention tool interface. Both screenshots show a navigation bar with 'documents' and 'text-input' tabs.

Left Screenshot (Clean Scan):
- **Input:** A text area containing 'Text for analysis'.
- **Current Template:** A dropdown menu set to 'JPL'.
- **Keywords:** A list containing 'SpaceX', 'Something', 'Test', 'Multiple Words', and 'case insensitive', with a green 'Add' button.
- **Templates:** A red 'Delete' button.
- **Scan Button:** A grey button labeled 'Scan'.
- **Result:** A large white box containing the text 'Data is clean' in blue.

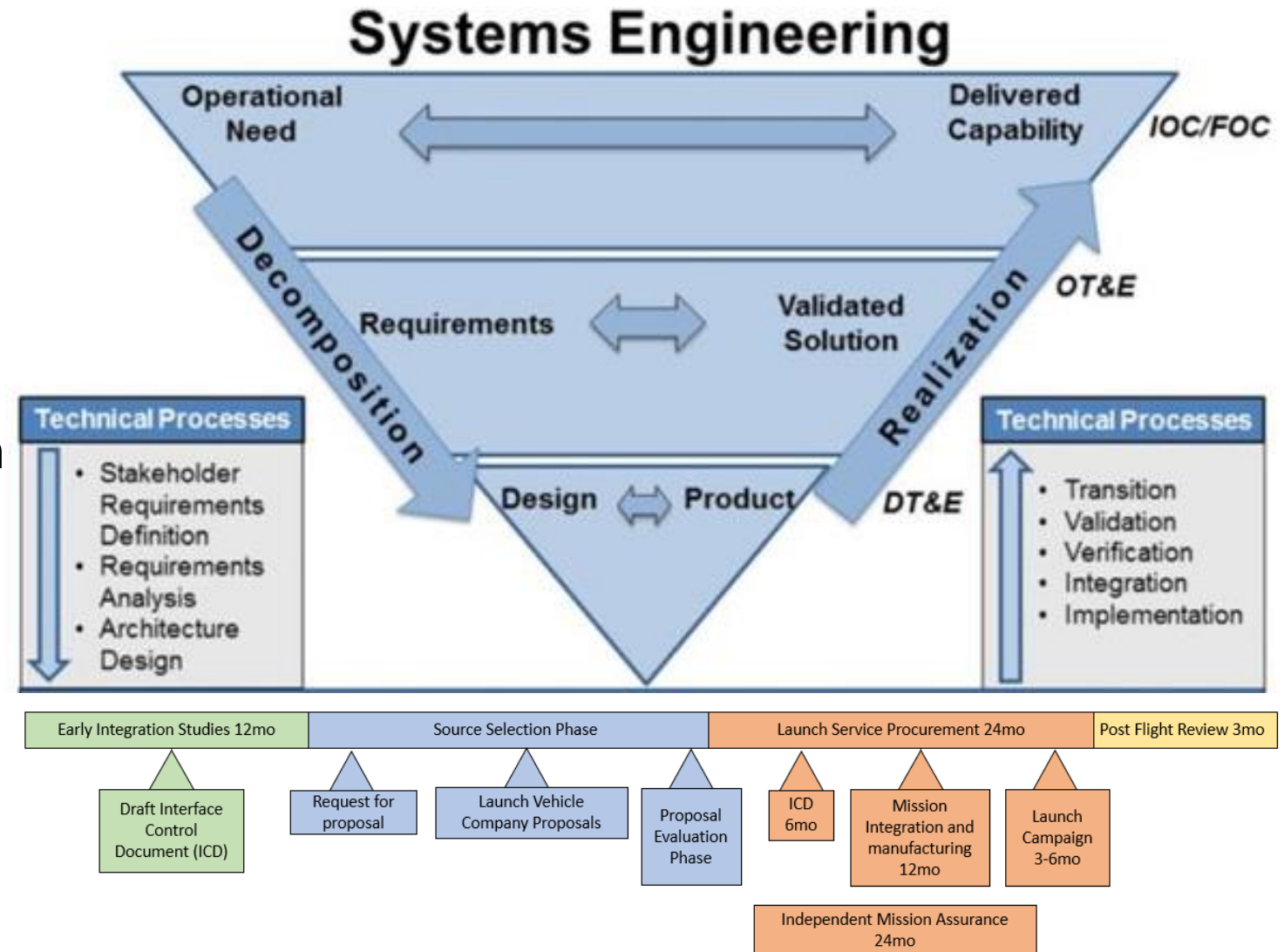
Right Screenshot (Sensitive Data Found):
- **Input:** A text area containing 'Text for analysis, test'.
- **Current Template:** A dropdown menu set to 'JPL'.
- **Keywords:** A list containing 'SpaceX', 'Something', 'Test', 'Multiple Words', and 'case insensitive', with a green 'Add' button.
- **Templates:** A red 'Delete' button.
- **Scan Button:** A grey button labeled 'Scan'.
- **Result:** A large white box with a red heading 'FOUND SENSITIVE DATA'. Below it, the word 'Test' is highlighted, followed by 'Found 1 breaches' and a 'Show Sentences' button. At the bottom, the text 'text for analysis, test' is shown with 'test' in red.

Protecting Sensitive and proprietary data is important to the program



Utilize Digital Transformation for the betterment of AATS

- Enabling the program office through MBSE and full lifecycle tool solutions
- Support pre-acquisition through development of requirements traceability and document generation
- Support execution of CDRLs, automated analysis, and data leak prevention



Builds the “foundation” for future developments

Acknowledgement



Space Force

Mr. John Wong
Maj. William Deavor
Lt. Col. Frank Clark



The Aerospace Corp

Mr. Jeerapong Wongchote



ManTech

Mr. Tyler Peterson
Mr. John Gomez
Ms. Katherine Nava