



Integrated Mission Operation Concepts for the *Dream Chaser*[®] Cargo System

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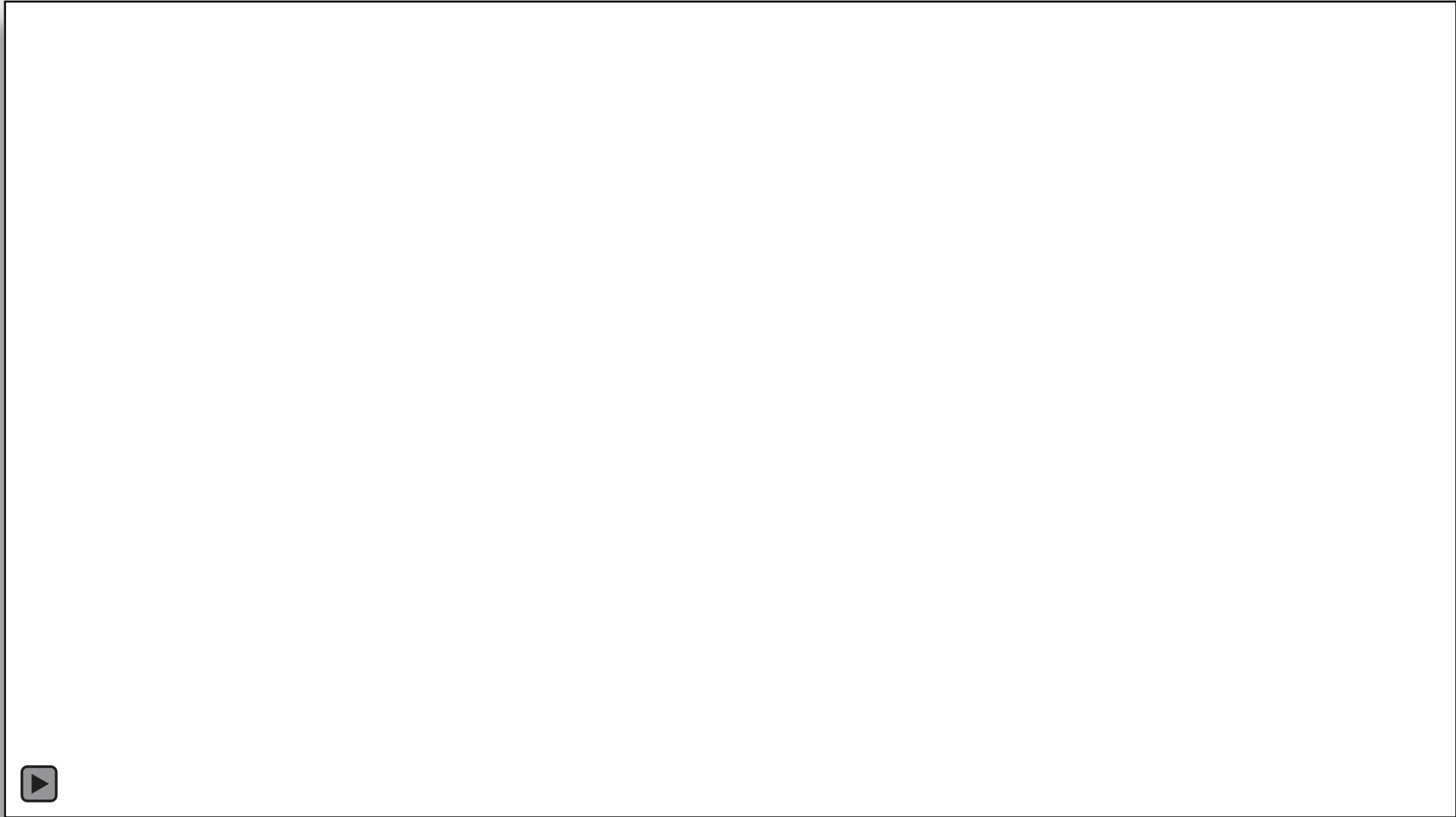
SNC[®] Dream Chaser Cargo System

Sierra Nevada Corporation's (SNC) Space Systems is leading an effort to create a low-cost space system to support the transport of cargo to and from low-Earth orbit, including the ISS. This effort called the Dream Chaser Program is focused on the development of the Dream Chaser Cargo System.

The Dream Chaser Cargo System consists of the uncrewed Dream Chaser and Cargo Module. The Dream Chaser is a reusable, autonomous, lifting-body spaceplane that launches vertically on top of a launch vehicle and lands horizontally on a conventional runway. The Cargo Module is an expendable element that attaches to the Dream Chaser to carry cargo and is jettisoned for atmospheric burnup prior to entry.

Credit: Sierra Nevada Corporation

Dream Chaser Cargo System ConOps



[Link](#)

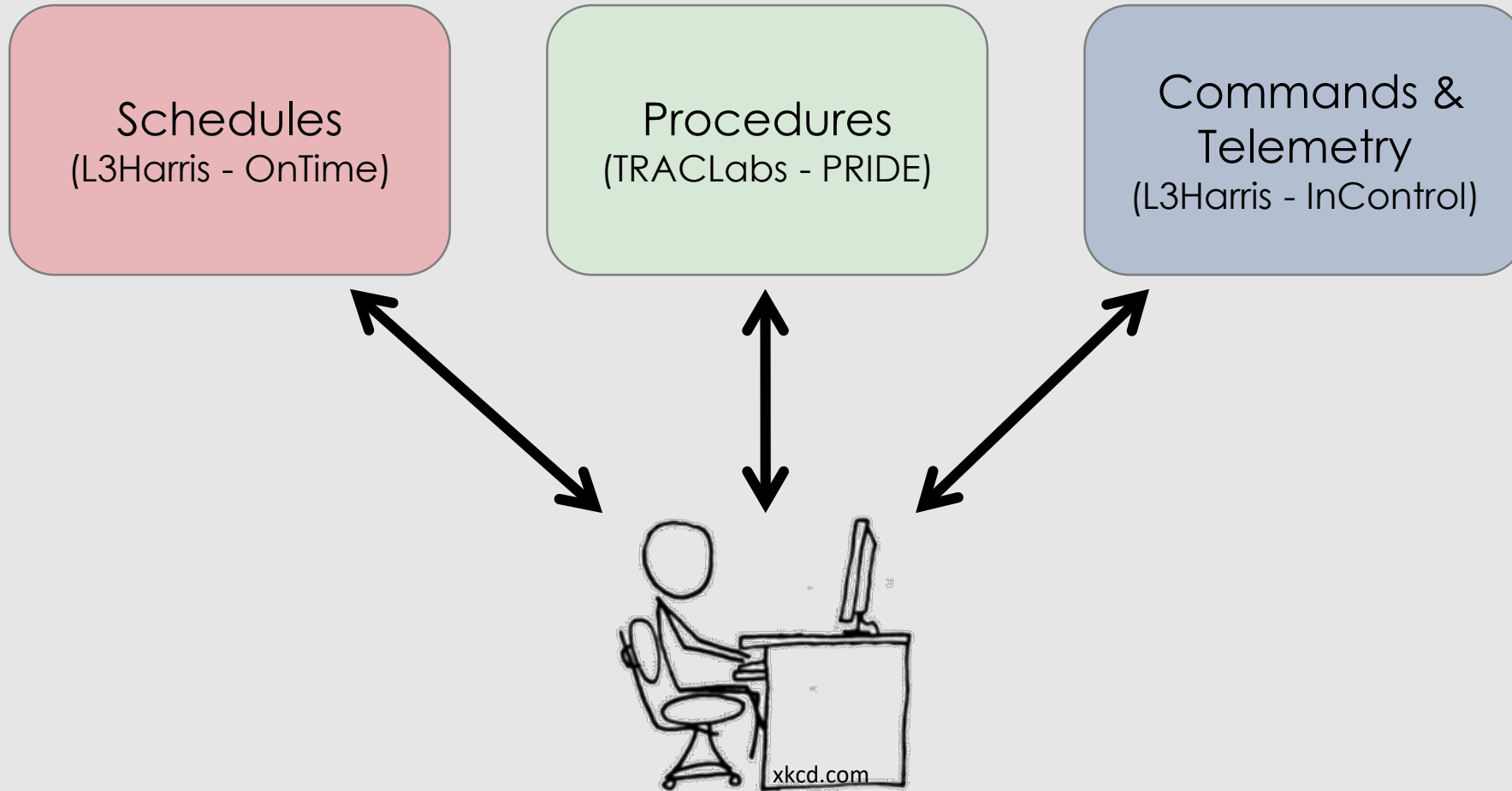


L3HARRIS™

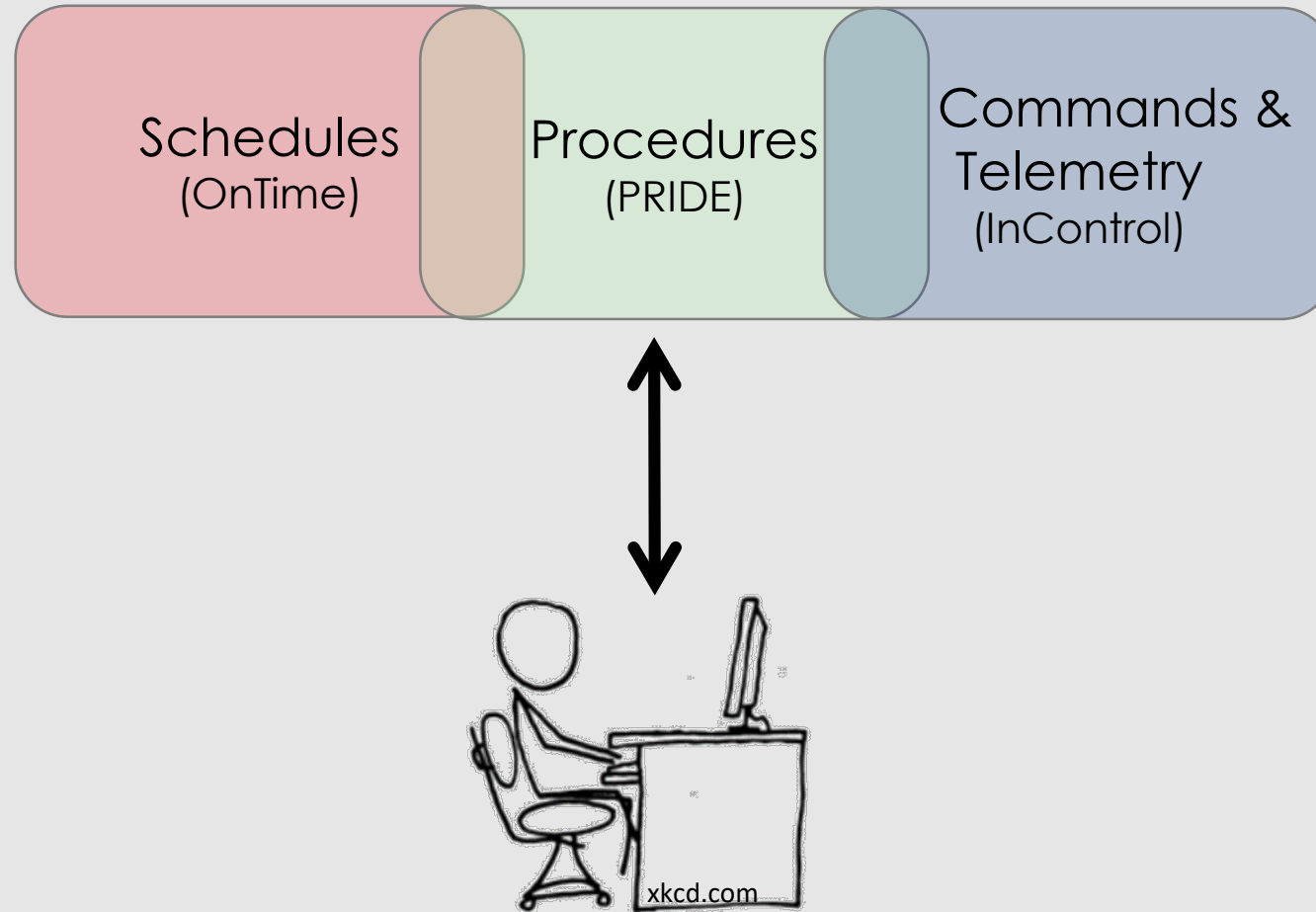


traclabs

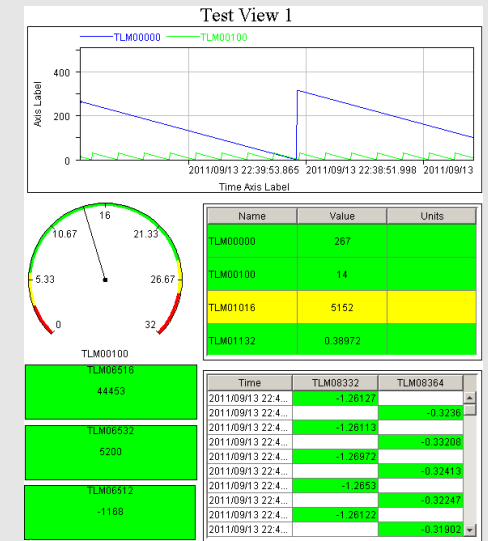
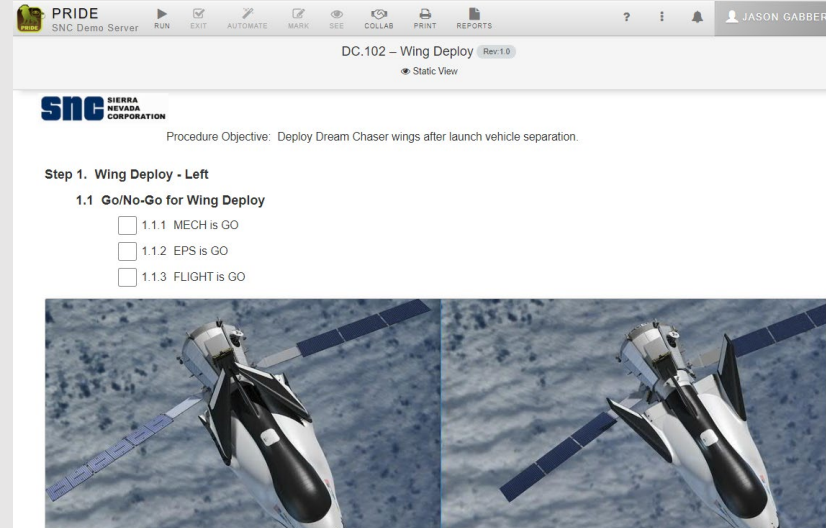
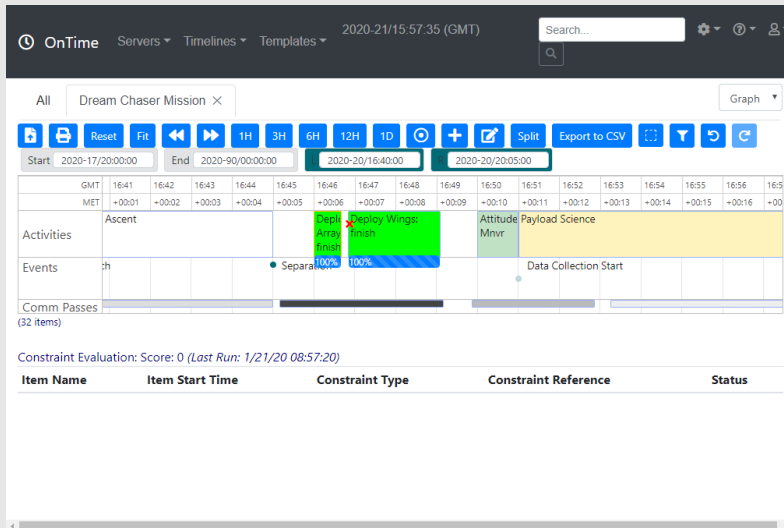
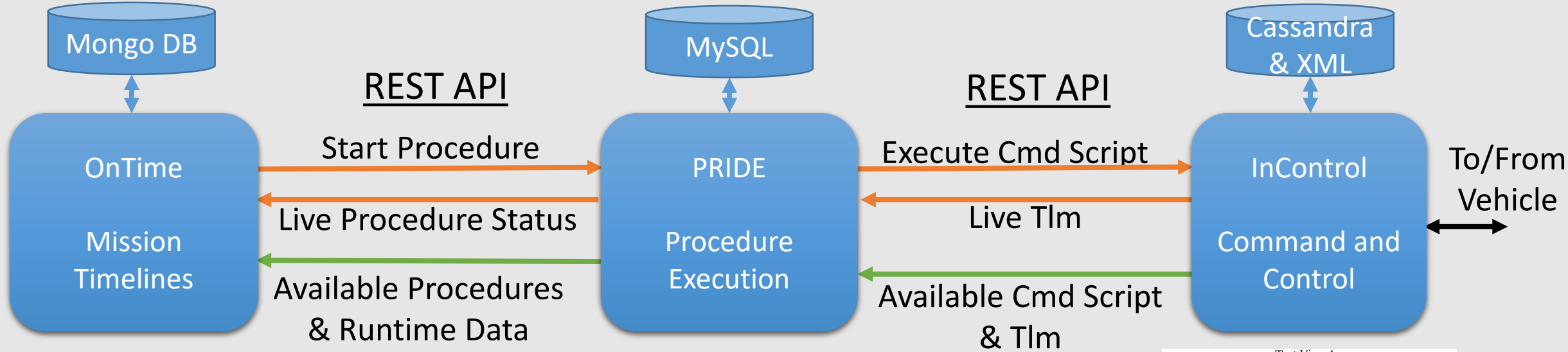
Typical Spacecraft Operations



Our Spacecraft Operations

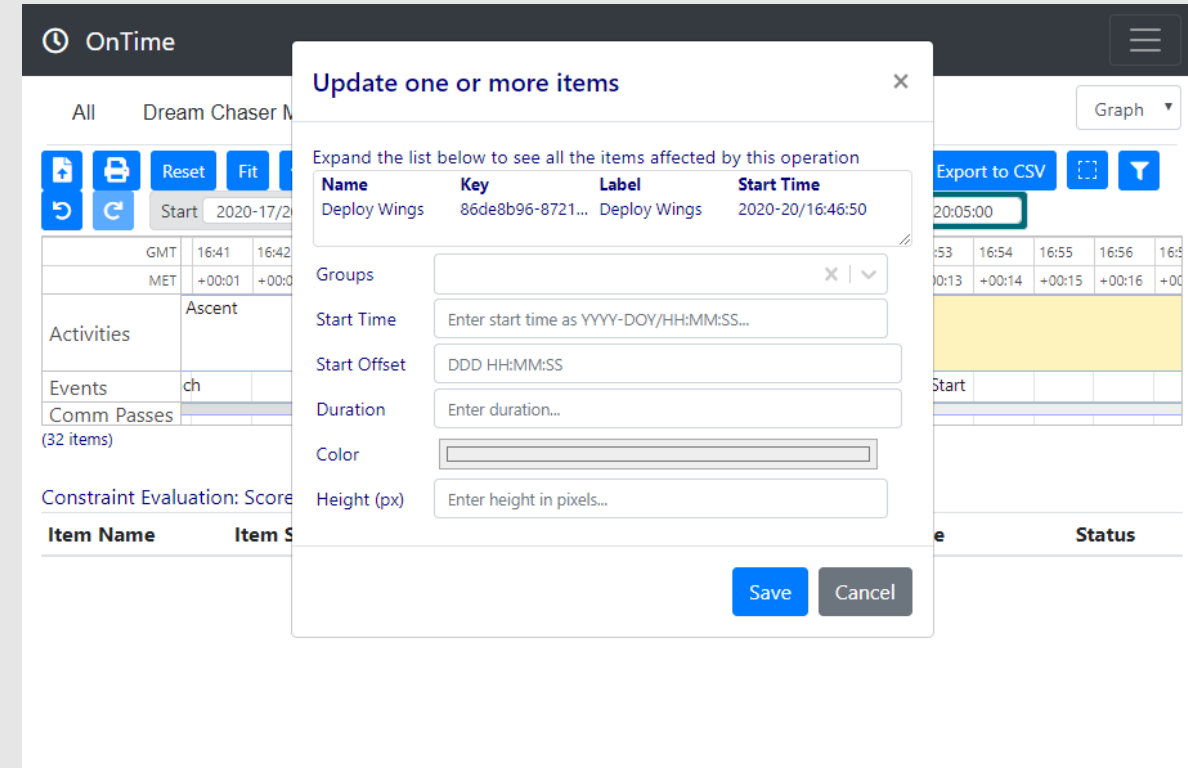


Architecture & Connectivity



Mission Planning & Scheduling with OnTime

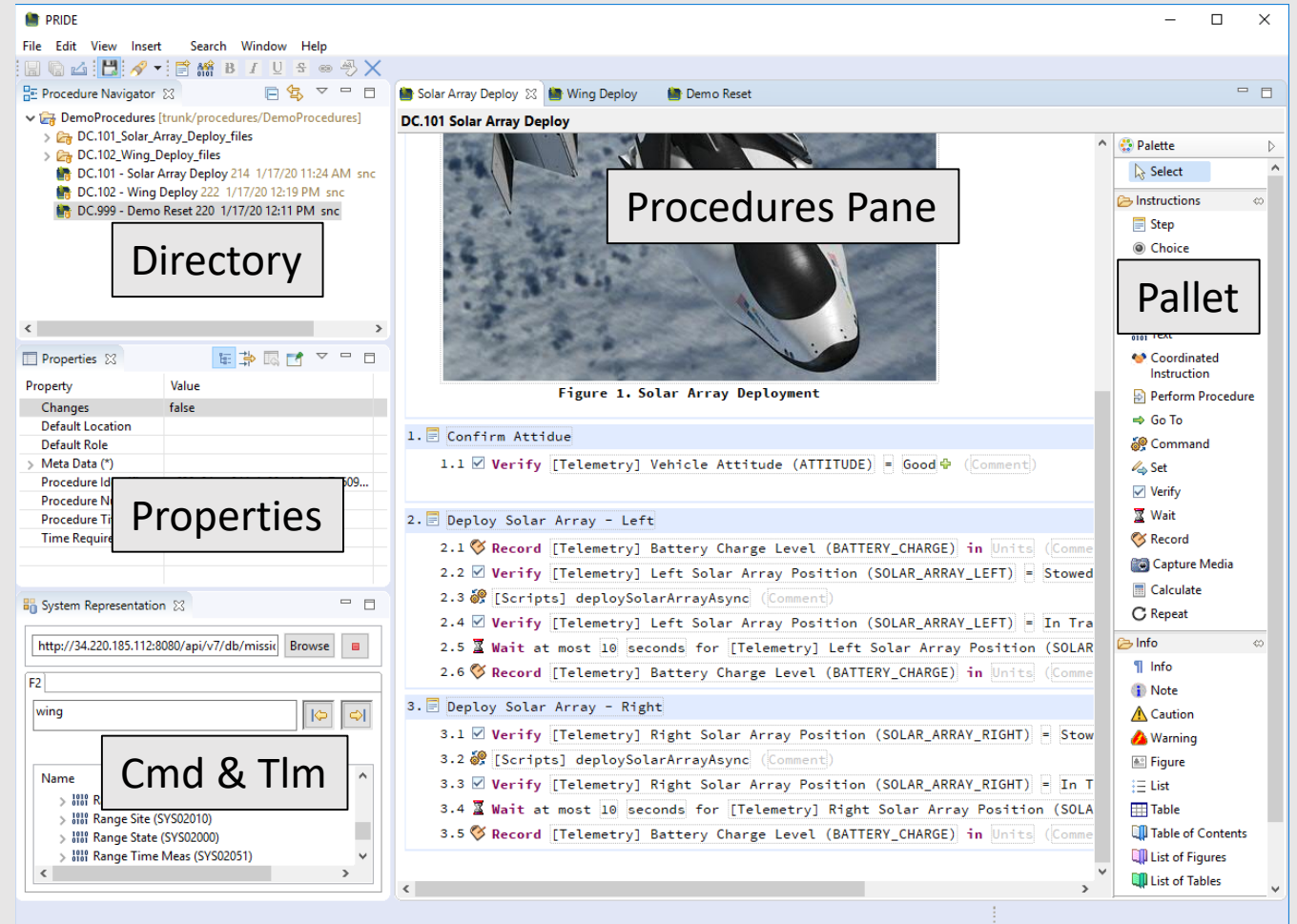
- Distributed, collaborative mission planning and scheduling
 - Cloud-native (public or on premises), Web UI and REST interfaces
 - Live concurrent editing across sites and users
 - Back-end storage is fault tolerant and distributed
- Integrated with multiple procedure execution and command and control systems
- Real-time constraint checking, conflict resolution and AI algorithms to optimize schedule allocation



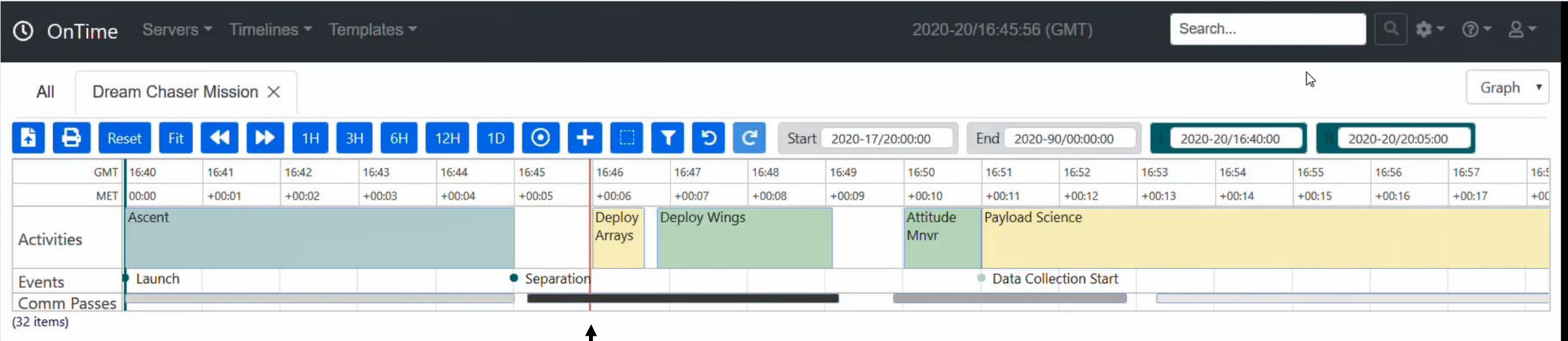
Electronic Procedures using PRIDE

- Drag-and-drop authoring
- Automatic formatting
- Server-based, collaborative procedure execution system
- Multiple operators can interact with the same procedure
- Integrated telemetry and commanding
- Back-end database stores as-run procedure data
- Automation capabilities

PRIDE Author



Demo Scenario



Current Time

Demo Scenario

	GMT	23:40	23:41	23:42	23:43	23:44	23:45	23:46	23:47	23:48	23:49	23:50	23:51	23:52	23:53	23:54	23:55	23:56
	MET	00:00	+00:01	+00:02	+00:03	+00:04	+00:05	+00:06	+00:07	+00:08	+00:09	+00:10	+00:11	+00:12	+00:13	+00:14	+00:15	+00:16
Activities	Ascent							Deploy Arrays: running	Deploy Wings			Attitude Mnvr		Payload Science				
Events	Launch						Separation						Data Collection Start					
Comm Passes																		

(32 items)

When time bar reaches an automated activity, a PRIDE procedure is started:

The screenshot displays the PRIDE SNC Demo Server interface. The top navigation bar includes icons for EXIT, AUTOMATE, MARK, SEE, COLLAB, PRINT, and REPORTS. The main header shows the procedure title "DC.101 – Solar Array Deploy" with a revision of "Rev. 1.0" and the owner "Madeline Devereaux". The SIERRA NEVADA CORPORATION logo is visible on the left. The procedure objective is stated as "Autonomously confirm spacecraft is in proper attitude and then deploy the arrays." A yellow caution banner reads "CAUTION This activity should be performed ASAP to ensure power generation." Below this, a control bar shows a "Wait 7 seconds" checkbox, a timer at "Time: 00:00:02", and play, pause, and refresh buttons. A small inset image shows a spacecraft with solar arrays deployed in space.

Demo Scenario

Procedure runs automatically, sending commands and verifying telemetry

The screenshot displays the PRIDE SNC Demo Server interface. The top navigation bar includes icons for EXIT, AUTOMATE, MARK, SEE, COLLAS, PRINT, and REPORTS, along with a user profile for MADELINE DEV... The main window title is "DC.101 – Solar Array Deploy" (Rev:1.0). Below the title, there's a "Guided View" button and the owner "Madeline Devereaux". The interface shows a sequence of steps in a deployment procedure. Steps 2.5, 2.6, 3.1, 3.2, and 3.3 are marked as completed with green checkmarks. Step 3.4 is the current step, marked with a green square and a red 'X' icon, indicating it is in progress. Step 3.5 is the upcoming step, marked with a green square. On the right side, there's a "Recorded Telemetry" section showing values for "Deployed" (90) and "Stowed" (90). Below that, a "Live Telemetry" section shows values for "In Transit" (87) and "PA" (87). The interface also includes a "Time" display (00:00:05) and a "Record" button.

Completed Steps

Current Step

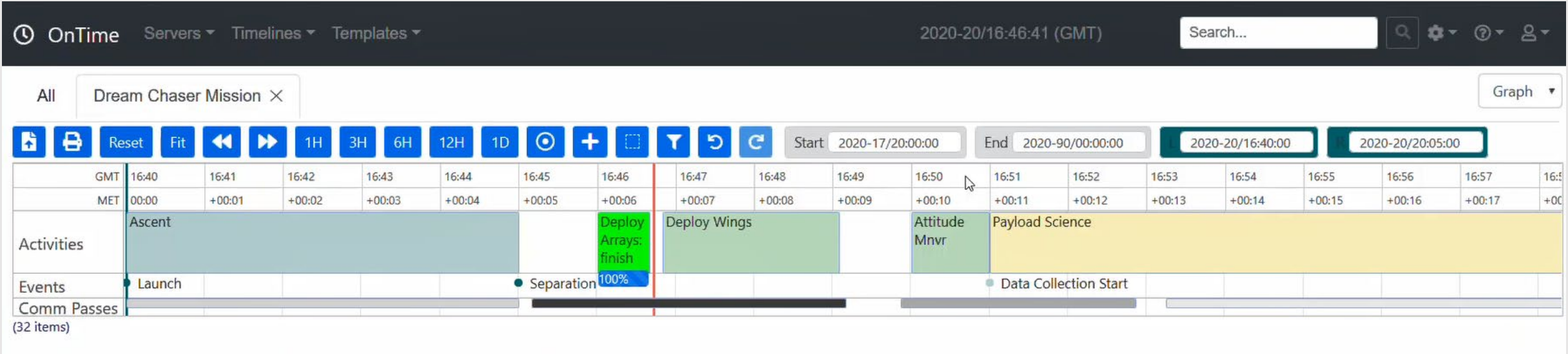
Upcoming Step

Recorded Telemetry

Live Telemetry

Demo Scenario

When procedure is complete, status updates on timeline




Demo Scenario

Procedures can also have manual steps requiring user input between automation

	GMT	23:40	23:41	23:42	23:43	23:44	23:45	23:46	23:47	23:48	23:49	23:50	23:51	23:52	23:53	23:54	23:55	23:56
	MET	00:00	+00:01	+00:02	+00:03	+00:04	+00:05	+00:06	+00:07	+00:08	+00:09	+00:10	+00:11	+00:12	+00:13	+00:14	+00:15	+00:16
Activities	Ascent							Deploy Arrays: finish	Deploy Wings: running			Attitude Mnvr	Payload Science					
Events	Launch						Separation	100%	50%					Data Collection Start				
Comm Passes																		

▼ Step 1. Wing Deploy - Left

▼ 1.1 Go/No-Go for Wing Deploy 


(Mon Jan 20 2020 08:47:03 GMT-0800 (Pacific Standard Time)) by Madeline Deveniaux

☒ 1.1.1 MECH is GO

☐ 1.1.2 EPS is GO

☐ 1.1.3 FLIGHT is GO

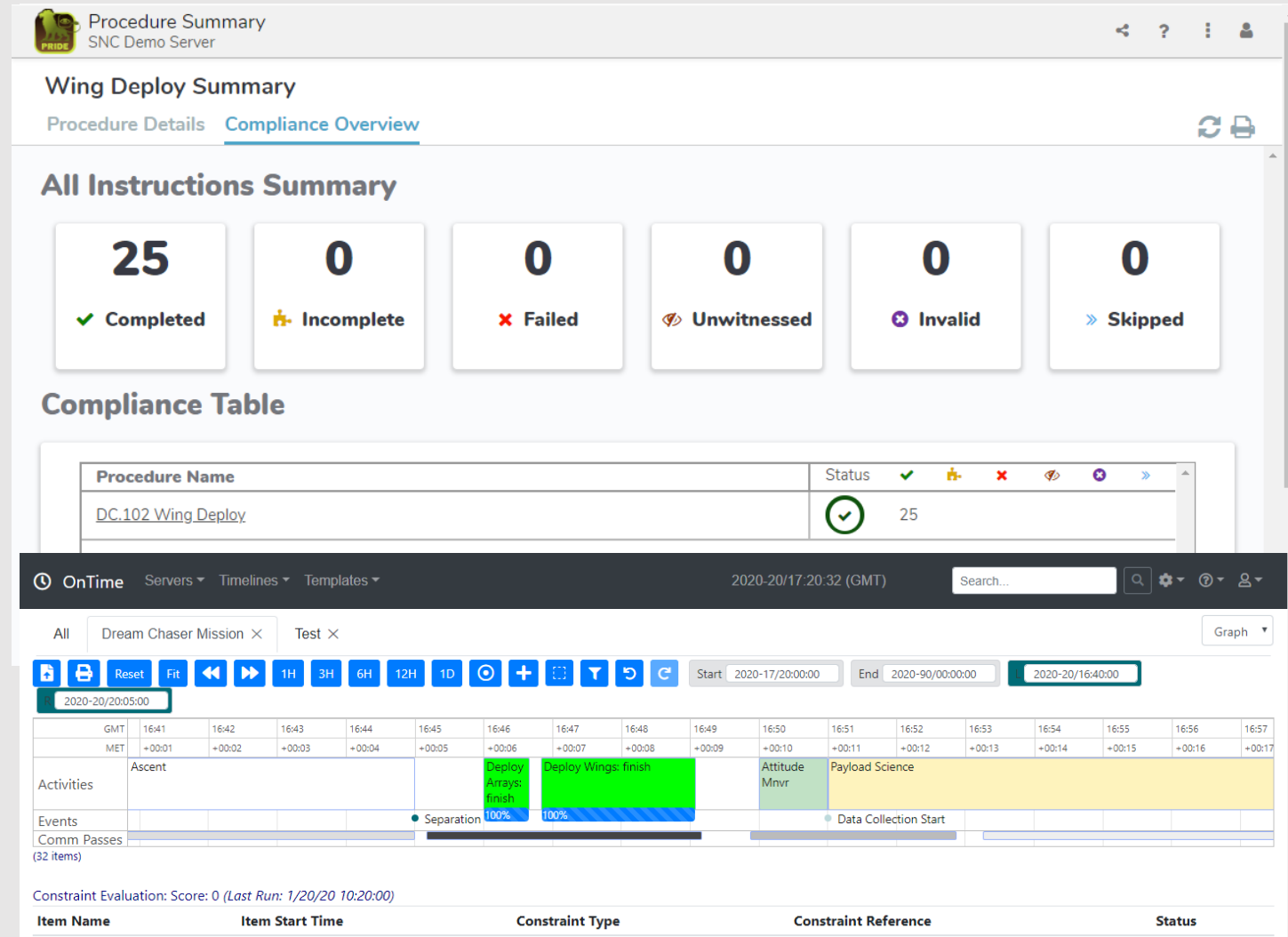
PA MD JG





Activity Analysis and Metrics

- As-run procedure database contains
 - all operator interactions
 - all telemetry used to make procedure decisions
 - timestamps for all instructions
- Machine learning algorithm estimates time-to-complete for each procedure from current instruction
- Metrics available via API for feedback into scheduling



Summary

- We have developed a seamless operator interface between the main flight execution tools featuring:
 - Automatic standards enforcement
 - Collaborative real-time execution
 - Data sharing
- Building flexibility into ground system tools through REST API enables creative integration
 - Optimizing operator actions
 - Interfacing between different providers
 - Ability to adopt evolving best practices in space systems command and control

The background of the slide is a collage of aerospace-related images. At the top center is the International Space Station. To its left is a small satellite or probe. To its right is a dark, sleek aircraft. Below the ISS is a rocket launch with a plume of fire. To the left of the launch is a small aircraft. To the right is a dark, sleek aircraft. At the bottom left is a rocket launch with a plume of fire. At the bottom right is a dark, sleek aircraft. The word "Questions" is centered in the middle of the slide in a large, white, serif font.

Questions

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