



# ***Prototype USSF Enterprise Satellite Operations***

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# ...From GSAW 2023

## Started with a Private Cloud


**RDSMO and LDPEs**

- Long Duration Propulsive ESPA (LDPE)
  - RDSMO operates multiple LDPEs with varying payloads (six available ports)
    - "[LDPEs are] an affordable path to space for both hosted and separable payloads," Space Force's Space Systems Command
  - LDPE-3a launched in January 2023
- RDSMO Ground Segment
  - LDPE manifest decisions impact ground segment
    - Highest payload classification drives the system (space and ground segment) classification
  - RDSMO created a new ground system to satisfy LDPE-3A data distribution requirements


Successfully launched and continued operations

## Announced We Were Going to a Commercial Cloud

**Nebula Project**



Nebula is a giant cloud of dust and gas in space  
- Definition from NASA

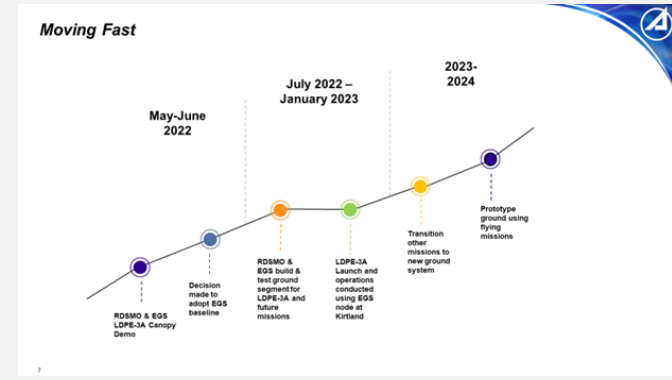


RDSMO is designing, building, and testing an off-premise, commercial cloud-based operations center for its missions  
- Not just a cloud SIL  
- Military relevant  
• Operators, Cyber, Crypto, Interfaces, ground station, contracting, ...

ATO'd Environment

Mission Unique Requirements

## Same End Goal but Different Path



Not to plan

Maintained timeline and objective

# Stronger Together



- SSC/SZI is the Innovation & Prototyping Delta for space and ground capabilities and has a legacy of on-orbit experiments and enterprise ground capability development
  - SZI is commanded by Colonel Joseph Roth
- Space RCO is the acquisition org tackling first-of operational capabilities and critical enablers that defend space assets or protect the Joint Force from adversary attacks using space.
  - R2C2 is the Combined Program Office that combined Space RCO's Ground Command Control and Communication (GC3) and SSC's Enterprise Ground Service (EGS)
  - PEO for R2C2 is Dr. Kelly Hammett at Space RCO



**AEROSPACE**

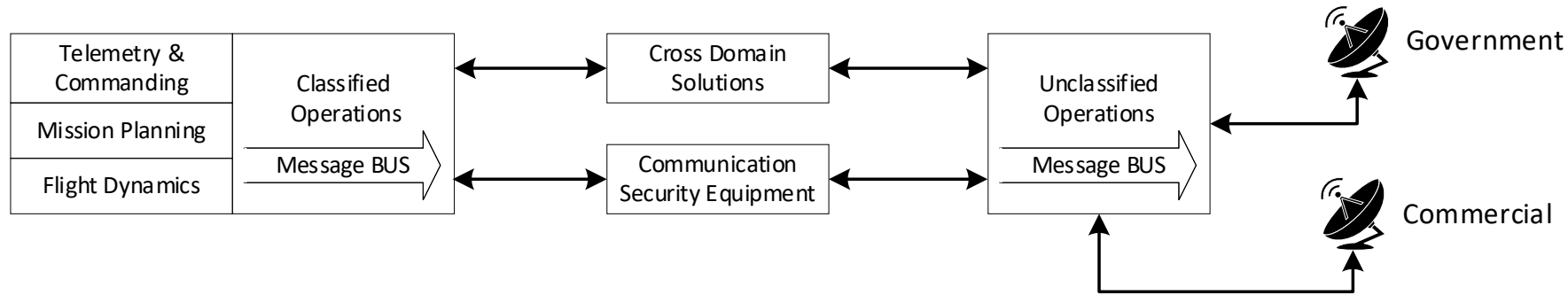
**Space Dynamics**  
LABORATORY  
Utah State University

**MITRE**

# Element Highlights



- Standardized Architecture Elements (Representative)



- Leverage the Public Cloud Infrastructure and Services

- Unclassified and Classified AWS platform to increase resilience and decrease ownership cost
- Inherited physical and infrastructure security controls, alleviating years of program work
- Secure Authority to Operate in 3 months of project start

- Leverage proven CI/CD Pipeline

- Big Bang based pipeline deployment (provides secondary inheritance of security controls)
- Focus on automated testing to increase speed and consistency of deployments (updated in days/not months)
- Proven deployment model

# Element Highlights

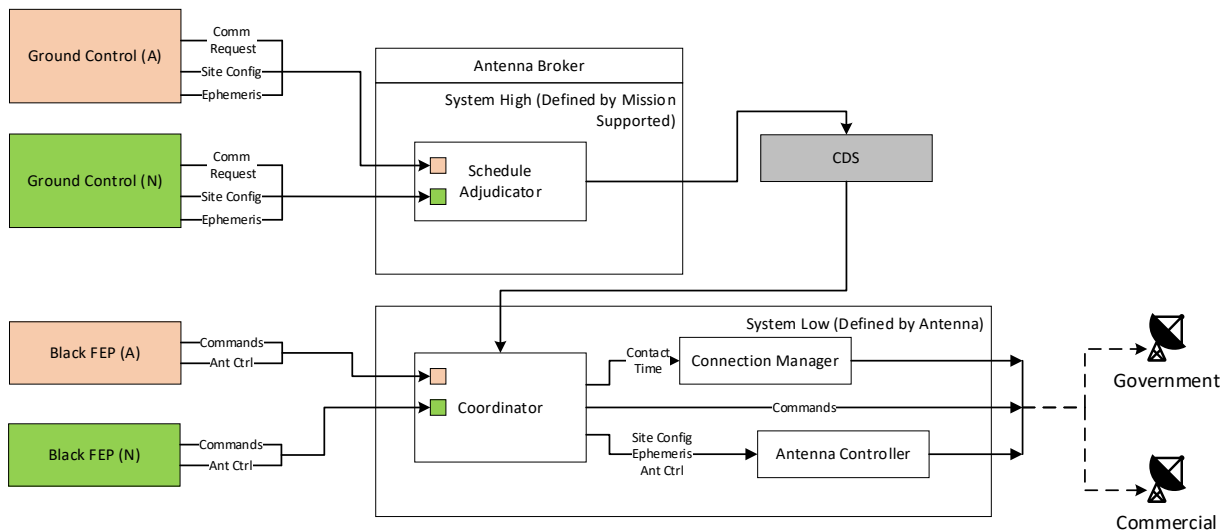


- Common Scheduler

- Single scheduler to communicate across multiple antenna networks
- Standardized interface to the Missions
- Modular design to adapt to antenna architectures

- Common Telemetry & Commanding

- Allows for standardized look and feel across multiple mission customers
- Modular design for implementation across different satellite architectures
- Scripted procedures for test and operations



The screenshot shows the OpenC3 COSMOS Enterprise Admin Console. The top bar displays the system name 'CmdTlmServer', the date '007 19:24:46 UTC', and the user 'The Operator'. The main content area shows a table of interfaces:

Name	Action	Connected	Clients	Tx Q	Rx Q	Tx bytes	Rx bytes	Cmd pkts	Tlm pkts
EXAMPLE_INT	Connect	DISCONNECTED	0	0	0	0	0	0	0
INST2_INT	Disconnect	CONNECTED	0	0	0	127	5624572	9	7281
INST_INT	Disconnect	CONNECTED	0	0	0	108	5542488	8	7085
TEMPLATED_INT	Connect	DISCONNECTED	0	0	0	0	0	0	0

Below the table, there is a Log Messages section showing various system messages:

Time	Level	Source	Message
2024-01-07 12:24:46.674	WARN	DEFAULT_DECOM_INST2	INST2_HEALTH_STATUS GROUND2STATUS = UNAVAILABLE is YELLOW (2024/01/07 19:24:46.666)
2024-01-07 12:24:46.102	INFO	DEFAULT_DECOM_INST	INST HEALTH_STATUS TEMP2 = 22.71715039062508 is GREEN (2024/01/07 19:24:46.083)
2024-01-07 12:24:45.672	INFO	DEFAULT_DECOM_INST2	cmd(INST2 COLLECT with DURATION 7')
2024-01-07 12:24:45.670	ERROR	DEFAULT_DECOM_INST2	INST2_HEALTH_STATUS TEMP1 = 82.929850000000002 is RED_HIGH (2024/01/07 19:24:45.666)
2024-01-07 12:24:45.126	WARN	DEFAULT_DECOM_INST	INST HEALTH_STATUS GROUND2STATUS = UNAVAILABLE is YELLOW (2024/01/07 19:24:45.083)
2024-01-07 12:24:43.676	ERROR	DEFAULT_DECOM_INST2	INST2_HEALTH_STATUS TEMP2 = nan is RED_LOW (2024/01/07 19:24:43.666)



# USSF ROOSTER-4 Ground Segment Progress

## MISSION

- ROOSTER-4, Rapid On-orbit Space Technology Evaluation Ring,
  - Own Power, Avionics, Propulsion
  - Maximize launch vehicle payload capacity
  - Up to 6 payloads

## WHY EVEN GO TO THE CLOUD

- DoD service ATOs are the biggest challenge
- Able to leverage the work of others
- Easily and quickly replicated

## PROGRESS

- DoD ATO'd environment at the appropriate classification
- Plug-Ins developed and validated against mission simulator
- Moving to on-orbit demonstrations

Name	Connect / Disconnect	Connected	Clients	Tx Q Size	Rx Q Size	Tx Bytes	Rx Bytes	Cmd Pkts	Tlm Pkts
LDPE3A_INT	DISCONNECT	CONNECTED	0	0	0	104	323896914	10	69976
STPSAT2_INT	CONNECT	DISCONNECTED	0	0	0	0	0	0	0

Time	Log Level	Source	Message
2024-01-09 16:38:55.518	NORMAL	DEFAULT_INTERFACE_LDPE3A_INT	LDPE3A_INT: Connection Lost
2024-01-09 16:38:55.517	NORMAL	DEFAULT_INTERFACE_LDPE3A_INT	LDPE3A_INT: Internal disconnect requested (returned nil)
2024-01-09 16:38:55.515	NORMAL	DEFAULT_INTERFACE_LDPE3A_INT	LDPE3A_INT: read_interface requested disconnect
2024-01-09 16:38:55.514	NORMAL	DEFAULT_INTERFACE_LDPE3A_INT	LDPE3A_INT: OpenC3:TcpipClientStream read returned 0 bytes (stream closed)
2024-01-09 16:38:45.514	NORMAL	DEFAULT_INTERFACE_LDPE3A_INT	LDPE3A_INT: Connection Success
2024-01-09 16:38:45.511	NORMAL	DEFAULT_INTERFACE_LDPE3A_INT	LDPE3A_INT: Connecting ...
2024-01-09 16:38:40.504	NORMAL	DEFAULT_INTERFACE_LDPE3A_INT	LDPE3A_INT: Connection Lost
2024-01-09 16:38:40.503	NORMAL	DEFAULT_INTERFACE_LDPE3A_INT	LDPE3A_INT: Internal disconnect requested (returned nil)
2024-01-09 16:38:40.502	NORMAL	DEFAULT_INTERFACE_LDPE3A_INT	LDPE3A_INT: read_interface requested disconnect
2024-01-09 16:38:40.501	NORMAL	DEFAULT_INTERFACE_LDPE3A_INT	LDPE3A_INT: OpenC3:TcpipClientStream read returned 0 bytes (stream closed)
2024-01-09 16:38:30.502	NORMAL	DEFAULT_INTERFACE_LDPE3A_INT	LDPE3A_INT: Connection Success
2024-01-09 16:38:30.499	NORMAL	DEFAULT_INTERFACE_LDPE3A_INT	LDPE3A_INT: Connecting ...
2024-01-09 16:38:25.492	NORMAL	DEFAULT_INTERFACE_LDPE3A_INT	LDPE3A_INT: Connection Lost
2024-01-09 16:38:25.491	NORMAL	DEFAULT_INTERFACE_LDPE3A_INT	LDPE3A_INT: Internal disconnect requested (returned nil)
2024-01-09 16:38:25.490	NORMAL	DEFAULT_INTERFACE_LDPE3A_INT	LDPE3A_INT: read_interface requested disconnect
2024-01-09 16:38:25.489	NORMAL	DEFAULT_INTERFACE_LDPE3A_INT	LDPE3A_INT: OpenC3:TcpipClientStream read returned 0 bytes (stream closed)

The new challenge of adapting a new C2 application was born after embracing another organization's ATO'd environment



# What have we learned and where are we going...

- What have we learned
  - Early ATO approval is a must and can either accelerate your program or hinder it
  - Avoid stovepipe solutions ensures simpler integration disparate satellite architectures
  - Demonstrations with relevant missions positively engages leadership and removes hurdles
  
- Where are we going...
  - Simulation demo will transition into full flight operations in 2024
  - Integration of other satellites into the R2C2 Ground Segment
  - Continued collaboration between SZI and R2C2 for more prototypes

# Opportunity to Collaborate



## **Aerospace SSC/SZI Support**

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## **Aerospace R2C2 Support**

Ronak Patel

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## **SSC Front Door**

<https://www.ssc.spaceforce.mil/Connect-With-Us/Space-Systems-Command-Front-Door>

## **Space RCO Front Door**

Email: [spaceRCO.Innovations@spaceforce.mil](mailto:spaceRCO.Innovations@spaceforce.mil)





***Thank you***