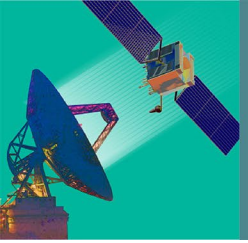
Ground System Architectures Workshop

Stronger Together: Improving Interoperability for Users and Operations

February 22–March 2, 2023 | The Aerospace Corporation | El Segundo | California

GSAW Workshop Summary

Christian Wallisch,
The Aerospace Corporation



Ground System Architectures Workshop

Recent Past and Present

- GSAW 2020 : “Opportunities in Data Exploitation”

In-person

- GSAW 2021 : “Adapting Critical Operations”
- GSAW 2022 : “Driving Innovation for Enterprise Integrations”

zoom

Virtual

- **GSAW 2023:**

GSAW 2023

“Stronger Together: Improving Interoperability for Users and Operations”

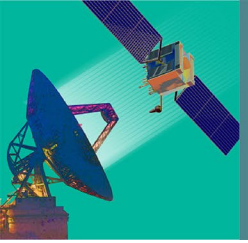
Tutorials*—February 22-23

General Session—February 27-March 2 | **Classified Session**—March 2

Location—The Aerospace Corporation | El Segundo | California

In-person / Virtual

Congrats to everyone for making GSAW 2023 a great success!!!



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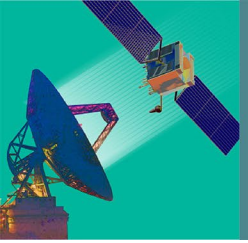
Virtual Tutorial - Summary

GSAW 2023 Kicks-off with Virtual Tutorials

- **22 Feb 2023**
  - *A. An Overview of Ground Systems for Satellite Operations*
  - *B. Agile Approaches for Ground Systems*
  - *C. Software Defined Networking Leveraging Cloud Processing for Ground Satellite Operations*
  - *D. Introduction To Satellite Communications*
  - *E. DevSecOps Concepts and Considerations for Ground Systems*
  - *F. CCSDS Course – Review of the International Standards for Space Communications*

- **23 Feb 2023**
  - *H. Six Sigma Green Belt Tutorial*
  - *I. Modeling Information with the Common Core Ontologies*
  - *J. Digital Engineering Overview*
  - *K. Cloud Native Architectures for GMSEC and EGS Microservices*
  - *L. Demystifying Machine and Deep Learning*
  - *M. Reducing the Software Risk in Space System Software*
  - *N. Model-Based Reviews for Systems*



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Metrics: GSAW 2023 by the numbers

Tutorial Participants:

- Tutorial A - 55
- Tutorial B - 22
- Tutorial C - 49
- Tutorial D - 40
- Tutorial E - 46
- Tutorial F - 23
- Tutorial G cancelled
- Tutorial H - 17
- Tutorial I - 19
- Tutorial J - 51
- Tutorial K - 41
- Tutorial L - 20
- Tutorial M - 31
- Tutorial N - 26
- Total # of Tutorial Attendees: 440*

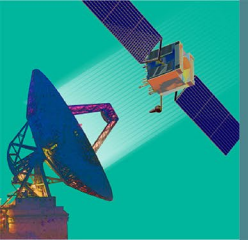
Working Groups

Working Group A	*44 in person / 31 virtual*
Working Group B	*54 in person / 53 virtual*
Working Group C	*30 in person / 10 virtual*
Working Group D	*43 in person / 18 virtual*
Working Group E	*40 in person / 36 virtual*
Working Group F	*36 in person / 53 virtual*
	41 in person / 33 virtual (ave)

Total # Working Group: 345 in person/201 virtual*

Breakdown of on-site vs virtual: Onsite 231/Virtual197

Number of international attendees: 9 in person/Total: 43



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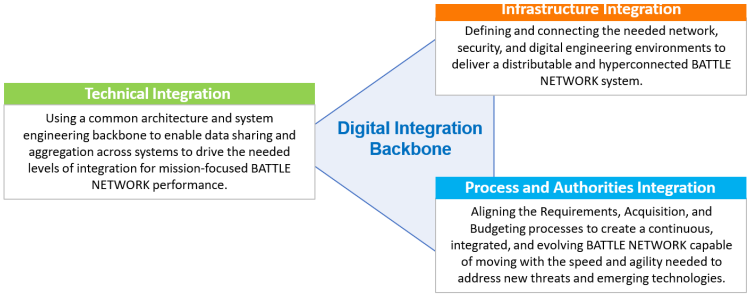
Keynote Summary : Gen Cropsey

- Blue Printing an architecture for System of Systems Capabilities
  - *System of Systems Integration vs Platform Integration*

- Digital Integration Backbone
  - *Technology*
  - *Infrastructure*
  - *Process & Authorities*



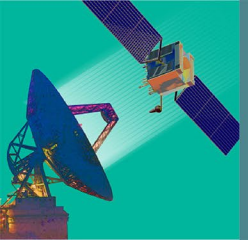
A comprehensive strategy to address three distinct, but interdependent, integration challenges

- Digital Engineering (DE) Environment
  - *PowerPoint doesn't work anymore*

- "Manage Capabilities with a ruthless focus on specific operational outcomes"

- "***A Complex system that works*** in invariably found to have **Evolved** from a ***simple system that worked***" John Gall

"Own The Data"



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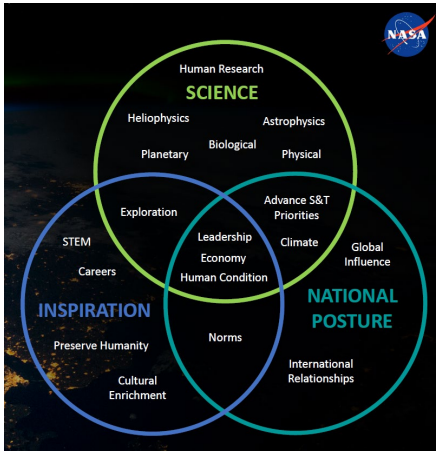
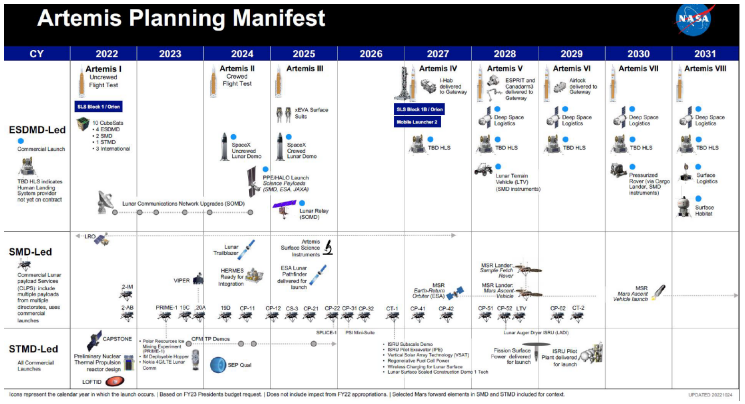
Keynote Summary : AC Charania

- **Artemis Concept of Operations**
- **HLS / LTV Detailed Descriptions**
- **Space Technology Portfolio**
  - *Early-Stage Innovation and Partnerships*
  - *SBIR/STTR Programs*
  - *Technology Maturation*
  - *Technology Demonstration*
- **Detailed Artemis Planning Manifest (Artemis I, II, and III)**
- **Enabling Technologies for Future Science & Exploration Missions**





"Ensuring American Global Leadership in Space Technology"

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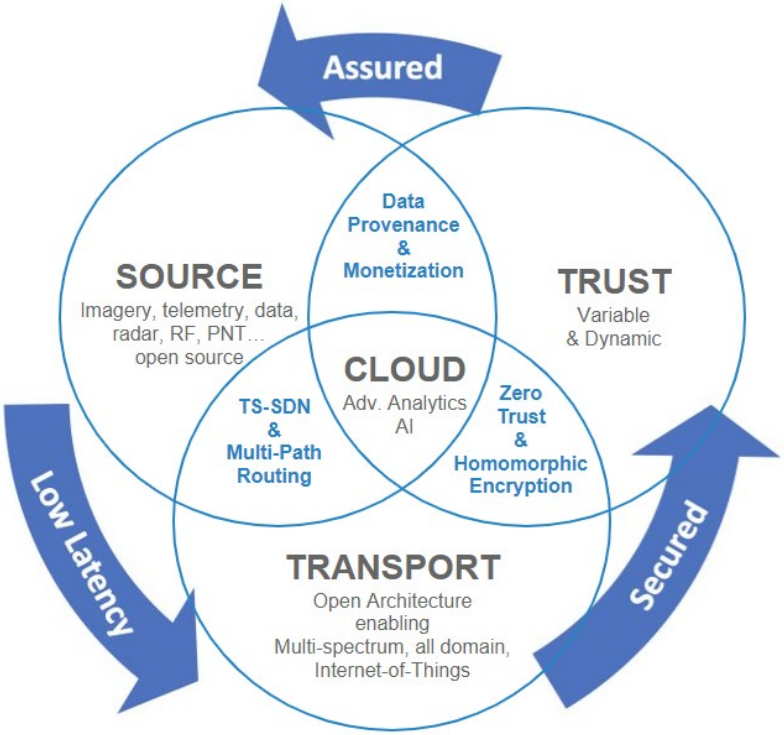
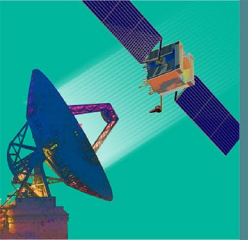
Keynote Summary : Steve Kitay

- **Satellite Direct to Cloud**
- **Hybrid Space Network Architecture**



"Strength will come from our ability to move a hybrid space architecture from proof of concepts to a scaled, global capability"



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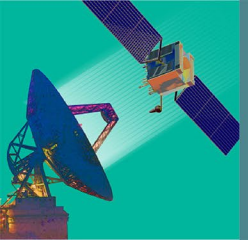
Highlights from Plenary Sessions

- **NOAA EGS:** Impact of future disaggregation causing a **significant load** Ground Systems. Baseline support requirements above the Ops O & M Budget (2035)
- **Spatiam:** Delay And Disruption Tolerant Networking **(DTN)**
- **Airbus: Domino-X** Project **10 partners** benefitting from massive innovation from New Space

- **OHB Digital:** High Availability Architecture with redundant components & paths
- **PULP** **U**nified **L**ayer **P**ackage: Focus on Mission Support vs Building Mission Control Center

- **USSF Satellite Control Network (SCN) :** Breaking the Malthusian Paradigm
- **ESA and CNES:** What's new at the Guiana Space Centre in French Guiana
- **Sandia National Laboratories:** A Decision support prototype based upon an Artificial Intelligence (AI) agent

- **ESA:** New Generation Control Systems – **Lessons Learned & Recipe For Success**



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Highlights from Plenary Sessions

- **SCOPE:** System-of-Systems, Capabilities, Operations, Programs, and Enterprises (SCOPE) "Model"
- **Navigating the standards process** : The Right People in The Right Roles

- **MARS 2020 JPL:** Science Intent Capture Architecture
- **JHU/APL New Horizons**: Why GS Freezes Can Have a Large Impact
- **JPL:** Command Encryption & Key management
- **KSAT:** Cloud-Based Digital Signal Processing
- **OpenC3:** Scaling a C2 System to Hundreds of Satellites
- **RDSMO Mission**: Innovate, Prototype, Sustain and Evaluate USSF GS systems

- **Aerospace:** Verification & Validation of A Cognitive Adaptive Systems
- **Aerospace:** Selected Technologies for Machine Learning at the Edge
- **NASA GRC:** Cognitive Systems for Integration of Commercial Gateways

- **Deloitte:** Model-Based Technical Reviews for Future Systems
- **Aerospace:** MBSE;
- **Parsons:** Space Observe, Orient, Decide, Act Loop
- **Boeing:** GPS-IIF Sustainment

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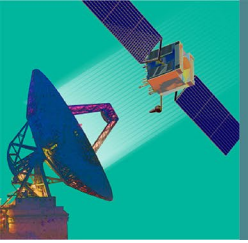
Another way of looking at it…. The Word cloud

Plenary sessions word cloud



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Highlights from Technical Exhibits

Huge Thanks to All of the GSAW Technical Exhibitors!!!!

APL
JOHNS HOPKINS
APPLIED PHYSICS LABORATORY

BLUEHALO

KRATOS
READY FOR WHAT'S NEXT™

ASRC

OPENC3

Interstel
Technologies, Inc.

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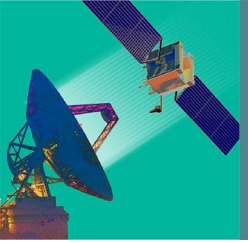
INNOVATING SOLUTIONS

ORACLE

Rocket
Communications



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Conclusion

Thanks to everyone who attended GSAW, virtually or in-person, presenting or attending

- Tutorials
- Working Groups
- Plenary Sessions
- Technical Exhibits
- Keynote Speakers

See You Next Year!!