



The poster features a dark blue background with a glowing satellite in the upper center and a space shuttle in the lower left. The shuttle is shown in profile, flying towards the right. The satellite is a small, rectangular object with solar panels extended. The background is filled with a network of white lines representing orbital paths and a bright, glowing sphere representing Earth. The text is in white and yellow, providing details about the workshop's dates, locations, agenda, and objectives.

SPACECRAFT ANOMALIES & FAILURES WORKSHOP
"Creating a Community Solution for Anomaly Attribution"

Co-Sponsored by NRO and NASA
MARCH 29-30, 2023

Locations:
DAY 1 (UNCLASSIFIED): NASA Goddard Space Flight Center
DAY 2 (CLASSIFIED): NRO HQ Westfields

Presentations run from 9:00 AM to 4:00 PM EDT.
Check-In begins at 8:00 AM

AGENDA TOPICS:

- Spacecraft Anomalies, Failures, and Operations.
- Space Environmental Effects and Debris.
- Anomaly Recovery Operations and Anomaly Investigations.

OBJECTIVES:

- Review & share lessons learned from spacecraft anomalies & failures.
- Improve tradecraft for anomaly attribution & root cause determination.
- Reinforce relationships in the Space Community that do not regularly interact.

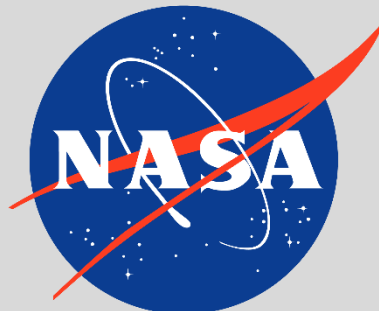
NRO POC: Dong Ryu, ryudong@nro.mil, 703-460-3697
NASA POC: Joseph Minow, joseph.minow@nasa.gov, 256-544-2850

Spacecraft Anomalies and Failures 2023 Workshop: Post-workshop Summary

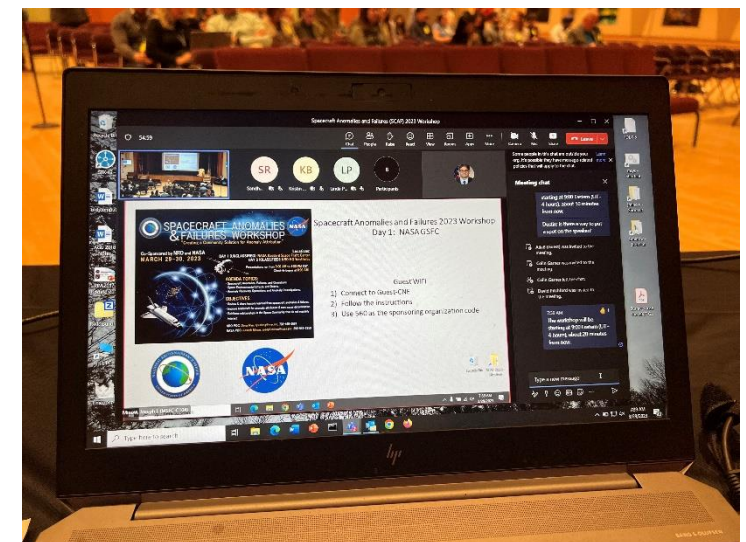
Dong Ryu/NRO and Joseph Minow/NASA

***NASA/NRO Working Group Meeting
28 April 2023, virtual***

ryudong@nro.mil
joseph.minow@nasa.gov



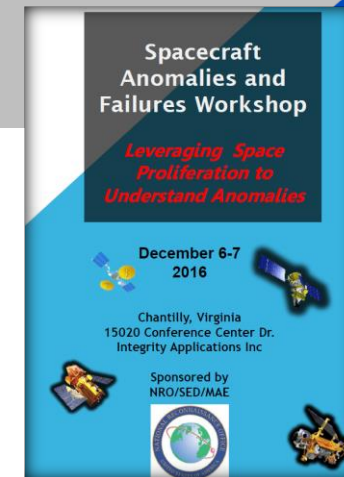
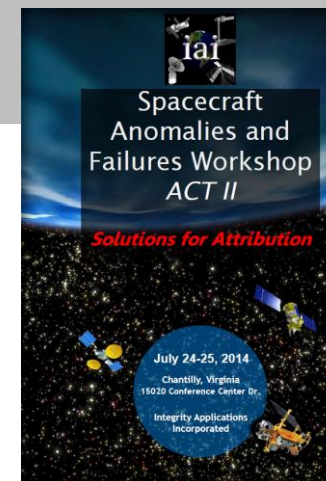
- **SCAF is an annual event organized by NRO and NASA focused on:**
 - Improvements in space system anomaly and failure identification and attribution
 - Refinement and document of best practices for root cause determination
 - Sharing of anomaly identification and reporting methodologies used by civil and military space agencies
- **Workshop content includes:**
 - Space environment interactions with space systems (e.g., ionizing radiation, spacecraft charging, meteoroid and orbital debris impacts, atomic oxygen, and other environments and effects)
 - Workmanship issues and hardware deployment failures
 - Design flaws and hardware qualification procedure failures
 - Operational procedures for identifying and mitigating on-orbit anomalies
- **Workshop goal** is to bring together civil and military government, industry, and academia personnel who do not regularly interact with common interests in space system anomalies and failures including flight and ground system operators, space environment experts, spacecraft designers and operators, and mission assurance professionals
- **SCAF 2023 was held 29-30 March 2023 in the Washington DC metropolitan area:**
 - **Day 1 (unclassified)** sessions hosted by NASA at Goddard Space Flight Center in Greenbelt, MD using a hybrid in-person and virtual option for remote participants. Participation was open to a public audience due to the hybrid option
 - **Day 2 (classified)** sessions hosted by NRO at NRO Headquarters, Westfields in Chantilly, VA using a hybrid in-person and virtual option for remote participants





SCAF Workshop History

- SCAF 2023 is the 10th in the SCAF workshop series that started in 2013
- Dr. Darren McKnight, Technical Director, Integrity Applications Incorporated (IAI) developed the original SCAF Workshop concept as an IAI organized event in 2013
- Workshops organized as annual event starting in 2013 through 2022 (no workshop in 2020) using a two-day format with invited presentations:
 - Day 1 unclassified sessions
 - Day 2 classified sessions
- NRO sponsorship of SCAF started with the 2016 workshop and NASA was included as a co-sponsor beginning in 2018 with Dr. McKnight/IAI and NRO continuing to serve as the primary organizer for the workshop
- In addition to the domestic SCAF workshops, Dr. McKnight organized an international Spacecraft Environmental Anomalies and Failures (SEAF) Workshop held in Toulouse, France in 2017 and Los Angeles, CA in 2019
- NASA and NRO took over as the co-organizers in 2021 with NASA organizing and hosting Day 1 (unclassified) presentations with NRO continuing to organize the Day 2 (classified) workshop





Day 1

- NASA Goddard Space Flight Center, Greenbelt, MD
- Registered participants: 227
 - In-person 153
 - Virtual 74

SCAF Day 1 Registrations

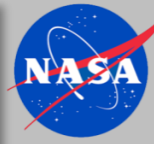
Affiliation	SCAF 2021	SCAF 2022	SCAF 2023
DoD*	29	13	38
NASA	18	29	70
Other govt	1	9	5
Industry	94	136	103
Academia	2	46	9
Other	5	33	2
Total	149	266	227

*NRO, USAF, USSF, and other



SPACECRAFT ANOMALIES & FAILURES WORKSHOP

"Creating a Community Solution for Anomaly Attribution"

[Note: Times are US Eastern Daylight Time, UTC – 4 hours]

Wednesday, 29 March 2023
Unclassified Day, NASA GSFC and Virtual

08:00 – 09:00	Check-in	
09:00	GSFC Welcome	Antti Pulkkinen NASA GSFC
09:00 – 09:30	NASA SCAF 2023 Welcome and Introductory Comments	Joseph Minow NASA MSFC
09:30 – 10:00	Double Asteroid Redirection Test (DART) Lessons Learned	Elena Adams Applied Physics Laboratory Johns Hopkins University
10:00 – 10:30	Investigation of Shuttle and Orion Reentry Temperature Anomalies	Mike Squire NASA LaRC
10:30 – 11:00	Break	
11:00 – 11:30	JWST Meteoroid Impacts	Mike Menzel NASA GSFC
11:30 – 12:00	Risks from Decreasing Ground Support for Human Spaceflight Missions Beyond Low Earth Orbit	Alonso Vera NASA ARC
12:00 – 12:30	~~Space Environments – an Ops Perspective~~ Cancelled	Chris Kilzer The Aerospace Corporation
12:30 – 13:30	Lunch Break	
13:30 – 14:00	Moon to Mars Space Weather Analysis Office Anomaly Support	Yari Collado-Vega NASA GSFC
14:00 – 14:30	Long-term Environmental Anomaly Forecast (LEAF) Tool	T.P. O'Brien, Alex Boyd The Aerospace Corporation
14:30 – 15:00	Models and Applications for Assessing Space Weather Hazards from Earth to the Moon	Janet Green Space Hazards Applications, LLC
15:00 – 15:30	Break	
15:30 – 16:00	NASA Small Spacecraft Anomaly Reporting Process: Overview and Next Steps	Craig Burkhard NASA ARC
16:00 – 16:30	Closing Remarks	Joseph Minow NASA MSFC



Day 2

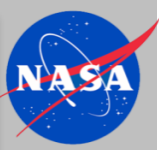
- NRO Headquarters, Westfields, Chantilly, VA
- Registered participants: 280-300
 - In-person 90 - 110
 - Virtual 196



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Thursday, 30 March 2023
Clearance Required, NRO HQ Westfields and Virtual

08:00 – 09:00	Check-in (JD Hill Atrium)	
09:00 – 09:10	Introductions – Administrative	Dong Ryu NRO
09:10 – 09:15	Introductions – Welcome	Darwyn Banks NRO
09:15 – 09:45	Uncontrolled Reentries of the CZ-5B Core Stages	Ted Muelhaupt The Aerospace Corporation
09:45 – 10:15	Diagnosis of Internal Charging with Van Allen Probes	Mike Kelly Applied Physics Laboratory Johns Hopkins University
10:15 – 10:30	Break	
10:30 – 11:00	Space Safety Institute	Josef Koller The Aerospace Corporation
11:00 – 11:30	SCP Toggle Due to Asynchronous Process at RTI Rollover	Doug Blackmer Boeing
11:30 – 12:30	Lunch Break	
12:30 – 01:00	Anomaly Resolution	Ray Martin, Brittney Riley NRO
01:00 – 01:30	Platform Disturbance Anomaly	Alicia Woods NRO
01:30 – 01:45	Break	
01:45 – 02:15	Space Risk Update	Chris Kunstadter AXA XL
02:15 – 02:45	Ongoing NRO Satellite Anomaly	Michael Braun NRO
02:45 – 03:00	Break	
03:00 – 03:30	NRO Satellite Program Anomaly	Megan Frechette NRO
03:30 – 04:00	ADF-SW Collection Managers' Brief	Sarah Cameli, Dana Wojculewicz NRO
04:00 – 04:05	Closing Remarks	Dong Ryu NRO



- **Participant feedback from post-workshop surveys:**
 - Day 2 survey:
 - Sustains:
 - Satellite case studies
 - Opportunity to collaborate and network
 - Improves:
 - More focus on case studies and recent satellite anomalies
 - Day 1 survey (in progress)
- **Workshop presentations will be posted to a public website** (pending speaker approval)
 - We will post information at the NASA Applied Space Environments (NASE) site and e-mail the link to workshop participants when ready:
 - NASE: <https://www.nasa.gov/nase>
 - SCAF 2023 site: <https://www.nasa.gov/nase/conferences/SCAF2023>
 - Still working to confirm approval for a couple of presentations
- **SCAF 2024 planning:**
 - Watch for announcements
 - SCAF 2024 should be about the same time of the year (TBD)
 - Let us know if you are interested in giving a presentation





The poster features a dark blue background with a glowing satellite in the upper center and a space shuttle in the lower left. The shuttle is shown in profile, flying towards the right. The background also includes a stylized representation of Earth's orbit with glowing points. The title 'SPACECRAFT ANOMALIES & FAILURES WORKSHOP' is prominently displayed at the top in a large, white, serif font. Below the title is the subtitle '“Creating a Community Solution for Anomaly Attribution”' in a smaller, white, sans-serif font. The NASA logo is in the top right corner. The text 'Co-Sponsored by NRO and NASA' is on the left, followed by the dates 'MARCH 29-30, 2023'. The locations for Day 1 and Day 2 are listed on the right. The agenda topics and objectives are listed in the center-right. The contact information for the NRO and NASA points of contact is at the bottom.

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& FAILURES WORKSHOP**
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Questions?

Dong Ryu/NRO

ryudong@nro.mil

Joseph Minow/NASA

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