NASA CARA and JSpOC Orbital Safety Analyst (OSA) Overview

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NASA CARA Team

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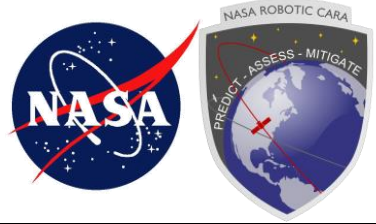


Topics

- **CARA OSA Overview**
- **JSpOC Spaceflight Safety Cell Overview**
- **Comparison matrix of activities**
  - With amplifications
- **Risks/Intangibles stemming from elimination of NASA CARA OSA position**

NASA CARA OSAs

- **5 FTE dedicated to CARA's ~65 missions**
  - 1-2 individuals per crew, depending on shift
  - Staff fully trained in OD, ASW, and conjunction analysis
  - Most members have over 5+ years of CA experience
- **Customer-focused approach**
  - Staffed 20 hours per day (0600 – 0200 PT), 7 days per week
  - Additional support provided for launches, contingencies, and emergencies
  - On-call support for after-duty hours and holidays
- **Intimately familiar with NASA missions and CARA team processes**
- **Personnel possess catalogue update privileges**
- **Personnel use matured procedures, checklists, and scripts**
- **Dedicated SME level support for OSAs/CARA**
  - Scripting, contingencies, and advanced analysis support

JSpOC Spaceflight Safety Cell

- **Composed of CA Duty Technicians (CADTs) and HSF OSAs for ~1,400 payloads**
  - CA CADTs: 12 military, 2 civilians, plus backups
  - HSF OSAs: 3 military, 5 civilians, plus backups
- **3 individuals per crew**
  - 1 HSF OSA for orbit determination (OD) support, and 2 CADTs dedicated to CA screenings and customer service
- **Provide 24-7 crew support**
  - Perform routine JSpOC conjunction analysis (but not risk assessment) tasks
  - Only HSF OSAs perform ODs on the SP catalogue for CA
- **Provide CDMs and emergency notifications to O/O of primary object**
  - NE: TCA < 3 days away, miss distance < 1.0 km, and radial miss < 200 m
  - DS: TCA < 3 days away, miss distance < 5.0 km overall
- **Other products and expanded screening can be requested via ODR**

Comparison Matrix

	Item	JSpOC Spaceflight Safety Cell	CARA OSAs
Staffing	Crew Availability	24/7	20/7, plus on call / contingency support
	Crew Experience	• CADTs: 12 military, 2 civilians (5 crews, 2 OAs each, with backups) • HSF OSAs: 3 military, 5 civilians (1-2 per crew) • Average 2-3 years experience	5 crew OSAs (1-2 per crew, depending on shift); average 7 years experience
	Crew-to-payload ratio	2-4: ~ 1400	1-2 : ~65
Screenings	Full screenings per day	3 for LEO, 1 for GEO, 1 for MEO, 1 for HEO	3 for LEO, 2 for GEO/HEO
	Screening criteria available	• Basic emergency criteria for all O/Os • “Large” criteria for O/Os w/ ODR for Advanced CA	"Large" criteria
	Maneuver ephemeris screenings	Yes, 4-hour turn-around (60-min average)	Yes, 90-min turn-around requirement (45-min average)
	Launch CA screenings	Yes (all 14 CADTs are trained to perform launch CA)	Yes
	1 vs 1 generation	Yes, 4-hour turn-around (30-min average)	Yes, 30-min turn-around requirement (10-min average)
	Specialized on-demand screenings	Yes: (1) On-demand for USG (2) ODR may be required for non-USG entities	Yes, 90 min turn-around requirement (45-min average)
Products	OCMs	Yes: (1) Always for DoD missions (2) As requested for other USG entities	Yes
	CDMs	Yes	Yes
	Full covariance in OCM/CDM	Yes, for USG entities	Yes, for USG entities
	VCMs	Yes: (1) Automatically for missions that have requested recurring transmission (2) By request for all other USG	Automatically for certain criteria
	Sensor and Tracking File	Yes, for all USG entities (3 x day for NE)	With each full catalogue delivery, (5 x day)
	Space Weather Trade Space	N/A	Once per day
OD-Related Services	Review of HIE secondaries	Daily threshold checks	Daily manual review
	OD quality assessment/modeling	No cumulative assessment	Routine checks
	Manual DC when warranted	Yes	Performed indigenously
Other	Specialized support (Ascent, on-orbit testing, Fly-by)	Yes	Yes
	HIE new-tracking notification	As requested for specific events	Starting APR 2016: < 60 min latency

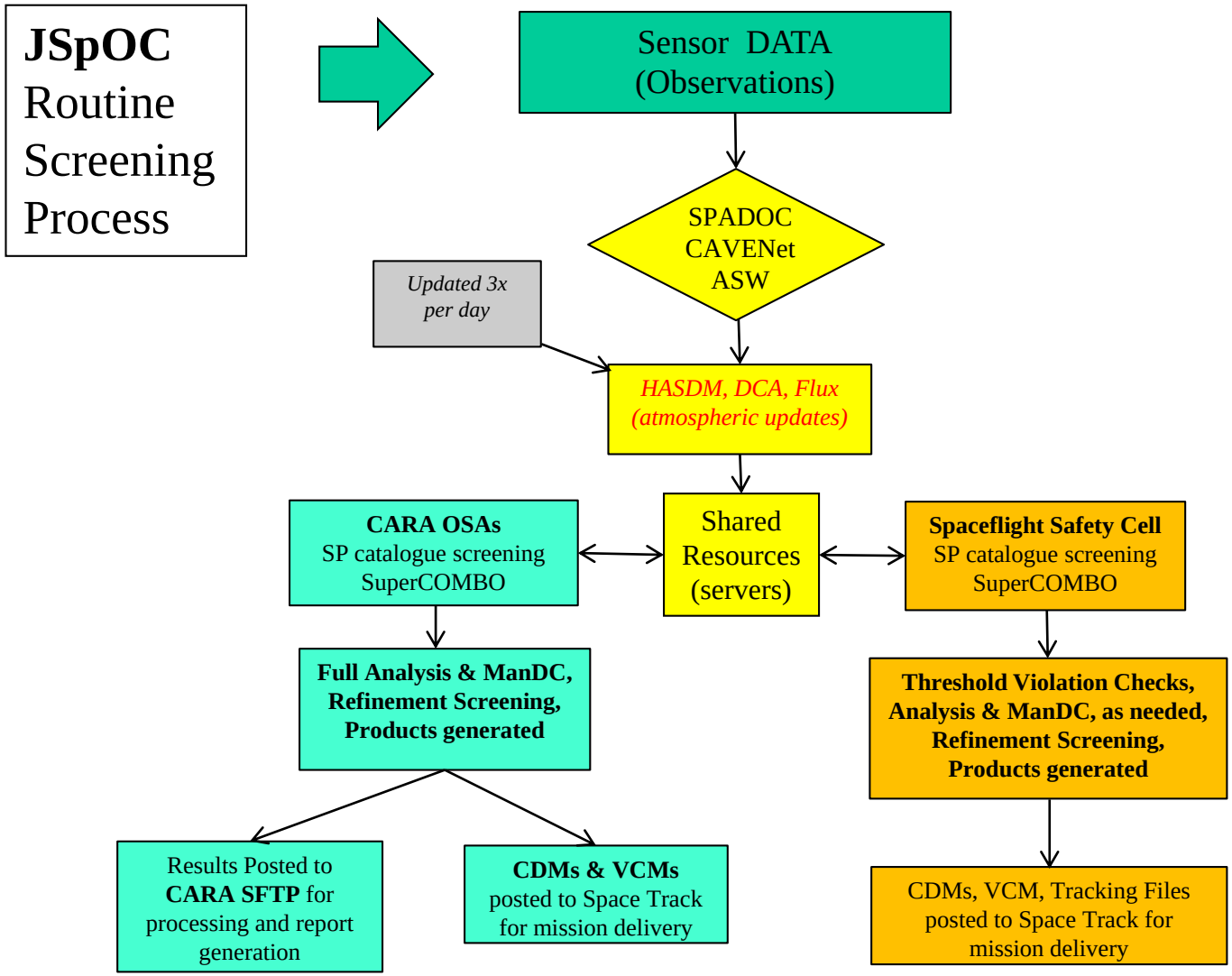
Spaceflight Safety Cell and CARA OSAs: Staffing

- **Spaceflight Safety Cell offers 24/7 support**
- **CARA OSAs on-call for the four hours of each day not directly staffed**
- **Crew-size-to-payload ratio quite different:**
  - 2-4 : 1400 for Spaceflight Safety Cell versus 1-2 : 65 for CARA OSAs
  - Much of OSA's virtue due to this favorable staff-to-payload ratio

Spaceflight Safety Cell and CARA OSAs: Screenings

- **Both groups offer multiple screenings per day**
- **Both offer expanded screening accommodations**
- **Both cells provide as rapid a response as any given day's exigencies allow and as quick a turn around as possible**
  - CARA OSAs have maximum turn-around time requirements associated with many products
- **System issues affect both groups equally**

Collaborative Screenings



Spaceflight Safety Cell and CARA OSAs: Products

- **Both groups offer:**
  - The basic CDM/VCM product set
  - Full covariance in CDMs for USG customers, 6 x 6 covariance for all others
  - A Sensor Tracking/Tasking File
    - Sensor and Tasking File; contains useful object historical tracking and current sensor tasking data
- **CARA OSAs offer additional products**
  - Space Weather Trade Space: analyzes and graphically depicts conjunction's sensitivity to atmospheric density mismodeling

Spaceflight Safety Cell and CARA OSAs: OD-Related Services

- **Both groups provide some level of monitoring of conjunction-related OD**
  - Spaceflight Safety Cell performs threshold violation checks
  - CARA OSAs perform this through manual review of each HIE secondary, in order of severity based on OD quality statistics (“OSA Worklist”)
- **Both groups pursue OD improvements when warranted**
  - HSF OSA performs manual OD updates for Spaceflight Safety Cell
  - CARA OSAs perform manual OD updates themselves

Spaceflight Safety Cell and CARA OSAs: Other Services

- **CARA OSAs provide automatic notification of new tracking on HIEs**
  - Within 60 mins of new tracking, a notification and new 1 vs 1 CA product set will be generated and sent to CARA for forwarding to missions
- **Spaceflight Safety Cell provides interface with Space-track.org**
  - Serve as a focal point for 24/7 data dissemination
  - Intimately involved in the day-to-day management of the website, and the development of future capabilities

Intangibles: CARA OSA Presence as Innovation Engine

- **Items below are available due to NASA/JSpOC collaboration:**
  - Multiple daily screenings
  - Release of VCMs to missions under certain conditions
  - Full covariance data in OCM/CDMs
  - Sensor tracking and tasking data to missions
  - Releasability Matrix to secure release of data to necessary mission personnel
- **Highlighted NASA CARA innovations**
  - Screening volume sizing studies
  - Sensor tasking studies to help reduce overtasking concerns
  - Vector staleness assessment
  - Space weather trade space
  - Pc Uncertainty study
- **Reduction/elimination of CARA OSA role would also eliminate funding for continued innovation**

Intangibles: Risks to Eliminating CARA OSA Presence

- **CARA OSAs are contracted to the CA mission and cannot be re-tasked**
  - Guaranteed mission dedication
- **Focused CARA OSA efforts**
  - Low ratio of missions to OSAs enhances customer service & mission support
  - Dedicated OD support to include manual catalogue updates in NASA orbit regimes and manually increased tasking analysis/validation
- **CARA OSAs have significant space and military experience**
  - Serve as knowledgeable liaisons for information flowing from the JSpOC to NASA/CARA and back
  - Skill is developed and retained to ensure continuity
- **CARA and Spaceflight Safety Cell analysis and process collaboration provides focused and shared CA group alignment**
- **Dedicated reach back to Omitron OD/CA SMEs**
  - Dave Ward, Bill Schick, Steve Casali, Bob Teets provide script updates and analysis as needed for cell support

Summary

- **CARA OSAs are an important extension of the CARA mission and philosophy**
- **Innovations and collaborations with JSpOC CA personnel are mutually beneficial and add value to CA mission**
- **CARA OSAs provide dedicated and focused support and ensure mission safety and timeliness of required data streams**