# Ground System Mission Assurance Requirements Flow-Down for the Joint Polar Satellite System

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**RAYTHEON COMPANY**
**INTELLIGENCE, INFORMATION AND SERVICES (IIS)**
**JPSS CGS PROGRAM**
**AURORA, COLORADO**

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# Subcontractor Mission Assurance

As a prime contractor to NASA, Raytheon is engaged in the Safety & Mission Assurance efforts in the following ways:

- EHS Safety:
  - Raytheon has engaged in the configuration capture, movement, shipping, receiving and placement of more than 87 equipment racks at multiple sites, both CONUS and OCONUS to support the Block 2.0 upgrade
    - **Zero damage and zero EHS violations**

- Application of the NASA Gold Rules:
  - Adapted from the Flight Gold Rules for implementation to the ground system
  - Fully compliant at Critical Design Review
  - Requirements flowed and addressed by program stakeholders

# Subcontractor Mission Assurance Efforts

- **System Safety Collaboration:**
  - System Safety program implemented to develop hazards and controls
  - Software Safety program implemented based on NASA-STD-8719.13B
  - SW Assurance implemented via scheduled process audits; coordinated with the NASA JPSS SW Lead and GSFC SW Assurance Chief
  - Engaged in multiple Shoulder to Shoulder meetings
  - Twice weekly Raytheon led System Safety Review Boards
  - Support to weekly NASA led System Safety Working Group
    - Continuous communication multiple times weekly to work issues

- **Participation in the NASA bi-weekly Ground Availability and Reliability Working Group (GARWG)**
  - Established to implement the Reliability and Maintainability Assurance requirements
    - Continuous comms between NASA and Raytheon RMA engineers
    - This collaboration led a successful JPSS CGS Critical Design Review in January 2014 from an RMA perspective

# Subcontractor Mission Assurance Efforts

- Weekly NASA/Raytheon MA telecons
  - Established to ensure that applicable MAR requirements are implemented and that MA is engaged to ensure compliance
  - In process action items , product/process audit status, special topics, PMR prep, etc.
    - Additional path of communication to ensure that customer and supplier are both united in resolving issues pertaining to anything related to Mission Assurance

- Monthly Mission Assurance Splinter meetings
  - Coincident with Program Management Review
  - Multiple topics brought forward: Program execution focus from a Mission Assurance perspective
    - The entire NASA and Raytheon JPSS MA teams are engaged

# Safety Metrics - Site Mishaps*

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**Zero Mishaps in past12 Months**

Chart y-axis: 0 to 10

Chart x-axis: Sep-13, Oct-13, Nov-13, Dec-13, Jan-14, Feb-14, Mar-14, Apr-14, May-14, Jun-14, Jul-14, Aug-14
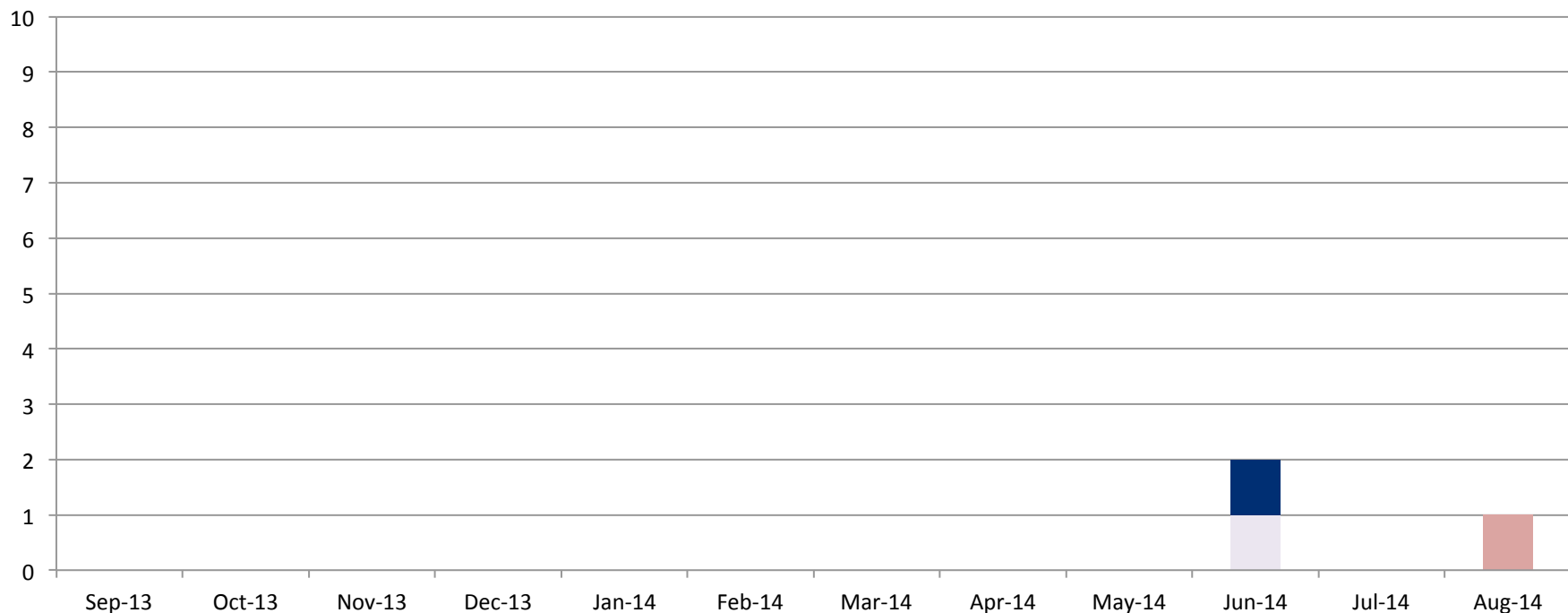
**\*Mishap: Incident that results in equipment damage or recordable personnel injury.**

- Purpose: Identify Site Mishaps when/where they occur

- Analysis: The program has been able to minimize mishaps with given improvements employed by the safety team and update of site safety processes since September, 2013

- Action:
  - Team will continue their vigilance regarding safety reviews and safety involvement with the sites

*Zero mishaps since September, 2013*

# Safety Metrics – Close Call*



- Purpose:  Identify Site Close Calls when/where they occur
- Analysis: With the changes made within the safety team and update of site safety processes since September, 2013, the program  has been able to minimize mishaps and close calls

- Action:
  – Team will continue their vigilance regarding safety reviews and safety involvement with the sites

*Close Call: No injury or minor injury and/or no equipment/property damage but which possesses a potential to cause a mishap

*The Close Calls were all due to facilities issues and not with JPSS Hardware or personnel*

# Raytheon Subcontract Management Team Overview

The Raytheon Subcontract Management Team consists of 4 disciplines to provide the correct management, technical, quality and contractual balance

- Program Subcontract Manager (PSM) – Team lead
  - The PSM is accountable for delivery of the required products, responsible for cost, schedule, and technical performance of the Subcontractor.
  - Ensures that all requisite disciplines are engaged to facilitate and validate proper subcontractor performance and integration.

- Subcontract Administrator (SCA)
  - Holds sole Raytheon warrant to create and maintain a contractual agreement and is the conduit for all contractual written communications.
  - Co-located with the program. Full time support to the program and its mission.

# Raytheon Subcontract Management Team Overview

The Subcontract Management team disciplines (cont.)

Technical Subcontract Manager (TSM)

- Responsible for contractual technical compliance and flow down of technical requirements (SOWs and Procurement Specifications).
- Provides technical oversight, Resolves issues and barriers, ensures technical integrity, and maintains technical alignment between subcontractor and program.
- Interfaces with functional areas (especially systems engineering) to assure Subcontractor performance and product delivery.

  – Mission Assurance Supplier Quality Manager (MASQM)
  - Assures that suppliers deliver products and services that meet or exceed Raytheon's requirements, resulting in customer mission success.
  - Assures that supplier processes are in compliance with flow-downs

# Raytheon's JPSS Subcontractors

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| Subcontractor | Value to Program | Contract |
|---|---|---|
| AT&T | Wide Area high-speed networks; 24x7 Monitoring with high Operational Availability. Professional Services in support of delivery and maintenance of WAN. | SLA |
| Computer Science Corporation | Security administration, operations and security compliance support | Tech Services |
| IBM | COTS data processors (high capacity computers) and data storage; Provide Engineering | COTS and T&M Services |
| Kongsberg Satellite Services | Operates and maintains Ground antenna at north polar location. Provide data services for downlinked weather data. | SLA |
| L-3 Datron | Develop/install receptors for multiple polar location deployment. Annual maintenance. | Development and T&M Services |
| Optus Networks Ltd | Satcom services for south polar data collection. | SLA |
| Raytheon Indiannapolis, IN | Integrated Logistics Support, Training, Mission Assurance surveillance. | Ongoing services |
| Kongsberg Spacetec | Design, development, integration, test, training and support of custom data distribution units | Development and T&M Services |
| RT Logic | Design, development, integration, test, training and support of custom data distribution units | Development and T&M Services |
| Golden Star Technologies | Small business equipment procurement and integration | Development |

# MAR Flowdown History

The NASA and Raytheon MA team collaborated during 2012 to develop the program's Mission Assurance Requirements

An initial Compliance Matrix for Raytheon and subs was collaboratively developed to establish draft implementation strategy

Final matrix contracted to Raytheon via Change Order in March 2013

Raytheon Supply Chain initiated discussion and negotiation of requirements to subs following award

Subsequent Change Order awarded to Raytheon in April 2013 adding several subs requiring MAR implementation

Raytheon conducted technical negotiations with each subcontractor to obtain buy-in to each requirement and cost negotiations for implementation

Raytheon modified MAR Implementation Matrix and obtained NASA CSO approval

SSOWs/Contracts were either modified to include the MAR requirements or new MAR SSOWs were created and flowed to Subcontractors

Implementation complete prior to CDR in November, 2013

# MAR Compliance Matrix Items

1.2 System Safety and Mission Assurance Program

1.3 Management

1.5 Suspension of Work Activities

1.7 Surveillance

2.2.1 Control of Nonconforming Product

2.2.2 Material Review Board (MRB)

2.2.3 Reporting of Anomalies

3.1 General

3.2.1.1 Software Safety Analysis

3.3.1 Preliminary Hazard Analysis

3.3.2 Operational Hazard Analysis

3.4 Lifting Device Safety Requirements

3.5 Safety Waivers

3.6 Mishap Reporting and Investigation

4.1 Probabilistic Risk Assessment

4.1.1 Reliability, maintainability and availability plan

4.1.1.1 Maintainabillity

4.2 FMEA+CIL

4.3 FTA

4.5 LLI

5.1 Applicable Software Definitions

5.2 Software Assurance Program

5.4 Verification and Validation

5.7 Reviews

5.8 Surveillance of SW Development, maintenance and Assurance Activities

6 Risk Management Plan

8.3 Electrostatic Discharge Control (ESD)

8.4 Training

9 Parts, material and Equipment Lists DID 9-1 As Built Parts, Material and Equipment List

10.1 Government Industry Data Exchange Program (GIDEP)

10.2 Reviews

10.3 Actions

10.4 Reporting

11.1 Metrology and Calibration Program

12 End Item Acceptance Data Package

# MAR Implementation Strategy

- Each Subcontractor's scope of work and contract vehicle was evaluated for the applicability of each individual MAR requirement

  - e.g. Requirements for Software not applicable to service provider or COTS hardware provider

- Our general philosophy conveyed to subcontractors is that Mission Assurance should be a part of core values

  - Effective for eliminating or reducing cost for long-term service providers

  - Not effective for suppliers with no long-term development or support commitment

- Cost minimized by optimizing use of Time and Materials-type contracting (T&M) where possible

  - Avoids "standing army" engagement for support-only providers

  - Engages and funds subcontractors only for work that is necessary and requested

# MAR Implementation Validation

The MASQM worked with each Sub to validate implementation of the MAR

- Meetings were scheduled with each Subcontractor to review implementation details

    ▫ Some face to face meetings held; many meetings conducted via teleconference with files sent to Raytheon for review

- A spreadsheet was created to track Subcontractor implementations

- Objective evidence was reviewed for each MAR requirement flowed to each Subcontractor - Posted in a Raytheon JPSS program folder

- While validation was in process, status was briefed in the monthly JPSS Program Management Reviews – see next status slide

- The MAR objective evidence was reviewed by NASA during an assessment in 2Q2014

    – *"The MASQM has done a commendable job ensuring MAR Compliance assessments have been completed for all major suppliers and the artifacts are well organized…"*

# JPSS Subcontractor MAR Status

| Supplier Name | MAR Contract Date | MAR Compliance Checklist | SMA Assessment Type | Assessment Complete | Comments |
|---|---|---|---|---|---|
| KSAT | 7/16/2013 | 5/7/2013 | Compliance | N/A | Audit performed January 2014 by John Zanoff, JPSS MA lead. There were no findings, KSAT is MAR compliant. |
| Spacetec/KSPT | 1/9/2014 | 12/9/2013 | Compliance | 5/16/2014 | Spacetec/KSPT is MAR compliant |
| RTSC | 7/19/2013 | 5/9/2013 | Compliance | 4/25/2014 | RTSC is MAR compliant |
| RT Logic | 7/24/2013 | 7/18/2013 | Compliance | 4/28/2014 | RT Logic is MAR compliant |
| Optus | 12/20/2013 | N/A | Capability | 5/29/2014 | Optus is MAR compliant |
| IBM | 12/20/2013 | 12/19/2013 | Compliance | 5/29/2014 | IBM is MAR compliant |
| AT&T | 8/16/2013 | 5/10/2013 | Compliance | 4/28/2014 | AT&T is MAR compliant |
| Ingenicomm | 12/10/2013 | 11/6/2013 | Compliance | 5/20/2014 | Delayed audit until after FAT. Ingenicomm is MAR compliant |
| L3 Datron | 12/17/2013 | N/A | Capability | 6/10/2014 | L3 Datron is MAR compliant |
| GST | 7/17/2013 | N/A | Capability | 6/5/2014 | GST is MAR compliant |

# MAR Future Surveillance

As new Subcontractors are added to the JPSS Program, applicable MAR requirements are flowed to them via a SSOW, and subsequent MAR assessments performed during subcontract performance

MAR requirements flow down is included in the JPSS Subcontractor Assessment Desk Instruction which identifies criteria that trigger future MAR assessments

Criteria include:

- Medium or high risk new Subcontractors
- Repeated unsatisfactory Subcontractor monthly scores
- The scope of the Subcontract changes
- Significant Subcontractor changes including new ownership, change in management or significant facility change
- If Subcontractor has not been assessed in 3 years for any other reason, consider doing targeted MAR assessments

# Other MA / Supply Chain Contributions

- Raytheon Supply Chain has employed an effective system to assure compliance to Peoples Republic of China (PRC) procurement constraints

- Supply Chain supports Reliability, Maintainability, and Availability implementation through mandating supporting monthly metrics and Availability data of service-level suppliers

- Supply Chain has implemented system Information Assurance and Security requirements at suppliers and requires regular compliance confirmation

- Supplier Quality Assurance audits suppliers regularly for compliance to all required processes

- Supplier Quality and Supply Chain regularly impose process improvements upon subs for optimal performance and program support

JPSS Common
Ground System

# Conclusions

**Raytheon**
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- Raytheon is committed to Mission Assurance excellence

- Raytheon works hand-in-hand with NASA Mission Assurance to implement Gold Rules across all program entities

- System and personnel safety, Reliability and Maintainability, and all other MAR requirements are of primary import to the Raytheon team and it's suppliers

- Mission Assurance expectations and requirements have been communicated and supported within all participating suppliers

JPSS CGS Form J-136 05/21/2012

Page 18