Joint Polar Satellite System (JPSS)

Program Overview and Status

Presented to:
Goddard Contractors Association

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JPSS Topics

● How did we get here? (some history)

● What is it?

● Why is it needed?

● What’s the plan?

● What have we accomplished?
JPSS will be NASA/NOAA’s next generation of polar Earth observing science data satellites

- Increase timeliness and accuracy of severe weather event forecasts
- Provide advanced atmospheric temperature, moisture and pressure profiles from space
- Provide advanced imaging capability to analyze fires, volcanoes, Gulf oil tracking and other adverse incidents
- Direct broadcast data to field terminals at hour scale latency
- Maintain continuity of climate observations and critical environmental data from the polar orbit
Introduction (cont’d)

- **JPSS consists of five satellites (Suomi-NPP, JPSS-1, JPSS-2, FF-1, FF-2), ground system and operations through 2028**
  - JPSS mission is to provide global imagery and atmospheric measurements using polar-orbiting satellites

- **JPSS is a partnership between NOAA and NASA**
  - NOAA has final decision authority and is responsible for overall program commitment
  - JPSS Program is the subset of JPSS managed by NASA
  - NASA is the acquisition agent for the flight system (satellite, instruments and launch vehicle), ground system, leads program systems engineering, and program safety and mission assurance
  - NOAA is responsible for operations, data exploitation and archiving, infrastructure

- **Partnership is governed by the NOAA and NASA JPSS Management Control Plan**
  - JPSS Program is executed in accordance with NPR 7120.5D as a loosely-coupled program

- **NASA Categorization for JPSS-1 and JPSS-2**
  - Mission Category 1
  - Risk Class B Mission
  - Category 2 Expendable Launch Vehicle

- **NASA Categorization for FF-1 and FF-2**
  - Mission Category 2
  - Risk Class C Mission
  - Category 2 Expendable Launch Vehicle
Background

- Since the 1960’s the United States has operated two separate polar-orbiting environmental satellite programs
  - NOAA’s Polar-orbiting Operational Environmental Satellite (POES) series
  - USAF’s Defense Metrological Satellite Program (DMSP)
- The NPOESS program was created with the expectation that combining the civil (POES) and military (DMSP) programs would reduce duplication and result in cost savings
  - Established under a Presidential Decision Directive in 1994
- A tri-Agency Integrated Program Office (IPO) was formed to manage the program
  - NOAA responsible for overall program management of the converged system and satellite operations
  - USAF responsible for acquisition
  - NASA responsible for technology insertion
- Program was to launch NPOESS Preparatory Project (NPP) to reduce risk
- First NPOESS contract awarded in 2002
  - Program estimated to cost $7 billion through 2018
  - Scope of program included six satellites (three orbits) each hosting up to 13 instruments, and a ground system
Background (cont’d)

- **NPOESS program encountered significant challenges**
  - Technical challenges in VIIRS sensor development
  - Program cost growth
  - Schedule delays

- **By 2005:**
  - Cost had increased to $10 billion
  - First launch delayed from 2008 to 2010

- **A decision to restructure the program was made in 2006**
  - Driven by a Nunn-McCurdy breach
  - Satellites reduced from six to four (in two orbits) – EUMETSAT would provide mid-morning orbit
  - Number of instruments reduced from 13 to nine

- **Even after restructure, program continued to encounter issues**
  - Technical issues continued with VIIRS
  - Management challenges with governance structure
  - Cost increases – expected to exceed $14 billion
  - Further schedule delays
Restructure

- In 2009 EOP/OSTP led task force to investigate management and acquisition options that would improve NPOESS
- In February 2010, with the release of the FY2011 President’s Budget, OSTP announced the restructure of the NPOESS program – specifically, NOAA and DoD would be responsible for different orbits
  - NOAA responsible for the afternoon orbit - JPSS
  - DoD responsible for the early morning orbit - DWSS
  - Partnership with EUMETSAT would continue for mid-morning orbit
  - Both agencies would share a common ground system

Restructure codified and executed through:
- National Space Policy
- Administration’s Implementation Plan for Polar-orbiting Environmental Satellites
- NPOESS Deputies Meeting Summary
- Series of DoD Acquisition Decision Memorandums
  - Continued support to NPP
  - Close out of the IPO
  - Transfer of sensors and ground system from DoD to NOAA/NASA
  - Identified sensor suite on DWSS
NPOESS Lessons Learned

• Unrealistic cost estimation tainted the budget process, dictated acquisition strategy, distorted management decisions and set the program up for cost over-runs
  – JPSS has validated Program Office Estimate with an Independent Cost Estimate
  – Sufficient reserves

• Incomplete, inaccurate assertions of heritage contributed to cost estimation problems and led to significantly optimistic assessments of technical and programmatic risk
  – NPP launched and commissioned. Provides heritage for JPSS

• Multiple factors constrained and eventually eliminated the SPD’s authority to make performance trades
  – Roles and responsibilities clearly outlined in the Management Control Plan

• From the start mission priorities of the key Convergence stakeholders were divergent
  – Budget and requirements, therefore priorities, now rest with one Agency

• The acquisition strategy contained major flaws, including co-mingling DoD and NASA acquisition programs (for NPP)
  – JPSS only uses NASA acquisition program
JPSS implements US civil commitment interagency and international agreements to afford 3-orbit global coverage.
Joint Polar Satellite System Program

**JPSS External Relationships**

**Department of Commerce**

- National Oceanic & Atmospheric Administration
  - Office of Systems Development (OSD)
  - Office of Satellite & Product Operations (OSPO)
  - Satellite Applications & Research (STAR)
  - National Climatic Data Center (NCDC)

**Department of Defense**

- Air Force Space Command
- Air Force Space & Missile Systems Center
- Air Force Weather Agency (AFWA)
- Naval Oceanographic Office (NAVO)
- Fleet Numerical Meteorology & Oceanography Center (FNMOC)

**National Aeronautics & Space Administration**

- Science Mission Directorate (SMD) / Joint Agency Satellite Division (JASD)

**International Partners**

- European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT)
- Japan Aerospace Exploration Agency (JAXA)
- Centre Nationale d’Etudes Spatiales (CNES)
- Canadian Dept of National Defense (DND)
- NSF McMurdo Station

**International SARSAT**

- Ensure SAR service availability

**JPSS**

- NOAA JPSS Office and NASA JPSS Program

**External Support**

- Launch Services Program (LSP)
- Flight Dynamics Facility (FDF)

**External Services**

- Space Communication and Navigation (SCaN) Networks
- NOAA Fairbanks Command & Data Acquisition Station
- NSF McMurdo Station
- NSC/Svalbard Station

**JPSS Data Users**

- **NOAA Users**
  - NOAA National Weather Service
  - NOAA National Marine Fisheries Service
  - NOAA National Ocean Service
  - NOAA Oceanic & Atmospheric Research

- **Other Agencies**
  - National Aeronautics & Space Administration
  - US Department of Agriculture
  - Environmental Protection Agency
  - US Fish and Wildlife Service
  - US Forest Service

- **Other Users**
  - Search and Rescue – Many Users –
  - Academic Community
  - Civilian
  - Military
  - International

**Notes**

- Directs DOD to take primary responsibility for the morning orbit.
- Directs NOAA, with NASA, to take primary responsibility for the afternoon orbit.

JPSS Overview

Space Segment

Launch Segment

TDRSS

Alternate T&C, SMD Reception

GPS

GPS

JPSS-1

JPSS-2

Suomi NPP

Free Flyer-1

Free Flyer-2

Svalbard Primary T&C, SMD Reception

Direct Broadcast Users

White Sands Complex

VAFB

JPSS

Command, Control, & Communication Segment

VAFB

McMurdo

SMD Reception

Mission Management Center (MMC)

NESDIS CBU

Ground Segment

Mission Data

Data Delivery

Processing

Ingest

AFWA

DATA

NESDIS

DATA

CLASS

GRAVITE

SDS

Weather / Climate Products

Offline Support

Algorithm Support

Integrated Support Facility

Weather Centrals

Interface Data Processing Segment

Data Delivery

Processing

Ingest

DoS

Ingest

Ingest

Ingest

Ingest

Ingest
JPSS Overview

- **Three primary satellites**
  - Operation of Suomi-NPP* satellite
  - JPSS-1 (ATMS, CrIS, CERES, OMPS, VIIRS)
  - JPSS-2 (ATMS, CrIS, CERES, OMPS, VIIRS)

- **Two Free-Flyers**
  - A-DCS, SARSAT and TSIS
  - Science data processing for TSIS

- **Launch Services for primary satellites as well as Free-Flyers**

- **Ground system**
  - Command, Control and Communications Segment (C3S)
  - Interface Data Processing Segment (IDPS) – Science data processing
  - Field Terminal Segment – Support to direct broadcast users

- **Operations and Sustainment for all satellites**

- **Program Management, Systems Engineering, Mission Assurance and Science**

* NPP is a risk reduction mission which was developed by the IPO and NASA
Joint Polar Satellite System Program

Fly-out
(Fiscal Years)
Climate Adaptation and Mitigation

Weather Ready Nation

To understand and predict changes in climate, weather, oceans, and coasts. To share that knowledge and information with others, and To conserve and manage coastal marine ecosystems and resources

Resilient Coastal Communities and Economies

Healthy Oceans

Joint Polar Satellite System Program

NOAA Mission
1. Reduced loss of life, property and disruption from high-impact events.
2. More productive and efficient economy through relevant environmental information.
3. Healthy people and communities due to improved air and water quality services.
4. Improved transportation efficiency and safety.

1. Improved understanding of ecosystems to inform resource management decisions.
2. Safe, environmentally sound Arctic access and resource management.
3. Coastal communities that can adapt to the impacts of hazards and climate change.

1. Assessments of current and future states of the climate system that identify potential impacts and inform science, service and stewardship decisions.
2. Mitigation and adaptation efforts supported by sustainable, reliable and timely climate services.
3. Improved scientific understanding of the changing climate system.

1. Improved coastal water quality supporting human health and coastal ecosystem services.
2. Safe, environmentally sound Arctic access and resource management.
3. Coastal communities that can adapt to the impacts of hazards and climate change.

1. Improved understanding of ecosystems to inform resource management decisions.
VIIRS (22 EDRs)  
RDRs & SDRs (for each band)
- EDRs
- ALBEDO (SURFACE)
- CLOUD BASE HEIGHT
- CLOUD COVER/LAYERS
- CLOUD EFFECTIVE PART SIZE
- CLOUD OPTICAL THICKNESS
- CLOUD TOP HEIGHT
- CLOUD TOP PRESSURE
- CLOUD TOP TEMPERATURE
- ICE SURFACE TEMPERATURE
- NET HEAT FLUX
- OCEAN COLOR/CHLOROPHYLL
- SUSPENDED MATTER
- VEGETATION INDEX
- AEROSOL OPTICAL THICKNESS
- AEROSOL PARTICLE SIZE
- ACTIVE FIRES

OMPS (2 EDRs)  
RDR & SDR
- EDRs
- \( \text{O}_2 \), TOTAL COLUMN
- \( \text{O}_3 \), NADIR PROFILE

CERES (2 EDRs)  
RDR & SDR
- EDRs
- NET SOLAR RADIATION (TOA)
- OUTGOING LW RADIATION (TOA)
- SDRs
- LONG WAVE RADIANCE (TOA)
- REFLECTED SOLAR RADIANCE (TOA)
- TOTAL RADIANCE (TOA)

CrIS/ATMS (3 EDRs)  
RDR & SDR
- EDRs
- ATM VERT MOIST PROFILE
- ATM VERT TEMP PROFILE
- PRESSURE (SURFACE/PROFILE)

GCOM AMSR-2  
(11 EDRs)
- EDRs
- CLOUD LIQUID WATER
- PRECIPITATION TYPE/RATE
- PRECIPITABLE WATER
- SEA SURFACE WINDS SPEED
- SOIL MOISTURE
- SNOW WATER EQUIVALENT

KEY
- RDR = Raw Data Record
- SDR = Sensor Data Record
- EDR = Environmental Data Record

- EDRs with Key Performance Parameters

JPSS Ground System (NPP, JPSS – ½)
ESPC (GCOM-W1)
Free-flyer Ground System (FF-1)

Figure 3-4, Rev.B, 4/5/12

(1) CERES and TSIS Climate Data Record (CDR) production is outside the scope of JPSS
• **Two organizations established**
  – NOAA JPSS Office (NJO, an Office within NOAA/NESDIS)
  – NASA JPSS Program (established within GSFC)

• **NASA Joint Agency Satellite Division (JASD) oversees reimbursable programs**

• **Funding shortfalls in FY2010 and FY2011 limited development effort**
  – Did not receive additional funding in FY2010 which delayed the transition
  – President’s Budget Request in FY2011 was $1.06 billion, of which only $471 million was received
    • Appropriations of $382 million as a result of the year-long Continuing Resolution
    • Department of Commerce reprogramming of $89 million – arrived at the end of the year limiting its contribution to FY2011 effort
  – NPP was highest priority for both NOAA and NASA in order to reduce risk of a gap in the afternoon orbit from POES and EOS
  – Spacecraft (JPSS-1) and instrument contracts were minimally funded
  – Launch of JPSS-1 slipped from early 2015 to 1st Quarter FY2017

• **Appropriations in FY2012 were also less than President’s Budget Request**
  – Only $924 million of $1.07 billion requested was received
  – Launch of JPSS-1 slipped to 2nd Quarter of FY2017

• **JPSS updating requirements to match new budget profile and LCC cap**
JPSS Governance and Programmatic Direction, Administrative and Oversight Authorities

Joint Polar Satellite System Program

Programmatic Direction, Administrative and Oversight Authorities
Joint Polar Satellite System Program

JPSS Program Plan

- **Loosely Coupled Program**
  - “These programs address specific objectives through multiple space flight projects of varied scope” (NASA NPR 7120.5)
- **NOAA responsible for overall program commitment**
  - JPSS operations, data exploitation and archiving, infrastructure
- **NASA responsible for specific development commitments**
  - JPSS-1/2 satellites and launch services
  - Free Flyer satellites, including launch services, ground system, and operations
- **NASA responsible for Ground System sustainment (block updates) until transition to NOAA**
- **JPSS Program in Formulation**
  - JPSS Projects simultaneously in all Life Cycle Phases

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<th>(Concept Development)</th>
<th>(Preliminary Design)</th>
<th>(Final Design &amp; Fabrication)</th>
<th>(System Assembly, Int. &amp; Test, Launch)</th>
<th>(Operations &amp; Sustainment)</th>
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<td>S-NPP JPSS Ground System</td>
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<td>JPSS-1 Mission</td>
<td>JPSS-1 spacecraft</td>
<td>JPSS-1 instruments</td>
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<td>Free Flyer-1 Mission</td>
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</table>
JPSS-1 Flight Configuration

- VIIRS
- CrIS
- ATMS
- OMPS
- CERES
JPSS-1 Satellite Overview

● **Mission Design**
  – Payload: ATMS, CrIS, VIIRS, OMPS-Nadir, and CERES
  – Spacecraft:
    • 3-axis stabilized (50 arc-sec control, 21 arc-sec knowledge, and 75m position)
    • Mass: 2540 kg (wet)
    • Power: 1932 W (BOL)
  – Ka-band 300 Mbps Stored Mission Data (SMD) downlink
  – X-band 15 Mbps High Rate Data (HRD) direct broadcast to users
  – Lifetime: 7 years
  – Orbit: Sun-Synchronous
    • Altitude: 824 km +/- 17 km
    • Ground Track: 20 km repeat accuracy at the Equator with 20 day repeat cycle
    • LTAN: 1330 +/- 10 minutes
  – LRD: December 2016 from the Western Range
  – EOM Disposal: Controlled Re-entry

● **NASA Categorization**
  – Category 1 Project in accordance with NPR 7120.5
  – Class B Payload Risk Classification in accordance with NPR 8705.4
  – Launch Vehicle Risk Category 2 in accordance with NPR 8610
### JPSS-1 Instruments

<table>
<thead>
<tr>
<th>JPSS Instrument</th>
<th>Measurement</th>
</tr>
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<tbody>
<tr>
<td><strong>ATMS</strong> - Advanced Technology Microwave Sounder</td>
<td>ATMS and CrIS together provide profiles of atmospheric temperature, moisture, and pressure</td>
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<tr>
<td><strong>CrIS</strong> - Cross-track Infrared Sounder</td>
<td>Provides daily high-resolution imagery and radiometry across the visible to long wave infrared spectrum</td>
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<tr>
<td><strong>VIIRS</strong> – Visible Infrared Imaging Radiometer Suite</td>
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<tr>
<td><strong>OMPS</strong> - Ozone Mapping and Profiler Suite</td>
<td>Spectrometers with UV bands for ozone total column measurements</td>
</tr>
<tr>
<td><strong>CERES</strong> - Clouds and the Earth’s Radiant Energy System</td>
<td>Scanning radiometer which supports studies of Earth Radiation Budget</td>
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## JPSS-1 Development Partners / Contracts

<table>
<thead>
<tr>
<th>Hardware Element</th>
<th>Responsible Organization</th>
<th>Contractor</th>
<th>Contract Type</th>
<th>Def. Date</th>
<th>JPSS ICDs</th>
<th>JPSS MAR</th>
<th>H/W % Complete</th>
<th>Flight Status</th>
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</thead>
<tbody>
<tr>
<td>ATMS</td>
<td>NASA-GSFC</td>
<td>NGES</td>
<td>CPAF</td>
<td>04/13/12</td>
<td>N*</td>
<td>N*</td>
<td>85%</td>
<td>Integration</td>
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<tr>
<td>CrIS</td>
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<td>Exelis (ITT)</td>
<td>CPAF</td>
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<td>Y</td>
<td>Y</td>
<td>85%</td>
<td>Integration</td>
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<tr>
<td>VIIRS</td>
<td>NASA-GSFC</td>
<td>Raytheon SAS</td>
<td>CPAF</td>
<td>ECD ** 6/21/12</td>
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<td>Y</td>
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<td>Acquisition</td>
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* Pending Contract modification
** Contract Negotiations completed on April 24, 2012
Joint Polar Satellite System Program

JPSS Free Flyer Mission

Project Description:
- Integrate TSIS, A-DCS4, SARR & SARP sensors (two of each) onto appropriate satellite platforms, launch, and produce satellite data products

Science Objectives:
1. Continue measurement of the Sun’s Direct and Indirect Effects on Climate through the measurement of the Total Solar Irradiance (TSI) and the Solar Spectral Irradiance (SSI)
2. Continue operation of the SAR instruments as part of the international COSPAS-SARSAT system designed to detect and locate Emergency Locator Transmitters (ELTs), Emergency Position-Indicating Radio Beacons (EPIRBs) and Personal Locator Beacons (PLBs)
3. Continue operation of the Data Collection System obtaining a wide variety of data from platforms dedicated to environmental study
## Free Flyer Instruments

<table>
<thead>
<tr>
<th>JPSS Instrument</th>
<th>Measurement</th>
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<tbody>
<tr>
<td><strong>SARR</strong> – Search and Rescue Repeater</td>
<td>The Search and Rescue instruments are part of the international Cospas-Sarsat system designed to detect and locate Emergency Locator Transmitters (ELTs), Emergency Position-Indicating Radio Beacons (EPIRBs), and Personal Locator Beacons (PLBs)</td>
</tr>
<tr>
<td><strong>SARP</strong> – Search and Rescue Processor</td>
<td>The A-DCS provides a worldwide in-situ environmental data collection and Doppler-derived location service with the basic objective of studying and protecting the Earth environment</td>
</tr>
<tr>
<td><strong>A-DCS</strong> - Advanced Data Collection System</td>
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</tr>
<tr>
<td><strong>TSIS TIM</strong> – Total &amp; Spectral solar Irradiance Sensor Total Irradiance Monitor</td>
<td>TIM is an active cavity radiometer that monitors changes in Total Solar Irradiance (TSI) at the top of the Earth’s atmosphere</td>
</tr>
<tr>
<td><strong>TSIS SIM</strong> – Total &amp; Spectral solar Irradiance Sensor Solar Irradiance Monitor</td>
<td>SIM is a prism spectrometer that monitors changes in Solar Spectral Irradiance (SSI) as a function of wavelength</td>
</tr>
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</table>
Free Flyer Options

● Evaluated numerous mission scenarios driven by an ‘evolving’ budget profile and shifting priorities:
  – Mission Scenarios:
    • TSIS ‘only’
    • User Services ‘only’ (A-DCS, SARR & SARP)
    • Individual instruments on separate spacecraft
    • Fully Loaded (TSIS, A-DCS, SARR & SARP)
  – Various Spacecraft options (Microsat, SmallSat / ESPA Class, Medium size, GEO & LEO)
  – Hosted Payloads (DSCOVR, GEO Sats, & GSFC group)
  – Spacecraft Acquisition Strategy (RSDO, Commercial, Full & Open, JOFOC)
  – Spacecraft Mission life (2, 5 or 7 yrs)
  – Dedicated Launch Vehicle vs. Rideshare
  – Ground System and Mission Operations (current PPBE assumption is LASP but still under evaluation)
Free Flyer Progress

- Aug & Nov 2011 - Presented Strategic Path Forward options for ‘TSIS only’ mission to NOAA
- Dec 2011 - Completed ‘TSIS only’ RFO documentation for procurement via RSDO
  - Documentation release for TSIS only placed on-hold
- January 2012 - Direction provided by NOAA to focus on a ‘Fully Loaded’ mission but continue to evaluate other options
- Feb 2012 - Completed RSDO documentation for a ‘Fully Loaded’ spacecraft technical study
  - Release of the Study was placed on-hold
- April 2012 - Completed ‘Fully Loaded’ RFO documentation for procurement via RSDO
  - Free Flyer Team proceeding with Table Top reviews
  - Developing additional documentation (i.e., Instrument Accommodation Requirement Documents, Concept of Operation…) in support of the RFO release
  - Release of the RFO is contingent upon receiving the official direction / authority to proceed from JASD (anticipated in early July 2012)
TCTE / STP3-Sat Mission
Total Solar Irradiance (TSI) Calibration Transfer Experiment (TCTE)

- **Opportunity:** USAF Space Test Program (STP) Mission #3
  - One of the four payloads for the STPSat-3 mission was de-manifested which opened up an opportunity for LASP and JPSS to provide an sensor to acquire Total Solar Irradiance data

- **Objective:** To provide a NIST traceable calibration link between current and future Total Solar Irradiance (TSI) measurements
  - Provides a bridge for the continuation of the 35 year TSI data record

- **Feasibility:**
  - Ball Aerospace study confirmed TCTE compatibility and the launch manifest opportunity was approved by USAF for STPSat-3 mission

- **Minimum success criteria:**
  - Periodic TSI Measurements
    - Minimum once per week / Preferred at least once per day

- **Commitment:** The TCTE needs to be delivered by September 3\textsuperscript{rd}, 2012
  - The opportunity provided by the Air Force requires an aggressive schedule for the TCTE
  - TCTE composed of residual flight hardware at LASP (TIM Sensor originally built for the Shuttle Hitchhiker Mission, a modified Free Flyer TSIS TIM Generic Channel Interface Electronics box and a Fine Sun Sensor flight spare from Glory)
  - The Free Flyer Project must also provide a mass model of TCTE and technical support during I&T

- **Costs:**
  - Total cost of the TCTE mission is estimated at $13.8M (includes LASP, USAF/Ball spacecraft integration, data processing and extended mission operations thru March 2017)

- **TCTE is not a substitute for Free Flyer 1 TSIS:**
  - TCTE will not fulfill the Level 1 Climate Data Record for Total Solar Irradiance because it is less accurate and is not operated continuously, but it does mitigate a gap until TSIS gets on-orbit.
STPSat-3 Mission Overview

**Launch:** August 2, 2013 on Minotaur 1 from Wallops Flight Facility, VA
- Possibly 60 days earlier, but won’t know until Sept 2012

**Orbit:** 500 km, 40.5° (or 48.2°) inclination

**Operations:** Nominal 1 month commissioning, 12 months normal ops under STP program
- BCP-100 spacecraft bus has 18 month design life
- NOAA/NASA have requested extending mission ops.
TCTE Observation Phases

3 Phases:

1. SORCE-to-TCTE Overlap Calibration Transfer
   Observations to span at least 2 solar rotations (~50 days)
   Minimum once every other day
   Preferred at least once per day

2. Periodic TSI Measurements
   Observations between SORCE & TSIS
   Minimum once per week
   Preferred at least once per day

3. TCTE-to-TSIS Overlap Calibration Transfer
   Observations to span at least 2 solar rotations (~50 days)
   Minimum once every other day
   Preferred at least once per day
TCTE Current Status

• Accomplishments:
  1. Ball Aerospace successfully completed funded study for USAF to evaluate flying a SORCE TIM instrument on the STPSAT-3 mission on March 21st
  2. Written authorization from JASD to proceed with the TCTE mission received on April 6th
  3. Kickoff Technical Interchange meeting at LASP with Free Flyer project, USAF STP, Ball Aerospace and TSIS IIRT representative (April 24th)
  4. First Mission Operations Working Group (MOWG) with all the five Sat-3 instrument teams at Kirtland AFB, Albuquerque (May 2nd)
  5. TCTE Memorandum of Agreement signed by US Air Force and NASA (May 8th)
  6. Weekly coordination telecon established between LASP and Ball with Free Flyer Project participation

• TCTE Flight Hardware and Software:
  1. TIM flight sensor from the Hitchhiker program partially disassembled and inspected-ok
  2. Sat-3 Spacecraft Simulator delivered to LASP by Ball Aerospace for development of software test scripts for integrated testing
  3. CAD models exchanged between LASP and Ball
  4. TCTE to Sat-3 Engineering model harnesses in fabrication at Ball
  5. Modifications to the TSIS GCI (electronics) are designed and spare TSIS GCI engineering unit being modified for performance testing
Joint Polar Satellite System (JPSS) Ground System

Provides Enterprise Management & Ground Operations, Flight Operations, Data Acquisition, Data Routing, Data Product Generation, Data Product Cal/Val and Direct Readout Support services.
**JPSS Ground System High-level Architecture OV-1**

**JPSS Ground System**
- TDRSS
- Coriolis/WindSat MetOp
- DMSP
- POES

**Field Terminal Support Node**
- SvalSat
- Fairbanks CDA
- TrollSat
- McMurdo

**Launch Service**
- SMD (J-1+)
- MD Frames

**Management & Operations Node**
- NSOF MMC
- Fairmont CBU Alt MMC

**Cal/Val Node**
- FVS
- FVTS

**Data Processing Node**
- NSOF IDPS
- AFWA IDPS
- Fairmont Alt IDPS

**Simulation Node**
- Alg. Support
- RDRs, IPs

**Field Terminal Users**
- SNPP
- JPSS

**Common Ground System (CGS)**
- Provider of SMD Only

**Provider of SMD, TT&C, LRD/HRD/MSD**
- No Internal Support, Pass-thru Only

**Network**
- Supports routing of NASA SCaN-supported missions, POES & McMurdo NSF data

**Supporting Ops**
- Fit Dynamics System
- Support Nodes

**External**
- AFWA
- FNMOC
- NAVO
- ESPC
- CLASS

**Internal**
- FVM, IPs
- Correlative Data Sources

**Findings**
- Alg, ASF, DRs, Findings

**STAR**
- Alg & Val LCFs
Joint Polar Satellite System Program

The NESDIS Central

Office of Satellite & Product Operations (OSPO) will provide common services:
- Data Center Operations
- Telecommunications
- User Services (Help Desk)
- Config. Management
- Security Controls
- Distribution
- Ingest

Center for Satellite Applications and Research (STAR) and partners provides:
- Validation of sensor and environmental data records
- Algorithm development and improvements
- Supports both JPSS IDPS and NDE
JPSS Program Status

- **NPOESS to JPSS restructuring/transition nearly complete**
  - All NPOESS instruments (ATMS, CrIS, VIIRS, and OMPS) and Ground System under direct contracts with NASA/GSFC JPSS Program
  - J-1 spacecraft contract established with BATC
  - CLIN 5050 work (Cal Val) to be transitioned mid summer
  - NGAS IP issue unresolved, but not impeding programmatic and technical progress

- **Program staffing at 85% of FY2012 EOY plan**
  - Critical vacancies being addressed
  - Not an issue in the near term

- **SNPP Operations successfully transitioned to JPSS Program from NPP in March 2012**
  - NASA to NOAA transition in work

- **All necessary NOAA/NASA agreements in place to support JPSS Program**
Summary

- JPSS will improve weather forecasting and knowledge of transient Earth events
- JPSS will provide time-critical weather information for the nation
- JPSS will be a critical element in maintaining NOAA/NASA climate knowledge continuity from the afternoon orbit
- On behalf of NOAA, GSFC leads a large team of industrial partners to make this happen
- To lessen programmatic risk, JPSS-1 is baselined as a clone of NPP
- JPSS will continue to maintain a collaborative relationship with DoD throughout the mission
- Although located offsite in Building 40, JPSS (Code 470) is an integral part of GSFC
A 'Blue Marble' image of the Earth taken from Suomi NPP's VIIRS instrument. This composite image uses a number of swaths of the Earth's surface taken on January 4, 2012.
The Visible/Infrared Imager Radiometer Suite (VIIRS) produced these 'true-color', color scaled, and gray scaled variations. This was taken on January 19, 2012, the first day the full complement of VIIRS' 22 channels were active.
First Global Image from VIIRS

The Visible Infrared Imager Radiometer Suite (VIIRS) gets a complete view of our planet every day. This image from November 24, 2011, is the first complete global image from VIIRS.
Suomi NPP Satellite Acquires First VIIRS Image

This Visible Infrared Imager Radiometer Suite (VIIRS) image is of a broad swath of Eastern North America from Canada's Hudson Bay past Florida to the northern coast of Venezuela.
NPP Satellite Acquires First ATMS Measurements

The image shows the ATMS channel 18 data, which measures water vapor in the lower atmosphere. Tropical Storm Sean is visible in the data, as the patch of blue, in the Atlantic off the coast of the Southeastern United States.
## JPSS Acronym List

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA</td>
<td>Associate Administrator</td>
</tr>
<tr>
<td>ADCS</td>
<td>Advanced Data Collection System</td>
</tr>
<tr>
<td>AFWA</td>
<td>Air Force Weather Agency</td>
</tr>
<tr>
<td>AHRPT</td>
<td>Advanced High Resolution Picture Transmission</td>
</tr>
<tr>
<td>AMSR2</td>
<td>Advanced Microwave Scanning radiometer 2</td>
</tr>
<tr>
<td>ATMS</td>
<td>Advanced Technology Microwave Sounder</td>
</tr>
<tr>
<td>CERES</td>
<td>Cloud and Earth Radiant Energy System</td>
</tr>
<tr>
<td>CLASS</td>
<td>Comprehensive Large Array Data Stewardship System</td>
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<tr>
<td>CPD</td>
<td>Capabilities Production Document</td>
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<tr>
<td>CrIS</td>
<td>Cross-Track Infrared Sounder</td>
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<tr>
<td>CS</td>
<td>Civil Servant</td>
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<tr>
<td>C3S</td>
<td>Command, Control, and Communications Segment</td>
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<tr>
<td>DoD</td>
<td>Department of Defense</td>
</tr>
<tr>
<td>DUS</td>
<td>Deputy Under Secretary</td>
</tr>
<tr>
<td>EDR</td>
<td>Environmental Data Record</td>
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<tr>
<td>ERBS</td>
<td>Earth Radiation Budget Suite</td>
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<tr>
<td>FOC</td>
<td>Final Orbital Capability</td>
</tr>
<tr>
<td>FT</td>
<td>Field Terminal</td>
</tr>
<tr>
<td>FTEs</td>
<td>Full Time Equivalents</td>
</tr>
<tr>
<td>FTS</td>
<td>Field Terminal Segment</td>
</tr>
<tr>
<td>GCOM</td>
<td>Global Changing Observation Mission</td>
</tr>
<tr>
<td>GOES-N</td>
<td>Geostationary Operational Environmental Satellite - N</td>
</tr>
<tr>
<td>GS</td>
<td>Ground System</td>
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<tr>
<td>GSFC</td>
<td>Goddard Space Flight Center</td>
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<tr>
<td>HQ</td>
<td>Headquarters</td>
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<tr>
<td>HRD</td>
<td>High Rate Data</td>
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<tr>
<td>I&amp;T</td>
<td>Integration &amp; Test</td>
</tr>
<tr>
<td>ICD</td>
<td>Interface Control Document</td>
</tr>
<tr>
<td>IDPS</td>
<td>Interface Data Processing Segment</td>
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<tr>
<td>IOC</td>
<td>Initial Orbital Capability</td>
</tr>
<tr>
<td>IORD-II</td>
<td>Integrated Operational Requirements Document - II</td>
</tr>
<tr>
<td>JASD</td>
<td>Joint Agency Satellite Division</td>
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<tr>
<td>JPSS</td>
<td>Joint Polar Satellite System</td>
</tr>
<tr>
<td>LRD</td>
<td>Launch Readiness Date</td>
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<tr>
<td>LRD</td>
<td>Low Rate Data</td>
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<tr>
<td>MMC</td>
<td>Mission Management Center</td>
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<tr>
<td>MOU</td>
<td>Memorandum Of Understanding</td>
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<tr>
<td>NG</td>
<td>Northrop Grumman</td>
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<tr>
<td>NASA</td>
<td>National Aeronautics and Space Administration</td>
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<tr>
<td>NESDIS</td>
<td>National Environmental Satellite, Data, and Information Service</td>
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<tr>
<td>NGAS</td>
<td>Northrop Grumman Aerospace Systems</td>
</tr>
<tr>
<td>NGST</td>
<td>Northrop Grumman Space Technology</td>
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<tr>
<td>NOAA</td>
<td>National Oceanic and Atmospheric Administration</td>
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<tr>
<td>NPOESS</td>
<td>National Polar-orbiting Operational Environmental Satellite System</td>
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<tr>
<td>NPP</td>
<td>National Polar-orbiting Partnership</td>
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<tr>
<td>NSOF</td>
<td>NOAA Satellite Operations Facility</td>
</tr>
<tr>
<td>OMPS</td>
<td>Ozone Mapping and Profiler Suite</td>
</tr>
<tr>
<td>OSD</td>
<td>Office of Systems Development</td>
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<tr>
<td>OSTP</td>
<td>Office of Science and Technology Policy</td>
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<tr>
<td>PMC</td>
<td>Program Management Council</td>
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<tr>
<td>RDR</td>
<td>Raw Data Record</td>
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<tr>
<td>SARSAT</td>
<td>Search and Rescue Satellite-Aided Tracking</td>
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<tr>
<td>SDE</td>
<td>Selective Data Encryption</td>
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<tr>
<td>SDR</td>
<td>Science Data Record</td>
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<tr>
<td>SDS</td>
<td>Science Data Segment</td>
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<tr>
<td>SMA</td>
<td>Safety and Mission Assurance</td>
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<tr>
<td>SMC</td>
<td>Space and Missile Systems Center</td>
</tr>
<tr>
<td>SMD</td>
<td>Science Mission Directorate</td>
</tr>
<tr>
<td>T&amp;C</td>
<td>Telemetry &amp; Command</td>
</tr>
<tr>
<td>TSIS</td>
<td>Total Solar and Spectral Irradiance Sensor</td>
</tr>
<tr>
<td>WBS</td>
<td>Work Breakdown Structure</td>
</tr>
<tr>
<td>USAF</td>
<td>United States Air Force</td>
</tr>
<tr>
<td>VIIRS</td>
<td>Visible Infrared Imager Radiometer Suite</td>
</tr>
</tbody>
</table>
Backup Charts
## NPOESS to JPSS Major Changes

<table>
<thead>
<tr>
<th>NPOESS</th>
<th>JPSS</th>
<th>Impact</th>
</tr>
</thead>
</table>
| **Mission Scalability** | Support up to 2 missions (3 satellites), Flying up to 2 satellites, plus DMSP and MetOp support | Flight ops for up to 3 satellites concurrently, plus GCOM W1 data processing and DMSP and MetOp, data acquisition and routing support | • Fleet Management  
• Mission planning  
• Prioritization/scheduling  
• Lifecycle concurrency  
• Mixed Mode Operations |

<table>
<thead>
<tr>
<th>Early AM Satellite</th>
<th>C2 Mission</th>
<th>DWSS Program Terminated, – maintain DOD contacts during requires formulation &amp; AoA</th>
<th>• Reduced scope</th>
</tr>
</thead>
<tbody>
<tr>
<td>GCOM</td>
<td>None</td>
<td>GCOM-W Series (Threshold)</td>
<td>New Req’t - Provide SMD processing thru RDR’s,</td>
</tr>
<tr>
<td>LRD</td>
<td>Data Programmable at VC level w/ 5 predefined configurations</td>
<td>No LRD on J1, potentially on J2 – revised</td>
<td></td>
</tr>
<tr>
<td>FTS</td>
<td>FTS Concept driven by needs of diverse community</td>
<td>Revised FTS Definition for J1, HRD for J1 only</td>
<td></td>
</tr>
<tr>
<td>SMD ConOps and Latency</td>
<td>SafetyNet – 28 min latency</td>
<td>80 min latency JPSS-1/2</td>
<td>SMD from polar ground stations and TDRSS/SN as backup</td>
</tr>
</tbody>
</table>
| Operations         | Contractor led till Full Operational Capability (FOC) | NOAA led at NSOF beginning with NPP; DoD responsible for operations at AFWA | • Increased programmatic complexity  
• Increase in H/W and facility resources  
• Change in I&T approach |
<p>| Sustainment        | NPOESS Program responsibility | JPSS, NESDIS, DoD shared responsibility | |</p>
<table>
<thead>
<tr>
<th>NPOESS</th>
<th>JPSS</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cal/Val and Algorithm</td>
<td>JPSS DPA/DPE organization responsible for algorithm development and changes process</td>
<td>•New org/ConOps</td>
</tr>
<tr>
<td>Security</td>
<td>NIST 800-53 rev 3 FIPS 199 – High Impact</td>
<td>Significant impact to all level 3 elements</td>
</tr>
<tr>
<td>COOP</td>
<td>ACGS - both MMC and DP nodes</td>
<td>•Revised System architecture</td>
</tr>
<tr>
<td>Ground Sys. Evolution</td>
<td>Multiple Blocks and sub-blocks</td>
<td>•Increased concurrency of lifecycle phases</td>
</tr>
<tr>
<td>Data Consumers (IDPS deployments)</td>
<td>Two Centrals continue to receive IDPS at AFWA/NESDIS for JPSS-1 – Support NAVO/FNMOC</td>
<td>Revised Data Architecture to incorporate reduced IDPS but also include COOP (ACGS) capability and still support NAVO/FNMOC</td>
</tr>
<tr>
<td>GRAVITE</td>
<td>Gov’t led and managed, support users</td>
<td>Intermediate Cal/Val products to data consumers via DP vs GRAVITE</td>
</tr>
<tr>
<td>Simulation Capability</td>
<td>FVTS suite of EM fidelity and Ops Simulators being developed for JPSS-1</td>
<td>Less reliance on Observatory for testing ground system</td>
</tr>
</tbody>
</table>
Total Solar and Spectral Solar Irradiance Sensor (TSIS)

- **TSIS is composed of two sensors - TIM & SIM:**
  - TIM continues the collection of Total Solar Irradiance (TSI) data following the SORCE mission to update the 33+ year climate record from space. TIM is an active cavity radiometer that monitors changes in Total Solar Irradiance (TSI) at the top of the Earth’s atmosphere. TSI is a critical parameter in global climate models.
  - SIM continues the collection of Solar Spectral Irradiance (SSI) data following the SORCE mission to update the long-term climate record. SIM is a prism spectrometer that monitors changes in SSI as a function of wavelength.
The Search and Rescue instruments are part of the international Cospas-Sarsat system designed to detect and locate Emergency Locator Transmitters (ELTs), Emergency Position-Indicating Radio Beacons (EPIRBs), and Personal Locator Beacons (PLBs).

- The SARP detects the signal only from 406.05-MHz beacons but stores the information for subsequent downlink to a LUT. Thus, global detection of 406.05-MHz emergency beacons is provided. This processor consists of a receiver power unit (RPU) and signal processing unit (SPU).

- The SARR transponds the signals of emergency beacons. However, these beacon signals are detected on the ground only when the satellite is in view of a ground station known as a Local User Terminal (LUT).
A-DCS Instrument

- The Advanced Data Collection System (A-DCS), also known as ARGOS is presently jointly operated by NOAA and CNES. With the A-DCS instruments installed on MetOp-1, 2 and 3 Eumetsat will become the third agency to operate the Argos system.

- The A-DCS is to provide a worldwide in-situ environmental data collection and Doppler-derived location service with the basic objective of studying and protecting the Earth environment. The picture of the A-DCS shows (from left to right) the Transmitter Unit (TXU), the Receiver and Processing Unit (RPU).

- A-DCS instrument is provided by Centre National d'Études Spatiales (CNES) Toulouse, France and developed by Thales Elancourt, France and Alcatel Space Toulouse, France. Data processing is performed by CLS Argos a CNES subsidiary in France and Service Argos Inc in the US.