Space and Missile Systems Center

Weather Systems Update

Abe Awwad, SMC/RSR

Jan 2016

Agenda

- WSF Update
- ECP Update
- SSAEM/COSMIC-2
- Weather Technology Roadmap
  - OPIR Status
  - Space Based Environmental Monitoring Status
- Commercialization RFI

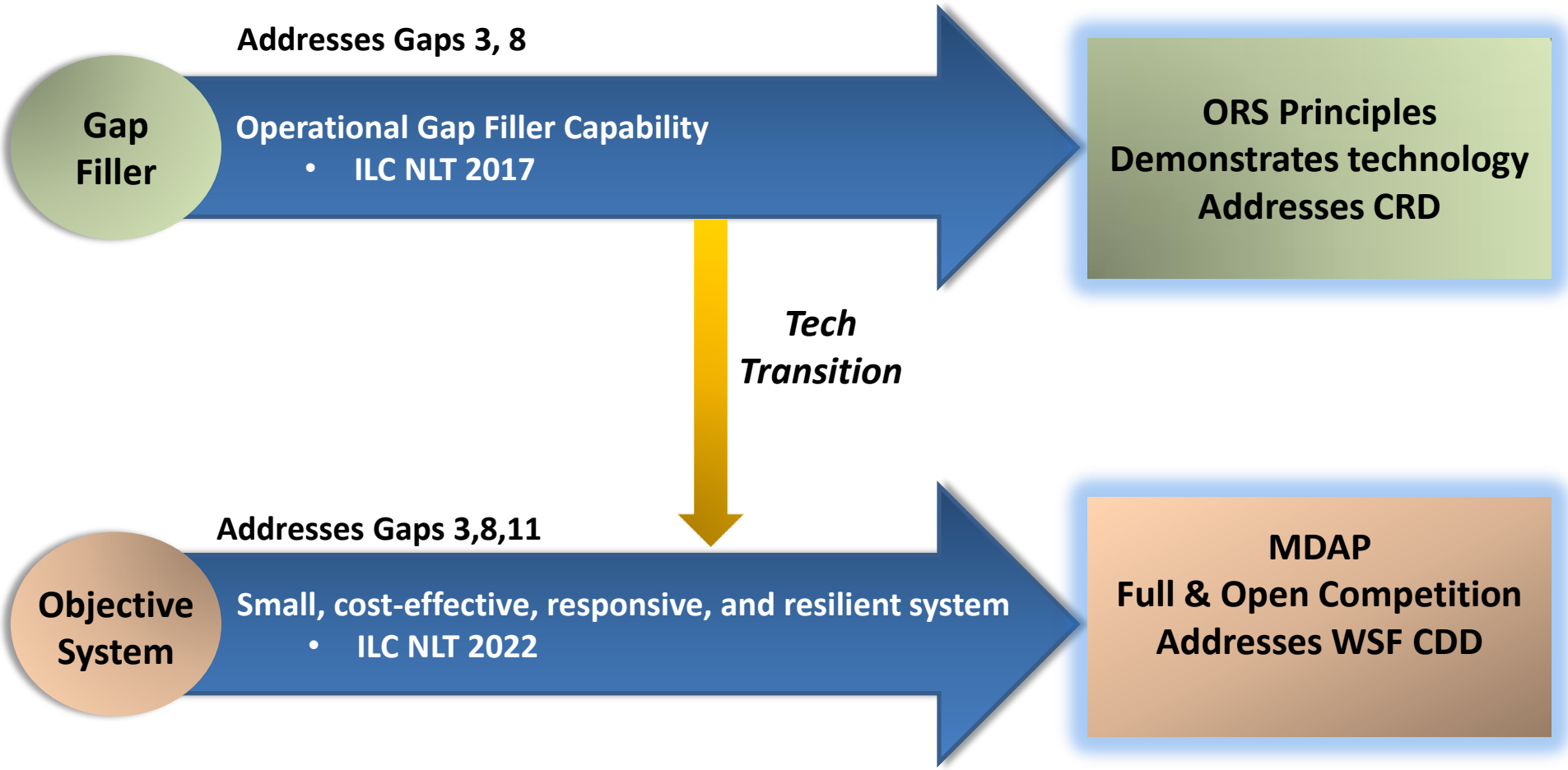
Weather System Follow-on (WSF)

- **Weather System Follow-on (WSF) is:**
  - **Portfolio of "materiel solutions" intended to meet Joint Staff validated Space Based Environmental Monitoring (SBEM) requirements**
  - **Systems of Systems approach for integrating space-based weather observing capabilities**
  - **Addresses JROCM-validated capability needs through near-term gap filler followed by a long-term enduring objective program**

Gap Priority	Description	Use	AoA Gap Need Date	Sensor Type
1	Cloud characterization	Flying operations (long range strikes), ISR planning/execution optimization	2020/2025*	EO/IR
2	Theater Weather Imagery	Supports tactical weather forecasting: CSAR1, battlespace awareness	2020/2025*	EO/IR
3	Ocean Surface Vector Winds	Critical for fixing tropical cyclone position for resource protection, including evacuation & ship operational maneuvers	2015	MW
4	Ionospheric Density	Communications/UHF/SATCOM, GPS-guided systems	2023	Space
5	Snow Depth	High operational risk to mission, asset protection – ground maneuvers, river gap crossings	2020/2025*	MW
6	Soil Moisture	Supports Army trafficability & ground maneuvers. Key environmental input to improve forecasts from global weather models	2021	MW
7	Equatorial Ionospheric Scintillation	Communications on signals/GPS-guided systems	2023	Space
8	Tropical Cyclone Intensity	Tropical cyclones forecasting in PACOM AoR for resource protection (evacuation, ship maneuvers)	2021	MW
9	Sea Ice Characterization	Arctic submarine operations & future Naval surface operations	2020/2025*	MW
10	Auroral Characterization	Space surveillance and missile defense radar operations No Military Utility	2020	
11	LEO Energetic Charged Particle Characterization	Satellite anomaly assessments and space protection [attribution]	2021	Space
12	Electric Field	Space surveillance and missile defense radar operations scintillation in support of communications/UHF/SATCOM	2020/2025*	Space

- JROCM 092-14: The Air Force materiel solution "shall focus on DoD materiel solutions to meet the OSVW, TCI, and Low Earth Orbit Energetic Charged Particle gaps (gaps 3, 8, and 11)"

WSF Program Acquisition Approach



COWVR: Compact Ocean Wind Vector Radiometer
- Flight demo (w/JPL-built sensor) planned in 2017

WSF Path Forward

- **Pursue low cost partial capability solution**
  - **Fund algorithm & ground software improvements for OSVW & TCI using existing on-orbit sensors**
- **Proceed to competition of an objective system to award in FY17**

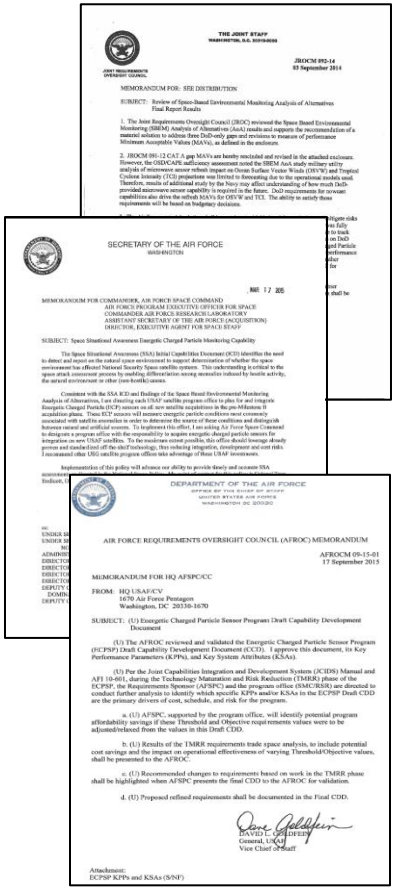
WSF-ECP Background

- **Space Based Environmental Monitoring (SBEM) Analysis of Alternatives (AoA) determined material solution for Low Earth Orbit (LEO) Energetic Charged Particles (ECP) (Gap 11) - Joint Requirements Oversight Council Memorandum (JROCM) 092-14 – *3 Sep 2014***

- **Office of the Executive Agent for Space (EA4S), citing the National Space Policy and United States Strategic Command (USSTRATCOM) Space Situational Awareness (SSA) Initial Capabilities Document (ICD) and the SBEM AoA, determined all DoD satellites, in all orbits, would benefit from low-Size, Weight and Power (low-SWaP) ECP sensors for anomaly attribution purposes – *Late 2014***

- **Secretary of the Air Force (SECAF) policy memo mandated satellite programs to integrate an ECP Sensor for anomaly attribution – *17 Mar 2015***

- **USAF Requirements Oversight Council approved draft Capabilities Development Document (dCDD) for Energetic Charged Particles Sensor; *AFROCM signed 17 Sep 2015***


THE JOINT STAFF
WASHINGTON, D.C. 20318-9999

JROCM 092-14
03 September 2014

MEMORANDUM FOR: SEE DISTRIBUTION

SUBJECT: Review of Space-Based Environmental Monitoring Analysis of Alternatives Final Report Results

SECRETARY OF THE AIR FORCE
WASHINGTON

MEMORANDUM FOR COMMANDER, AIR FORCE SPACE COMMAND
AIR FORCE PROGRAM EXECUTIVE OFFICER FOR SPACE
COMMANDER, AIR FORCE RESEARCH LABORATORY
ASSISTANT SECRETARY OF THE AIR FORCE (ACQUISITION)
DIRECTOR, EXECUTIVE AGENT FOR SPACE (EA4S)

SUBJECT: Space Situational Awareness Energetic Charged Particle Monitoring Capability

DEPARTMENT OF THE AIR FORCE

AIR FORCE REQUIREMENTS OVERSIGHT COUNCIL (AFROC) MEMORANDUM

AFROCM 09-15-01
17 September 2015

MEMORANDUM FOR HQ AFSPC/CC

FROM: HQ USAF/CV
1670 Air Force Pentagon
Washington, DC 20330-1670

SUBJECT: (U) Energetic Charged Particle Sensor Program Draft Capability Development Document

(U) The AFROC reviewed and validated the Energetic Charged Particle Sensor Program (ECPSP) Draft Capability Development Document (CCD). I approve this document, its Key Performance Parameters (KPPs), and Key System Attributes (KSAs).

(U) Per the Joint Capabilities Integration and Development System (JCIDS) Manual and AFI 10-601, during the Technology Maturation and Risk Reduction (TMRR) phase of the ECPSP, the Requirements Sponsor (AFSPC) and the program office (SMC/RSR) are directed to conduct further analysis to identify which specific KPPs and/or KSAs in the ECPSP Draft CDD are the primary drivers of cost, schedule, and risk for the program.

a. (U) AFSPC, supported by the program office, will identify potential program affordability savings if these Threshold and Objective requirements values were to be adjusted/released from the values in this Draft CDD.

b. (U) Results of the TMRR requirements trade space analysis, to include potential cost savings and the impact on operational effectiveness of varying Threshold/Objective values, shall be presented to the AFROC.

c. (U) Recommended changes to requirements based on work in the TMRR phase shall be highlighted when AFSPC presents the final CDD to the AFROC for validation.

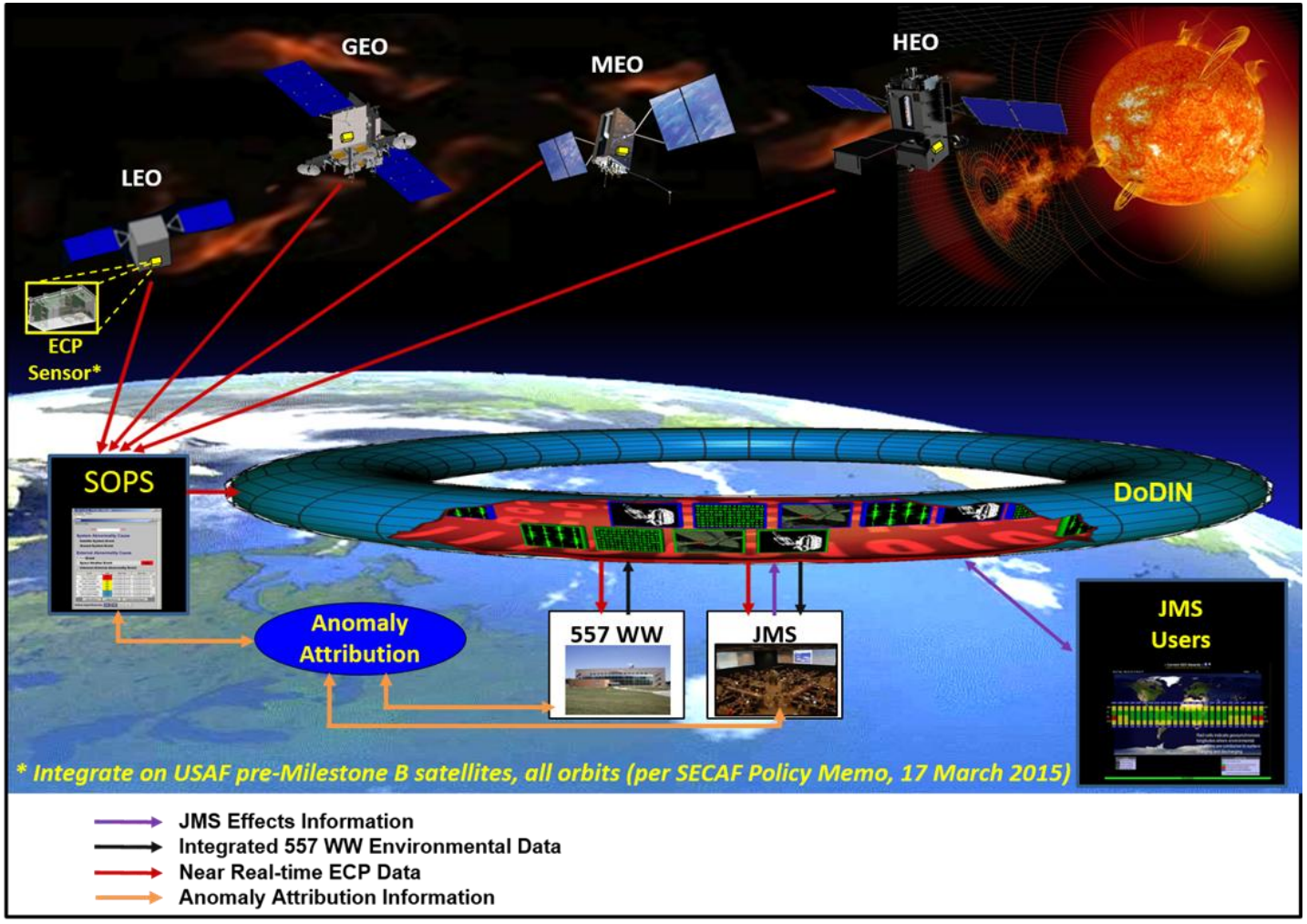
d. (U) Proposed refined requirements shall be documented in the Final CDD.

DAVID L. GOLDFEIN
General, USAF
Vice Chief of Staff

Attachment:
ECPSP KPPs and KSAs (S/NF)

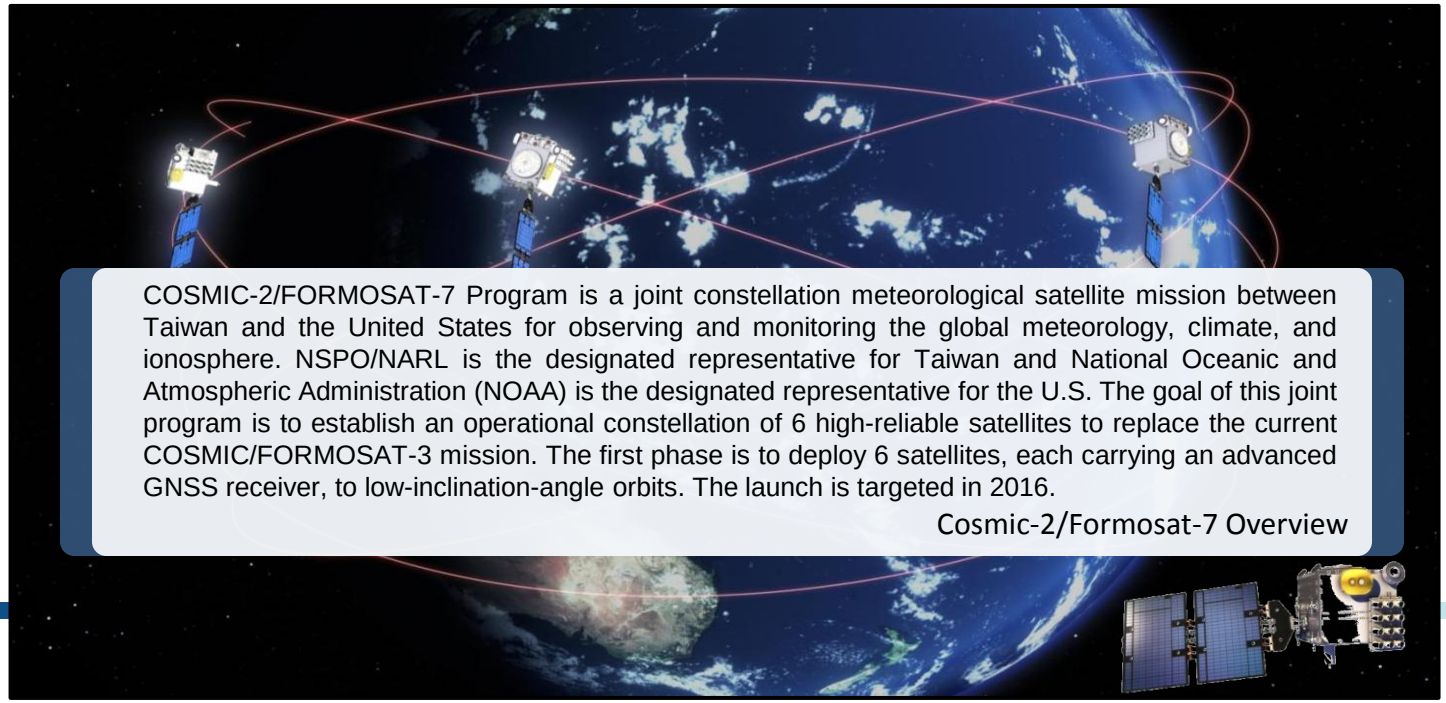
"… directing each USAF satellite program office to plan for and integrate ECP sensors on all new satellite acquisition in the pre-Milestone B acquisition phase."
- SECAF Memo 17 March 2015

WSF- ECP Architecture View (OV-1)



SSAEM/COSMIC -2

- **International Partnership between Taiwan's National Space Organization (NSPO) & US National Oceanographic & Atmospheric Administration (NOAA)**
- **3 SSAEM payloads hosted on 6 COSMIC-2 equatorial spacecraft:**
  - **Tri-GNSS Radio Occultation receiver (TGRS) [6 units total]**
  - **Ion Velocity Meter (IVM) [6 units total]**
  - **Radio Frequency Beacon (RF Beacon) [6 units total]**



COSMIC-2/FORMOSAT-7 Program is a joint constellation meteorological satellite mission between Taiwan and the United States for observing and monitoring the global meteorology, climate, and ionosphere. NSPO/NARL is the designated representative for Taiwan and National Oceanic and Atmospheric Administration (NOAA) is the designated representative for the U.S. The goal of this joint program is to establish an operational constellation of 6 high-reliable satellites to replace the current COSMIC/FORMOSAT-3 mission. The first phase is to deploy 6 satellites, each carrying an advanced GNSS receiver, to low-inclination-angle orbits. The launch is targeted in 2016.

Cosmic-2/Formosat-7 Overview

OPIR Background & Status

- **OPIR weather demonstrated successful application during 2013 response to CENTCOM JUON (28th OWS)**
- **SMC/RS continues to receive environmental OPIR data requests from DoD, Civil, IC and Int'l partners**

SBIRS/DSP environmental application in R&D Acquisition—
capabilities are maturing now

OPIR Benefits & Challenges

BENEFITS

- AF OPIR provides global coverage in multiple IR bands
- Environmental IR characteristics supplement MW/MD
- Exploit “staring” data without impact to MW/MD

CHALLENGES

- OPIR channel optimization requires study
- Integration of OPIR data in existing numerical models
- Secret classification of OPIR capabilities limits use
- Satellite coverage is growing
- Sensor tasking priority

Space Based Environmental Monitoring S&T Activities

S&T Dev and Demos

1. BAA Risk Reduction Technology Projects
2. Compact Ocean Wind Vector Radiometer (COWVR)
3. AFRL Compact Environment Anomaly Sensor (CEASE-RR) (ECP Demonstration)
4. AFRL Compact Environment Anomaly Sensor with ESA (Cease III-RR/ESA)
5. MagDos (Aerospace Corp)
6. Responsive Environmental Assessment Commercially Hosted (REACH) / Low Energy Additional Dosimeter (LEAD)
7. Polarimetric Receiver Contractor IR&D (2015&2016)

Commercialization RFI

- **Released Request for Information from interested parties in support of Space-Based Environmental Monitoring (SBEM) Terrestrial Weather and Space Environment Data Commercialization**
  - **SMC/RS is seeking information on currently available industry capabilities, as well as emerging future capabilities to provide the environmental data that could address the Department's weather requirements, or augment DoD's plan to address those requirements**
  - **Additionally, SMC/RS is seeking business case information from the industry in procuring such data, as well as addressing the long-term market viability for this effort**
- **Responses to this RFI are due by 2:00 PM Pacific Time on 29 January 16**

Questions