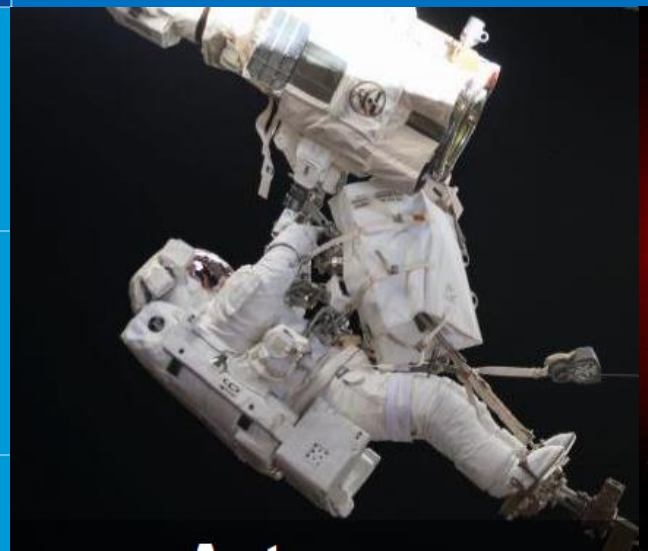
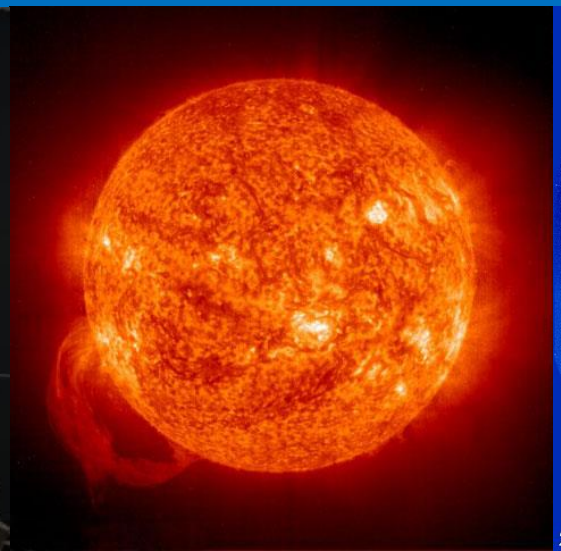
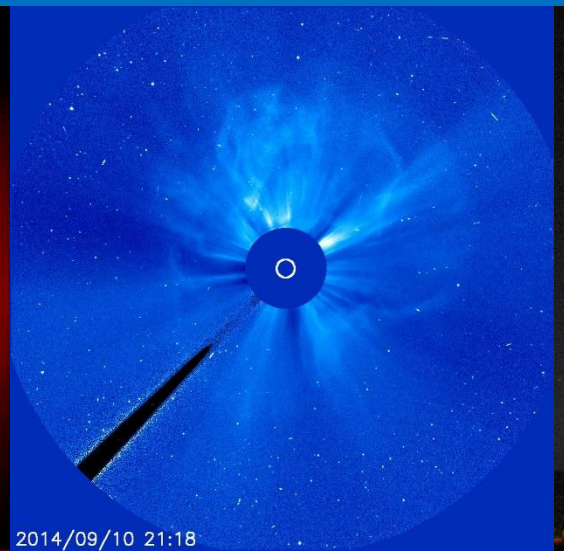
Space Weather Pre-Formulation

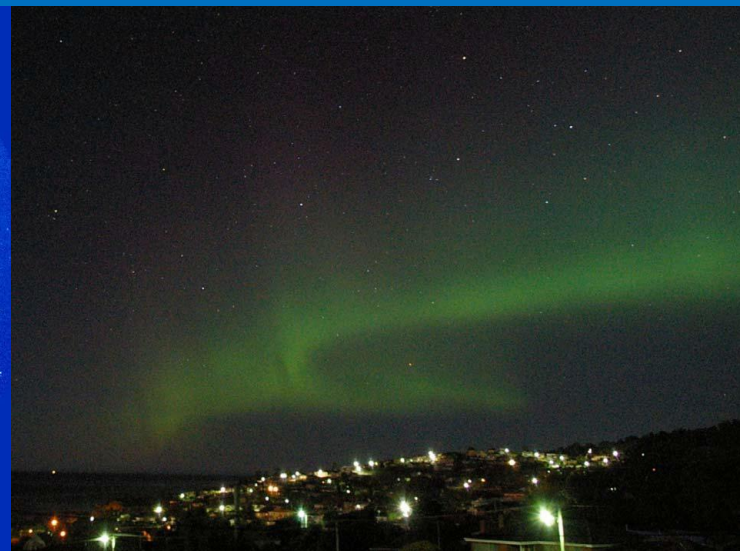
Joanne Ostroy, Formulation Lead, MITRE

September 30, 2020









Agenda

- Bottomline Upfront
- Pre-formulation objectives.
- Space Weather Program Milestone 0 (MS0)
- Space weather planning roadmap to MS 1
- Planning the Space Weather Program
- Summary

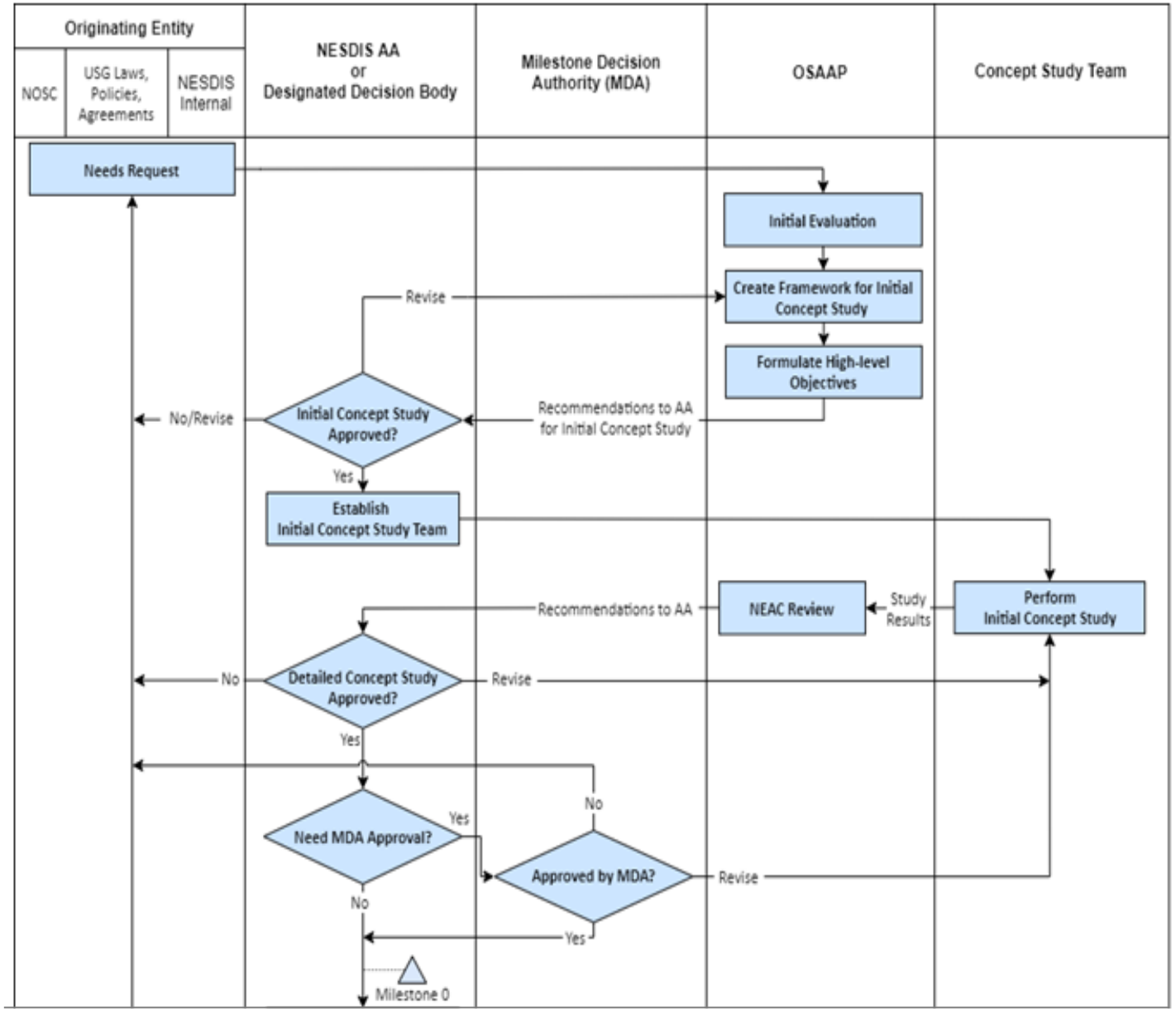
Bottomline upfront

- Space weather program satisfied milestone 0 through the GEO-XO program milestone 0
- NESDIS Assistant Administrator, Dr. Volz, authorized the planning of the space weather program as a separate program, April 17, 2020
- Planning is progressing:
  - Milestone 1 expected in Q3 FY21
  - Milestone 2 expected in Q3 FY22
- Formulation of Space Weather Program expected after Milestone 2

Pre-Formulation Objectives

- Define and scope user needs of the mission
  - Identifying stakeholders
  - User Requirements Document
  - Based on Consolidated Observation Requirements Lists (COURL), Space Platform Requirements Working Group (SPRWG), and other user requirements
- Translating User Need Statements into observational requirements
  - Evaluation of the science and modeling requirements based on the signature parameters of the events.
  - Identifying the operational requirements based on time cadence of the phenomenology associated with the user needs.
- Understanding the societal and economic impacts of the mission
  - Identifying stakeholder impacts
  - Qualitative and quantitative evaluation of mission impacts on stakeholders
- Initial Concept Study
  - Identify operational concepts
  - Evaluate feasibility

Process to Milestone 0 (NESDIS-PLN-1220.1)



Establishing Space Weather Program

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL ENVIRONMENTAL SATELLITE, DATA,
AND INFORMATION SERVICE

April 17, 2020

MEMORANDUM FOR Mark Paese
Deputy Assistant Administrator for
Satellite and Information Service

Karen St. Germain
Deputy Assistant Administrator for Systems for
Satellite and Information Service

FROM: Stephen M. Volz
Assistant Administrator for
Satellite and Information Service

SUBJECT: Establishment of a New Space Weather Program Office in NESDIS

I am directing NESDIS to develop a plan to establish a new Space Weather program office to be a sustained element within NESDIS. The new program office will be responsible for the newly established space weather observing system SWFO, and for the implementation planning and development of the space weather observing system of the future. The observing system must include the interests and investments of our interagency partners. As with the LEO and GEO programs, the Space Weather program will work within NESDIS to integrate the NESDIS architecture into the planning, to define and arrange for the near term and future ground system, to include algorithm and product development, and to support sustained operations of the DSCOVR satellite and the space weather instruments on the GOES platforms.

Pillars of NESDIS Observing System Implementation

Integrated, Adaptable and Affordable: Orbits, Instruments & Systems

GEO

Continuous real-time observations supporting warnings and watches of severe weather and hour-by-hour changes. High-inclination orbits to observe northern latitude & polar regions.

LEO

Miniaturized instruments on small, affordable and proliferated satellites and partner data improving forecasts through better and additional data. Better precipitation forecasts, wave height predictions, ocean currents, and more.

Space Weather

Reliably monitoring space weather from L1, GEO and LEO can protect the nation's valuable, vulnerable infrastructure. New capabilities at L5 and HEO can provide additional insight and improve forecasts.

Common Ground Services

Secure ingest of data in different formats from different partners requires a flexible, scalable platform. Common Services approach integrates Cloud, AI and machine-learning capabilities to verify, calibrate and fuse data into new and better products and services.

Space Weather Milestone 0

- Space weather requirements were part of the GEO-XO program

- GEO-XO went through Milestone 0 December 18, 2019
  - Assumption GEO-XO Milestone 0 approved space weather mission

- Assistant Administrator of National Environmental Satellite, Data, and Information Service (NESDIS), Dr. Volz authorized the planning of the Space Weather Program, April 2020
  - Space weather responsibilities were shifted to the planning of the Space Weather Program (SWX)

Space Weather planning to Milestone 1

- **GEO-XO went through Milestone 0 December 18, 2019**
  - DOC & NESDIS Milestone Zero Framework & Scope
  - GEO-XO Milestone 0 included space weather mission
- **Working closely with the GEO-XO formulation**
  - Several BAA's are focused on the space weather needs
    - Ball Aerospace: Auroral Imager for a Tundra Orbit
    - Xplore Inc.: Commercial Solar Observatory at L1
    - LASP: Space Weather Architecture Trade Study
    - Maxar: Trade study of Commercial Hosting Services
- **Initial Studies**
  - Requirements
  - Benefits
  - Architectures
    - Observatories
    - Instrumentations
    - Communications

GEO-XO BAA Studies of Interest to Space Weather Formulation

- Ball Aerospace: Auroral Imager for a Tundra Orbit
  - Trade study of two auroral imager architectures (imaging spectrometer & staring radiometer) using realistic aurora scene generation, detector specs, instrument models, and algorithm-in-the-loop in order to assess each relative to resulting products.

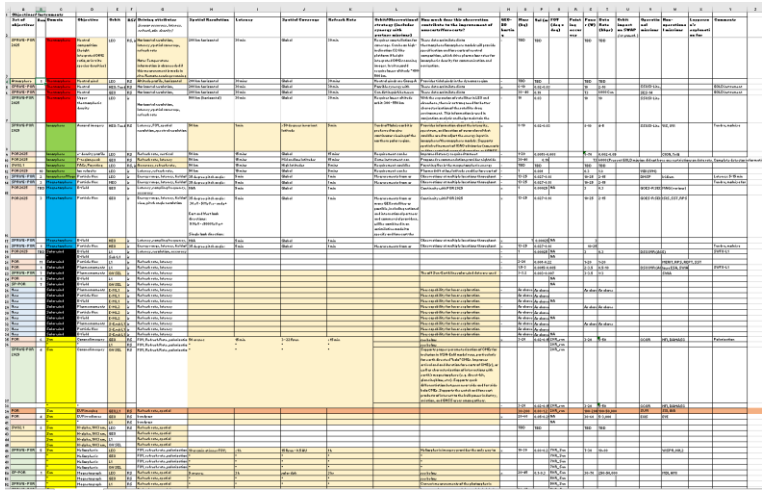
- Xplore Inc.: Commercial Solar Observatory at L1
  - Study to generate a business case, including costs and draft service agreements, for space as a service using their Xcraft™ vehicle with an instrument suite selected for L1 priority measurements. Study will provide the deltas for an L5 mission also.

- LASP: Space Weather Architecture Trade Study
  - Mission concept trade study of varying degrees of spacecraft, instrument disaggregation for the most beneficial orbits (GEO, L1, L5), evaluating each for cost, benefit to NOAA according to six metrics.

- Maxar: Trade study of Commercial Hosting Services
  - Identification and analysis of commercial hosting services at GEO, HEO, L1, as well as acquisition strategy alternatives as an alternative to the reference business model of government-owned satellites. To include a 20-year lifespan cost assessment.

Initial Studies

- Developed an IPT
  - SMEs from NESDIS (OPPA, NCEI), NWS (SWPC), NASA/GSFC
  - Additional support from FFRDCs and academia
- Organized an initial AOA
  - Requirements refinement
    - Evaluated findings from the two NAS workshops in June and September 2020
    - Space weather domain requirement teams working on requirements
  - Prioritization of observational trade studies
  - Architecture studies:
    - Communication
    - Spacecraft
    - Ground impact options
    - Enterprise architectures
    - Launch options
- Developing potential partnerships
  - Met with Canadian Space Agency to discuss possible hosting of space weather instruments, September 11, 2020
  - Working with Department of Defense (DoD) on their next generation weather architecture studies including space weather. Briefing, September 22, 2020
  - ESA-NOAA workshop on solar imagers and interplanetary instruments, September 23, 2020
  - NASA cooperative and collaboration efforts. (IMAP, GDC)
- Benefits analyses
  - Previous studies review
  - Conducted user community evaluation in collaboration with SWPC and GEO-XO
  - User needs study with Space Weather Prediction Center (SWPC)
  - Working with STAR's ASPEN
- Documentation preparation
  - Formulation Authorization Document (FAD) currently in review
  - Developing the preliminary CONOPS and Level 1 Requirements Document



Sensor, orbit, and product analyses

NOAA NESDIS

SPACE WEATHER PROGRAM FORMULATION AUTHORIZATION DOCUMENT (FAD)

September 28, 2020
Version 1.0

TITLE: SWX PROGRAM FORMULATION AUTHORIZATION DOCUMENT VERSION 1.0

SWP preliminary FAD

Summary

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- Planning is progressing
  - Milestone 1 expected in Q3 FY21
- Formulation of Space Weather Program expected Q3 FY22