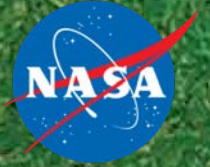


National Aeronautics and
Space Administration



EXPLORE EARTH

**Commercial Smallsat Data Acquisition Program Side
Panel Discussion**

Kevin Murphy - AMS 2020



Private-Sector Small Constellation Satellite Data Product Pilot Project

- Initiated in November 2017
- Pilot activity to evaluate data from operating commercial small-satellite constellations for research and applied science activities
 - Augment and/or complement NASA observations
 - Cost effective means to advance/extend research and applications
- Pilot activity ending early 2020

Pilot Project Vendor Selection

- The commercial small satellite constellations from which the data is obtained shall be:
 - Comprised of a minimum of three satellites;
 - In non-geostationary orbit with consistent, large-scale (complete longitudinal) coverage.
 - The vendor shall demonstrate that it already has a constellation of small satellites functioning in orbit by:
 - Describing the instrument(s) used in the data acquisition and their sampling characteristics;
 - Describing in detail pre-launch instrument characterization and calibration as well as on-board calibration and stability metrics;
 - Documenting launch date and commissioning information; and
 - Providing plans for data continuity from subsequent launches.
- 11 vendors responded to the Request For Information (RFI) and four vendors were selected and were asked to respond to a Request For Proposal (RFP).
- Blanket Purchase Agreements were awarded in October 2018 to DigitalGlobe Inc., Planet Labs Inc., and Spire Global.



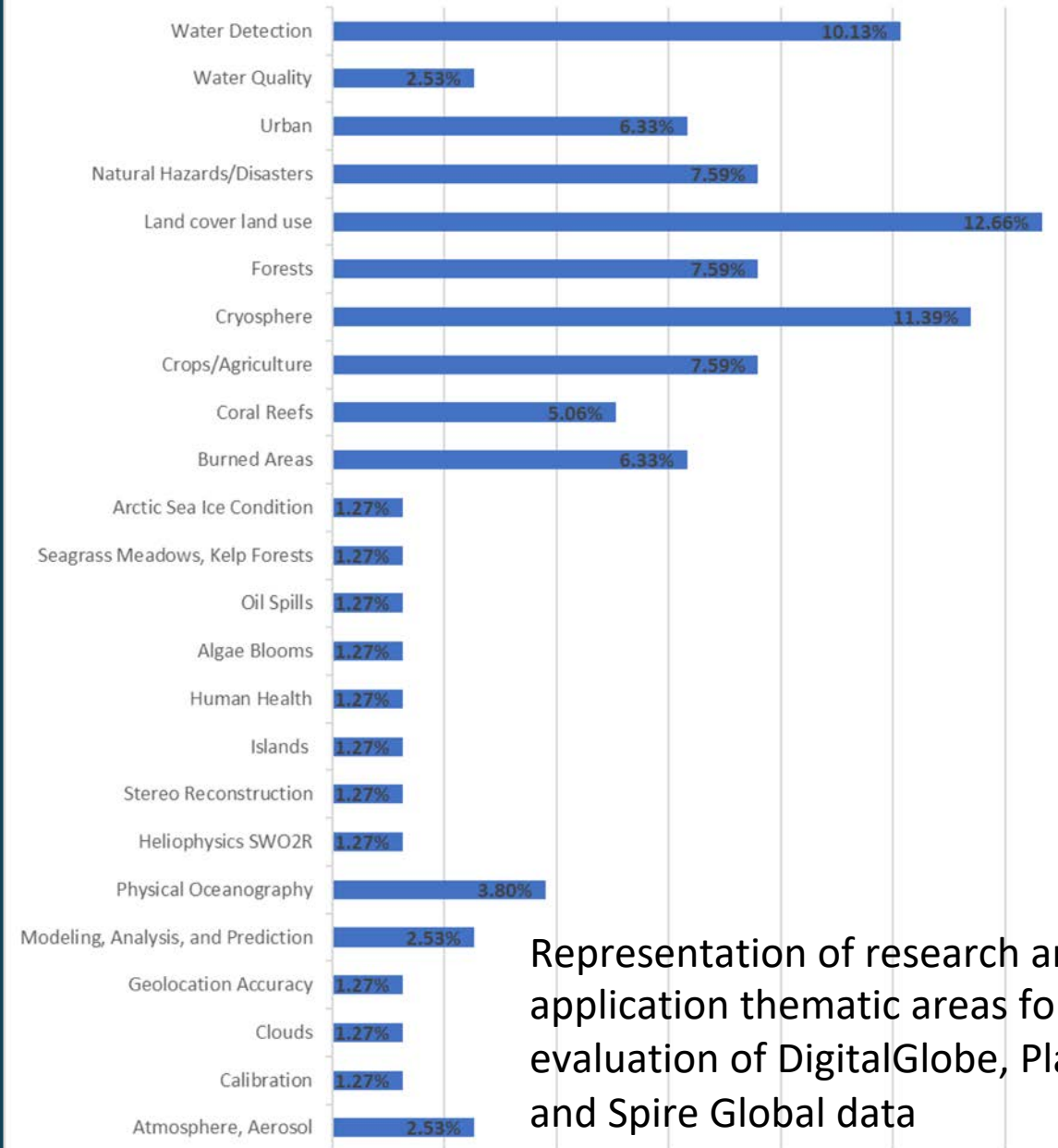
Terms & Conditions for the Pilot Purchased Data for Scientific Use

- Use by NASA or its Related Entities of the Data Products pursuant to a NASA-initiated, US Government-funded and/or US Government-peer reviewed investigation established through a NASA Research Announcement or similar public notice of opportunity, and performed for the purpose of conducting experiments, evaluation, research, and/or development, including basic and applied research under the NASA Applied Sciences Program.
- Scientific Use is not intended for the development of commercial products or services and does not include activities funded or sponsored by non-governmental organizations or activities outside of NASA.
- No Publication or third-party access of Data or derivatives without permission from the vendor.
- Maintain Copyright notices and any restrictive markings.

Pilot Evaluation Approach

NASA ESD identified 41 existing projects to evaluate data from DigitalGlobe Inc. (now known as Maxar), Planet Labs Inc., and Spire Global.

- All six ESD Research and Analysis (R&A) thematic areas, the four Applied Science program elements, and Heliophysics Space Weather were represented.
- An independent assessment of calibration and geolocation was conducted.
- Each project developed reports independently using common evaluation criteria.
- NASA HQ developed a summary report from the individual project reports for each vendor.



Representation of research and application thematic areas for evaluation of DigitalGlobe, Planet, and Spire Global data

A satellite image of a cracked ice surface, likely a glacier or ice sheet, with a large dark crack running diagonally across the frame. The image is partially obscured by a dark teal circular graphic on the right side.

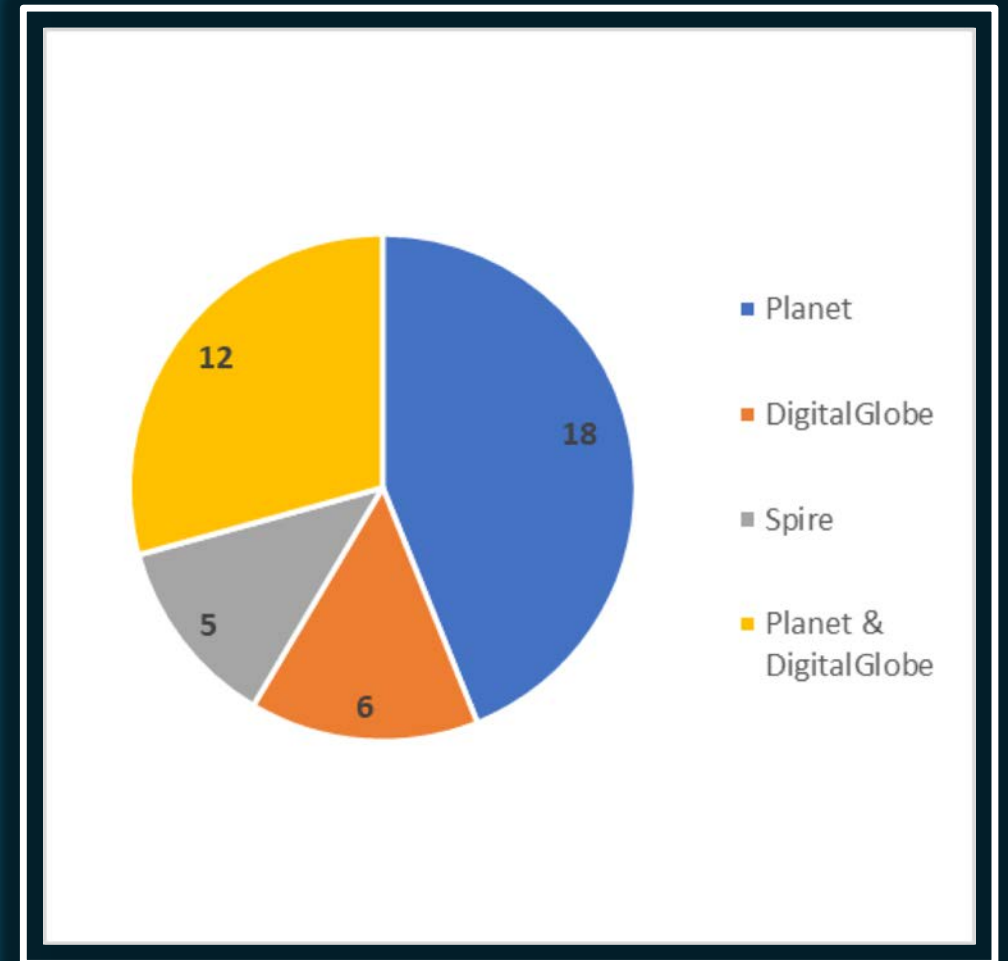
Pilot Evaluation Criteria

All projects were asked to evaluate and comment on the following:

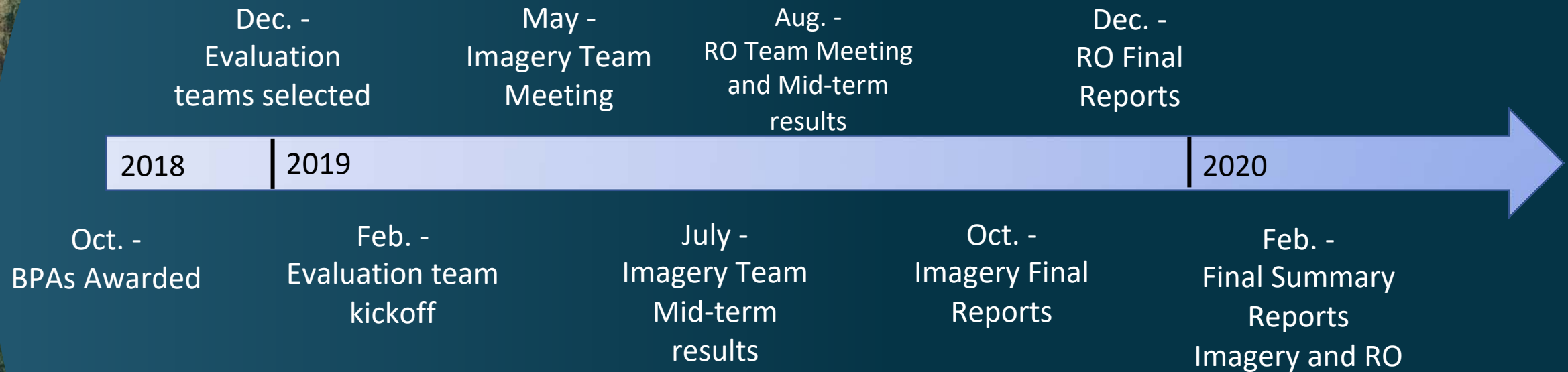
1. **Accessibility of vendor supplied imagery and data:** The ease and efficiency with which data can be searched, discovered, and downloaded from the vendor systems.
2. **Accuracy and completeness of metadata:** The accuracy and completeness of metadata that accompanies the imagery provided by the vendor.
3. **Quality of User Support Services:** The availability, responsiveness, and technical expertise required to answer Investigator inquiries.
4. **Appropriateness of End User License Agreement (EULA):** The suitability of EULA to allow Investigators to practice and perform open science.
5. **Utility of data and imagery for advancing Earth system science research and applications:** The ability of vendor provided imagery and data to support Earth system science research and application activities.
6. **Quality of vendor supplied imagery and/or data:** Data attributes such as geolocation accuracy, quality of radiometric calibration, platform intercalibration, etc.

Pilot Evaluation Reporting

- The 41 projects were separated into two groups based on type of data being evaluated
 - Radio Occultation
 - Imagery
- Less than half of the Pilot investigators evaluated multiple commercial vendors for their projects.
- Investigators in each group submitted interim, midterm and final reports and attended one in-person meeting.



Pilot Evaluation Timeline





- DESIS (183)
- Planet (370)

Select a month

Stop January 2015





Evaluation Results – DigitalGlobe Inc.

- Data augmented and complement existing NASA research and applied activities
 - Data are primarily suited to point-in-time analyses because of not frequent data acquisitions outside of Arctic and Antarctic areas.
 - Monitoring long term trends is possible where data exist with excellent calibration and radiometric performance.
- No issues with data access/download*
- Documentation and metadata are sufficient
- User services are very good
- Standard scientific collaboration is inhibited by license terms

**The DigitalGlobe datasets evaluated in the Pilot were made available through the NextView license from the National Geospatial Intelligence Agency and distributed through NASA's CAD4NASA project at Goddard Space Flight Center.*



Evaluation Results - Planet Labs Inc.

- Data augmented and complement existing NASA research and applied activities
 - PlanetScope data are primarily suited to point in time analysis and verification; monitoring long term trends is difficult because of inconsistent calibration, uneven radiometric performance and inconsistent geolocation – revisit frequency is excellent
 - RapidEye and SkySat suited to point-in-time analyses because of not frequent data acquisitions
- Direct PI data access/download needs improvement
- Documentation and metadata need improvement
- User services are very good
- Standard scientific collaboration is inhibited by license terms

Evaluation Results – Spire Global, Inc.

- The radio occultation (RO) measurements were of quality consistent with the other GNSS-RO observing systems
 - Data are comparable to other RO observing system in terms of their weather forecast impact, and the spatial distribution was complementary in filling data void regions
 - Vertical information content was suitable for studying the fine structures and seasonal variabilities of the tropopause, and their penetration depth was very good and may be useful in the study of the planetary boundary layer
- The GNSS reflected measurements show promise to measure sea surface height with a precision of 2.5 cm over 1 sec averages and an accuracy of < 10 cm
- The Precise Orbital Determination (POD) products were found to be useful in retrieving thermosphere density via satellite drag – particularly in quantifying day-to-day variability
- The mechanism for accessing and ordering from Spire’s data catalog needs improvement to enable ease of data discovery
- No issues with data access/download*
- Documentation and metadata was reasonable
- User services are very good
- Standard scientific collaboration is inhibited by license terms

**The Spire Global datasets evaluated in the Pilot were made available and distributed through NASA’s GMAO system at Goddard Space Flight Center.*

The background of the slide is a cosmic scene. The top half features a dark blue and black space filled with numerous small white stars and a prominent, bright blue nebula on the right side. The bottom half is dominated by a large, glowing orange and yellow nebula on the left, which transitions into a greenish-blue nebula on the right. The overall effect is a vibrant, multi-colored starfield.

Transitioning from Pilot to Sustained Program

Commercial Small Satellite Data Acquisition Program

Program Objectives:

- Establish continuous and repeatable process to onramp new commercial data vendors and evaluate data for its potential to advance NASA's Earth science research and applications activities.
- Enable sustained use of purchased data for broader use and dissemination by NASA scientific community.
- Ensure long-term data preservation through establishment of data management processes and systems to support rapid evaluation; access and distribution of purchased data; and long-term access to purchased data for scientific reproducibility.
- Coordinate evaluation and scientific use with the European Space Agency

<https://earthdata.nasa.gov/csdap>

FY20 Activities & Beyond: Onramp and Evaluation

NASA ESD will continuously monitor the development of companies and acquire relevant data to complement NASA's observation data.

- Each 12-18 months an RFI will be issued with the goal of identifying data that is potentially valuable for NASA's Earth science research and application activities.
- All RFIs, RFPs and BPAs will contain a standardized scientific use license to minimize the effort by NASA and confusion by users on how data can be used.
- Data from selected vendors will be evaluated by teams of Principal Investigators (PIs) selected through the annual Research Opportunities in Space and Earth Science (ROSES) solicitation.
- A web-based tool, Smallsat Satellite Data Management Tool (SSDMT), will be developed to provide a consistent interface for the PIs to request and manage their data allocation.
- All data purchased by NASA will be made available to NASA funded researchers with a standard scientific use license. Language will be added to ROSES solicitations to ensure access and usage of the purchased data by the broader community.

Scientific Non-Commercial Use License

- NASA has determined a necessity for the U.S. Government to acquire minimum rights to Data for any and all Data procured under any agreement to support intended Scientific Non-Commercial Use.
- At a minimum, the U.S. Government and its related entities shall have the ability to copy, store, share and use Data and any Derivatives for Scientific Use including but not limited to inclusion in scientific and technical articles and publishing academic, technical or professional journals, symposia proceedings, or similar works.
- The minimum data rights apply to all phases of the Commercial Smallsat Data Acquisition Program.

Onramp 2 Evaluation Timeline - 2019

RFI release in FedBizOpps for new vendors	September
RFP release to on-ramp new vendors	RFI+6 months
ROSES solicitations for PI selection for evaluation	RFI+7 months
Evaluation team selection	RFI+10 months
Blanket Purchase Agreement (BPA) awarded	RFI+10 months
Evaluation kick-off	RFI+11 months
Evaluation reports	RFI+24 months
Summary report to ESD management	RFI+25 months

Summary

- Results from pilot program indicate data is of sufficient quality for continued access
- Pilot program is transitioning to the Commercial Smallsat Data Acquisition Program
- Next RFI will be released September of 2020