

National Aeronautics and
Space Administration



EXPLORE

Surface Topography and Vegetation (STV) Incubation Study NASA Headquarters Perspective

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The background of the slide is a composite of two cosmic images. The top half features a dark blue and black space filled with numerous bright stars and a prominent, glowing blue nebula. The bottom half shows a similar starry field but with a warm, golden-yellow and greenish glow, suggesting a different nebula or a different spectral filter.

Earth Science Technology Office (ESTO) Overview

Flexible, Science-driven Strategy

Science-focused solicitations that encourage broad participation among academia, industry, federal labs, and NASA

Competitive, peer-review process to enable selection of best-of-class investments

Active approach to:

Project management – cost / schedule / performance

Partnering – leverage existing technologies and opportunities (including SBIR, external consortia, and other federal efforts)

Communications – effective reporting to a variety of audiences and stakeholders

This strategy has resulted in:

A portfolio of emerging technologies that will enhance and/or enable future Earth science measurements

An ever-growing cohort of infusion successes into science campaigns, instruments, applications, ground systems, and missions

Earth Science Technology Program Elements

ESTO manages, on average, 120 active technology development projects. Most are funded through the primary program lines below. Over 830 projects have completed since 1998.

Advanced Technology Initiatives: ACT and InVEST

Advanced Component Technologies (ACT)

Critical components and subsystems for advanced instruments and observing systems



12 projects awarded in 2018
Solicitations planned in FY20, and FY22
- **proposals due July 21, 2020**

In-Space Validation of Earth Science Technologies (InVEST)

On-orbit technology validation and risk reduction for small instruments and instrument systems.



Four projects selected in FY18
Solicitations planned in FY21 and FY24

Instrument Incubator Program (IIP)

Earth remote sensing instrument development from concept through breadboard and demonstration

ICD – instrument concept demonstrations
IDD – instrument development and demonstrations

19 projects awarded in FY19
Solicitations planned in FY21 and FY23



Advanced Information Systems Technology (AIST)

Innovative on-orbit and ground capabilities for communication, processing, and management of remotely sensed data and the efficient generation of data products

NOS – new observing strategies
ACF – analytic center framework

22 projects awarded in FY19
Solicitations planned in FY21 and FY23



****New Program**** Decadal Incubation

Maturation of observing systems, instrument technology, and measurement concepts for **Planetary Boundary Layer and Surface Topography and Vegetation observables** through technology development, modeling, system design, analysis activities, and small-scale pilot demonstrations

Two study teams awarded in FY20
Solicitation planned in FY21



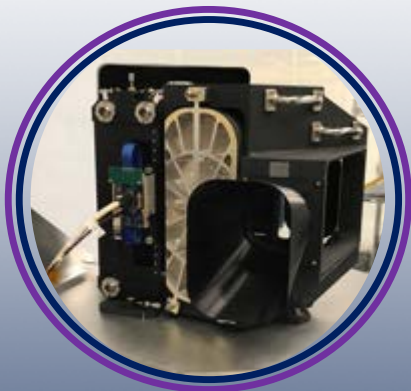
Other ESD Technology Activities Managed by ESTO

ESTO also manages specific sets of technology development and integration projects on behalf of the ESD Flight programs and research

Sustainable Land Imaging – Technology

Funded by the Flight Program, the **Sustainable Land Imaging-Technology (SLI-T)** program develops innovative technologies to achieve future land imaging (Landsat) measurements with more efficient instruments, sensors, components and methodologies.

*First solicitation released in FY16
Solicitation planned in FY20
- proposals currently in review*



Earth Venture Instruments – Technology

With funding from the Flight Program's Earth Systems Science Pathfinder (ESSP) program, the **Earth Venture Instruments – Technology (EVI-T)** program develops promising, highly-rated Earth Venture proposals that require additional technology risk reductions (average award: \$5 - 8M)



Airborne Instrument Technology Transition

The **Airborne Instrument Technology Transition (AITT)** program provides campaign ready airborne instrumentation to support the objectives of the R&A Program. AITT converts mature instruments into operational suborbital assets that can participate in field experiments, evaluate new satellite instrument concepts, and/or provide calibration and validation of satellite instruments.



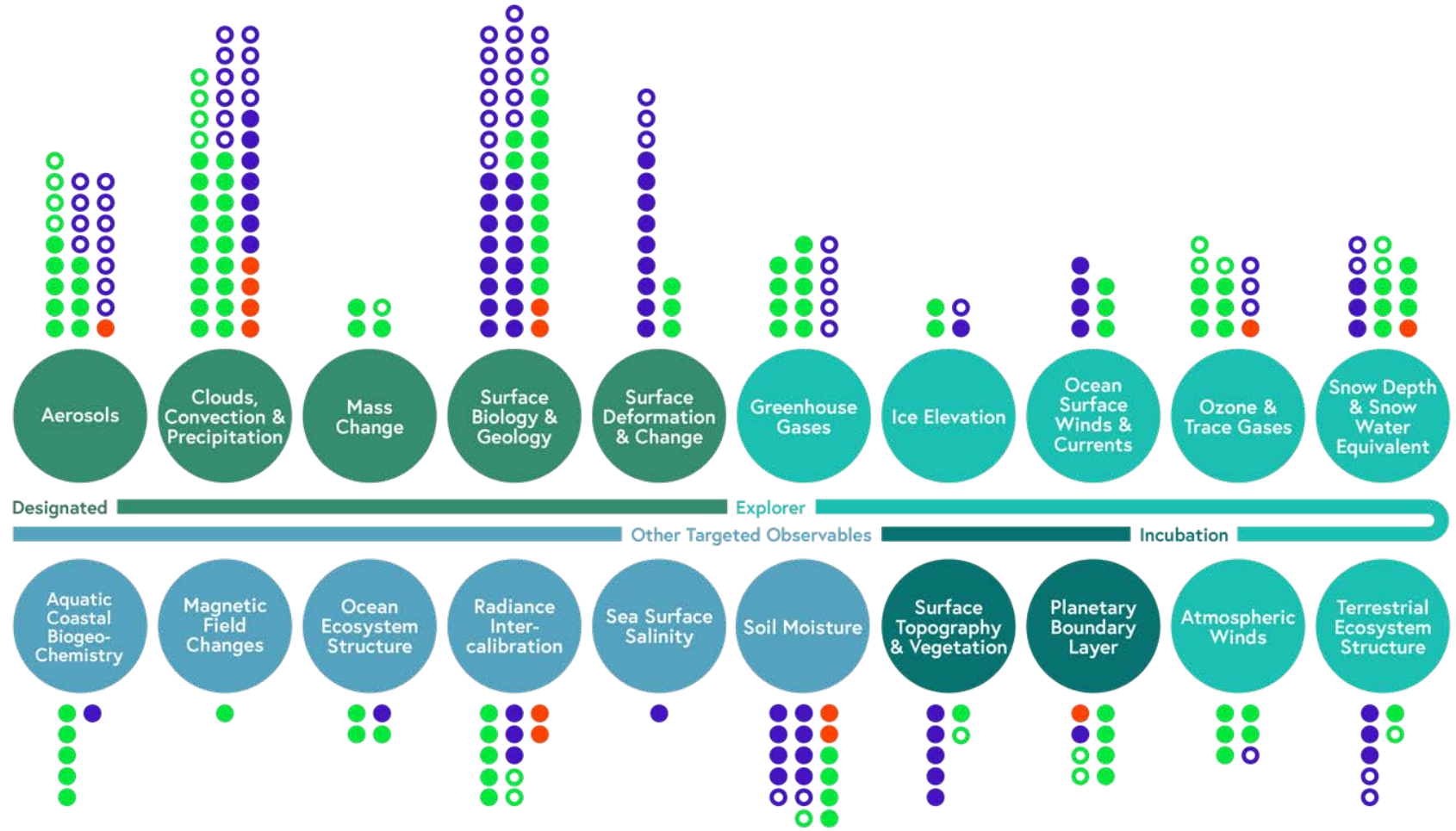
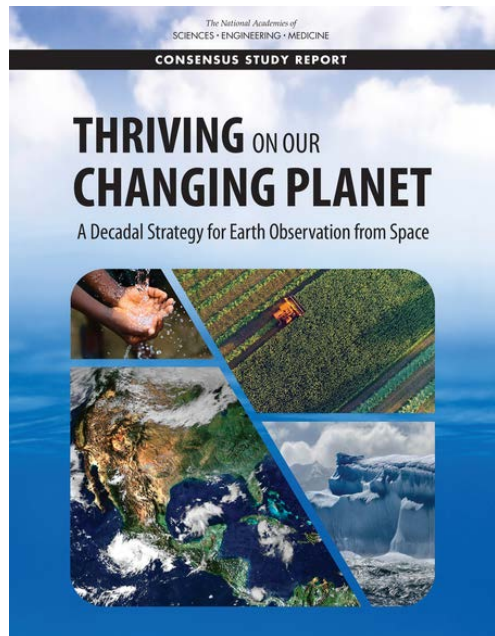
Ocean Biology and Biogeochemistry

With funding through the R&A Program, the **Ocean Color Remote Sensing Vicarious Calibration Instruments** program develops in situ vicarious calibration instrument systems to maintain global climate-quality ocean color remote sensing of radiances and reflectances



ESTO Projects Supporting the 2017 Decadal Survey

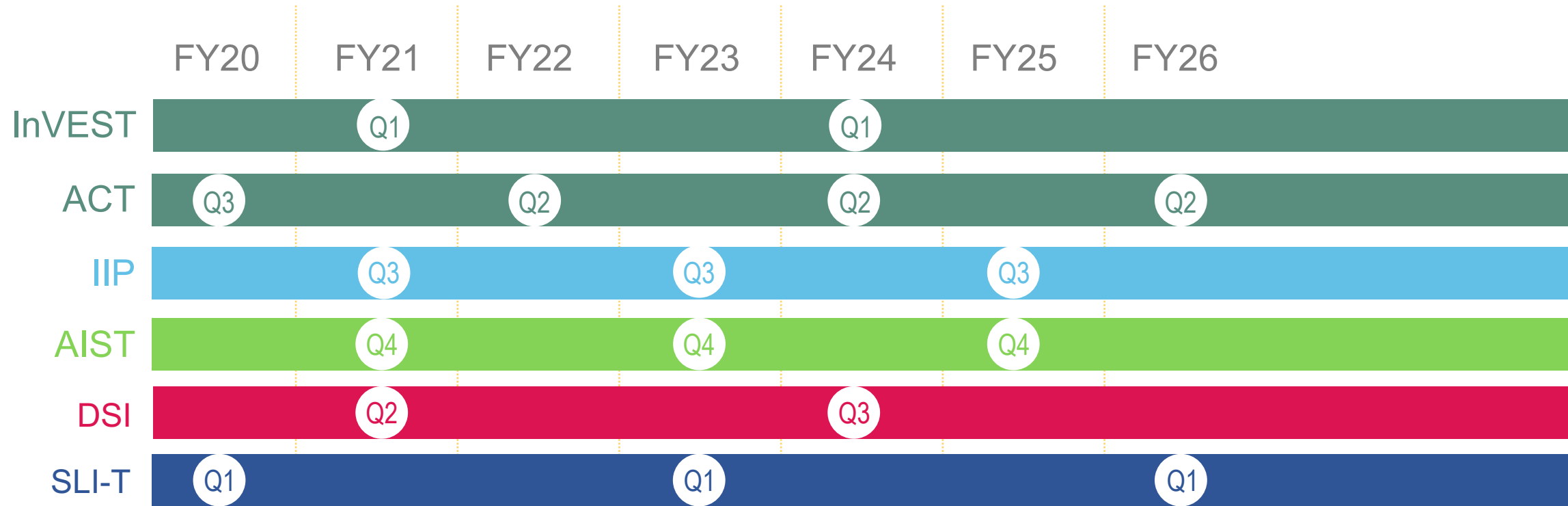
Targeted Observables in lieu of missions provides flexibility for creative affordable observing systems



- Information Systems
- Observation Technology
- Solid circle indicates project solicited prior to 2017 Decadal Survey
- Technology Validation
- Ring shape indicates project solicited after release of 2017 Decadal Survey



Solicitation Calendar





NASA's Earth Science Technology Office

Investing in technologies to advance our understanding of Earth's natural systems

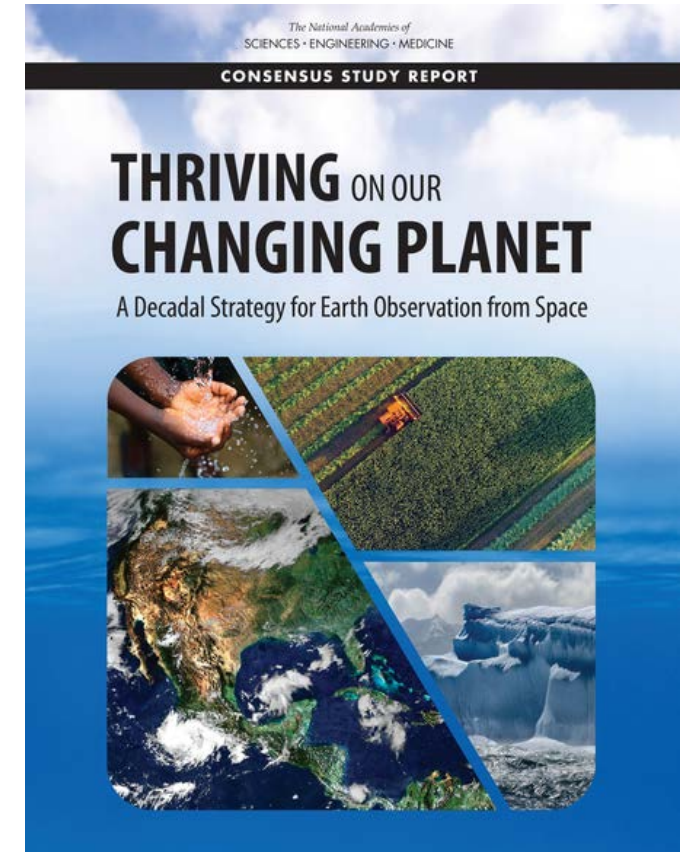
Visit us at: <https://esto.nasa.gov>

The background of the slide is a composite of two cosmic images. The top half features a dark blue and black space filled with numerous small, bright stars and a prominent, glowing blue nebula on the right side. The bottom half shows a similar starry field but with a warm, golden-yellow and green color palette, suggesting a different spectral filter or a different region of space. The text is centered in a white horizontal band that spans the width of the slide.

Decadal Survey Incubation (DSI) Overview

Decadal Survey Incubation Program

- A new program element in the 2018 Decadal Survey, focused on investment for priority observation capabilities needing advancement prior to cost-effective implementation
- Two elements: Planetary Boundary Layer (PBL), and Surface Topography and Vegetation (STV)
- Supports maturation of mission, instrument, technology, and/or measurement concepts to address specific high priority science (for the following decade)
- Managed by ESTO and run as a partnership with R&A
- Anticipate a mix of activities:
 - Technology development activities
 - Modeling/system design and analysis activities
 - Small scale pilot demonstrations
 - Typically 1- to 3-year activities



Incubation Targeted Observables: Decadal Survey

TABLE S.2 Continued

Targeted Observable	Science/Applications Summary	Candidate Measurement Approach	Designated	Explorer	Incubation
Planetary Boundary Layer	<i>Diurnal 3D PBL thermodynamic properties and 2D PBL structure</i> to understand the impact of PBL processes on weather and air quality through high vertical and temporal profiling of PBL temperature, moisture, and heights	Microwave, hyperspectral IR sounder(s) (e.g., in geo or small sat constellation), GPS radio occultation for diurnal PBL temperature and humidity and heights; water vapor profiling DIAL lidar; and lidar* for PBL height			X
Surface Topography and Vegetation	<i>High-resolution global topography</i> , including bare surface land topography, ice topography, vegetation structure, and shallow water bathymetry	Radar; or lidar*			X

National Academies of Sciences, Engineering, and Medicine 2018. Thriving on Our Changing Planet: A Decadal Strategy for Earth Observation from Space. Washington, DC: The National Academies Press. <https://doi.org/10.17226/24938>.

STV Incubation Trajectory

- **ROSES-2019, A.54** DECADAL SURVEY INCUBATION STUDY TEAMS: PLANETARY BOUNDARY LAYER (PBL) AND SURFACE TOPOGRAPHY AND VEGETATION (STV)

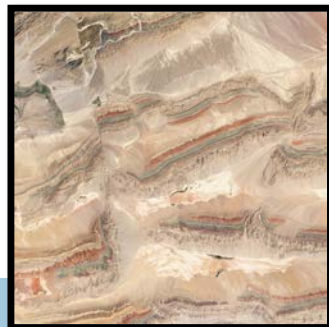
“...to identify methods and activities for improving the understanding of and advancing the maturity of the technologies applicable to these two TOs and their associated science and applications priorities.”

- Nov. 2019 – Two study teams selected; one for PBL, one for STV
- Dec. 2019 – NASA Surface Topography and Vegetation Incubation Community Forum
- Mar. 2019 – Study Team work began
- Each team is to produce a white paper for delivery to NASA HQ in early CY21, that will help inform the next ROSES solicitation in FY21 and funding in FY22+
 - Outline potential future methods and activity areas, such as modeling and OSSEs; field campaigns; and a range of potential observing system architectures utilizing emerging sensor and information technologies
 - Other deliverables include a preliminary Science and Applications Traceability Matrix (SATM)
 - Each Study Team “*will solicit input from the broader scientific community*”

STV Incubation Study Objectives

- Decadal Survey: “A new program element called ‘Incubation,’ intended to accelerate readiness of high-priority observables *not yet feasible for cost-effective flight implementation.*”
- STV is not a mission or an observing system
- The STV Incubation Study is not a Designated Observables Study
- The STV Incubation Study is focused on:
 - State-of-the-Art Evaluation
 - Identification of Gaps and Investment Needs
 - Preliminary Requirements Refinement

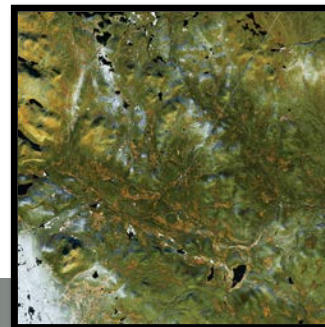
**Bare-surface
Topography**



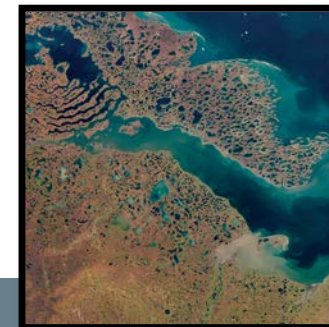
**Ice
Topography**



**Vegetation
Structure**



**Shallow-water
Bathymetry**



**STV Science/
Applications**

Decadal Survey Incubation – HQ Points of Contact

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