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.
NASA’s Earth Science Technology Office

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

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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
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<tr>
<th>Targeted Observable</th>
<th>Science/Applications Summary</th>
<th>Candidate Measurement Approach</th>
<th>Designated</th>
<th>Explorer</th>
<th>Incubation</th>
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<tr>
<td>Planetary Boundary Layer</td>
<td>Diurnal 3D PBL thermodynamic properties and 2D PBL structure to understand the impact of PBL processes on weather and air quality through high vertical and temporal profiling of PBL temperature, moisture, and heights</td>
<td>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</td>
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<td>Surface Topography and Vegetation</td>
<td>High-resolution global topography, including bare surface land topography, ice topography, vegetation structure, and shallow water bathymetry</td>
<td>Radar; or lidar*</td>
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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

STV Science/Applications

- Bare-surface Topography
- Ice Topography
- Vegetation Structure
- Shallow-water Bathymetry
Decadal Survey Incubation – HQ Points of Contact

Program Manager: Robert Bauer/ESTO, robert.bauer@nasa.gov

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<tr>
<th>Topic</th>
<th>Program Scientist</th>
<th>Technology Lead</th>
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<td>Surface Topography &amp; Vegetation (STV)</td>
<td>Ben Phillips</td>
<td>Bob Connerton</td>
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