GLOBAL SCIENCE & TECHNOLOGY, INC.

Partnering for Success

Satellite Remote Sensing Science

Highlights

Differentiators:

- More than 30 years supporting NOAA & NASA hands-on technical experience
  - Instrument Lab bench testing
  - Spacecraft testing
  - Commissioning studies
  - Applied data analysis
  - Derived products
  - Visualizations
- Real-world societal benefits from GST scientific research and technological innovations.
- Commercial weather products

Customers and Contracts:

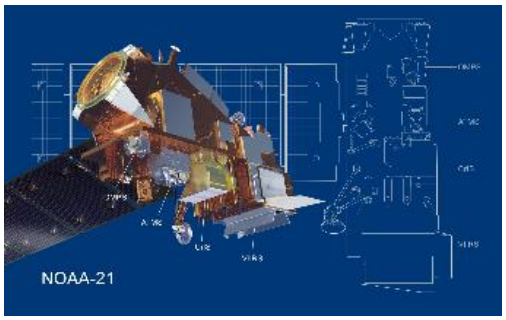
- NOAA Protech Satellite
  - JPSS TSESS
  - JPSS SEAM
  - STAR SENSORS
  - STAR OSTA
  - OSC TRACSS
  - NCO GPS
  - NWS Satellite Readiness
  - NESDIS Business Operations
- NASA Hydrosphere Biosphere Geophysics (HBG)
- NASA OMES II Direct Readout Laboratory (DRL)
- USDA Agricultural Research Service (ARS)
- Air Force Research Laboratory (AFRL) WeatherSat

Core Competencies:

- Instrument and Sensor Engineering
- Calibration and Validation
- Algorithm Development
- Environmental Product Development
- Product Processing
- Data Integration
- Data Dissemination

GST Support for Environmental Measurements

GST's extensive experience in satellite remote sensing science and satellite engineering provides us with a comprehensive understanding of the entire satellite lifecycle. This expertise encompasses every phase from initial design and development to deployment, operation, and eventual decommissioning. For GST scientists and engineers, the satellite lifecycle begins at the concept/planning stage where current and future societal needs are incorporated, technological advancements are integrated, and innovative approaches are introduced in environmental science, computational algorithms, data integration, simulation and modeling. A satellite mission's lifecycle can span 20 years or more, beginning with the concept phase, continuing through pre-launch and post-launch operations, and concluding with decommissioning and data archival. Our deep knowledge of these areas ensures that we can effectively manage and optimize each stage, delivering reliable and innovative solutions for our clients.



Instrument and Sensor Engineering:

GST will create spectral calibration algorithms for the GeoXO GXS instrument scheduled for launch in 2032, using simulated lunar data and synthetic observations to rigorously test the lunar calibration algorithm to ensure robust pre-launch capabilities and successful operations in the future. The GXS is a hyperspectral infrared sounder in geostationary orbit. The hyperspectral design increases the number of spectral bands from 18 to over 1550 that will improve weather forecasting and prediction as well as Trace Gas Monitoring.

GST scientists conduct lidar and detector development for numerous airborne and space-based missions. We participate as science team members of ICESAT-1 and engineering team members for ICESAT-2. We are also the Product Development Lead for Global Ecosystem Dynamics Investigation (GEDI) and Hazard Detection Lidar (HDL) subsystems. Additionally, we support the Land, Vegetation, and Ice Sensor (LVIS) scanning and upgrades of airborne lidar detectors.

Calibration and Validation:

GST scientists transformed raw digital data received from satellites into meaningful environmental data images on our NOAA Sensors contract. GST analyzed trends in instrument performance to ensure the quality of the data and of its mapping on the surface of the Earth. GST developed and sustained NOAA's Integrated Calibration and Validation System (ICVS), which provided near real-time monitoring of spacecraft instrument performance.

GST supported data operations and calibrations for MODIS, VIIRS, and other land and atmosphere imaging sensors. We also support near-real-time data delivery, including facilitating Earth science calibration, data analysis, quality assurance, and field missions and providing science team and project cloud services. We also provide programming for Earth-orbiting imager data operations, product processing, calibration, image geo-location, data product archiving, and data product delivery.

Algorithm Development:

A GST employee won the 2020 NOAA David Johnson Award for creating an innovative technique, fully focused synthetic aperture radar (FF-SAR) altimetry, which improves along-track resolution of high-rate satellite radar altimeters.

GST staff contributed significantly to establishing Radio Occultation (RO) atmospheric soundings at STAR. GST developed an algorithm package for total column water vapor (TCWV) using STAR-derived 1D-Var algorithms. The RO TCWV has been included in the annual Bulletin of the American Meteorological Society special issue "State of the Climate" each year since 2019. Our staff performed inter-sounder comparisons, and

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presented findings at professional meetings, leading to COSMIC-2 being declared NOAA's backbone RO mission.

Data Integration:

GST is implementing a cloud-based data pipeline prototype for USDA Agricultural Research Service (ARS) using satellite and in situ data from the NOAA MADIS system. GST developed the GeoHub System with USDA partners with the objective of breaking down data silos, reducing data duplication, and improving data interoperability across USDA applications.

GST supports the National Weather Service's (NWS) effort to integrate JPSS products into its systems. We provide expertise in systems and software engineering, satellite data processing, and user outreach and engagement. Our scientists and developers meet NWS needs and assimilate JPSS data-based products into the Advanced Weather Interactive Processing System (AWIPS).

Data Dissemination and Archive:

GST managed ingest of up to 15 TB per day, distribution of up to 20 TB per day, and the archive of total data volume of more than 15 PB of environmental data and information. The system services more than 1,000 unique users and millions of data access orders.

At the NASA Direct Readout Laboratory (DRL), GST developed and operated processing and archive systems for multiple research and operational satellites, including Aqua, Aura, SNPP, NOAA-20, and GOES-16. These satellites conduct research on land, ocean, and atmospheric phenomena. GST staff monitored all systems including the Data Archive/Access and developed Disaster Recovery using load-balancing computational architectures.

Modeling and Simulation:

GST works on the CRW global 4-Month Coral Bleaching (CB) Outlook system for shallow water coral reefs at 0.5˚ x 0.5˚ spatial resolution. Outlooks are generated by applying CRW's operational satellite CB heat stress monitoring algorithm to the sea surface temperature (SST) predictions from NCEP's operational Climate Forecast System Version 2 (CFSv2).

GST worked with STAR to develop proxy geo sounder hyperspectral datasets that could be used in OSSEs and OSEs to assess effects of increased data assimilated into NWP. GST staff contributed to a study on the impact of hyperspectral soundings in such areas as evolving structure in storm formation and diurnal cycle in atmospheric patterns. This information is then used to assess the impacts of varying frequency, density, and latency of sounding data sets in the OSSEs and OSEs.

GST developed a long short-term memory (LSTM) neural network to model maximum mechanism temperature using ATMS RDR telemetry data as the input. GST identified ways to use the model predictions of maximum ATMS temperature to identify when ATMS instruments should enter safe mode without losing valuable data for ATMS downstream operational products and published the results in Atmosphere (2023).