



Forum Welcome and Plenary Address

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Associate Director for Research and Technology

Earth Science Technology Forum
June 11, 2019, Moffett Field, CA



EXPLORE EARTH

YOUR HOME, OUR MISSION



EXPLORE FLIGHT

WE'RE WITH YOU WHEN YOU FLY

EXPLORE HUMANS *in* SPACE

FOR ALL HUMANITY



EXPLORE MOON *to* MARS

MOON LIGHTS THE WAY



EXPLORE SOLAR SYSTEM & BEYOND

DISCOVERING THE SECRETS OF THE UNIVERSE



EXPLORE SPACE TECH

TECHNOLOGY DRIVES EXPLORATION

Ames Research Center



- Occupants:
 - ~1200 civil servants; ~1,900 on-site contractors; ~2,500 NRP workforce
 - ~700 summer students in 2018
- FY19 Budget (est.): ~\$910M (including reimbursable/EUL)
- ~1,900 acres (400 acres security perimeter); 5M building ft²
- Airfield: ~9,000 and 8,000 ft. runways

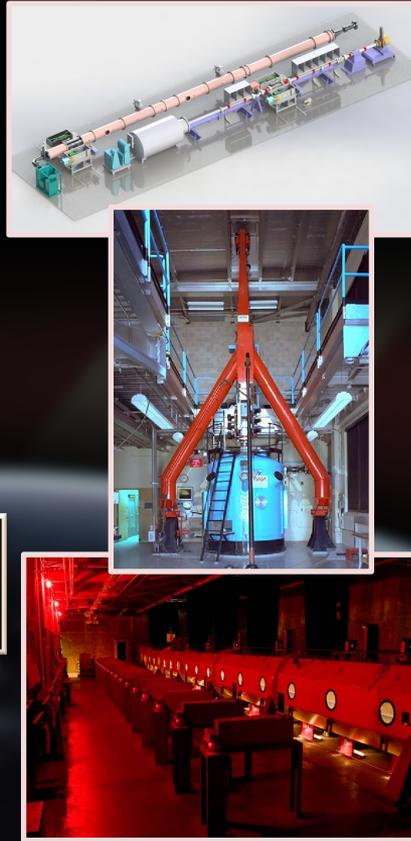
Major Research Facilities



Wind Tunnels



ARC Jet Complex



Range Complex



Simulators

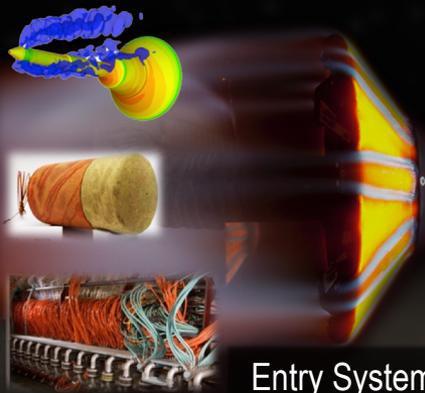


Advanced Supercomputing

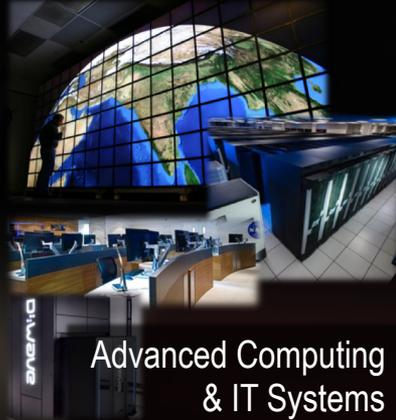
Core Competencies at Ames Today



Air Traffic Management



Entry Systems



Advanced Computing & IT Systems



Intelligent/ Adaptive Systems



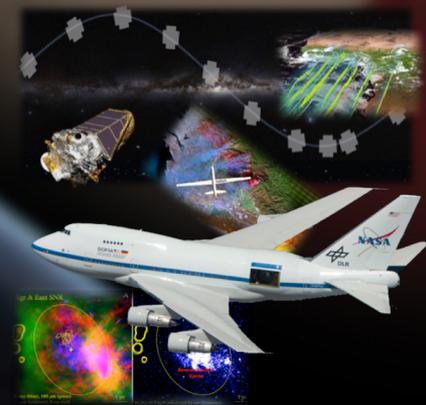
Cost-Effective Space Missions



Aerosciences

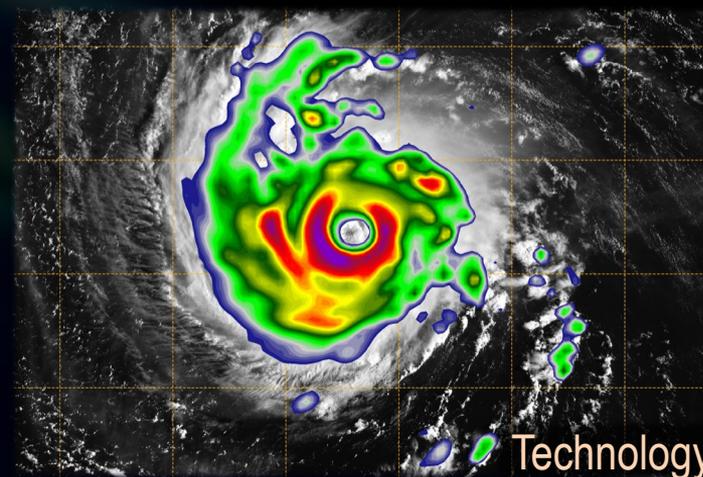
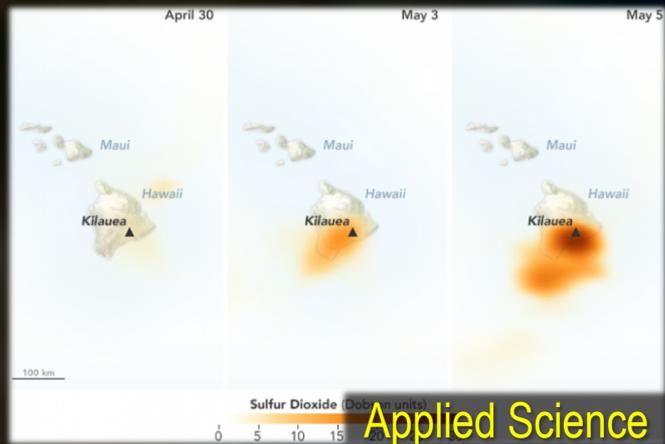
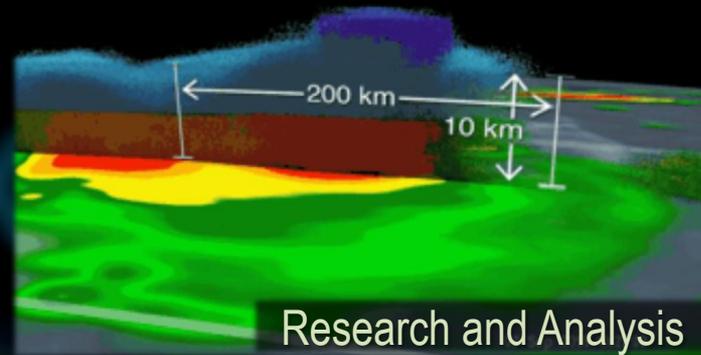


Astrobiology and Life Science



Space and Earth Sciences

Earth System Science



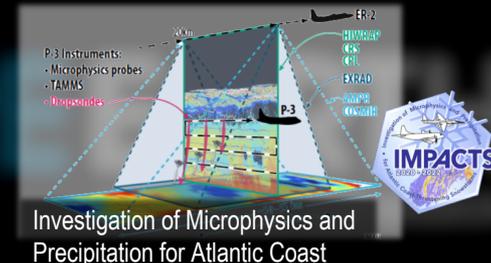
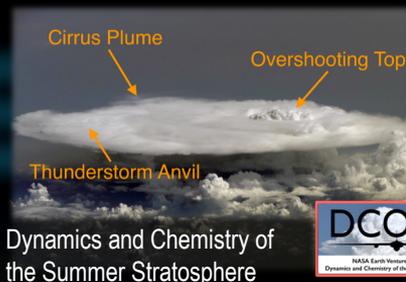
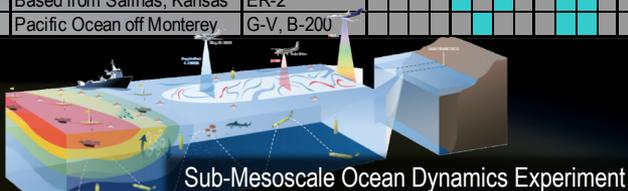
Flight Projects



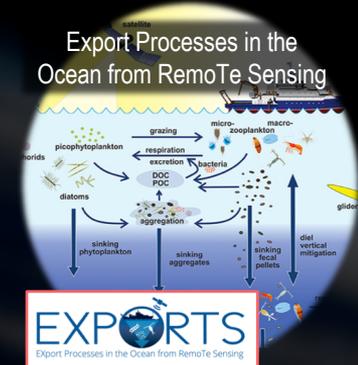
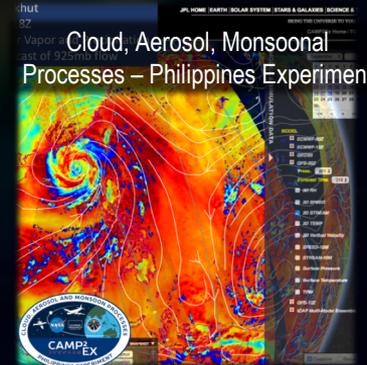
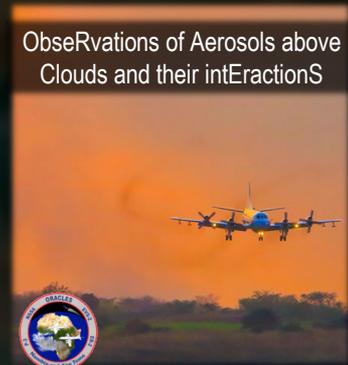
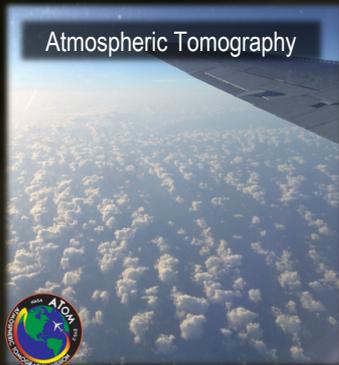
Earth Venture Suborbital 3 (EVS-3) Project And Mission Management

Mission	Location	Aircraft	CY2019	CY2020	CY2021	CY2022
IMFACTS	U.S. East Coast	P-3, ER-2				
DCOTSS	Based from Salinas, Kansas	ER-2				
S-MODE	Pacific Ocean off Monterey	G-V, B-200				

S-MODE



EARTH SCIENCE SATELLITE Calibration/Validation and Airborne Process Study Management



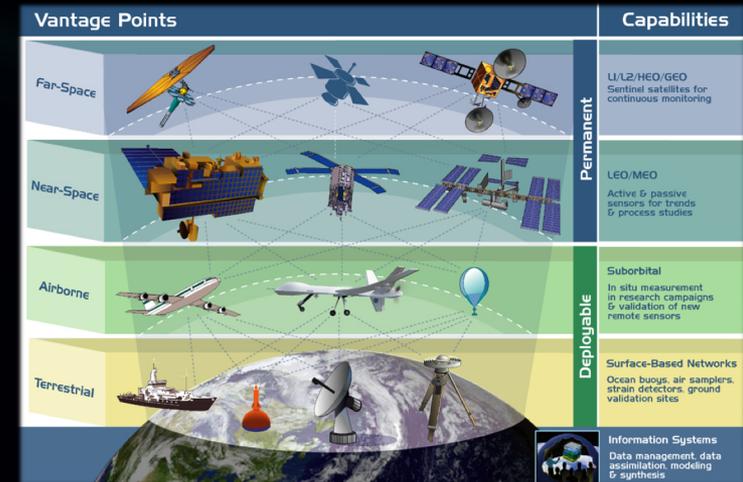
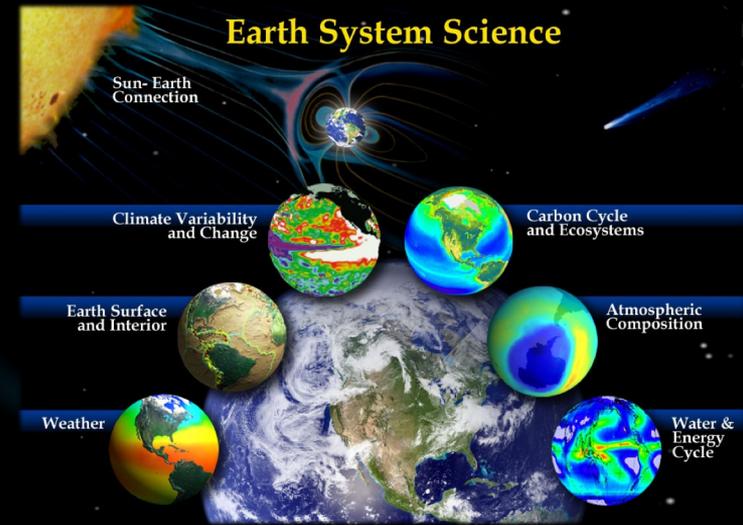
Research & Analysis

Scientific Research

- Atmospheric Composition – Aerosol and radiation studies, air quality, atmospheric chemistry
- Climate Variability and Change – Atmospheric dynamics, coastal and ocean ecosystems
- Carbon Cycle and Ecosystem – Terrestrial ecosystems, carbon dioxide and methane fluxes

Airborne Science

- Instrument and Payload Development
- Field campaign planning and execution
- UAS development and operations
- Alpha Jet (AJAX) satellite calibration and validation





Applied Science

Mapping Crop Water Requirements to Assist Growers in Optimizing Water Use Satellite Irrigation Management Support (SIMS)



Terra Satellite

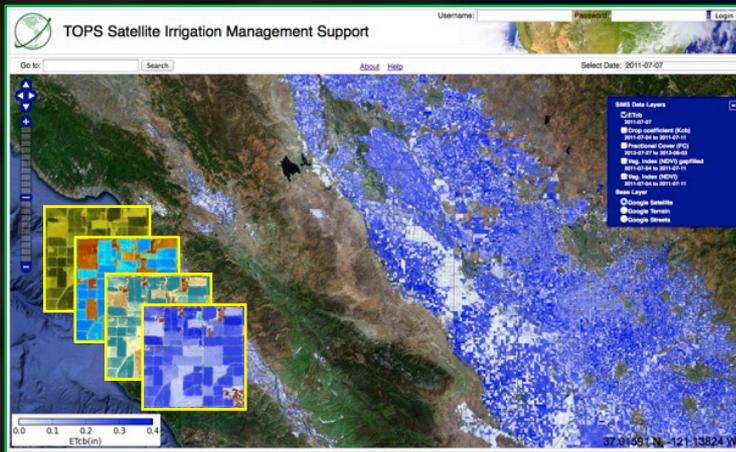


Landsat 8



California agricultural sector produced \$46.4B In 2013

NASA SIMS web and mobile data services puts irrigation demand across 8 million acres of farm land directly into the hands of farmers and water managers



Students work hand in hand with growers to validate the system and quantify benefits

Technology Projects



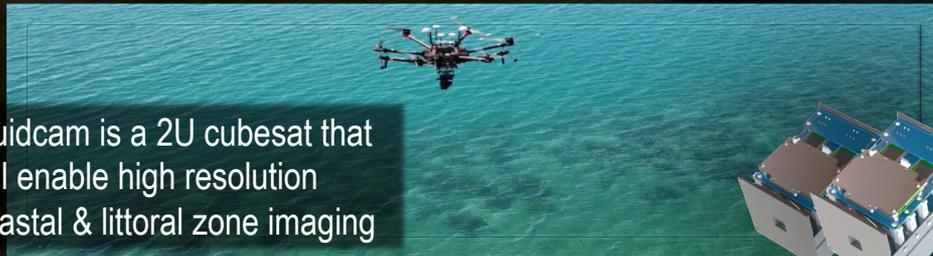
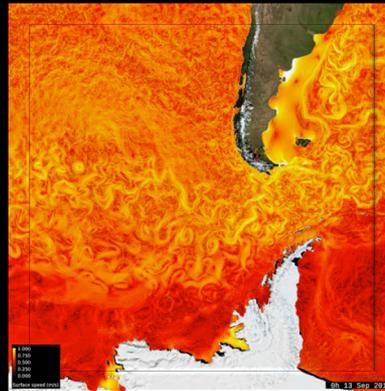
Airborne Science Onboard Networks Enable Realtime Science



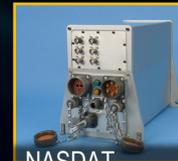
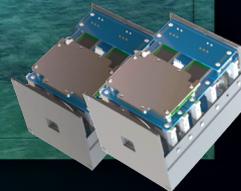
NASA Earth Exchange



Pleiades Supercomputer



Fluidcam is a 2U cubesat that will enable high resolution coastal & littoral zone imaging



NASDAT Network Server



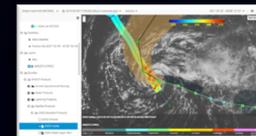
Experiment Interface Panels



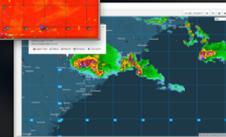
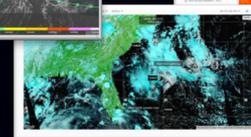
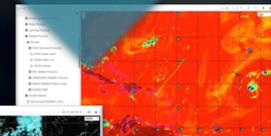
Telemetry & Payload Computer



Ames is a leader in demonstrating and making new unmanned aircraft available to science from SUAS to HALE



MISSION TOOLS SUITE (MTS)



Supercomputing @ NAS



Pleiades: 7.25 PF peak – 11K+ multi-generational nodes;
#27 on TOP500 (#11 in US)

D-Wave System Hardware:

- Space Act Agreement (2013) between Google and USRA
- 2031-qubit Whistler processor
- 10 kg of metal in vacuum at ~15 mK
- Magnetic shielding to 1 nanoTesla
- Protected from transient vibrations
- Single annealing typically 20 ms
- Typical run of 10K anneals (incl. reset & readout takes ~4 sec)
- Uses 15 kW of electrical power

Electra: 8.32 PF peak
3456 nodes; container-based
#33 on TOP500 (#12 in US)



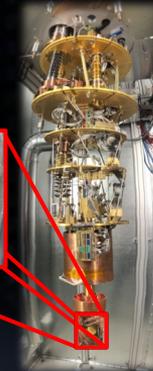
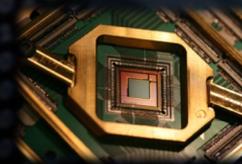
Modular Supercomputing Facility:
Capacity: > 120 PFs; 1M cores



Storage:

- Global storage (Lustre based): ~46 PB
- Archival storage capacity: 1 EB

Network connectivity: 10GB/s



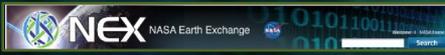


NASA Earth Exchange (NEX)

Providing a Work Environment for "Science As A Service"

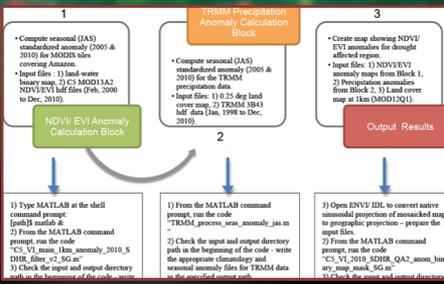
COLLABORATION

Support for projects in Earth Science Research and Analysis, Applied Science, and National Climate Assessment



CENTRALIZED DATA REPOSITORY

Stage over 4 PB of data next to compute



COMPUTING

Scalable
Diverse
Secure/Reliable



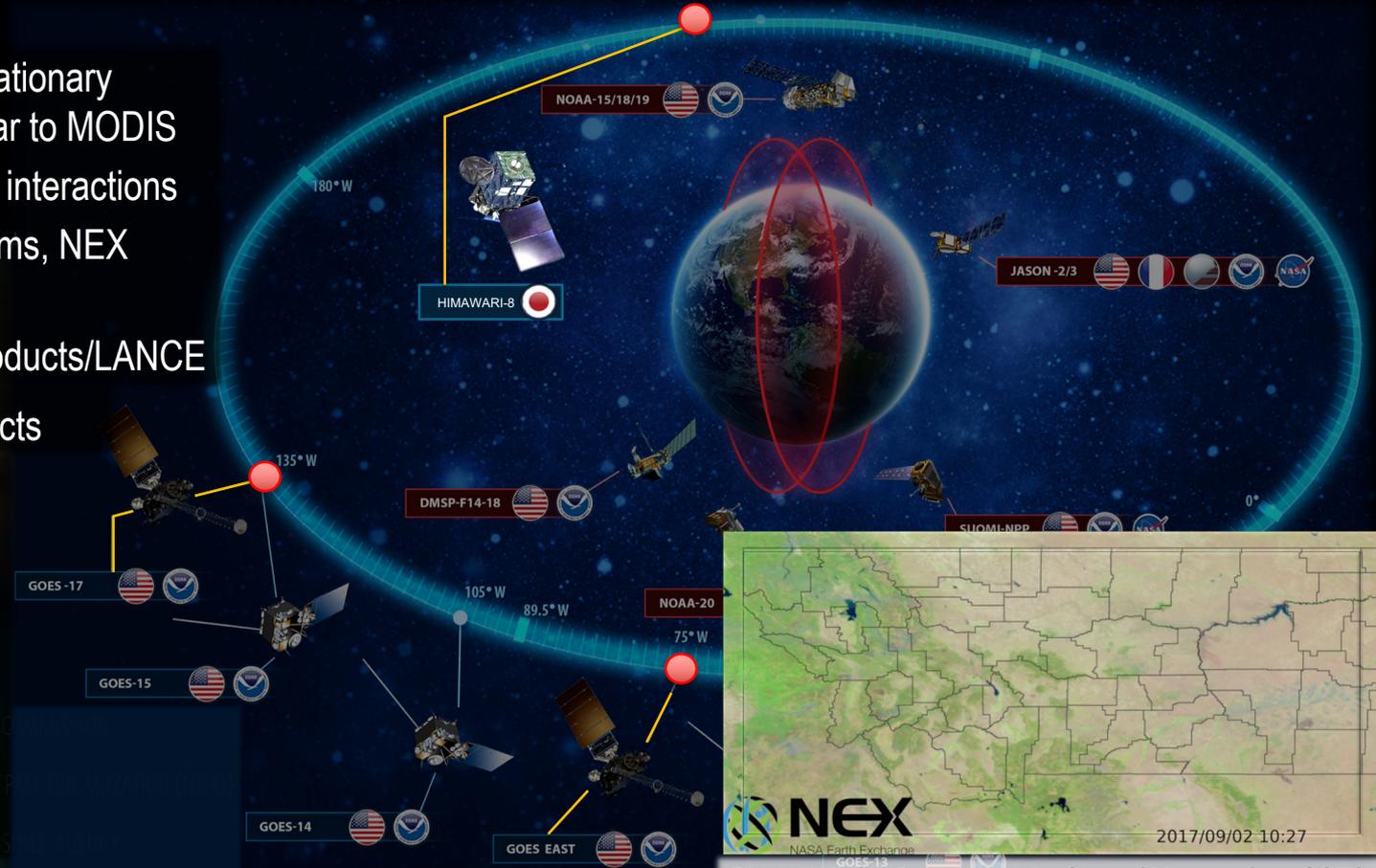
KNOWLEDGE

Workflows
Machine Images
Model codes
Re-useable software

GeoNEX: Earth Monitoring from Geostationary Sensors



- New generation of geostationary sensors: ABI,AHI – similar to MODIS
- Diurnal land-atmosphere interactions
- Leveraging EOS algorithms, NEX (compute, storage)
- Near real-time (5min) products/LANCE
- Regional EOS-like products
- Collaborators:
 - NOAA,
 - JAXA (Japan),
 - BOM (Aus),
 - KARI (S.Korea),
 - IPMA (Portugal),
 - GSFC and MSFC.



Diurnal Wildfire Dynamics in the State of Montana from GOES

UAVs and Earth Science



SIERRA complements other UAVs in the NASA science fleet specializing in dangerous, low altitude missions that require larger payload capacity than typical small UAVs

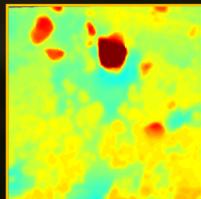
New suborbital platform capabilities; high altitude pseudosatellite (HAPS)



FluidCam, MIDAR, and NEMO NET



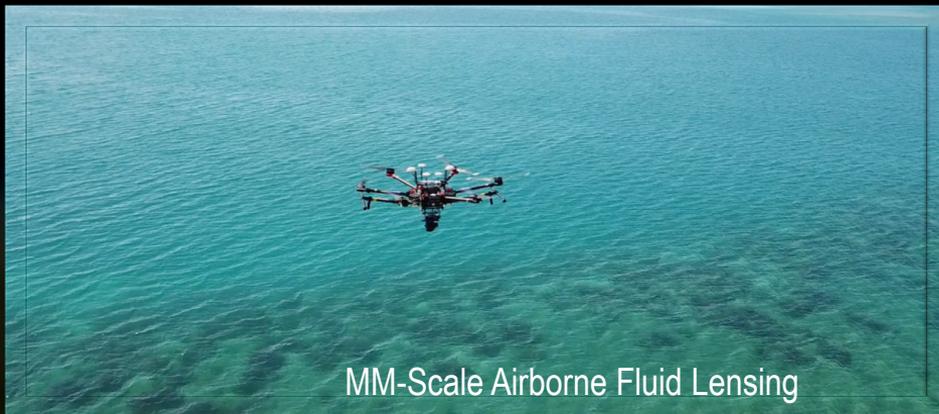
MM-Scale
Airborne Fluid
Lensing



MM-Scale
Airborne Fluid
Lensing DEM



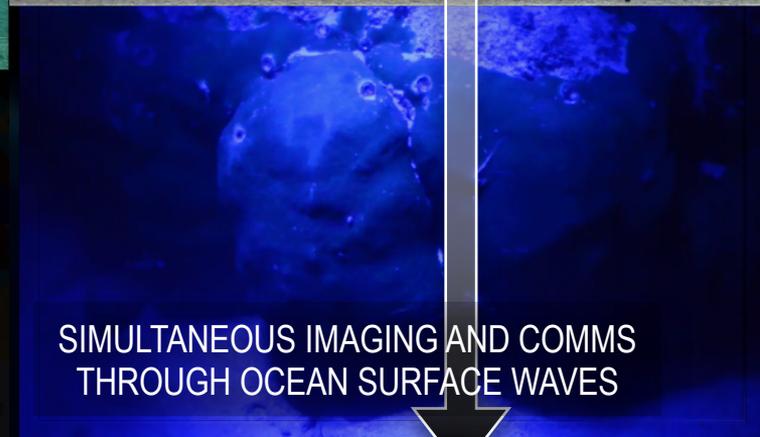
M-Scale Airborne
& Satellite Data



MM-Scale Airborne Fluid Lensing



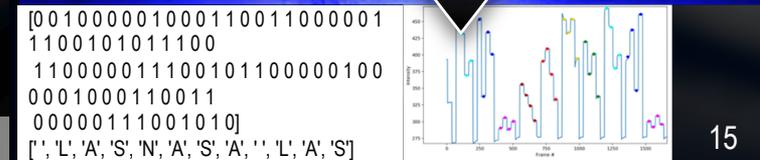
AIRBORNE MIDAR TEST WITH UNDERWATER
RECEIVER (GUAM 2018)



SIMULTANEOUS IMAGING AND COMMS
THROUGH OCEAN SURFACE WAVES



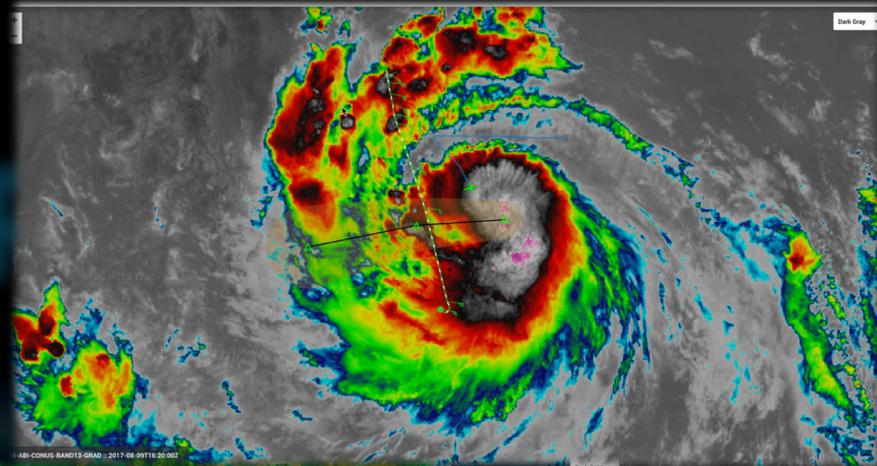
Active Learning Training of Coral Cover & Morphology Type



Mission Tools Suite (MTS)



- Tactical decision-making and distributed team situational awareness
- Real time position and instrument telemetry ingest and visualization for single- and multi-asset campaigns
- Access to low latency satellite, radar, global lightning and other meteorological and mission products
- Communication and collaboration tools including document sharing and turn-key chat solutions
- Satellite pass prediction and swath visualization
- Mission operation and planning tools



- brightness temperature
- Storm Centric Visible
- JPL TCIG Products
- Microwave Rain Signatures
- Aircraft Payload
- Stormscope (NASAB7Z, AV6)
- HAMSR Quick Looks
- AVAPS Quick Looks
- 1 AV6 Dropsonde Release & Prc
- NOAA Dropsonde Quick Looks
- NOAA Aircraft RADAR
- HIWRAP Quicklooks
- HDOB
- KNHC
 - KWBC
 - KBIX
 - PGUA
 - RCTP
- Forecast & Model Products
 - NRL COAMPS-TC
 - NRL COAMPS-TC Adjcent
 - U Albany Products

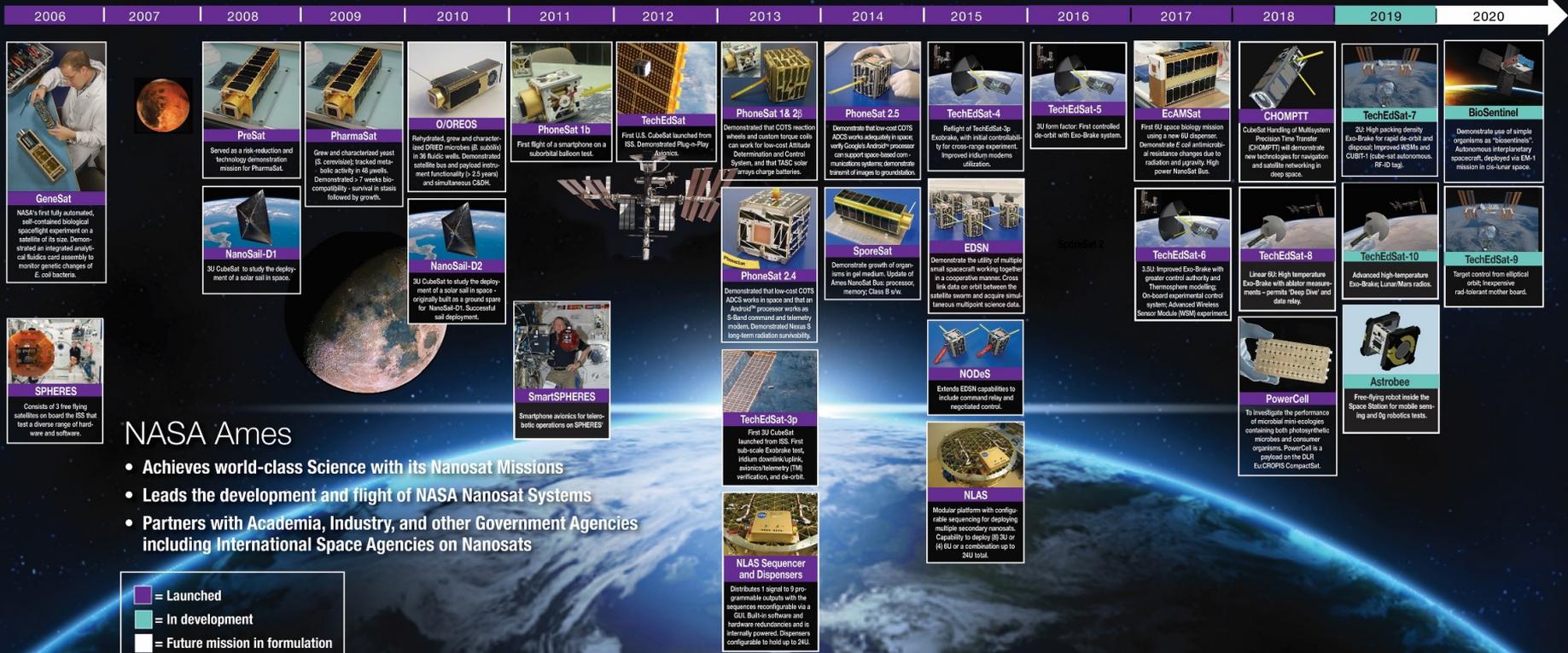


Sensing Hazards with Operational Unmanned Technology: Impact Study of Global Hawk Unmanned Aircraft System Observations for Hurricane Forecasting

NanoSat Missions and Plans at Ames



Supporting the Goals of Science Investigations, Technology Development and Advanced Exploration Systems



NASA Ames

- Achieves world-class Science with its Nanosat Missions
- Leads the development and flight of NASA Nanosat Systems
- Partners with Academia, Industry, and other Government Agencies including International Space Agencies on Nanosats

= Launched
 = In development
 = Future mission in formulation

Partnerships

Virtual Institutes



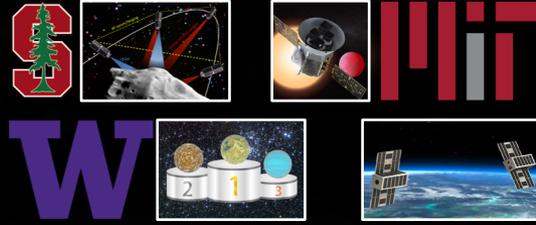
Inter-Agency



Commercial



Academia



International

