



7th International sCO₂ Power Cycles Symposium

22 FEBRUARY 2022
SAN ANTONIO, TEXAS

ADAM L. HAMILTON, P.E.
PRESIDENT & CEO



ADVANCED SCIENCE. APPLIED TECHNOLOGY

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Welcome to San Antonio!

- 7th Largest City in the United States
- At the Intersection of Two Pan-American Highways
- Home of the Top Two Attractions in Texas
 - River Walk
 - Alamo
- “Military City USA”
 - Home of Military Medicine
- Broad Technological Base
- Cultural Kaleidoscope



Advancing science and applying technology to solve humankind's most difficult technical challenges



Southwest Research Institute

One of the largest (by revenue), broadest (by technologies), and deepest (by expertise) independent nonprofit applied research & development organizations in the United States

*Deep Sea to
Deep Space®...*

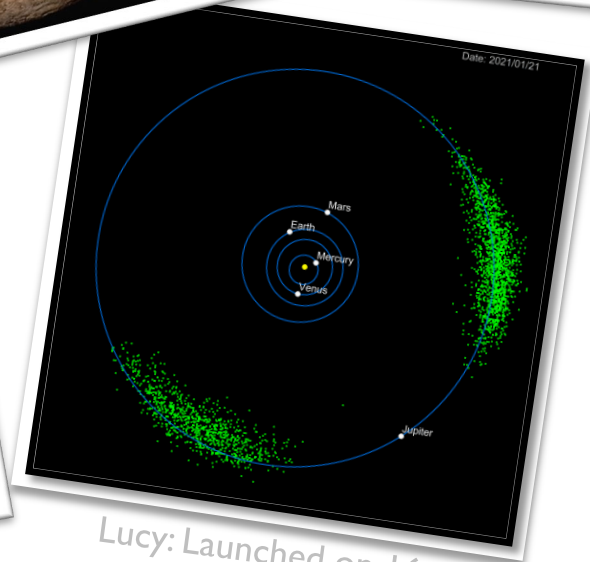
Pluto from New Horizons Spacecraft



GRB 080913: 12.8 BLY



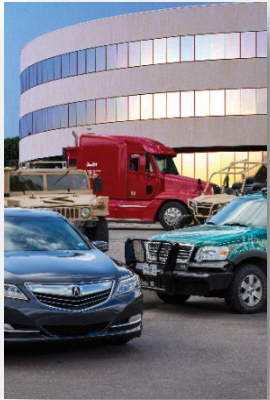
Alvin Pressure Hull



Lucy: Launched on 16 October 2021



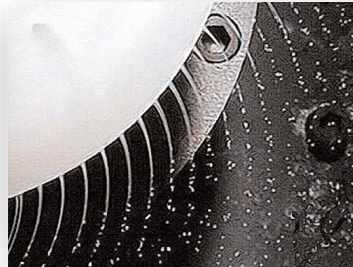
...And Everything Between



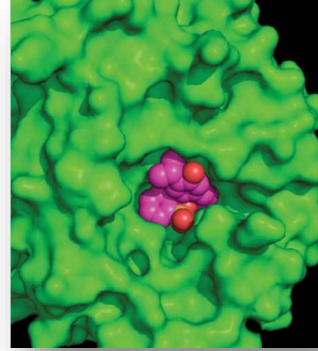
Autonomous Vehicles



Robotics



Micro- and Nano-Encapsulation



In Silico Drug Screening



Water & Geological Engineering



O&G Engineering



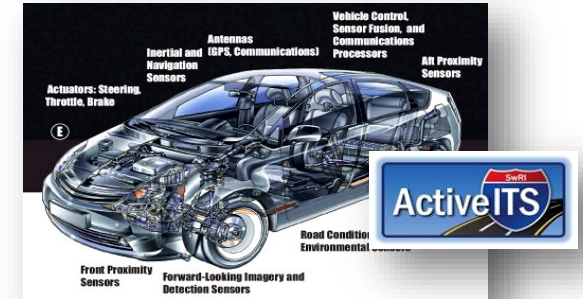
Clinical Materials Manufacturing



Fire Protection Technologies



Clean Energy Research



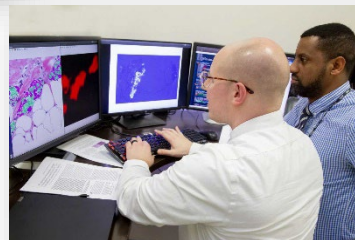
Infrastructure Communications



Engine Design, Optimization, & Hybridization



Recycling Technologies



Artificial Intelligence & Machine Learning Diagnostics

Environmental Sampling, Analysis, & Monitoring



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Business Model

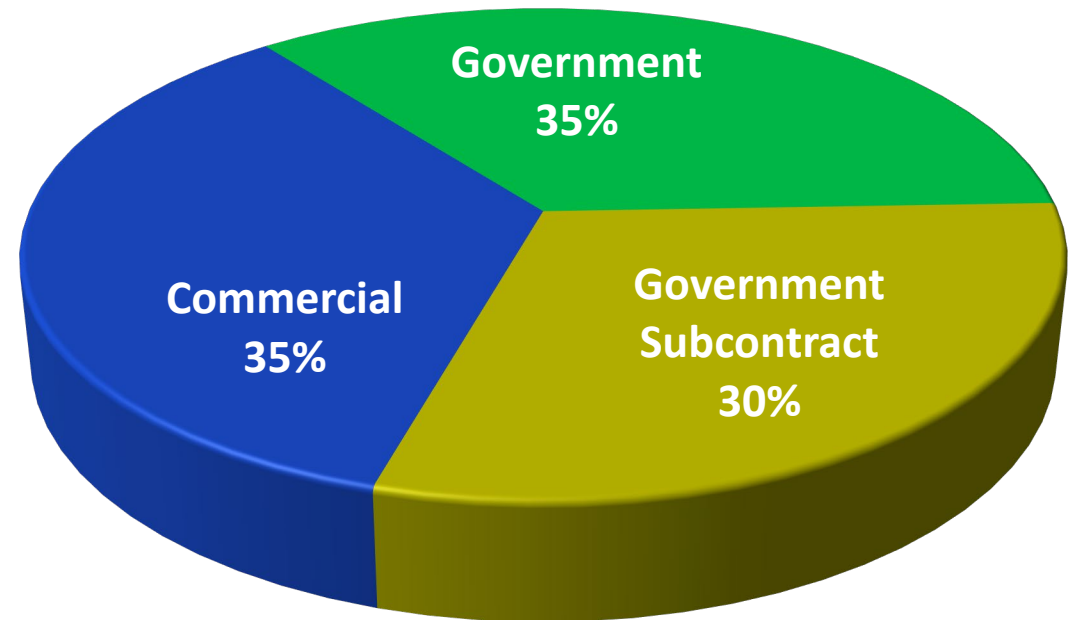
- 501(c)(3) tax-exempt status
 - Not for profit, but
 - Not for loss
- Revenue from contracts and grants
 - No “endowment” fund
- Robust Internal Research and Development (IR&D) program
- Collaborative
 - Created more consortia than any other organization in the United States



Natural Beauty on the SwRI Campus

The Numbers

- \$716M: FY 2021 consolidated revenue
- >2,850: Staff members
- >3,000: Personnel, including contractors
- >\$10M: FY 2021 IR&D
 - 50: R&D 100 Awards, three in 2021!
- >4,000: Active projects on any given day
 - > 240: Buildings on San Antonio campus
- >1,400: Patents



Approximate Revenue Source Distribution

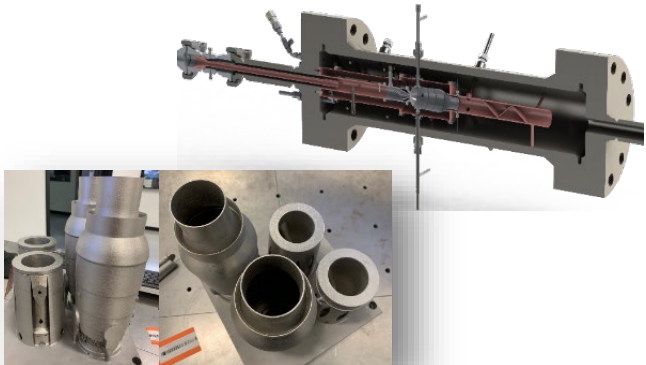
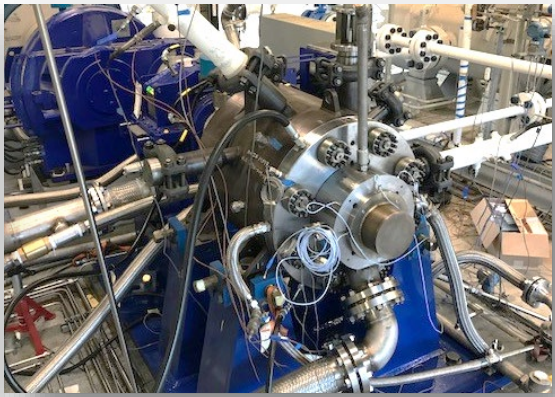
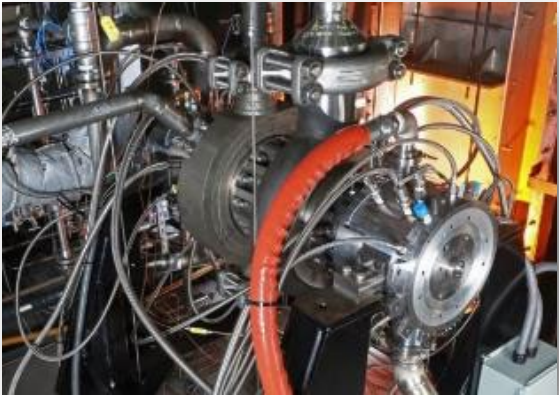
65% "Government"
35% Commercial

Supercritical CO₂ Power Cycles Promise Advantages for Diverse Applications

- Transformational power cycles and systems
 - 2-5% point net plant efficiency improvement
 - 3-4% reduction in LCOE
 - Reduced emissions, fuel, and water usage
- Pathway to decarbonize multiple power generation and industrial sectors
 - Waste heat recovery, concentrating solar power, nuclear power, oxy-combustion, energy storage, and other applications

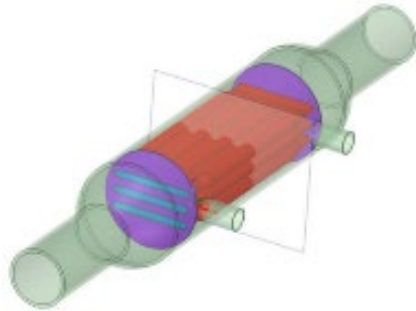


Unparalleled Experience & Capabilities in sCO₂ Cycles, Components, and Systems

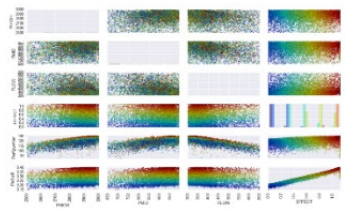
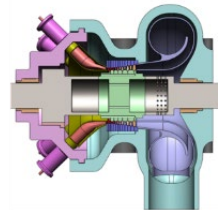
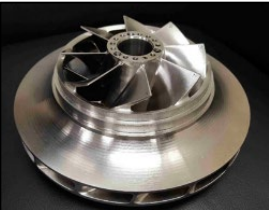
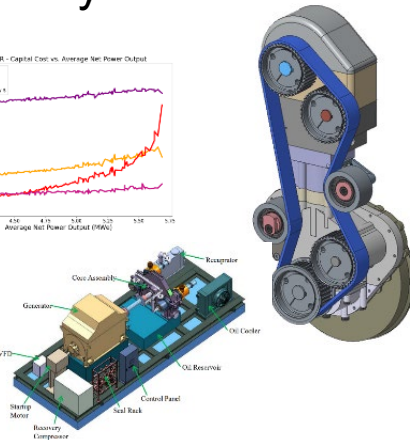
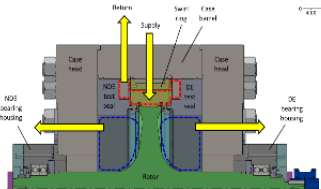
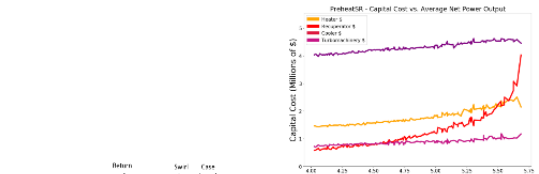


Oxy-Combustor Development and Testing

Design, Fabrication, Testing of 10 MWe-Scale Machinery



Heat exchanger Development and Testing



...and More Design, Analyze, Optimize, and Test Capabilities



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Supercritical Transformational Electric Power (STEP Demo)

Design, construct, commission, and operate a **10 MWe sCO₂ Pilot Plant Test Facility** - reconfigurable to accommodate other testing



Advance state of the art from **Proof of Concept (TRL3)** to **System Prototype validated in an operational system (TRL7)**

Project Team:

U.S. Department of Energy (**DOE NETL**)
Gas Technology Institute (**GTI**®)
Southwest Research Institute (**SwRI**®)
General Electric Global Research (**GE-GR**)



Joint Industrial Partners:



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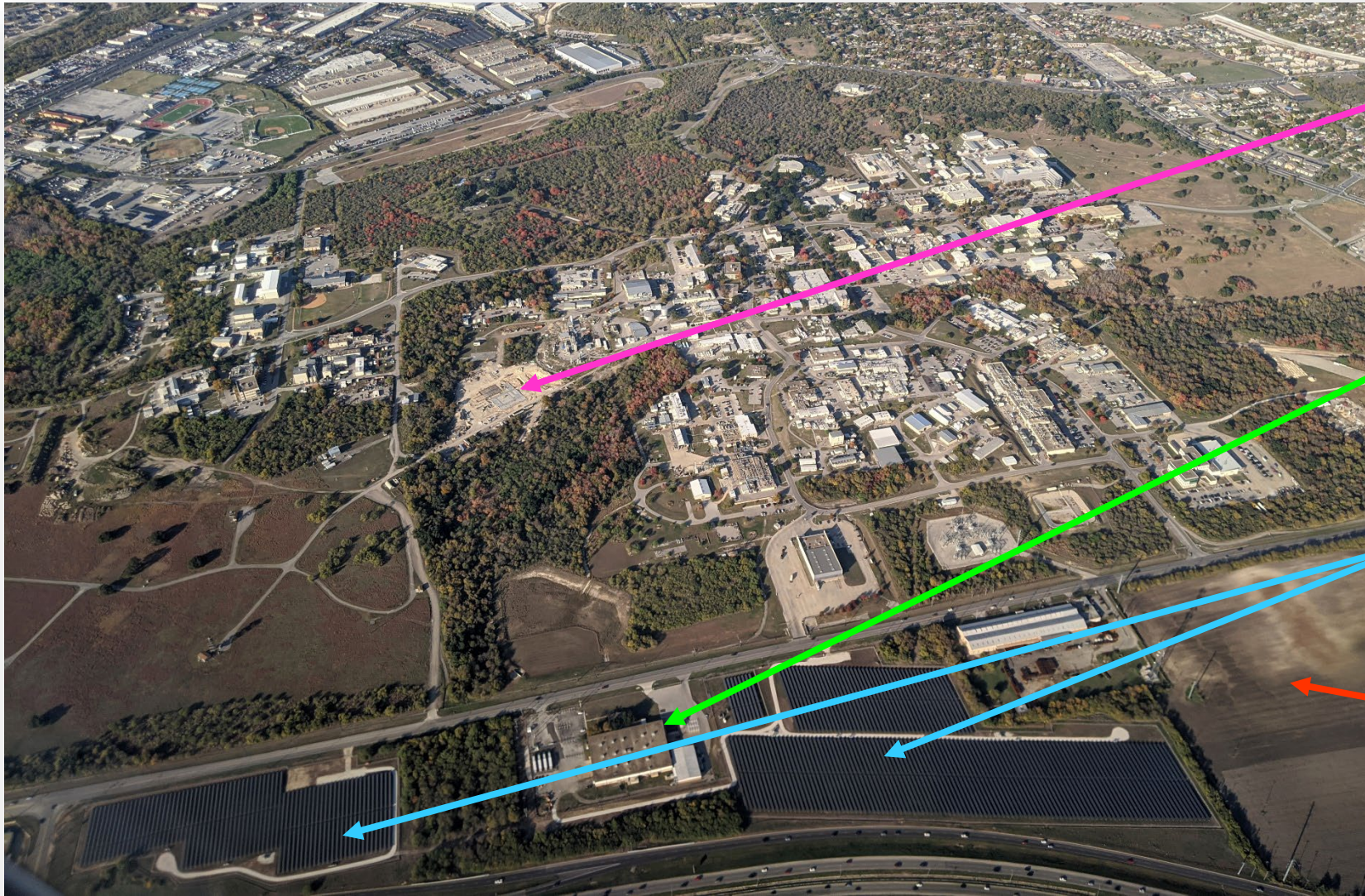
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SwRI's Roles in the STEP Pilot Plant Project

- SwRI is a project partner leveraging past experience to lead tasks and procurements:
 - System integration
 - Data acquisition & controls
 - Piping
 - Turbine design & fabrication (with GE)
 - Heater protection valve
- As host site, SwRI provided \$12.1M general-purpose facility
- Future use cases include expanded testing conditions, full-scale system & component tests, control system development and optimization, more



Recent Campus Additions



STEP Demonstration Power Plant

Energy Storage Technology Center (10 MW Grid Energy Storage)

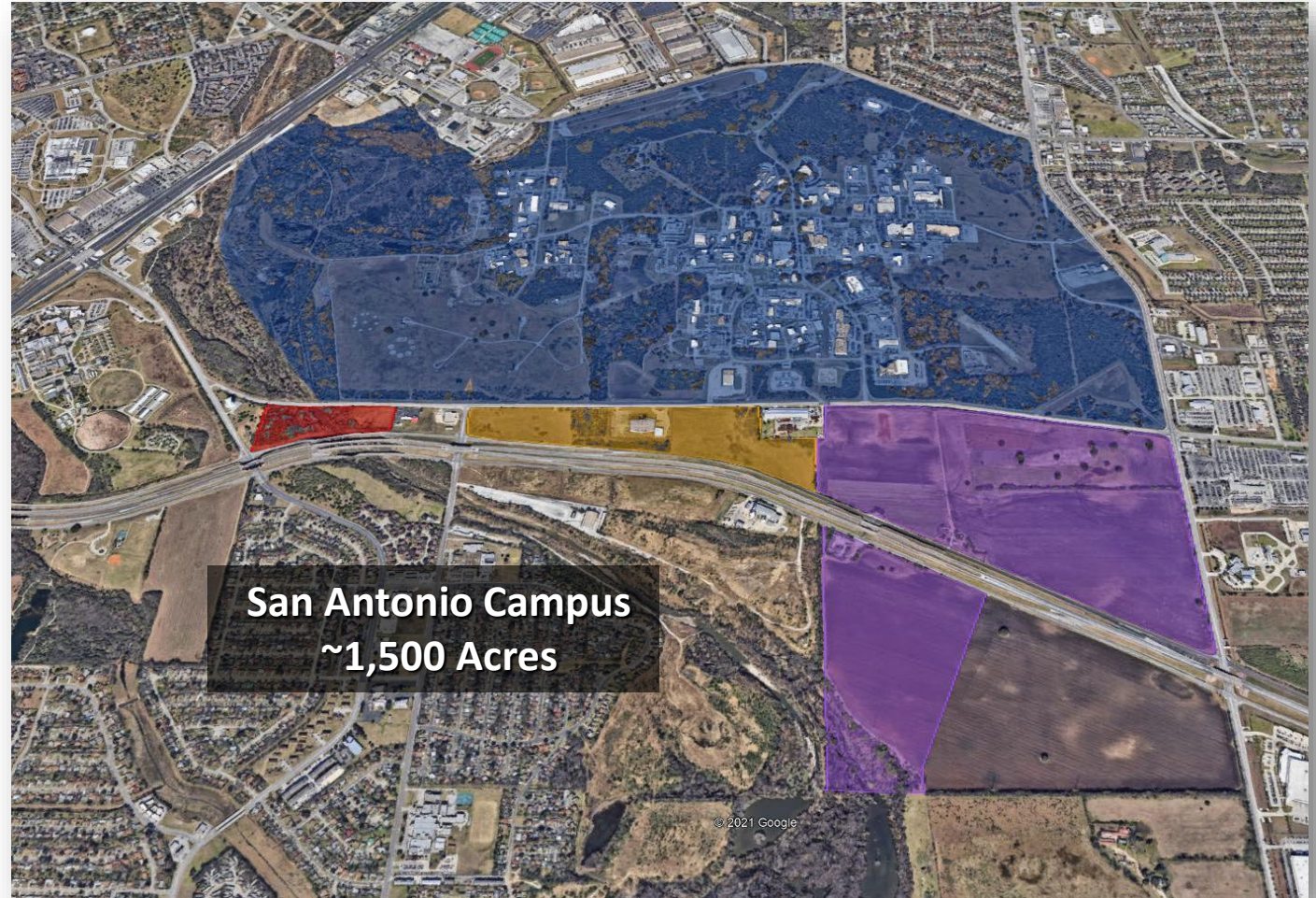
~50 Acres of Solar Panels

~252 Acres New Property

Extended Campus

>1,500 Acres

- Main Campus
- Energy Storage Technology Center
- Future Use
- Buffer/Future Use





**If you are interested in
touring the STEP facility,
please sign up for a tour!**

Thank you!

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President & CEO

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Southwest Research Institute

Benefiting government, industry, & the public through innovative science & technology

Core Values:

- **Integrity:** Fulfilling our mission and serving our clients with excellence, honesty, and accountability.
- **Innovation:** Solving problems and creating value with novel ideas and multidisciplinary collaborations.
- **People:** Fostering an employee-centric culture in a safe, inclusive, healthy, and supportive workplace.
- **Stewardship:** Caring for our communities and protecting the environment now and for the future.



Contemporary Mission



Advancing science and applying technology to solve humankind's most difficult technical challenges from ***Deep Sea to Deep Space***[®] and practically everywhere in between.