Stephanie L Vivod

Research Chemical Engineer

NASA Glenn Research Center

Cleveland, Ohio



CWRU_PANEL2020 Transitioning Ideas into Reality

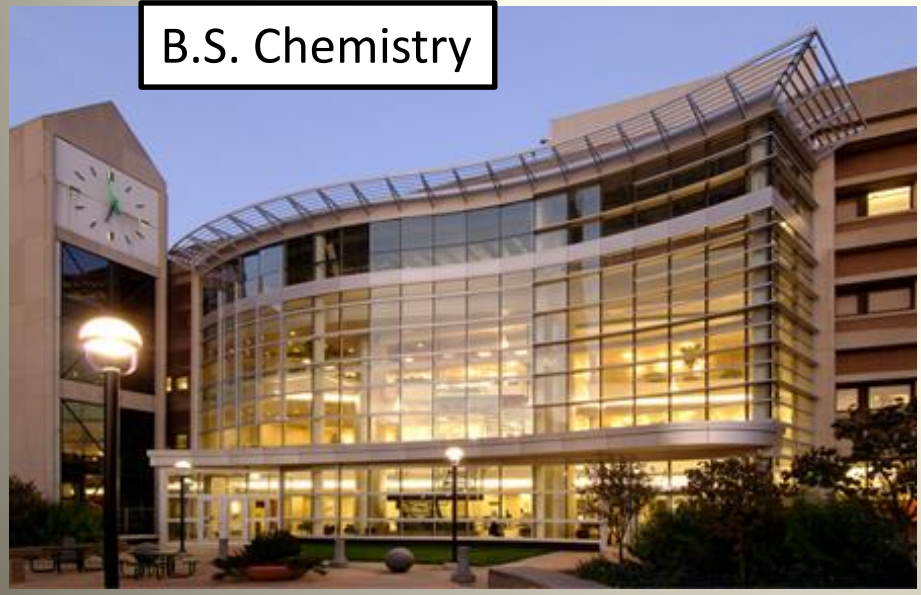
EDUCATION

NASA Glenn Research Center

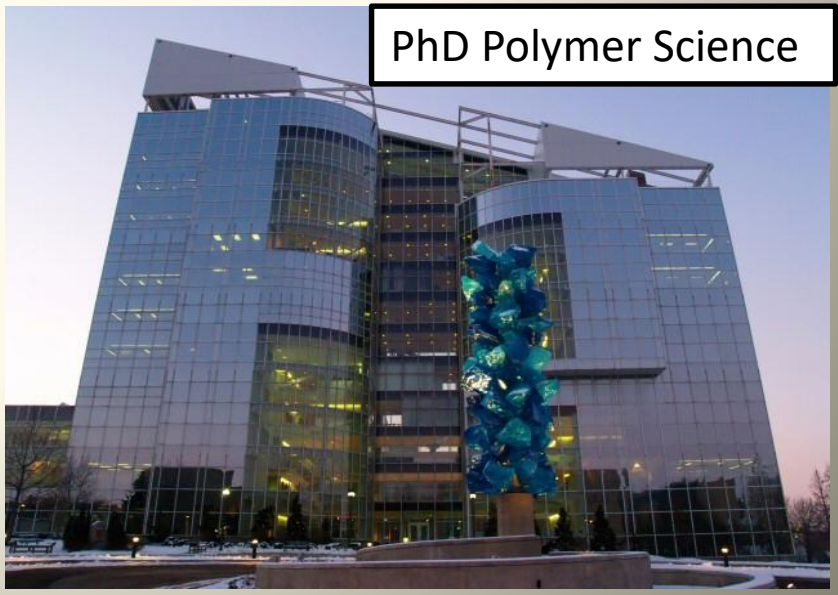


NASA Cooperative Education Program

B.S. Chemistry



PhD Polymer Science



Typical day as an:

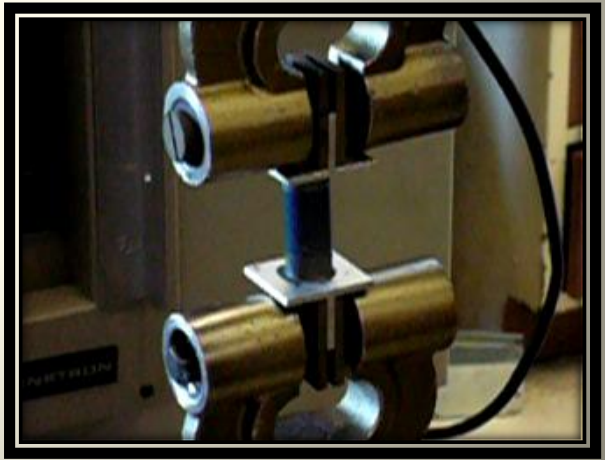
AST (Aerospace Technology) Research Chemical Engineer, Aerospace Polymeric Materials



- Synthesis
- Literature search, materials research









- Technology transfer
- Operate the Supercritical Fluid Extractor
- Materials Analysis & Characterization



Outreach Events



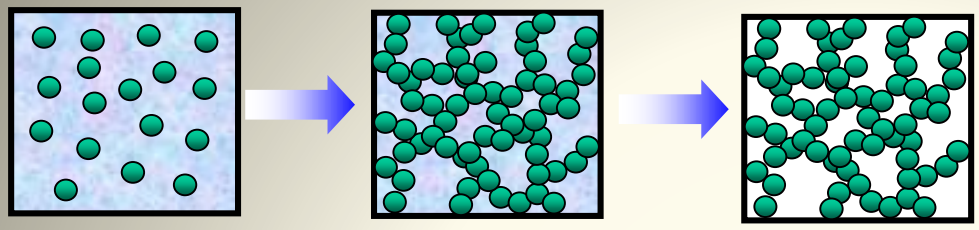


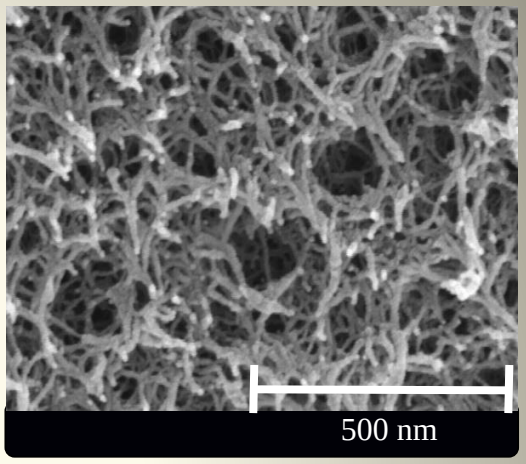
Field trip to the Great Lakes Science Center



Internal Activities

What are aerogels?





Scanning Electron Micrograph of polymer aerogel matrix

- LIGHTEST WEIGHT SOLID –Guinness Book of World Records!!!
- Highly porous solids (>95%)
- Pore sizes extremely small (typically 10-40 nm)
- Large surface areas (500-850 m^2/g

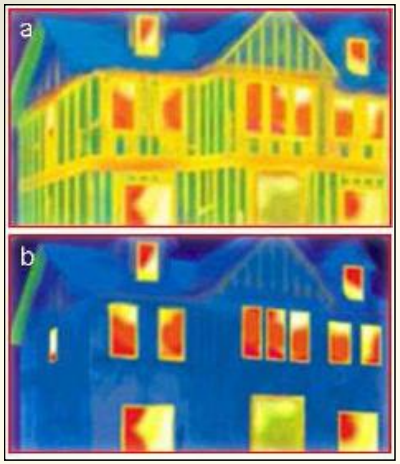




Commercial applications



Outdoor gear/apparel



Home insulation



Pipeline wrap

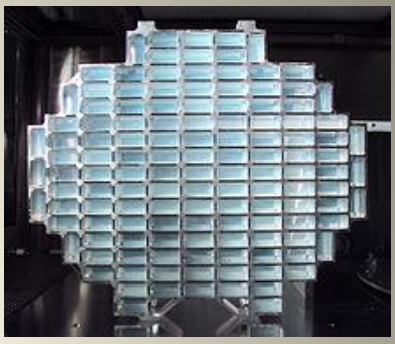


Architectural day lighting

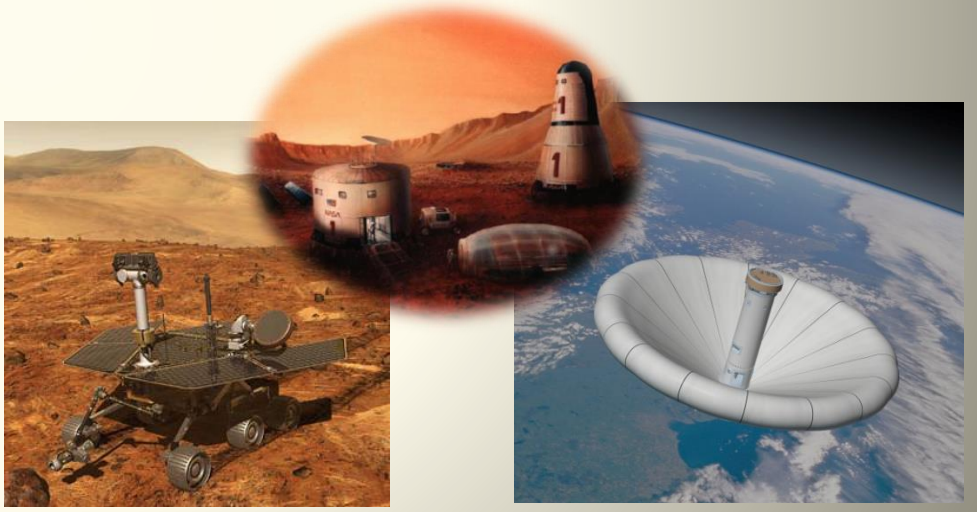
Space exploration applications



Insulation for EVA suits



Particle capture



Ultra-lightweight, multifunctional structures for rovers, habitats, and thermal protection systems (TPS)

www.nasa.gov

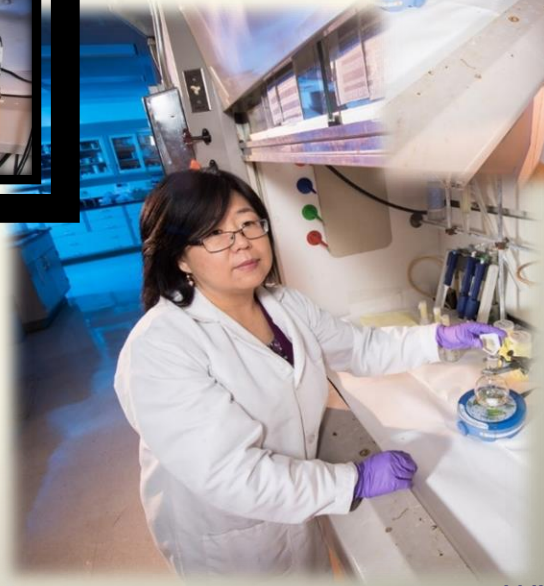
Aerogel insulation for building applications: A state-of-the-art review

Aerogel Laboratories

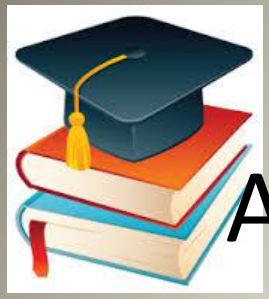








THE AEROGALS!

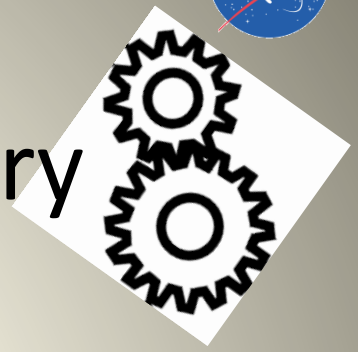


Government

Academia



Industry



* **Funding:**

  industry: structured projects with budget requirements
  academia: requires constant search for funding
  government: policy based funding, varies and unreliable

***Time and Scale**:

  industry and government: larger scale due to resources
  academia: less deadline specific

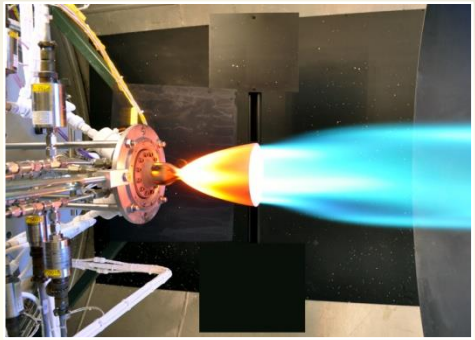
***Products**:

  academia: get money and publish
  industry: produce something of value to the company
  government: both

GRC Core Competencies



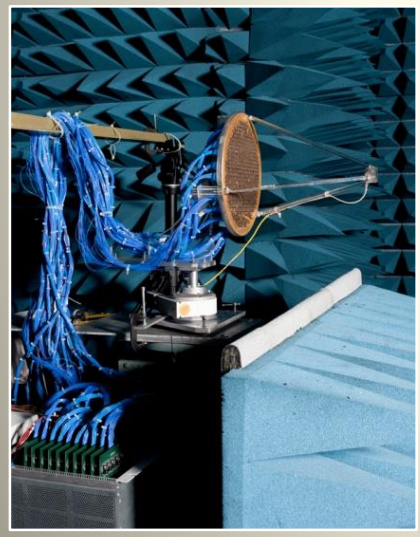
Air-Breathing Propulsion



In-Space Propulsion and Cryogenic Fluids Management



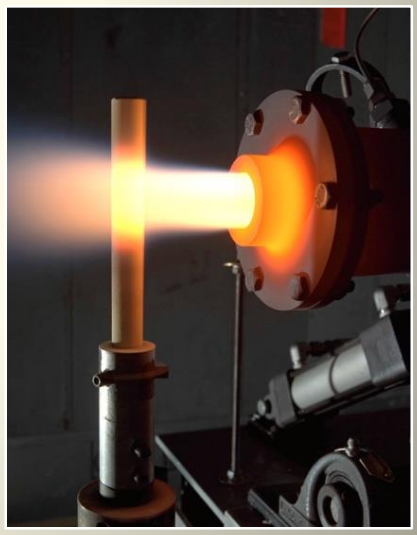
Physical Sciences and Biomedical Technologies in Space



Communications Technology and Development



Power, Energy Storage and Conversion

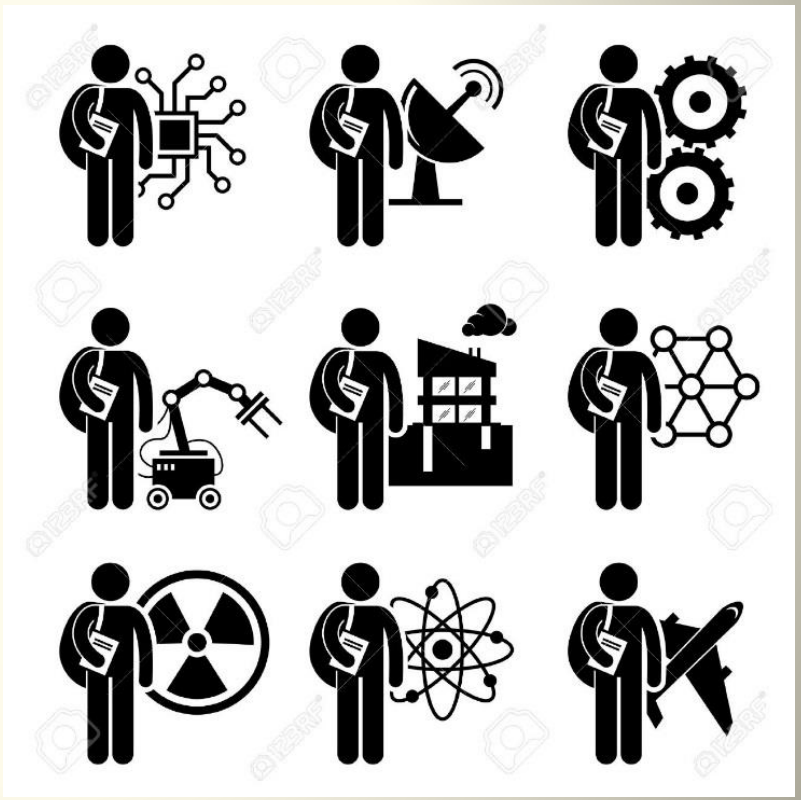


Materials and Structures for Extreme Environments

Engineers

- Engineering combines **mathematics**, **science**, and **technology** to produce creative solutions to real world problems
- Professional, Engineering and Scientific (70% of NASA's positions)

➢ Major branches of engineering:
- Mechanical
- Chemical
- Civil
- Electrical
- Biomedical
- Computer



***Hundreds of different subcategories of engineering under each branch**

http://typesofengineeringdegrees.org/

National Aeronautics and Space Administration

What Does NASA Do?

"TRANSITION IDEAS INTO REALITY"

NASA vision:

To reach for new heights and reveal the unknown so that what we do and learn will benefit all humankind

Thousands of people have been working around the world -- and off of it -- for more than 60 years, trying to answer some basic questions:

- What's out there in space?
- How do we get there?
- What can we learn there, or learn just by trying to get there, that will make life better here on Earth?

SPIN OFF TECHNOLOGIES



http://www.nasa.gov/about/highlights/what_does_nasa_do.html

www.nasa.gov

NASA IMPACT Glennovation



RESEARCH

GLENN RESEARCH

OPERATING SPACE EXPERIMENTS FROM EARTH

GLENN'S EMBEDDED WEB TECHNOLOGY (EWT) SOFTWARE ENABLED SCIENTISTS TO OPERATE EXPERIMENTS ON THE INTERNATIONAL SPACE STATION IN REAL TIME FROM ANYWHERE ON EARTH.



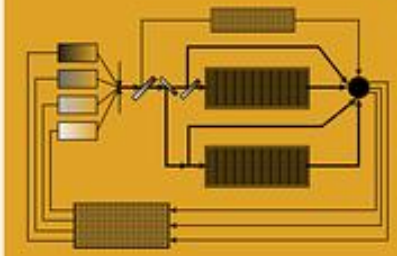
BENEFIT

RESEARCH BENEFIT

TEXTING OR GOOGLING YOUR OVEN

TMIO'S CONNECT IO INTELLIGENT OVEN USED TECHNOLOGY BASED ON EWT TO ENABLE USERS TO CONTROL ROASTS AND CASSEROLES REMOTELY VIA ANY DEVICE WITH WEB ACCESS.

NASA IMPACT Glennovation

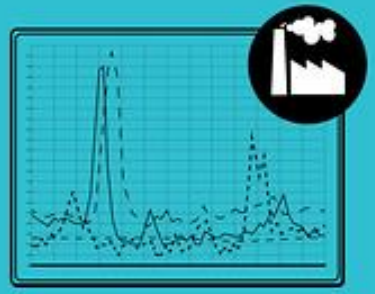


RESEARCH

GLENN RESEARCH

STUDIES OF AIRCRAFT EMISSIONS

GLENN TECHNOLOGY HELPED USED AERODYNERESEARCH INC.'S (ARI'S) TO DEVELOP A TUNABLE SPECTROMETER (TILDAS) TO MEASURE, IN PARTS PER BILLION, EMISSION GASES FROM AIRCRAFT, CITY BUSES IN NEW YORK, AND TRAFFIC IN MEXICO CITY.



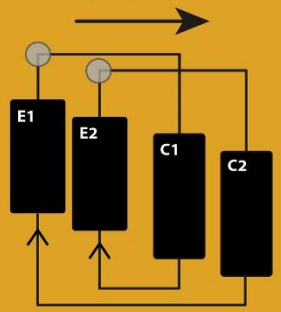
BENEFIT

RESEARCH BENEFIT

DEVICE FOR STUDYING AIR QUALITY AND CLIMATE CHANGE

ARI'S QUANTUM CASCADE (QC) TILDAS HAS BEEN USED TO STUDY AND MONITOR CLIMATE CHANGE, GAS TURBINE EMISSIONS, HEALTH AND SAFETY, AND AIR QUALITY.

NASA IMPACT Glennovation

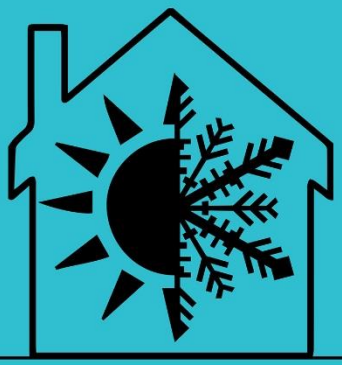


RESEARCH

GLENN RESEARCH

EFFICIENT COOLING IN SPACE

GLENN DEVELOPED A NEW, HIGH PERFORMANCE, PASSIVE, AND LIGHTWEIGHT PASSIVE HEAT TRANSPORT SYSTEM FOR SPACE COOLING APPLICATIONS.



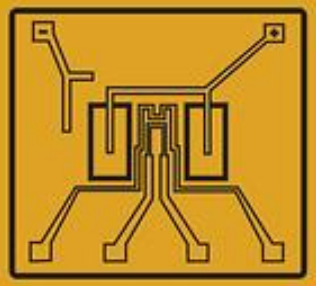
BENEFIT

RESEARCH BENEFIT

IMPROVED RESIDENTIAL HEATING AND COOLING

LENNOX INC. USED THE GLENN TECHNOLOGY TO BUILD AND TEST A LARGE SCALE PASSIVE HEAT TRANSPORT SYSTEM FOR USE IN A MORE EFFICIENT AND EFFECTIVE HOME HEATING AND COOLING SYSTEM.

NASA IMPACT Glennovation

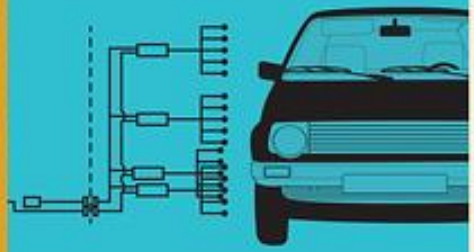


RESEARCH

GLENN RESEARCH

AUTOMATED HYDROGEN LEAK DETECTION

GLENN ENGINEERS DEVELOPED CHEMICAL SENSORS TO DETECT POTENTIAL HYDROGEN LEAKS DURING SPACE SHUTTLE LAUNCH OPERATIONS.

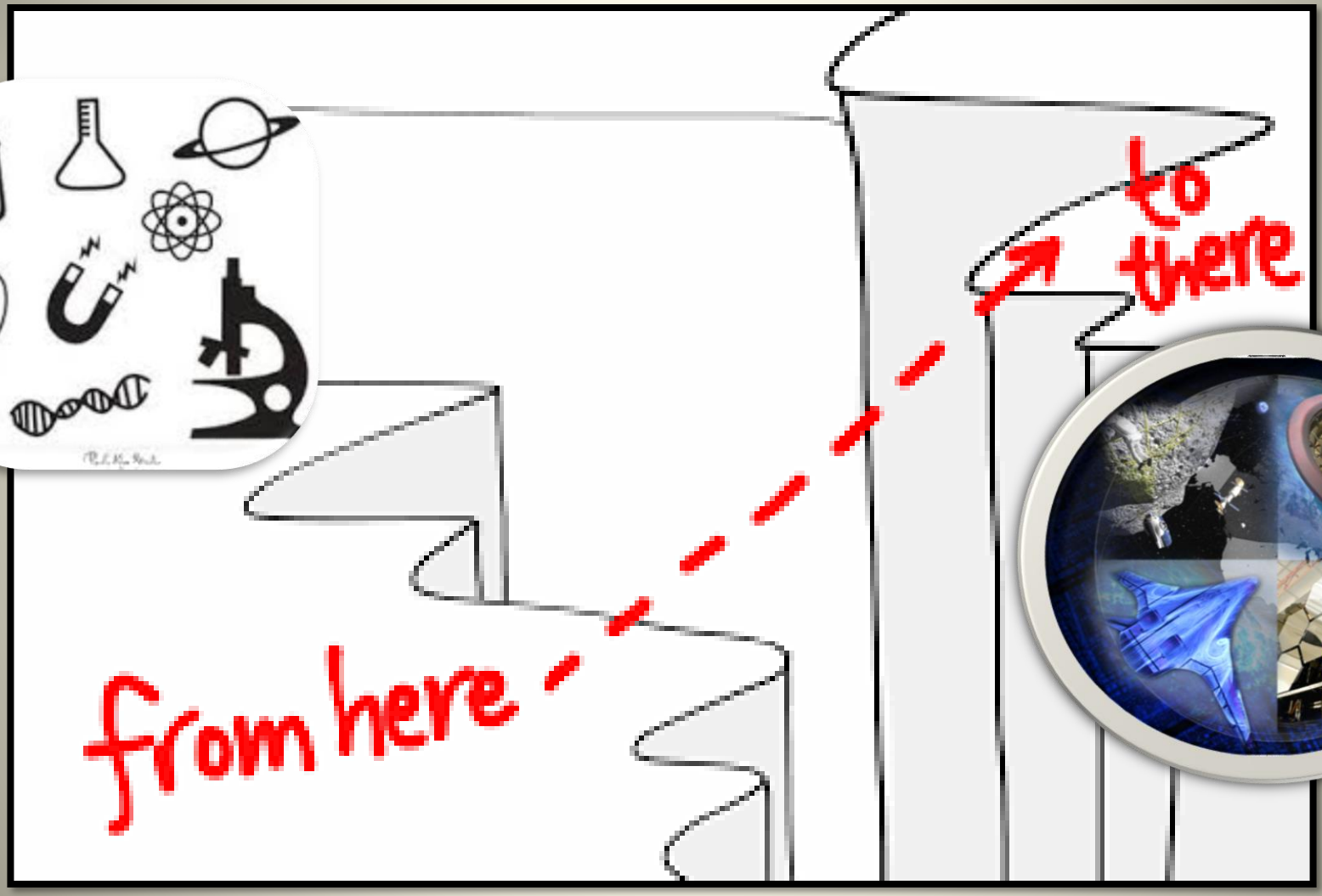


BENEFIT

RESEARCH BENEFIT

SAFER HYDROGEN POWERED VEHICLES

MAHLE ENGINEERING, INC., COMMERCIALIZED GLENN'S AUTOMATED HYDROGEN SENSING TECHNOLOGY TO PROVIDE A LEAK-SENSING SYSTEM FOR FORD MOTOR COMPANY'S PROTOTYPE HYDROGEN-POWERED HYBRID VEHICLES.


from here
to there

Technology Transfer





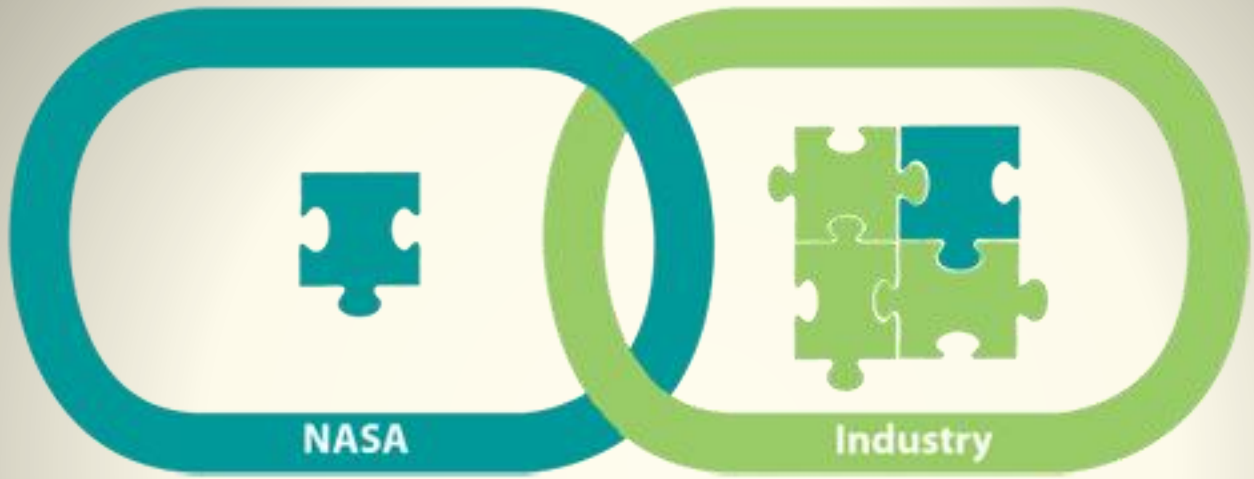
Automotive Industry Workshop at NASA Glenn





The Auto Technology Workshop hosted by MAGNET and the Center for Automotive Research at The Ohio State University

Glenn Research Center | NASA TECHNOLOGY TRANSFER PROGRAM



Leverage the outstanding capabilities and accomplishments of NASA's Glenn Research Center for the benefit of both NASA and U.S. taxpayers

COLLABORATIVE EFFORTS TO UTILIZE NASA TECHNOLOGY

- Licensing- NASA's patent portfolio
- Innovative Research Grants
- Cooperative Agreement
- Interagency Transfer

https://technology.grc.nasa.gov/

Rovers Pave the Way for Hospital Robots

Jet Propulsion Laboratory (JPL)

Vecna Technologies
Cambridge, MA



NASA Technology

- Designing various Mars rovers over the years have yielded advances in artificial intelligence.
- A prototype rover called Rocky 7 was developed in the mid 1990s, with the ability to discern which rocks were interesting enough to pick up and then to follow through with the action.

Technology Transfer

- During this time, JPL provided the Massachusetts Institute of Technology (MIT) with funding to advance object acquisition capabilities in robots.
- An MIT grad student built a mock-up of Rocky 7 and committed research toward autonomous robot behavior, then joined Vecna Technologies to develop robots that could be used on Earth.

Benefits

- The QC Bot performs a variety of hospital-related duties—from completing bedside registrations to capturing vital signs—all while autonomously navigating itself around a facility.
- The QC Bot is used in hospitals around the world, helping to improve efficiency and reduce medical errors.

Polymers Advance Heat Management Materials for Vehicles

Marshall Space Flight Center

StarFire Systems Inc.
Schenectady, NY



NASA Technology

- On Space Shuttle missions following the Columbia accident, a powerful sealant was to be made available on all flights to repair external spacecraft damage.
- Especially important was that the sealant be resistant to extreme heat.

Technology Transfer

- With NASA funding, StarFire Systems Inc. demonstrated and tested SMP-10, a polymer that would convert to ceramic when exposed to temperatures above 1500°F.
- The ceramic held up to burning temperatures present during re-entry into the earth's atmosphere.

Benefits

- StarFire now has an offshoot line of extreme-heat-resistant polymers called StarPCS, used in the military, aviation, and automotive markets.
- The product is being tested for use in Formula 1 race cars, both as a heat shield to protect drivers from engine components and as part of a new exhaust system meant to increase horsepower.

Sensors Enable Plants to Text Message Farmers

Marshall Space Flight Center

AgriHouse
Berthoud, CO



NASA Technology

- Astronauts living in space for extended periods of time, like those on deep-space missions, will need to grow their own food.
- As resources in space are severely limited and costly, systems that maximize efficiency will make long-term space flight possible.

Technology Transfer

- AgriHouse partnered with BioServe Space Technologies, recipient of Small Business Innovation Research (SBIR) funding, to develop sensors that use electrical pulses to determine when a plant loses its rigidity to the point where it needs water.
- In a laboratory test, the new system decreased water usage by between 25 and 45 percent.

Benefits

- The technology will allow farmers in the water-scarce West to conserve their resources.
- While current users are researchers, MBA students are working on business models to expand the product's reach in the market.
- AgriHouse sees a future where farmers can receive text messages on their plants' health.

A Universe of NASA Opportunities



https://intern.nasa.gov/

