



# NextFlex Innovation Days

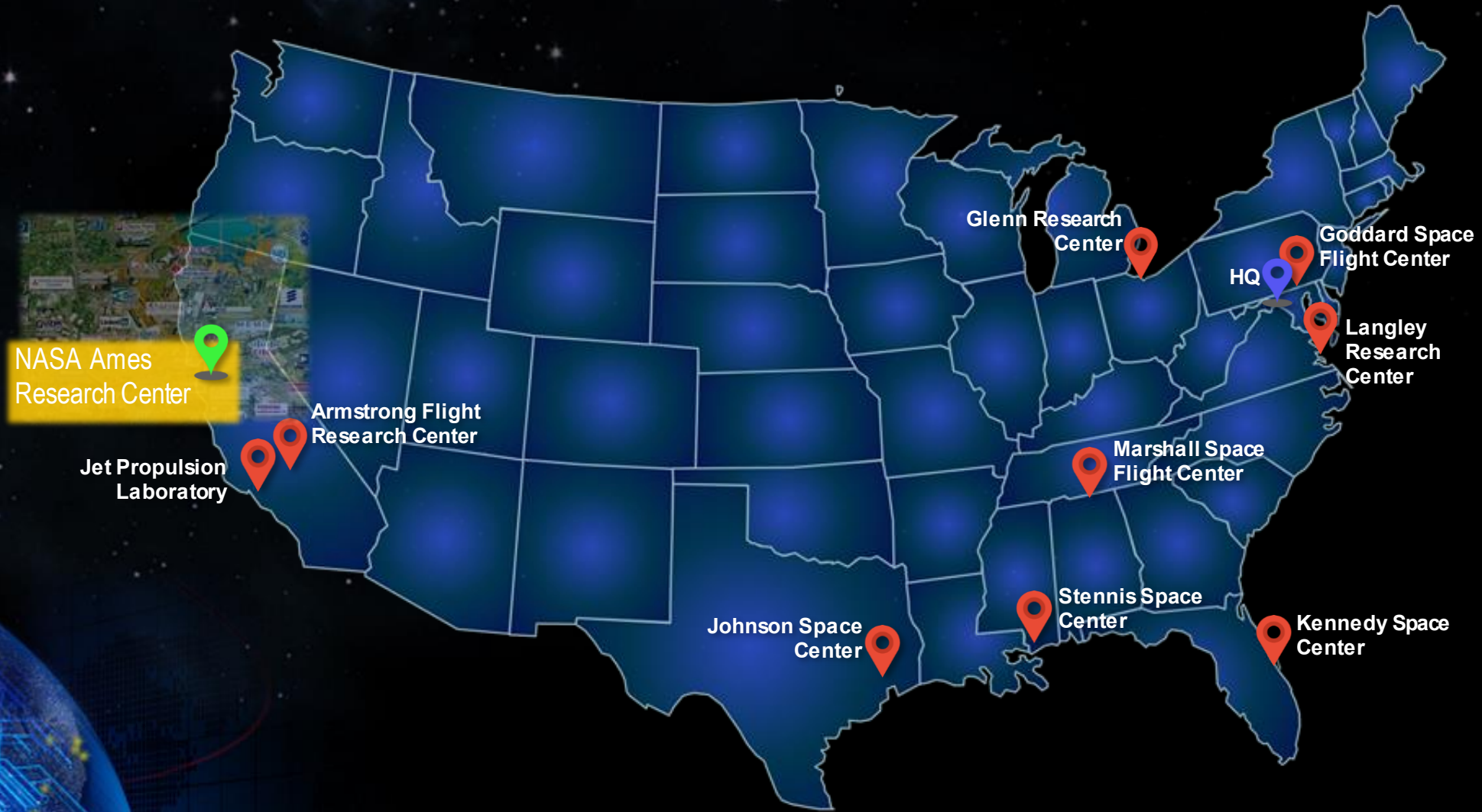
Karen Bradford  
Director of Strategic Partnerships  
NASA Ames Research Center

August 2021





# NASA Centers



NASA Ames  
Research Center

Jet Propulsion  
Laboratory

Armstrong Flight  
Research Center

Johnson Space  
Center

Glenn Research  
Center

Marshall Space  
Flight Center

Stennis Space  
Center

Kennedy Space  
Center

HQ

Goddard Space  
Flight Center

Langley  
Research  
Center

# NASA Ames Research Center

- Occupants: ~1130 civil servants; ~2,100 contractors; 1,650 tenants
- Size: ~1,900 acres; 5M building ft<sup>2</sup>
- Airfield: ~9,000 and 8,000 ft runways

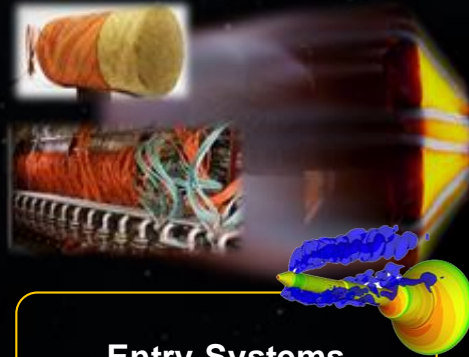




# Core Competencies



**Air Traffic  
Management**



**Entry Systems**



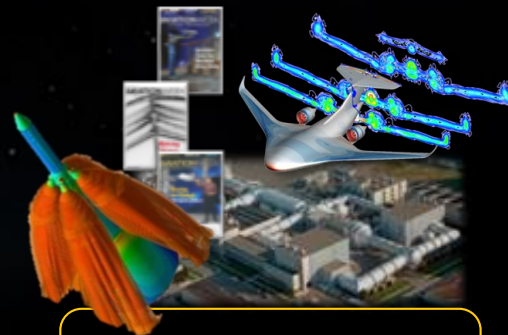
**Advanced Computer & IT  
Systems**



**Intelligent/Adaptive  
Systems**



**Cost-Effective  
Space Missions**



**Aerosciences**



**Astrobiology & Life  
Science**



**Space & Earth  
Sciences**



# Major Research Facilities



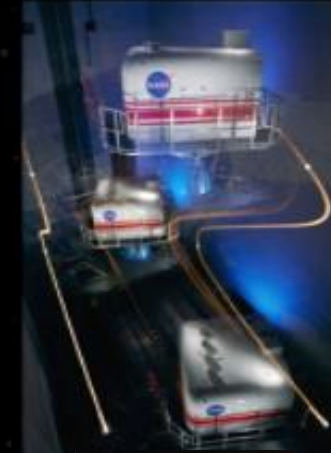
Wind Tunnels



ARC Jet  
Complex



Range  
Complex



Simulators



Advanced  
Supercomputing



# Sustainability Base and Biosciences Building

Autodesk

Bloomenergy





# NASA Partnerships

- NASA has over 60 years of experience in strategic partnership with academia, commercial, industry and government organizations.
  - <https://www.youtube.com/watch?v=2uRBfj75lQY>
- NASA Ames Research Center in the Heart of Silicon Valley, is leading the way with innovative and non-traditional ways of reaching out to provide opportunities for a diverse and inclusive next generation.
  - <https://www.nasa.gov/ames/partnerships>



# NASA Ames Partners

## Commercial



## Virtual Institutes



NAI: the  
Community

## Academia



## International



## NASA Centers



## Military



## NASA Research Park



## Interagency





# Small Business Innovation Research (SBIR)/ Small Business Technology Transfer (STTR)

SBIR/STTR

Headquarters Level II  
Program Office

<https://sbir.nasa.gov/>

The screenshot shows the NASA SBIR/STTR website. At the top, there is a search bar and navigation links for Home, About SBIR/STTR, Solicitations, Schedule & Awards, Handbooks, Resources, and Contact Us. The main content area features a large banner for the "NASA SBIR AND STTR PROGRAM SOLICITATION 2020" with a date range of "Jan 21-Mar 20". Below the banner, there is a section titled "NASA SBIR/STTR Solicitation Now Open!" with a sub-headline stating "The NASA SBIR/STTR Program's Phase I solicitation period is open from January 21<sup>st</sup> through March 20<sup>th</sup>, 2020". Two buttons are visible: "Read the 2020 Solicitation" and "Apply Now". On the left side of the banner, there is a vertical menu with links for "2020 SOLICITATION", "SOLICITATION RESOURCES", "SOLICITATION SCOPE", "GETTING STARTED", and "SPINOFF MAGAZINE". The banner itself contains images of an astronaut, a satellite, and a person in a lab coat.



# NASA Technology Transfer

[software.nasa.gov/](https://software.nasa.gov/)



[technology.nasa.gov/patents](https://technology.nasa.gov/patents)

Patent Portfolio

The NASA patent portfolio is available to benefit US citizens. Through partnerships and licensing agreements with industry, these patents ensure that NASA investments in pioneering research find secondary uses that benefit the economy, create jobs, and improve quality of life. Click on each of the category icons for a list of patents in that category or use the search below to explore NASA's patent portfolio.

## Public Domain

### NASA TECHNOLOGIES

To stimulate the innovation economy, NASA makes a portion of its technology portfolio **freely available** for anyone to use.

The technologies in this public domain portfolio do not require a license agreement, and anyone may freely pursue independent product development right away without the need to contact NASA in any way.



[technology.nasa.gov/patents](https://technology.nasa.gov/patents)



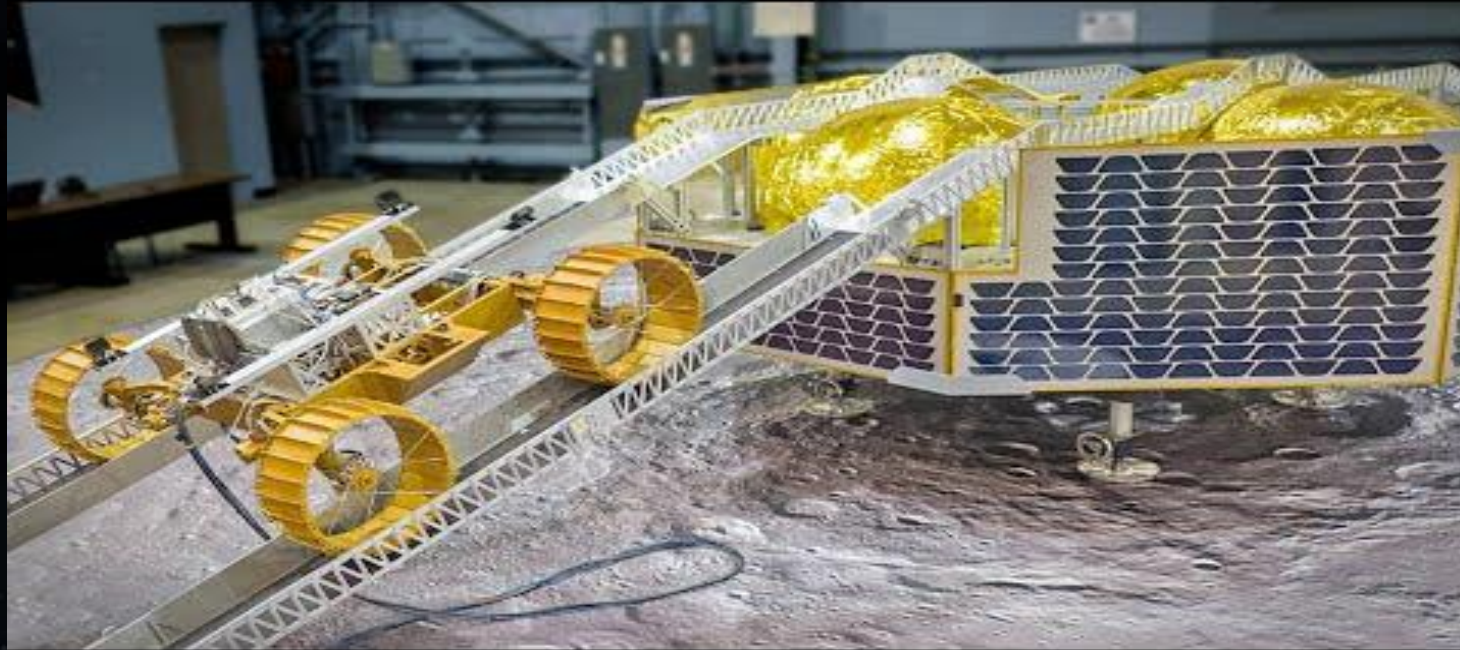
# The Artemis Accords

- The Artemis program will assemble the broadest and most diverse international space exploration coalition in history.
- The founding member nations that signed the Artemis Accords are: Australia, Canada, Italy, Japan, Luxembourg, United Arab Emirates, United Kingdom and the United States of America.
- The Accords are a practical set of principles that reinforce and implement the 1967 Outer Space Treaty and guide space exploration cooperation among nations participating in NASA's Artemis program. These principles include peaceful exploration, transparency, interoperability, rendering emergency assistance, the public release of scientific data, and much more.
  - <https://www.nasa.gov/specials/artemis-accords/index.html>



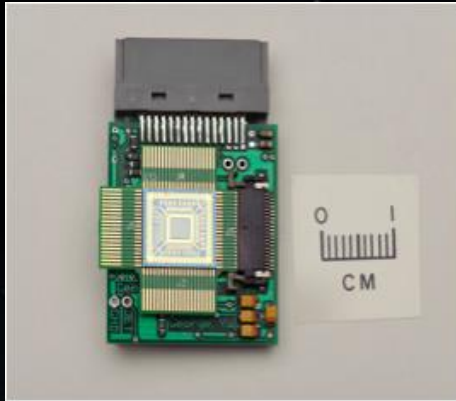


# VIPER - Volatiles Investigating Polar Exploration Rover



[https://www.youtube.com/watch?v=R82CBqd\\_xsk](https://www.youtube.com/watch?v=R82CBqd_xsk)

# Intelligent Sensing Devices



This technology won NASA Government Invention of the Year Award in 2012.

A newly developed sensing device with 64-sensors for breath analysis of COVID (funded by HHS).



# Achievements



First ever nanosensor device flown in space on a Navy satellite launched in 2007 for trace chemical detection.

*Ames Honor Award, 2007*

ENose on EXPRESS Rack



Two CNT sensors were on JPL ENose platform deployed on ISS for environmental monitoring of chemicals, such as alcohols, ammonia, formaldehyde, sulfur compounds, mercury, et al.

*NASA Group Achievement Award, 2010*

- Development work at NASA Ames started 2002
- 50+ peer-reviewed journal publications
- 11 US patents on this ChemSensor technology



# Benefit to Society

- Public safety
- Healthcare
- Automobile industry
- Forest fire detection
- Buildings, tunnels and mines air monitoring



This design and assembly is funded by DHS S&T Cell\_All program.  
PI: Jing Li <[jjing.li-1@nasa.gov](mailto:jjing.li-1@nasa.gov)>





# In-Space Manufacturing Path Towards Exploration

In-space Metals  
Demo

Commercial  
Cargo and Crew

Space Launch  
System

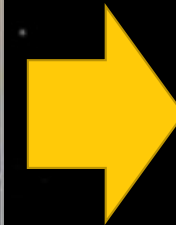
Asteroids

## Planetary Surfaces Platform

- Additive Construction Technologies
- Regolith Simulant Materials Development and Test
- Execution and Handling
- Synthetic Biology Collaboration

## Earth-Based Platform

- Certification & Inspection Process
- Material Characterization Database
- Additive Manufacturing Automation
- In-space Recycling Technology (SBIR)
- External In-space Manufacturing and Repair





# In-Space Manufacturing Portfolio



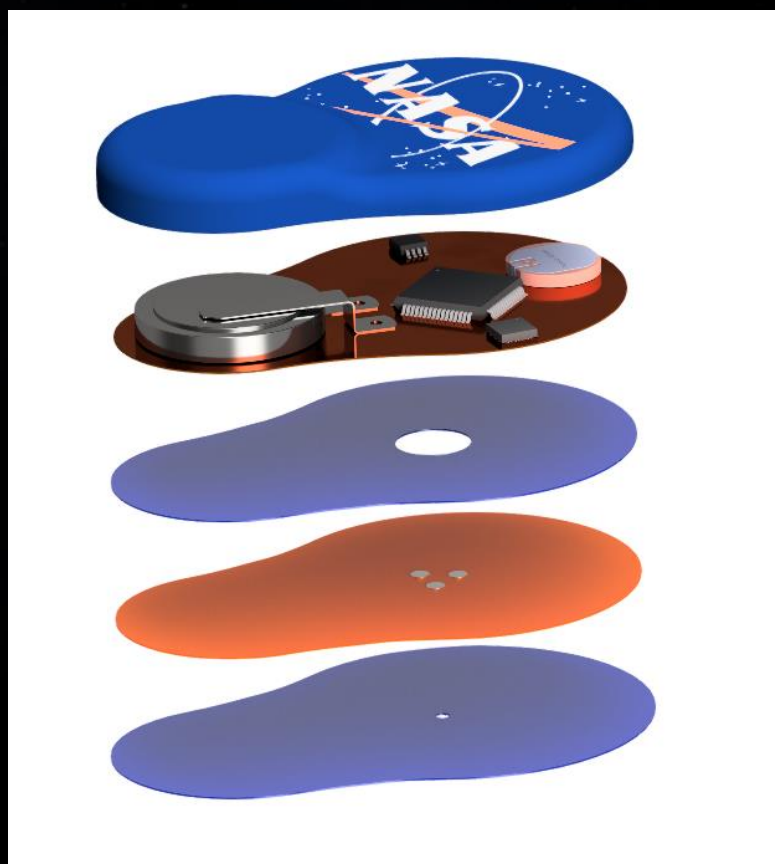


# Astrosense - Wearable Sensor Patch for Crew Health Monitoring

## AstroSense



## AstroSense Layered Assembly and Team



- Wearable directly on skin
- Sweat wicks to sensor surface
- Cortisol measured from sweat
  - Cortisol is a biomarker of stress
- Device operates over one day period
- Data transmits via RFID
- Flexible and small component hardware to maintain overall patch flexibility

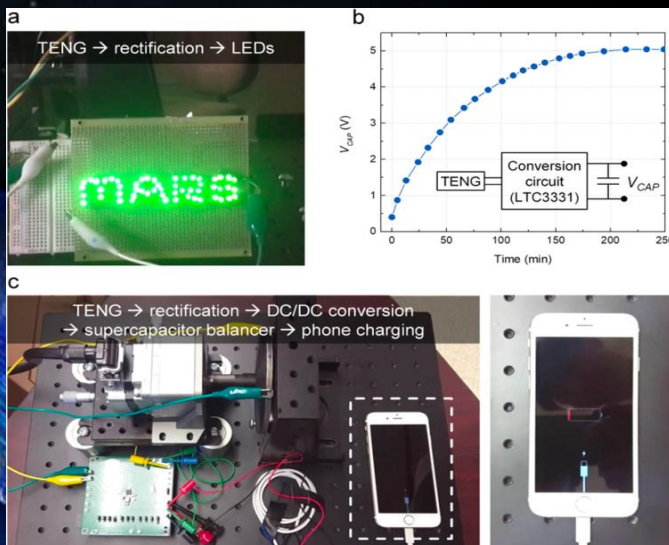
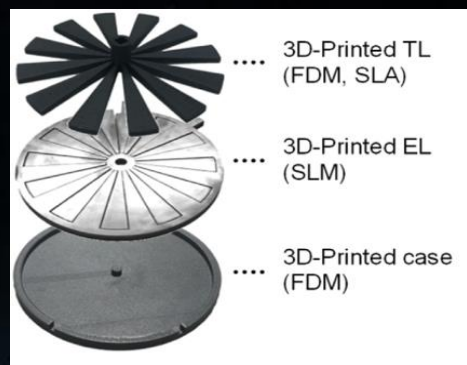
- **NASA Ames Research Center**
  - Printed cortisol sensor
- **NextFlex**
  - Development of integration and assembly technologies
- **NASA Marshall Space Flight Center**
  - Printed humidity sensor and materials development
- **NASA Johnson Space Center**
  - Collaboration with RFID communications



# Printed Technologies

## Triboelectric Energy Harvester

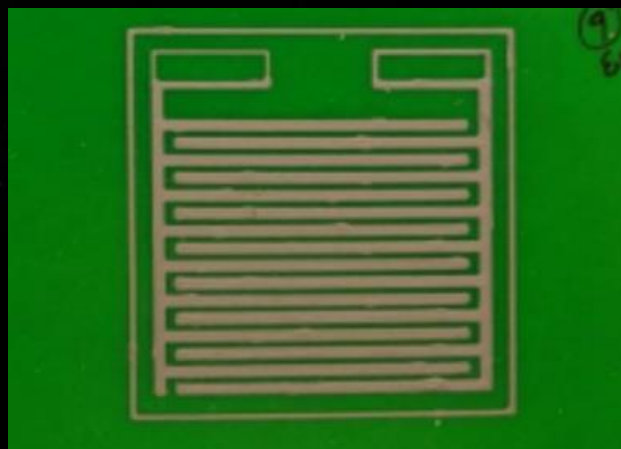
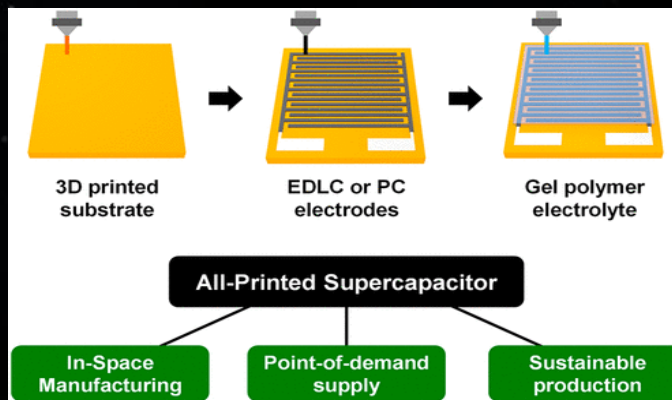
Grating style triboelectric nanogenerator  
3D printed triboelectric and electrode layers



M. L. Seol, et al., *Nano Energy*, 52 (2018) 271-278.

## Supercapacitor

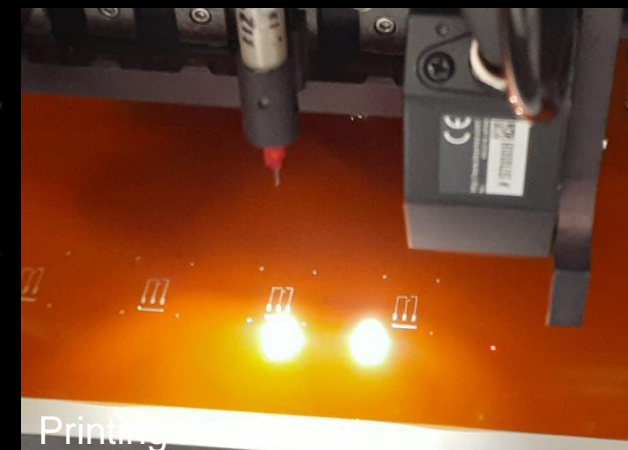
Activated carbon and graphene-Mn<sub>3</sub>O<sub>4</sub> nanocomposite  
Electrochemical double-layer capacitor: 800.3 W/kg  
Pseudocapacitor: 1601 W/kg



M.L. Seol, *ACS Appl. Energy Mat.*, 3 (2020) 4965-4973.

## Electrochemical Sensor

Carbon working and counter electrodes  
Silver/Silver chloride reference electrode

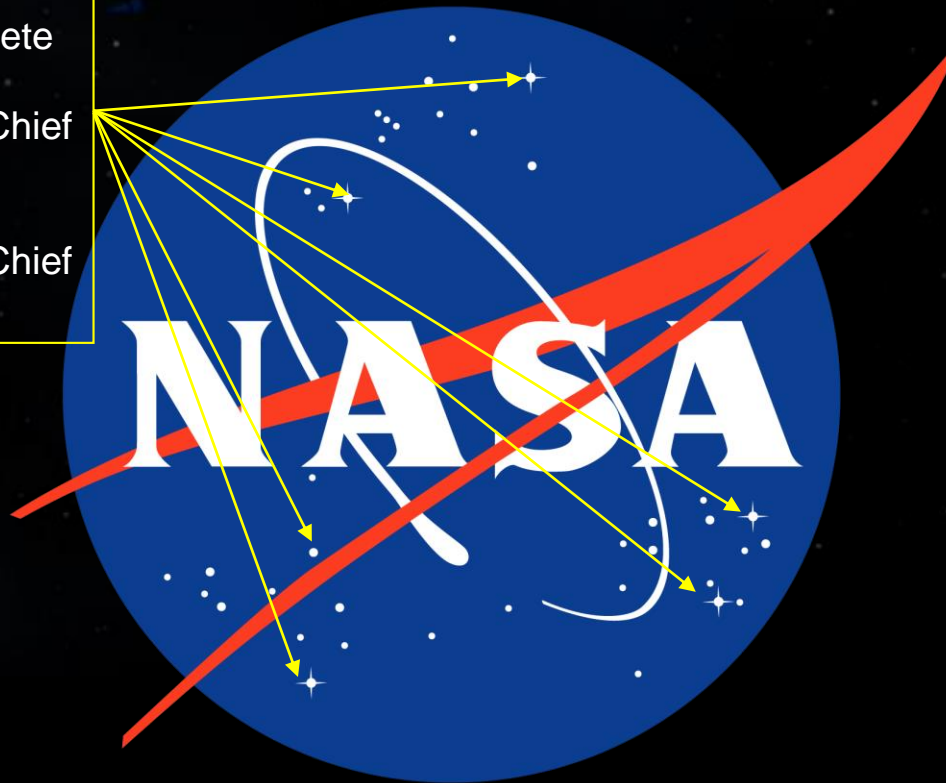




# Where does Karen fit on the meatball?

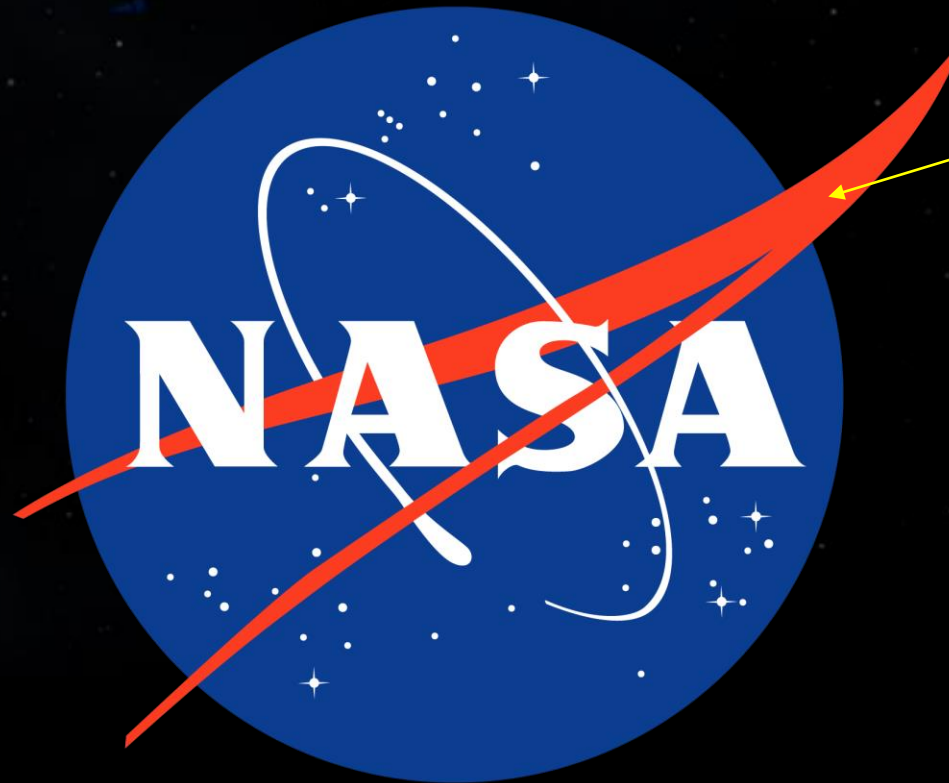
## Directors Office

- NASA Astrobiology Institute
- NASA Code C Resource Analyst - RA for Code D
- NASA Office of the Center Director  
Executive Assistant to the Director – Pete Worden
- NASA Office of the Center Director – Chief of Staff P. Worden
  - J. Boyd's Rules for COS
- NASA Office of the Center Director – Chief of Staff E. Tu





# Where does Karen fit on the meatball?

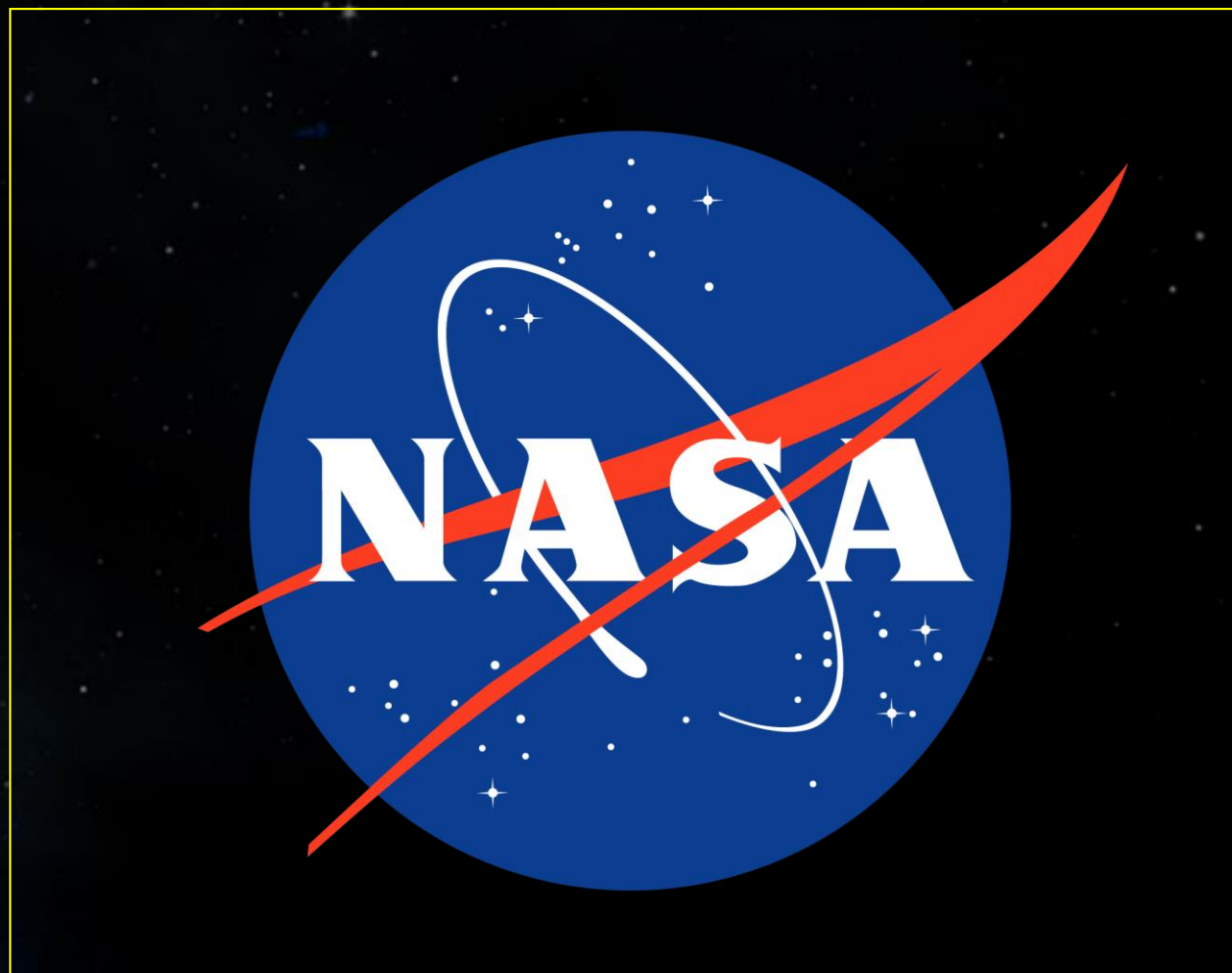


Director of  
Partnerships

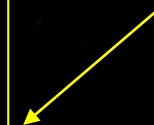




# Where does Karen fit on the meatball?



All together





# Who is on the Enterprise?

In addition to traditional STEM Path careers, there are a plethora of Mission Enabling careers (STEAM) as well that are vital to the success of a mission/goal. Here are just a few!

- **Law**

- International Law
- Space Law (emerging field)
- Community Laws/Guidance for social constructs
- Agreements/Treaties

- **Theological/Counselors**

- Faith support
- Psychiatric and Social Development Counselors
- Guiding Principles of Engagement

- **Logistics**

- Launch prep
- Cargo lift/movement
- Travel (Prior to and on planet)
- Conference/workshop planning
- Project managers
- Procurement

- **Nutrition**

- Nutritionists
- Chefs
- Botanist
- Farmers

- **Environment**

- Artists
- Journalists
- Musicians
  - <https://www.clickorlando.com/news/local/2020/05/27/what-did-spacex-astronauts-listen-to-on-their-way-to-the-launchpad/>
- Organization Space Designers
- Clothing design and function (wearables)
- Event management



# Engage and Take Opportunities

*“Look for and/or create your own opportunity and don’t forget to take them. If it’s not obvious, if it’s not knocking on your door then go find it.”*

– Mamta Patel Nagaraja – MissionStem

- How are we going to the moon (1 minute)
- <https://www.youtube.com/watch?v=7LoI3lumMTo>
- Students 5<sup>th</sup>-8<sup>th</sup> Grade information/opportunities
- <https://www.nasa.gov/audience/forstudents/5-8/career/index.html>
- Students 9<sup>th</sup>-12<sup>th</sup> Grade information/opportunities
- <https://www.nasa.gov/stem/forstudents/9-12/index.html>
- STEM Opportunities at NASA HS-College (Note Pathways and Internships)
- <https://www.nasa.gov/centers/johnson/stem/student-activities/index.html>
- Videos of various information areas for students/educators
- <https://gpm.nasa.gov/education/subtopics/stem-careers>



# What you see in the office



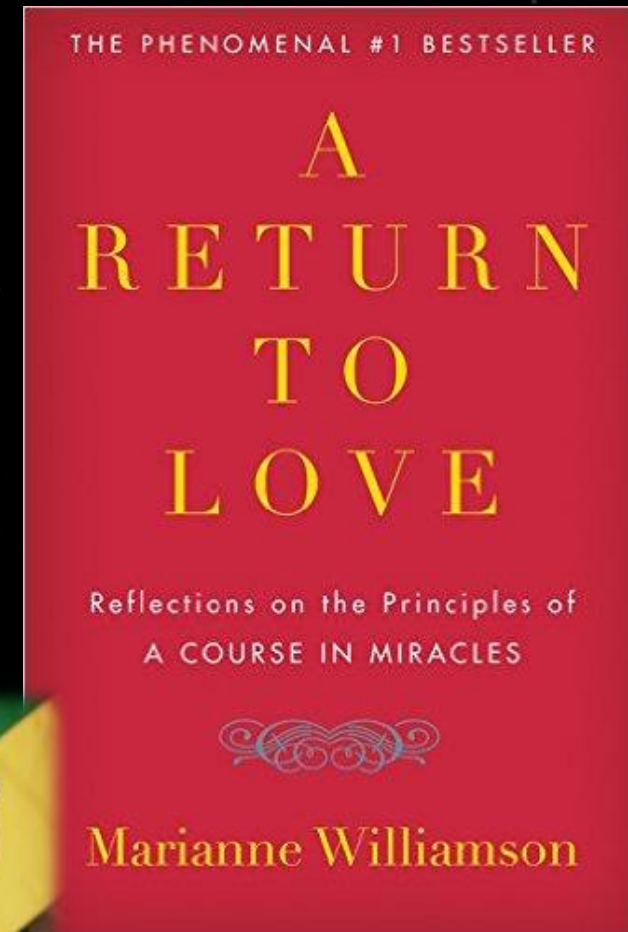


# What you don't see





- "...Our **deepest fear** is not that we are inadequate. Our deepest fear is that we are **powerful beyond measure**. It is our light, not our darkness that most frightens us. We ask ourselves, **Who am I to be brilliant, gorgeous, talented, fabulous?** Actually, who are you not to be? You are **a child of God**. Your playing small does not serve the world. There is nothing enlightened about shrinking so that other people won't feel insecure around you. **We are all meant to shine,** as children do. We were born to make manifest the glory of God that is within us. It's not just in some of us; it's in everyone. And as we let our **own light shine,** we unconsciously give other people **permission to do the same**. As we are liberated from our own fear, our presence automatically **liberates** others."





# Thank You! Any Questions?





SILICON  
VALLEY

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AMES RESEARCH CENTER