



NASA Chief Technologist Introduction

Presentation to NASA Advisory Council Technology,
Innovation, and Engineering Committee
May 16, 2023

A.C. Charania
Agency Chief Technologist (ACT)
Office of Technology, Policy, and Strategy (OTPS)
NASA





- **Background**
- **OTPS**
- **Proximate Objectives**
- **Mental Map**
- **Study Categories**
- **Team ACT**
- **Shock Thoughts**



Background

As a global innovator turning advanced concepts into reality, I have been involved in shaping the recent aerospace revolutions within small satellites, launch vehicles, hypersonics, human/robotic exploration, planetary defense, and aviation autonomy. I have direct experience in project management, technology evaluation, product conception, business development, customer engagement, proposal development, sales, marketing, international trade compliance, and government advocacy.

Prior Organizations:

- Reliable Robotics
- Blue Origin
- Virgin Galactic
- Planetary Resources
- SpaceWorks Enterprises

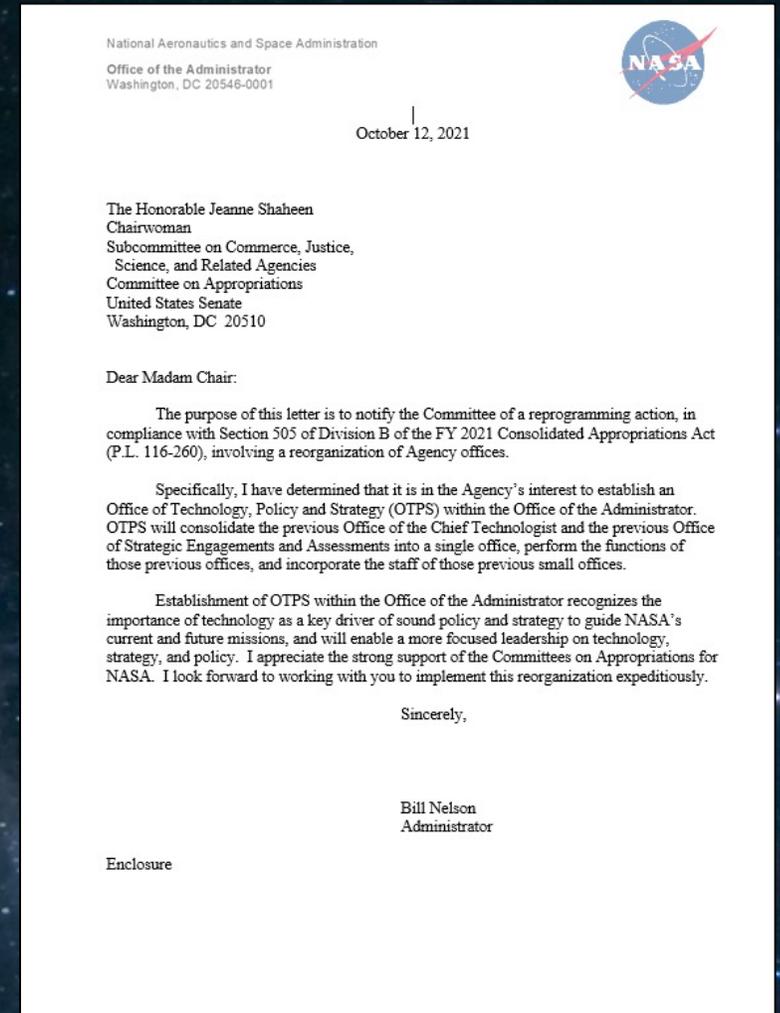




November 2021 Genesis of OTPS

In his letter to the Chair of the Congressional Committees on Appropriations requesting the creation of the office, Administrator Bill Nelson wrote that

- “Establishment of OTPS within the Office of the Administrator ...will enable a **more focused leadership** on technology, strategy, and policy.”
- OTPS will “serve as the NASA Administrator’s **advisor on strategic engagement** in key areas to align Mission and Agency-level activities, supported by assessments to inform NASA senior leadership.”
- OTPS will “continue to serve as the NASA **Administrator's principal advisor and advocate on matters concerning Agency-wide technology policy and programs**, including advocacy for NASA research and technology programs through communication and integration with technology efforts being conducted by other Federal agencies.”





OTPS Enshrined in NASA Procedural Requirements

2.1.2.6 The **Associate Administrator for Technology, Policy and Strategy** directs the Office of Technology, Policy and Strategy. This position is responsible for developing and shaping Agency policy in response to Administration direction, as well as coordinating strategy across the Agency, in support of the Administrator.

2.1.2.9 a. **Office of Technology, Policy and Strategy (OTPS)**. The OTPS provides data and evidence-driven advice to NASA leadership to assure an integrated enterprise approach to technology, policy, and strategy. The office supports and promotes the Administration's and NASA leadership's top policy agenda and priorities, providing special studies as needed. The OTPS maintains awareness of critical emerging issues, both internal and external to the Agency. The OTPS includes the position of the Chief Technologist, as a senior representative for NASA.

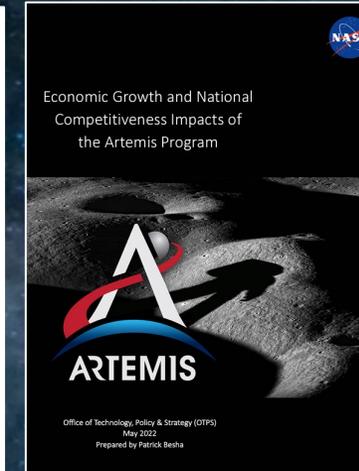
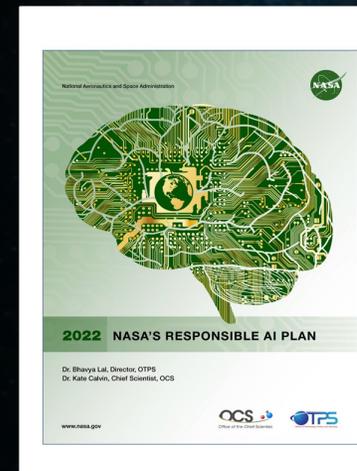
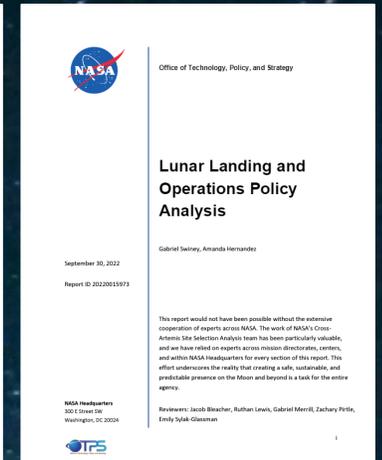
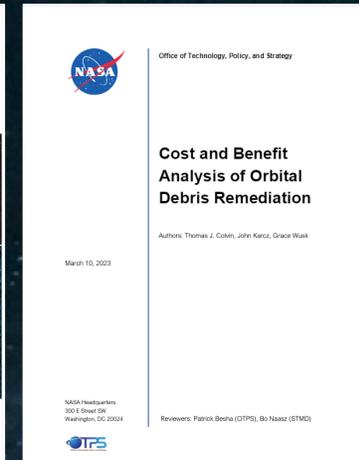
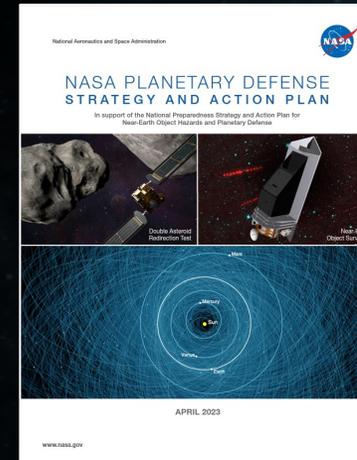
- **Develop and shape** Agency policy in response to Administration direction, as well as **coordinate strategy across the Agency**, in support of the Administrator.
- **Provide data and evidence-driven advice** to NASA leadership to assure an integrated enterprise approach to technology, policy, and strategy.
- **Support and promote** the Administration's and NASA leadership's **top policy agenda and priorities**, providing special studies as needed.
- Maintain **awareness of critical emerging issues**, both internal and external to the Agency

Source: NASA Procedural Requirements, NPD 1000.3E,
https://nodis3.gsfc.nasa.gov/displayDir.cfm?Internal_ID=N_PD_1000_003E_&page_name=Chapter2



OTPS – Recent Selected Assessments/Reports

- NASA Planetary Defense Strategy and Action Plan
- Cost and Benefit Analysis of Orbital Debris Remediation Report
- Lunar Landing and Operations Policy Analysis Report
- 2022 NASA's Responsible AI Plan
- Economic Growth and National Competitiveness Impacts of the Artemis Program





Proximate Objectives

Reference Source: Good Strategy Bad Strategy by Richard Rumelt

First Step of Strategy – Diagnosis of problem (underway)

Then approaches could include:

- Proximate Objectives: One that is close enough at hand to be feasible – Reasonably expected to hit, even overwhelm

Some examples:

- Proximate objective 1: Need better data driven decision making and communication to help optimize technology identification, evaluation, selection, maturation, and infusion
- Proximate objective 2: Do more and expand activities to get closer to North Stars



What Does AI Tell Us About This?

AC

What should NASA's Chief Technologist focus on?



As NASA's Chief Technologist, there are several areas of focus that would be important to ensure the continued success and advancement of the agency's missions:



1. **Develop and advance new technologies:** NASA's Chief Technologist should prioritize the development and advancement of new technologies that can enhance the agency's capabilities and enable new types of missions. This could include areas such as robotics, propulsion, materials science, and artificial intelligence.
2. **Foster partnerships:** The Chief Technologist should work to foster partnerships with other government agencies, private companies, and international organizations to share knowledge and expertise, leverage resources, and collaborate on innovative projects.
3. **Support the commercial space industry:** With the rise of commercial space companies, NASA's Chief Technologist should focus on supporting and promoting partnerships with these companies to develop new technologies and capabilities that can benefit both NASA and the commercial space industry.
4. **Ensure safety and reliability:** The Chief Technologist should also prioritize safety and reliability in all NASA's missions, by developing and implementing new technologies that can reduce risk and enhance safety.
5. **Encourage innovation:** Finally, the Chief Technologist should encourage innovation across the agency, by promoting a culture of creativity, experimentation, and collaboration that can lead to new breakthroughs and discoveries.

Source: ChatGPT 3.5



ACT Preliminary Mental Map

ACT North Stars

Sustainable Lunar Exploration

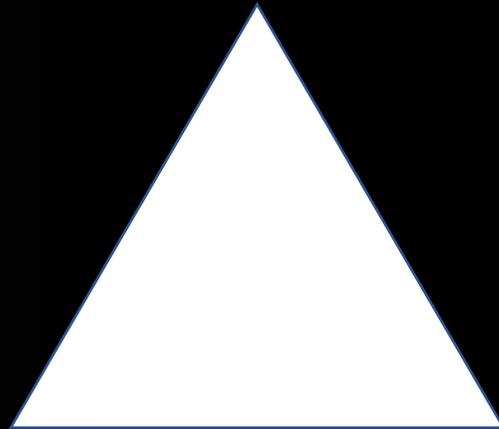
“The Search for Life” – Mars, Icy Worlds, Exoplanets

Protecting and Enhancing the Planet

- Climate
- Planetary Defense
- Aviation Enhancement

Foundational References:

- NASA Authorization Act
- NASA Strategic Plan
- Moon to Mars Objectives
- Decadal Surveys
- Climate Strategy
- Planetary Defense Strategy
- White House Strategic Documents



• Major Initiatives

- Technology Inventory and Scouting
- Short Studies
- IRAD
- Inventions and Contributions Board (ICB)

NASA Direct Funding

Commercial/Academic Collaborations

Other Government Agency (OGA) Collaborations

International Collaborations

Process Optimization

Tools





ACT Study Categories

Kardashev scale analogy

Type I “harness all the energy that reaches its home planet from its parent star”	Type II “harnessing the energy radiated by its own large star”	Type III “possession of energy at the scale of its own galaxy”
~1 week	~1-2 month	~ 6 months
<=6 page memo	<15 pages (preferably <=6 pages)	<100 pages
Mostly internal research by OTPS direct staff	Could include external inputs but mostly OTPS direct staff	Internal and external inputs (workshops, ext. consultants)
One primary author	One to two primary authors	One to several primary authors
Informational, possible options, could lead to additional and/or larger studies	Informational, options, recommendations	Larger in scope
Few framing questions	Few framing questions / light terms of reference	Full terms of reference

“Writing your argument (versus a presentation) can help force out issues more clearly, adds nuance, and optimizes your intellectual time.”

- Based upon a technique in industry – six page memo format (useful for decision memos)
- Another technique is the writing out a future press release for a successful project

Team ACT



NASA Chief Technologist Council (CTC)
Face to Face Meeting at NASA HQ - Q1 2023



Along with OTPS Staff, the NASA Center Chief Technologists (CCTs) Support the Agency Chief Technologist (ACT)

Center Chief Technologists (CCTs)



Harry Partridge
Ames Research Center (ARC)
Interest areas:

- Space Technology
- Commercial Space
- Hypersonics
- Materials Genome Initiative



David Voracek
Armstrong Flight Research Center (AFRC)
Interest areas:

- Sustainable Aviation
- AI and ML in Aviation
- Technology integration and validation



Kurt Sacksteder
Glenn Research Center (GRC)
Interest areas:

- Combustion and Fluid Physics in Reduced-Gravity Environments
- In-Situ Resource Utilization: Lunar and Mars
- Power and Propulsion Systems and links to Climate Remediation



Peter Hughes
Goddard Space Flight Center (GSFC)
Interest areas:

- Artificial Intelligence & Autonomous Systems
- Digital Engineering
- Space Communications and Navigation
- Quantum Technologies
- Emerging and Critical Technologies



Tom Cwik
Jet Propulsion Laboratory (JPL)
Interest areas:

- Computational Engineering and Design
- Leadership of Innovative Space Exploration Teams



Nicholas Skytland
Johnson Space Center (JSC)
Interest areas:

- Early stage technology opportunities and advancement and early career development
- Technology infusion and partnerships
- Open Innovation
- Digital Transformation



Kathy Loftin
Kennedy Space Center (KSC)
Interest areas:

- Specialized in Environmental and Materials Research
- Subject matter Expert on mass spectrometers and ruggedizing instrumentation for space flight



Julie Williams-Byrd
Langley Research Center (LaRC)
Interest areas:

- Photonic integrated circuits to miniaturize lidar instruments
- Trusted autonomy for aerospace applications
- Advanced materials development for lunar dust mitigation



John Dankanich
Marshall Space Flight Center (MSFC)
Interest areas:

- Propulsion Technology Development and Testing
- Mission Design and Trajectory Optimization



Anne Peek
Stennis Space Center (SSC)
Interest areas:

- Propulsion Technology Development and Testing
- Mission Design and Trajectory Optimization

Deputy Center Chief Technologists



Jill Bauman
Ames Research Center (ARC)
Interest areas:

- NASA's early-stage concept investment (process and impact)
- Earth Science instrumentation



Bhanu Sood
Goddard Space Flight Center (GSFC)
Interest areas:

- Cradle-to-cradle digital engineering
- xR, digital twins and MBx (Model Based engineering approaches)
- Microelectronics engineering policy



Charles D. Norton
Jet Propulsion Laboratory (JPL)
Interest areas:

- Small Satellite Science and Technology Validation Missions
- High Performance Computing for Earth and Space Science Modeling
- Advanced Information Systems Technologies



Ronnie Clayton
Johnson Space Center (JSC)
Interest areas:

- Early stage technology opportunities and advancement and early career development
- Technology infusion and partnerships
- Open Innovation
- Digital Transformation



Kelvin Ruiz
Kennedy Space Center (KSC)
Interest areas:

- Embedded electronics, avionics, and software
- In-Situ Resource Utilization (ISRU) technologies
- SmallSats/CubeSats
- Technology Development Solicitations and Partnerships



Phillip A. Williams
Langley Research Center (LaRC)
Interest areas:

- Physics; structures and materials; nanotech
- Microscopy and molecular spectroscopy; NDE
- Space mission & systems analysis; technology and capability assessment and integration; in-space assembly



John Carr
Marshall Space Flight Center (MSFC)
Interest areas:

- Gossamer technologies including solar sail, thin-film solar arrays, etc.
- Printed electronics
- Power Systems





Interesting Thoughts

Stay tuned for more updates from the NASA ACT

- Technology inventory and scouting
- NASA IRAD
- Sustainable lunar exploration acceleration
- Commercial/OGA/international
- Quantum
- Autonomy/AI
- Wildfire tech
- Planetary defense
- Process optimization