



RADIOISOTOPE POWER SYSTEMS PROGRAM

2026 Nuclear and Emerging Technologies for Space (NETS): NASA's RPS Program Status and Future Outlook

April 29, 2026

Carl E. Sandifer II¹, David Frate¹, Lauren Clayman¹, Emily Hsu², Allen Guzik¹, Kristin Jansen¹,
Leah Sopko¹, Colleen Van Lear¹, Christofer Whiting¹, Ryan Edwards¹, and Margaret Simon³

¹NASA Glenn Research Center, ²Department of Energy, ³The Aerospace Corporation

Power to...



EXPLORE



DISCOVER



UNDERSTAND

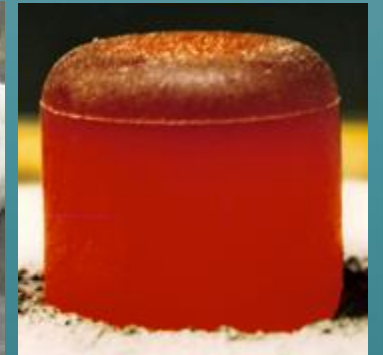
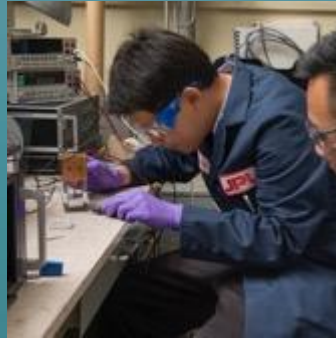
RPS Program Elements

- Deliver reliable radioisotope power systems to enable science and exploration missions resulting in the following tangible outcomes over time

- ✓ Flights of RPS powered science missions



- ✓ Sustaining RPS capabilities for future missions (talent, infrastructure, and production)



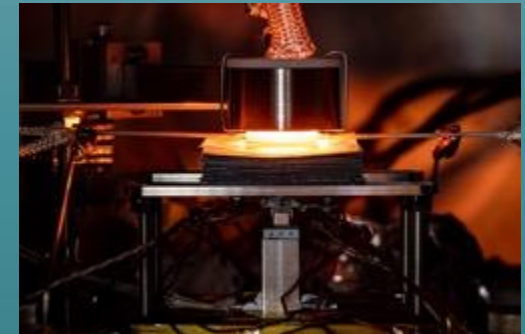
- ✓ Efficient and cost effective NEPA and launch authorization



- ✓ Develop a new vacuum rated RPS for future missions



- ✓ Develop technologies for future flight systems



HQ Program Commitment Agreement (PCA) update includes focus on commercial and international RPS development opportunities



Embeds / POCs

Chief Engineer:
Carmel Conaty

Safety & Mission Assurance:
Maggie Jones

General Counsel:
Michael Anderson

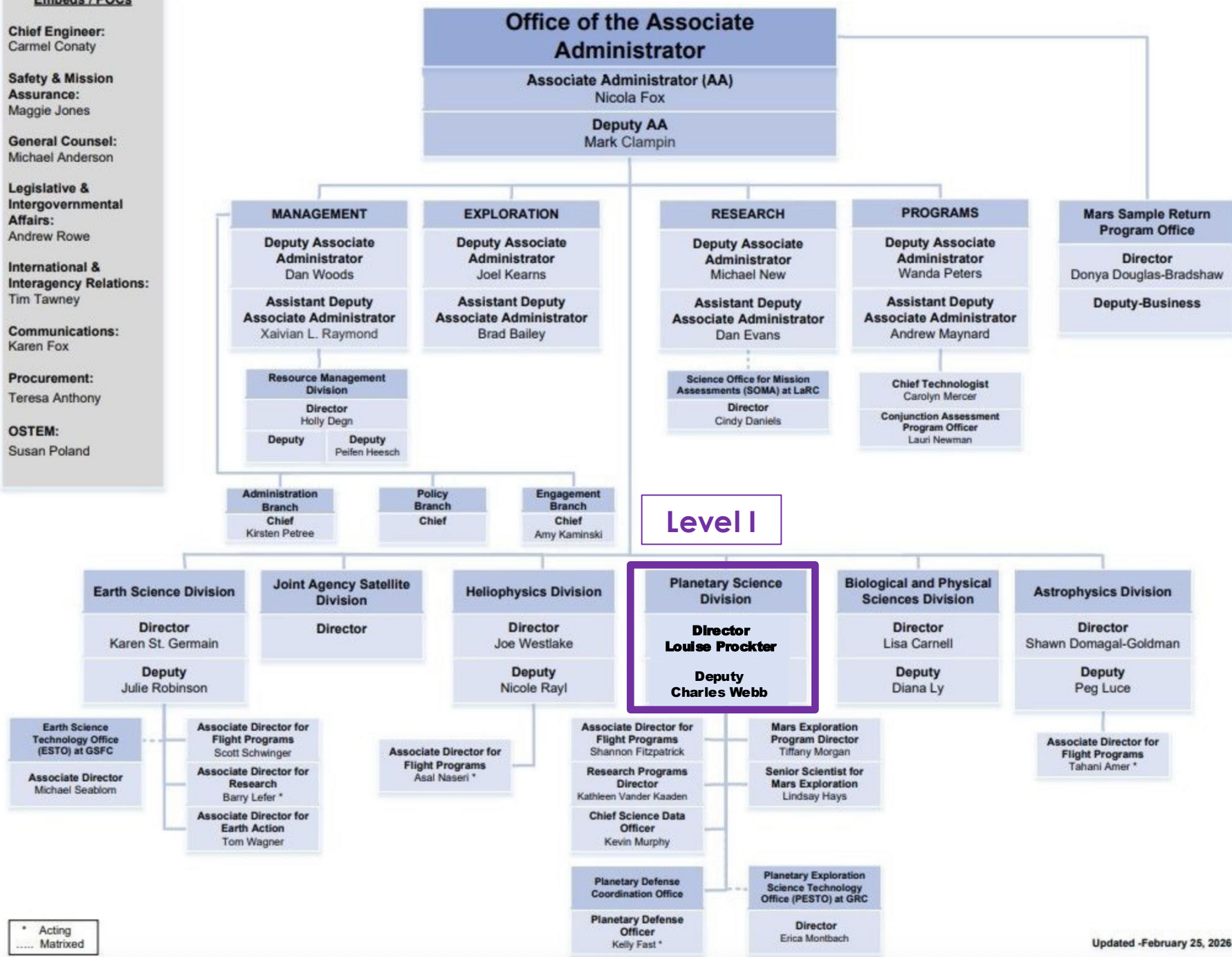
Legislative & Intergovernmental Affairs:
Andrew Rowe

International & Interagency Relations:
Tim Tawney

Communications:
Karen Fox

Procurement:
Teresa Anthony

OSTEM:
Susan Poland



* Acting
..... Matrixed



RPS Program Functionality



Department of Energy (DOE)

Constant Rate
Production and
Mission Support

Radioisotope Power Systems Program Office

Program Manager (PM)
Deputy Program Manager (DPM)
Chief Engineer (CE)
Chief Safety Officer (CSO)
Configuration and Data Management (CM/DM)
Administrative Assistant

Center POCs

- Applied Physics Lab (APL)
- NASA GRC
- NASA JPL

Program Integration

- Scheduling
- Risk Management
- Acquisitions and Contract Management
- Budget Analysis/Planning/Forecasting
- Export Control

Systems Engineering & Integration

- SE&I Technical Mgmt.
- Requirements & Studies
- Surrogate Mission Team
- Tech Assessment
- V&V and Product Transition to Mission Integration

Stakeholder Engagement

- Strategic Comm
- Public Engagement
- STEM
- Website
- Messaging/Branding/Marketing
- Nuclear Community Coordination

NEPA & Launch Authorization

- NEPA Coordination
- Launch Authorization
- Multi-Mission Databooks (MMDB)
- Radiological Contingency Planning Coord
- Policy Support

Mission Integration

- RPS/RHU Missions (Dragonfly, RFM)
- AO Formulation and Support
- RPS Builds (MMRTG, F-5R), Users Guides
- Decadal Support
- Modeling and Testing

Technology Development & Commercialization

- Commercial, International & Gov't RPS Assessment
- Technology Maturation
- Commercial RPS Launch Auth. Liaison

NG RTG Mod 1 Project

HEPGT

Level II

Program Office Resides at NASA GRC

Level III



Technology Investments Enable New Radioisotope Generators

Radioisotope Power System
Heat Source



LRHU

Light Weight Radioisotope
Heater Units

$\sim 1W_{th}$

Multi-Mission Radioisotope Power System



MMRTG

Multi-Mission Radioisotope
Thermoelectric Generator

$\sim 110W_e$

Vacuum-Rated Radioisotope
Power System



Next Gen RTG

Next Generation
Radioisotope
Thermoelectric Generator

$\sim 252W_e$

Current Flight Systems

RPS Program Highlights and Accomplishments

- F-5R GPHS-RTG
 - Successfully completed the unfueled F5 GPHS-RTG Refurbishment at INL
 - Electrically-heated thermal Vacuum testing completed
 - Measured power of $260W_e$ at $4100 W_{th}$
 - F-5R Users Guide completed



INL Team with Refurbished F5 GPHS-RTG

NASA Current and Future RPS Missions: The Power to Explore

• Perseverance

- Launched in July 2020
- Seeking signs of ancient life and collecting rock and soil sample
- Provided an MMRTG under budget, ahead of schedule, above power, during the COVID-19 pandemic



Active RPS Missions

Mission	Launch Date	Type of RPS	Quantity	Current Avg Power (W _e)	Power Reading Date
*Perseverance	7/30/2020	MMRTG	1	95.9	9/2025
*Curiosity	11/26/2011	MMRTG	1	73.5	9/2025
New Horizons	1/19/2006	GPHS RTG	1	168.68	8/2025
Voyager 1	9/5/1977	MHW RTG	3	215	4/2026
*Voyager 2	8/20/1977	MHW RTG	3	234.6	9/2021

* Still working to get data due to JPL staffing impacts

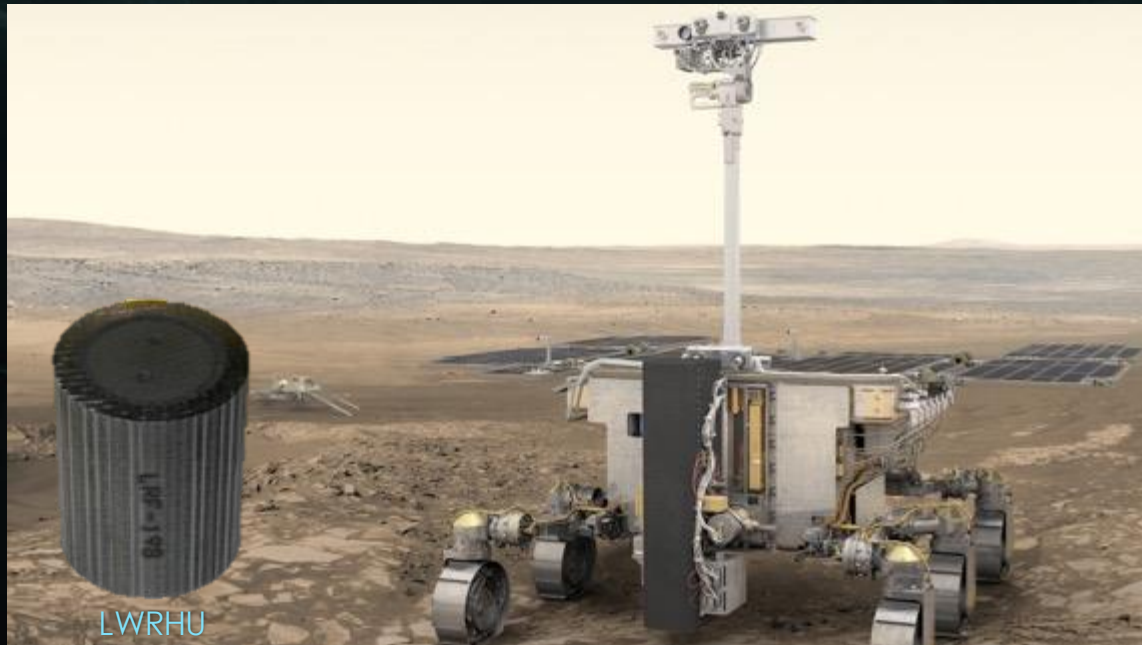
• Dragonfly

- Flights to explore Saturn's moon Titan, an organic-rich ocean world
- Planned launch in July 2028
- A Multi-Mission Radioisotope Thermoelectric Generator (MMRTG) and LWRHUs will enable Dragonfly to explore beneath the thick, hazy atmosphere of Titan



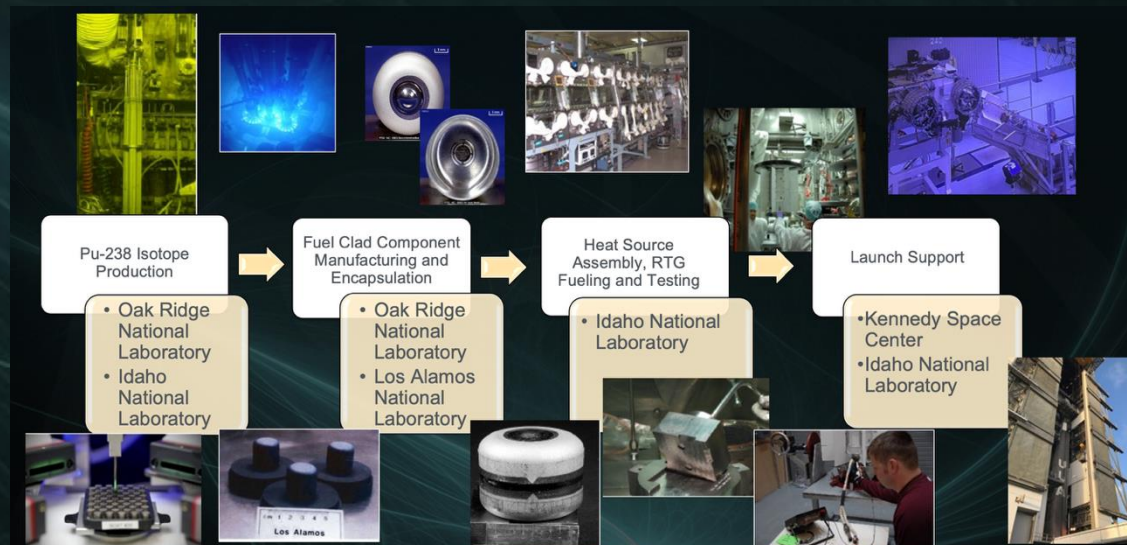
NASA Future RPS Missions: The Power to Explore

- NASA Rosalind Franklin Project
 - ESA Mars robotic rover mission with NASA contributions
 - Up to 24 LWRHUs, planning one Am-241 RHU from UK
- Potential New Frontiers Mission
 - AO release no earlier than 2026



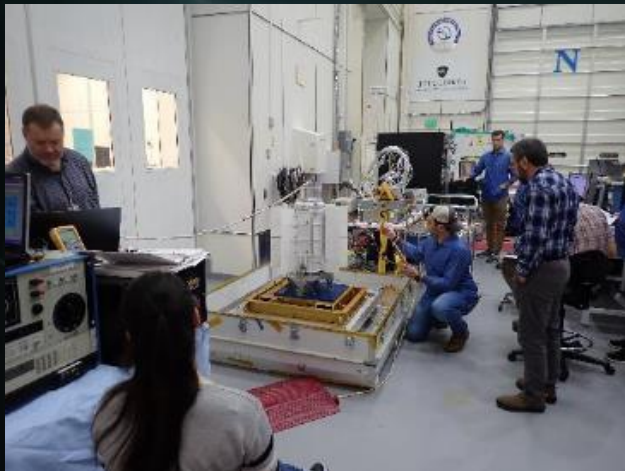
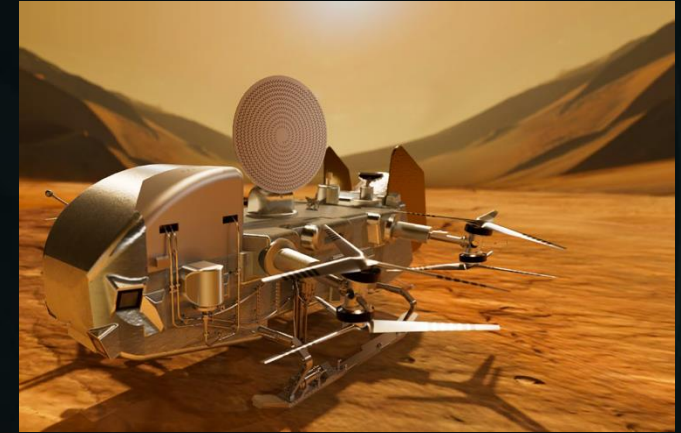
RPS Program Highlights and Accomplishments - DOE

- DOE Constant Rate Production (CRP) – **Demonstrated Capability to produce 1.5 kg/yr on average**
- Continuing efforts to:
 - Scale up production
 - Optimize processes
 - Maintain, modernize, and replace equipment and infrastructure throughout the DOE laboratories.
- DOE reconstituted ~ 1 W_{th} LWRHU production capability

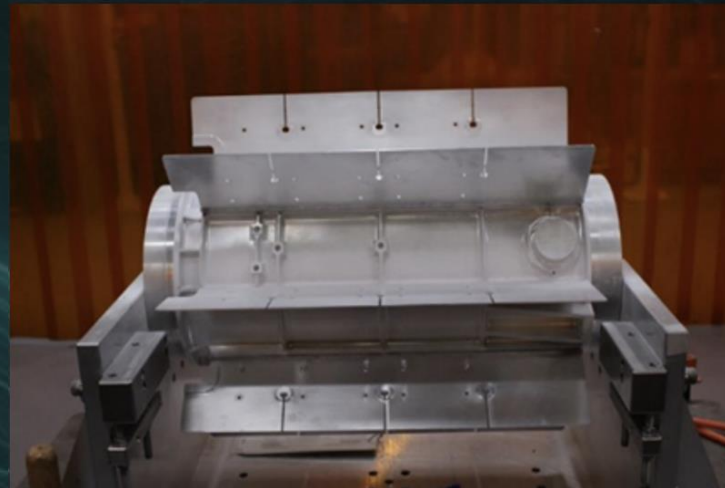


RPS Program Highlights and Accomplishments - Missions

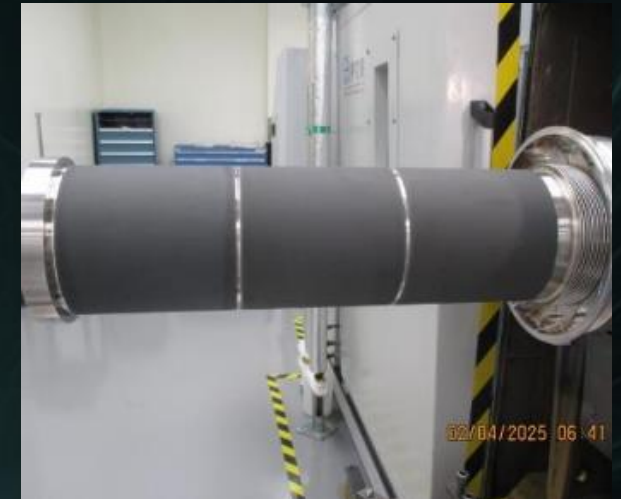
- Dragonfly
 - Successful Lander and Mission CDR
 - MMRTG ICD and LWRHU ICD signed
 - Nuclear Launch Authorization Plan (NLAP) approved



INL-APL team performing heated QU testing with prototypic Dragonfly critical bus power electronics



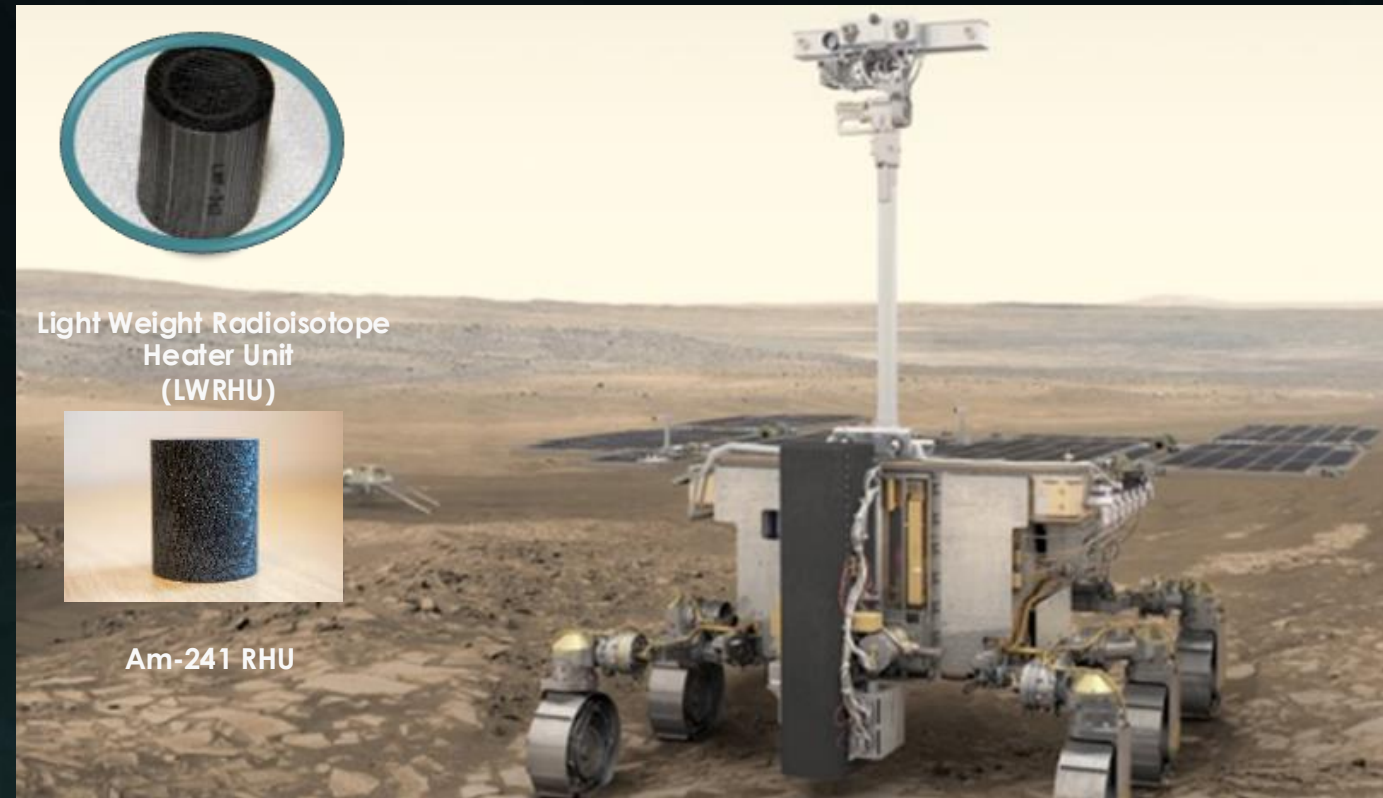
Dragonfly DSM fins welded



F4 liner assembly

RPS Program Highlights and Accomplishments - Missions

- Rosalind Franklin Mission and ROSA Project
 - Successful PDR and DPMC for KDP-C/D
 - DOE ready to produce LWRHUs in FY27
 - Nuclear Launch Authorization Plan (NLAP) approved
 - **Launch Vehicle selection**
 - **SpaceX Falcon Heavy**
 - NEPA compliance documentation being finalized by Environmental Management Division



RPS Program Highlights and Accomplishments

- NEPA and Launch Authorization Management (NLAM)
 - Leading inter and intra-Agency meetings for Radiological Contingency Planning (RCP)
 - LOX/LCH₄ testing
 - Propellant Reaction Characterization (PRC) Testing Campaign Complete
 - Consisted of 24 successful tests
 - Cryogenic Mixing Testing Complete
 - Methane Oxygen Vertical Impact (MOVI) Testing
 - Collaborating with United States Space Force (USSF) and NASA Space Operations Mission Directorate (SOMD)
 - Will generate necessary data needed to properly assess the use of the new generation of launch vehicles in support of RPS missions that utilize LOX/LCH₄ propellant.



LOX/Methane PRC Test

RPS Program Highlights and Accomplishments

• Next Gen Project

- Passed L3Harris/Aerojet system CDR successfully
- SiGe Unicouple Production
 - All uncouple production steps are beyond development and at Initial Production Readiness (IPR) or better

• High Efficiency Power Generator Technology (HEPGT)

- Developed Pu-238 and Am-241 testbeds
- GRC and University of Leicester collaborated to integrate/test Stirling technology with UofL's Am-241 electrical heat source
- Team contributed the data to support the (SRSC) Technology Readiness Assessment



Process	Q4 2025 Status	Q1 2026 Status
Powder Blending	ProdR	ProdR
Hot Pressing	Exited ProcR	ProdR
N-P Bonding	ProcR	Exited ProcR
Ni Plating	ProdR	ProdR
Rad Attachment	ProdR	ProdR
Cold Stack Assembly	ProcR	ProcR
Pellets	ProdR	ProdR
Segments	ProcR	ProcR
Hot Shoes	ProcR	Exited ProcR
1st Bond	ProcR	ProcR
LPCVD	ProcR	ProcR
2nd Bond	IPR	Exited IPR
Couple Pre-Assembly	IPR	Exited IPR
Couple Assembly	Pathfinder	Exited IPR
Stuffing	IPR	IPR
Wrapping	Pathfinder	IPR

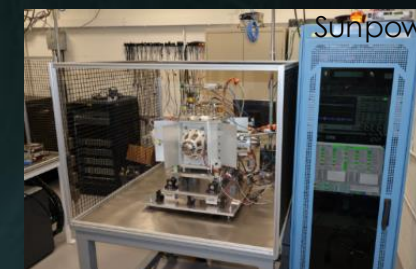
Color Key	Fidelity / Order
Pathfinder	1
IPR	2
ProcR	3
ProdR	4

✓ Maturation changed since last Quarterly

*Note: If a process is noted as exited it means the exit review was successful conducted, but parts are still being made to meet down stream needs



New Material SiGe Unicouples Produced at TESI



Stirling Generator Testbed

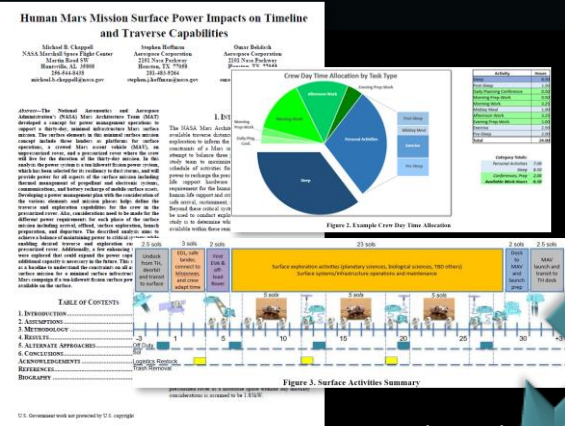


Sunpower Robust Stirling Converter

RPS Can Support Human Spaceflight Missions

MMRTG

Roughly to-scale

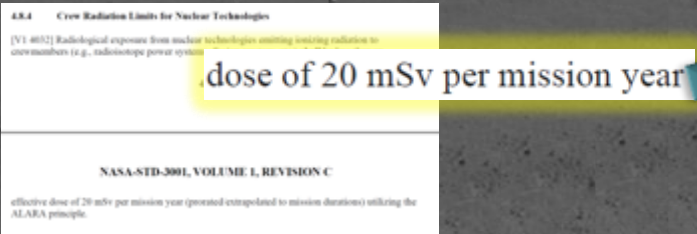


Reference Mars Architecture Team (MAT) Ops:
23-day Mars surf mission: 15 EVA days & 6.5 work-hr/day

Strawman case for illustration/discussion

Activity	Activity Time-Split	Distance from MMRTG Endcap	Mission Total NO SHIELDING
Driving the Rover	25%	0.5 m	13.5 mSv
Working Close to Rover	25%	2 m	1 mSv
Working Far from Rover	50%	5 m	0.5 mSv
TOTAL			15 mSv

NASA-STD-3001 on RPS Radiation limit for crew:



Prospect is high for meeting RPS radiation

Enhanced Focus on Commercialization and Alternative Isotopes

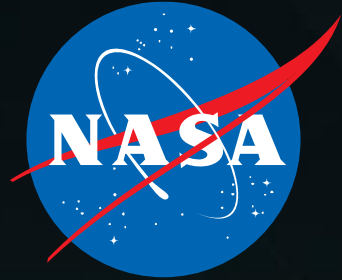
- NASA is interested in high-efficiency RPS in addition to utilizing existing thermoelectrics capabilities to enable a variety of radioisotope power systems
 - Supports an assortment of future missions and applications
- Widespread technology investments in conversion efficiency have enhanced the viability of alternative isotopes
- In addition to plutonium-238, research and development in alternative fuels are underway globally across the industry

HQ Program Commitment Agreement (PCA) update incorporates commercial RPS development opportunities

RPS Program: Stakeholder Engagement

- RPS Program Power to Explore Student Challenge continues
 - Next year's Power to Explore Challenge effort will incorporate RPS and fission content.





NASA



NASA



@NASA



NASA

POWER TO EXPLORE



<https://rps.nasa.gov>
nasa-rps@mail.nasa.gov