Space Technology Industry-Government-University Roundtable

Dr. Kristi A. Morgansen
Professor and Department Chair
Boeing-Egtvedt Chair for Excellence in Engineering

Perspective

Expertise:

Nonlinear control and sensing and GNC in engineered and biological systems: underwater, air, space

Chair, William E. Boeing Department of Aeronautics & Astronautics (2018 – present)

Chair, Aerospace Department Chairs Association (2023 – present)

AIAA Committee on Higher Education (2018 – present)

Director, Washington NASA Space Grant Consortium (2021– present)

PI, BioS-ENDURES, Space Biology Consortium (2024 – 2029)

I am a strong advocate of data-based decision making with intentional engagement of all relevant parties.

Prioritization Process

1. How effective was NASA STMD’s outreach soliciting input for the technology ranking process? Were any key groups missed?
2. Was the input requested by NASA STMD clear? Yes
3. Was the process of providing the input straightforward or difficult?   Straightforward
4. How often should this technology ranking process be repeated (annually? Every other year? Every 5 years? Other?)
5. What feedback do you have on STMD's overall strategic planning process? Is it addressing NASA's space technology needs with the correct emphasis and priority? What gaps would you suggest addressing differently?

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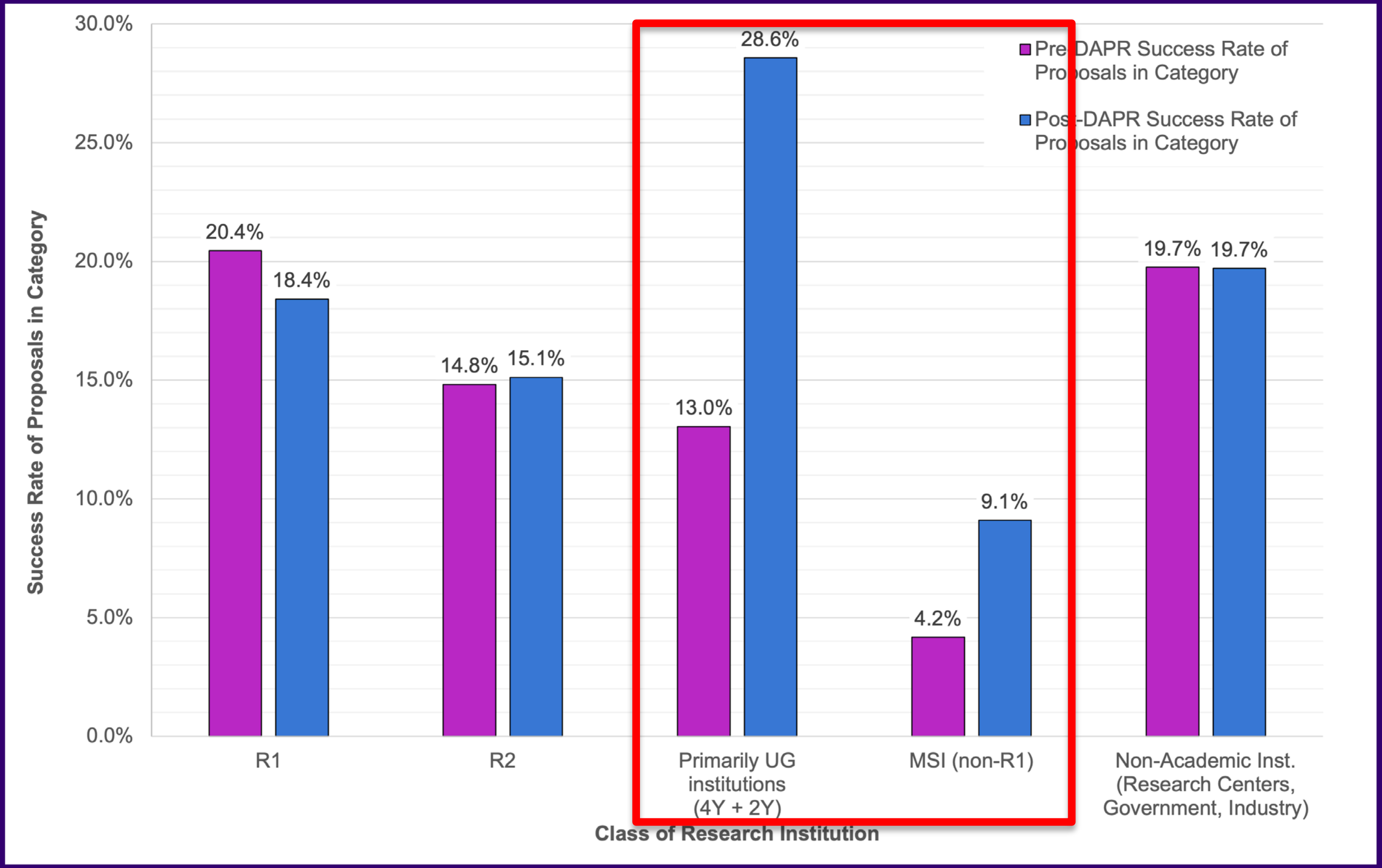
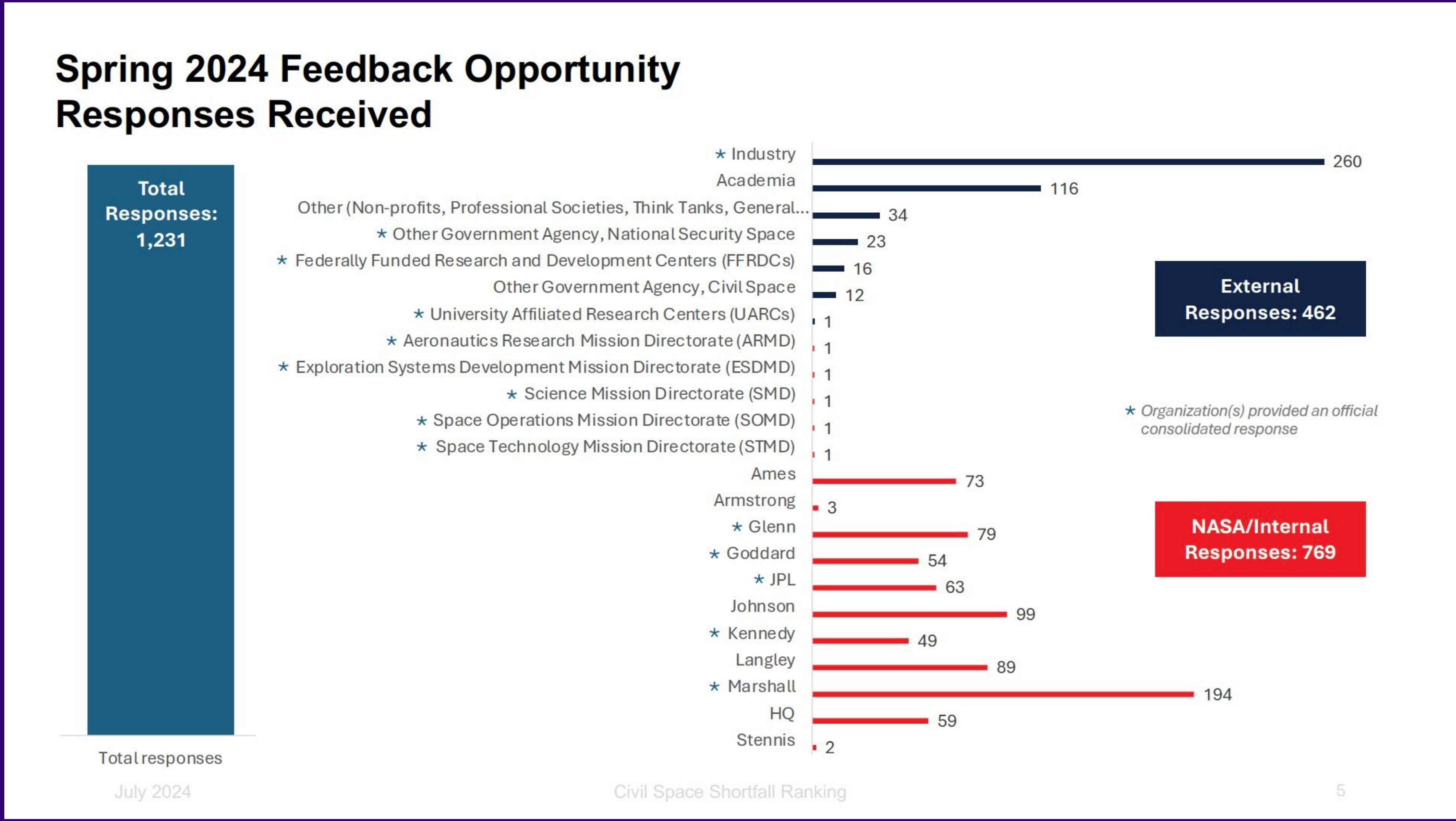
Intentional Engagement



Impact of DAPR in SMD programs – Institutional success rates of astrophysics proposals
Space Biology Program – Program Element E.11 Town Hall

Statistical Significance of Data



Statistical Significance of Data

- NASA overall: 18,000+, 11,000+ contractors
  - Johnson Space Center: 3,200 civil servants
  - JPL: 6,300 employees
- Washington State
  - Space cluster: 100+ companies
  - Aerospace-related: 1,500 companies
- Academia
  - Engineering faculty (tenured/tenure track all fields): ~31,000
  - Aerospace faculty (not joint depts): ~800
  - University of Washington engineering faculty (all fields): 289
  - University of Washington space-relevant faculty (all fields): ~250

Integrated Top 30 Shortfalls Compared to Stakeholder Group Rank

Higher Ranking Shortfalls	>	Lower Ranking Shortfalls				
1	30	60	90	120	150	180

Not Ranked (NR)

Integrated Rank	Shortfall ID	Category	Stakeholder Group Rank								
			Academia	Small Industry	Large Industry	OGA	Other	NASA Centers	ESDMD	SMD	Other MDs
1	1618: Survive and operate through the lunar night	Thermal Management Systems	4	2	2	2	9	6	4	9	1
2	1596: High Power Energy Generation on Moon and Mars Surfaces	Power	13	1	1	40	20	4	21	NR	16
3	1554: High Performance Onboard Computing to Enable Increasingly Complex Operations	Avionics	80	28	21	27	13	3	34	1	56
4	1557: Position, Navigation, and Timing (PNT) for In-Orbit and Surface Applications	Communication and Navigation	9	11	15	29	67	10	28	NR	3
5	1545: Robotic Actuation, Subsystem Components, and System Architectures for Long-Duration and Extreme Environment Operation	Autonomous Systems and Robotics	34	27	28	63	10	40	13	9	49
6	1552: Extreme Environment Avionics	Avionics	**176**	49	6	38	23	54	6	9	62
7	1519: Environmental Monitoring for Habitation	Advanced Habitation Systems	20	**101**	72	75	61	49	17	19	13
8	709: Nuclear Electric Propulsion for Human Exploration	Propulsion: Nuclear	43	**131**	23	4	52	32	7	NR	7
9	1304: Robust, High-Progress-Rate, and Long-Distance Autonomous Surface Mobility	Autonomous Systems & Robotics	27	42	30	**121**	**91**	34	25	25	66
10	1520: Fire Safety for Habitation	Advanced Habitation Systems	23	24	78	12	12	12	29	55	14
11	1531: Autonomous Guidance and Navigation for Deep Space Missions	Autonomous Systems & Robotics	47	67	24	3	89	42	64	23	15
12	1591: Power Management Systems for Long Duration Lunar and Martian Missions	Power	40	12	10	52	24	68	35	NR	27
13	702: Nuclear Thermal Propulsion for Human Exploration	Propulsion: Nuclear	36	**114**	36	14	78	62	7	NR	11
14	1559: Deep Space Autonomous Navigation	Communication and Navigation	62	**129**	27	5	**120**	38	64	23	10
15	1527: Radiation Countermeasures (Crew and Habitat)	Advanced Habitation Systems	5	23	22	6	2	5	63	NR	6
16	1526: Radiation Monitoring and Modeling (Crew and Habitat)	Advanced Habitation Systems	6	53	41	81	1	13	27	38	35
17	879: In-space and On-surface, Long-duration Storage of Cryogenic Propellant	Cryogenic Fluid Management	21	37	3	**95**	22	1	59	NR	2
18	1548: Sensing for Autonomous Robotic Operations in Challenging Environmental Conditions	Autonomous Systems & Robotics	42	17	26	**90**	16	44	14	26	57
19	1558: High-Rate Communications Across The Lunar Surface	Communication and Navigation	25	73	29	77	**162**	20	5	NR	51
20	1626: Advanced Sensor Components: Imaging	Sensors and Instruments	18	75	12	45	**160**	22	NR	18	68
21	792: In-space and On-surface Transfer of Cryogenic Fluids	Cryogenic Fluid Management	17	29	4	51	26	2	62	NR	29
22	1569: High-Mass Mars Entry and Descent Systems	Entry Descent and Landing	**152**	**156**	48	**117**	5	33	16	NR	12
23	1525: Food and Nutrition for Mars and Sustained Lunar	Advanced Habitation Systems	8	32	**116**	41	45	30	11	NR	58
24	1571: Navigation Sensors for Precision Landing	Entry Descent and Landing	14	62	37	23	4	31	45	28	9
25	1573: Terrain Mapping Capabilities for Precision Landing and Hazard Avoidance	Entry Descent and Landing	30	31	9	12	8	11	45	28	53
26	1562: Advanced Algorithms and Computing for Precision Landing	Entry Descent and Landing	54	65	45	23	3	25	45	28	8
27	1597: Power for Non-Solar-Illuminated Small Systems	Power	85	26	5	39	**125**	47	**93**	12	20
28	1568: Entry Modeling and Simulation for EDL Missions	Entry Descent and Landing	**101**	**115**	76	60	15	50	45	5	45
29	1516: Water and Dormancy Management for Habitation	Advanced Habitation Systems	49	**98**	**127**	**158**	53	69	26	51	22
30	1524: Crew Medical Care for Mars and Sustained Lunar	Advanced Habitation Systems	12	64	**94**	1	11	21	58	NR	17

ESDMD and SMD provided ranked lists (numbers shown above) in addition to shortfall scores (used for integrated list).
ESDMD and SMD did not score all shortfalls. Unscored shortfalls were also not ranked.

Statistical Significance of Data

Recommendations

- Define levels of engagement to provide sufficient data in each category
- Pull feedback continually to achieve appropriate response levels
    - Engage communities
        - April-May in academia is a difficult time to obtain feedback
        - Small companies are bandwidth limited all the time

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Strategic Planning Process

Overall, the process is an excellent start.

Addressing a number of the identified shortfall areas require significant changes in educational capabilities for maximum impact

- Aerospace data science
- Nuclear engineering

Recommendations

– Plan for coordination with OSTEM and academia to build educational capacity. Expect at least 5 years lag from time of request.

Prioritization Results

1. Is there good alignment between the resulting technology ranking and NASA's near and long-term objectives?
2. Are the relative ranking of the technologies appropriate or would you suggest changing the rankings?
3. Given NASA's objectives, are there technologies that are missing from the rankings?

Given the above comments on statistical significance and data sources, my assessment is that the results cannot be viewed as conclusive in any way in terms of feedback external to NASA.