An Overview of Commercial Space Transportation Research

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Presentation to the RE&D Advisory Committee –
NAS Operations Subcommittee
5 September 2018

Federal Aviation Administration

AGENDA

1. AST R&D Overview & Philosophy
2. Overview of Four Research Areas
3. Research Area 1 Programs, Goals, and Tasks
4. AST R&D Long-Term Road Map
5. Summary & Questions

EXECUTIVE SUMMARY

Executive Summary: The rapidly accelerating commercial space industry has brought about the need to build a more agile and responsive R&D profile.

Background:

- Since summer 2017, the National Space Council issued three key policy directives (PD-1, 2, 3).
- Formation of AST Directorate of Advance Programs and Innovation to address upcoming R&D needs.

Recent Activities/Milestones:

- AST conducted a review of key Space Council, DOT, & FAA priorities
- 2019 R&D activities are anchored around these priorities

Way Forward: Research Area 1 (RA1) continues to support FAA responsibilities for NAS integration as the space and air domains converge.

AST R&D PORTFOLIO OVERVIEW

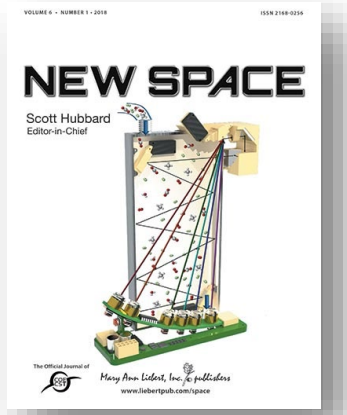
Leading-edge research and development (R&D), delivering innovation for safe and efficient integration of commercial space transportation into the National Airspace System (NAS)

Why is this <u>important to the Nation</u>?

- Advances safety and efficiency of the NAS
- Development of new, highly experimental technologies
- Low investment, high-payoff research prevents overly conservative regulatory regimes
- Understanding of complex commercial space sector and its role in advancing the U.S. economy, global competitiveness

<u>Agile research priorities</u> designed to meet National Space Council/DOT objectives, maximize operational impact

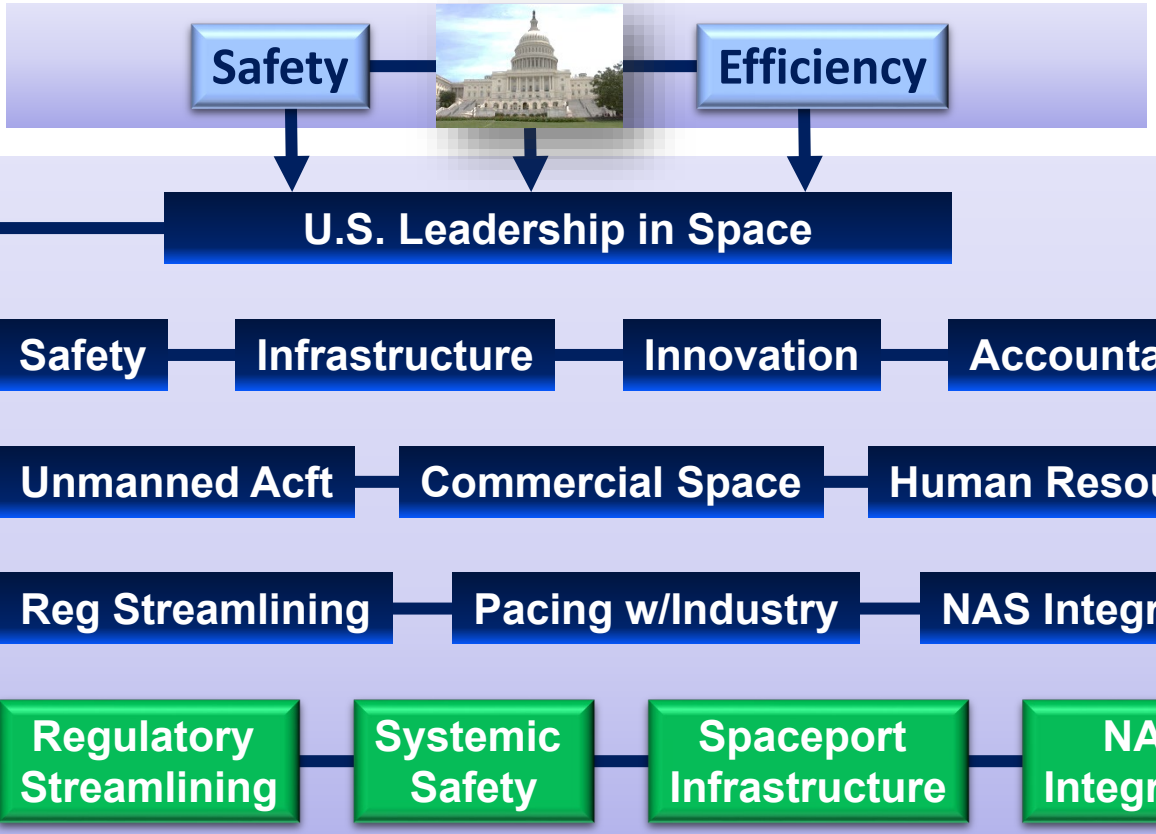
- Regulatory Streamlining (21st Century Licensing)
- Deployment of Innovation: safe integration of CST into NAS
- Spaceport Infrastructure Research: airspace integration, operations, safety of population centers
- Systemic Safety: e.g. risk-informed approach to human safety



Nationally recognized journal featured articles from academia, contributions from Elon Musk

Workshops garner feedback from academia/industry

R&D PHILOSOPHY "STRATEGY TO RESEARCH"



R&D Priorities/Investments Drive Project Alignment with Space Council, DOT/FAA Strategy

TWO KEY R&D PILLARS: ACADEMIA & "ORGANIC" INNOVATION

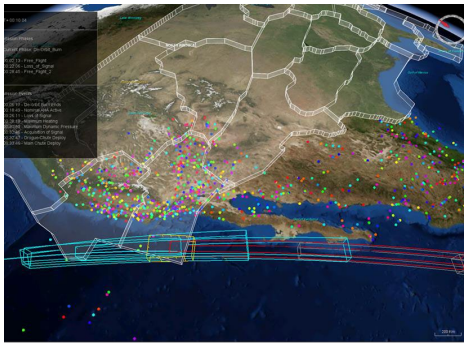
Pillar 1: University Research (COE CST)

- Vital link to cutting-edge research in academia
- Leverages funding from academia and industry for broad engagement of innovation; participants match gov't funding
- **Expansive:** Achieved 41 industry/academic partners in 2017
- **Cost efficient:** Achieved greater than 2/1 fund matching from academia in 2017 to stretch value for taxpayers
- New Space Journal 6.1 featured COE university research, Elon Musk recent article contributor

Research Recognized with DOT Level Awards

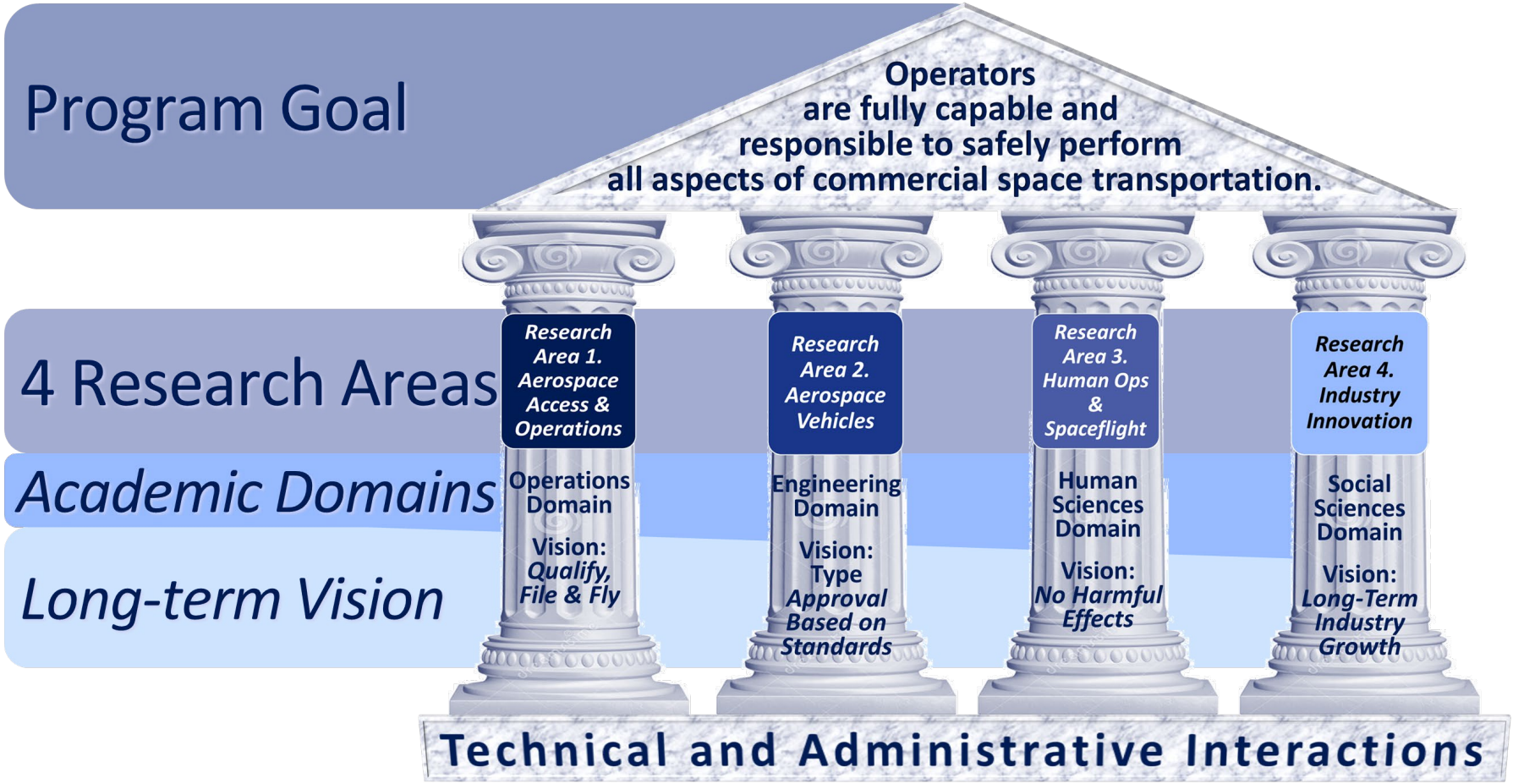
Pillar 2: Contractor/Internal R&D Innovations

- Designed to respond to rapidly developing operational needs
- Emerges from research, industry feedback, or internal reviews
- Ideas can emanate from any stakeholder, including internal AST representatives, other FAA lines of business, or other agencies

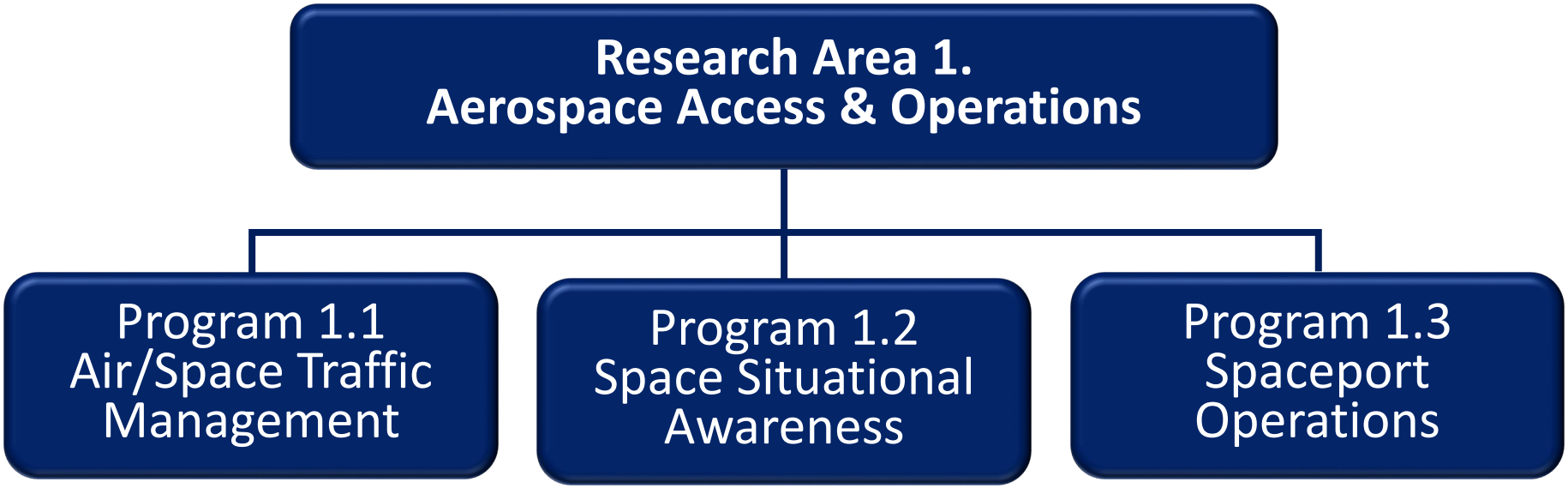


Spaceport Assessment Tool (Organic AST R&D Investment)

AST 2019 R&D PORTFOLIO OVERVIEW

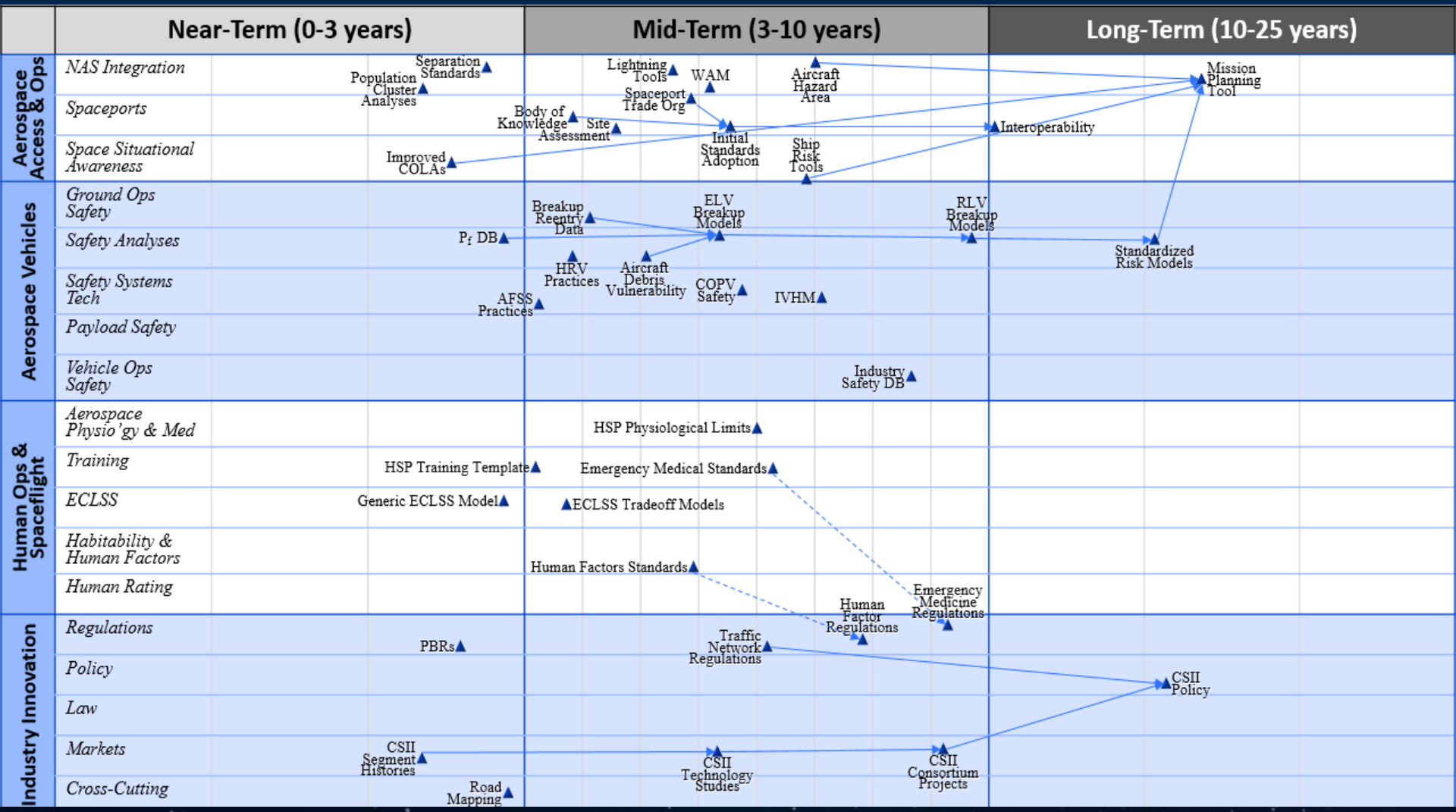


RESEARCH AREA 1 PROGRAMS AND GOALS



- Safe integration of air & space traffic management.
- Improved analytical and computational methods to evaluate safety of uninvolved public and property.
- Improved spaceport interoperability and development of necessary spaceport industry infrastructure resources.

Commercial Space Research Roadmap (Draft)



SUMMARY

- AST commercial space R&D Program is responsive to NSC, DOT, FAA priorities
- University and “organic” research activities are pursued, individually and in combination, as needed to achieve goals
- Four research areas (knowledge domains) can be combined as needed to encompass all research priorities
- All AST research funded in CY2018 (to date) is NAS-Ops-related research

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QUESTIONS?

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AST Commercial Space Transportation

Backup Slides

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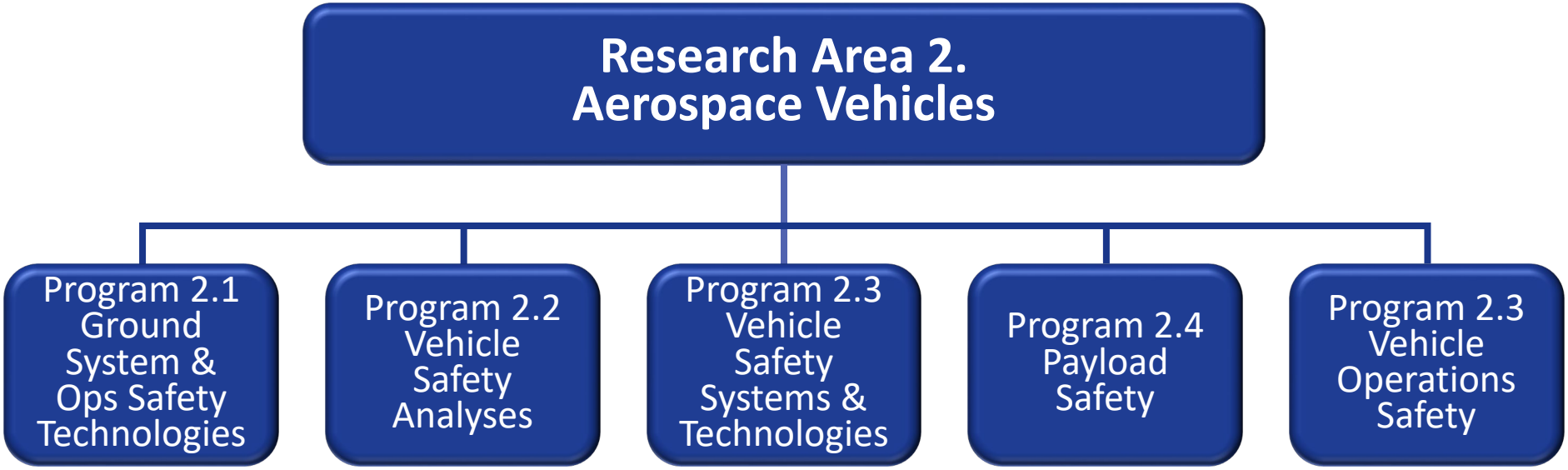
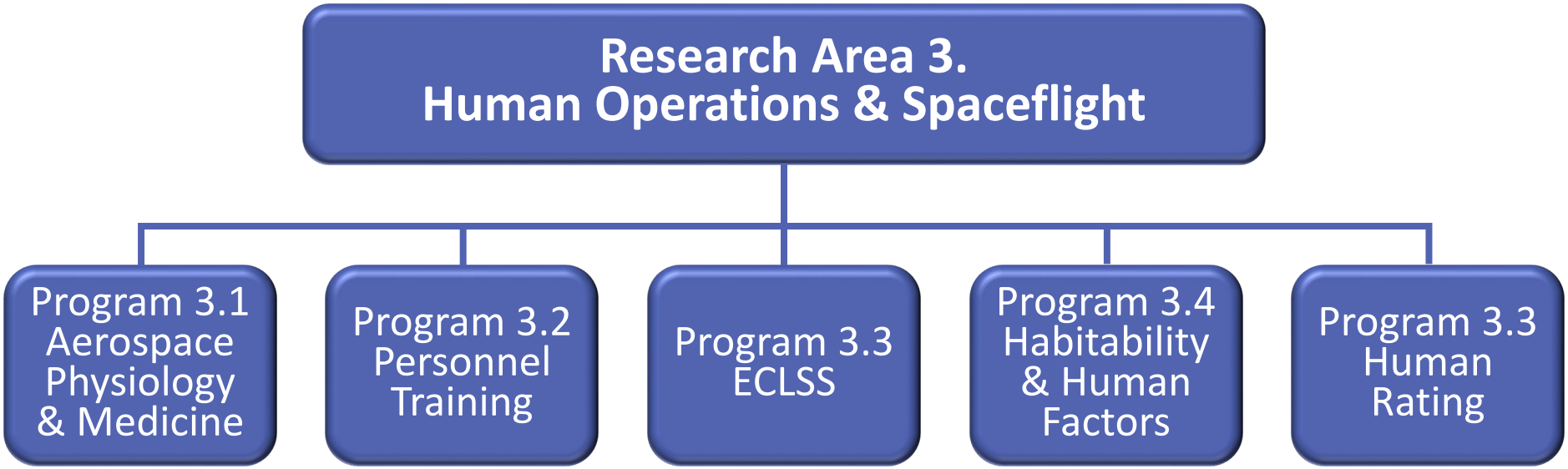
RESEARCH AREA 2 PROGRAMS AND GOALS



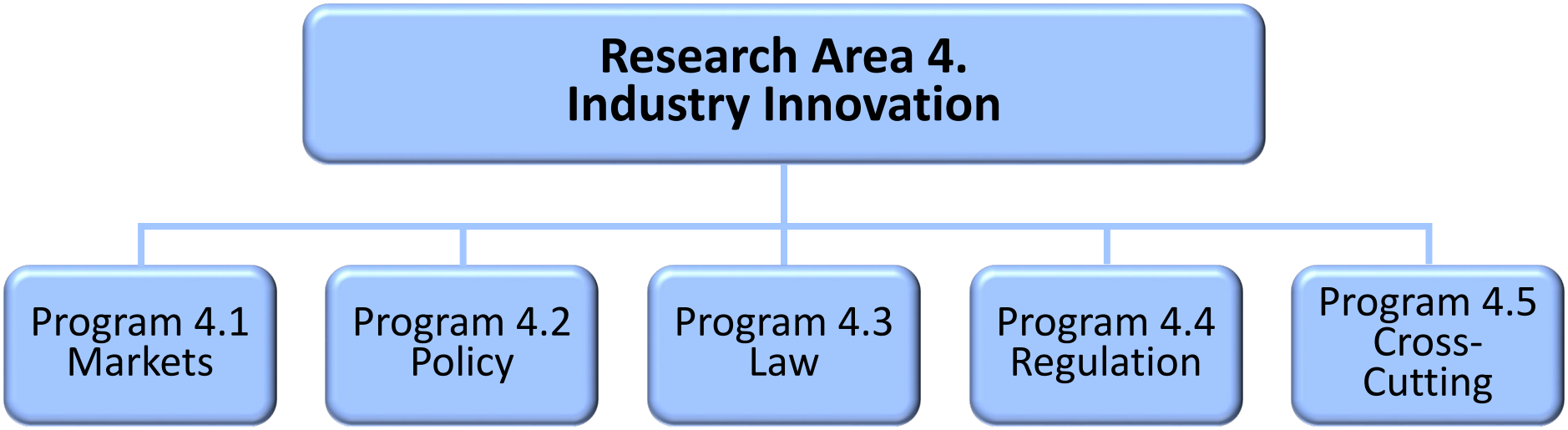
- Improve vehicle safety and risk analyses and management, including knowledge of all safety-critical components, systems of the space vehicles, and their operations.
- Improve the manufacturability, assembly, operational efficiencies of vehicles, systems, and subsystems.

RESEARCH AREA 3 PROGRAMS AND GOALS



- Identify and reduce avoidable risks of human spaceflight.
- Facilitate the continuous improvement of the operational safety of human-carrying vehicles (during both launch and reentry), and spaceports.

RESEARCH AREA 4 PROGRAMS AND GOALS



- **Develop improved criteria for evaluating public safety, such as performance based requirements for the protection of public property and critical assets.**
- Encourage growth of evolving space industry sectors through relevant economic, legal, legislative, regulatory, and market analyses and modeling.
- Support effective policy decision-making in the accomplishment of the dual regulatory and promotional missions of FAA AST.
- Provide a better understanding of the relationship between governmental policy, innovation adoption, and industry growth.