

HUMAN SPACE EXPLORATION

DMGT 750: COLLABORATIVE CULTURE IN DESIGN ORGANIZATIONS
 SPRING 2021 | Prof. TOM HARDY

ARTEMIS PROGRAM OVERVIEW



GOAL OF HUMAN SPACE EXPLORATION

"Humans are driven to explore the unknown, discover new worlds, push boundaries of our scientific and technical limits and then push farther."

"Human space exploration helps to address fundamental questions about our place in the Universe and the history of our solar system."

PROJECT OVERVIEW

For this design project, our team was tasked with researching and understanding the complex collaborative culture within NASA through the lens of NASA's Space Launch System (SLS).

Our overarching goal was to apply our research learnings to the field of Design Management by designing a visual model that explains the value of collaboration.

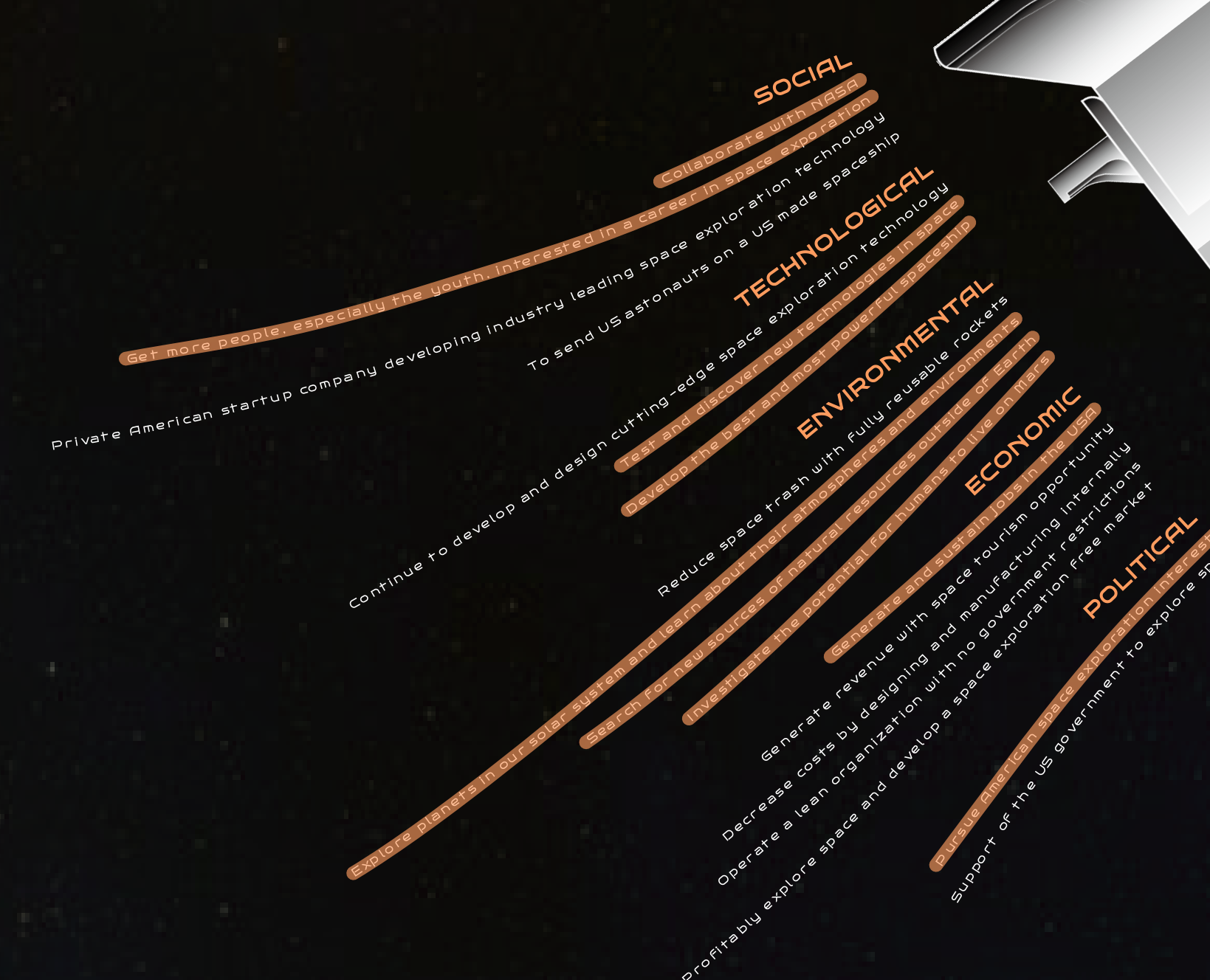
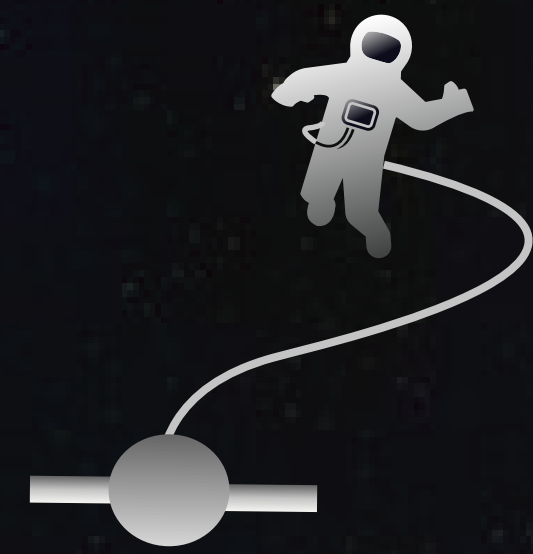
Our research learnings were developed by gaining insights on SLS's complex collaborative culture that utilizes extreme metrics and collaborates with 1,000 external partners, and by assessing the partnerships between NASA and its Human Landing System program partners - SpaceX, Blue Origin, and Dynetics.

NASA SPACE LAUNCH SYSTEM

NASA's Space Launch System (SLS), is a super-heavy-lift launch vehicle that provides the foundation for human exploration beyond Earth's orbit. With its unprecedented power and capabilities, SLS is the only rocket that can send Orion, astronauts, and cargo to the Moon on a single mission.

SPACEX STARSHIP

SpaceX's Starship spacecraft and Super Heavy rocket (collectively referred to as Starship) represent a fully reusable transportation system designed to carry both crew and cargo to Earth orbit, the Moon, Mars and beyond. Starship will be the world's most powerful launch vehicle ever developed, with the ability to carry in excess of 100 metric tons to Earth orbit.



NASA NASA SLS

- S** People: Core capabilities/corporate knowledge
- S** Leaders in collaboration and innovation
 - Good and Strong external collaborations (NSRF, academia etc) and connections with external communities
 - Open collaboration and innovation is moving to be the norm
 - Integrate the international life sciences community
- S** Risk management
 - Serious approach to risk management
 - Interdisciplinary atmosphere to solve problems
 - Mission and risk focused to deliverables
- S** Human Resource Planning (HRP) specific
 - Well managed, structured and use of HRP ahead for optimal use of organizations
- S** Resources & Resource management
 - Clear Project Management
 - Flexibility allowing the organization to evolve and survive
 - Pathfinder, forward-looking
 - Mature processes
 - Excellent facilities for research

- W** Poor project management
- W** Technical issues, bad management and poor performances from the NASA contractors.
- W** Over-budgeted SLS project
\$18.3 billion spent if the rocket flies in 2021
- W** Shortcomings in quality control
- W** Infrastructure issues
 - The many NASA locations and partner locations cause inefficiencies when transporting parts for testing and launching

- O** \$1.35 billion total projected economic impact
8,000 Jobs nationwide
- O** The launch vehicle's power and versatility allows for heavier payloads and opens new possibilities such as robotic missions to Mars, Saturn and Jupiter
- O** Most powerful rocket in history
- O** NASA's Space Launch System to boost science with secondary payloads

- T** Time management for clearance in project launch for low casualties or negative outcomes
- T** SpaceX as a competitor

SPACEX SPACEX SPACESHIP

- S** Quality control
- S** Internal management of the entire product development process
 - Control of the R&D
 - Development, testing and fabrication
- S** Competitive pricing
- S** Innovative design
- S** Faster development timeline than any rocket
- S** No competition aside from NASA SLS
- S** Reusable rocket system
- S** SpaceX being under contract by NASA for resupply missions
- S** Industry-leading technological prowess has allowed SpaceX to win majority of space exploration contracts from NASA

- W** Capital intensive
- W** Lack of collaboration with other companies
- W** High level of uncertainty investment leading to drastic failure
- W** Commercial market stagnation
 - The global market for commercial space launches is not big.
- W** Failure leading to bankruptcy

- O** No restrictions on revenue opportunities
- O** Becoming the only service NASA uses to send things to space
- O** Potential future Artemis program launch contracts

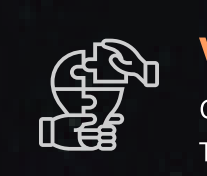
- T** NASA SLS as a competitor
- T** Potential new entrants into the untapped space market
- T** Threat of losing current contracts with bigger agencies
- T** Potential cost increase in raw materials, labor, R&D

RESEARCH TAKEAWAY

HOW

- Information and Resource Sharing
- "Honesty" of Financial obligation and Organizational structure
- SpaceX
 - Must generate revenue and profit
 - Lean management structure
 - Fall fast, often, and quickly.
 - Design-centered
- Divide and Conquer Short-term Goals

- NASA
 - Gov. issued yearly budget
 - Large bureaucratic organization
 - Reports to congress



VALUE

- Collaboration & Transparency

BIG PICTURE GOAL

Human Space Exploration

