STANDARDS AND REGULATIONS

TEAM A: MIND THE GAP

THE ROBOTICS INSTITUTE

Sankalp
Mech Wizard

Hari
Integrator

Sudhansh
Visionary

Sandhya
Controller

Dhanvi
Man with the Plan

THE ROBOTICS INSTITUTE

AGENDA

THE ROBOTICS INSTITUTE

TWO NASA TECHNICAL STANDARDS

A. DEFINITION AND PURPOSE
B. PRESCRIPTION
C. APPLICATION MARKET
D. APPLICATION TO PROJECT

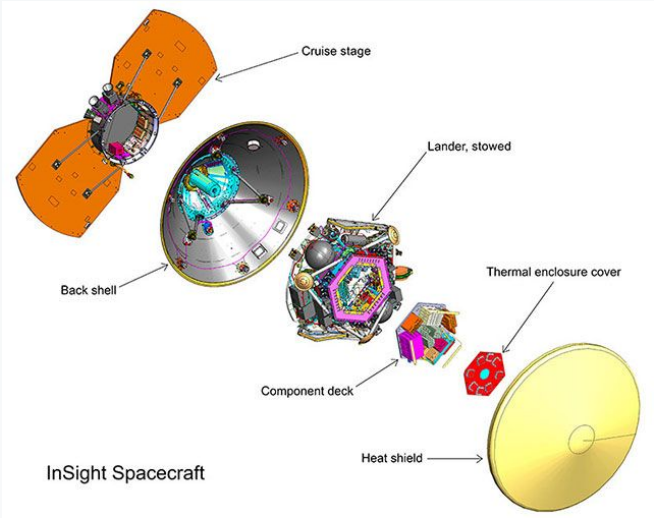
NASA-STD-5017
DESIGN AND DEVELOPMENT REQUIREMENTS FOR MECHANISMS

NASA TECHNICAL STANDARD

DEFINITION AND PURPOSE

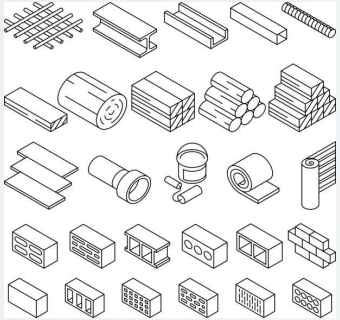
NASA-STD-5017 PURPOSE: ENSURES SPACE MISSION MECHANISMS MEET RIGOROUS SPACE ENVIRONMENT REQUIREMENTS.

SCOPE: COVERS VARIOUS MECHANISMS, INCLUDING HINGES, LATCHES, ACTUATORS, AND DEPLOYMENT SYSTEMS.



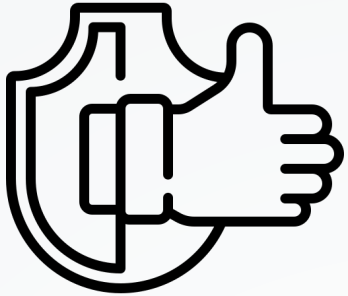
INSIGHT SPACECRAFT

PRESCRIPTIONS



MATERIALS AND PROCESSES

DESIGN REQUIREMENTS



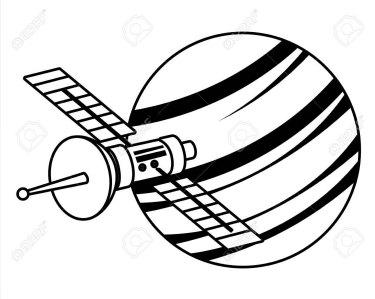
RELIABILITY AND SAFETY

TESTING AND VERIFICATION

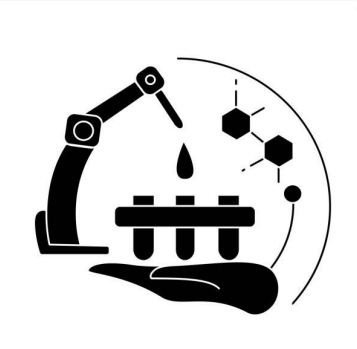
DOCUMENTATION

APPLICATION MARKET

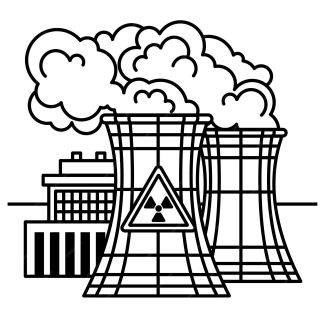
AEROSPACE



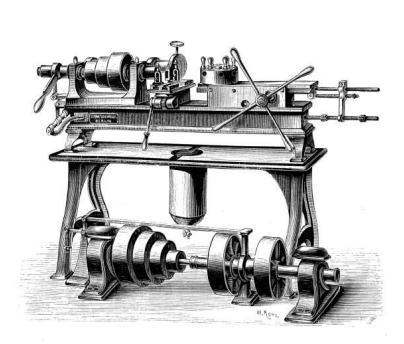
SATELLITE AND SPACE



MEDICAL AND SCIENCE

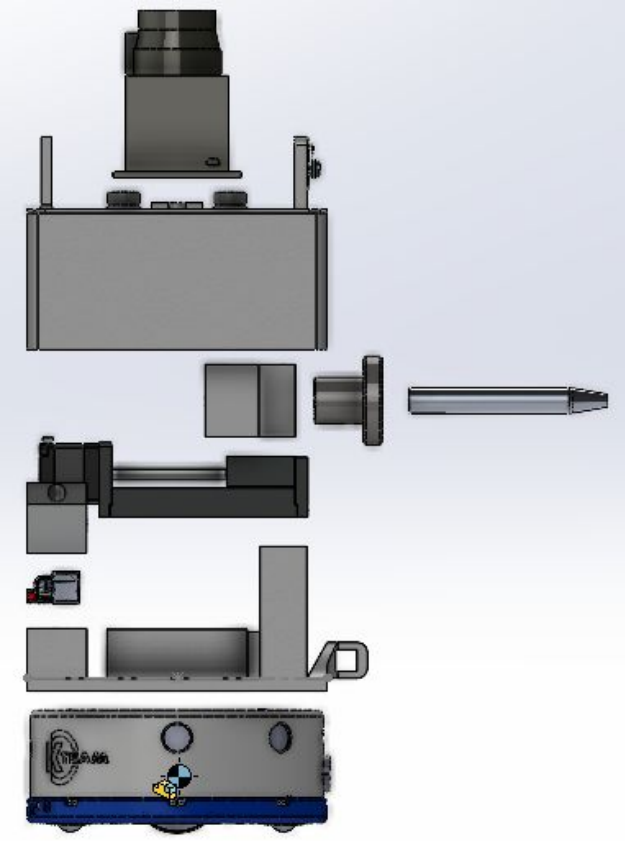


NUCLEAR AND ENERGY



CUSTOM MACHINERY

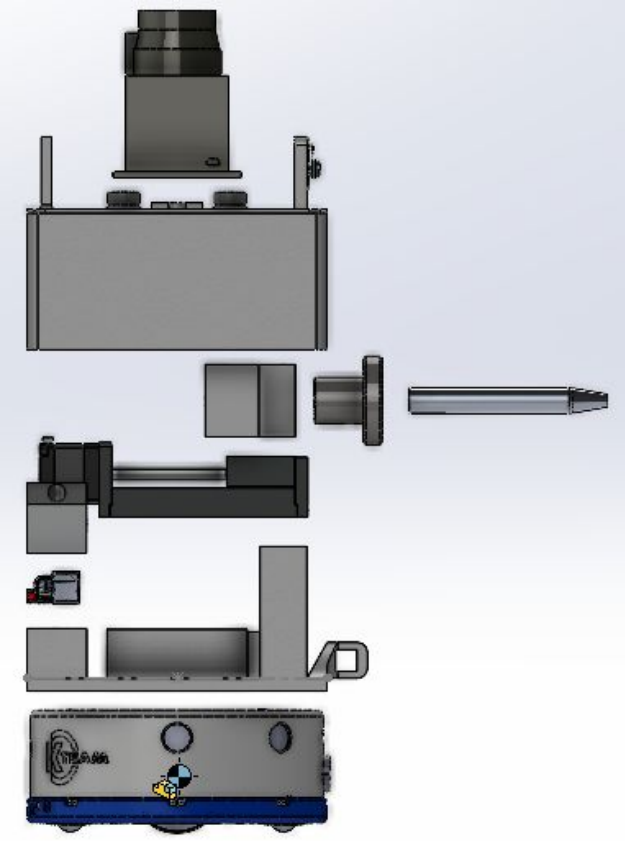
HOW DOES THIS RELATE TO OUR PROJECT?



DESIGN AND DEVELOPMENT OF PHYSICAL COUPLING MECHANISM

- PIN AND HOLE MECHANISM FOR COUPLING
  - PRECISE INFERENCE
  - SLIDING MOTION
- LATCHING MECHANISM
  - LOAD ON MOVING COMPONENT

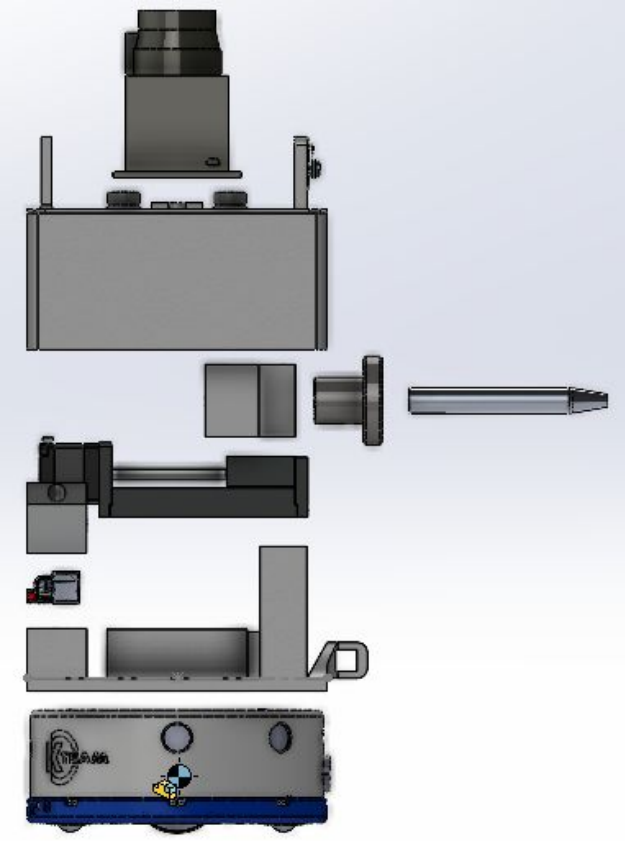
HOW DOES THIS RELATE TO OUR PROJECT?



MATERIAL AND PROCESSES

- PLA FOR ENCLOSURE
- ALUMINUM FOR LINEAR BEARING ASSEMBLY
- 3D PRINTING TO SUPPORT MANUFACTURING OF COMPLEX FEATURES IN THE PARTS

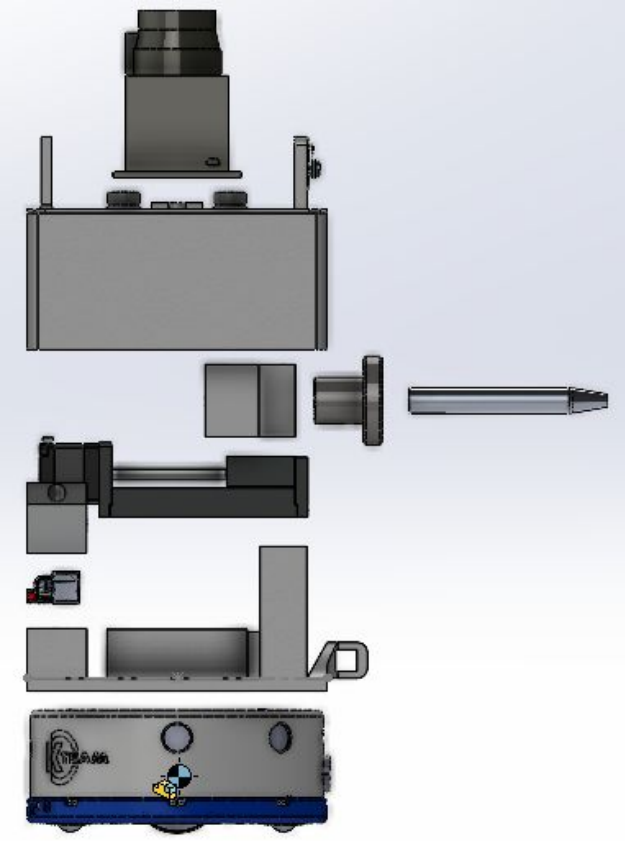
HOW DOES THIS RELATE TO OUR PROJECT?



DESIGN REQUIREMENTS

- MODULAR TO KHEPERA IV
- SLIDING AND LATCHING MOTIONS
- ENCLOSE ALL THE ELECTRONICS

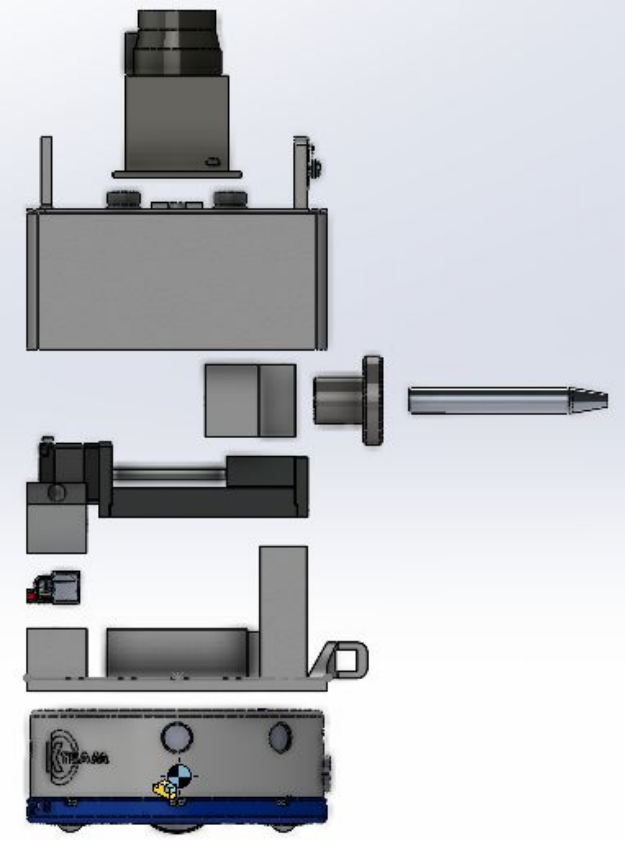
HOW DOES THIS RELATE TO OUR PROJECT?



SAFETY AND RELIABILITY

- HRI DURING TESTING
- REPEATABILITY OF SLIDING MOTIONS OF INDIVIDUAL AGENTS

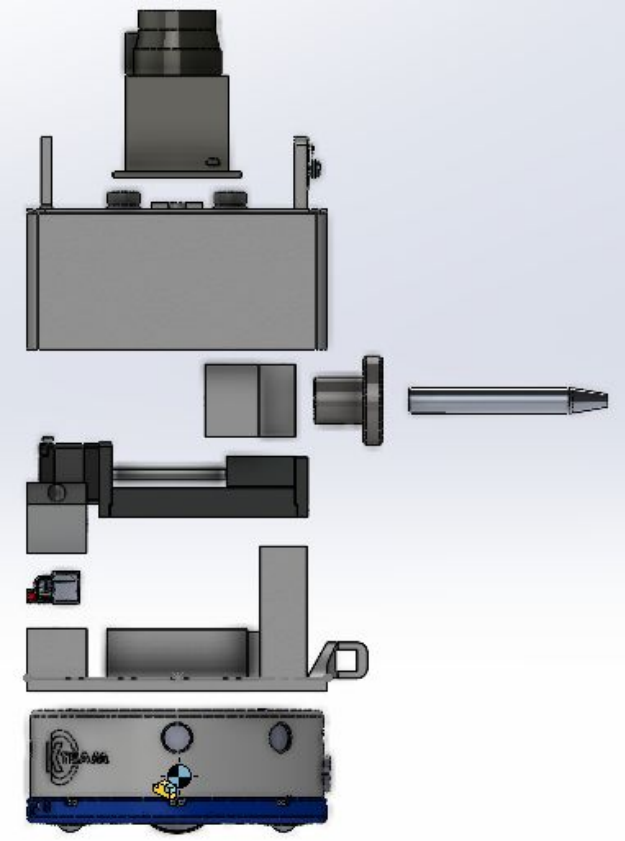
HOW DOES THIS RELATE TO OUR PROJECT?



TESTING AND VERIFICATION

- AGENT LOAD TESTS
- COUPLING MECHANISM INFERENCE TEST
- LATCHING TEST

HOW DOES THIS RELATE TO OUR PROJECT?



DOCUMENTATION

- CAD DRAWINGS
- 3D PDFS
- DIMENSIONS
- TOLERANCES

NASA-STD-5001

STRUCTURAL DESIGN AND TEST FACTORS OF SAFETY FOR SPACEFLIGHT HARDWARE

NASA TECHNICAL STANDARD

DEFINITION AND PURPOSE

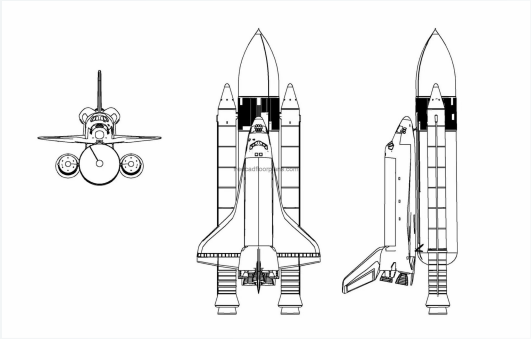
NASA-STD-5017 PURPOSE: ENSURE THAT SPACEFLIGHT HARDWARE IS STRUCTURALLY SOUND AND CAPABLE OF WITHSTANDING THE VARIOUS STRESSES AND CONDITIONS ENCOUNTERED DURING SPACE MISSIONS

SCOPE: COVERS A WIDE RANGE OF HARDWARE, INCLUDING LAUNCH VEHICLES, SPACECRAFT, AND PAYLOADS

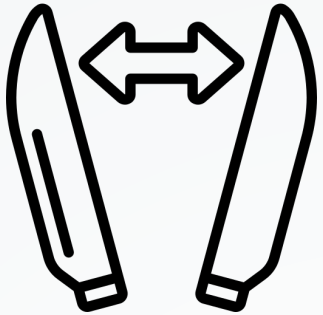
ARTEMIS III

PRESCRIPTIONS

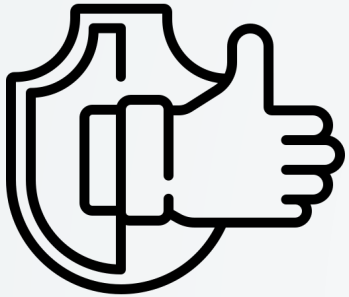
FACTOR OF SAFETY



STRUCTURAL DESIGN AND TESTING



PAYLOAD INTEGRATION

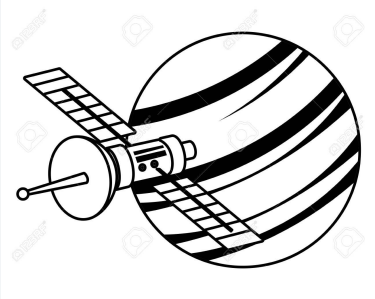


RELIABILITY AND SAFETY

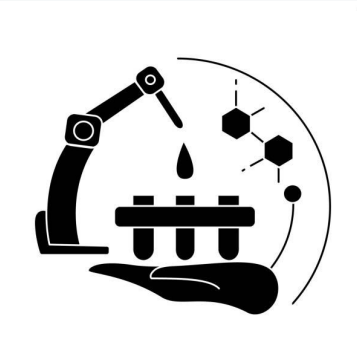
DOCUMENTATION

APPLICATION MARKET

AEROSPACE



SATELLITE AND SPACE



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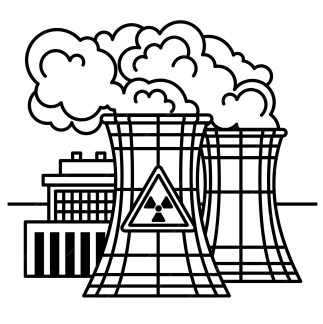
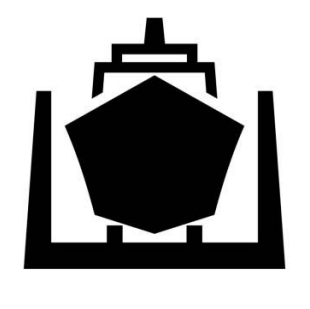
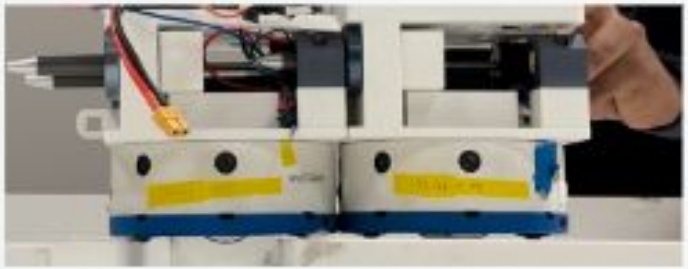


NUCLEAR AND ENERGY



MARINE INDUSTRY

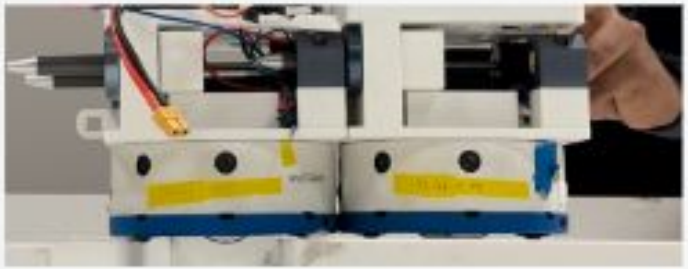
HOW DOES THIS RELATE TO OUR PROJECT?



MECHANISM PAYLOAD AND COUPLED MOTION OF MULTIPLE AGENTS

- THE ADDED MECHANISM CAN BE CONSIDERED AS A PAYLOAD ON KHEPERA IV
- MULTIPLE AGENTS IN COUPLED STATE ACT AS ONE AGENT WHICH ARE SUBJECTED TO COMPLEX CONDITIONS SUCH A CROSSING OF THE GAP

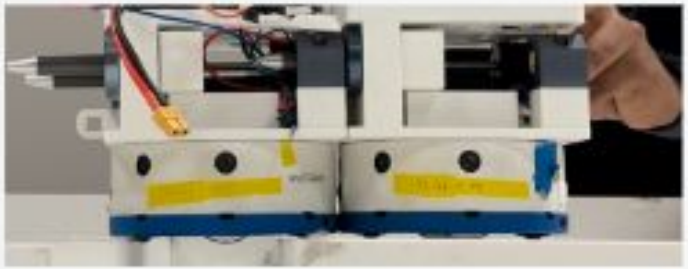
HOW DOES THIS RELATE TO OUR PROJECT?



FACTOR OF SAFETY

- MAXIMUM PAYLOAD ON KHEPERA = 3000 GMS
- ADDED PAYLOAD = 1500 GMS
  - FOS = 1.5
- GAP CROSSING
  - MAX LIMIT = 21 CM
  - POSSIBLE LIMIT = 19 CM

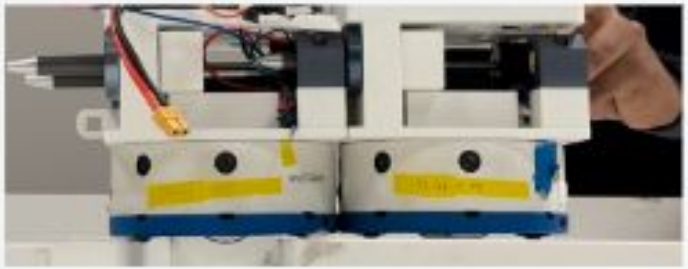
HOW DOES THIS RELATE TO OUR PROJECT?



STRUCTURAL DESIGN AND TESTING

- INDEPENDENT DESIGN AND PROCUREMENT OF COMPONENTS
- INDIVIDUAL AGENT LOAD BEARING CAPACITY
- COUPLED MOTION TESTS OVER VARIED SIZED GAPS

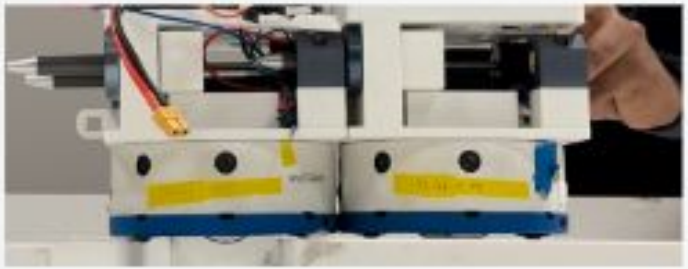
HOW DOES THIS RELATE TO OUR PROJECT?



PAYLOAD INTEGRATION

- THE ADDED MECHANISM CAN BE CONSIDERED AS INTEGRATED PAYLOAD ON KHEPERA IV

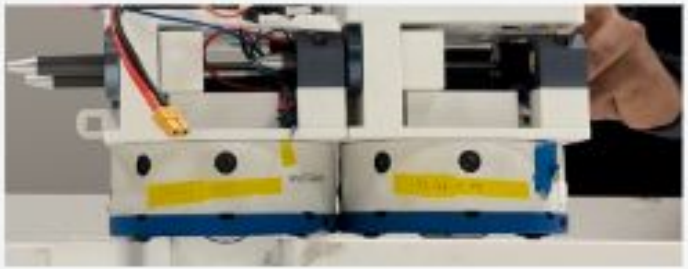
HOW DOES THIS RELATE TO OUR PROJECT?



RELIABILITY AND SAFETY

- AGENTS SHOULD COUPLE, LOCOMOTE AND CROSS THE GAPS 80% OF TIMES
- DURING GAP CROSSING THE AGENTS SHOULD MAINTAIN THEIR PHYSICAL STATE TO ACHIEVE REPEATABILITY

HOW DOES THIS RELATE TO OUR PROJECT?



DOCUMENTATION

- TEST RESULTS FROM COUPLED MOTION TESTS
- CAPABILITY PARAMETERS OF THE AGENTS IN INDIVIDUAL AND COUPLED STATES
  - SPEED
  - GAP SIZE
  - MAX PAYLOAD

REFERENCES

- NASA-STD-5017
  - Design and Development Requirements for Mechanisms
  - https://standards.nasa.gov/standard/nasa/nasa-std-5017
- NASA-STD-5001
  - Structural Design and Test Factors of Safety for Spaceflight Hardware
  - https://standards.nasa.gov/standard/nasa/nasa-std-5001

THANK YOU FOR YOU ATTENTION

Any Questions?