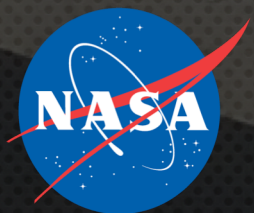


# MARS HELICOPTER KITS

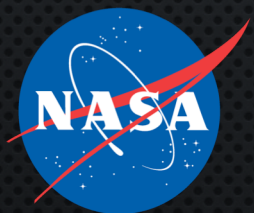
AN EDUCATIONAL DRONE ASSEMBLY PROJECT







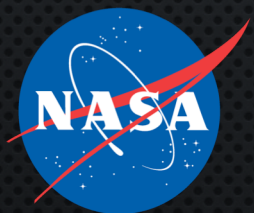
1. JUNIOR IN MECH ENGINEERING
2. MINOR IN AEROSPACE
3. INTERNEED AT NASA AMES,  
ROTORCRAFT AEROMECHANICS
4. GOVERNMENT CONTRACTOR  
THROUGH SCIENCE & TECHNOLOGY  
CORPORATION





# OUTLINE

1. BACKGROUND
  1. WHAT IS THE MARS HELICOPTER?
2. GOALS
3. DESIGN PROCESS
4. RESULTS
5. FUTURE DESIGN





# THE MARS HELICOPTER

## BACKGROUND

### PURPOSE

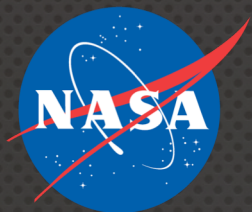
- Assist rover
- Reconnaissance
- Optimize path-making decisions
- Increase lifespan of rover
- Find points of interest for sampling

### SPECIFICATIONS

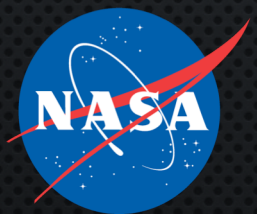
- Mass: 1.5 kg
- Rotor diameter: 1.2 m
- Coaxial rotors
- Chassis dimensions: 14 cm cube
- Power: 220 W
- Battery: 6 x Li-Ion (2 Ah)
- Flight time: 90 s (daily)

### CHALLENGES

- Atmosphere
- Solar power
- Dust

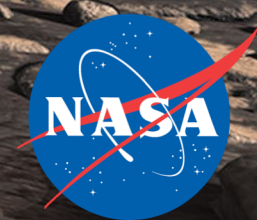




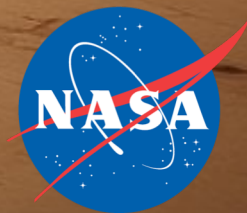




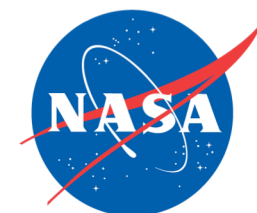
HELP!













# GOALS & LEARNING OUTCOMES

## HIGH SCHOOL KIT (HSK):

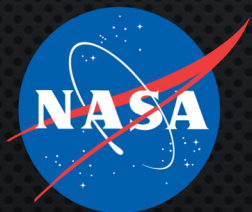
### DESIGN A FUNCTIONAL DRONE

- Affordability
- Teach basic mechanical assembly
- Circuit construction
- Arduino programming
- Wiring
- Soldering
- 3D printing
- Repurposing components

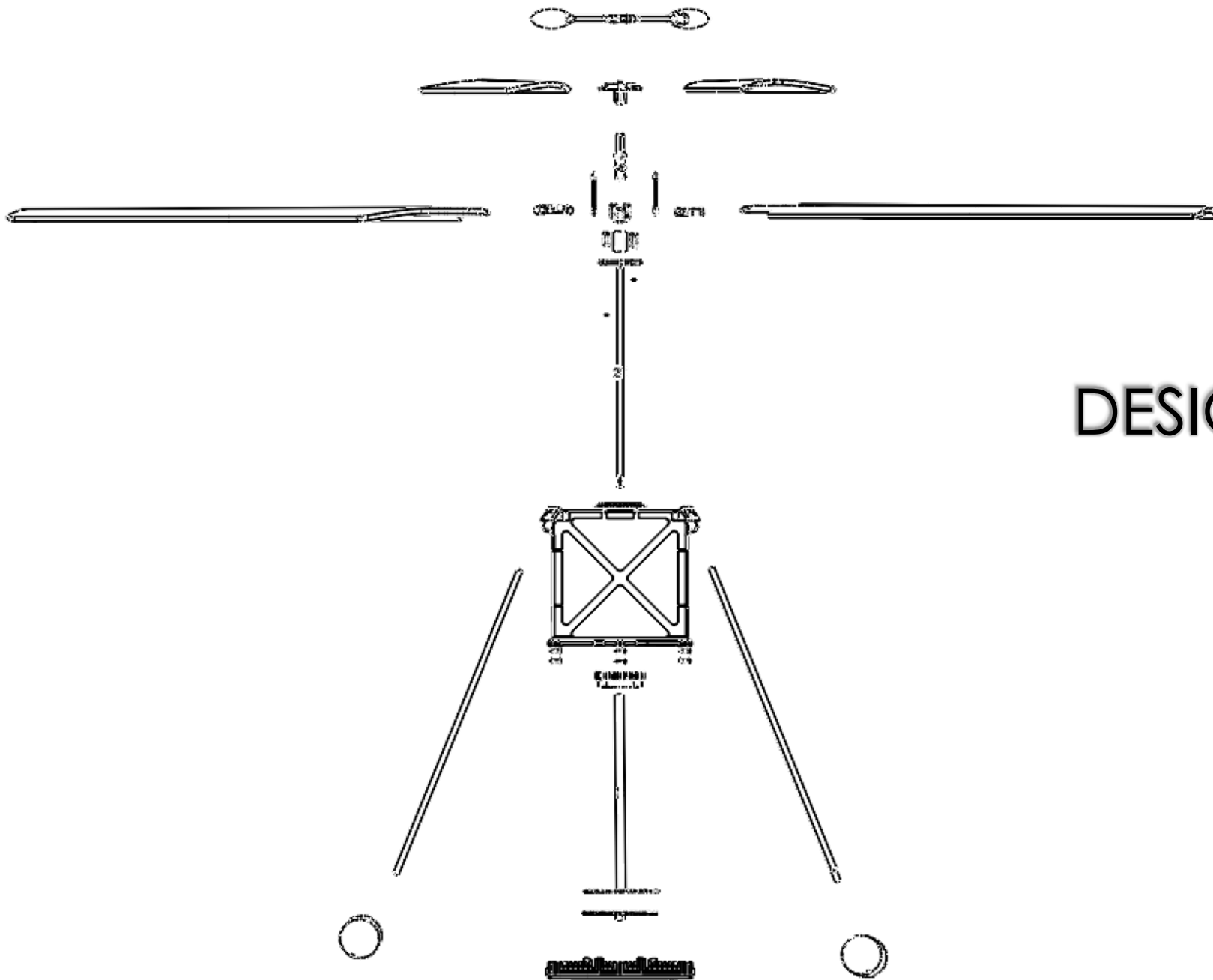
## ELEMENTARY SCHOOL KIT (ESK):

### DESIGN A LEGO MODEL

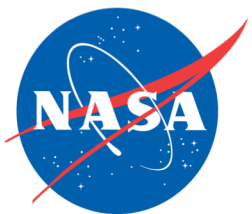
- Compile parts list
  - Compile manual
  - Teach assembly skills
  - Learn about NASA
  - Learn about the 2020 mission to Mars
- Compile parts list
  - Compile manual
  - Teach basic assembly skills
  - Inspire young students



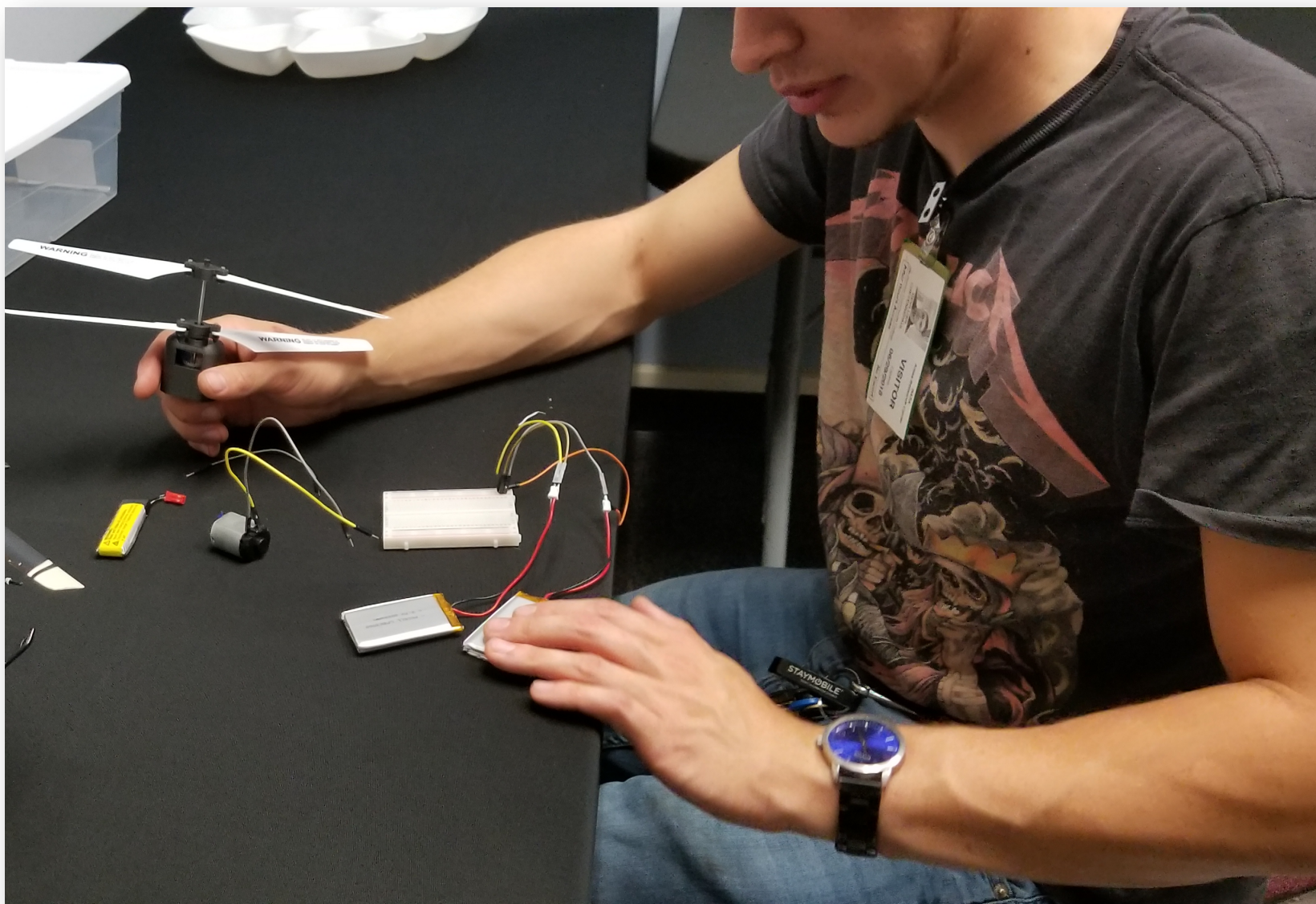




# DESIGN PROCESS







## ANALYSIS OF PREVIOUS DESIGN (1:3 SCALE)



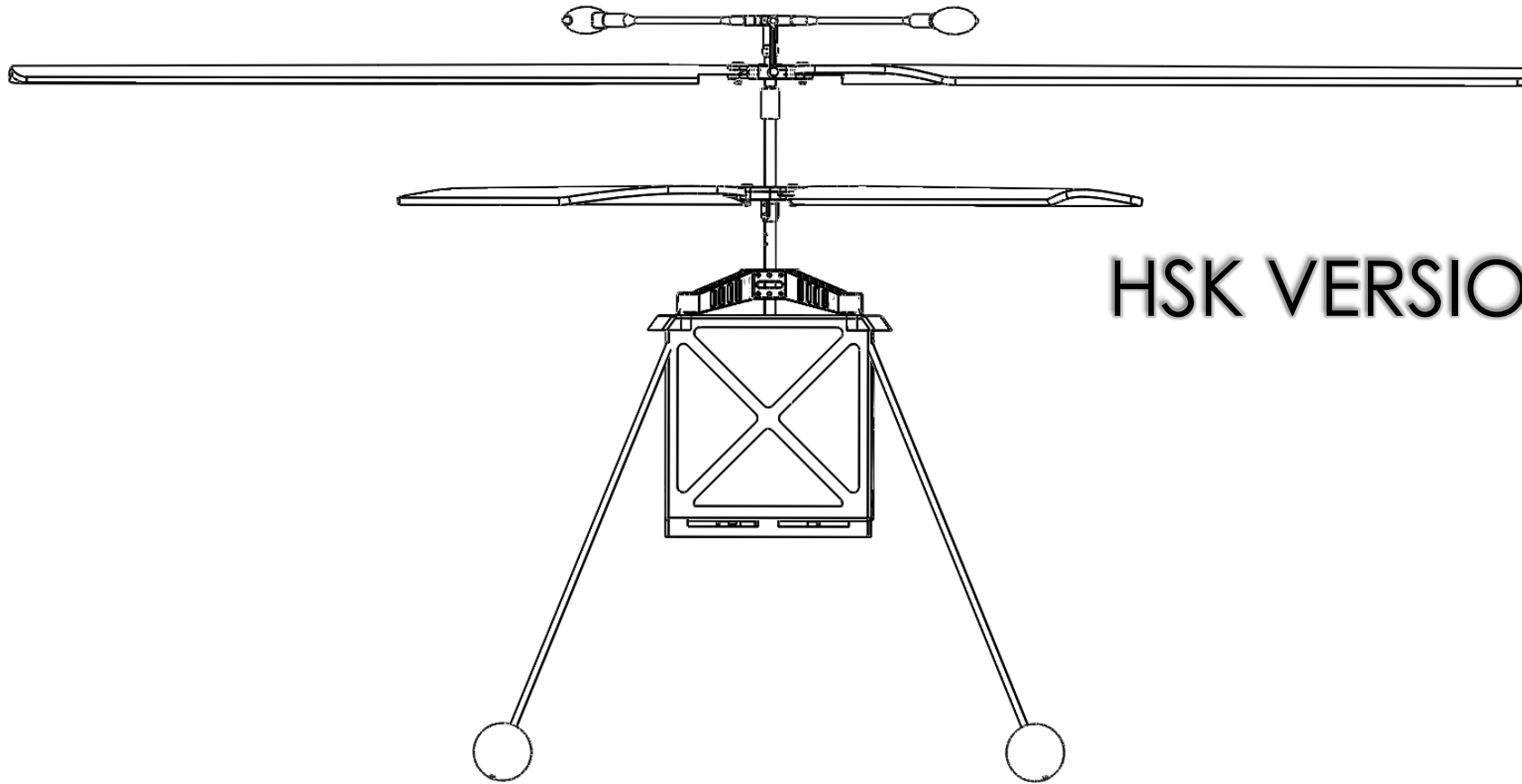




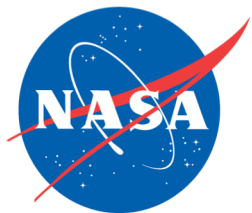
## ANALYSIS OF PREVIOUS DESIGN (FULL SCALE)



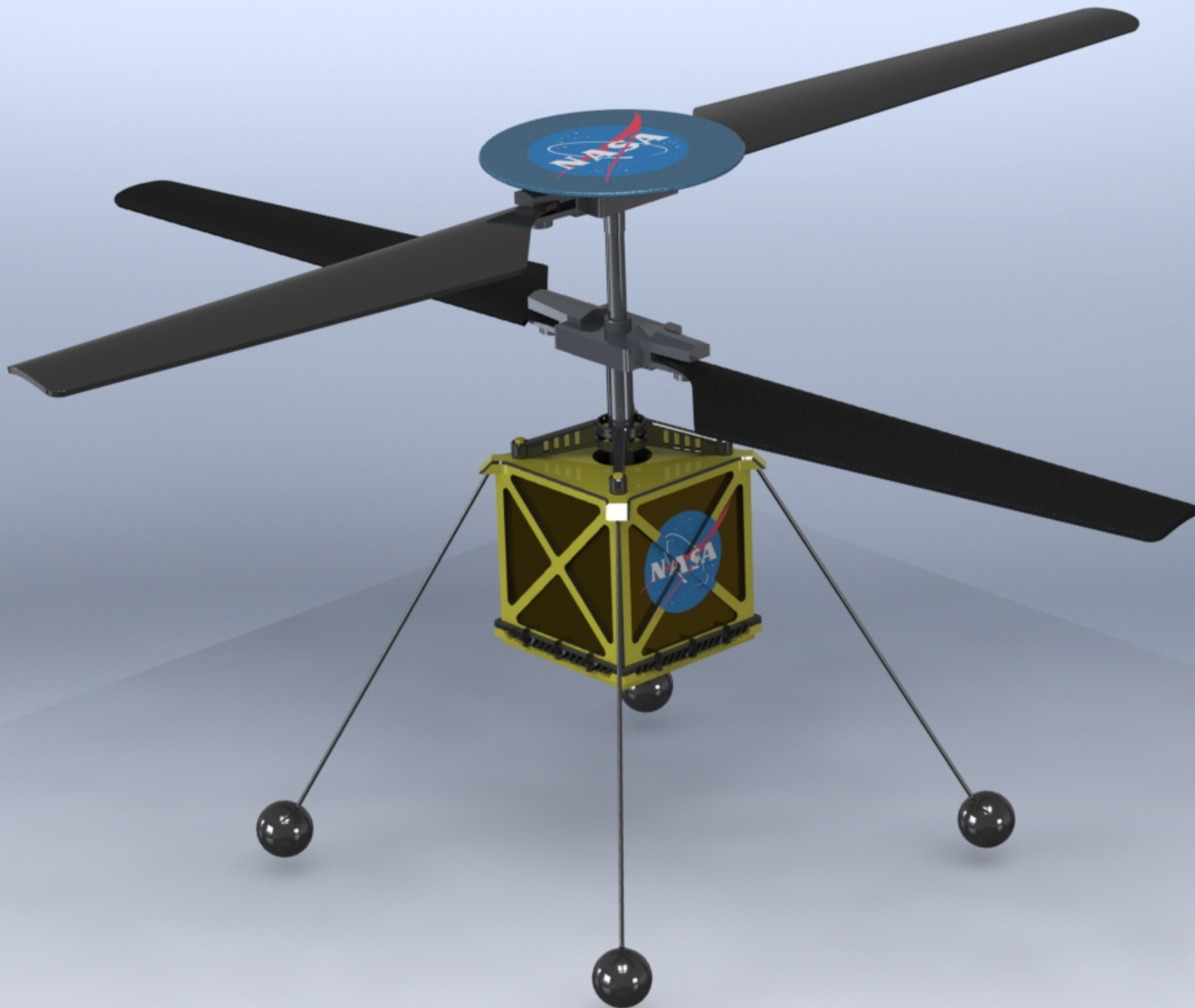




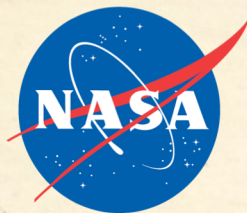
## HSK VERSION 1: DESIGN



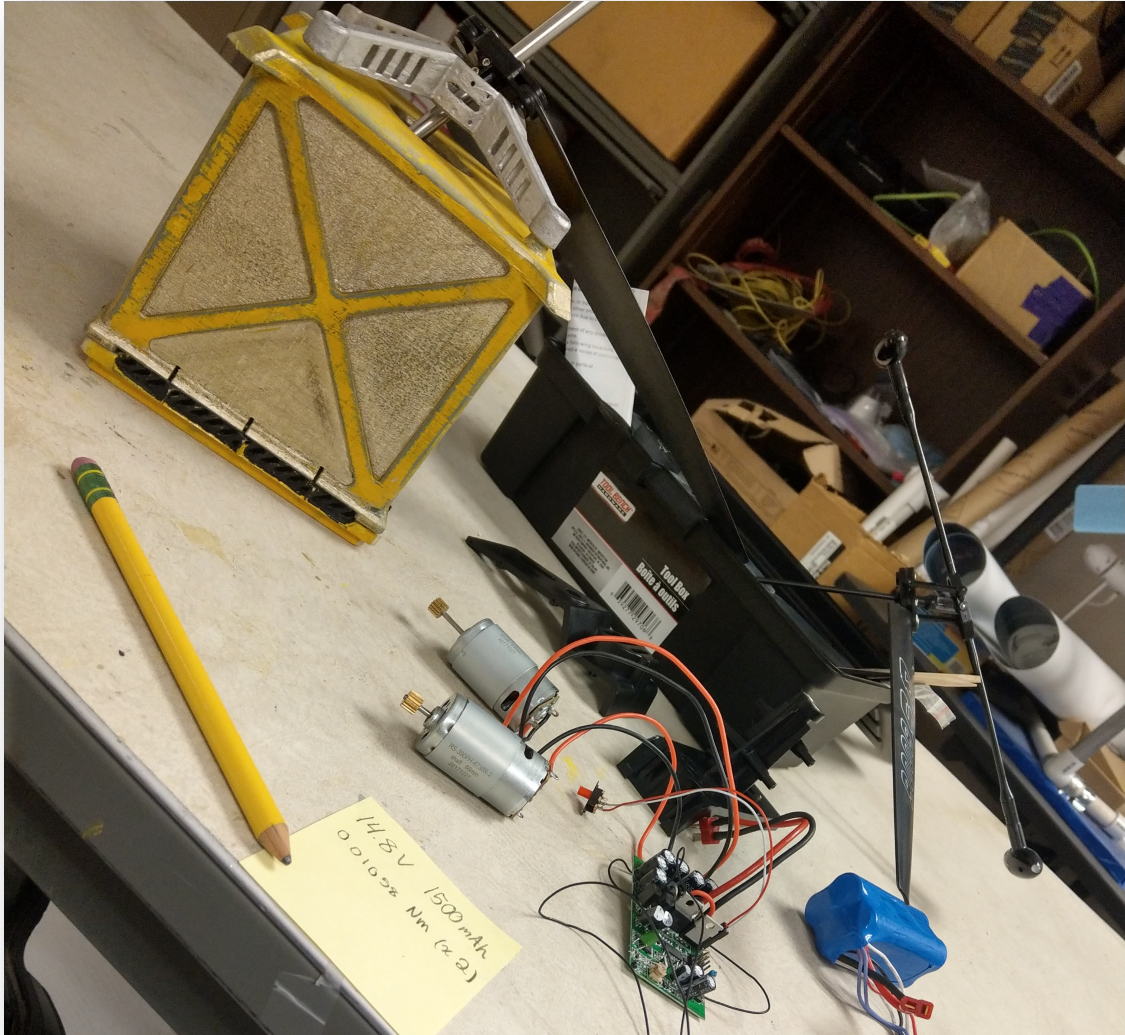






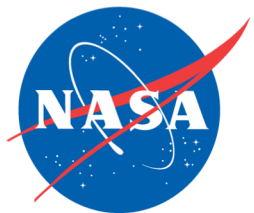




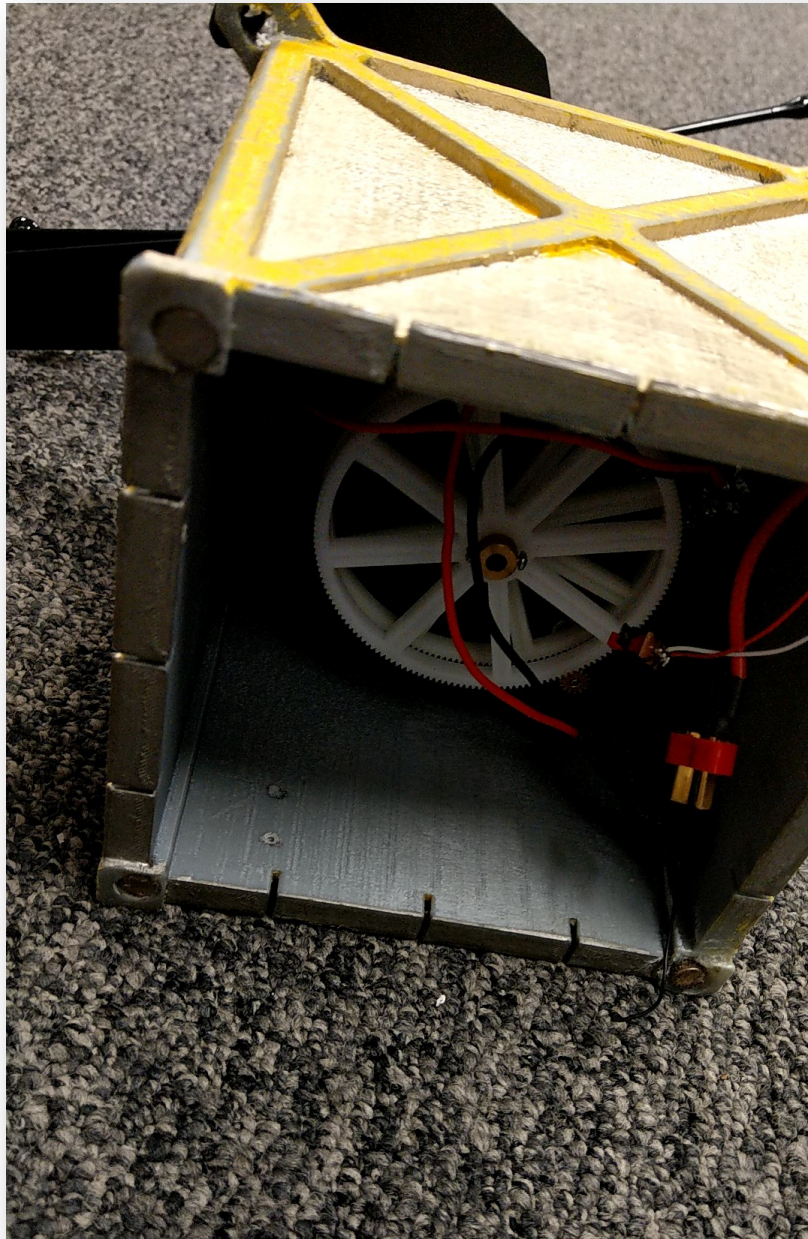
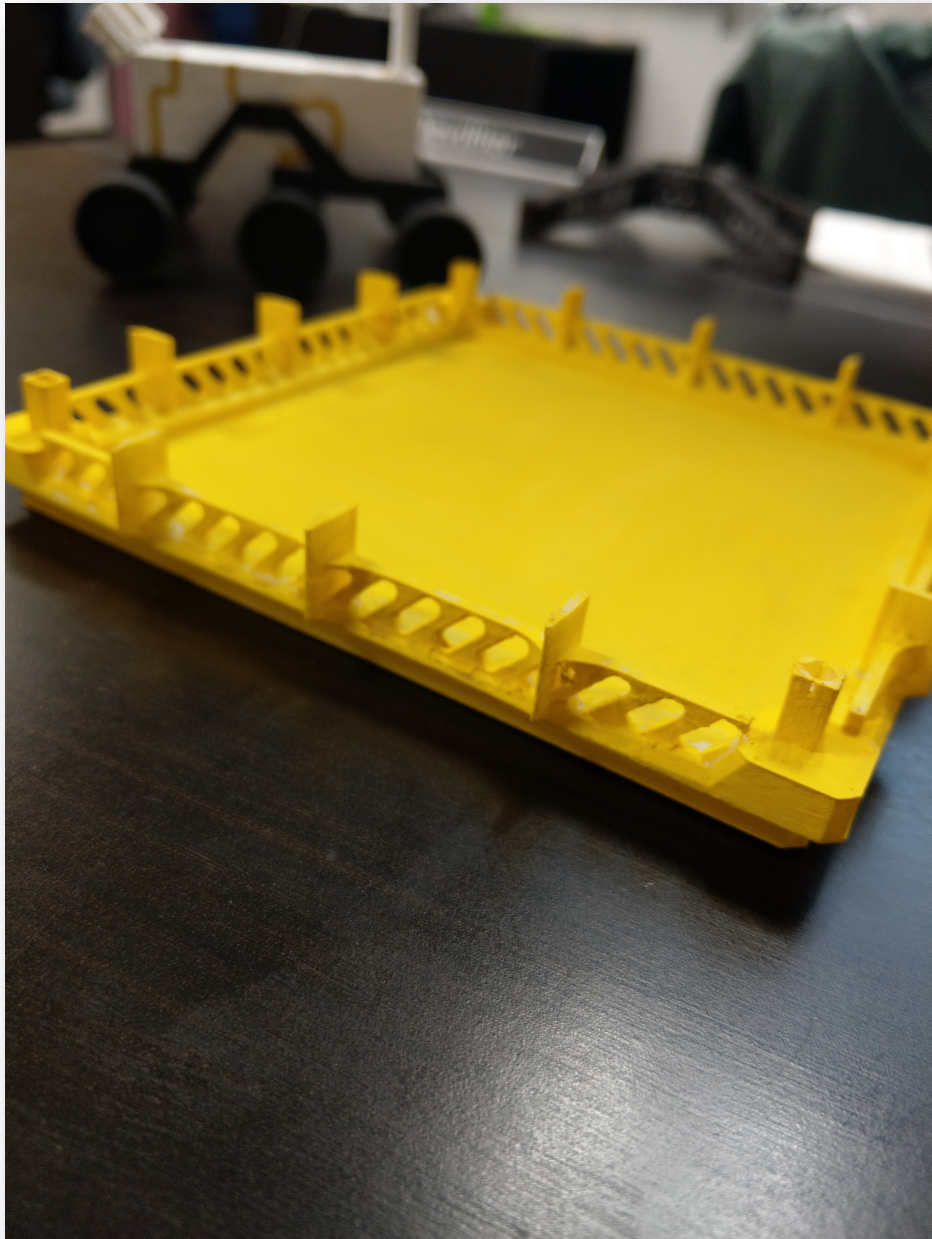


# HSK: INITIAL DESIGN SPECS

- Mass: 2.2 kg
- Rotor diameter: .80 m
- Coaxial rotors
- Chassis dimensions: 14 cm cube
- Battery: 1 x Li-Ion
- Cost ~ \$200

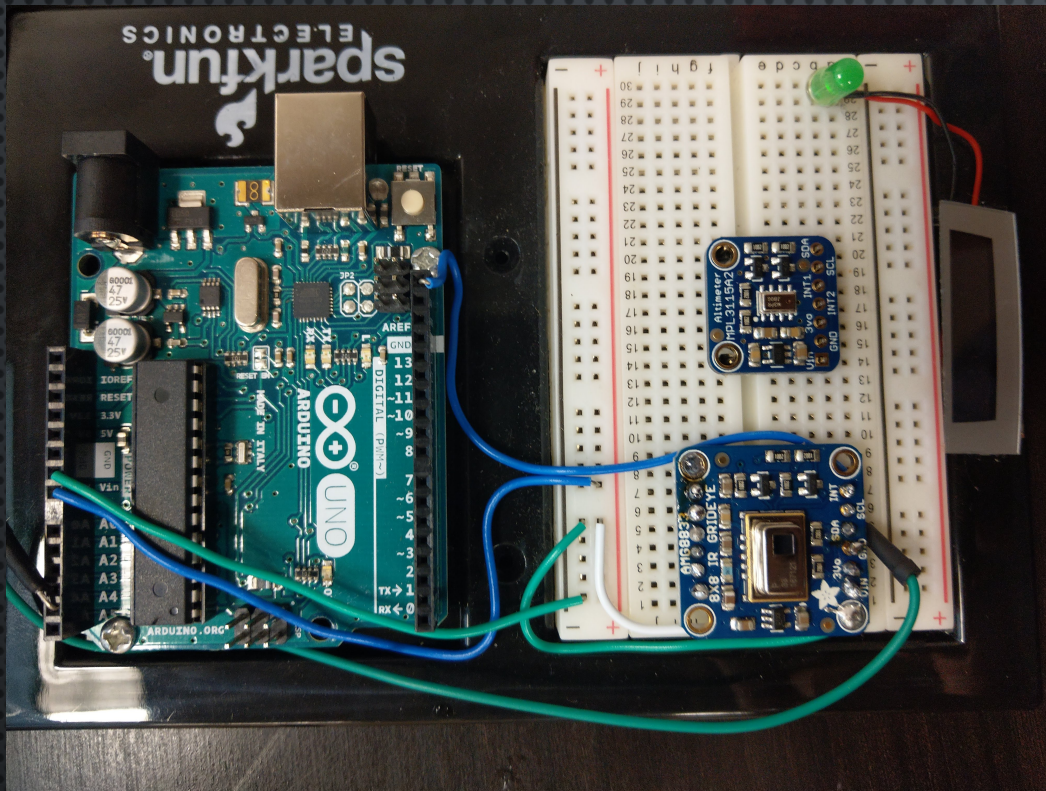






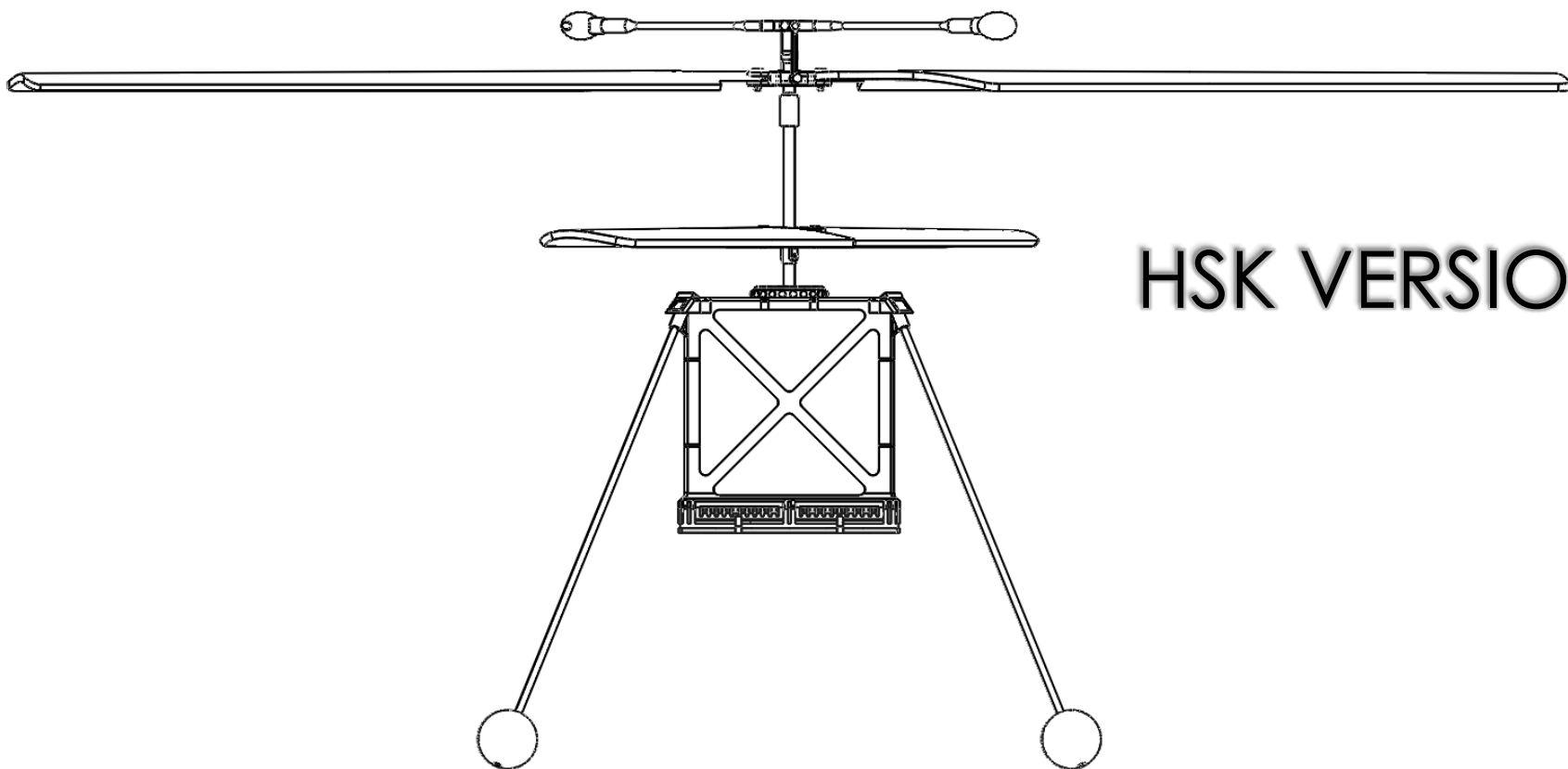


# MODULES

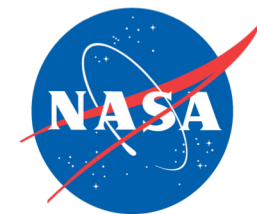


- Thermal camera
- Altimeter
- Range finder



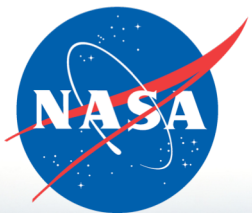
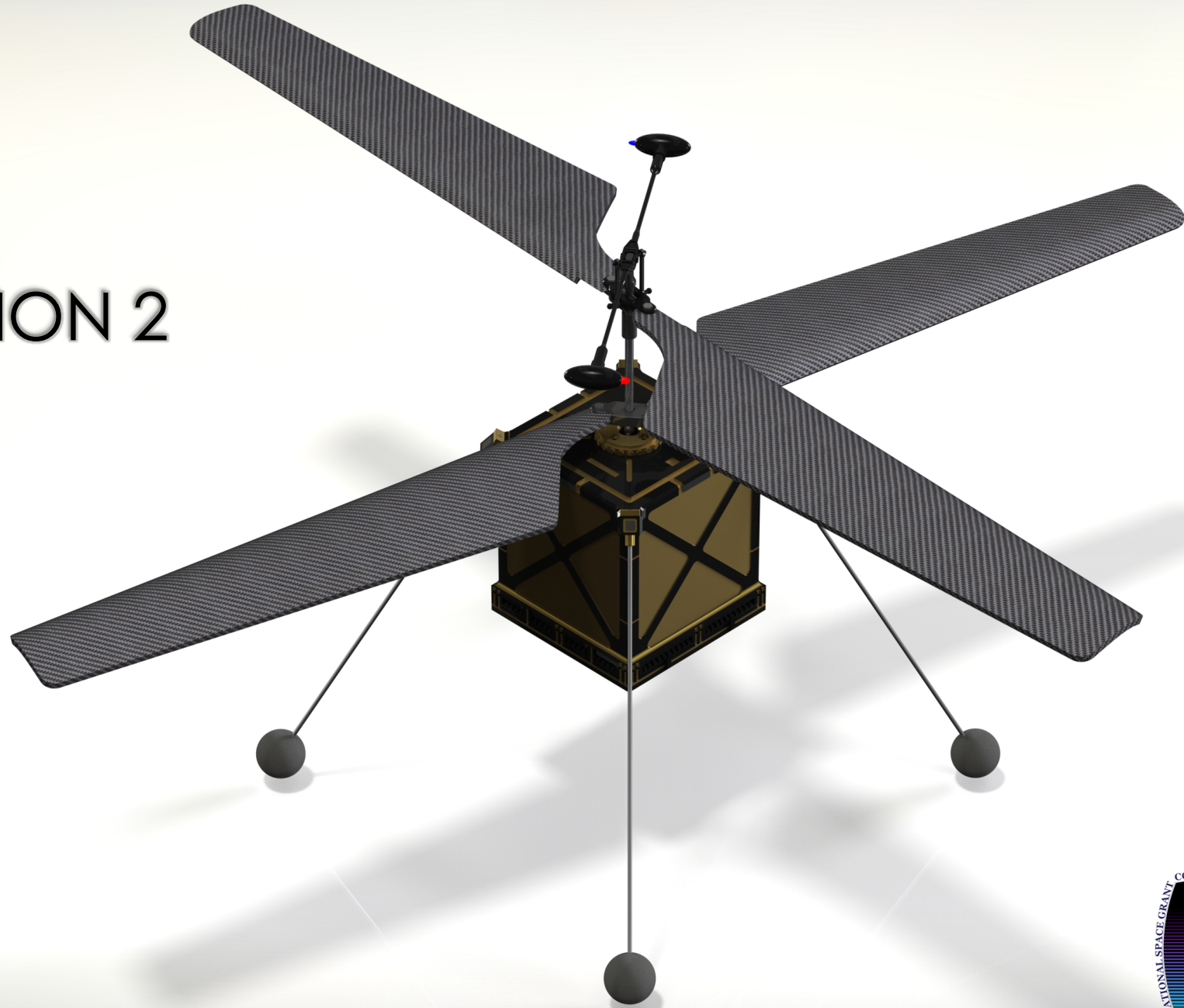


## HSK VERSION 2: DESIGN

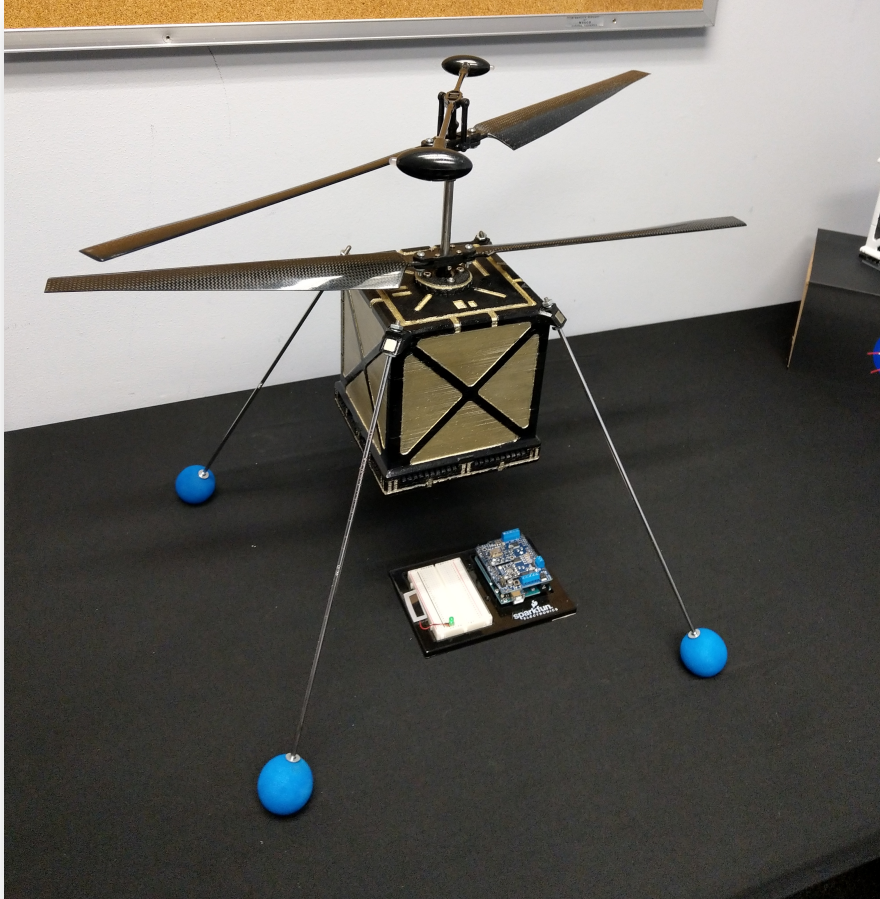




# HSK: VERSION 2







# IMPROVEMENTS

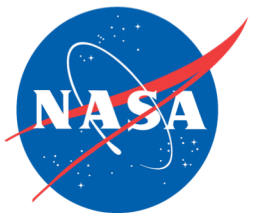
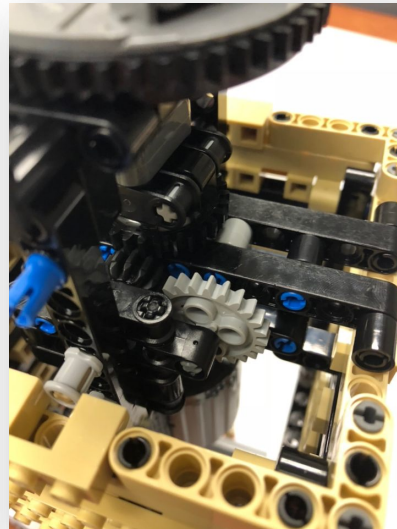
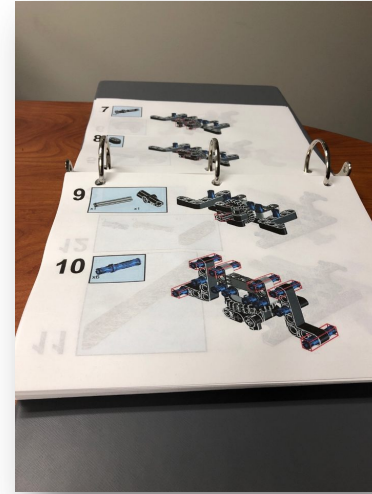
- Significantly reduced weight: 1.195 kg from 2.3 kg
- Carbon fiber blades
- Removed rotor guard
- Increased number of magnets securing bottom plate





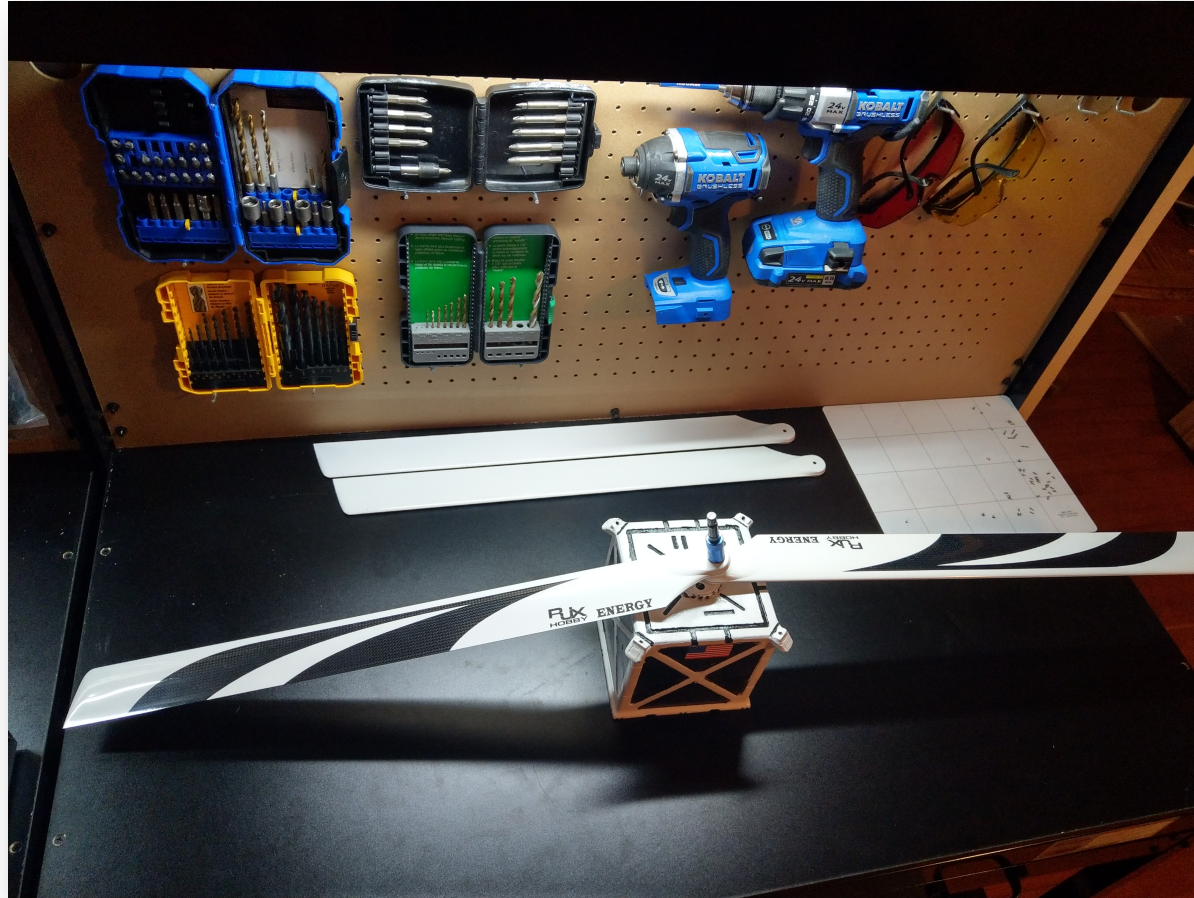
# ESK: LEGO MARS HELICOPTER

- 1:3 Scale and Full Scale
- Coaxial rotors





# FUTURE DESIGN





# A SPECIAL THANKS

- OREGON SPACE GRANT CONSORTIUM
- NASA AMES RESEARCH CENTER
- OREGON STATE UNIVERSITY
- LINN BENTON COMMUNITY COLLEGE