Ingenuity Mars Helicopter

MEPAG 6/21/21

Teddy Tzanetos

Contributors: M. Aung, J. Balaram, H. Grip, M. Golombek, N. Williams, J. Maki

Jet Propulsion Laboratory, California Institute of Technology

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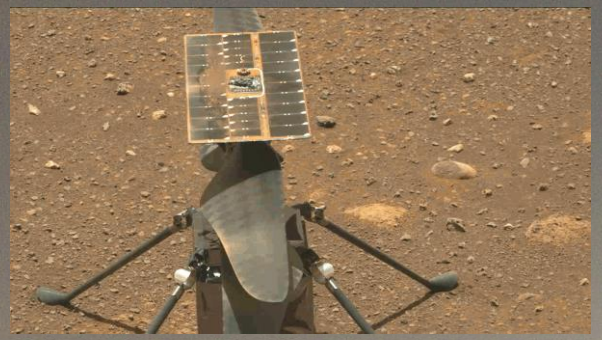
Ingenuity Mars Helicopter

- Technology Demonstration
  - Prime Directive– Martian Wright brothers flight
- Wealth of unique vehicle and sensor data
  - Color(13MP) / B&W(0.5MP) cameras, IMU, laser altimeter, insolation, thermals, flight dynamics
  - Pathfinder for future science applications on Mars
- Tech. Demo Complete!
  - Transitioned to Ops. Demo ~May 8

Flight #1 4/19/21 100% Mission Success



Flight Log

	Flight	Sol	Date	Description	Height (m)	Tot. Distance(m)	Time(s)
Tech Demo	1	58	4/19	Takeoff, hover, land	3m	0m	39.1s
	2	61	4/22	Takeoff, 2m lateral, return, land	5m	4m	51.9s
	3	64	4/25	50m out and back	5m	100m	80s
	4	69	4/30	133m out and back	5m	266m	117s
	5	76	5/7	Move to new landing site	10m	129m	108s
Ops Demo	6	91	5/23	Fly southwest, image, land	10m	215m	140s
	7	107	6/8	Fly south, image, land	10m	106m	62s

⋮

More to come…

Flight #4 – 4/30/21 Aerial Mapping

- Onboard Navigation(0.5MP) and Color Cameras (13MP)
- Mapped to orbiter basemap

Flight #6 – 5/23/21 Seitah Imaging

- Aerial science scouting
- Heli color images →serendipitously used for science targeting

Ingenuity – The Technology Today

Accomplishments to Date

- Flight Log
  - 820m total flight distance(7 flights)
    - Longest flight to date 266m
  - 10mins total flight time
  - Downlinked 430 B&W and 32 Color images
- Imaging of science targets with color camera
  - 2.5 mm/pixel - 3cm/pixel in flight
  - 100's of microns resolution when helicopter is landed – enables grain counts
- Creation of orthoimages and digital terrain models using both Navigation(B&W) and Color cameras
- Scouting
- More to come…

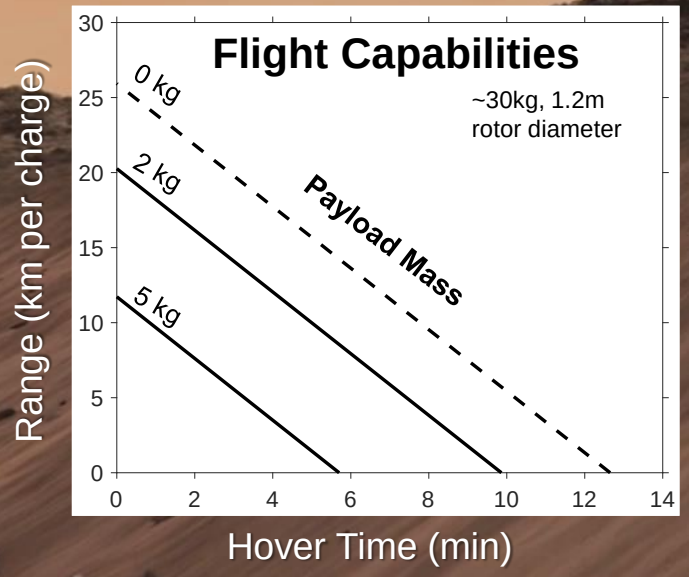
Potential Next Flights

- Stretch capabilities - ~1km, 3 mins aloft
- Operations Demos - Scouting surveys of Seitah region prior to rover driving campaigns
- Science & Eng. Data Mining from Collected Data
- High performance computer available for data compression/analysis
- Please submit your requests…

Future of Martian Rotorcraft

Next-Generation Hexacopter

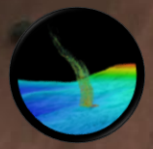
- Science payloads up to 5kg e.g.
  - GPRs, multi/hyper-spectral imagers, magnetometers, meteorology, …
- Sortie distance approx. 10km
- Explore inaccessible or hazardous terrain



*Jezero air densities

Potential Science Themes…

Geologic mapping and stratigraphy



Atmospheric science

Astrobiology and special regions

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tzanetos@jpl.nasa.gov