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Most Significant Long Poles for Humans to Mars

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Key Technology Areas

- Autonomous & Piloted Guidance, Navigation, and Control (GN&C)
  - Planetary Ascent, Descent, and Landing
  - Rendezvous, Proximity Operations, and Docking (RPO&D)
  - Earth Re-entry and Hypersonic Flight
- Fault Tolerant System Architecture and High Reliability Flight Computing
- Radiation Hardened Electronics
- Specialized Sensors and Electronic Systems
- Model-based Design, Systems Engineering, Simulation, and V&V

Draper Space Systems Highlights

Shuttle

Dreamchaser

Cygnus

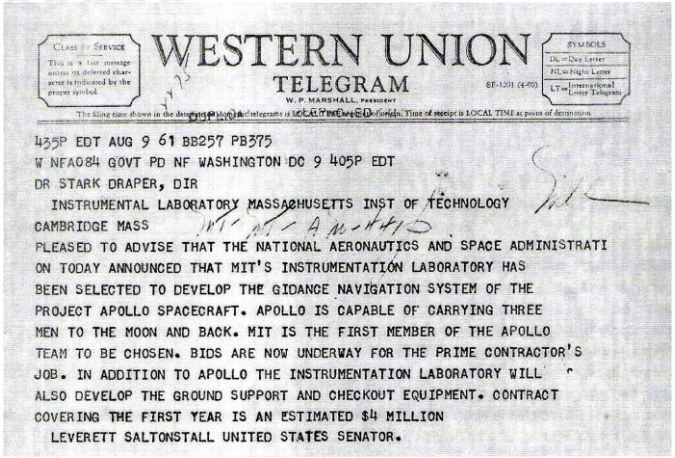
ISS

Orion

SLS

Gateway

HLS



WESTERN UNION
TELEGRAM

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DR STARK DRAPER, DIR
INSTRUMENTAL LABORATORY MASSACHUSETTS INST OF TECHNOLOGY
CAMBRIDGE MASS
PLEASED TO ADVISE THAT THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATI
ON TODAY ANNOUNCED THAT MIT'S INSTRUMENTATION LABORATORY HAS
BEEN SELECTED TO DEVELOP THE GIDANCE NAVIGATION SYSTEM OF THE
PROJECT APOLLO SPACECRAFT. APOLLO IS CAPABLE OF CARRYING THREE
MEN TO THE MOON AND BACK. MIT IS THE FIRST MEMBER OF THE APOLLO
TEAM TO BE CHOSEN. BIDS ARE NOW UNDERWAY FOR THE PRIME CONTRACTOR'S
JOB. IN ADDITION TO APOLLO THE INSTRUMENTATION LABORATORY WILL
ALSO DEVELOP THE GROUND SUPPORT AND CHECKOUT EQUIPMENT. CONTRACT
COVERING THE FIRST YEAR IS AN ESTIMATED $4 MILLION
LEVERETT SALTONSTALL UNITED STATES SENATOR.

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- Precision landing and GNC will enable future human Mars missions
  - *Critical for pre-positioning assets*
  - *Long-duration surface excursions*
  - *Science mapping*
  - *Entry and landing profiles that can support a de-conditioned crew*

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- Any future long-duration, deep-space human mission will endure prolonged radiation exposure, requiring
  - *Avionics that are always on-line and available*
  - *Considerations of human health risks from cumulative exposure*

- Key hurdles and tech enablers
  - *Radiation hardening and long-life certification for individual component availability*
  - *Fault-tolerant avionics and avionics architectures to ensure 100% availability in the event of component failure*
  - *Shorter interplanetary transit times for humans (nuclear propulsion)*
  - *Onboard human protection (SWaP burden)*