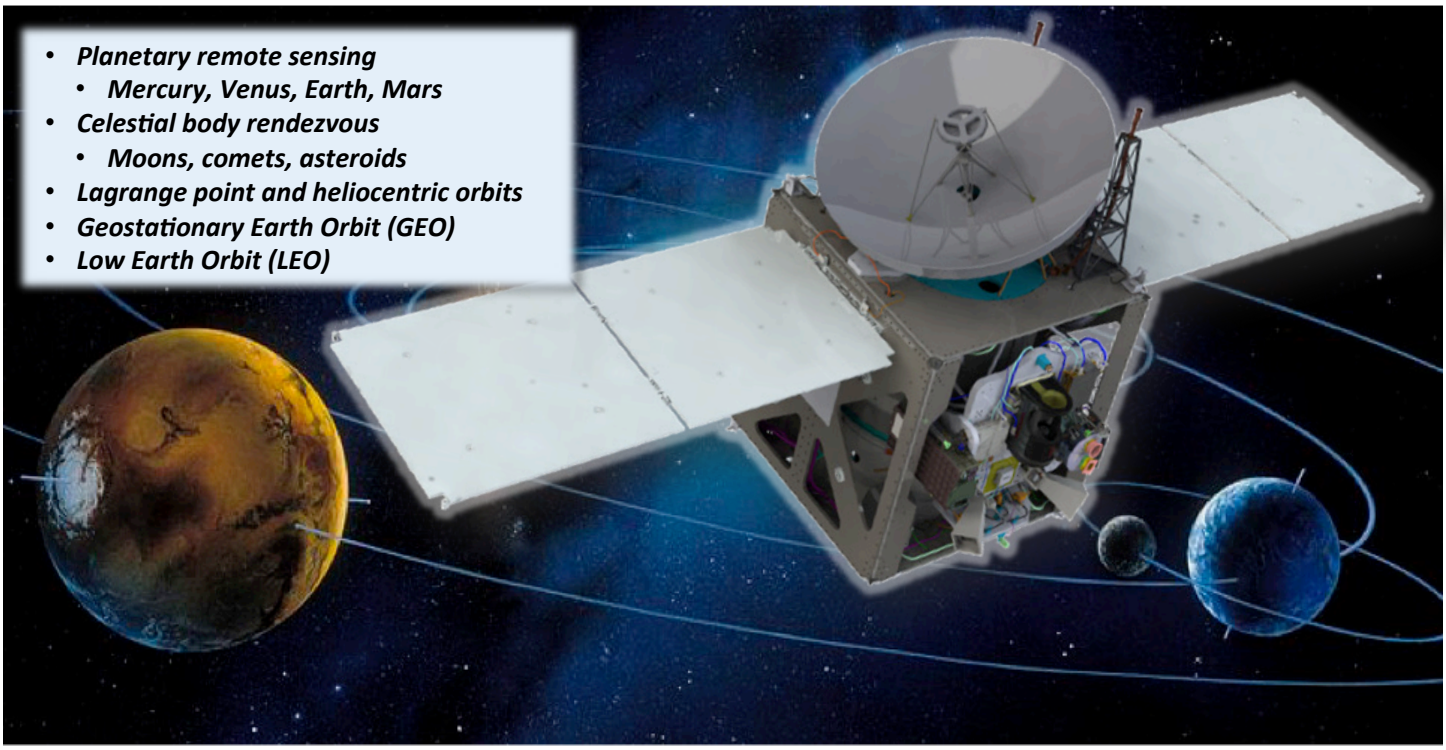
The Astrolabe Bus

Astrolabe can take you where you want to go

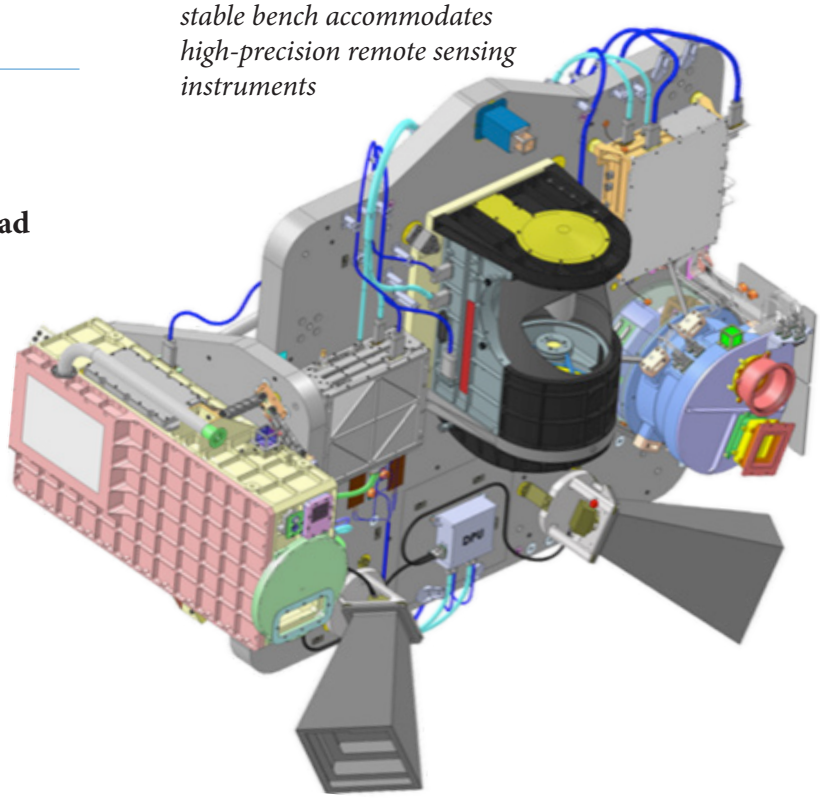
Laboratory for Atmospheric and Space Physics
University of Colorado **Boulder**



Instrument Accommodation (highly configurable)

- **Surface or kinematic mounting**
- **RS-422, LVDS, Spacewire, 1553 interfaces available**
- **Up to 500 kg available to instrument payload**
- **Up to 700 Watts available to instrument payload**
- **~1 Mbps data to Earth from deep space or 10's of Mbps from LEO or GEO**
- **Nadir, zenith, limb, solar pointing**
- **Scanning or stationary**
- **High precision pointing**
  - **Control: 6 arcmin**
  - **Knowledge: 1 arcmin**
  - **Jitter: 2 arcsec/3 sec**
- **Sun avoidance/Sun protection**
- **Thermally isolated or thermally sinked**
- **Precision thermal control available**

Thermally and optically stable bench accommodates high-precision remote sensing instruments



Leveraging our 70 year history of successful space exploration, LASP achieves cost-effective mission and spacecraft customization through whole-system synthesis by our highly experienced systems engineering and program management teams, together with our world-renowned scientists and mission operations group. This unique combination of mission segments within a single organization creates the critical ethos necessary to produce a targeted, effective, and collaborative mission solution.

Astrolabe is a highly configurable bus that can accommodate deep-space, GEO, or LEO missions.

The Emirates Mars Mission (EMM) bus, the origins of Astrolabe, was a joint international effort between LASP and the Mohammad Bin Rashid Space Center in the United Arab Emirates.

- **Heritage components in custom solutions**
- **Parallel integration design maximizes available instrument development time**
- **Agile, responsive, inclusive, and payload-focused development team**
- **Highly test-driven development philosophy**
- **Significant experience developing high-performance pointing platforms**
- **Highly configurable fault-protection systems**
- **International collaboration: ITAR/EAR/Export control and licensing successfully implemented over three years**
- **On-site development labs, clean rooms, and thermal-vacuum testing chambers**

Spacecraft Overview

- **ADCS**
  - 3-axis stabilized, inertially pointed
  - Redundant star trackers and IRUs
  - 4 for 3 reaction wheels
  - 8 for 4 one-Newton RCS thrusters for reaction wheel desaturation, safe mode, and roll control during Delta-V maneuvers
- **Command and Data Handling**
  - Selectively redundant computer with extensive fault protection
  - Architecture supports a fully redundant configuration
- **Flight Software**
  - Based on NASA's open-source CFE-CFS software with mission-specific applications
- **Electrical Power Systems**
  - Direct energy transfer system
  - Deployable, non-articulating arrays, 12 strings; articulated arrays available
  - Lithium ion battery with m-for-n cell redundancy
  - Fully internally redundant Power Control Unit
- **Thermal**
  - Thermostatically and flight software controlled heaters (most redundant)
  - Multi-layer insulation (MLI)
  - Passive radiators
- **Telecom**
  - 1.85-meter high gain antenna
  - Spherical coverage low gain antennas
  - High-reliability deep-space X-band radio talking to NASA's DSN; Ka-band available for higher rate communications
  - 100-watt TWTA
- **Propulsion**
  - Regulated monopropellant hydrazine
  - 6 x 100 Newton Delta V thrusters for planetary orbit insertion or celestial body rendezvous
  - 8 x one-Newton RCS thrusters; larger thrusters available for greater maneuverability
- **Structure**
  - Central thrust cylinder with honeycomb composite panels
- **Launch Vehicle**
  - Compatible with any GEVS enveloped launch capability
  - Proven interface heritage with Mitsubishi Heavy Industries HIIA

Additional Services

Program Management—Adept at tailoring projects for customer-desired levels of engagement, reporting, and access

Mission Design and Navigation—Significant experience in implementing complex, interplanetary orbits and trajectories with partners

Mission, Spacecraft, and Instrument Systems Engineering—Broad experience architecting and implementing mission, spacecraft, and instrument solutions; all under one organizational group to foster collaboration and cohesion

Mission Operations—On-site mission operations experts and facilities implementing turn-key solutions with extensive experience flying both Earth-orbiting and deep-space missions

Data Systems—Hosted data centers, data processing experts, and web-based interactive data tools developers

For more info on Astrolabe and LASP engineering services, please contact:
Pete Withnell at 303-492-1326 or pete.withnell@lasp.colorado.edu.

The Laboratory for Atmospheric and Space Physics (LASP) combines all aspects of space exploration through our expertise in science, engineering, mission operations, and data management. As an institute at the University of Colorado Boulder, LASP includes students throughout our activities. Learn more at http://lasp.colorado.edu.

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