



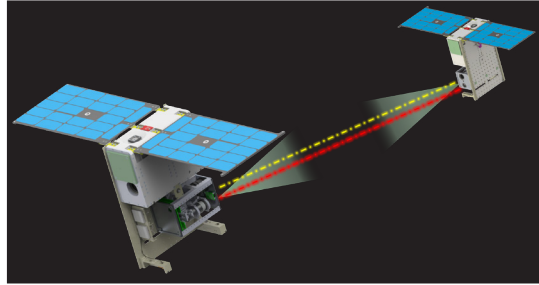
CubeSat Laser Infrared Crosslink

Demonstration of low-cost and low-complexity laser communication technology for CubeSats

The CubeSat Laser Infrared Crosslink (CLICK) mission will demonstrate technology to advance the state of the art in intersatellite communications for small spacecraft. The primary objective of the mission is an on-orbit demonstration of full-duplex (send and receive) laser, also called optical communication, crosslink between two six-unit (6U) small satellites that range in distance between 15 and 360 miles (25 - 580 kilometers) apart at data rates greater than 20 megabits per second (Mbps). The mission will also demonstrate precision satellite-to-satellite clock synchronization and ranging at the 10 cm level. Miniaturized optical transceivers capable of both transmitting and receiving laser communications will form a communication crosslink between the two satellites with their alignment supported with a new fine pointing capability. The miniature optical transceivers are an improvement over radio frequency (RF) technology due to the power efficiency of lasercom high data rate transmission, which lessens the impact on the small platform's already severe constraints on size, weight and power.

Optical technology is mature for terrestrial use through fiber-optic-based systems. Transitioning optical technology to space-based platforms to create communication crosslinks between satellites will leverage commercially available optical components to benefit from their advantages in power efficiency and compact form factor. The CLICK mission will use commercially available components in the near-infrared ITU-C band (1550 nm) to enable high rate crosslinks to prove the next generation, low-cost and low-complexity communication technology that is scalable to gigabits per second (Gbps) data rates.

The CLICK technology will provide crosslink communication for small satellites that will enable NASA science missions that involve constellations or swarms of small satellites. High rate crosslinks are needed when communication nodes within small satellites must rapidly exchange or route significant amounts of data to other satellites or to the ground.



The CLICK mission's wide field of view beacon lasers, depicted as green beams between the spacecraft, help prepare for fine closed-loop pointing. These enable the narrow (<1 degree) field of view full duplex communication lasers, depicted as blue and red dashed lines, to link with each other.

Rapid exchange of observational data can enable onboard image processing that fuses images from multiple spacecraft to look for indicators that would trigger action or additional high-priority observations. NASA science missions involving multiple CubeSats that form a constellation or swarm may carry one or more moderate to high-resolution imaging or scientific sensors that require high data rate processing.

The Massachusetts Institute of Technology in partnership with the University of Florida will design and build the two miniature optical transceiver payloads to be integrated into small satellites provided by NASA Ames Research Center in California's Silicon Valley. It is anticipated that the CLICK mission will require 2 years to develop and prepare for launch.

The CLICK mission is managed and funded by the Small Spacecraft Technology (SST) program within the Space Technology Mission Directorate. The SSTP expands U.S. capability to execute unique missions through rapid development and in space demonstration of capabilities for small spacecraft applicable to exploration, science, and the commercial space sector. The SSTP will enable new mission architectures through the use of small spacecraft with goals to expand their reach to new destinations and challenging new environments.

For more information about the SSTP, visit:
www.nasa.gov/directorates/spacetech/small_spacecraft/

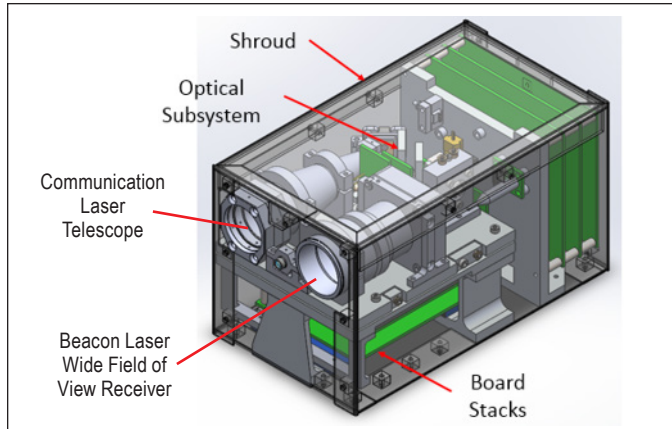
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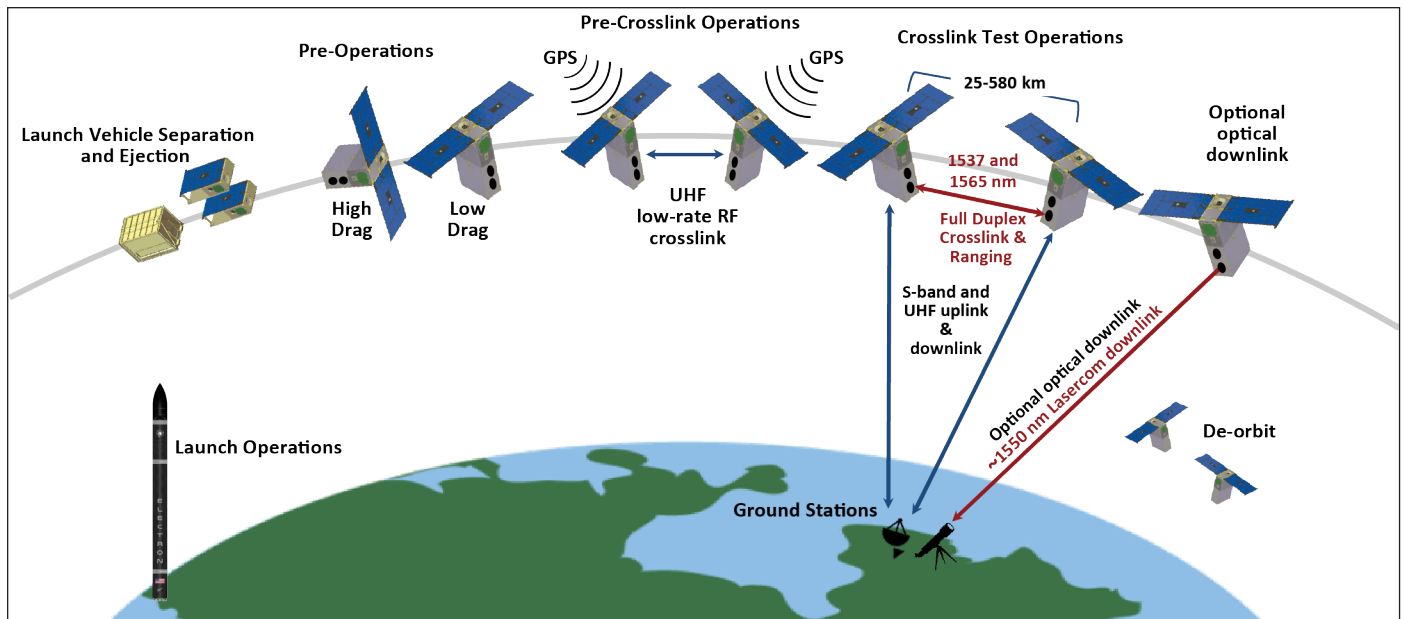
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Top: An isometric view of the CLICK mission's 2-unit (2U) laser communication payload showing the beacon wide field of view (WFOV) receiver, communication telescope and optical table in gray. The electronic boards are shown in green.



The CLICK mission concept of operations involves the following: deployment of the two spacecraft from a 12-unit (12U) dispenser (rocket mount not shown) to minimize separation velocity; differential drag is used to control spacecraft separation; radio frequency crosslink shares the locations of the spacecraft for initial coarse drag crosslink pointing; laser crosslink operations use beacon for acquisition and fine steering mirror with infrared laser for high speed communication crosslink; optional laser downlink; and deorbit at end of mission.

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NASA Facts