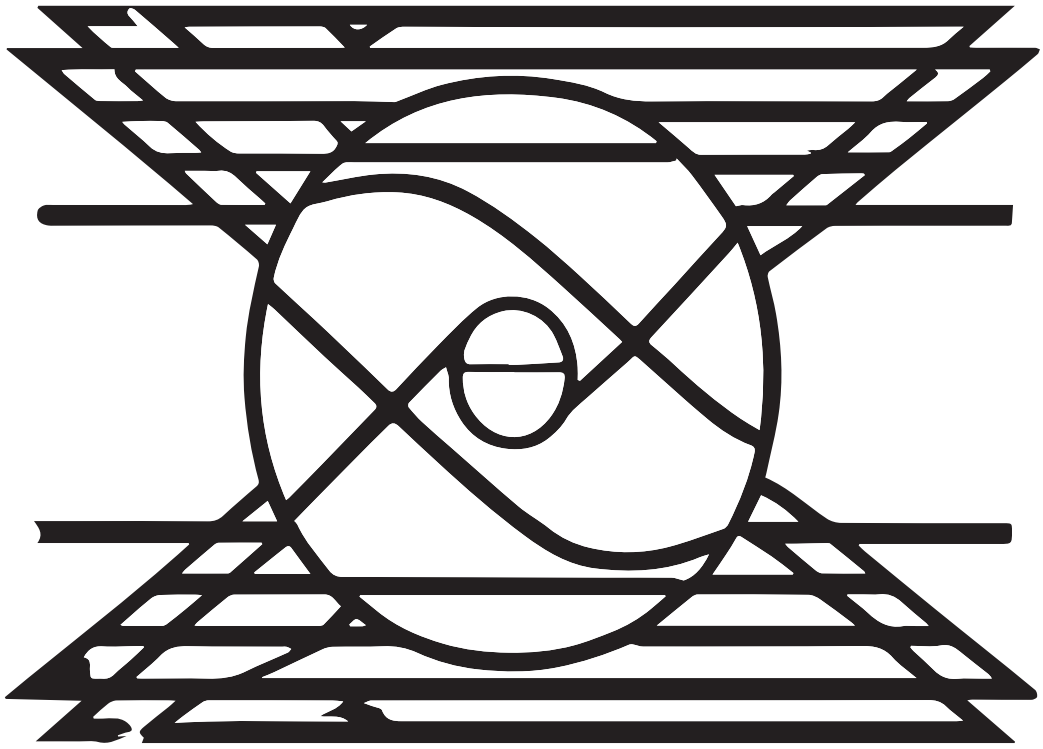

This vitrine contains materials related to Mission Requirement: SOLAR SAIL.

Supercut of videos of solar sails. These videos come from both professional missions to space, concept art, as well as student projects. See if you can also see a few timelapses from the construction of TX-2: MOONSHADOW. Duration: 21:43, no sound.

TX-2: MOONSHADOW Ground Station. This screen presents live telemetry transmitted via Morse code from TX-2: MOONSHADOW in the gallery to the ground station and displayed life. Transmissions happen every five minutes and can be listened to using the headphones. The transmissions and ground station are meant to simulate information that would be necessary for understanding the overall health of the spacecraft as it travels in space.

***Solar Sails: A Novel Approach to Interplanetary Travel* (2014), edited by Giovanni Vulpetti, Les Johnson, and Gregory L. Matloff**. One of the few textbooks about solar sails, as most of the material can only be found in research articles.

"An Advanced Composites-Based Solar Sail System for Interplanetary Small Satellite Missions" (2018), by Juan M. Fernandez, Geoff Rose, Olive R. Stohlman, Casey J. Younger, Gregory D. Dean, Jerry E. Warren, Jin Ho Kang, Robert G. Bryant and Keats W. Wilkie, and presented at the 2018 AIAA Spacecraft Structures Conference. Supported by NASA Langley Research Center. Key information that informed the construction of the sail for TX-2: MOONSHADOW. All details regarding how to cut the sails, how to build them up from smaller fragments of Mylar, of how to attach the ripstops, of what tape to use (and what tape needed to be fabricated by us due to export restrictions), of how to think about the booms, etc., came from this research.

See also: *Low-Cost Gossamer Systems for Solar Sailing & Spacecraft Deorbiting Applications*, PhD dissertation by Juan M. Fernandez.

Solar sail boom test articles, constructed during the development of TX-2: MOONSHADOW. The booms are made from two segments of measuring tape that are themselves taped together using Kapton tape, which has been used for space missions since the 1960s. Booms made from such materials have flown on actual space missions in the past, proving that going to space sometimes only requires commodity materials.

Hand colored engraving of *Acrophylla titan*, by Lebrun after an illustration by Blanchard from Charles d'Orbigny's "Dictionnaire Universel d'Histoire Naturelle" (Universal Dictionary of Natural History), Paris, 1849. One inspiration for the shape of TX-2: MOONSHADOW's solar sails. The eventual goal is to be able to adjust spacecraft attitude by movement of the upper sails, thus imparting torques on the spacecraft due to differential reflection of photons from the Sun.

Solar sail test article, constructed during the development of TX-2: MOONSHADOW. Note the corners, ripstops, fabricated Mylar tape.

Custom fabricated mylar tape. This tape was made using 3M 966 double-sided transfer tape (which has been using in space missions in the past) with Mylar strips adhered to one side. We had to fabricate this tape ourselves as the actual tape that is used for space missions is considered a munition subject to export restrictions.

Completed prototype custom avionics board for TX-2: MOONSHADOW. Due to the current global chip shortage, we had to use a number of breakout boards for the individual components. This board is installed in the sculpture in the gallery and transmits telemetry every five minutes to the MOONSHADOW GROUND STATION situated nearby.

Prototype "antenna" board for TX-2: MOONSHADOW. Some spacecraft now use flat-pack "antennas" for communication with Earth (such as the MARCO cubesats that NASA sent to Mars). Here, we developed our own version that repurposes the antenna boards for the presentation of sigils for queer and trans joy/protection.

Prototype solar panel board for TX-2: MOONSHADOW. This board is an attempt to make thin solar panels using commodity solar cells. Like many other things in the project, the back of the board has protection symbols imprinted on it–you can never be too careful.

TX-2 MOONSHADOW