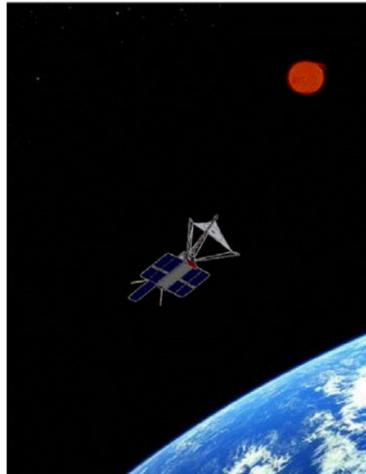
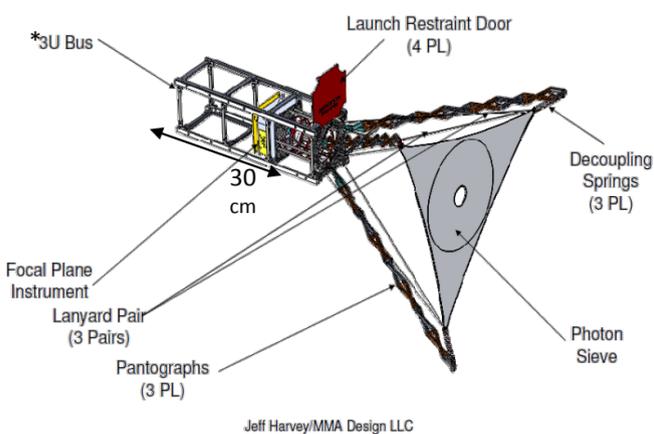


# FalconSAT-7

FalconSAT is an Academy program where cadets design, build, launch and operate their own small satellite. Many departments are involved including physics and astronautical engineering, electrical engineering and mechanical engineering. We are also collaborating with the NRO, DARPA, AFOSR, AFIT, NASA, MMA Design and AFRL to achieve launch by 2014.

FalconSAT-7 is a 3U CubeSat satellite measuring just 30cmx10cmx10cm. The payload is Peregrine: the world's first space-based membrane telescope. The program goals are:

- Deploy a rigid structure supporting a 0.2m membrane photon sieve
- Image the Sun at the H-alpha wavelength of 656.3nm

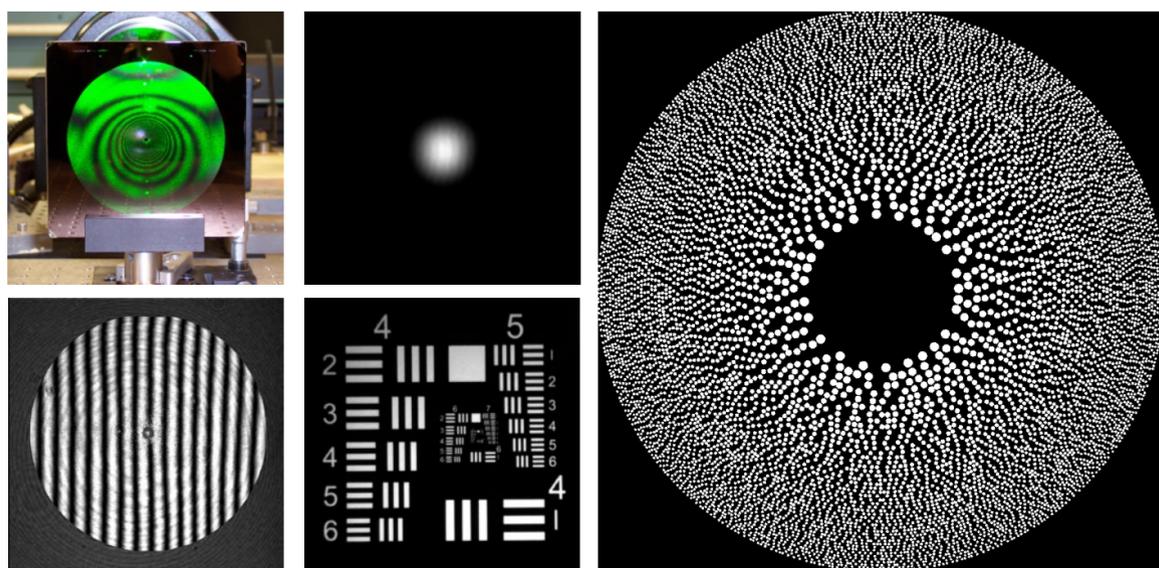


A photon sieve is a novel optical element consisting of a flat opaque sheet with millions of tiny holes. Light passing through these holes is focused in a similar manner to a lens or a mirror. Photon sieves have several key advantages over those more conventional optics:

- Focusing can be achieved from a flat, thin sheet that can be unfurled from a very compact, lightweight package
- Surface quality tolerances are orders of magnitude more relaxed
- The fabrication costs are much lower

The trade-offs include:

- Lower efficiency / loss of light
- Narrow bandwidth giving what are essentially grayscale images



Clockwise from top left: A 4-inch photon sieve lit by laser light. The focal spot produced. A magnified image of the central 25mm. An image of a resolution chart produced by the sieve. An interferogram of the wavefront that indicates perfect focusing capability.

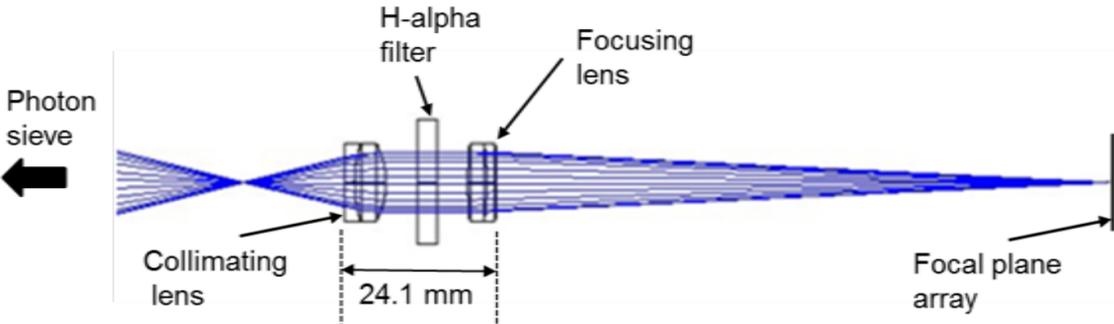
The photon sieve will have the following design parameters:

- 200mm diameter, 400mm focal length, 656.3nm wavelength
- 2.5 billion holes ranging in size from 2-277 microns
- 50% fill factor, 30% focusing efficiency

The telescope has a relatively simple design due to space constraints and has:

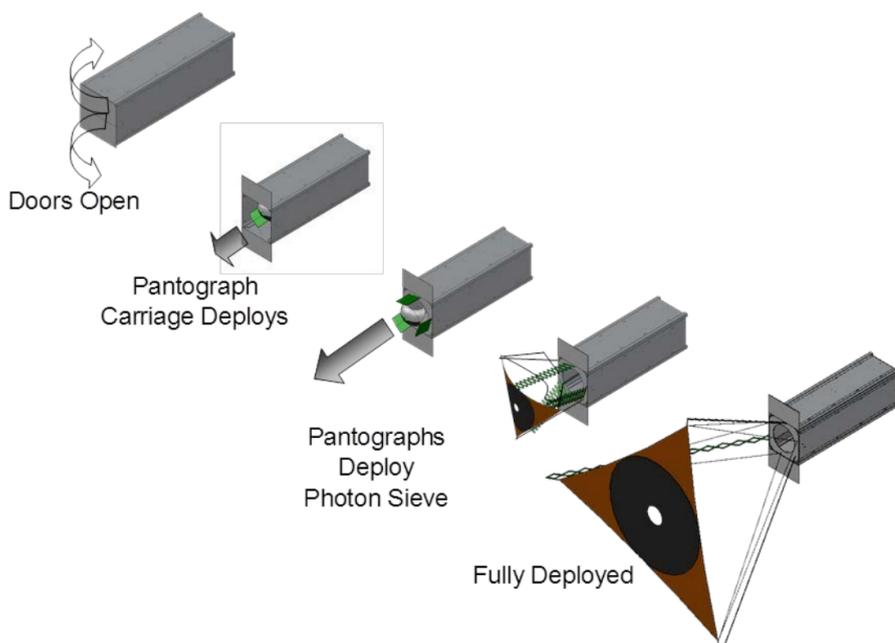
- 4 μrad resolution which equates to 600 km at Sun surface
- ~0.1 degree field of view (about a 1/5<sup>th</sup> of the Sun's disk)
- 1 Ångstrom spectral bandwidth

A schematic of the secondary optics is shown below.



The primary, support structure, two cameras, secondary imaging elements and imaging electronics are all configured to fit within one half of the 3U satellite, with the other half occupied by communications, power, attitude control and miscellaneous avionics.

As well as having a revolutionary focusing element, Peregrine will demonstrate a novel deployable structure. The deployment mechanism consists of pantographs and lanyards designed to deploy the primary from a stowed configuration to a flat sheet under tension. A series of images showing the deployment process is shown below.



For more information contact:

- Dr. Mike Dearborn: [michael.dearborn@usafa.edu](mailto:michael.dearborn@usafa.edu), 719-333-4800
- Dr. Geoff McHarg: [matthew.mcharg@usafa.edu](mailto:matthew.mcharg@usafa.edu), 719-333-2460
- Dr. Geoff Andersen: [geoff.andersen@usafa.edu](mailto:geoff.andersen@usafa.edu), 719-333-2829