# 14. Deployment Mechanisms and Structures

The GOES-NOP spacecraft contains seven appendages and mechanisms that are stowed for launch and later deployed during transfer orbit or at various phases of on-orbit testing. These deployable mechanisms and appendages are:

- Aft omni antenna
- Deployable aft blanket (DAB)
- Solar array
- X-ray positioner (XRP)
- Magnetometer boom
- Optical port covers
- Instrument radiant cooler covers

Each deployment is initiated by pyrotechnically driven bolt cutters or pin pullers. Each bolt cutter contains a redundant initiator and cutting anvil. Each pin puller contains redundant initiators that fire into a common chamber. The bolt cutters cut a tensioned bolt, which is retracted, into a bolt catcher. These deployments occur at four phases during the GOES-NOP mission.

- Shortly after separation from the launch vehicle on day 1 of Launch and Orbit Raising (LOR), the Aft omni and DAB are deployed.
- On approximately LOR day 12, once geosynchronous orbit is achieved, the solar array is deployed. This is followed by release of the XRP and magnetometer boom deployment on LOR days 13 and 14.
- The instrument optical port covers are deployed at the end of Bus In-Orbit Testing (IOT) on LOR day 17.
- Deployment of the instrument radiant cooler covers occurs after 30 days of instrument outgassing, which begins at the start of PLT.

## Aft Omni Antenna

The aft omni antenna is shown in Figure 14-1. The aft omni assembly consists of two tubes bonded and bolted into two fittings. The omni antenna is mounted to the end of the assembly. When deployed, the aft omni provides omni antenna coverage throughout transfer orbit.

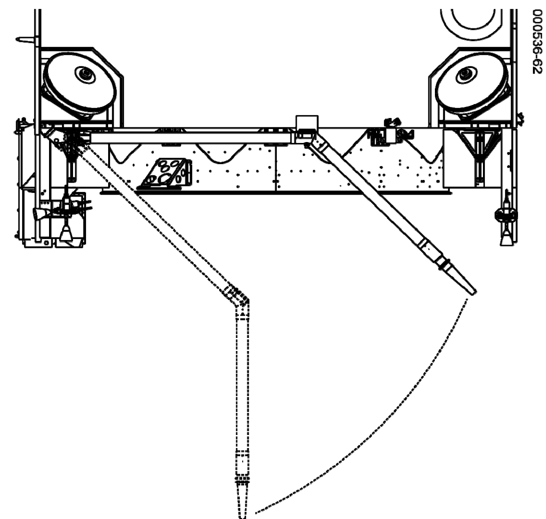


**Figure 14-1. GOES Aft Omni Antenna**

## Deployable Aft Blanket

The DAB should be viewed as a pair of blankets with a launch lock rather than as a mechanism. The DAB consists of two semi-circular blankets that close out the aft section of the spacecraft. The blanket is held against the thrust cylinder by battens. The battens act as stiffeners that hold the blanket in the deployed position. When stowed, the battens are curved such that the restraining cords along the perimeter of the DAB reach the launch lock.

## Solar Array

The GOES-NOP solar array comprises two elements. The solar panel contains most of the solar cells that power the spacecraft. The solar array yoke serves as a platform for the solar observatory containing the SXI and XRS/EUV instruments as well as a precision sun sensor and angular displacement sensor. During launch, the solar array is restrained by six launch locks. Figure 14-2 shows both solar array elements. The solar array mates to the solar array drive through a 90° viscously damped hinge mechanism called the solar array actuator.

The solar array is released by firing six pyrotechnic bolt cutters. The bolt cutters are fired in pairs. The top pair is fired first followed by the bottom pair, then the center pair. Solar array motion is initiated by push off springs located at each of the six launch lock locations. The spring forces separation of the panel and yoke from the spacecraft. After release of the launch locks, the solar array actuator deploys the solar array through a 90° angle and latches it in place. The two hinges located at the panel to yoke interface rotate 180° and latch. Coordination of the motion of the actuator, yoke, and panel is maintained by a coordination cable that connects the hinge in the solar array actuator to the hinge line at the yoke to panel interface.

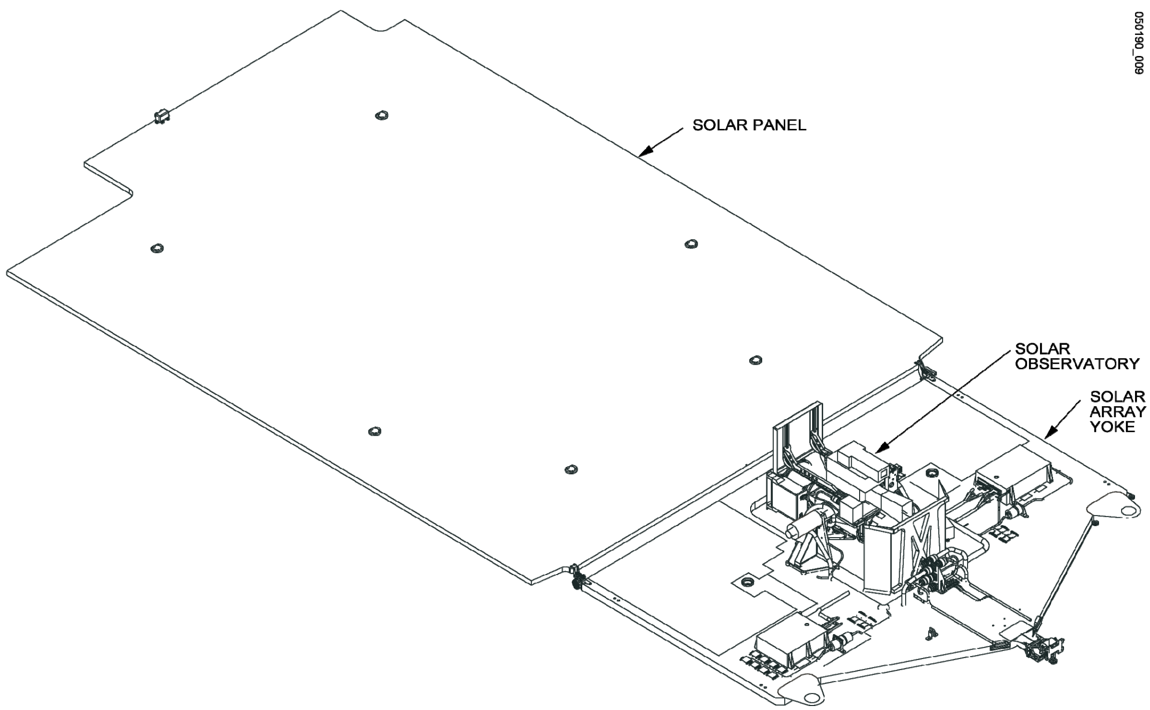


**Figure 14-2. Elements of the GOES-NOP Solar Array**

## X-ray Positioner

The XRP, shown in Figure 14-3, is a single axis closed loop control gimbal that rotates to maintain SXI pointing accuracy. The XRP rotates the entire solar observatory suite consisting of the SXI telescope, the XRS/EUV instrument, angular displacement sensor, and a precision sun sensor.

The XRP is locked during ascent and transfer orbit with two pyrotechnic pin pullers. One pin puller is located on each half of the XRP. When fired, the pin is retracted, releasing each half of the mechanism. Release is confirmed using motor current measurements. The XRP launch locks are fired after the solar array is deployed on station prior to the initial outgassing period.

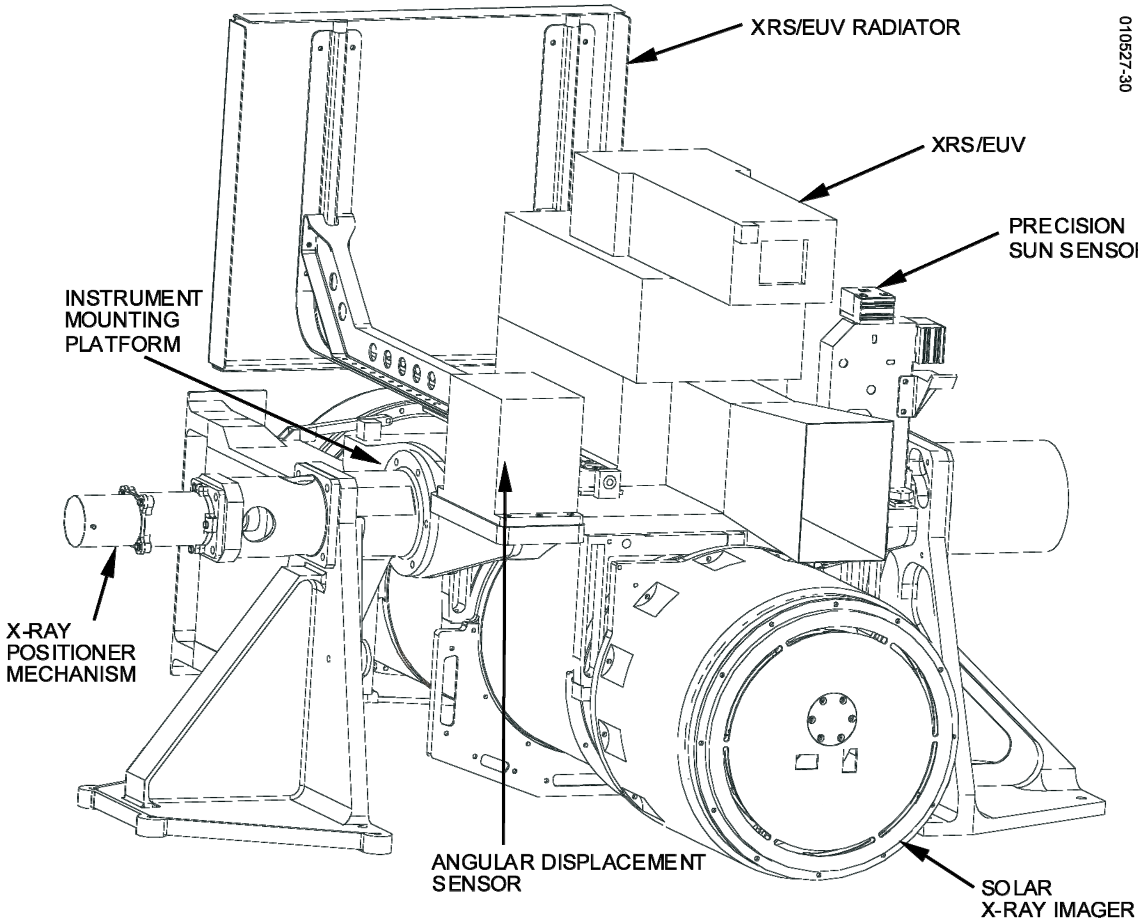


**Figure 14-3. X-ray Positioner in Deployed Orientation**

## Magnetometer Boom

The magnetometer boom is a coilable truss element that is contained within a canister during LOR. The deployed magnetometer boom is 8.5 meters long and contains two magnetometer sensors that are approximately 0.8 meters apart. The magnetometer boom is restrained by a pyrotechnic pin puller. The stored strain energy in the coiled boom elements provides the energy required to deploy the boom. Deployment speed is regulated by a friction damper that acts as a brake.

## Optical Port Covers

The optical port covers are two separate deployable covers that protect the imaging port of the Imager and Sounder prior to deployment. The port covers serve two purposes. First, the optical port is protected against falling debris during the launch and ascent phase of the mission. Secondly, the covers serve to limit heat loss through the optical ports during transfer orbit. Increased heater power would otherwise be required during transfer orbit. The optical port covers are deployed pyrotechnically using a bolt cutter.

On command, the bolt cutter cuts a tensioned bolt that allows the hinge mechanism to rotate approximately 270° as shown in Figure 14-4, clearing the Imager and Sounder Fields-of-View as shown in Figure 14-5. Each cover is deployed separately. Nominally the Sounder port cover is deployed first followed several seconds later by the Imager cover. Both bolt cutters contain redundant initiators in the event of a failure of the primary. Field of view analysis has been done with the covers deployed out of order (Imager first). That analysis shows that the sensor field of view requirements are met in either configuration. The location of the optical port covers on the Imager/Sounder mounting plate is shown in Figure 14-6.

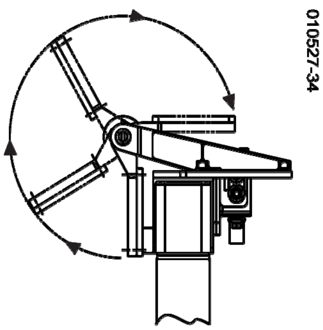


**Figure 14-4. Optical Port Cover Deployment**

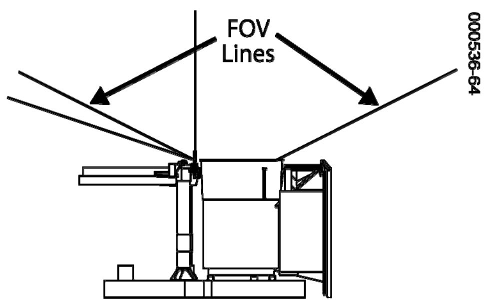


**Figure 14-5. Imager and Sounder FOV requirements are met after the optical port cover is deployed.**

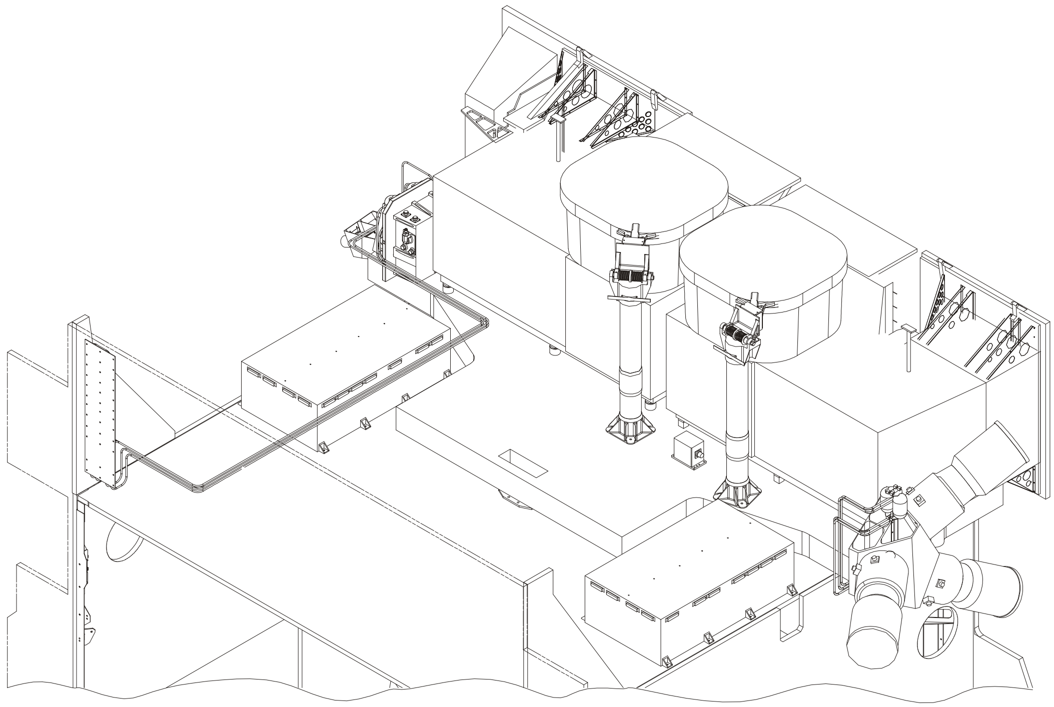

Figure 14-6. a) Optical Port Cover Locations—Stowed Configuration

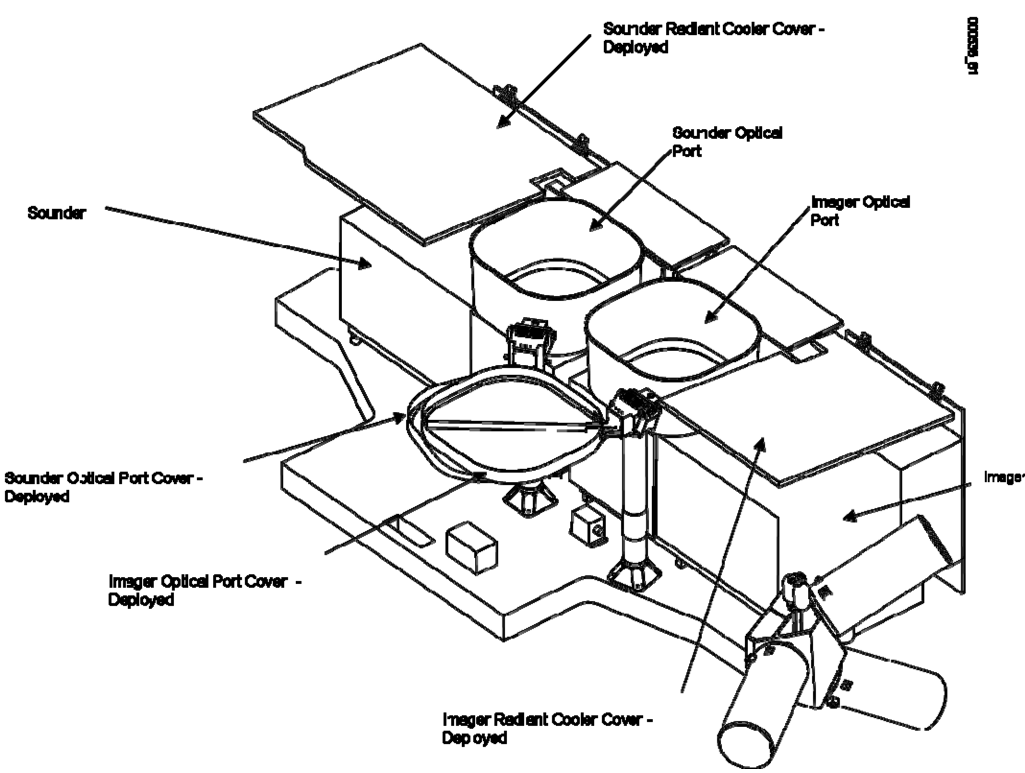


Figure 14-6. b) Optical Port Cover Locations—Operationally Deployed

## Instrument Radiant Cooler Covers

There are two covers integral to the Imager and Sounder. Each instrument contains the release device, restraint cable, and hinge mechanism. The radiant cooler covers are deployed during in orbit testing after the initial outgassing period. The cooler covers perform the following functions:

- Protect the infrared detectors from being heated by direct sunlight during the launch and orbit raising period.
- Protect the radiant coolers and emitters from contamination during launch and orbit raising period.
- Reduce outgas heater power requirements at acquisition of geosynchronous orbit.

Figure 14-7 shows the Imager or Sounder instrument with the cover in the closed position.

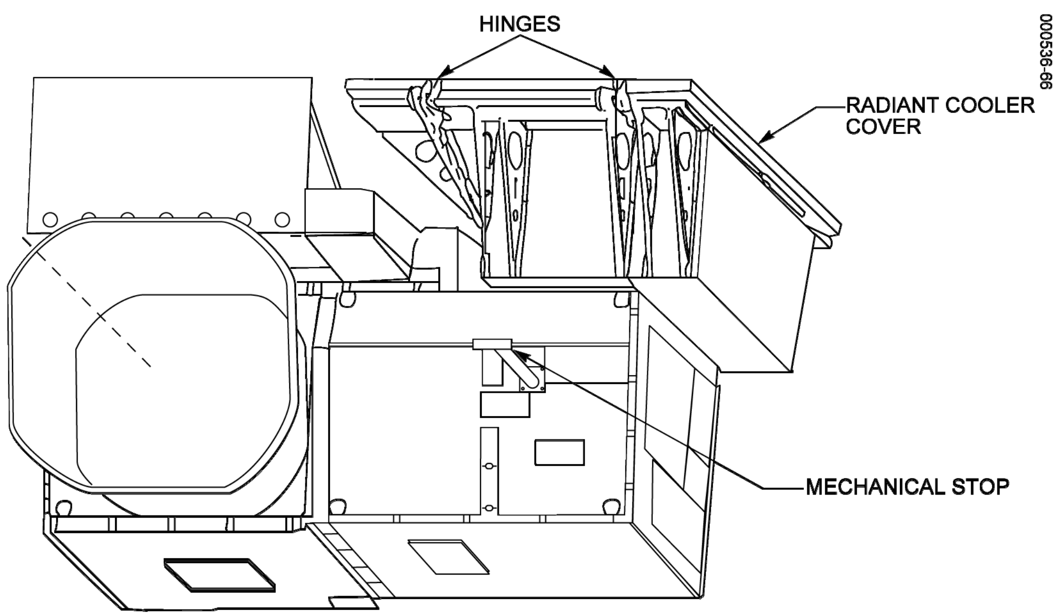


**Figure 14-7. Radiant Cooler Cover in Closed Position**

## Structure Subsystem

The GOES-NOP spacecraft structure is based on the Boeing 601. The structure consists of honeycomb structural panels, which form a box. The honeycomb panels are mounted to corner posts that serve as primary load carrying elements to react to launch loads through the structure. Internal struts and stiffeners provide additional stiffness. An

Imager/Sounder mounting plate, optical bench, is mounted on top of the box and also carries star trackers and the inertial reference unit. The Imager/Sounder mounting plate is thermally isolated from the spacecraft in order to limit the impact of spacecraft temperature changes on the Imager and Sounder performance. The spacecraft structure is optimized for weight efficiency. The entire structure is mounted on an adapter ring that provides a mating interface to the launch vehicle. The spacecraft primary structure is shown in Figure 14-8.

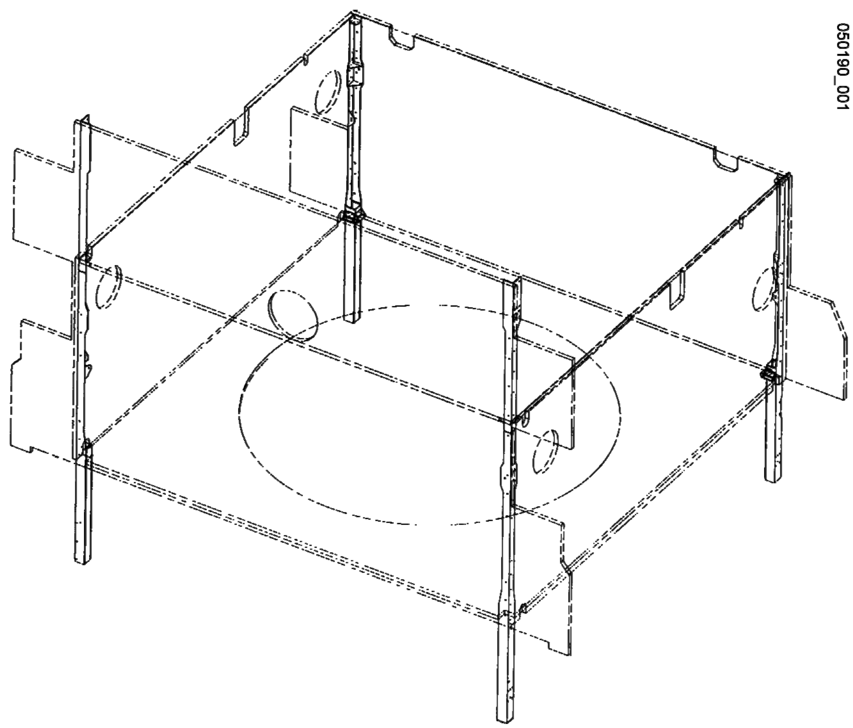


**Figure 14-8. Spacecraft Primary Structure**