Mounting Instruments on NASA's P-3 Aircraft

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1 Introduction

This memo describes the options available for mounting instruments on NASA's P-3 research aircraft. Data and pictures presented here were compiled mainly from a visit made by the author to the aircraft on June 20, 2002. At this time, the P-3 was located at NASA's Wallops Flight Facility (WFF) at Wallops Island, VA, and was being prepared for the 2002 Soil Moisture Experiment (SMEX'02). Experiments already installed on the aircraft included the following: NASA GSFC's Electronically-Steered Thinned Array Radiometer (ESTAR), NOAA's Polarimetric Scanning Radiometer (PSR), and a GPS Ground Reflectometry experiment.

2 Bomb Bay

The P-3's modified bomb bay is shown in Figures 1 and 2. The overall exterior dimensions of the bomb bay are approximately 82" wide × 41.4" deep × 153" long.

The bomb bay is unpressurized and consists of forward, middle, and rear areas. Each of these three areas is accessible from underneath as well as through access panels on both sides. On the day of the visit, ESTAR was mounted in the forward area and PSR was mounted in the rear area. The center area was vacant except for a baffle which was mounted outside and underneath the middle area. Some additional detail of the center area is shown in Figure 3.

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Figure 1: View of the bomb bay from the starboard side. The nose of the aircraft is to the right.

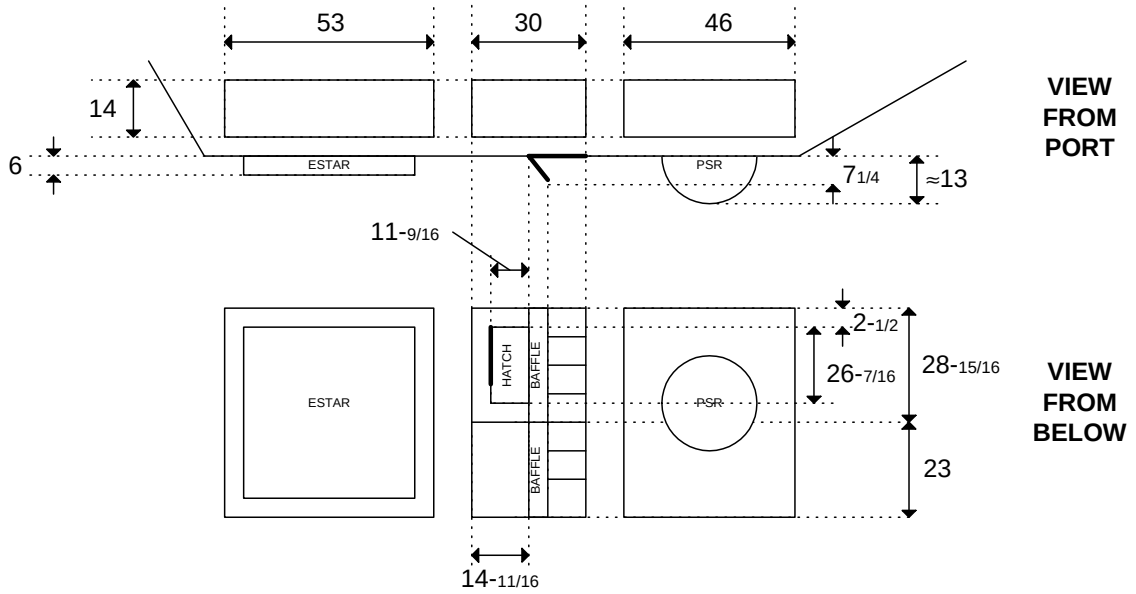

Figure 2: Dimensions of the bomb bay. All dimensions are in inches. This drawing is approximately, but not exactly, to scale.

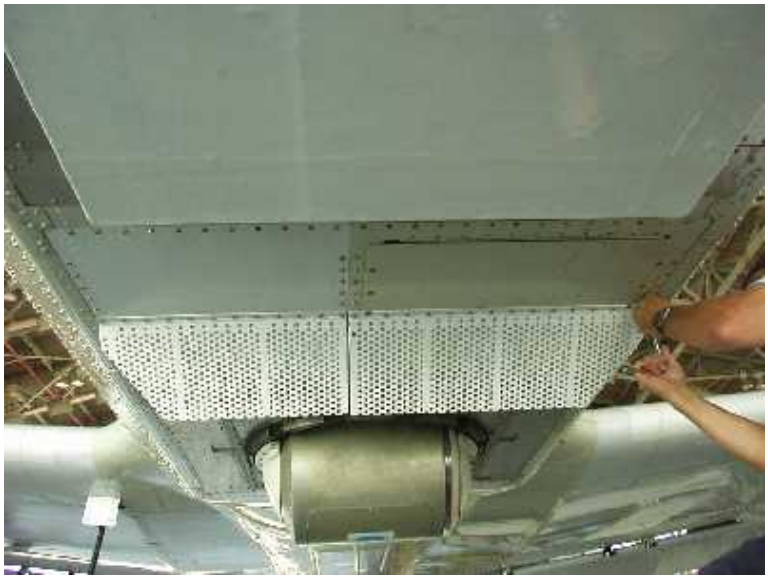

Figure 3: Detail of center area of bomb bay and baffle. Note the hinged door on the port side (right side of the picture). This door appears to open out normally, but here is pinned down by the baffle hardware. If the door were open and the baffle were removed, the resulting aperture would be 24" wide × 25" in the direction of flight.

WFF personnel stated that the maximum wind load expected on sensors using the bomb bay was about 2 pounds per square inch. They also stated that 090-thickness aluminum was sufficient for wind-bearing surfaces.

Figure 4 shows the exterior of the center area of the bomb bay with the port side access panel removed. Looking inside, one sees the views shown in Figures 5 and 6. Since the bomb bay is not pressurized, cable egress between the instrument modules in the bomb bay and the consoles in the cabin is through a bulkhead plate. For example, the ESTAR cables shown in Figure 6 emerge into the cabin as shown in Figure 7. Four additional circular bulkheads, unused but presumably also for cable egress into the cabin, were noted. These are visible in Figure 6.

3 Cabin Area

The cabin area consists of a small passenger area immediately behind the cockpit, followed by a large area which is divided into bays containing instrument racks, consoles, and a pair of seats. Figure 8 shows a view of two equipment bays. A closeup

Figure 4: Bomb bay viewed from port, with the side access panel for the center area removed.

Figure 5: View from just inside open access shown in Figure 4, looking slightly forward. The large black enclosure is ESTAR. The yellow rectangular area in the foreground is the port side half of the nadir facing center access panel. The interior of the bomb bay is 46.5" high. The ribs running along the floor of the bomb bay are 2.5" high.

Figure 6: View from just inside open access shown in Figure 4, looking up (toward the floor of the cabin) and slightly forward. The bundle of cables towards the top of the picture is for PSR, and the bundle of cables towards the bottom is for ESTAR.

Figure 7: ESTAR cables emerging into cabin area. The diameter of the circular bulkhead is 7-3/8".

of the ESTAR bay is shown in Figure 9. Forward of the cabin door, there are 5 bays on the port side and 2 bays on the starboard side. There are additional bays to the rear of the cabin door.

Each rack was of the standard 19" type, and was bolted to the floor as follows. The floor of the cabin has two pairs of parallel tracks. Each pair of tracks is separated by 31-1/2", which is a little less than the width of a pair of 19-in racks. Each track has openings 3/4" in diameter at a spacing of one inch, for inserting bolt heads. The thread ends of the bolts (pointing up) fit through holes in L-shaped brackets running along the bottom front and rear of the pair of racks. The brackets in turn are bolted to the racks. The spacing between bolts on the rack-sides of the L-brackets was about 24".

Each bay (here, pairs of racks) receives power from overhead outlets using MS3476W18-8P connectors (for pinout, see [1]). When equipment is installed, WFF personnel can provide standard 110VAC power strips that plug into these outlets, providing two $\times$ 15A per bay.

Only bays with installed equipment had seating. Experimenters typically fly with their equipment.

Figure 8: A view of the instrument racks from the middle of the large cabin area, looking forward. Two instruments are visible, both on the left (port) side: ESTAR (closest to the observer) and PSR (just behind ESTAR).

The cabin contains a pair of 21" × 18.5" (oval) on both sides of the forward cabin area and at least three additional 18" × 15" (oval) windows in the main cabin area.

4 Nadir-Facing Tail Ports

This section describes some of the nadir-facing ports available on the tail end of the aircraft. Figures 10 through 12 show various ports intended for optical equipment. Each uses "scientific-grade" glass and has room for mounting equipment behind the glass. The equipment areas behind the glass are pressurized.

Figure 13 shows a location for mounting a small antenna. In addition, at least four additional small teardrop-shaped mounting points were noted. All of the teardrop-shaped ports were located further to the rear, beyond the rearmost optical port.

Acknowledgments

Thanks to David Easmunt of Dyncorp (at NASA WFF) for providing information and access to the aircraft.

Figure 9: The ESTAR equipment bay.

Figure 10: Forward Nadir Optical Port. Located immediately behind the trailing edge of the wings. This port can be accessed via a hatch located a few feet forward of the port (just barely visible in picture). Equipment is mounted on a pair of parallel rails running along the direction of flight above the port. These rails are identical to the ones appearing in the floor of cabin (described in Section 3). *Picture courtesy of D. Easmunt, WFF.*

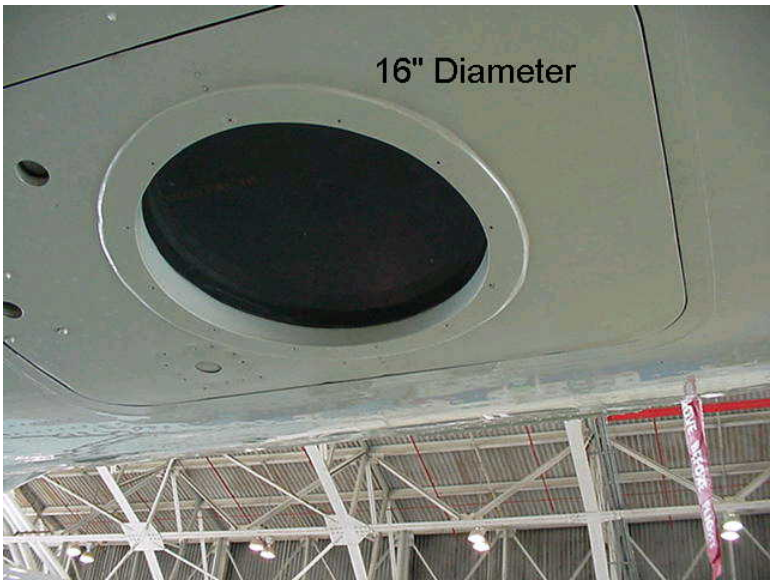

Figure 11: Middle Nadir Optical Port, located a few feet to the rear of the forward port (Figure 10). *Picture courtesy of D. Easmunt, WFF.*

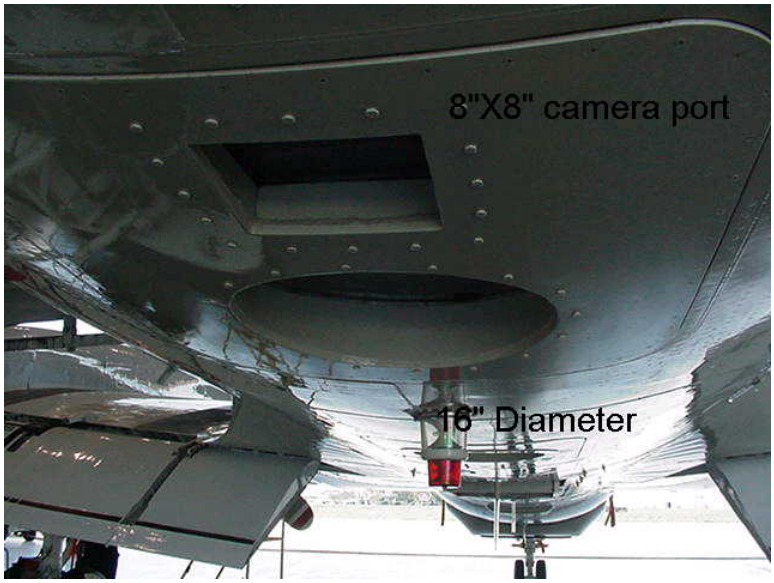

Figure 12: Rear Nadir Optical Port(s), located a few feet to the rear of the middle port (Figure 11). *Picture courtesy of D. Easmunt, WFF.*

Figure 13: Small mounting point for an external antenna (also visible forward of the optical port shown in Figure 10). At the time of the visit, the nadir-looking antenna for the GPS reflectometry instrument was mounted here. *Picture courtesy of D. Easmunt, WFF.*

References

[1] http://www.wff.nasa.gov/~apb/epwr.htm