PHOTOVOLTAIC ARRAY ASSEMBLY (PVAA):

Payload Bay

185 pounds

Overview

The STS-97 crew will bring the first of eight sets of solar arrays that – at the completion of Space Station construction in 2006 – will comprise the Station's electrical power system, converting sunlight to electricity.

The ISS derives its power from the conversion of solar energy into electrical power. The Photovoltaic Power Module – or "P6" – performs this energy conversion.

The P6 has four primary functions: the conversion or generation, storage, regulation and distribution of electrical power for the ISS.

The Solar Arrays Unfurl to their Full Length

The P6 has two identical PVAAs which themselves consist of two major elements:

The Solar Array Assembly (SAA) containing two Solar Array Wings (SAW) connected to a mast which is folded into a Mast Canister before deployment.

The Beta Gimbal Assembly (BGA) consists of: a) Mast Canister which houses the folded mast, b) "Bearing, Motor and Roll Ring module" (BMRRM) used to rotate the SAW and transfer power, c) Electronic Control Unit (ECU) used to control the BGA motor and mast rotation, and d) Sequential Shunt Unit (SSU) used to coarsely regulate the SAW output voltage. Power generated by the PVAA is routed via the SSU to the IEA.

There are two solar array wings on the P6 module, each deployed in the opposite direction from each other. Each SAW is made up of two solar panels mounted to a common mast. Prior to deployment, each panel is folded into a Solar Array Blanket Box (SABB) measuring 20 inches high and 15 feet in length.

The mast is housed in a Mast Canister Orbital Replacement Unit (ORU). The mast ORU is comprised of the following items: the canister, the Folding Articulated Square Truss (FAST), upper and lower pivot fittings, tip fitting, a Motor Drive Assembly (MDA), wire harness and beta gimbal platform assembly.

When fully deployed, the SAW extends 115 feet and spans 38 feet across. Since the second SAW is deployed in the opposite direction the total wing span is over 240 feet.

Each Solar Array Wing is the largest ever deployed in space, weighing over 2,400 pounds and using nearly 33,000 solar arrays, each measuring 8-cm square with 4,100 diodes. Each SAW is capable of generating nearly 31 Kilowatts (kW) of direct current power. There are two SAWs on the P6 module yielding a total power generation capability approaches 64 kW, enough power to meet the needs of 30 average homes – without air conditioning (based on an average 2kW of power.)

BGA measures 8 x 8 x 2 feet and provides a structural link between the Integrated Electronics Assembly (IEA.)

The BGA's most visual functions are to deploy and retract the SAW and rotate it about its longitudinal axis. The BGA consist of three major components: the Bearing, Motor and Roll Ring Module (BMRRM), the Electronic Control Unit (ECU) and the Sequential Shunt Unit (SSU).

The motor used to rotate, deploy and retract the solar arrays is a three-phase, 200W DC stepper motor. The system has a rotational pointing accuracy of +/- 1 degree and a maximum rotational rate of +/- 200 degrees per minute. Rotational rate is obtained by pulse width modulation of the input DC power. The motor has a maximum operating torque of 380 in-lb. and a maximum stationary torque of 1,700 in-lb.

The Roll Rings allow the transfer of power from the rotating (Mast Canister) side of the BGA to the stationary (IEA) side of the BGA. These rings can transfer up to 35kW.

The ECU controls the motor that rotates,deploys and retracts the SAW. The ECU operates off of 120 VDc and receives its power from the DDCU located within the IEA. Commanding of the ECU is from a computer also located within the IEA. The ECU measures 23 x 12 x 14 inches.

The SSU is designed to coarsely regulate the solar power collected during periods of insolation – when the arrays collect power during sun-pointing periods . A sequence of 82 separate strings, or power lines, leads from the solar array to the SSU. Shunting, or controlling, the output of each string regulates the amount of power transferred. The regulated voltage setpoint is controlled by a computer located on the IEA and is normally set to around 140 volts. The SSU has an overvoltage protection feature to maintain the output voltage below 200 V DC maximum for all operating conditions. This power is then passed through the BMRRM to the DCSU located in the IEA. The SSU measures 32" by 20" by 12" and weighs 185 pounds.
