12. Propulsion

The GOES N-P propulsion subsystem provides the means for attitude control and the incremental velocities at apogee and perigee required for final injection into geostationary orbit. This is a bipropellant propulsion system consisting of one 490 N (110 lbf) liquid apogee motor (LAM) and twelve 9.25 N (2 lbf) low thrust thrusters (LTT) for attitude control. Monomethylhydrazine (MMH) is the fuel, and nitrogen textroxide (NTO/MON-3) is the oxidizer. These hypergolic propellants are contained in four spherical tanks pressurized by helium (He) supplied from two cylindrical tanks. In-line filters are used to filter the pressurant and propellants. The propellants and pressurant are loaded into the propulsion subsystem through several fill and drain valves. These valves also allow offloading if necessary. Check valves are used upstream of the propellant tanks to mitigate propellant vapor migration into the pressurant tanks. A block diagram of the propulsion subsystem is given in Figure 12-1. Figure 12-2 illustrates various GOES propulsion subsystem components.

The 490 N thruster is a restartable unit designed for multiple transfer orbit firings. The 9.25 N thrusters provide attitude control during apogee thruster firing, stationkeeping, and on-orbit control throughout the mission.

After the orbit transfer maneuvers are completed, squib valves are fired isolating the high pressure portion of the subsystem, and the propulsion subsystem is operated in a blow-down mode for the remainder of the mission. Pressure transducers are used to monitor the pressure in the subsystem. A propellant management device (PMD) in each propellant tank controls the location of propellant in the zero-gravity space environment. This device enables gas-free propellant to be supplied to the tank outlet for all thruster firings throughout the spacecraft's operational life. Latch valves are located at the exit of each propellant tank to isolate the tanks during extended periods of nonuse and to control the spacecraft center of mass movement.

All GOES propulsion subsystem components have extensive Boeing Satellite Systems flight heritage. The GOES spacecraft is based on the Boeing 601 design.

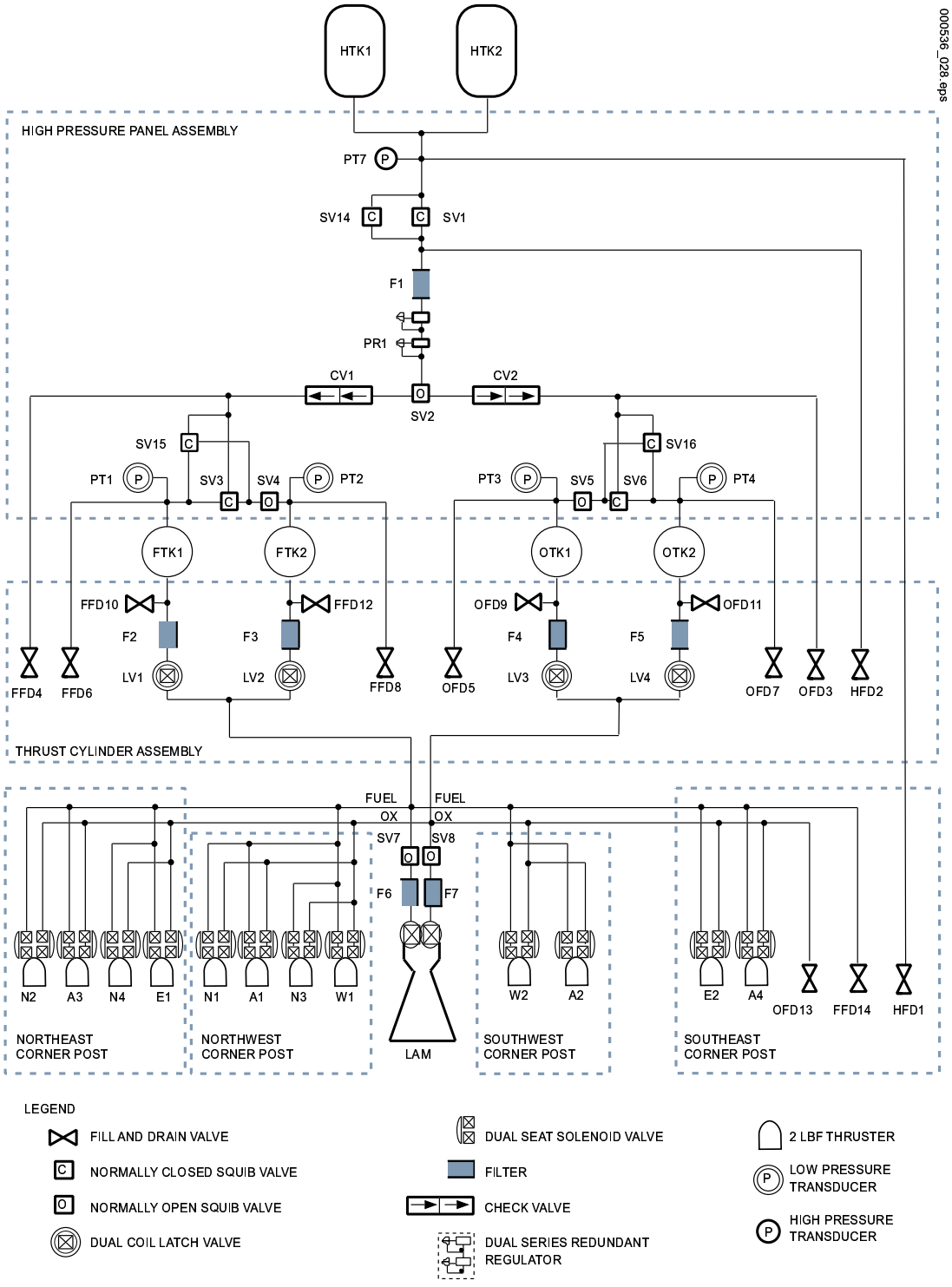
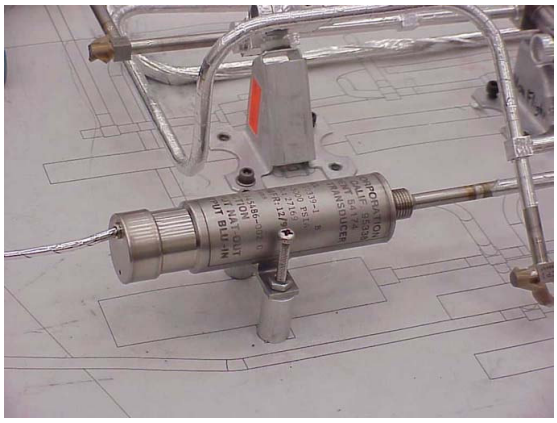


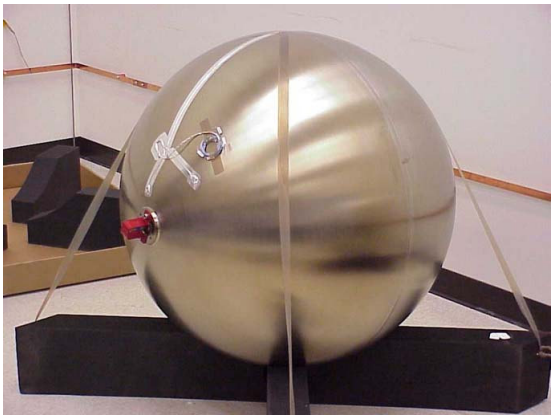
Figure 12-1. GOES Propulsion Subsystem

a) 490 NEWTON THRUSTERs

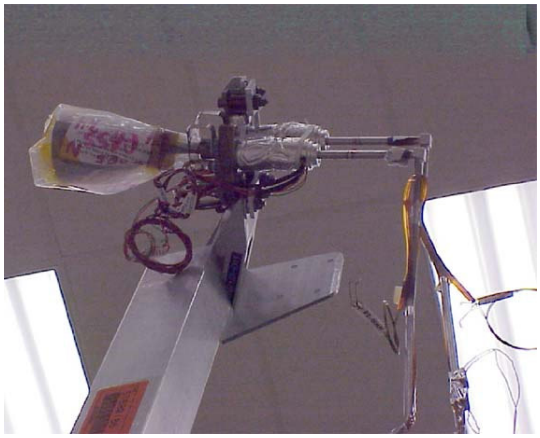
b) IN-LINE FUEL FILTER



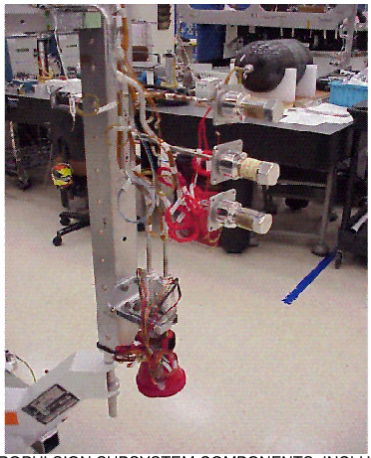
c) PRESSURE TRANSDUCER



d) PROPELLANT TANK



e) 9.25 NEWTON THRUSTERS



f) VARIOUS PROPULSION SUBSYSTEM COMPONENTS, INCLUDING HELIUM TANK (REAR RIGHT), FILL AND DRAIN VALVES (BOTTOM MIDDLE RIGHT), AND 9.25 N THRUSTER (BOTTOM CENTER)

Figure 12-2. Various GOES Propulsion Subsystem Components

The 9.25 N attitude control thrusters perform control operations required in geostationary orbit throughout the mission. These operations include:

- Sun acquisition and attitude maintenance
- Earth acquisition
- Momentum wheel spinup control
- Apogee dispersion correction
- North-south stationkeeping
- East-west stationkeeping
- On-orbit attitude control operations
- Station change (relocation in geostationary orbit)
- De-orbit at end of life