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Space-to-Space Weapons Situation (Continued)

Orbits in the LEO domain can also be defined as either 'prograde' or 'retrograde' orbits. Prograde orbits are orbits with inclinations between 0° and 90° while retrograde orbits are orbits with inclinations between 90° and 180° . The distinction is based on the fact that satellites with inclinations greater than 90° rotate about the earth in the direction opposite to the rotation of the earth on its axis, hence, the term retrograde. Conversely, prograde satellites rotate about the earth in the same direction as the earth's rotational motion. The term is of significance only in that there exists a special class of retrograde orbits that are known as sun-synchronous orbits. Because the earth is not a true sphere, gravitational forces cause the orbit plane of a satellite to precess in inertial space. Here inertial space is simply a reference frame to which all motions can be described relative to the orientation of its composite axis system. The precession rate of the orbit depends upon its inclination and altitude above the earth. If these parameters are selected carefully, an orbit can be established that exhibits a special rate of precession whereby the plane of the satellite orbit rotates once per year in inertial space. To an observer on the ground, a satellite covers the same track in the sky at the same time each day because the precession rate of the orbital plane just matches the day to day change in the earth's relation to sun as the earth moves around the sun. This orbit is referred to as sun-synchronous and is of particular interest to satellites carrying optical instruments like photo-reconnaissance and remote sensing satellites since the angle between the sun and the surface of the earth is relatively constant for all observation points along a particular latitude.

Figure 2-3 illustrates the distribution of the satellites for the past four years according to the orbital parameters, inclination and semi-major axis. For a circular orbit, the semi-major axis is simply the altitude of the orbit above the surface of the earth plus the mean radius of the earth measured from its geometric center. The three dimensional plot excludes 4 civilian interplanetary, 4 civilian highly elliptic astronomical and one military satellite for which the orbital elements have not been published. Figure 2-4 focuses on the low earth orbit satellites in the