If the earth were a perfectly homogenous sphere, and if no further propulsion were applied to the satellite, the plane in which its orbit lay would never change. However, the earth is slightly flattened at the poles, and the resulting effect of its gravitational attraction on the satellite is to cause the plane of the orbit to rotate very slowly at a rate determined by the angle it makes with the equator (called the inclination), and also by the height of the orbit above the earth. Orbits passing directly over the north (and south) pole will not rotate. By selecting an inclination of about 98° the orbit can be made to rotate through 360° in one year, and therefore (as the earth goes around the sun) to preserve a constant angle with the sun. There are advantages to be gained from such a "sun synchronous" orbit. For a satellite designed for overhead (or low angle shadowed) photography of the earth's surface, the preferred angle can be maintained throughout the year. Or it may be important to keep the satellite out of the earth's shadow and illuminated by sunlight 24 hours a day in order to receive maximum solar energy to supply electrical power for the satellite's sensor, control devices, and communications.

Satellite Paths as Seen from the Earth

Although the rotation of the earth provides an initial component of velocity with which the satellite is propelled into space, once the latter is in its trajectory above the atmosphere the only further influence of the earth is its force of gravity. To trace the path of a satellite as seen from the surface of the earth, it is helpful to visualize the motions of both the earth and the satellite with respect to space itself.

Figure 6 illustrates a satellite following a low circular orbit, in a plane with an inclination of 75° and a period of 91 minutes. The flattened shape of the earth will cause this plane to rotate about 2° per day in a westward direction with respect to space. Meanwhile, the earth is rotating eastward about its own polar axis, at a rate of one revolution per day. The satellite crosses the equator going northeast every 91 minutes. To follow one complete orbit, suppose that the satellite crosses the equator at time 0 at longitude 0°, going northeastward. The point on the surface of the earth directly beneath the satellite will proceed on a track curving northeast towards east, graze latitude 75°N,