**Satellite Orbits**

Reference Notes:

1. Killer satellite ASAT in low orbit
2. Manipulated by Jihad to cause erratic behavior
3. Repositioning causes alerts to NORAD
4. Attempt to disable PCS first, followed with GPS and COMM satellites
5. Disables PCS systems – low orbit
6. Disables GPS systems – medium orbit
7. Disables TV/Radio signal communications systems – high orbit

Low Earth Orbit (Observation / Asynchronous 80 – 1,200 miles)

* Surveillance/spy/military satellites
* PCS – Personal Communications System – Cell phones
* Reconnaissance satellites are in Low orbit approx 250 – 450 miles
* Within the Van Allan radiation belt
* Constellation for Satellite Phone service
* Iridium – 66 satellites coverage
* Globalstar system
* Direct/Mobile TV broadcast
* Internet access
* Signal latency is low

Low Earth Orbit (Science / Asynchronous 3,000 – 6,000 miles)

* Researching plants and animals
* Earth science, such as monitoring volcanoes
* Tracking wildlife
* Astronomy, using the Infrared Astronomy Satellite
* Physics, by NASA's future study of microgravity
* Current Ulysses Mission studying solar physics

Medium Earth Orbit (Navigation / Asynchronous 6,000 – 12,000 miles)

* GPS systems – 24 to 32 satellites for global coverage
* Semi synchronous
* Orbit at 12 hours a day
* 12,645 miles
* In a ship at sea
* In another spacecraft
* In an airplane
* In an automobile
* In your pocket

High Earth Orbit (Synchronous / Geosynchronous 22,223 – Geostationary)

* Geosynchronous near Equator
* Geostationary
* Synchronized with earth orbit once daily
* Typically 550 to 650 milliseconds round-trip signal delay
* Communications satellite
* TV, Radio Communications
* Signal Relay Communications
* Signal latency is high – 250 milliseconds

Cellular telephony has brought us a new technological "system"-- the personal communications system (PCS). In the fully developed PCS, the individual would carry his telephone with him. This telephone could be used for voice or data and would be usable anywhere. Several companies have committed themselves to providing a version of this system using satellites in low earth orbits (LEO). These orbits are significantly lower than the TELSTAR/RELAY orbits of the early 1960s. The early "low-orbit" satellites were in elliptical orbits that took them through the lower van Allen radiation belt. The new systems will be in orbits at about 500 miles, below the belt.

The most ambitious of these LEO systems is Iridium, sponsored by Motorola. Iridium plans to launch 66 satellite into polar orbit at altitudes of about 400 miles. Each of six orbital planes, separated by 30 degrees around the equator, will contain eleven satellites. Iridium originally planned to have 77 satellites-- hence its name. Element 66 has the less pleasant name Dysprosium. Iridium expects to be providing communications services to hand- held telephones in 1998. The total cost of the Iridium system is well in excess of three billion dollars.

A group of satellites working in concert is known as a satellite constellation. Two such constellations, intended to provide satellite phone services, primarily to remote areas, are the Iridium and Globalstar systems. The Iridium system has 66 satellites. Another LEO satellite constellation known as Teledesic, with backing from Microsoft entrepreneur Paul Allen, was to have over 840 satellites. This was later scaled back to 288 and ultimately ended up only launching one test satellite.

A **low Earth orbit** (**LEO**) is generally defined as an orbit within the locus extending from the Earth’s surface up to an altitude of 2,000 km. Given the rapid orbital decay of objects below approximately 200 km, the commonly accepted definition for LEO is between 160 - 2,000 km (100 - 1,240 miles) above the Earth's surface.

With the exception of the lunar flights of the Apollo program, all human spaceflights have been either in LEO or have been sub-orbital. The altitude record for a human spaceflight in LEO was Gemini 11 with an apogee of 1,374.1 km.

**Orbital characteristics**

Objects in LEO encounter atmospheric drag in the form of gases in the thermosphere (approximately 80–500 km up) or exosphere (approximately 500 km and up), depending on orbit height. LEO is an orbit around Earth between the atmosphere and below the inner Van Allen radiation belt. The altitude is usually not less than 300 km because that would be impractical due to the larger atmospheric drag.

Equatorial low Earth orbits (ELEO) are a subset of LEO. These orbits, with low inclination to the Equator, allow rapid revisit times and have the lowest delta-v requirement of any orbit. Orbits with a high inclination angle are usually called polar orbits.

Higher orbits include medium Earth orbit (MEO), sometimes called intermediate circular orbit (ICO), and further above, geostationary orbit (GEO). Orbits higher than low orbit can lead to earlier failure of electronic components due to intense radiation and charge accumulation.

**Global Spy Satellites**

A **spy satellite** (officially referred to as a **reconnaissance satellite**) is an Earth observation satellite or communications satellite deployed for military or intelligence applications.

These are essentially space telescopes that are pointed toward the Earth instead of toward the stars. The first generation type (i.e. Corona and Zenit) took photographs, then ejected canisters of photographic film, which would descend to earth.

Corona capsules were retrieved in mid-air as they floated down on parachutes. Later spacecraft had digital imaging systems and downloaded the images via encrypted radio links.

In the United States, most information available is on programs that existed up to 1972. Some information about programs prior to that time are still classified, and a small trickle of information is available on subsequent missions.

A few up-to-date reconnaissance satellite images have been declassified on occasion, or leaked, as in the case of KH-11 photographs which were sent to *Jane's Defense Weekly* in 1985.

Examples of reconnaissance satellite missions:

* High resolution photography (IMINT)
* Measurement and Signature Intelligence (MASINT)
* Communications eavesdropping (SIGINT)
* Covert communications
* Monitoring of nuclear test ban compliance (see National Technical Means)
* Detection of missile launches

**U.S. reconnaissance satellites**

[**IMINT**](http://en.wikipedia.org/wiki/Imagery_Intelligence)

Photographic: KH-1 CORONA**·** KH-2 CORONA**·** KH-3 CORONA**·** KH-4A CORONA**·** KH-4B CORONA**·** KH-5 ARGON**·** KH-6 LANYARD**·** KH-7 GAMBIT**·** KH-8 GAMBIT**·** KH-9 HEXAGON**·** KH-10 DORIAN

Electro-optical: SAMOS**·** KH-11 KENNAN**·** KH-12**·** KH-13**·** FIA

Synthetic aperture radar: LACROSSE**·**

Infrared: ???

[**SIGINT**](http://en.wikipedia.org/wiki/Signals_intelligence)

Low Earth orbit: GRAB**·** Poppy**·** White Cloud**·** SAMOS F

Highly elliptical orbit: [Jump seat](http://en.wikipedia.org/wiki/Jumpseat_(satellite))**·** Trumpet

Geosynchronous Earth orbit: Canyon**·** Magnum**·** Mentor**·** Mercury**·** [Rhyolite/Aquacade](http://en.wikipedia.org/wiki/Rhyolite/Aquacade)**·** Vortex