SPACE POLICY AND LAW COURSE 2019

ORBIT AND LAUNCH CASE STUDY
THESE EXAMPLES ARE TRUE

CASE STUDY 1:

1. On 3 February 2009, Iran launched a satellite into orbit for the first time.

2. On 4 February 2009, it was commented that the satellite was "put into geostationary orbit over Israel?"

3. *Discuss the above Comment*.

CASE STUDY 2:

1. During the early-mid 1960s, the USAF planned to fly a spacecraft known as the 'Manned Orbiting Laboratory' (MOL) on a series of missions to explore, through experiments and tests, tasks a military space crewman could usefully perform in orbit.

2. About halfway through its development cycle (before the first launch), the programme, which had been announced publicly, became 'dark'.

3. At about the same time, the proposed launch site was moved from Cape Canaveral (Kennedy Space Centre) to Vandenberg AFB in California.

4. Vandenberg AFB is on the California coast near Santa Barbara – the coastline runs north-west to south-east with the launch pads ranged along the coast.

What reasons might the USAF have had for this change of location?

Historical notes:

a. The program director had to testify before Congress in 1966, and took questions about this change, which he could not answer!

b. The MOL program was cancelled in 1969 before any operational flights.

c. The 'answer' to this puzzle was finally declassified in 2014.

CASE STUDY 3:

1. 2nd June 1979 saw the launch of Ariel VI, the UK's last satellite in the Ariel series. It was finally switched off in February 1982.

2. Some aspects of the satellite operated in an unpredictable way. High voltage power supplies and tape recorders switched off unexpectedly with server loss of data.

The spacecraft itself seemed not to be faulty, what might have been the cause?

CASE STUDY 4:

1. In the 1970's the science community was looking for the next generation of X-ray observatory.

2. They wanted a satellite that could maintain long, uninterrupted observations of distant newly discovered X-ray sources without the day-night problems of Low Earth Orbit (LEO).

3. They could not afford access to NASA's deep space network and did not want to be dependent on on-board storage tape-recorders that were unreliable.

4. The radiation levels in GEO are not compatible with sensitive X-ray instrumentation.

What was their solution?

ORBIT AND LAUNCH CASE STUDY
SOLUTIONS AND DISCUSSION POINTS

CASE STUDY 1:

You could not position a geostationary satellite 'over' Israel, since it is not on the Equator. At best, you could put it at the same longitude, where it would 'see' Israel at an oblique angle.

It would be within sight of Iran at the same time, so there would be no major communication issues.

What mission might it perform? It would struggle due to orbital altitude and look angle to provide imagery at any sort of detail. It could provide missile launch warning (though this is a technically challenging task), or other surveillance. Or it might carry a communications payload.

Nobody has yet (2019) to my knowledge achieved direct injection into GEO; it would be a tremendously inefficient way of getting there. GEO is typically reached via a transfer orbit, and for a practical payload it would take days/weeks/months before achieving an operational system.

Iran would, of course, need to apply for a GEO 'slot' – it has been an ITU member in good standing since 1869.

CASE STUDY 2:

The reason for the change of launch location was to allow the MOL to be launched into a polar orbit, as opposed to a more moderately inclined orbit from Cape Canaveral (launch safety arc).

Vandenberg has an unobstructed southerly track over the Pacific, which allows a safe launch into a polar orbit.

The polar orbit would allow the MOL to eventually overfly everywhere on the Earth's surface. The MOL had acquired an operational role as a reconnaissance system.

For many reasons manned spacecraft are not ideal reconnaissance platforms, although cancellation meant they did not become apparent.

The Congressional Committee included members from Florida – who assumed the launch transfer was due to nefarious influence from the 'West Coast Space Community'. The program director could not enlighten them, due to the classification of the mission.

CASE STUDY 3:

Terrestrial interference from Soviet early warning radar was found to be the cause. The problems occurred as the satellite entered the domain of this system.

Since it was not likely that the Soviets would cooperate to avoid this problem a partial solution was found by the addition of extra ground stations in the USA, Kenya and Australia.

Ultimately around 50% of the science data was lost. However, the disruption to the satellite's science programme was probably the greater harm, since operations planning was very difficult

Ariel V had been a great success, but not so Ariel VI

CASE STUDY 4:

The mission was ExoSat that had a highly eccentric orbit that took it over the North Pole.

Its inclination was 72^{o} ; its orbit was 340 km (perigee) – 193,000 km (apogee); Its orbital period was 90.6 hours.

A single ground station in the Spain could remain in continuous contact with the satellite with no need for significant on-board storage. Observations could be up to 80 hours.

This was the first effective real-time X-ray Observatory.