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MAN-MADE METEORS

Ken Tapping, 10th March, 2015

In late February, Western Canada was treated to a spectacular display. A Chinese space vehicle had entered the atmosphere, disintegrated and burned up. Brilliant, burning fragments crossed the sky, leaving glowing trails as they disintegrated. This sounds just like the story of a conventional, natural meteor (often called shooting stars), but there are differences you can look for when seeing such things that will enable you to make a good guess as to whether it is "one of ours".

The Earth's atmosphere does not just end at some height, it just gets thinner and thinner until it merges with the solar wind. A few hundred kilometres up it is more rarefied than the vacuum in the cathode ray tube in an old TV, but there is still something there. When you are moving through it at around 30,000 km/h, it is something to be reckoned with.

Somewhere in the beginning chapters in most of the standard books on space flight, there is a cartoon to show what "being in orbit" really means. The cartoon shows a cannon, on a hilltop, with its barrel horizontal. It fires a cannonball which travels for some distance in a trajectory that curves downwards to the ground. After it leaves the gun there is no further propulsion; the ball is just falling. Then the gun is reloaded with another cannonball and more gunpowder. So the ball goes further before it hits the ground. Eventually, after a number of firings with increasing amounts of gunpowder, assuming we have not blown up the cannon in the meantime, we see something intriguing. Once again the cannonball leaves the gun and follows the usual curving downward trajectory, except that the curvature is now so shallow that the ground is curving away under it. The Earth is a sphere, and the ball falls along its curving path, not hitting the ground until it has gone all the way round the world. Assuming it does not slam into the breach of the cannon it will just keep going round and round the Earth, not managing to hit the ground. It is in orbit. That is why we refer to something in orbit as being in "free fall", because that is exactly what is going on. Any passengers in an orbiting spacecraft need to get used to a continuous feeling of falling.

We put the cannon on top of a hill to suggest getting above the atmosphere, because friction against the air will bring the cannonball to ground sooner, and it would never get around the world no matter how hard we fired it. The cannonball would be vaporized by atmospheric friction.

Even hundreds of kilometres up there is some atmosphere, which eats away at the speed of anything orbiting through it. This causes the orbit height to drop, which brings it into a denser atmosphere, which in turn makes the orbit drop further. It is a vicious cycle that ends up with the spacecraft diving into thick atmosphere at high speed and burning up. The only way to avoid this for spacecraft in "Low Earth Orbit" (LEO for those in the business), which includes the International Space Station, is to give it an occasional boost.

Natural objects coming in from space are usually solid objects of rock or iron, or a combination of the two, moving at speeds that can exceed 100,000 km/h, which often dive into the atmosphere at steep angles. This hypersonic "belly flop" can make almost anything burn up and disintegrate, but it happens very quickly. Manmade things are hollow, and usually in almost circular orbits by the time they start their final dives, and are moving more slowly. So when we see something streaking across the sky, burning up in a few seconds, it probably comes from Mother Nature. On the other hand, if it takes ten seconds or more to cross the sky, disintegrating and burning up as it goes, it may be one of ours.

Venus lies in the southwest after sunset, with Mars close by and much fainter. Jupiter dominates the southern sky overnight and Saturn rises around 1am. The Moon will reach Last Quarter on the 13th.

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