

Artificial comet over Cape Town

Greg Roberts

Introduction (Editor)

When asked by the public what the best time is to observe a comet, they often want to know the time to the minute, expecting it to zip across the sky at great speed. Conditioned by Hollywood, they may even anticipate the passage to be accompanied by sound effects! Well, if you happened to look towards the south-east, low on the horizon on the morning of 28 June 2006, you would have seen such an “artificial comet” passing in just more than 5 minutes, before disappearing over the eastern horizon. And if you had a radio tuned to the correct frequency, you could have added the Hollywood-style sound track. Since he anticipated this event, Greg Roberts successfully observed it from Cape Town. It was also seen by others, by accident, who wanted to know what it was. Greg Roberts explains:

As part of a worldwide network of amateur radio and visual observers who concentrate on observing classified objects, I was able to observe this expected event. The object was from the NROL-22 launch – a classified National Reconnaissance Office (USA) launch from Vandenberg Air Force Base in California. Although it was the 14th flight of the EELV (Evolved Expendable Launch Vehicle) program, this was the first launch from the west coast of America and of the new generation powerful Boeing Delta IV rocket which can place in excess of 4000 kg into a Molniya type orbit, a highly elliptical, highly inclined orbit, often used by spy satellites.

Launch was originally scheduled for 03.20 UT on 28 June 2006, but due to strong local winds, was delayed to just before the 13 minute launch window closed and lift-off took place at 03.33 UT. At 03:34:35 the two strap-on solid fuel booster rockets burnt out and were jettisoned whilst the main liquid hydrogen/liquid oxygen RS-68 engine continued to burn for a further 2½ minutes when the first stage separated and fell back to earth. The second stage, consisting of an RL10B-2 liquid hydrogen/liquid oxygen engine, then ignited and fired for almost 10 minutes at which time the spacecraft was travelling southwards towards the tip of South America, in an elliptical parking orbit of 193 x 2215 kilometres (see Fig. 1).

A mere 40 minutes after launch, the spacecraft cleared the South African horizon, within range of the Overberg Test Range (OTB) tracking station, who were providing S-band coverage of telemetry data for the mission for the US tracking network. At this point, the second stage was re-ignited (Fig. 1, point 3) and was fired for 3 minutes, performing the final orbital insertion burn.

The amateur group’s orbital analysts had pre-computed the flight trajectory and as the only amateur member who had optical visibility, I was required to track it. I had my video satellite tracking system set up and ready for action in the early hours of the morning. The second stage ignition was too low down on my horizon, obscured by local buildings, so I

only acquired it optically shortly after the end of the second stage burn which took place at 04h16:34.2.

I then tracked the spacecraft whilst the second stage was venting its hydrogen tank. This produced a comet-shaped cloud that moved across the sky from the south towards the east at about 28 degrees elevation. I followed it until the spacecraft set behind some local buildings at 04:32:04. At this time the vehicle was in a 1117 x 37642 km orbit inclined at 62.4 degrees to the equator.

The comet-shaped cloud was not very bright and on the video imagery acquired, was about 1.3 degrees long at the bottom trailing edge and about 48 arcminutes long at the top edge, the two sides forming a 60 degree apex triangle (Fig. 2). Brian Skinner, an experienced amateur from Cape Town, was walking his dog when he happened to see it naked eye and rushed home to call his wife, Beryl, who easily recognised it as a “comet”. He describes the sighting as quite

easy, not requiring averted vision or a vivid imagination. To him the plume also was asymmetric, fan-shaped, and not sharply pointed at its narrow end. Brian followed it in binoculars until close to the horizon where it gradually changed into a ring, larger in size than the fan and with a bright spot towards the upper-right (Fig. 2). From the onset, Brian realized that he saw something very unusual and after no mention in the media or luck from fellow amateurs, he was delighted when I could finally validate (and explain) his observation.

After I lost sight of it, the amateur network is not entirely sure what happened. At 04:23:04.5 whilst over Diego Garcia in the Indian Ocean, the payload was supposed to slowly spin up the spacecraft to 5 rpm and at 04:27:14.5 the top-secret payload was scheduled to separate from the second stage while flying just east of Madagascar (Fig. 1, point 5). I did not see this but then I may have been misled by tracking the vented plume rather than the actual satellite itself.

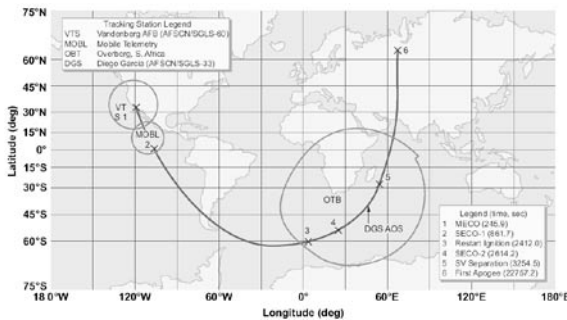


Fig. 1 A graphic from the Boeing press-kit, showing the ground-track of the NROL-22 spacecraft from launch until it reached apogee.

Shortly after I had optical loss, radio observers in the amateur network tracked the mission from Hungary, United Kingdom and Russia as the satellite was heading towards its first apogee or high point above the earth (Fig. 1, point 6). The radio observations showed that the craft was spinning at about 5 rpm but did not clearly indicate whether separation had taken place.

observing report

Starting 2 July, the satellite was optically visible from Cape Town in the mid-evening. Despite several searches it was not found. Radio observations indicated that an orbital change had taken place after being injected into orbit, making the task of finding it more difficult. However on 8 July I recovered the satellite and the amateur network now has a pretty good idea what the current orbit is. This will now enable higher powered, more narrow field telescopes to more precisely determine the orbit at two professional observatories which are part of the network.

Since it is a classified mission, we do not know the final destination for the satellite in the network of satellites to which it is thought this mission belongs. Further orbit changes cannot be ruled out which means the satellite will have to be tracked as often as possible. If we lose it, we simply will have to find it again – this is why tracking classified satellites is such a challenge. It involves a lot of work but is very rewarding when you finally see the satellite cross your camera's or telescope's field of view.

My reports on an Internet mailing list attracted the attention of the Boeing telemetry team. Despite being faint, they were thrilled by my time-stamped footage and asked permission to use these in their post-flight engineering data review. It also became apparent that I saw the plume drifting away from the second stage because hydrogen venting halted shortly before my observation. This may explain why I did not see the vehicle at the peak of the plume.

All in all an exciting experience, even though taking place at 6 am on a cold winter's morning. More rewarding was the fact that the amateur predictions were almost spot on, with the spacecraft appearing about a degree higher in the sky and less than two minutes late (the reason why it was slightly higher up). This satellite has now been added to the approximate 160 objects tracked by the amateur network. These objects do not appear in public domain orbital elements issued by the United States Air Force SPACETRACK. ☆

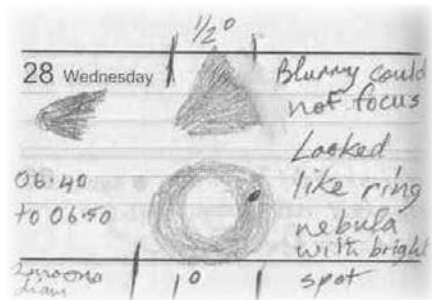


Fig. 2 An 4.3x3.4 degree field of view image, grabbed from Greg's video footage (left) compares well with Brian's naked eye observation as sketched in his pocket diary (right), both showing the skewed fan shape. Using 7x50 binoculars, Brian watched it gradually morph into a ring.