

October 12, 2006

BY HAND DELIVERY

Karl Kensinger
International Bureau
Federal Communications Commission
445 12th Street, S.W.
Washington, D.C. 20554

Re: *DIRECTV 6 De-Orbit Summary*

Dear Mr. Kensinger:

In response to questions the International Bureau has raised with respect to the recent de-orbiting of the DIRECTV 6 satellite, enclosed you will find a summary of the de-orbit process employed by DIRECTV and its contractor, Loral Long Term Operations, as well as an analysis of the results of that process.

If you have any further questions, please do not hesitate to call me.

Sincerely yours,



William M. Wiltshire
Counsel for DIRECTV Enterprises, LLC

cc: Robert Nelson

DIRECTV 6 DE-ORBIT SUMMARY

Background. DIRECTV 6 is a DBS satellite built by Space Systems/Loral. Since the satellite's launch in 1997, DIRECTV has used Loral LTO to "fly" the satellite. On August 14, 2006, at the request of DIRECTV, Loral LTO began the de-orbit process for DIRECTV 6. At that time, DIRECTV 6 was located at 109.5° WL. The de-orbit plan was as follows:

- First, Loral LTO would execute a series of four de-orbit maneuvers to raise both apogee and perigee approximately 400 km above geosynchronous altitude.
- Second, Loral LTO would conduct a series of propellant depletion maneuvers and final spacecraft shutdown, which were not intended to change the satellite's orbital parameters.

These maneuvers, once completed, were intended to leave DIRECTV 6 in a disposal orbit well above that called for under the Inter-Agency Space Debris Coordination Committee's guidelines.

De-orbit maneuvers. The first four de-orbit maneuvers were scheduled and executed as follows:

De-orbit 1:	Aug 14, 2006 1458z
De-orbit 2:	Aug 15, 2006 0258z
De-orbit 3:	Aug 15, 2006 0458z
De-orbit 4:	Aug 15, 2006 1658z

In each of these de-orbit maneuvers, thrusters 2A and 3A (as shown in Figure 1) were fired for 130 pulses with a pulse-width of 1.125 seconds

Following the De-orbit 4 maneuver, Loral ranged the satellite and measured the orbit, showing perigee at 383 km above GEO and apogee at 411 km above GEO.¹ This was later confirmed by orbital data downloaded from Space-Track, with nearly identical parameters. Based upon the information available to it, DIRECTV reported this final orbit to the Commission on August 22, 2006.

¹ At this point, the satellite had a westward drift rate of approximately 5.1deg/day.

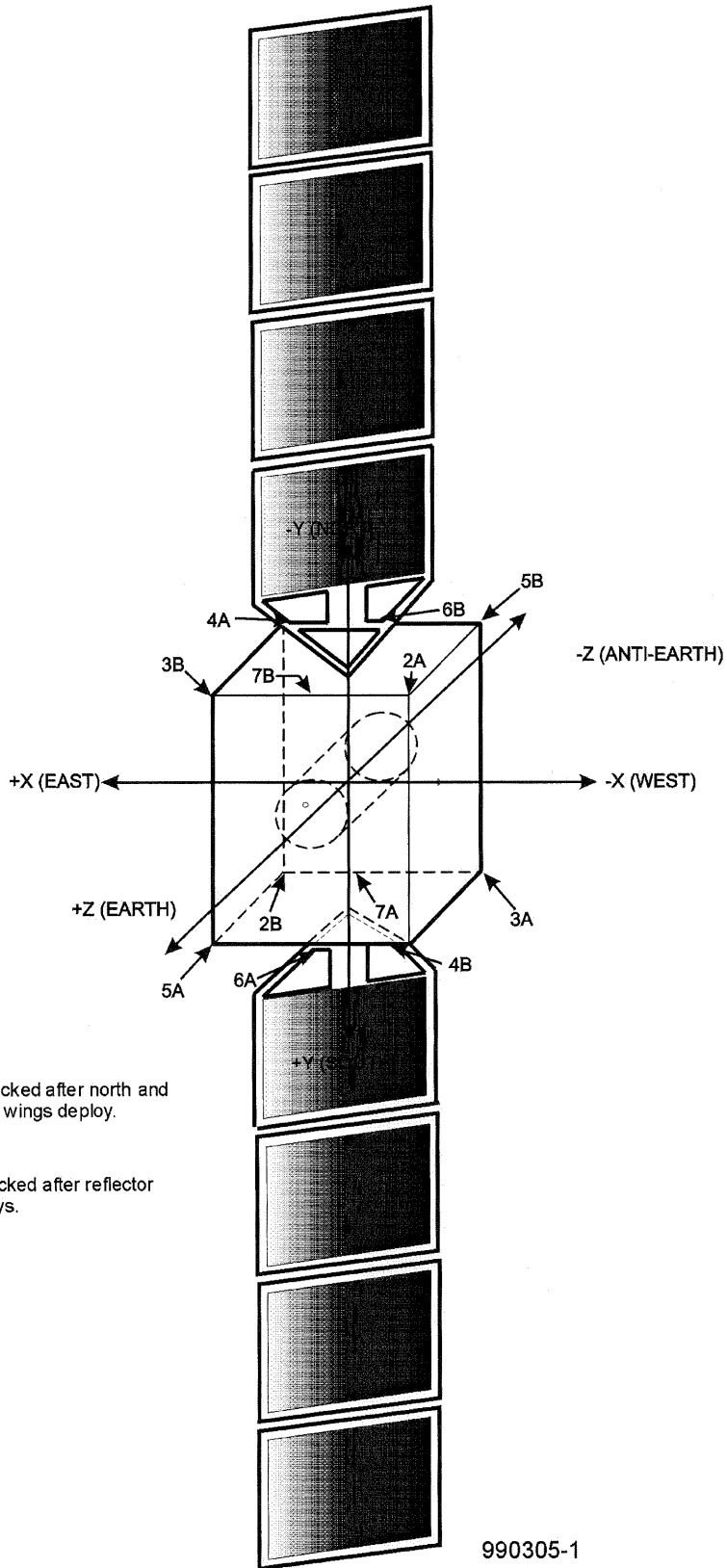


FIGURE 1

Propellant depletion. On August 16, Loral LTO began the second phase of the de-orbit plan by firing the satellite's thrusters to deplete satellite's remaining on-board fuel. The plan was to fire thrusters 7A and 6B (as shown in Figure 1), which were selected because they are on opposite sides of the spacecraft and the delta-v's would be expected to cancel each other out, and thus have zero net effect on the orbit. Two depletion maneuvers were executed as follows:

- Depletion 1: Aug 16, 2006 1554z (1000 pulses with pulse-width of 1.125 sec)
- Depletion 2: Aug 16, 2006 1628z (184 pulses with pulse width of 1.125 sec)

At the end of the second depletion maneuver, Loral saw the first signs of propellant depletion. This was followed by a couple of maneuvers to vent the remaining pressure from the propellant tanks. These final two maneuver executed as follows:

- De-press 1: Aug 16, 2006 1936z – 2025z (1211 pulses with pulse-width of 1 sec) Fired thrusters 7A and 6B
- De-press 2: Aug 16, 2006 2036z – 2200z (2000 pulses with pulse-width of 2 sec) Fired thrusters 7A, 7B, 6A, 6B

Again, the opposing thrusters were selected with the intention of canceling out any effects on the orbit from depressurization.

At the end of this process, the latch valves for thruster 7A and 6B were opened to vent out the last bits of pressurant. This was followed by the final Electrical Power System shutdown and turning off the transmitters. It is worth noting that, once propellant depletion was completed, neither Loral LTO nor DIRECTV itself conducted any ranging on the satellite, as it was drifting West at a high rate and was now out of view of our antennas with DIRECTV 6 range capability. It was also assumed that no ranging would be needed since the depletion maneuvers were expected to have no effect on the orbit.

Post de-orbit investigation. Several weeks after the final shut-down, the Commission informed us that DIRECTV 6 did not appear to be in the final orbit reported by Loral LTO and DIRECTV. The orbit reported to the Commission by Space Command showed a perigee of 236 km above GEO and an apogee of 470 km above GEO. As a consequence of receiving this information from the Commission, DIRECTV launched an investigation in conjunction with Loral LTO (the operator) and Space System/Loral (the manufacturer) to determine how the satellite could have ended up in this new orbit.

It was confirmed that the orbit measured by Loral and the orbit reported by Space Command immediately following the fourth de-orbit maneuver were consistent, both showing a nearly circular orbit of 400 km above GEO. This indicated that a problem of some sort must have occurred during the depletion and pressure venting process.

After reconstructing all of the thruster firings and analyzing the associated delta-v in all three directions, Loral realized that, although thrusters 7A and 6B have primary delta-v's in opposite directions along the y-axis (North/South), they each have a much

smaller secondary delta-v in the same direction along the z-axis (toward the earth). Firing both 7A and 6B for thousands of seconds during the depletion and venting process resulted in an unexpected delta-v of as much as 6.5 m/sec in the +z direction.

Figure 2 illustrates the results of these maneuver reconstructions, showing where in the orbit the maneuvers took place, and the resulting effect on the orbit (assuming full thrust). Please note that the exact delta-v applied could not be determined, since the propellant was gone and the pressures were dropping. The evidence indicates (and Loral assumes) that the final depressurization activities contributed nothing to the orbit, and the actual final orbit is closer to that of the orbit after De-Press 1.

Applying the results of these maneuver reconstructions to the measured orbit, obtained following the four de-orbit maneuvers, gives a resulting orbit of 282 km by 488 km above GEO, which is fairly close to the Space Command observation of 236 km by 470 km above GEO.

DIRECTV takes its responsibility to mitigate orbital debris very seriously. Now that the secondary effects of the de-orbit procedures used in this case are understood, DIRECTV will be sure to review future de-orbit plans to avoid a recurrence of these events. Loral is also in the process of developing new de-orbit procedures in light of the adverse effects of this tank-depletion strategy.

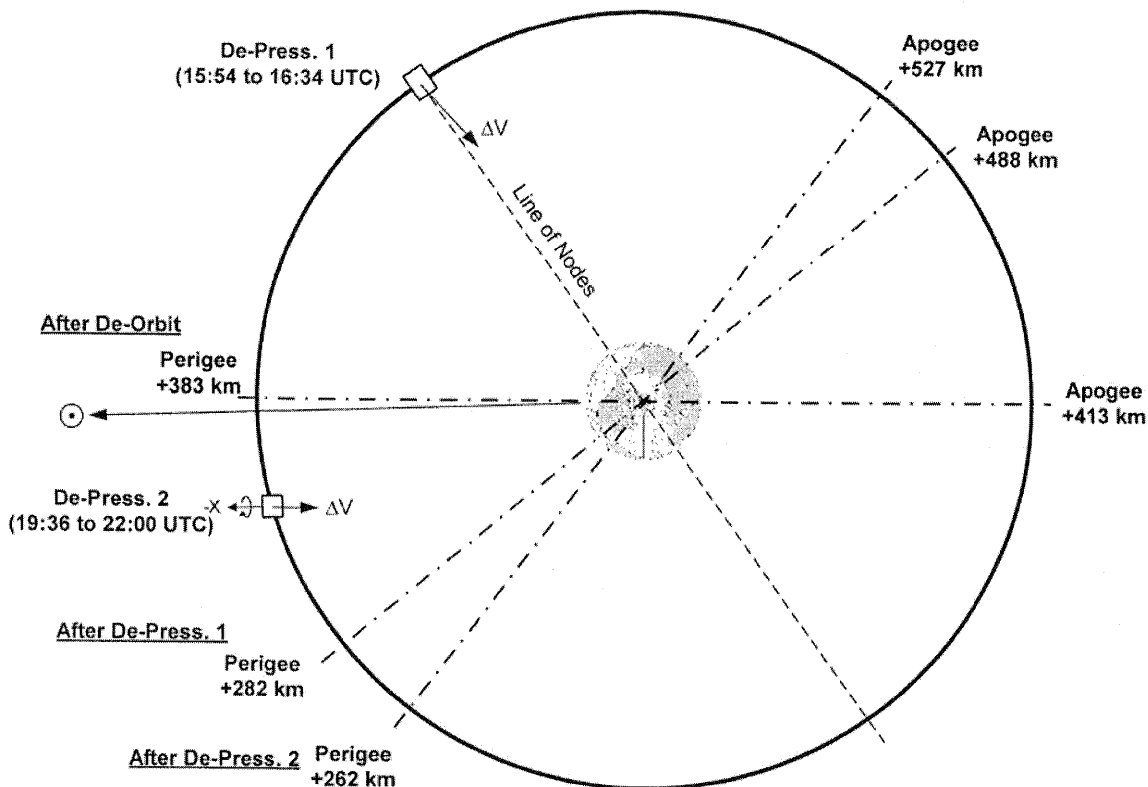


FIGURE 2