National Aeronautics and Space Administration

*NASA Case Study*

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# *Atlas Centaur-67*: Go or No Go for Launch?

Since 1968, NASA had flown dozens of scientific, defense, and commercial payloads into space on the *Atlas Centaur* rocket. On March 27, 1987, *Atlas Centaur Mission 67* (*AC-67*) sat on a launch pad at Cape Canaveral, Florida, waiting to carry the U.S. Department of Defense Fleet Satellite Communications (*FLTSATCOM*) F-6 spacecraft into orbit.

*FLTSATCOM* was a constellation of military satellites that served as a global, ultra-high frequency (UHF) link among U.S. Navy aircraft, ships, submarines, and ground stations. A high-capacity space-borne communications system, it provided shore-to-fleet and single-way communications. It was also used for high-priority communications with the U.S. Air Force Strategic Airlift Command aircraft, the E-3A airborne warning and control system (AWACS), and the presidential command structure. Four operational satellites positioned around the globe in near-equatorial geosynchronous orbits, as well as a fifth, on-station spare spacecraft, made up the *FLTSATCOM* system.

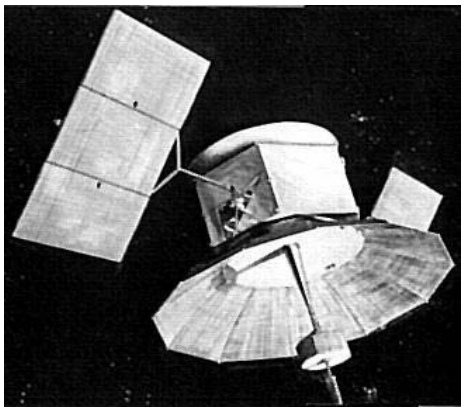

*Figure 1 - FLTSATCOM Satellite in Orbit. NASA image*

The *Atlas Centaur* was an expendable launch vehicle (ELV) used by NASA to place the *FLTSATCOM* spacecraft into geostationary transfer orbit (GTO). An apogee kick motor was employed to achieve the final mission orbit.

## Launch Day: Black Clouds

On the scheduled launch day for *AC-67*, the weather was not promising. Thunderstorms were building throughout central Florida not far from the launch site. The launch team included weather and safety officers responsible for ensuring that all launch weather and safety criteria.

The launch director, launch team members, management advisors, and spectators were gathered in the Mission Directors' Center (MDC). In the team environment, amidst the flurry of launch-preparation activity, it was not entirely clear who was an authority and who was an advisor. In addition, some of the two-way radios were not providing clear communications between the blockhouse and Kennedy Space Center. Messages had to be repeated for clarity, further adding to the confusion in the launch center.

At T-30, there are concerns about the weather. Balloons released to collect wind data at higher altitudes have been breaking, failing to reach sufficient altitude. One balloon remains in the air, but even if the necessary data is collected, it will need to be sent to San Diego for analysis and then uploaded to the guidance system. A delay is very likely.

As launch countdown proceeded, the wind profile was eventually uploaded in time, but a squall line developed, producing thunderstorms in areas adjacent to the launch facility. The clouds and the deteriorating weather conditions were apparent to the launch team at the site. The launch criteria stated: "The flight path of the vehicle should not be through middle-level cloud layers 6,000 feet or greater in depth, when the freezing level is in the clouds."

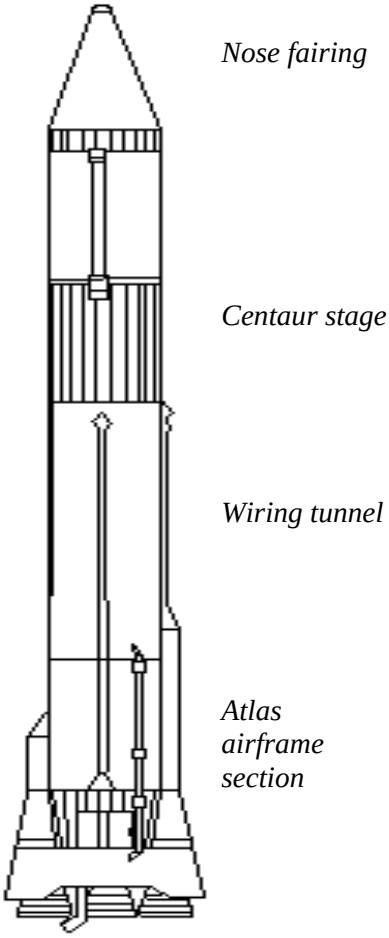


*Figure 2 - Typical Atlas Centaur configuration. NASA image*

A debate ensued in the launch center over the meaning of the weather criteria, with some questioning the reason for the cloud criteria. It did not look like a serious hazard, particularly in the context of NASA's *Atlas Centaur* track record: Over the previous two decades, the agency had successfully launched more than 60 *Atlas Centaurs*. Many members of the launch team felt that there was ample experience in the room to make the call. And on the Air Force side, the payload team was eager to use an available launch window for its $83 million spacecraft.

At the same time, a sidebar discussion of the weather criteria centered on vehicle icing concerns. One member of the team contacted a nearby U.S. Federal Aviation Administration (FAA) control center to gain insight from any aviation activity in the cloud cover. The FAA reported two recent flights through the clouds with no icing incidents noted.

This information was reassuring to the launch team members preoccupied by icing concerns—icing appeared not to be a risk. And the presence of clouds was not, in itself, a reason to halt the countdown. The team agreed to call the weather office for a final weather "go," just before launch.

> *T-6: "This is Atlas-Centaur launch control.. We got an assist from a T-38 aircraft landing at the Shuttle Flight Facility. The pilot reported no icing as he descended through the clouds..That would be a constraint if there were icing conditions within those clouds and that is consistent with the earlier data that there is none. There is an area of rain that has moved into the area. However, lightning activity is about 25 miles downrange and about 10 miles north of the Cape so we are acceptable at launch complex 36. … As long as there is no thunderstorm activity within five nautical miles of the vehicle's flight path we would have an acceptable launch condition. Also, we cannot have lightning within five nautical miles of the launch complex at liftoff time.*
>
> *T-5 and holding*
> *Cape forecaster reporting no cloud or ground lightning within the last ten minutes. Forecaster is recommending to launch director that we pick up the count. [picking up countdown at 4:17]*
>
> *T-5 and counting: "This would bring us to a liftoff at 4:22 should the Cape weather office not advise that we have a constraint due to lightning activity within five miles of the pad or the vehicle's projected flight path….*
>
> *Cape weather advising Launch Director… that there is some lightning potential within the area of the Shuttle Landing facility, however that is outside the five nautical miles constraint." …*
>
> *T-3: "Cape weather advising [Launch Director] that they recommend we proceed."*[1]

[1] Transcript of the Atlas Centaur Launch Control Video & Commentary.