NOAA Technical Memorandum NESS 91

IN-ORBIT STORAGE OF NOAA-NESS STANDBY SATELLITES

Washington, D.C.
September 1977

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Bruce Sharts and Chris Dunker

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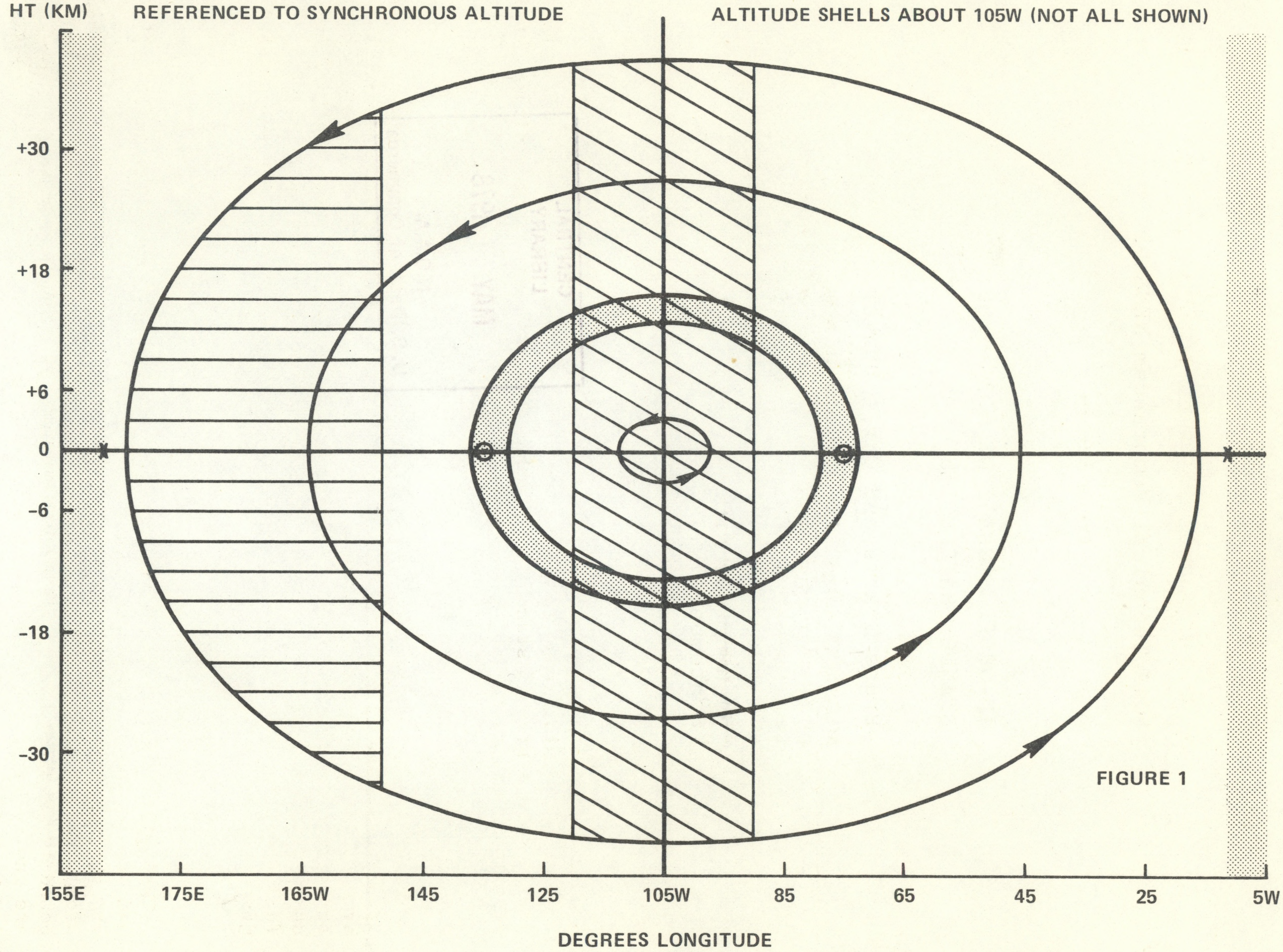
HT (KM)
REFERENCED TO SYNCHRONOUS ALTITUDE
ALTITUDE SHELLS ABOUT 105W (NOT ALL SHOWN)
+30
+18
+6
0
-6
-18
-30
155E
175E
165W
145
125
105W
85
65
45
25
5W
DEGREES LONGITUDE

FIGURE 1

IN-ORBIT STORAGE OF NOAA-NESS STANDBY SATELLITES

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ABSTRACT. This paper presents an operational proposal for the orderly storage, in-orbit, of NOAA-NESS satellites that are in some degree of Standby condition. This scheme would reduce to a reasonable minimum the monitoring of these satellites by the NESS ground system. This concept might be useful to others who face the problem of in-orbit storage of standby satellites.

PROPOSAL

NOAA-NESS would "store" its geosynchronous meteorological satellites that are in some degree of standby by placing them into orbits or altitude "shells" describing ellipses about the stable point at 105°W.

DEFINITION

The altitude "shells" have been arbitrarily selected by the authors to be at 3-km increments. In the conclusion, reference will be made to six standby satellites. Given six useable satellites, 3 km affords the minimum nomi-separation between any two satellites at any given time, while also allowing uninterrupted communication from Wallops to the uppermost shell (seven). This shell increment assumes avoidance of shells four and five for the reason given below.

LIMITATIONS

The upper bound would be that shell closest to the nonstable points, 11.5°W and 162°E. These points are marked by X's on the longitude axis of figure 1. The shaded areas beyond those points are those regions in which the nonzonal accelerations can no longer bring the satellite back toward 105°W. This upper bound is the 13th shell, and should be avoided. The intermediate bounds are are indicated by the central shaded region which is bounded by the fourth and fifth shells. These shells have turnaround points, at synchronous altitude, that are very close to 135°W and 75°W and should be avoided. Communication to Wallops from satellites in shells 8 through 13 will be interrupted for the time that these satellites spend in the region indicated by the horizontal hashmarks on the left. This region, west of 152°W (approximately), is the region that is "over-the-hill" from Wallops. We see no reason to avoid this region; however, it is a limitation. Communication to Wallops from a satellite not separated from its nearest neighbor by at least 15° of longitude will be affected by VHF interference. The central region indicated by the diagonal hashmarks is the region of definite conflict.

CONCLUSION

By the time of the GOES-F launch, NOAA may have eight satellites in orbit, two operational and six in some degree of standby condition. If the six standby satellites are all useable, they could occupy the synchronous altitude at 105°W, and shells one, two, three, six, and seven, all of which are in line-of-sight to Wallops. As NOAA satellites become unuseable, NOAA could use shell 12 for their disposal with no concern about collision. The shell originally occupied by an unuseable satellite would then again be available for an active satellite.

During periods of VHF conflict, the interfering transmitters may be turned off. The satellites could be monitored periodically to assure their integrity. Monitoring telemetered data periodically from standby satellites also will provide data for computing the latest spacecraft attitude and orbital elements. The requirements of space traffic control, engineering monitoring, and spacecraft navigation are all satisfied by one VHF receiver at Wallops. The only problem is that of scheduling data acquisition by that antenna.

(Continued from inside front cover)

NESS 68 Atlantic Tropical Cyclone Classifications for 1974. Donald C. Gaby, Donald R. Cochran, James B. Lushine, Samuel C. Pearce, Arthur C. Pike, and Kenneth O. Poteat, April 1975, 6 pp. (COM-75-1676/AS)

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