Identification of a debris cloud from the nuclear powered SNAPSHOT satellite with Haystack radar measurements

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Data from the MIT Lincoln Laboratory (MIT/LL) Long Range Imaging Radar (known as the Haystack radar) have been used in the past to examine families of objects from individual satellite breakups or families of orbiting objects that can be isolated in altitude and inclination. This is possible because for some time after a breakup, the debris cloud of particles can remain grouped together in similar orbit planes. This cloud will be visible to the radar, in fixed staring mode, for a short time twice each day, as the orbit plane moves through the field of view. There should be a unique three-dimensional pattern in observation time, range, and range rate which can identify the cloud. Eventually, through slightly differing precession rates of the right ascension of ascending node of the debris cloud, the observation time becomes distributed so that event identification becomes much more difficult.

Analyses of the patterns in observation time, range, and range rate have identified good debris candidates released from the polar orbiting SNAPSHOT satellite (International Identifier: 1965-027A). For orbits near 90^o inclination, there is essentially no precession of the orbit plane. The SNAPSHOT satellite is a well known nuclear powered satellite launched in 1965 to a near circular 1300 km orbit with an inclination of 90.1^o. This satellite began releasing debris in 1979 with new pieces being discovered and cataloged over the years. 51 objects are still being tracked by the United States Space Surveillance Network. An analysis of the Haystack data has identified at least 60 pieces of debris separate from the 51 known tracked debris pieces, where all but 2 of the 60 pieces have a size less than 10cm. The altitude and inclination (derived from range-rate with a circular orbit assumption) are consistent with the SNAPSHOT satellite and its tracked debris cloud.