USAF PERSPECTIVES ON LEONID THREAT AND DATA GATHERING CAMPAIGNS

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Abstract. The Air Force has long recognized the threat posed by the space environment to military satellite systems including the potential for disastrous effects resulting from a meteoroid impact. This concern has steadily elevated with our nation's increasing reliance on space assets for systems critical to national defense. The 1998/1999 Leonid Meteor Storm Operational Monitoring Program was initiated to address this threat. The goal of this Air Force-led, international cooperative program was to provide near real-time Leonid meteor flux measurements to satellite operators. The incorporation of these measurements with model predictions provided an approximate 2-hour lead warning of the peak storm activity, permitting satellite operators ample opportunity to exercise hazard mitigation procedures. As a result, Department of Defense (DoD) and other participating satellite operators may have helped avoid spacecraft damage. The extent of any minor damage to components impossible to detect by operators is difficult to ascertain and may not manifest itself for a period of time. Modest micrometeoroid precipitation may reduce spacecraft life expectancies as a consequence of the physical erosion or sandblasting of exterior surfaces, and damage sustained by electronic systems from concurrent high-energy plasma discharges. Later effects could take the form of premature failure of satellite sensors and other spacecraft components, leading to overall shortening of satellite mission duration. The Air Force intends to pursue further analysis of data and polling of satellite operators to fully assess the Leonid '99 event. Future U.S. Air Force involvement may include support for additional observations and analysis.

1. Introduction

In response to the potentially disastrous threat posed by meteors to DoD satellite systems, the U.S. Air Force teamed with government, commercial and academic research institutions to initiate the Leonid Meteor Storm Operational Monitoring Program. Beginning as a low-level effort in 1997, it evolved into a full-scale, worldwide scientific expedition in 1998 and 1999. With space systems becoming increasingly important to U.S. national security, threats posed to our satellite constellation must be monitored and better understood. This program enabled satellite operators to monitor the storm in near real-time, providing them with an opportunity to mitigate the threat by exercising risk-reduction actions. The quality and quantity of data collected during the 1999 storm is unprecedented. Analysis of this data will provide a better understanding of meteors, improved prediction modeling of future events and determine the best strategy for future meteor storm encounters. Although the Air Force does not plan to support a large-scale deployment to observe the Leonid meteor shower in the near future, support may be provided for additional data analysis and limited additional observations.

2. Meteors - space environment threat to DoD systems

Both the U.S. military and intelligence community are becoming increasingly reliant on space systems to achieve mission success. This was shown most dramatically in the last decade during conflicts beginning with DESERT STORM and concluding with operation ALLIED FORCE. The 1999 National Security Strategy recognizes the importance of space by stating: “unimpeded access to and use of space is a vital national interest -- essential for protecting U.S. national security, promoting our prosperity, and ensuring our well-being.” Space systems today enable our military leaders to dominate the battlefield by providing global communications, precise navigation, accurate meteorological data, early warning of missile launches, and near real-time signals and