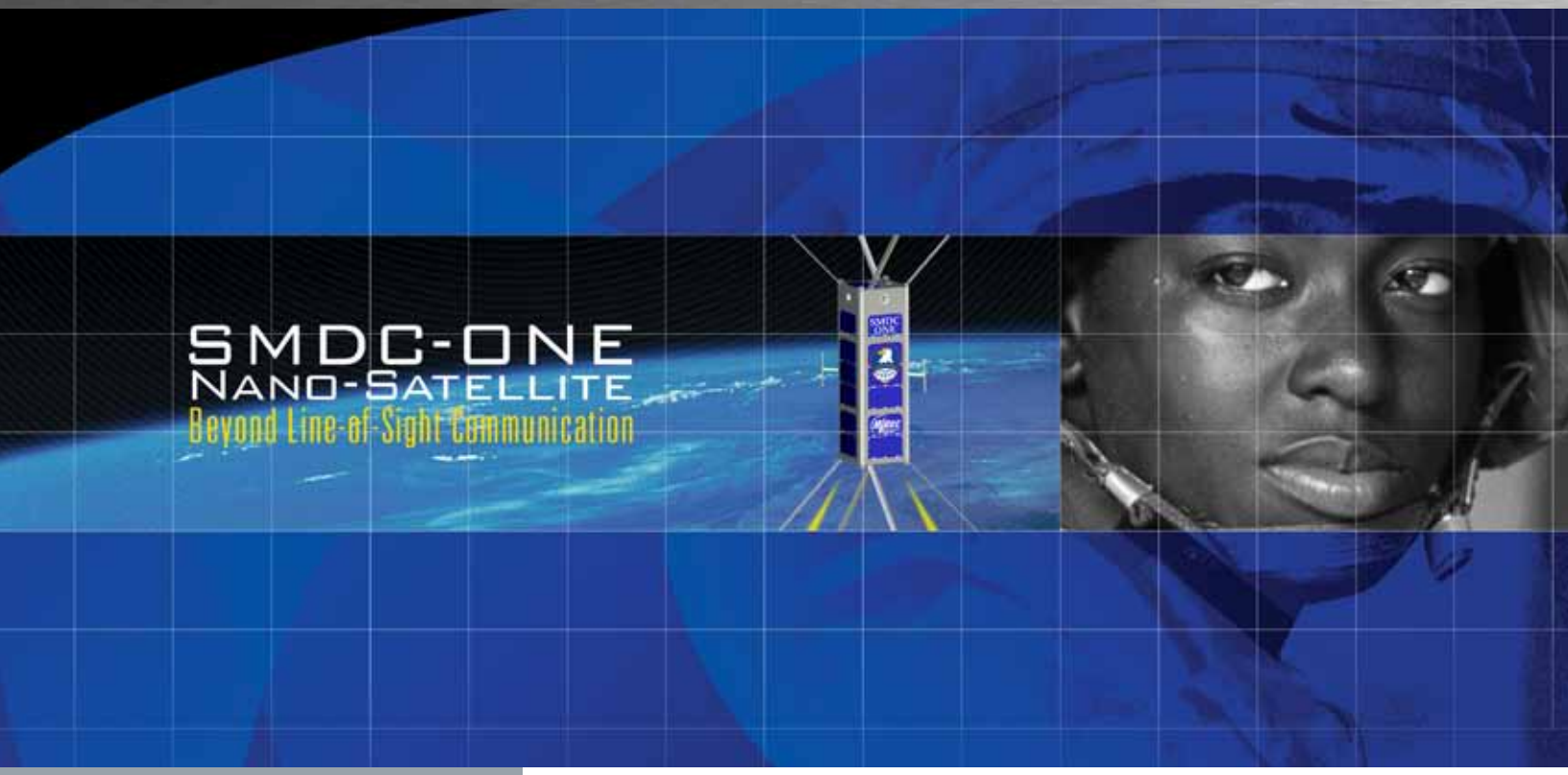
SMDC – ONE

Nanosatellite Technology Demonstration



Summary

- Eight nanosatellite technology demonstrators delivered within 12 months
- Over-the-horizon communications technology demonstrator for tactical forces
- Low cost: Less than $350K/spacecraft in production
- Operational life of greater than 12 months in low earth orbit
- Extremely successful first flight demonstrating over the horizon communications and extraction of military terrestrial hardware data

USASMDC/ARSTAT successfully demonstrated acquisition responsiveness in rapidly designing, developing and testing a militarily relevant low-cost spacecraft in one year. Flew successful space demonstration.

The Technical Center took delivery of eight 4-kilogram satellites at the end of a one-year development effort. The first SMDC-ONE nanosatellite was placed into orbit in December 2010. One ground station was located at U.S. Army Space and Missile Defense Command/Army Forces Strategic Command at Redstone Arsenal, Ala., with the second ground station at the command's Battle Lab in Colorado Springs, Colo. The primary objective for the satellite to receive data from a ground transmitter and relay that data to a ground station was fully met as an unqualified success. The intent of this technology demonstration series is to deploy a number of satellites to demonstrate persistent tactical communications capability and evaluate nanosatellite constellation performance.

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To achieve enhanced capabilities from space for the dismounted Warfighter, an approach holding great promise is the deployment of nanosatellite-class satellite constellations into low earth orbit. Because the unit cost for a nanosatellite (nanosat) is low (less than $1 million), large numbers for given specific missions can be built and deployed on orbit to generate a persistent effect. What a nanosat may lack in performance and long-life reliability compared to a single large traditional military satellite, it makes up by its extremely low cost and constellation proliferation potential.

Nanosats deployed in large numbers can provide enhanced capabilities over specific regions, over large latitudinal swaths of the earth, or even globally. Because they are low cost, they can be "refreshed" frequently by launching replacements. This allows rapid technology upgrades, reduces unit design life requirements, and allows manufacturing economies of scale. A nanosat constellation populated by inexpensive spacecraft could be useful in a myriad of applications including tactical ground operations, humanitarian support, and stability operations.

The first SMDC-ONE nanosatellite was launched Dec. 8, 2010, into a slightly elliptical orbit about 185 miles above the earth. Ground stations in Huntsville, Ala., and in Colorado Springs, Colo. sent messages back and forth via the satellite, demonstrating beyond-line-of-sight and over-the-horizon communications between the ground stations located more than 1,000 miles apart.

Each ground station operated in one of two modes: (1) as a command and control center; or (2) as a data file transmitter/receiver site for mission data. Various text and image files were sent in the mission data mode while spacecraft commands were issued to the satellite in the command and control center mode.

State-of-health data from the satellite were collected on the first orbital revolution and good communications with the satellite continued throughout the demonstration mission. After about three weeks in orbit, the satellite collected data from military ground hardware and sent that data down to a separate, very simple ground station consisting of a simple antenna, small gateway (radio) and laptop computer with software to display the information on a Google Earth ™ map. Due to the very low orbit altitude, the satellite re-entered the earth's atmosphere and disintegrated 35 days after launch, having performed exceptionally well throughout its five weeks in space.

This relatively brief space technology demonstration indicated great potential for these very small satellites with masses of only a few kilograms each. SMDC-ONE responded well to various commands. Army personnel learned a great deal about satellite tracking and communications in their operation of the two SMDC-ONE ground stations.

The satellite proved to be consistent and reliable during its predictable revolutions around the earth. Ground station anomalies were quickly identified and corrected as the ground stations experienced very cold, snowy and icy conditions at times. Undocumented features of the satellite were quickly addressed and accommodated. The mission exhibited flexibility by incorporating a separate, very small ground station with data collection and display from ground military hardware. At the time of launch, given the predicted short orbital life, such a demonstration was considered unlikely.

In summary, the Army's first satellite in 50 years proved to be a resounding success and a great encouragement to press forward in helping to secure the high ground with the assistance of nanosatellites.

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