

Sensor Integration Aids Mapping at Ground Zero

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Hours after the September 11, 2001, attack on the World Trade Center, the New York Office for Technology (NYSOFT) was tasked with gathering and managing the airborne data collection over Ground Zero. On September 14, they enlisted the help of EarthData, an airborne mapping and remote sensing company headquartered in Washington, D.C.

The EarthData team quickly determined that the combined use of three airborne imaging sensors – integrated with airborne GPS and inertial measurement systems — would provide the most detail to the recovery workers on the ground. The EarthData team therefore decided to use the three following sensors:

1. The lidar (Light Detection and Ranging) system, which provides highly accurate 3-D maps of the site and allows measurement of the rubble and shifts in the surrounding buildings.
2. A high resolution digital camera to complement the lidar and enable rescue and recovery workers to monitor the movement using geometrically corrected digital images
3. A thermal camera to complement the lidar and enable rescue and recovery workers to monitor the temperatures of the fires burning below.

No ground control was used in any of the mapping missions. Sensor exterior orientation parameters were obtained using an Applanix POS/AV system, which uses integrated GPS/IMU technology. The NOAA/NGS Liberty Island Station was used as the GPS base station.

The aircraft, which at the time was southwest of Washington D.C., had to be outfitted for the project at EarthData Aviation's hangar in Hagerstown, Maryland. With airspace closed to all flights, special permission and coordination were a must. Concurrently, preparations were made to relocate a subset of EarthData's data processing team, complete with computers and all peripherals, to the NYSOFT offices in Albany, New York. By early afternoon on September 15, the EarthData team had established a capable data processing center in Albany.

The Navajo Chieftain, with a two-man crew of a pilot and an airborne operations

coordinator, flew from Hagerstown on the morning of the 15th to conduct the first flight over Ground Zero, collecting lidar and digital photography data. The plane landed in Albany in the early afternoon and the data was rushed to the processing center where several mapping products were generated for the rescue and recovery teams. The lidar provided a Digital Elevation Model (DEM) that gave a three-dimensional perspective of the scene. Elevations were determined from the DEM to within six inches accuracy. Simultaneously, the digital images were merged together to provide one large, high-resolution, geometrically correct image over the disaster site. Because no ground control was available for the mapping missions, EarthData used existing vector data to verify mapping accuracy. Based on this method, an estimated accuracy of six inches vertically and better than 12 inches horizontally was achieved.

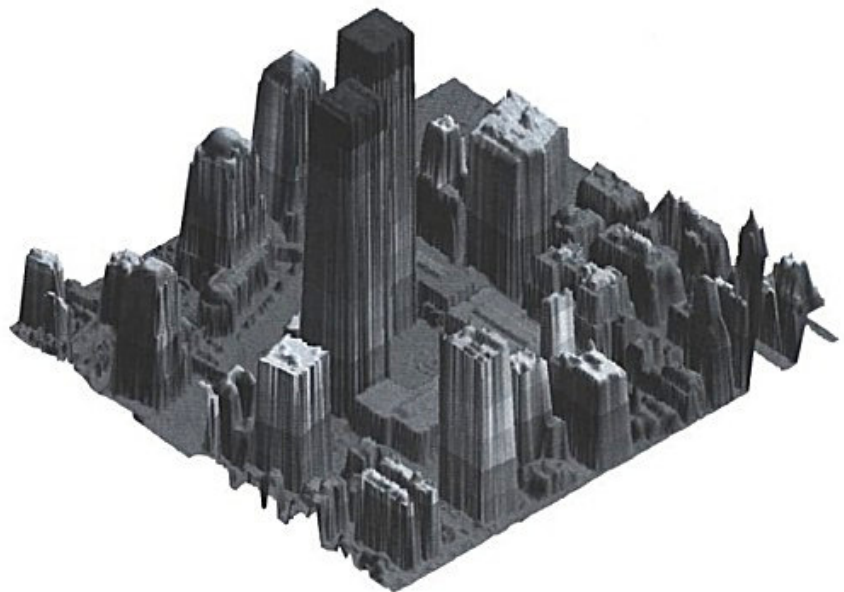
The final map products were transferred to NYSOFT within eight to 12 hours after landing. At sunrise on September 16, the Navajo Chieftain was again flown over Ground Zero to collect thermal imagery. The data was immediately processed in Albany, and delivered to NYSOFT. The New York State police escorted the images to New York

City's Pier 92 where the Emergency Mapping and Data Analysis Center had been set up.

After the two initial data collections were complete, EarthData established a routine that involved thermal data collection in the morning, with lidar and digital imagery collected midday. A total of 43 missions were flown between September 15 and October 22, 2001.

At Pier 92, EarthData's continually updated products were imported into New York City's Geographic Information System (GIS), which contains the NYCMAP (pronounced "nice map"), a digital database of highly detailed geographic information of the entire city accurate to within 18 inches. The NYCMAP was created over a period of five years by the New York City Department of Information, Technology and Telecommunications; the Department of Environmental Protection; and Hunter College's Center for the Analysis of Spatial Information (CARSI). The database contains information on New York City's buildings, curb lines, streets, parks, and transportation features. After September 11th, more than 50 GIS professionals from government, academia, and industry worked around the clock with the database

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3-dimensional lidar data captured over World Trade Center site during July of 2001.

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to generate the maps and analysis needed by many departments of New York City. With the historic data in the database, as well as up-to-the-minute mapping data provided by EarthData, this team played a vital effort at Ground Zero.

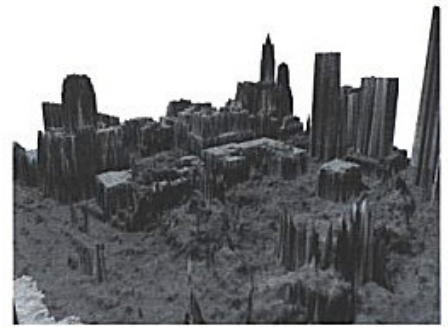
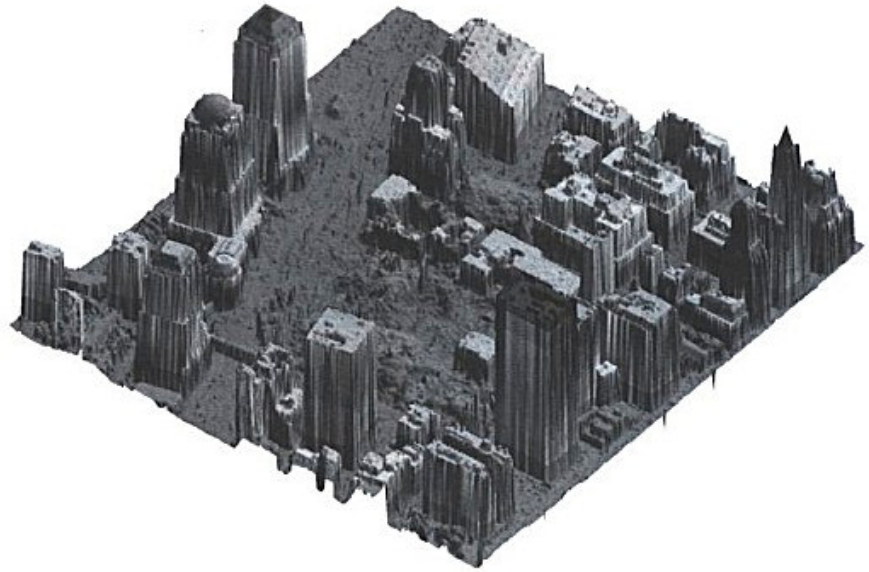
Since October 22nd, EarthData has flown over a dozen additional missions for NYSOFT as well as the Federal Emergency Management Agency, and the Environmental Protection Agency aimed at assessing conditions that would impact the re-opening of homes, schools, and businesses in and around Ground Zero.

For more information on EarthData's role at the World Trade Center or EarthData's services, please contact Mary Hiatt at 301-948-8550 or visit our website at www.earthdata.com.



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3-dimensional lidar data captured over World Trade Center site after September 11, 2001.