EMERGING TECHNOLOGY
AUTOMATED RANGE SURVEILLANCE USING RADIO INTERFEROMETRY

As NASA's primary launch operations center, Kennedy Space Center is very interested in new technologies that will lower Range Safety's operations and maintenance costs while increasing reliability. Kennedy Space Center's Advanced Systems Division has taken advantage of NASA's Small Business Innovation Research program to help develop advanced Range Safety technologies by successfully obtaining awards for contracts and managing the Small Business Innovation Research subtopic that solicits technologies for automated collection and transfer of range surveillance and intrusion data.

Range surveillance is a primary focus of launch range safety and often a cost and schedule driver. Because of the difficulty of verifying a cleared range, launch delays are common and will increase as spaceports are developed in new areas. To address this issue, a 2005 Small Business Innovation Research Phase I contract was awarded to Soneticom, Inc. to develop a system for automated range surveillance using radio interferometry.

Proposed Automated System

The proposed automated range surveillance system will use a small network of remote sensors to perform radio interferometry and time difference of arrival techniques to survey, identify, and locate radio frequency energy signatures within a given geographic area such as Kennedy Space Center's launch area. The survey mission will use radio interferometry techniques to create radio frequency "images" of the surveyed area. These images will show the locations of all radio frequency activity within an area. The intent is to capture and average a set of images to establish the nominal radio frequency baseline for the area.

Once a baseline is established, real-time radio frequency surveys will be instantly compared to the nominal baseline to detect the existence of radio frequency spectral anomalies. In addition to identifying these anomalies, the time difference of arrival and radio interferometry techniques provide the capability to determine precise locations of radio frequency activities. Therefore, Range Safety can quickly and cost effectively locate the spectral anomaly source and initiate steps to mitigate the source without delay.

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Phase I Efforts

During the Phase I efforts of the contract, the contractor's system, which is permanently located in the Melbourne area and covers 15 square miles, was able to locate the radio frequency activity to within less than 100 meters. The figure shows a typical network of seven remote sensors yielding optimum range coverage with economy of hardware. A standard Ethernet link allows the base station used for monitoring the sensor system to be remotely located.

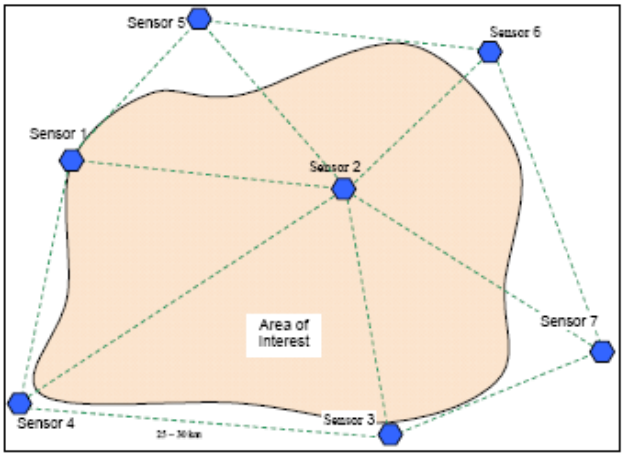

Figure 2.1 - Network of Remote Sensors

Capabilities of the System

The capabilities that the automated range surveillance using radio interferometry and time difference of arrival location techniques provide are listed below:

- Facilitate the expedient clearing of ranges by identifying and pinpointing sources of suspicious radio frequency energy emissions
- Increase Range Safety's ability to preemptively identify and locate potential range intrusions
- Reduce the vulnerability of operations to emission interference whether due to inadvertent or hostile acts, by identifying and locating sources of potential threats
- Allow an area to be remotely monitored in real-time from thousands of miles away
- Lower costs in the overall process of insuring clear and safe range and other restricted area operations

Currently, no commercial systems that offer all of the capabilities described above are available. This system will dramatically decrease the time and expense associated with clearing the range while simultaneously increasing safety by identifying and locating threats from interference, whether unintentional or hostile in nature.

Soneticom successfully met all the objectives for its 2005 Small Business Innovation Research Phase I contract. The Phase I efforts proved that radio interferometry, normally used for high-resolution imaging of celestial sources, could be used for terrestrial applications. With the success of Phase I, Soneticom submitted a Phase II

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proposal that would enhance the system's accuracy and decrease the data processing time so a viable system could be built for the commercial industry. Soneticom's Phase II proposal was selected with the contract currently being negotiated and contract award expected in December 2006.