

# Transition

An example of a U.S. Air Force supported Small Business Innovation Research (SBIR) or Small Business Technology Transfer (STTR) technology that has transitioned into an Air Force, other DoD agency, or commercial industry system or subsystem.

**Topic Number:**

AF071-291

**Topic Title:**

Data Fusion Visualization  
Development for OCS/  
DCS SSA Operations

**Contract Number:**

FA9453-08-C-0079

**SBIR Company Name &****Location:**

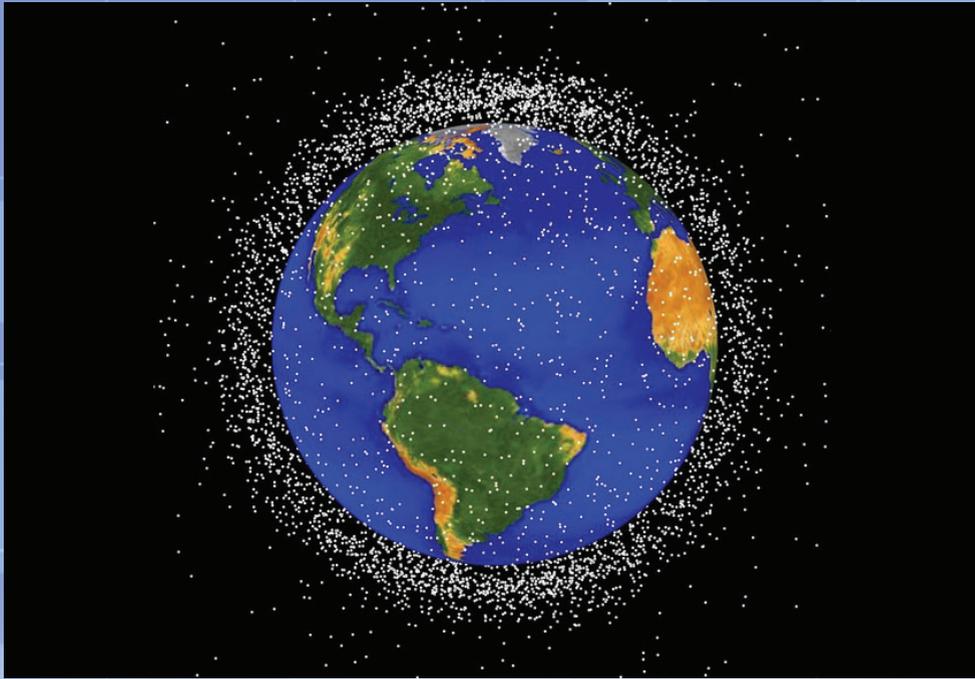
The Design Knowledge  
Company, Fairborn, OH

**Technical Project Office:**

AFRL Space Vehicles  
Directorate, Kirtland  
AFB, NM

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The computer generated image (above) depicts objects in Earth orbit that are currently being tracked. Approximately 95% of the objects in this illustration are orbital debris, i.e., not functional satellites. (Courtesy of NASA Orbital Debris Program Office)

## Ohio Firm Helps Mitigate Threats Posed by Space Debris

Most of us have heard the old adage “what goes up, must come down.” When it comes to space, dozens of countries now have satellites circling the globe, so we need to keep an eye on the skies due to the dangers posed by falling space debris. The space surveillance mission falls to the U. S. Strategic Command Joint Functional Component Command for Space (JFCC Space). Through its Joint Space Operations Center (JSpOC), artificial objects in the Earth’s orbit are detected, tracked and identified.

Since the launch of Sputnik in 1957, over 39,000 man-made objects have gone up and many of these have already come down. JSpOC tracks more than 16,000 objects currently orbiting the Earth.

## Air Force Requirement

The United States and its allies rely on JspOC to provide detection and early warning about threats posed by space debris. Accomplishing this mission requires referring to multiple data sources from disparate systems, thus introducing the possibility for errors. Air Force Space Command recognized the need for innovative technology to support space situational awareness (SSA) beyond the existing legacy toolset. JspOC needed a unified tool to bring integrated data from stove-piped systems, to include algorithms and tools for space situational awareness (SSA) and command and control (C2). JspOC enlisted the Air Force Research Laboratory to find a solution.

The U.S. Air Force requires an integrated data visualization software suite to provide information superiority to the warfighter. Through the software suite, experts would view data relationships derived from data mining software tool libraries, and would derive higher-level information useful to the satellite command center.

## SBIR Technology

Working with the Air Force under a Small Business Innovation Research (SBIR) award, the Design Knowledge Company (TDKC), a small business located in Fairborn, Ohio, developed the JSpOC Mission System (JMS) User Definable Operational Picture (UDOP). The JMS UDOP provides an Agile Work Environment (AWE) tailored to the space domain. The AWE proved its use as a core component of the Integrated Operational Environment for Joint Expeditionary Force Experiment (JEFX) 2011 and Advanced Concept Experiment (ACE) 2011 and 2013. The AWE is operational as JMS at Vandenberg AFB, California, and is supporting the Aircraft Repair Visualization and Integration Simulation Support (ARViSS) at Warner Robins Air Logistics Complex (WR-ALC), Robins AFB, Georgia. These applications demonstrate the feasibility of using the AWE in multiple domains, not just space. The potential for using the AWE across domains for all situation awareness and command and control applications would provide an enormous cost savings across all of the DoD.

The JMS UDOP is based on the open-source eclipse rich client platform, leveraging a service-oriented architecture (SOA) written in Java. It is cross-operating system/cross-platform capable. The JMS UDOP integrates heterogeneous data from disparate sources, including legacy systems, emerging SOA data sources, algorithms that operate on the data, and a variety of visualization, collaboration and work efficiency tools.

The JMS UDOP supports interoperability with Microsoft Office, role-based security and functionality, as well as the ability to customize the interface.

"Our approach emphasizes 'Composability above the code base.' [or the] capability of creating new information products without affecting the Information Assurance stance," said Dr. James McCracken, TDKC founder and vice president. "The JMS UDOP runs on a standard desktop computer. It employs NASA World Wind for 2D and 3D maps, but has incorporated Google Earth and Satellite Toolkit."

## Transition Impact

Assembling an integrated common operating picture from disparate data sources for the JFCC Space Joint Planning groups is crucial when responding to high-interest events such as the uncontrolled reentry of the Phobos-Grunt spacecraft in 2011. Calculating and communicating trajectory data used to be a time consuming task. Assembling a simple Microsoft PowerPoint slide from the various stovepipes could take up to an hour or more. No system prior to the JMS covered all aspects of the mission. There were a handful of specialized tools and legacy systems operating beyond end-of-life, some created by specialty companies, some homegrown, some from prime contractors and the Microsoft Office Suite. With JMS, the data is assembled and the picture is created and shared in near real-time.

TDKC was awarded a Phase III contract, worth close to \$10 million, to further mature the technology. This enhanced technology, known as VISTA (Virtual Information for Satellite Tactical Applications), delivers actionable information to the warfighter by leveraging data fusion and visualization to compress and encode massive amounts of data and provide access to the fused visualization products "at a glance." The key to VISTA's approach is providing this at-a-glance visualization and comprehension support in a near real-time fashion. With this capability, TDKC believes the space warfighters will be able to leverage VISTA to support tactical, as well as strategic space situation awareness functions.

## Company Impact

JMS has been the company's largest continuing project. It is the origin of the core AWE that has since been ported to a wide variety of domains beyond the space application. The core AWE has been instrumental in winning additional work, such as building AWEs for Air Operations Centers, managed by Air Combat Command for its Command and Control mission. TDKC has also created versions for a cyber-operations center, a nuclear weapons center, and an air logistics complex. To learn more about this company, visit its website at [www.designknowledge.com](http://www.designknowledge.com).



U.S. AIR FORCE

# SBIR/STTR

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