

**2011**

**NASA Range Safety  
Annual Report**

## **V. EMERGING TECHNOLOGY**

### **A. Autonomous Flight Safety System (AFSS)**

The NASA Autonomous Flight Safety System (AFSS) software has been transferred to the Test Resource Management Center for development of AFSS hardware for Operationally Responsive Space (ORS) by ATK. The software has also been transferred to the Air Force Research Laboratory for use with Northrop Grumman's work on flyback reusable boosters.

The NASA Independent Verification and Validation (IV&V) facility continues to support the analysis of the AFSS code. Initial code coverage and branch testing has been completed. A hazard and fault-tree analysis is in progress.

AFSS software and testing requirements are being developed using funding provided by the Ground Systems Development and Operations (GSDO) Program. There will be a Software Requirements Review with interagency support early in 2012. GSDO is also supporting development of a tab in the NASA Joint Advanced Range Safety System (JARSS) software to output the mission safety rules in the XML format AFSS needs. The configuration files will be verified by playing them back through a hardware-in-the-loop system at KSC that includes a GPS simulator.

For more background and information on the Autonomous Flight Safety System from previous annual reports, [click here](#).

### **B. Joint Advanced Range Safety System (JARSS)**

The Joint Advanced Range Safety System (JARSS) is a collaborative effort between several government organizations to develop a government-owned, state-of-the-art mission planning, risk analysis, and risk management tool for range safety. JARSS is designed to provide comprehensive range safety support for UASs, expendable launch vehicles (ELV), and reusable launch vehicles (RLV). A more detailed overview of JARSS is found in last year's NRS Annual Report.

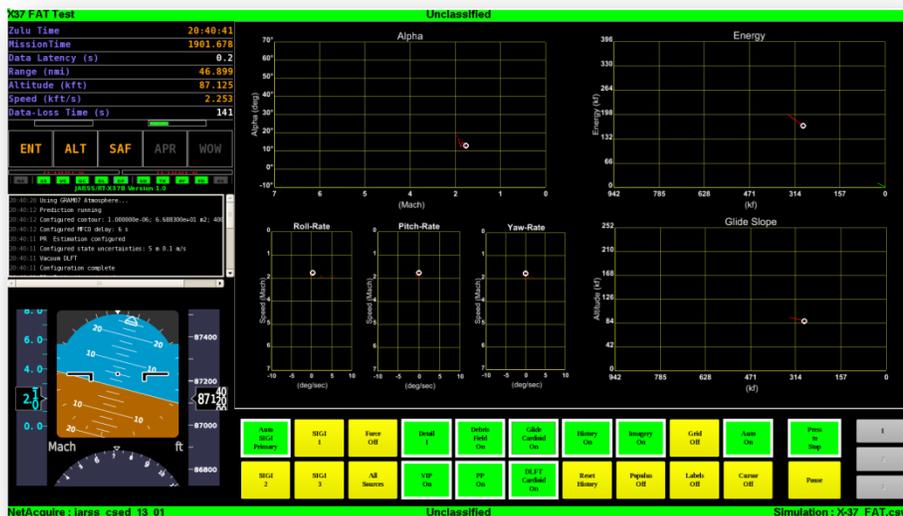
JARSS consists of two primary elements: a Mission Analysis Software Tool and the Real-Time Operations Tool. The JARSS Mission Analysis Software Tool is also known as JARSS Mission Planning (JARSS-MP). The Real-Time Operations Tool is known as JARSS-RT.

Major accomplishments this year include expanded training on the toolsets, updated training materials for JARSS Mission Planning, and successful support of the safe landing of the X-37B Orbital Test Vehicle (OTV) at Vandenberg Air Force Base. The X-37 program, while originally a NASA initiative, is now led by the Air Force's Rapid Capabilities Office. The Air Force's OTV-1, (shown in Figure 37) launched from Cape Canaveral Air Force Station on April 22, 2010 atop an Atlas V launch vehicle. OTV-1 performed on orbit for 224 days, 8 hours, and 24 minutes traveling approximately 91 million miles.

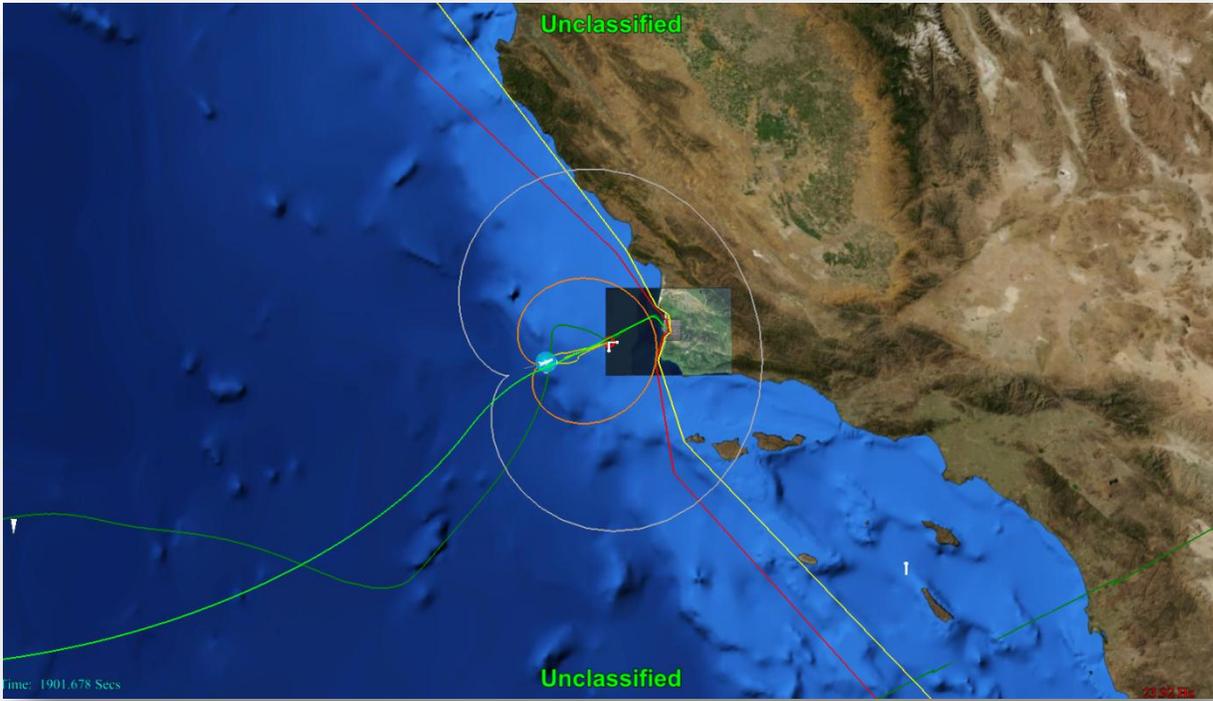


**FIGURE 37: ORBITAL TEST VEHICLE (OTV-1) ENCAPSULATION**

Without JARSS, the 30th Space Wing could not have met the critical time lines for this mission. JARSS-RT (Figure 38 and Figure 39) handled the telemetry data at both rates perfectly and provided both critical flight safety information and high fidelity mission awareness information. OTV-2 launched on 5 March from CCAFS and is currently still performing its on-orbit mission. The JARSS tool will once again be used to support the landing upon mission completion at VAFB. NASA Kennedy Space Center is closely following the X-37 project because OTV missions could land at KSC using the Shuttle Landing Facility in the near future.



**FIGURE 38: JARSS-RT 19-INCH LCD TOUCHSCREEN**



**FIGURE 39: JARSS-RT 19-INCH LCD DISPLAY**

For more background and information on the Joint Advance Range Safety System from previous annual reports, [click here](#).