

Technology Service Corporation

TACTICAL SPACE COMMUNICATIONS

Technology Service Corporation is the prime contractor and lead system engineering authority for what will be the first-ever space-platform Common Data Link (CDL) communications subsystem. The Air Force Research Laboratory's RoadRunner satellite, slated to launch in 2005 or 2006 as the Joint Warfighter Space Demo 1 (JWS-D1), includes a standard CDL capability, engineered by TSC, that provides 200kbps uplink and 274Mbps downlink for spacecraft sensor commanding direct from theater, as well as high-speed delivery of tactical imagery direct to theater. Through this capability, a warfighter tasks the tactical spacecraft's sensor and receives its data directly, much as he would with an airborne imager or other Intelligence, Surveillance, and Reconnaissance (ISR) platform.

SPACE SYSTEMS ENGINEERING

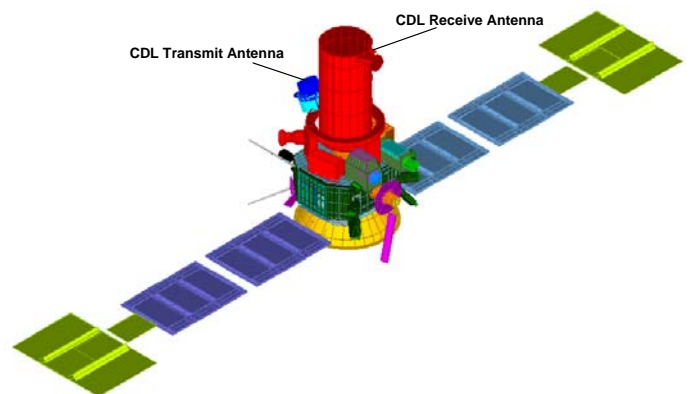
As prime contractor, TSC provides an adaptive linkage between the agile, experiment-oriented customer, and the industrial, product-oriented manufacturers of CDL equipment who are our strategic partners. This practice of *process impedance matching* improves customer satisfaction, reduces vendor frustration, and raises the probability of project success significantly.

As lead system engineer for the spacecraft CDL subsystem, TSC analyzes and captures application requirements for the vendor equipment and guides the vendors through development of suitable modifications. Application requirements include adaptation of vendor equipment to the spacecraft environment, and selection of specific interface details from among the numerous options available in each platform. TSC documents the final interfaces in a comprehensive Interface Control Document (ICD) and negotiates the inevitable mismatches between the CDL equipment and subsystems connected to it.

GROUND SYSTEMS AND SOFTWARE

TSC also provides system engineering for the tactical ground system used by warfighters in theater, defining its architecture and guiding its integration. At this end, TSC works with vendors of CDL ground station equipment and sensor data exploitation tools, specifying product modifications and operational procedures that are required to support connectivity with the spacecraft and negotiating mismatches. Just as is done for the spacecraft, ground system architecture and interfaces are documented in an ICD that incorporates both vendor information and as much descriptive glue as necessary.

Finally, TSC develops sensor data processing and theater-oriented sensor tasking software for the tactical ground system. Adapting spacecraft sensor data to the existing exploitation tool environment is essential: forcing warfighters to adapt to the new sensor's specific data format would be burdensome in military operations. To ensure compatibility, TSC negotiates sensor data formats with satellite sensor developers, then writes conversion software that runs on the ground to turn the final format into standard exploitable data. Similarly, scripts and software adapters are provided to ease the incorporation of space-based capability into existing operational routines.



Engineering model of the RoadRunner JWS-D1 spacecraft.

TECHNOLOGY

The Space CDL Subsystem combines various pieces of vendor equipment in a TSC-designed architecture shown at right. Critical components include the Microwave Modem Assembly (MMA), Electronically Steered Array (ESA) transmit antenna, and a simple patch receive antenna. The MMA and ESA offer control interfaces to the spacecraft flight computer, and the MMA provides dataflow interfaces for both high-rate (imagery) and low-rate (commands and telemetry) channels.

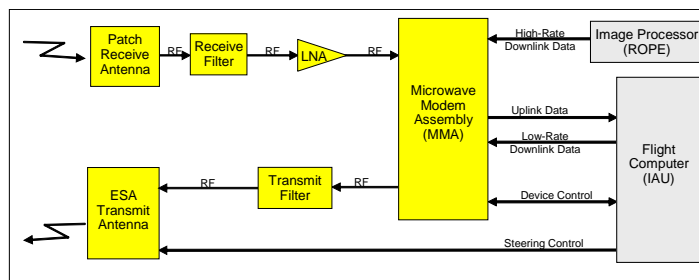
The Space CDL Ground System, the TSC-designed architecture of which is shown at right, provides termination of the wireless link to space via a legacy theater terminal (labeled "MIST" in the figure). A data recorder ("MIST Interface Module") and Remote Tasking Terminal (RTT) process application data such as commands, telemetry, and imagery. Images are handed off to a legacy warfighter workstation ("TES") for tactical exploitation.

The Space CDL Ground Station includes both off-the-shelf and custom software modules in the RTT to handle the various data streams. The RTT software architecture is shown at right; TSC's design is embodied in the data structures and scripts by which the modules communicate with one another. TSC also provides the Image Processing Software Module, which handles conversion of RoadRunner's custom data formats into standard JPEG-2000 image files for display at the RTT, and into National Imagery Transmission Format (NITF) files for the TES.

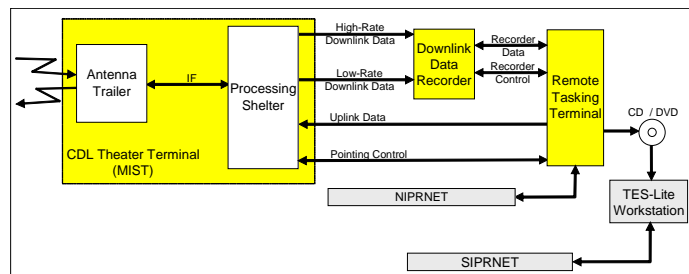
ARCHITECTING THE FUTURE

As JWS-D1, RoadRunner is the first in a long line of tactical satellites supporting the DOD's Operationally Responsive Space (ORS) initiative. Experience with RoadRunner and previous ISR projects positions TSC well for similar roles in Joint Warfighter Space Demonstration 2 (JWS-D2) and subsequent ORS missions. With TSC as lead system engineer, those projects will have a high probability of success.

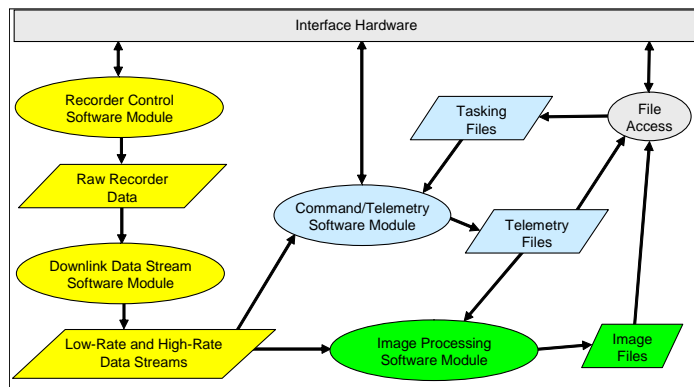
RoadRunner CDL Subsystem Architecture



RoadRunner CDL Ground System Architecture



RoadRunner RTT Software Architecture



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