Kodiak Launch Complex Spaceport Control System

Kodiak Launch Complex Spaceport Control System October 1999, Titusville, FL

In late 1998, Kodiak Island, a remote island in southern Alaska, will become the nation's first operational rocket launch facility that is not owned and operated by the federal government. Intent on capturing a share of the commercial polar launch market, Alaska has laid out a plan for a new low-cost state of the art spaceport that will be run entirely by a local authority similar to that used at airports. In order to receive the required launch site license, the spaceport must produce a comprehensive range safety and communications system that performs much of the functions of the billion-dollar range systems found in California and Florida. The challenge was to design a system that provided those functions at a fraction of the cost traditionally required. Using our Command and Control ToolkitTM software, CCT designed a comprehensive Spaceport Control System for Kodiak that handles all aspects of range operations:

- Telemetry and data acquisition
- Trajectory planning
- Flight termination system control
- Countdown clock and range timing management
- Range scheduling
- Launch pad interfaces
- Weather data
- Data display, archive, retrieval, playback, and simulation

Countdown Sequencer Range safety applications were designed to work together to provide critical information to form a launch commit solution and manage flight risks in real-time. Once the pre-mission planning and system configuration has been accomplished and verified, range safety can be divided into two areas: Range Safety Countdown with Launch Commit Criteria – This includes range clearance, hold-fire, stop-launch, and ground and pad safety functions. The SCS automates all aspects of the countdown and launch commit processes, allowing the spaceport operator to function with a minimal crew. It also includes signals that interface with launch control vans to control the launch vehicle countdown. In-flight Vehicle Tracking – During flight, range safety functions involve command destruct, and vehicle tracking, including instantaneous impact point and present position.

Created from a standard map and display database, these functions are managed with displays that clearly show booster impact areas, destruct boundaries, flight profiles, and ground tracks. SCS Architecture The SCS is comprised of multiple distributed processing subsystems connected together with standard COTS interfaces, operating systems, data/command processing modules, and data visualization tools. Starting at the launch pad, the SCS provides a range of relay closures, analog and discrete I/O signals, and potentially vehicle interfaces via the umbilical that can be configured as required by the spaceport or vehicle.

The launch site data backbone includes interfaces to local and remote ground stations, external range systems, facility monitoring devices, and vehicle operator-provided launch control systems. In the launch control center, a real-time control server runs the Command and Control ToolkitTM software to handle data and command management, while a front-end processor deals with incoming telemetry. Data is

available to any of dozens of consoles and view-only monitors located throughout the center. Incoming data is acquired and decommutated from the spaceport external interfaces, time-tagged, and multiplexed into a normalized sequential data stream by the front-end processor. This raw data is processed through commercial telemetry gear that handles EU conversion, linearization, limit checking, and derived data computations. Data values are then passed to the display engines and application execution environment in which integrated data, command, and event software drives the range safety algorithms and real-time graphic display workstations. An offline application environment provides the tools necessary to create new SCS applications for launch control and mission-specific control and monitoring algorithms. The graphic workstations provide the operator interface for navigation and presentation of real-time visual displays. Two- and three-dimensional display creation tools provided by the Command and Control ToolkitTM facilitate creation of new displays that can be executed on Windows NT or Unix-based computers.