

# Data Acquisition Systems Manager Application (DASMA) For a Munitions Test System

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**Category:** Prototype/Test

## NI Products Used

LabVIEW 7.1

PXI-1025 Mega PAC

PXI-1031 4-Slot Chassis

PXI-6115 (3) 4 Channel 10 Ms/s Simultaneous Sampling Multifunction Data Acquisition

PXI-8186 (2) Windows XP Controllers

PXI-6143 8 Channel 250 Ks/s simultaneous Sampling Multifunction Data Acquisition

SCB-68 Shielded Connector Blk

## The Challenge

Develop a system to productively manage, display, and archive the huge amount of data coming from the many subsystems that are part of a munitions test system. The subsystems collectively acquire, analyze, and evaluate characteristics of a flight path and trajectory of a war-shot projectile or missile (Figure 1). This system includes real-time simulation, multiple displays of real time data, large amounts of data at high rates streaming to file archives and communication with several subsystems via SCRAMNet.

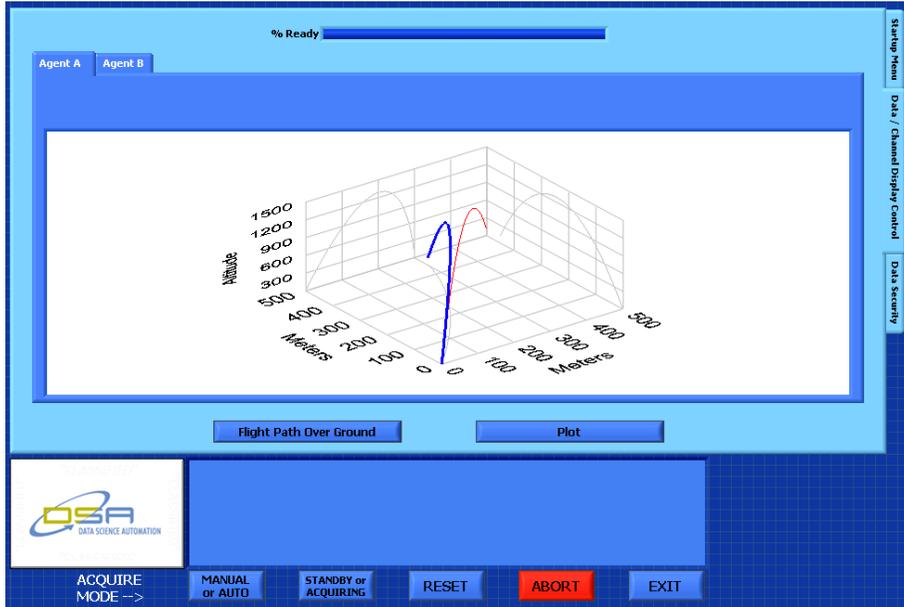


Figure 1. Munition Trajectory

**The Solution**

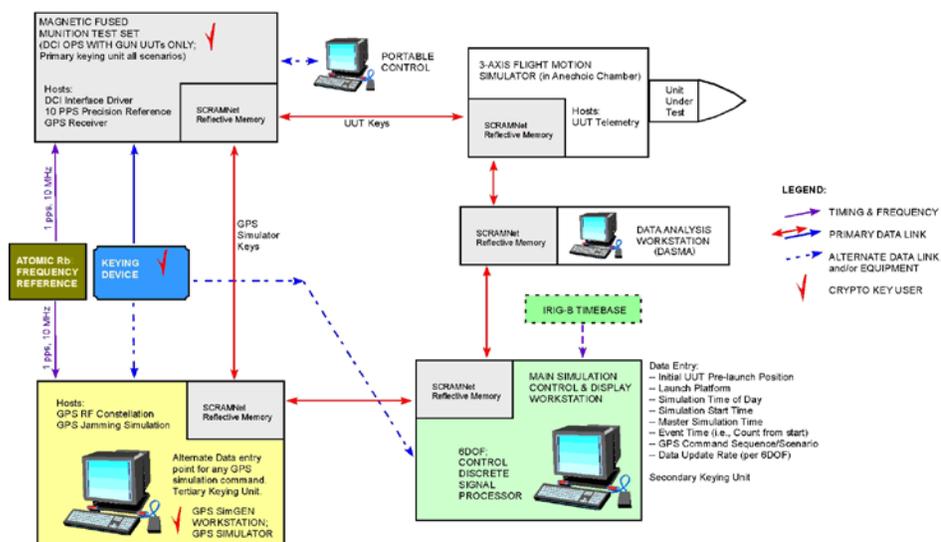
The solution was implemented with LabVIEW 7.1 and a custom SCRAMNet driver based upon VISA. The flexibility of LabVIEW allows for unknown types of munitions that will be developed in the future to be handled by simply creating a new module making the application highly scalable.

**Abstract**

The controlled testing of munitions requires a highly complex system that involves the tight synchronization of many subsystems including simulation components. SCRAMNet is one method by which subsystems can share data. One of the critical subsystems that will allow post test analysis consolidates and archives the data from all subsystems and provides a customizable user interface in which to view selected data during the test.

## Introduction

Data Science Automation was selected to develop this challenging application. A primary function of DASMA was the acquisition of sensor signals from the Unit Under Test (UUT) In addition to the acquisition of sensor signals the need to obtain large amounts of data from the SCRAMNet interface for display and archival was of high concern. The channel count for this application was approximately 20,000 channels at sampling rates up to 1000Hz. Along with the high channel count DASMA conducts handshaking with other nodes of the SCRAMNet network allowing acknowledgment of commands sent and received to assure correct test process sequencing. For the direct acquisition of sensor signals the computer hosting the manager application would also be connected to a remote PXI-1031 4-slot Chassis with Data Acquisition Cards which would acquire the UUT during the test. A second remote acquisition unit (PXI-1025 Mega PAC) would be used for down range acquisition and its data would be relayed by Ethernet or RF radio frequency (RF) telemetry (Figure 2). During the testing of the



**Figure 2. Subsystems Overview**

UUT, operator selectable plots of real time data can be monitored.

The manager application allows the introduction of new types of UUTs with different SCRAMNet and signal configuration to be handled using external configuration files without changing the base code of this application. The application had several operational states including a pre-launch state, a “Load and Go” state, and the post analysis state. In the pre-launch state the manager application loads configuration test information then, if desired, the operator to tailor the configuration of the parameters for the test to be performed. Configuration setup governs all operations for configuring the data acquisition subsystems for a UUT test flight simulation. This may be a new configuration or based on an assortment of predefined, equipment-specific setup files. Each scenario can be comprised of many different modules that are related to specific nodes or UUTs. The ability to choose which groups of data will be collected along with their sample rate and the estimated time the test should take allows a great degree of flexibility.

Estimating the time allows the pre-allocation of disc space in order to lessen the burden on the processor during the streaming of archived data. The “Load and Go” state loads all the selected parameters into the main application and start the data acquisition. During the first stage of this, DASMA loads each of the selected

modules and its parameters. As each module loads, an archive file is created on disk. As each module loads it is displayed in a sub panel on a tab control. Additional tabs are dynamically created for each module (Figure 3). Once all the modules are loaded the data acquisition begins saving all the data to file in a binary format. By utilizing the interrupt feature SCRAMNet, DASMA caches the entire system status of all 20,000 channels then only needs to respond to data changes

A PXI 1031 with three, XI 6/15 chassis was used to gather the 24 digital channels along with the 12 analog channels needed for the UUT pre-launch data and communication. The UUT is normally the guidance and payload section for a military war shot or telemetry pod, with signal I/O via slip ring connections in the three-axis flight motion simulator. DASMA also interfaces to other subsystems such as GPS tracking systems, infrared imaging system, RF telemetry system, Six degree of freedom rate table, MFMTS (Magnetic Fused Munitions Test Set, and a 3-Axis Flight Motion Simulator via SCRAMNet. By adding SCRAMNet nodes, other equipment and multiple UUTs can be added to the system with ease by simply modifying the configuration file and defining a new module, if necessary, if the data structure is different from those previously used.

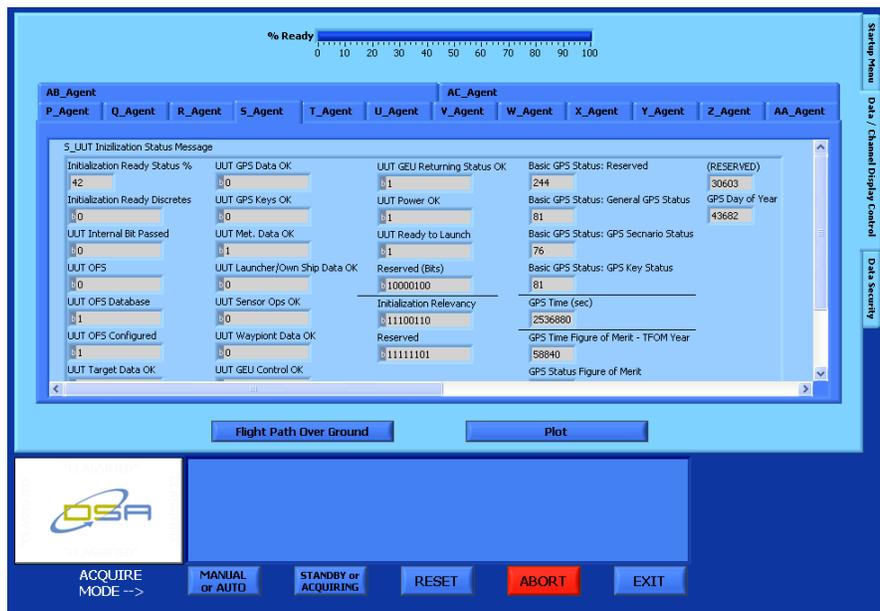


Figure 3. Tabs are created dynamically

### Summary

Data Science Automation, Inc. was able to design and construct a very high channel count application that managed and recorded the data parameters of the supporting subsystems of a munitions test system using National Instruments LabVIEW. DASMA interfaced with the subsystems using a SCRAMNet interface and recorded a configurable set of critical test information needed for the analysis of the flight trajectory of a war-shot for our client. The end result was a highly flexible application with a scalable architecture that can be adapted to new war-shots that have yet to be conceived. In addition, the expansion of the quantity of remote, down-range data acquisition subsystems can also be handled in a similar fashion.