Self-Contained Information Resource (SCIR) for Automated Real-time Data Acquisition, Data Archival, Data Analysis, and Data Exploitation of Ground Truth Radiometric Signatures from Scaled Ordnance (SCALO) High Explosive Events.

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Lydia Boye, Terry Herther
P.O. Box 5800
Sandia National Laboratories
Albuquerque, N.M. 87185-1207

Curt Harris, Garry Bender, Cecilia Castillo
2400 Louisiana Blvd. N.E.
Los Alamos Technical Associates (LATA)
Albuquerque, N.M. 87110

Mary Hoffman
MS1207 (5909)
Computer Sciences Corporation (CSC)
P.O. Box 5800
Albuquerque, N.M. 87185-1207

For the past 20 years, Sandia Center 5900 has managed, conducted, and performed radiometric field testing against a variety of sources and targets. Test planning, data acquisition, archival, analysis, reduction, and data distribution have always been costly and time-consuming components of these collections. As a result of the Scaled Ordnance (SCALO) High Explosives field test 1, a data acquisition system integrated with a data archival and retrieval database was conceived by Sandia, and developed by Los Alamos Technical Associates (LATA) with the assistance of Computer Sciences Corporation (CSC). The SCIR is an integrated, interactive system that records the ground truth data from an experiment relating to the test planning, and collection of optical signatures such as the SCALO explosive events. The software for the system is written in VisualBasic programming language and incorporates National Instruments data acquisition hardware and software, and Microsoft Access software for data archival. This approach provides facilitation of signal data collection, real-time analysis, data cross correlation, and data distribution. Experiments performed over a period of several days or several years can be archived. Additional parameters characterizing each event are documented in logs along with calibration values, site surveys, and meteorological data. The resource also provides analysis algorithms to reduce the radiometric data to apparent source radiance and source-integrated energy. Field test pictures, and explosive event video frames are also incorporated. The data in raw form is also exportable.

A graphical user interface gives the system the feel of an electronic encyclopedia. The electronic record provided by the SCIR, in addition to providing a repository of comprehensive experimental information, links and relates the knowledge imbedded in that information. The database is available in an executable form on CD-ROM, which can provide long-term storage of all information in one location and provides easy distribution.

Although the SCIR format and structure development was specific to High Explosive test series and data collection, it provides leverage for development of a database structure that is transparent to any type of field test effort for ground based multi-spectral radiometer optical data recording.
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Figure 1. Consequence of Field Test: Overwhelming Data Management

All relevant data provided to interested parties
All available from a single widely used interface
Systematic, interactive, intuitive, access
Executable methods included or hyper linked via Internet/Intranet (Secure Net)

Figure 2. Value of The Self-Contained-Information-Resource

Figure 3. Comprehensive Computer Assisted Experiment Documentation Objectives

Improve the quality of documentation of field test data acquisition
Improve timeliness, completeness, and quality of post acquisition data analysis
Provide in-the-field data analysis preview for test plan modification
Reduce the cost of executing, and documenting experiments
Standardize method for consolidating data from multiple organizations
Figure 4. Primary Objective

Provide an exhaustive record of the experiment in a compact, interactive form
All data recordings available and interactively accessible
Tools for visualizing the data
Complete context and methodology documentation
Complete set of executable tools used to analyze the data (or interface to analysis tools external to the system)

Figure 5. Experiment Documentation

Figure 6. Component Subsystems

Planning
Execution
Documentation
Analysis
Component type maintenance
  EG: Configuration and yield of devices to be used
Component maintenance
  List of specific components available (or needed)
Combine components into (event Producing apparatuses)
  EG: Three sixty lb. Spheres of material x
Define instruments
  Detectors, Optics, Filters, Apertures
  Calibration
Define events
  Apparatus, Place, Date, and Sequence
  EG: Apparatus 12, at test site 3, on test day, third event of the day
Instrument events
  Instruments, Configuration, Location, Gain, Sample Rate, etc.
Reorder events, Reconfigure Apparatuses & Instruments as Needed
Figure 9. Execution Functions

View and modify event order
Modify event specifications for each event
View changes from one event to the next
View configurations & inform system that changes have been made
Overview status of instruments, event, and safety
Inhibit execution until status=ready
Make multiple instruments settings
Enable execution
Receive initiation signal from fire control system
Initiate and terminate data acquisition/recording
Record and save execution anomalies
Save data to permanent storage
Input test director and team comments
Save aggregate data, comments, etc. to DB tables
Display user selected Graphic data

Figure 10. Analysis Functions

Storage
Store empirical test data in a format that can accept data from any test
Store data from all tests together and provide a consistent mechanism for retrieval

Retrieval
Retrieve empirical data sets and summary and aggregated data based on:
  Test and event parameters
  Where and when, etc.
Apparatus parameters
  Weight, number of components, component type, etc.
Instrument parameters
  Detector, filter, etc.

Basic Computation
Convert raw empirical data phenomenon domain data (EG: volts to radiance)
Identify start and end of event
Compute maximum phenomenon value of the event
Compute integrated energy of the event
Compute other aggregate functions as required

Display
Display line graphs of individual empirical data sets over time (i.e.: for a single instrument for a given event)
Display line graphs of user selected sets empirical data sets (i.e.: for a specific instrument over all events with certain characteristics)
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Reference: