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.

January 1999

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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.

Form SF298 Citation Data

Report Date *("DD MON YYYY")* 00011999	**Report Type** N/A	**Dates Covered (from... to)** *("DD MON YYYY")*

Title and Subtitle 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.	**Contract or Grant Number**
	Program Element Number
Authors	**Project Number**
	Task Number
	Work Unit Number
Performing Organization Name(s) and Address(es) Sandia National Laboratories P.O. Box 5800 Albuquerque, N.M. 87185-1207	**Performing Organization Number(s)**
Sponsoring/Monitoring Agency Name(s) and Address(es)	**Monitoring Agency Acronym**
	Monitoring Agency Report Number(s)
Distribution/Availability Statement Approved for public release, distribution unlimited	
Supplementary Notes	
Abstract	
Subject Terms	
Document Classification unclassified	**Classification of SF298** unclassified
Classification of Abstract unclassified	**Limitation of Abstract** unlimited
Number of Pages 6	

Figure 1. Consequence of Field Test: Overwhelming Data Management

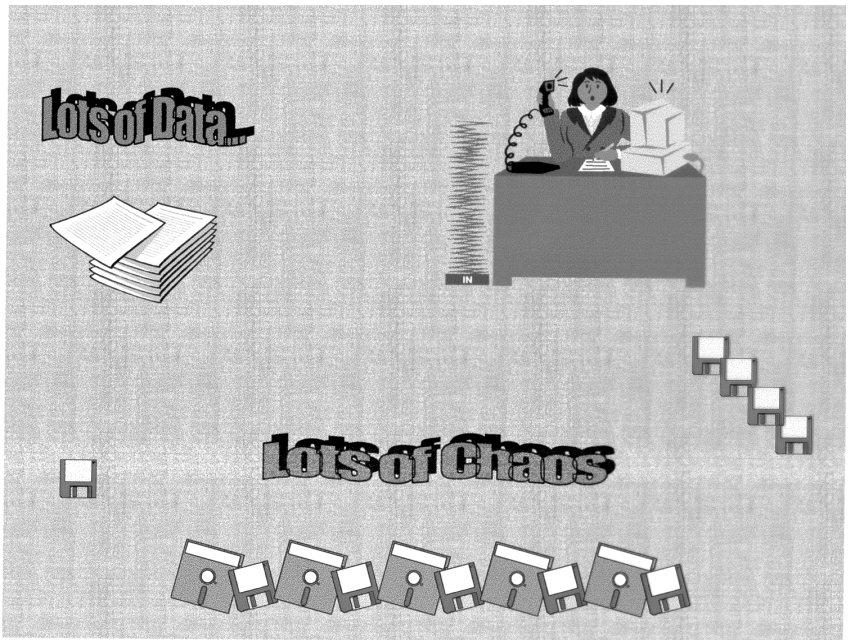


Figure 2. Value of The Self-Contained-Information-Resource

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 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

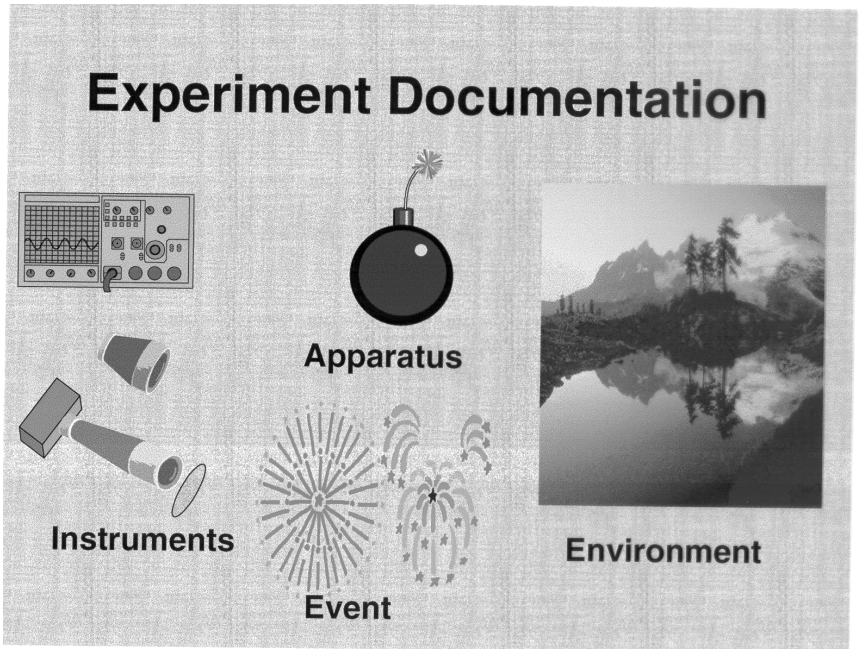


Figure 6. Component Subsystems

Planning Execution Documentation Analysis

Figure 7. Data Acquisition Planning and Execution Automation

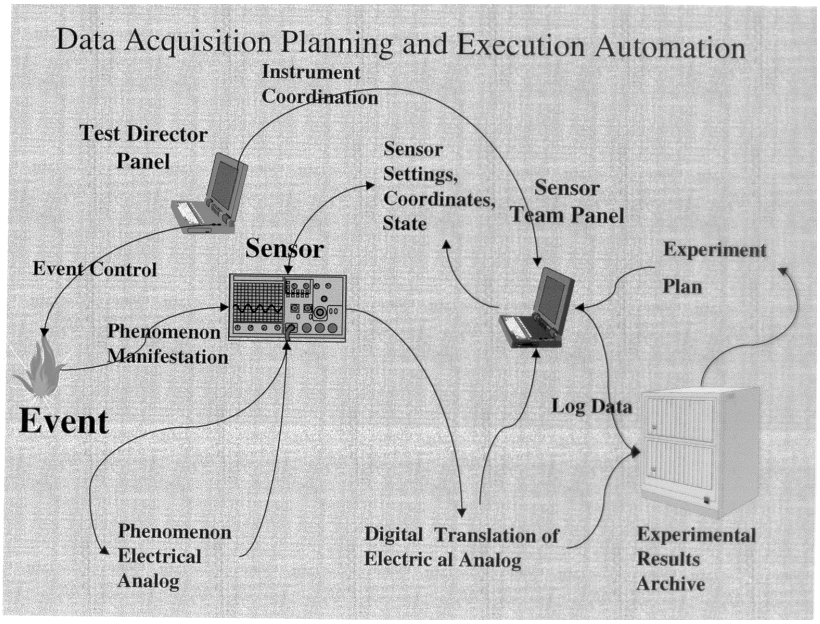


Figure 8. Planning Functions

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

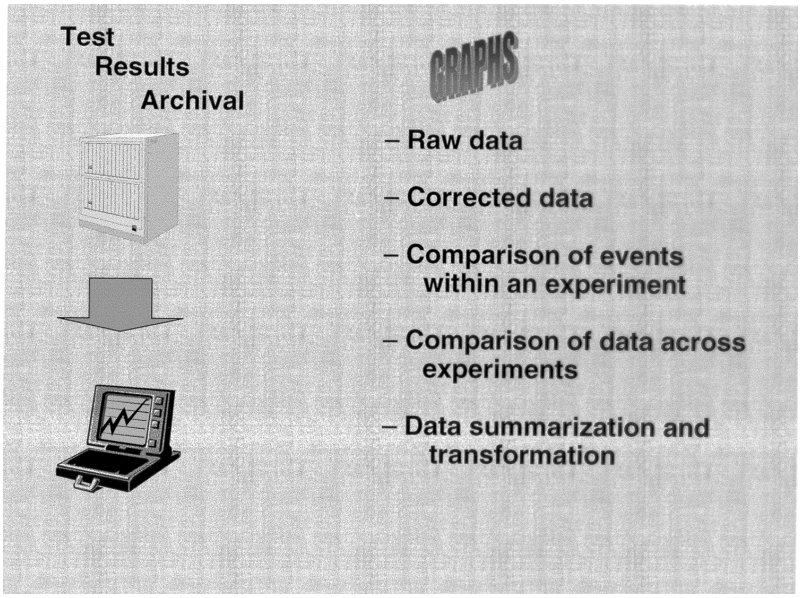
View and modify event order
Modify event specifications for each event
View changes from one event to the next
View configurations & inform system that changes have been made
Overview status of instruments, event, and safety
Inhibit execution until status=ready
Make multiple instruments settings
Enable execution
Receive initiation signal from fire control system
Initiate and terminate data acquisition/recording
Record and save execution anomalies
Perform "field" analysis computations
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)

Figure 11. Test Results Archival



Sandia is a multi-program laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy under Contract DE-AC04-94AL85000.

Reference:

(1) Boye, Lydia, Herther, Terry, et. al, "Remote Sensing Integrated Energy Models for Estimating High Explosives Weight From Multi-Spectral Radiometric Data Collected from Scaled Ordnance (SCALO) Field Tests and Other Military Munitions Deployments." (U), SAND 99-0019C, January 1999