Virtual Prototyping Feasibility/Benefit and CB Common Knowledge Base BA05MSB061

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Virtual Prototyping Feasibility/Benefit and CB Common Knowledge Base,

SCOPE

First, analysis and experimentation to determine the feasibility of virtual prototyping in support of CBRN developmental programs and quantify the benefit of virtual prototyping to these developmental programs. Second, develop an implementation plan for a Common Knowledge Base (CKB), which will become a community resource for the Chemical Biological Defense Program (CBDP).

- Work being performed by MSA Team, CBIAC, (and ITT as required)
- Synergy with ongoing PM CA efforts to develop component/system models

OUTCOME/STATUS

- Developed use case study plan. Metrics to quantify benefit of virtual prototyping still being evaluated.
- Needed JSLSCAD VP modifications coded
- Functional characteristics (black box) VP study nearly complete for JSLSCAD Field of Regard
- CBRN Data model training and review completed by the CBIAC team for version 1.2 of the CBRN Data Model
- Initial design and implementation plan for CB CKB ongoing

RELEVANCE

- The true benefit to a Program Manager (PM) in terms of cost, schedule or risk reduction, has not been demonstrated to an extent that the CBDP community will embrace the idea of virtual prototypes or prototyping.
- A body of agreed-upon data (threat agent date, environmental data, test data for past and current CBDP systems) that PMs and combat developers can access when doing analyses for various decisions is a long-standing need in the CBDP community.

ASSESSMENT

- VP is becoming a fact of life for at least the two CB PMs in this task
- Use cases straightforward—generalized quantification of VP benefits more difficult
- Expect transition in FY07 on completed CB CKB

Functional Performance VP Use Case

- PM addressing the issue of elevation angle extents for system field of regard

- Needed to consider impact of terrain, attack type, vehicle route, etc.

- Tradeoff between large FOR to avoid missing an attack and smaller FOR to increase probability of detecting attack given it is within the FOR

- Using a variant of CB Dial-A-Sensor™ (CB DAS) called CB Analyzer

Virtual Prototyping Use case for System Performance Requirements

CB Analyzer Adaptations

- Created capability to output the Minimum/Maximum detection Azimuths on cloud groups with air gaps between them. Analyzer originally assumed all clouds were in one large group.

- Created capability to output detailed and synopsis detection data to a text output file. This allowed easier ingestion for MathLab compared to the XML format.

- The Analyzer JSL Analysis Process (JSLAP) tool creates sensor positions around the cloud mass based off of distance and direction from the center of the cloud mass. The positions and distance to output were originally hard coded. JSLAP was modified to allow the user to select any distance and position to place a sensor.

Modifications funded by both PM and Tech Base collaboratively

JSLAP Tool
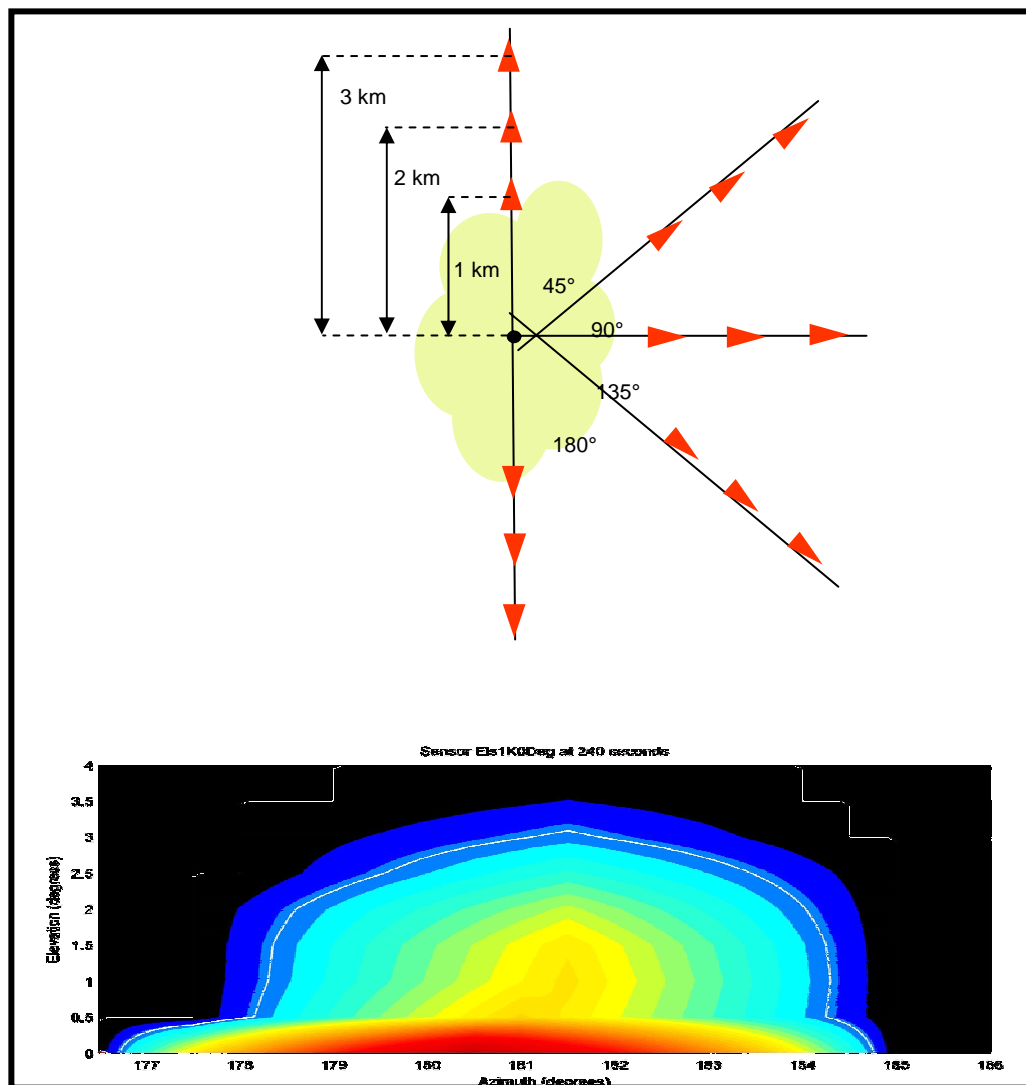
Operational Vignette
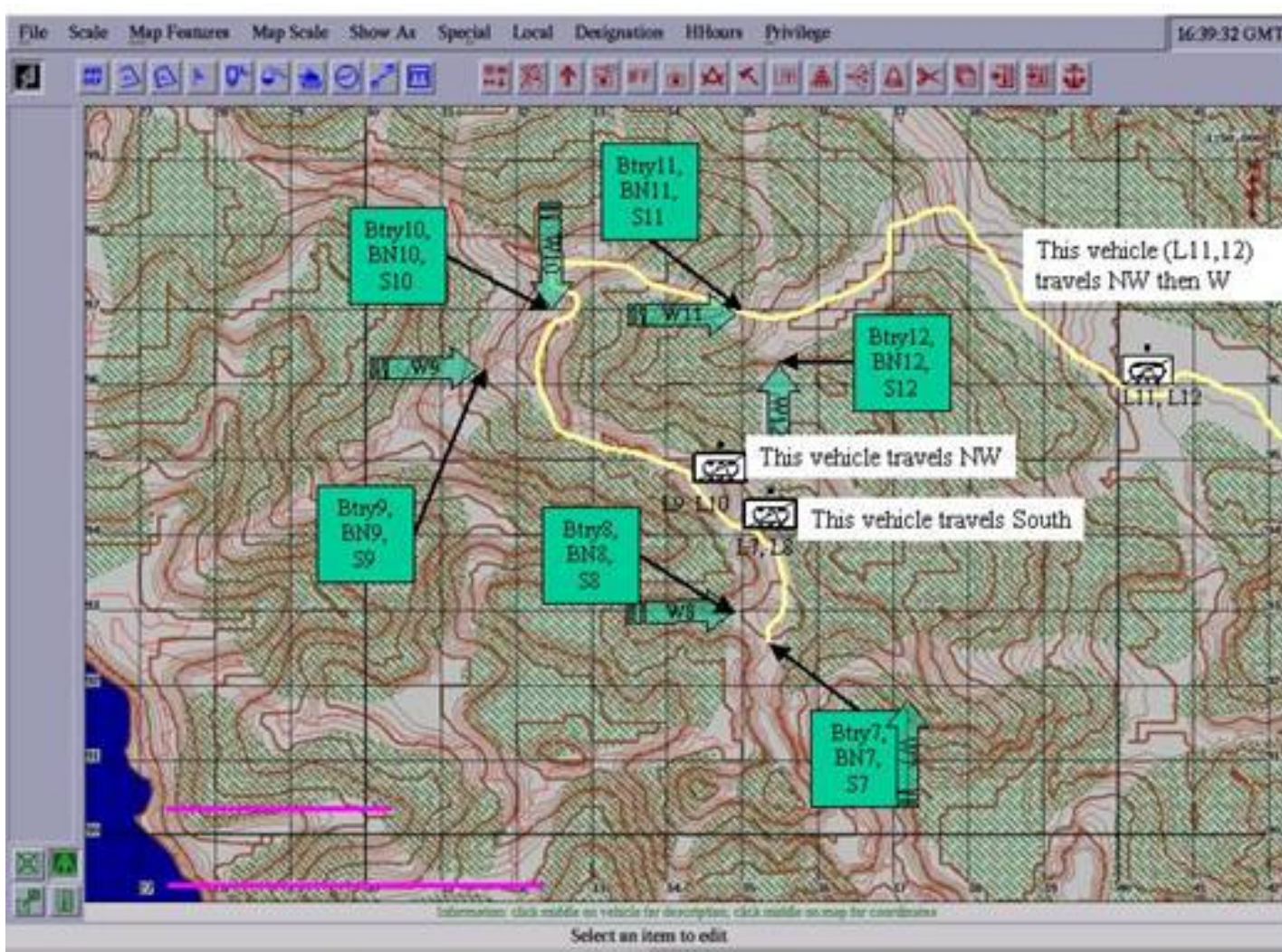## Moderate Elevation Terrain

All vehicles travel from SE to NW along recon route

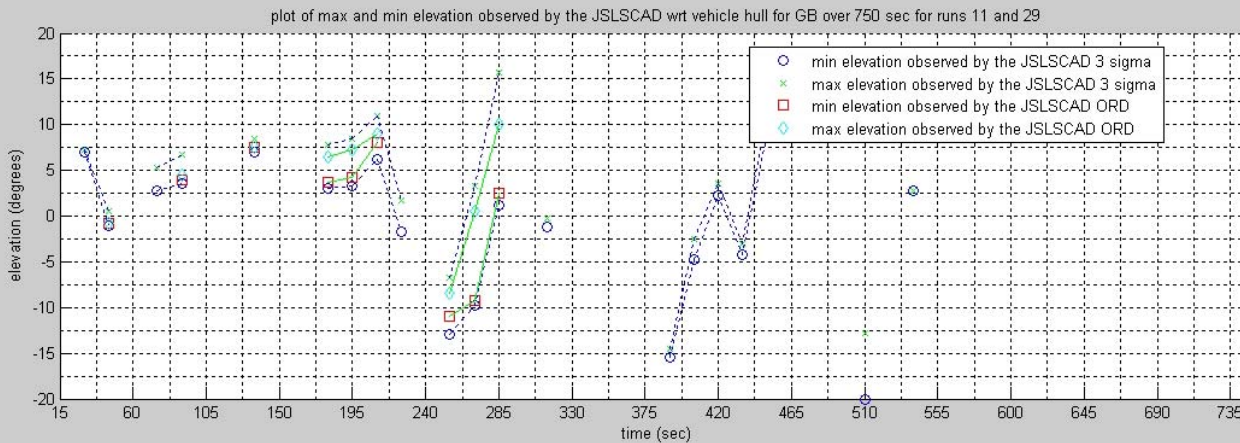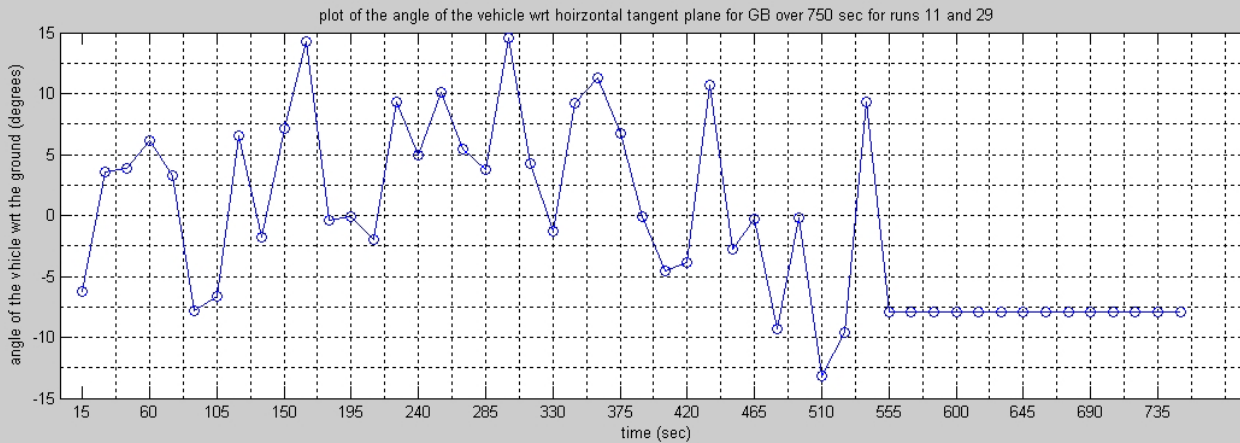Extend system evaluation to conditions not currently tested

Operational Vignette
Mountainous Elevation Terrain

Extend system evaluation to conditions not currently tested

M&S Captures the Decidedly Dynamic Situation

PM Perceptions

- Using VP to clarify/refine performance requirements translates to cost savings due to avoiding redesign
- PMs see need as they are funding on their own; however…
- A common VPS or suite would lead to better reuse of code
- Final quantification of benefit depends on:
  - Acceptance by T&E community
  - Ability to perform and document VV&A
  - Success or failure of PM to get performance requirements modified based on M&S results

Benefit Quantification Ongoing

CB Common Knowledge Base
(CB CKB)

- **TASK:** Develop a coordinated CB CKB which will become a community resource for the Chemical Biological Defense Program (CBDP)

- **Overall Program Goals:**
  - Conduct data level technical analysis of existing CB repositories
  - Compare to the CBRN data model produced by JPM IS
  - Produce implementation plan to establish, validate and provide data set product standards and performance metrics for those sources that will become a community-accessible resource ('05)
  - Implement a Pilot CKB supporting Detection VP ('06)
  - Establish a Secure On-Line CB CKB System for CB Community (expanded domains) ('07)

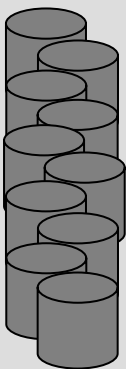Community Resource for the Chemical Biological Defense Program

CB CKB Architecture
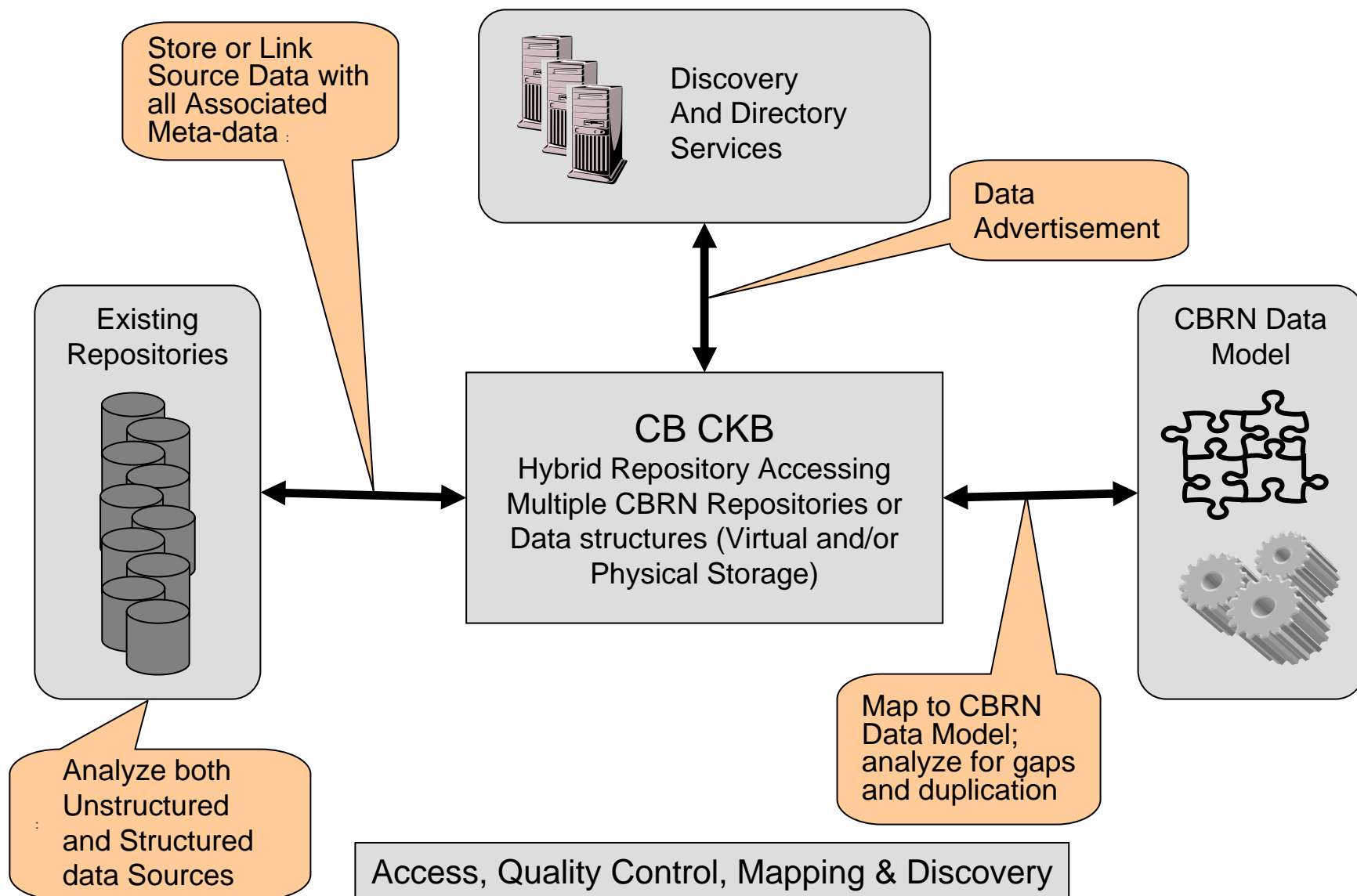
Store or Link Source Data with all Associated Meta-data :
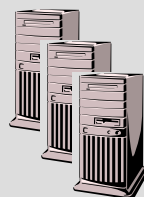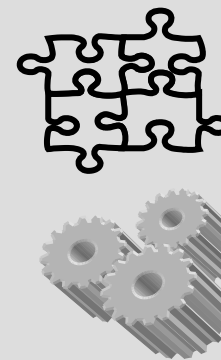
Discovery And Directory Services

Data Advertisement

Existing Repositories

CBRN Data Model

CB CKB
Hybrid Repository Accessing Multiple CBRN Repositories or Data structures (Virtual and/or Physical Storage)
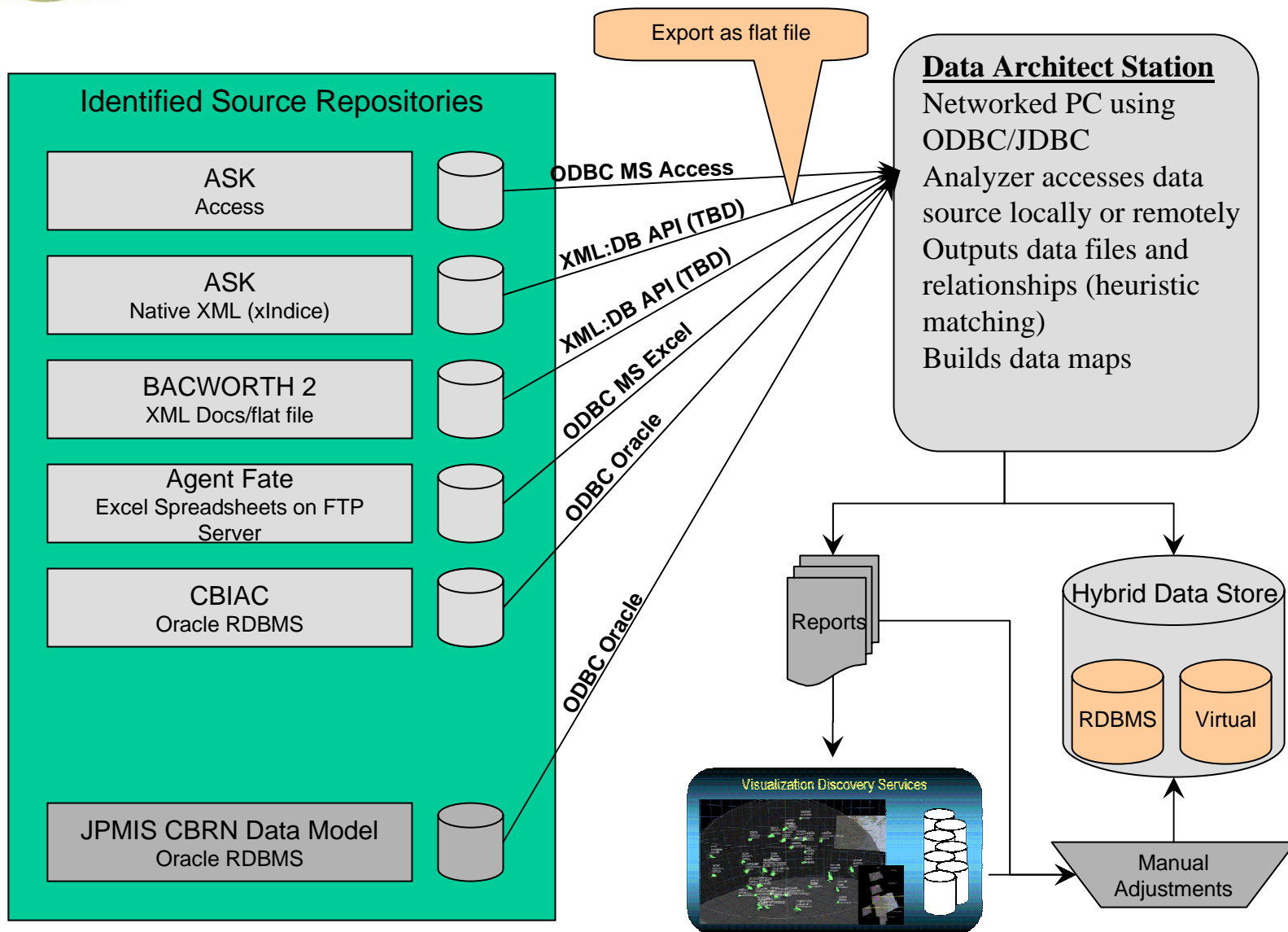
Map to CBRN Data Model; analyze for gaps and duplication

Analyze both Unstructured and Structured data Sources

Access, Quality Control, Mapping & Discovery

Information Fusion Build Process

Information QC and Access

Identified Source Repositories

- ASK — Access
- ASK — Native XML (xIndice)
- Agent Fate — Excel Spreadsheets on FTP Server
- BACWORTH 2 — Native XML DB
- CBIAC — Oracle RDBMS
- J.A.C.K.S — Unknown Doc Mgmt Sys (DMS)
- CB IDE — LiveLink DMS

Structured/Semi-Structured Data Sources

Federated Data Source

Unstructured Data Sources

Hybrid Data Store — RDBMS, Virtual

Data Advertisement

Application Access

Information QC

User Access

User Query

Index and Search Engine

Services - Directory

Web Services - Data

User Portal

CB CKB Milestones

- Phase 1 Milestones (June – Nov '05)
  - Define Data Requirements
  - Recommend Data-Centric Processes
  - Define CB CKB System

- Phase 2 Milestones (FY06)
  - Data Domain Analysis and Integration
  - Data Model Development
  - Engineering Design and Pilot System Development

- Phase 3 Milestones (FY07)
  - Establish Secure on-line CB CKB
  - Implement Process to Manage Data on CB CKB

Process and Methods to ensure future CB data is available and valid