

# Dynamic Data and Modeling Services Suite

Tina H. Chau

Alexander P. Moore

Richard L. Mullikin

Janet E. Wedgwood

Lockheed Martin Corporation

720 Vandenberg Drive

King of Prussia, PA 19406

571-313-6605, 610-354-7590, 917-497-0424, 856-792-9879

tina.h.chau@lmco.com, alexander.p.moore@lmco.com, rick.mullikin@lmco.com, janet.e.wedgwood@lmco.com

## Keywords:

counter-insurgency, data harvesting, data services, data query, innovation, integration, proof-of-concept fusion environment, services suite, modeling services, geo-location, social sciences

## 1. Research Objective

The objective of our research is to translate our proof-of-concept fusion environment – currently feeding its predictive models with comprehensive human terrain data from dynamic sources – into a complete Dynamic Data and Modeling Services Suite that is tailored for use by Counter-insurgency (COIN) Operations commanders, military advisors and intelligence analysts.

At the core of COIN Operations is the mission to win the hearts and minds of the population. Full-spectrum mission planning thus requires an actionable consideration of social dynamics and core social sciences, collectively referred to as the human terrain (*i.e.* indigenous populations' behaviors, motives, foundational thoughts and beliefs, etc.). This requirement raises two primary technical challenges:

1. Modeling Dynamic Behavioral Environments: COIN modeling services must support varied behavioral and predictive models to accommodate for differences in population compositions, actions, beliefs and motives.
2. Operationalizing Data Services: Dynamic socio-cultural models require vast and timely intelligence harvests, which is both challenging and time consuming. The evolving nature of the cyber domain renders online content, while of increasing value for near real-time behavioral data, difficult to collect, manage and store for operational use.

This project leverages ongoing research and development – including the integration of existing technologies and

innovative coding, algorithms, modeling and theoretical methodologies – to form a data and modeling services solution to the aforementioned challenges. This abstract outlines presentation material on the existing proof-of-concept fusion environment (hereafter referred to as “Environment”), as well as the future work that will form the complete services suite.

## 2. Fusion Environment and Services Suite

The Dynamic Data and Modeling Services Suite will build on the proof-of-concept fusion environment for end-to-end systems integration of human terrain datasets and modeling services. The Environment's GUI serves as the key interface to the dynamic data and modeling services.

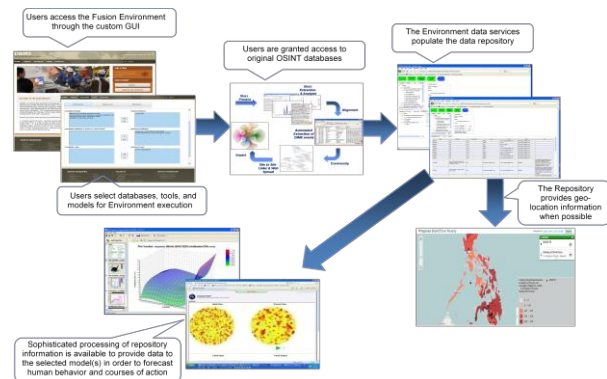
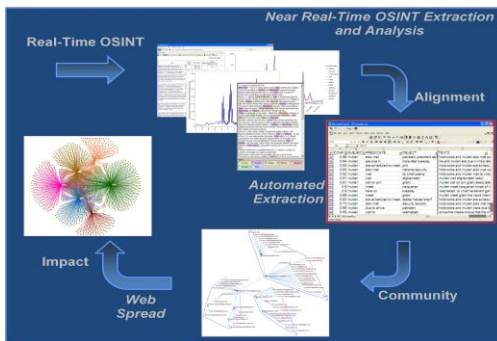


Figure 1. User Flow

The data services repository ingests, manages, stores and processes data to create User-customized model sets. Databases are ingested from diverse and dynamic human terrain sources, (*e.g.* Global Terrorism Database at the University of Maryland, Lockheed Martin internal

database, etc.) to provide full-spectrum coverage. The repository, supported by advanced service oriented architectures, aggregates and organizes datasets according to User-defined queries (*e.g.* date range, location, actors, targets, events, etc.). The User is furnished with organized dataset lists, links between coded events and raw data, query logic, and geo-spatial event locations. Geo-locations for each dataset are triangulated via a combination of GeoIQ, the geospatial engine from FortiusOne, and original coding for graphical and census overlay displays of the datasets on preconstructed maps.

The Environment is primed for additional data services. The future Suite will exploit the evolution of the Internet by generating original databases comprised of online social networking data, standard news feeds, structured databases, etc. Automated harvesting of near real-time behavioral data will be achieved by integrating innovative algorithms, which have been successfully developed and tested under Lockheed Martin, into the Services Suite.



**Figure 2. Suite Original OSINT Databases:** algorithms' capture of dynamic online social networking data.

The GUI also enables model selection that is pertinent to event(s) of interest. The Environment supports numerous models – including innovative and existing statistical, agent-based, decision, linear regression and structural equation models – to forecast enemy actions and population behaviors, as well as to assess User inputs.

As future work is conducted to transform the existing Environment into a complete Services Suite, existing and new models will be fully integrated into the underlying framework, which is agnostic to the modeling paradigm and model execution framework. Sophisticated data processing architecture enables the repository data to be pre-processed in nearly infinite ways to support these modeling service additions.

It is our assertion that data and modeling service additions to our proof-of-concept fusion environment will lead to a powerful and astute Services Suite that is tailored to address the challenges facing COIN operators.

### 3. References

Barber, Daniel and Nicholson, Denise, "Intelligent Resource Operational Network (IRON) for Cultural Modeling." BRIMS Conference. March 2009.

Global Terrorism Database, START. Accessed on October 2009.

Hayden, Michael, "Director's Remarks at the DNI Open Source Conference 2008." DNI Open Source Conference. Washington D.C. 2008.

Hu, D., Kaza S., and Chen, H., "Identifying Significant Facilitators of Dark Network Evolution." Journal of the American Society for Information Science and Technology 60.4 (2009): 655-665.

Hung, Victor C. and Gonzalez, Avelino J., "Towards A Human Behavior Model Based On Instincts." BRIMS Conference. University of Central Florida, School of Electrical Engineering and Computer Science. March 2007.

Petraeus, LTG David and Mattis, LTG James, "Counterinsurgency Field Manual 3-24." USMC. December 2006.

### 4. Author Biographies

TINA H. CHAU is an Intelligence Analyst at Lockheed Martin, serving as an analytical representative and jihadist subject matter expert for Human Terrain efforts.

ALEXANDER P. MOORE is a Systems Engineer at Lockheed Martin working on Human Terrain. He is also a Captain in the U.S. Army Reserve, and serves as the Brigade Assistant S-2 for the 304<sup>th</sup> Civil Affairs BDE.

RICK MULLIKIN is currently with Lockheed Martin working several behavioral modeling projects and holds a PhD in Information Science, with a focus on Artificial Intelligence from the Claremont Graduate School.

JANET E. WEDGWOOD is currently with Lockheed Martin and is a leader in the development of the core architecture for the proposed Dynamic Data and Modeling Services Suite.