Joint Research Centre Workshop on Spatial Data Infrastructure

GeoVMM

A method for measuring the value of geospatial information

Ispra, Italy
12 Jan 2006

Table Of Contents

The dimensions of integrating spatial information across the enterprise are often not well understood

- Evidence shows that geospatial information should be considered part of the core information infrastructure of an organization
- But the case for investing in geospatial information or associated technologies is often justified in technical terms or with a narrow focus on improved technical efficiencies
- How geospatial investments will pay off to the larger organization is both poorly substantiated and understood
- The problem is compounded by the difficulty of measuring the costs and benefits of knowledge assets
  - Difficult to use traditional cost-benefit methods to measure returns to groups other than direct users
  - United States Public sector agencies have no profit motive
- *Organizations need tools that adequately describe the multidimensional value of geospatial technologies*

GeoVMM is an adaptation of the Value Measuring Methodology specifically for geospatial information and technologies

- The Value Measuring Methodology (VMM) is a cost-benefit and risk analysis tool designed to capture the dimensions that are hard to quantify in a traditional financial return-on-investment study
- Originally developed by Booz Allen Hamilton and academics affiliated with Harvard University's Kennedy School of Government under contract with Social Security Administration and the General Services Administration
- VMM assesses costs, benefits, and risks for five major stakeholder groups:
  - Direct User
  - Government Financial
  - Government Operational / Foundational
  - Social
  - Political / Strategic
- *These categories provide a 360° view of government agencies and non-profit groups that do not measure returns in terms of sales, profits, and market share*

GeoVMM is an extension of the Value Measuring Methodology

- Effective use of geospatial information requires attention to the peculiarities of the data and associated technologies and processes
- The user experience with geospatial information is different than other media, and requires a specialized value framework
- Issues such as scale, resolution, and accuracy pose a special kind of risk to geographic analyses and geospatial decision support systems
- There are costs specific to geospatial technologies for development, operations, and maintenance
  - Photogrammetry
  - GPS
  - Remotely-sensed imagery
  - Geospatial metadata
- *GeoVMM extends the Value Measuring Methodology to answer questions about the costs, benefits, and risks of geospatial technologies*

There are regulatory drivers for GeoVMM within the United States

- **OMB A-4, Regulatory Analysis** - Stipulates regulatory agencies anticipate and evaluate the likely consequences of the rules they make. GeoVMM provides the analysis needed to demonstrate to public, to government agencies, as well as the agency conducting the analysis, the effects of different rules with respect to geospatial policies, protocols, and investments.

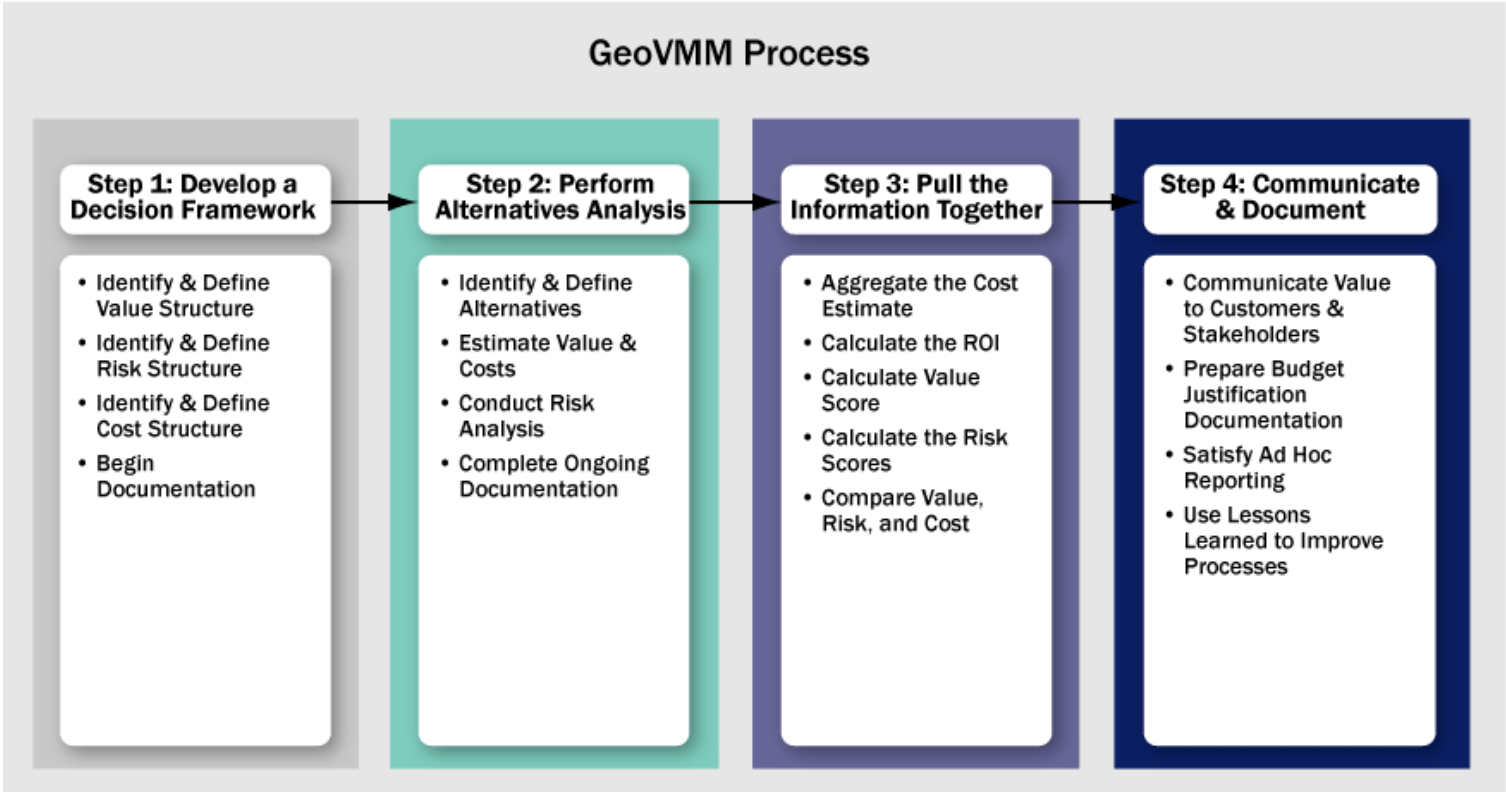
- **OMB A-11, Preparation, Submission and Execution of the Budget** – Includes many performance-based management objectives, including the President's Management Agenda. GeoVMM can provide insight needed for performance based budgeting, required for the Government Performance and Results Act (GPRA).

- **OMB A-130, Management of Federal Information Sources –** Provides policy on implementing the requirements of the Paperwork Reduction Act and Clinger-Cohen Act. GeoVMM provides necessary guidance on resource planning for geospatial information.

- **GASB-34 – Basic Financial Statements and Management's Discussion and Analysis for State and Local Governments –** A reporting model for financial and capital assets. GeoVMM can be used in conjunction with this report to show where cost, benefit, and risk accrue.

- *These drivers are not restrictive, but instead ensure that the results will be incorporated into end users' existing reporting structure*

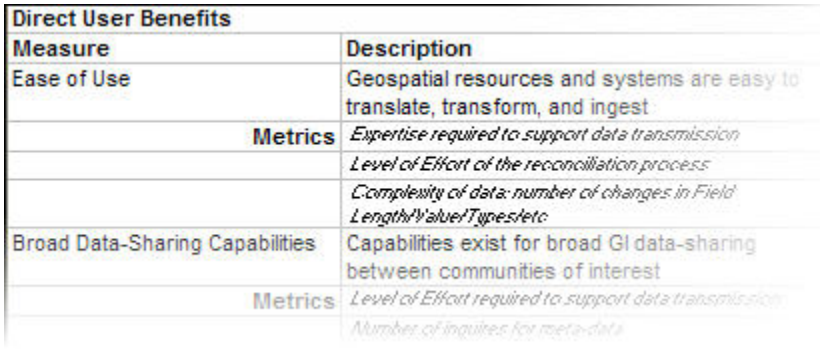
The GeoVMM process contains for steps



Independently prioritized values framework removes analyst bias insuring objective business case analysis

Because objectivity is a central concern, establishing an independent framework is essential

- **Step 1: Develop an Objective Decision Framework**
- Made up of three structures: **value, cost, and risk**
  - A blueprint for defining, analyzing, and evaluating decisions
  - Ensures that decision makers will have the level of information necessary to justify investments in geospatial information
  - Creates the overall framework and global assumptions in which the analysis will be structured



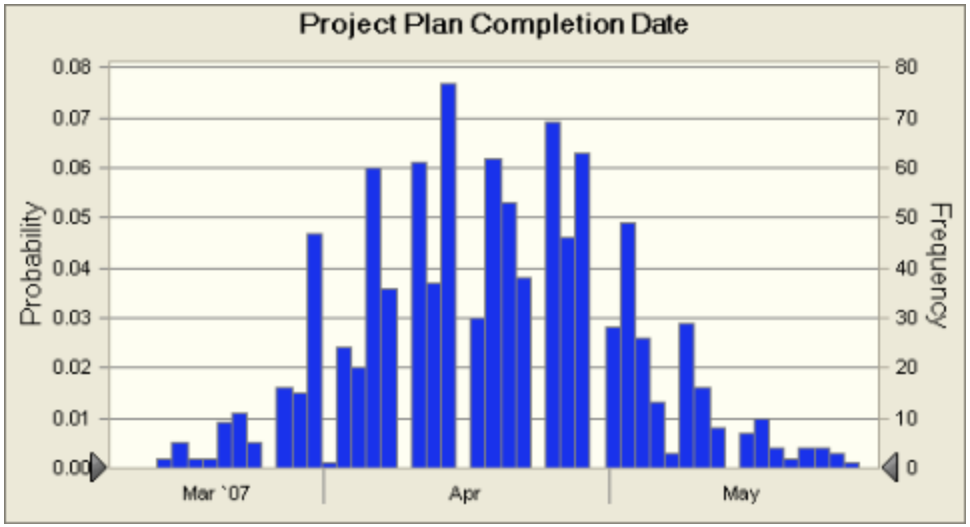
Direct User Benefits	
Measure	**Description**
Ease of Use	Geospatial resources and systems are easy to translate, transform, and ingest
Metrics	*Expertise required to support data transmission*
	Level of Effort of the reconciliation process
	Complexity of data: number of changes in Field Length/Value/Types/etc
Broad Data-Sharing Capabilities	Capabilities exist for broad GI data-sharing between communities of interest
Metrics	*Level of Effort required to support data transmission*
	Number of inquires for meta-data

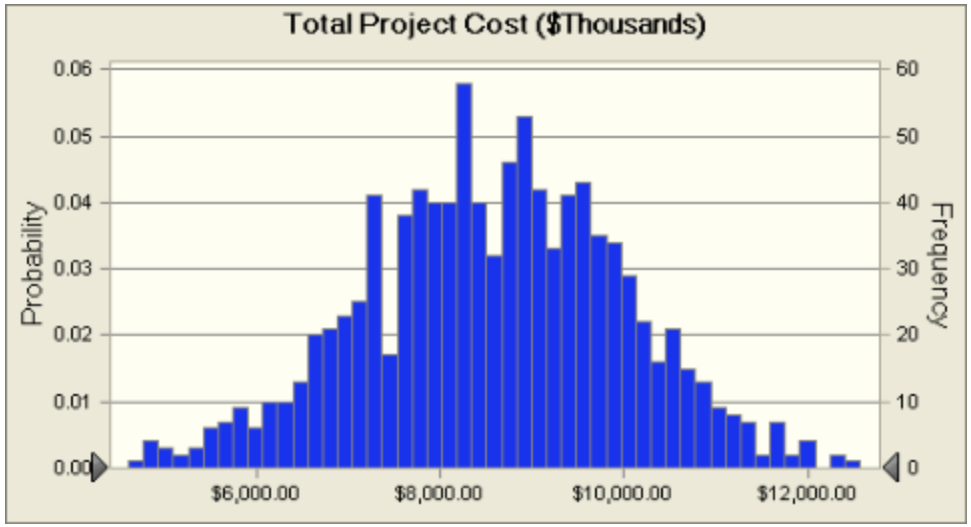
Cost Type
1.0 System Planning & Development
1.1 Hardware
1.2 Software
1.2.1 Licensing Fees
1.3 Development Support
1.3.1 Government
1.3.1.1 Program Management Oversight
1.3.1.2 System engineering Architecture Design
1.3.1.3 Change Management & Risk Assessment

Area of Risk
1 - Schedule
2 - Initial Costs
3 - Life-Cycle Costs
4 - Technical Obsolescence
5 - Feasibility
6 - Reliability of Systems
7 - Dependencies and Interoperability Between This and
8 - Surety (Asset Protection) Considerations
9 - Risk of Creating a Monopoly For Future Procurements

Different alternatives are weighed against the independent decision framework

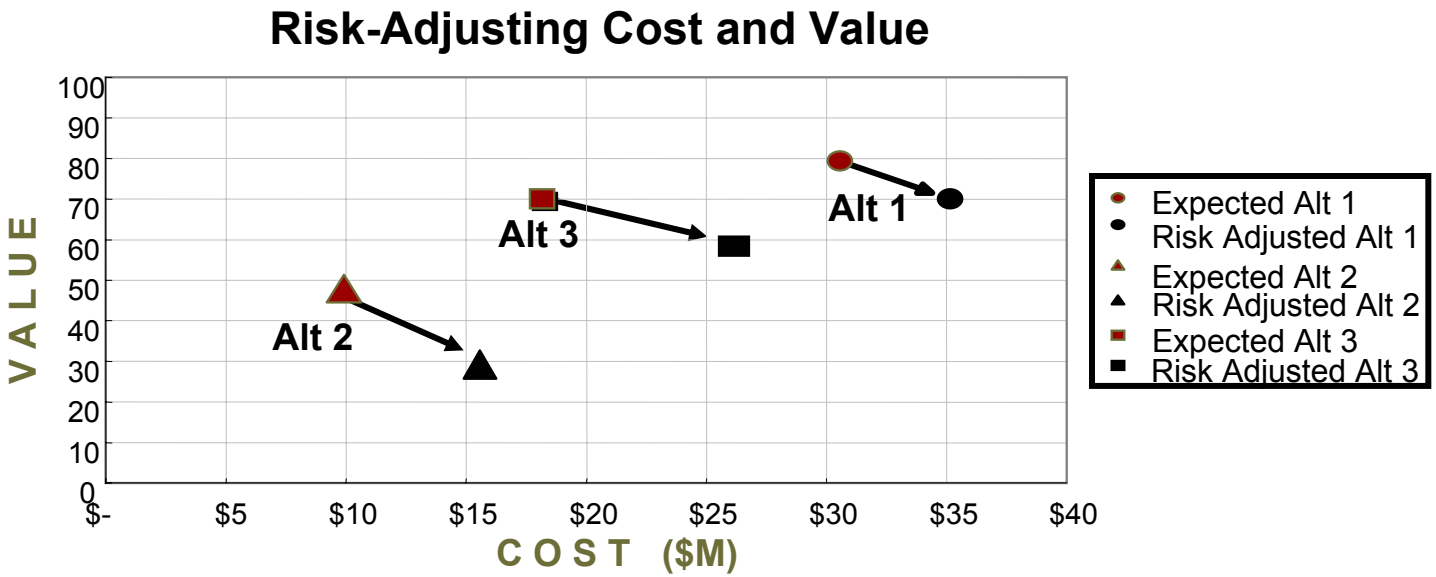
- **Step 2: Perform Alternatives Analysis**
  - Technical alternatives are compared within the Decision Framework The decision framework
  - Customer defined criteria
  - Costs and value derived from ranges that define specific elements of cost and measures of performance
  - Subjected to an uncertainty analysis to develop a range of expected value





The alternatives are compared to enable the selection of an alternative

- **Step 3: Pull Together the Information**
  - Financial measures are calculated and value, cost, and risk scores are calculated.
  - Alternatives are then compared to best case.
  - Conclusion is dependent on the completeness and quality of planning and analysis in the prior steps.



Communicating the results back to the stakeholders is the final step

- **Step 4: Communicate and Document**
  - The outputs of GeoVMM are used to communicate the value to stakeholders.
  - The planning and analysis required by GeoVMM produce artifacts and documents that can be used to audit the decision process.
  - The outputs can be used to support different technical alternatives or policy positions.

The GeoVMM can provide strategic guidance for the emerging Location Aware Enterprises

- GeoVMM is a compliment to the organizational design and change management processes.
  - Used in the planning stages, VMM studies can identify which stakeholders are likely to benefit from different alternatives,
  - Can surface risks to those stakeholders
  - Help identify capability gaps in the organization
- Supports organizational transformation:
  - Provides multi-dimensional analysis (time, stakeholders, alternatives) of different investment scenarios
  - Helps identifying early wins for the transformation process
- *By providing clear picture of benefits, risks, and costs for alternative scenarios, GeoVMM contributes to organizational resilience and responsiveness.*

The NASA Return On Investment is an example of GeoVMM in use

- ***NASA GI ROI Study:*** NASA's Geospatial Interoperability Office contributes to the development of geospatial interoperability specifications to facilitate the greater use of NASA's data assets. The standards and specifications under consideration include the ISO 19100-series standards, the Open Geospatial Consortium specifications, and the Federal Geographic Data Committee standards.

- **Problem:** NASA, and the larger geospatial community, needed to understand the value of geospatial interoperability specifications and standards and whether they provide value for those programs.

- **Solution:** The GeoVMM was used to compare and contrast programs with geospatial applications, one that implemented geospatial standards and specifications and one that did not. The comparison used cost figures from the each of the projects and an independently-developed value matrix to measure the value of geospatial interoperability specifications.

- **Result:** The GeoVMM demonstrated to NASA the value of supporting the geospatial interoperability standards. Standards-based projects were shown to have a 119% ROI over the program that did not implement standards.

Results: Standards reduce risk and lower costs

- Of the projects considered for this study, **the project that adopted and implemented geospatial interoperability standards had a risk-adjusted Return on Investment (ROI) of 119.0%**
  - A $1.00 invested in open standards-based projects nets a $1.19 in savings in Operations and Maintenance compared to projects not based on open standards
- **Standards lower transaction costs for sharing geospatial data when semantic agreement can be reached between parties.**
  - Higher implementation costs for Case Study 1, but lower operations and maintenance (O&M) costs
  - Risk adjusting the costs for Case Study 1 increases project cost 24.6% overall
  - Risk adjusting the costs for Case Study 2 increases project cost 56.6% overall

Results: Effect of Risk on Cost

- Identified risks were applied to specific elements within the Cost Element Structure (CES)
- Different areas of the CES are exposed to different levels of risk
- High expenditures in an area with high risk results in higher long-term costs

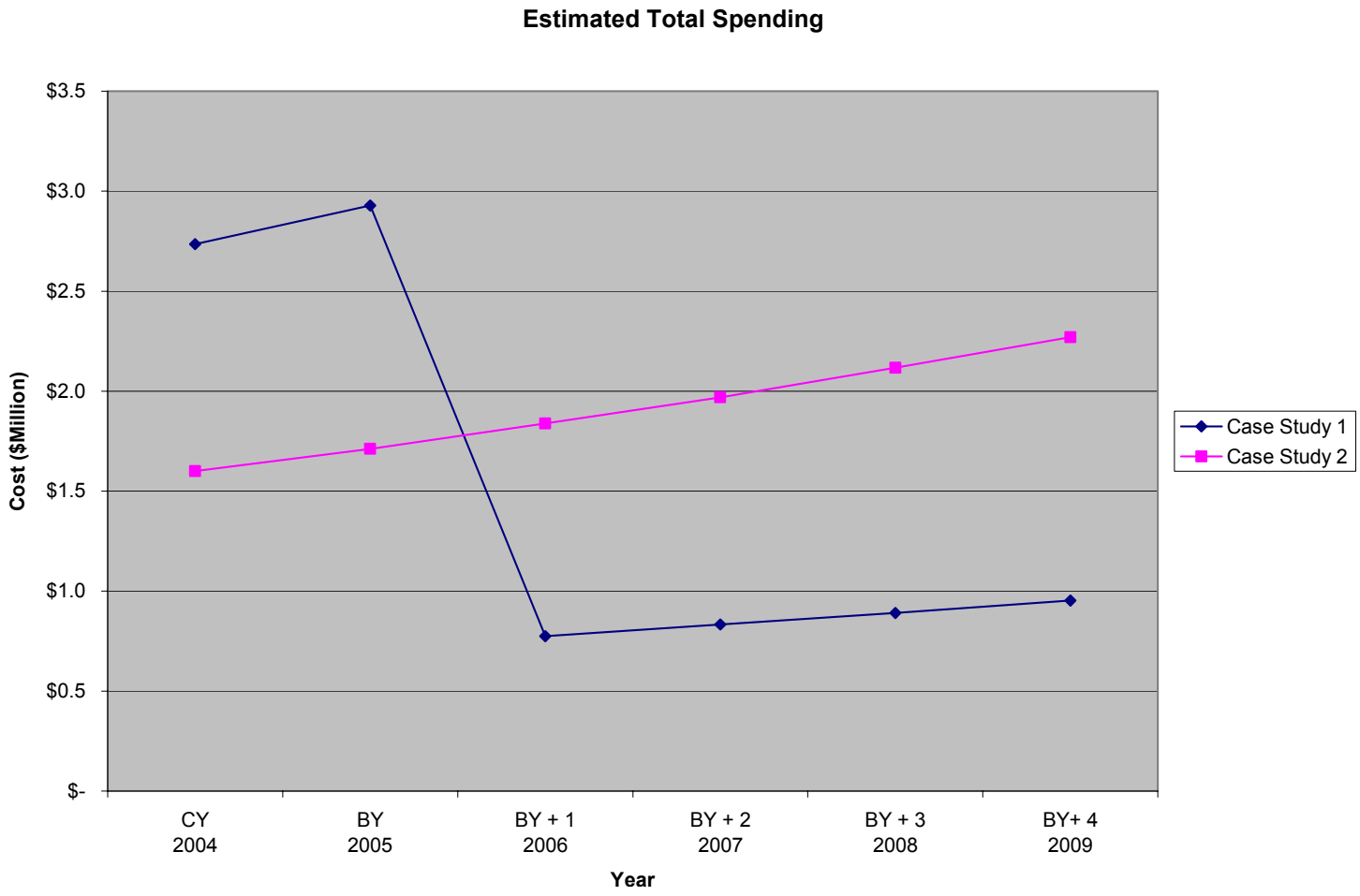
Risk Adjusted (Constant Year Dollars)

Case 1	**Total**	**%Increase due to risk**
1.0 System Planning & Development	$488,704	14.3%
2.0 System Acquisition & Implementation	$6,726,045	24.1%
3.0 System Maintenance & Operation	$1,901,380	29.3%
Total	$9,116,129	24.6%

Case 2	**Total**	
1.0 System Planning & Development	$399,227	27.4%
2.0 System Acquisition & Implementation	$619,718	33.2%
3.0 System Maintenance & Operation	$10,486,607	59.6%
Total	$11,505,551	56.6%

Results: Estimated Total Spending

- Initial costs for the standards-based project were higher
- Total costs for standards-based project dropped in the third year, reflecting lower costs for maintenance and operations



GeoVMM results can be used for setting strategic direction and ultimately for driving project management decisions

- Management may perceive that the upfront costs exceed the long-term return, that benefits accrue only to external partners
- As more enterprises work incorporate geospatial information in their applications, the users of geospatial technologies and information may be hesitant to adopt standards that appear to compromise business processes
- Geospatial standards may not be perceived as applicable for the typical geospatial application
  - Standalone within an organization and not networked
  - Standards may be perceived as not meeting business needs
- Standards profiling is poorly understood in many areas of the geospatial community
  - Standards are rejected because potential users do not know how to create a profile
  - Types of profiles: extending, tailoring, or constraining
- Most agencies are likely to adopt or develop a local standard
  - National and international standard don't meet local needs

Findings: Industry Perspectives on Risk Associated with Open Geospatial Standards

- Industry will be reluctant to contribute if it sees no tangible returns from standards setting, or a drain on its intellectual capital
  - Time horizon for realizing positive network effects
- Geospatial technology vendors that serve only the domestic market may feel little or no pressure (from market or government) to support geospatial standards, especially ISO standards
- Agencies sometimes do not see the need to adopt standards, arguing that their application domain extends only to their borders
  - A stronger case needs to be made that standards, particularly standards that improve geospatial information sharing, can foster improved decision-making and lower maintenance and operations costs over time
  - The contribution open geospatial standards make to lowering maintenance and operations costs and building business resilience should be compelling reason to adopt standards even in jurisdictions that claim to be isolated

For more information, please contact…

- Kevin Foley
  - 703-377-5444
  - (foley_kevin@bah.com)
- Alan Leidner
  - 212-551-6416
  - (leidner_alan@bah.com)
- Steven Johnson
  - 703-902-5149
  - (johnson_steven_e@bah.com)