

**2006 Spring Simulation Interoperability Workshop  
Invited Presentation Abstract – Space Track Forum**

**Title:** *An Overview of NASA's Program of Future M&S VV&A Outreach and Training Activities*, Lisa Caine, AEGIS Technologies Group, Inc./Joe Hale, Marshall Space Flight Center

**Abstract:** NASA's Exploration Systems Mission Directorate (ESMD) is implementing a management approach for modeling and simulation (M&S) that will provide decision-makers information on the model's fidelity, credibility, and quality. The Integrated Modeling & Simulation Verification, Validation and Accreditation (IM&S VV&A) process will allow the decision-maker to understand the risks involved in using a model's results for mission-critical decisions. The VV&A Technical Working Group (VV&A TWG) has been identified to communicate this process throughout the agency. As the VV&A experts, the VV&A TWG will be the central resource for support of VV&A policy, procedures, training and templates for documentation. This presentation will discuss the VV&A Technical Working Group's outreach approach aimed at educating M&S program managers, developers, users and proponents on the VV&A process, beginning at MSFC with the CLV program.



# ***An Overview of NASA's Program of Future M&S VV&A Outreach and Training Activities***

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# **Presentation Outline**

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- I. Outreach**
  - a. Definition**
  - b. Purpose**
  - c. Types (Top-Down vs. Bottom-Up)**
  - d. Consideration and Methods**
  - e. Steps to Planning an Outreach Program**
- II. The Importance of Outreach**
- III. IM&S**
- IV. VV&A**
- V. IM&S Goal**
- VI. NASA's Plan for M&S VV&A Outreach and Training**
  - a. General Approval**
  - b. Barriers to Initiative**
  - c. NASA's Plan**



## ***Outreach - Definition***



**According to the dictionary, Outreach is:**

- To reach out.
- The act or process of reaching out.
- A systematic attempt to provide services beyond conventional limits, as to particular segments of a community.

**When asked, people generally link Outreach to Communications.**

**While this is a major component, it is necessary to understand that Outreach usually consists of more than just 'spreading the word'.**

**To develop an effective outreach program, you must understand what response is desired from distribution of the information.**



## **Outreach - Purpose**



**Outreach programs are often aimed at changing behavior and request or require action by the audience.**

**-community outreach – education, preventive healthcare, environmental (recycling, public transportation), energy consumption**

**-consumer outreach – new products or services, recalls**

**-employee outreach – new policies, processes, or procedures, professional development, training, hr-related items (new employees, change in benefits, etc)**



# ***The Importance of Outreach***

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- **Initiate awareness**
- **Develop understanding**
  - **Provide detail and clarity of purpose**
- **Elicit response**
- **Reduce resistance to change**
- **Get buy-in**
- **Clarify responsibilities and/or actions required/requested**

The main purpose of outreach is to change a behavior; since people are resistant to change, developing awareness, understanding and buy-in will greatly improve the chances of changing behavior.

Conversely, without awareness, understanding, and buy-in, there is very little chance of successfully changing behaviors.



# **Outreach - Types**



## **Types of Initiatives:**

- ▶ **Top-down** is working from a policy perspective typically at the highest levels of management, then incorporating into operations within the organization.
- ▶ **Bottom-Up** implies an initiative that starts in operations, and if applicable at an organizational level, should be moved up and made into policy.

## **Types of Outreach:**

- ▶ **Top-down** is outreach that has been communicated and approved in upper management, and then is communicated and implemented into the organization.
- ▶ **Whereas bottom-up outreach** starts by communicating to those that the change will affect first, gathering consensus and/or incorporating into practice, then involving management to formalize the program or process.

**Which is more effective? It depends.**



# **Top-Down vs. Bottom-Up**



## **Top-Down**

### **Advantages:**

- more likely to be broad-scoped and relevant to multiple departments within the organization
- funding and resources more likely to be available

### **Disadvantages:**

- disconnected with actual needs at the operational level
- long lead-in time due to policy and procedures development, consensus building
- difficult to change people's behaviors, especially when dictated by others, unless relevancy and benefit can be clearly shown

## **Bottom-Up**

### **Advantages:**

- inherent buy-in
- reduced implementation issues, since already being utilized

### **Disadvantages:**

- no funding/resources if management is unaware or uninterested
- not widely applicable





# Outreach – Considerations and Methods

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## Considerations:

### 1. Audience size and location:

- Group (large, mid-size, small) vs. one-on-one
- Graphically dispersed vs. at one location

### 2. Audience constituency:

- Demographics (age, education/knowledge-base, job)
- Interest in the topic

## Methods (One-way and interactive):

- Videoconference/teleconference
- Presentation
- Meeting/Forum
- Hallway chat
- Conferences/Symposia
- Print (brochure, flyer, ad, poster, etc)
- Focus Group
- Survey
- Internet
- Bulletin/Message Boards
- Technical working groups
- Communities of Practice
- Training



# ***Outreach – Planning***



- **Determine Intent**
- **Determine Content**
- **Determine Budget**
- **Identify Targets of Opportunity**
- **Develop Schedule**
- **Execute Outreach**

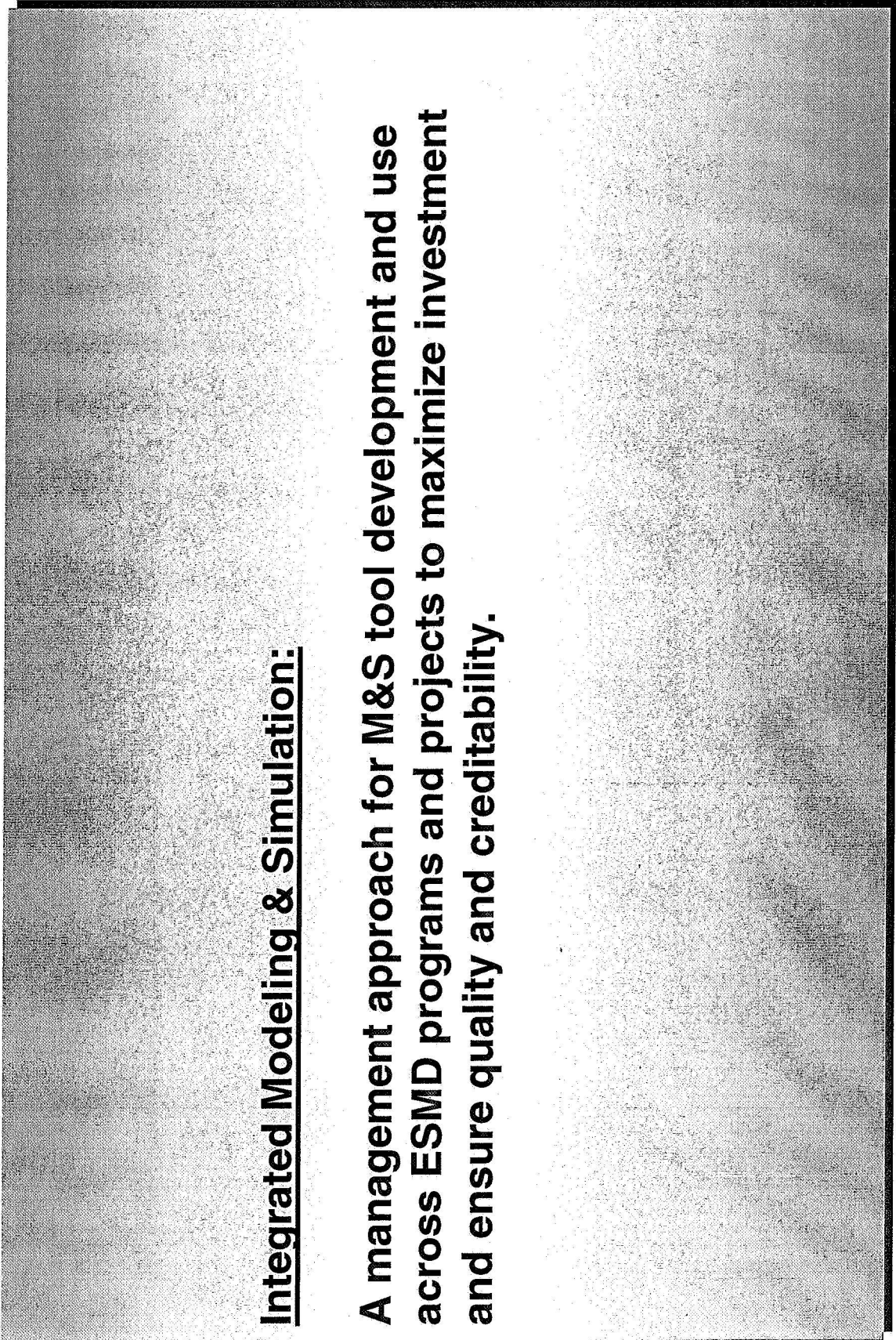


# NASA's ESMD IM&S and VV&A Initiatives

Pre-decisional DRAFT



# What is IM&S?



## Integrated Modeling & Simulation:

**A management approach for M&S tool development and use across ESMD programs and projects to maximize investment and ensure quality and credibility.**



## **What is VV&A?**

### **Verification, Validation & Accreditation:**

**VV&A is a process for measuring and approving the credibility of models and simulations.**

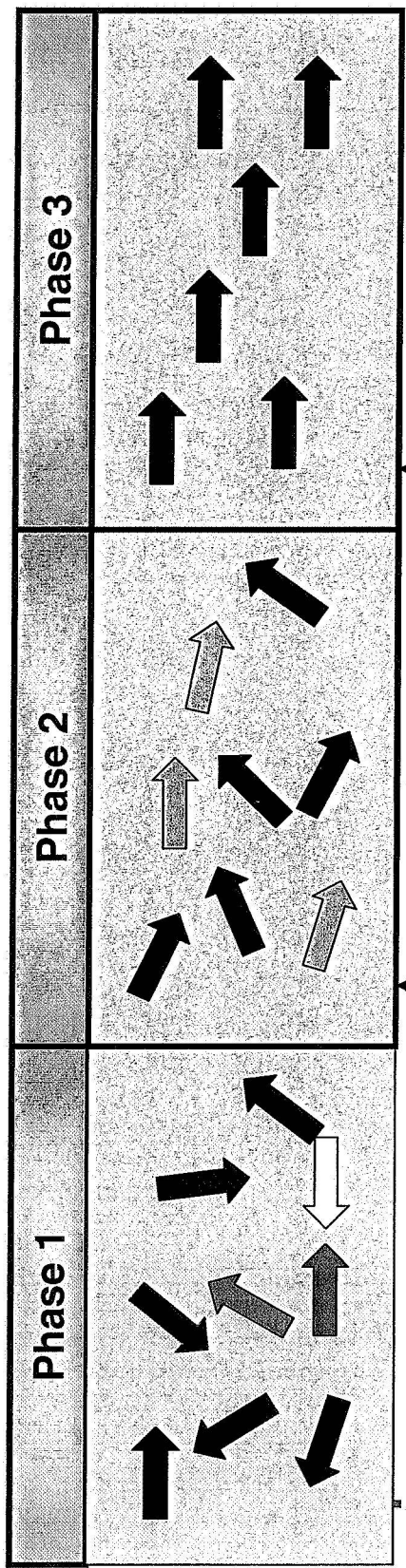
**IM&S VV&A is the complement to the overall IM&S Strategy!**

Pre-decisional DRAFT



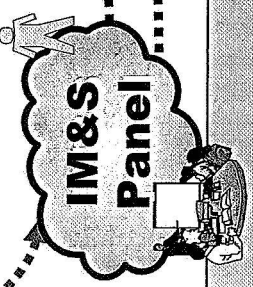
# IM&S Goal

## ESMD M&S Community



- Status
- Establish Structure
- Pilot Projects
- Feedback

Assess the current state of practice



- CM
- VV&A
- IMS Management
- Build Knowledge Base

Apply proven methods immediately

- Use Knowledge Base
- Strategic IM&S Planning
- Integrate w/ Constellation, CEV, LMS, ...

Support interoperability, reuse, affordability and effectiveness

## Phasing of an ESMD M&S Community of Practice

Pre-decisional DRAFT



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# NASA's Program of M&S VV&A Outreach and Training Activities

Pre-decisional DRAFT



# ***General Approach to NASA's Outreach Plan***

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- **Identify Stakeholders, Players, Roles and Organizations**
- **Identify POC for Each of the Stakeholders**
- **Develop Multiple Customized Outreach Briefings**
- **Establish Outreach Working Group**
- **Establish Collaborative Workspace**
- **Adopt Training Program**
- **Conduct Outreach Program**
- **Consult with Target Audiences**
- **Participate in Open Forums, Workshops, Conferences**
- **Conduct Training on VV&A Policy, Process and Methods**
- **Cultivate an ESMD Community of Practice**





# **Barriers to NASA's M&S VV&A Initiative**



## **Organizational**

- The need for implementation predates ability to get formal policy approval
- Organizational structure at NASA not finalized
- Significant change in manner of working that will require time, money and resources to implement

## **Communication of Message**

- IM&S ≠ Integrating the models and simulations
- IM&S is need-based, not tool-centric
- Risk distinction
- Not all tools will be VV&A'd – only those deemed necessary for use in making a critical decision
- Accreditation ≠ certification (VV&A is not IV&V)
- Terms (“user” = “decision-maker”)
- Amount of VV&A necessary



# **NASA's M&S VV&A Outreach Plan**



**Needs to be a combination of Top-down and Bottom-Up**

## **Top-Down**

**Mandated by Congress to develop a formal policy**

- **Formal documents are being drafted – policy, strategy, implementation plans, etc – which are identifying key roles and responsibilities**

## **Bottom-Up**

**But also need to get into workforce because time-critical**

- **M&S review cycles are moving forward**



# NASA's M&S VV&A Outreach Plan



## Top-Down

- **One-on-One Presentations to Management**
  - **Initial focus on CLV**
    - CLV Chief Engineer
    - Vehicle Integration Manager
  - **Communicate across Vehicle Integration Offices**
    - Requirement and Verification
    - Avionics Integration
    - Systems Design and Control
    - Systems Analysis
    - Vehicle Assembly and Integration
    - Flight Test Integration
  - **Communicate across Engineering Directorate**
- **Standing up the identified Panels, Boards, and Work Groups**



# NASA's M&S VV&A Outreach Plan



## Bottom-Up

- Meetings called by tool developers or analysts
- Coordinating with DAC cycles
- Prototype work-through
  - Training and implementation of process
- Website development
- Conferences
  - AIAA 4th Annual U.S. Missile Defense Conference
  - SISO & SCS 2006 Spring Simulation Multiconference (SpringSim'06) / Spring SIWC
  - DIA 2006 Canada's Defence & Security Technology Showcase (CANSEC)
  - SPIE Defense and Security Symposium
  - DoD18th Annual Systems and Software Technology Conference (SSTC 2005)
  - ITEA10th Annual Test Instrumentation Workshop
  - AHS The Vertical Flight Society's 62nd Annual Forum and Technology Display
  - SISO2006 Conference on Behavior Representation in Modeling & Simulation (BRIMS)
  - NTSA2006 Information Technology Exposition & Conference (ITEC)
  - IASTED17th IASTED International Conference on Modeling and Simulation ~ MS 2006 ~
  - SIAA2006 Simulation Technology and Training Conference (SimTect)
  - MORS Military Operations Research Society 74th Annual Symposium
  - SISO2006 European SIWSCS2006 Summer Simulation Multi-conference (SummerSim'06)
  - DEPS & ITEA5th Annual Directed Energy Test and Evaluation Workshop
  - SMDC9th Annual Space and Missile Defense Conference
  - AIAA Modeling and Simulation Technologies Conference and Exhibit
  - SISO2006 Fall SIW
  - USMC League Modern Day Marine Military Expo
  - AUSA Annual MeetingNDIA9th Annual Systems Engineering Conference



## *Closing Thoughts*



**Change is good!**

**...well, at least it is intended to bring about improvements.**

**But change is typically not well-received or easily accepted.**

**An effective outreach program will help mitigate the negative impacts of change by allowing those to be affected to gain understanding and have time to incorporate the new practices into their work.**



# Back-up Charts

Pre-decisional DRAFT



# The Purpose of IM&S



- **Modeling and Simulations (M&S) are integral to every aspect of the ESMD Program** (*Program -> Projects -> Components*)
  - Cost Analysis
  - Risk Assessments
  - Planning
  - Requirements Definition
  - Test and Verification
  - Technology Evaluation
  - Training
- **Effective Management of M&S has several key Objectives**
  - Provide Timely Trusted Data for Decision Makers
  - Reduce Lifecycle Cost and Risk
    - Better requirements, designs, tests, training
  - Minimize Slips in Schedule
    - Timely data for decision makers to support Prioritizing Efforts

**Institutionalizing M&S Management Practices Early is Critical to long-term Success**

Pre-decisional DRAFT



# The Core Process of IM&S VV&A



"It works as I thought it would."

Developer  
Verification Agent

## VERIFICATION

The process of determining that a model [or simulation] implementation and its associated data accurately represents the developer's conceptual description and specifications...

*Did we build that thing right?*

"It looks just like the real thing."



Functional Expert  
Validation Agent

## VALIDATION

The process of determining the degree to which a model [or simulation] and its associated data provides an accurate representation the real world from the perspective of the intended uses of the model or simulation...

*Did we build the right thing?*

"It suits my needs."



Requester/User  
Accreditation Agent

## ACCREDITATION

The official certification that a model or simulation or federation of models and simulations and its associated data is acceptable for use for a specific purpose...

*Should it be used?*

**An underlying implicit principle is Credibility: Can It be trusted?**





# Recommended Approach to Overcome Barriers



<b>COMMUNICATION MECHANISMS - COMMUNICATE</b>
Facilitate participation of ESMD business unit personnel in VV&A programs.
Have Chief Engineer/M&S Director sit on MSWG.
ESMD Corporate Executive Council sets M&S VV&A strategy through annual process.
Assign M&S personnel to select customers or PM offices.
Hold annual internal technical M&S conference(s).
Hold seminars and educational programs.
Use business units to help collect technologies.
Create an internal Web site for research to collaborate on new VV&A ideas.
Use cross-disciplinary and cross-Element teams to discuss problems and progress.
Use Peer-to-peer virtual networking and regular meetings to discuss problems and progress.



# Recommended Approach to Overcome Barriers



<b>COMMUNICATION MECHANISMS - EVALUATE</b>
Establish strategic M&S VV&A advisory panel.
Establish M&S assessment/oversight/ groups.
Poll annually on M&S needs to identify VV&A gaps.
Establish ad-hoc technical review groups.
To enhance communications, when possible co-locate M&S personnel with Element staff.



# Recommended Approach to Overcome Barriers



<b>COMMUNICATION MECHANISMS - GUIDE</b>
Involve M&S development groups in VV&A management.
Develop VV&A road maps to identify gaps and overlaps and to determine where to focus effort.
Tie M&S and VV&A to corporate strategy.
Use senior managers/researchers as liaison to business units and Elements.
Have an M&S steering group.
Share M&S VV&A ideas across business units and Elements.
Identify M&S projects with development groups to solve today's problems and meet future needs.
Build close relationships with Element PMs to determine near and long-term M&S needs and to help shape the VV&A program to meet needs of customers.
Create an M&S Improvement Program that is funded to correct problems identified from VV&A.
Business units provide part of funding and tell them what they need done. Details worked through negotiation.
Work with customers and Elements to identify "Top 100 plus" key objectives at beginning of year that will form basis for funding.
Do VV&A cost sharing/partnering with M&S development groups.
Focus on transition of M&S VV&A technology to M&S development groups.



# Recommended Approach to Overcome Barriers



OUTREACH MECHANISMS - COMMUNICATE
Maintain top level support.
Ensure a close, continuing relationship between the Chief Engineer and M&S Director.
Ensure that M&S Director maintains influence over course of all M&S development and VV&A efforts.
M&S Director is required to provide regular "State of M&S" reports to the ESMD Executives.
Solve business unit (Element) problems to demonstrate importance of long-term VV&A.
Science Center must be viewed as an important asset.
Hold corporate technical M&S conferences.
Use metrics to measure small business unit and VV&A performance.
Establish metrics for VV&A projects and overall program.
Review technical effectiveness of business units to determine VV&A resource allocation.
Document and advertise VV&A successes in organization.
Create internal journals, (e.g., <i>Science at Rockwell</i> ).