

DoD Modeling and Simulation in Support of Acquisition: Candid Observations and Personal Proposals for Improvement

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“The views and opinions expressed in this course are not necessarily those of the Department of Defense....

(although they probably should be.)”

JAMES F. O'BRYON

AC-130U Gunship III

Underfloor Armor

- *Armor works in conjunction with floor*
- *Attachment techniques were acceptable, due to resistance of floor*

Sidewall Armor Attachment

- *Use attachment techniques commensurate with threat*

U.S. Air Force Photo

How To Tell If There Is a Terrorist at the Airport



The Source of the Spinach Ebola Outbreak Has Been Narrowed



Definition of WMD

Title 18 USC, Section 2332a

“Any destructive device as defined in Section 921 of this title, (which reads)

(A) Any explosive, incendiary, or poison gas, bomb, grenade, rocket having a propellant charge of more than 4 ounces, missile having an explosive or incendiary charge of more than one quarter ounce, mine or device similar to the above,

(B) Poison gas,

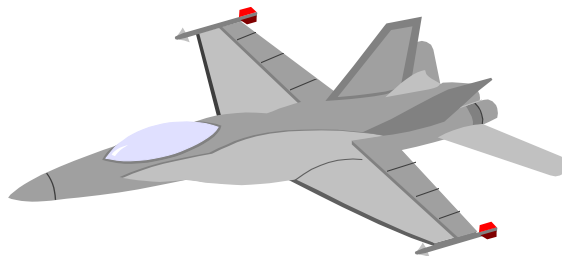
(C) Any weapon involving a disease organism,

(D) Any weapon designed to release radiation or radioactivity at a dangerous level to human life.”

Acquisition Reform is Pushing More Reliance on M&S but Is the M&S Train Ready?

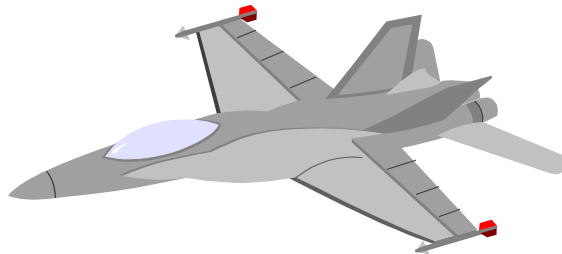
MODELING AND SIMULATION IN LIVE FIRE TEST & EVALUATION

Modeling and simulation are an integral part of LFT&E and not to be looked at as a substitute, nor a means to save money. M&S and testing are mutually supportive and none is complete without the other. It's not the pot of gold at the end of the rainbow.



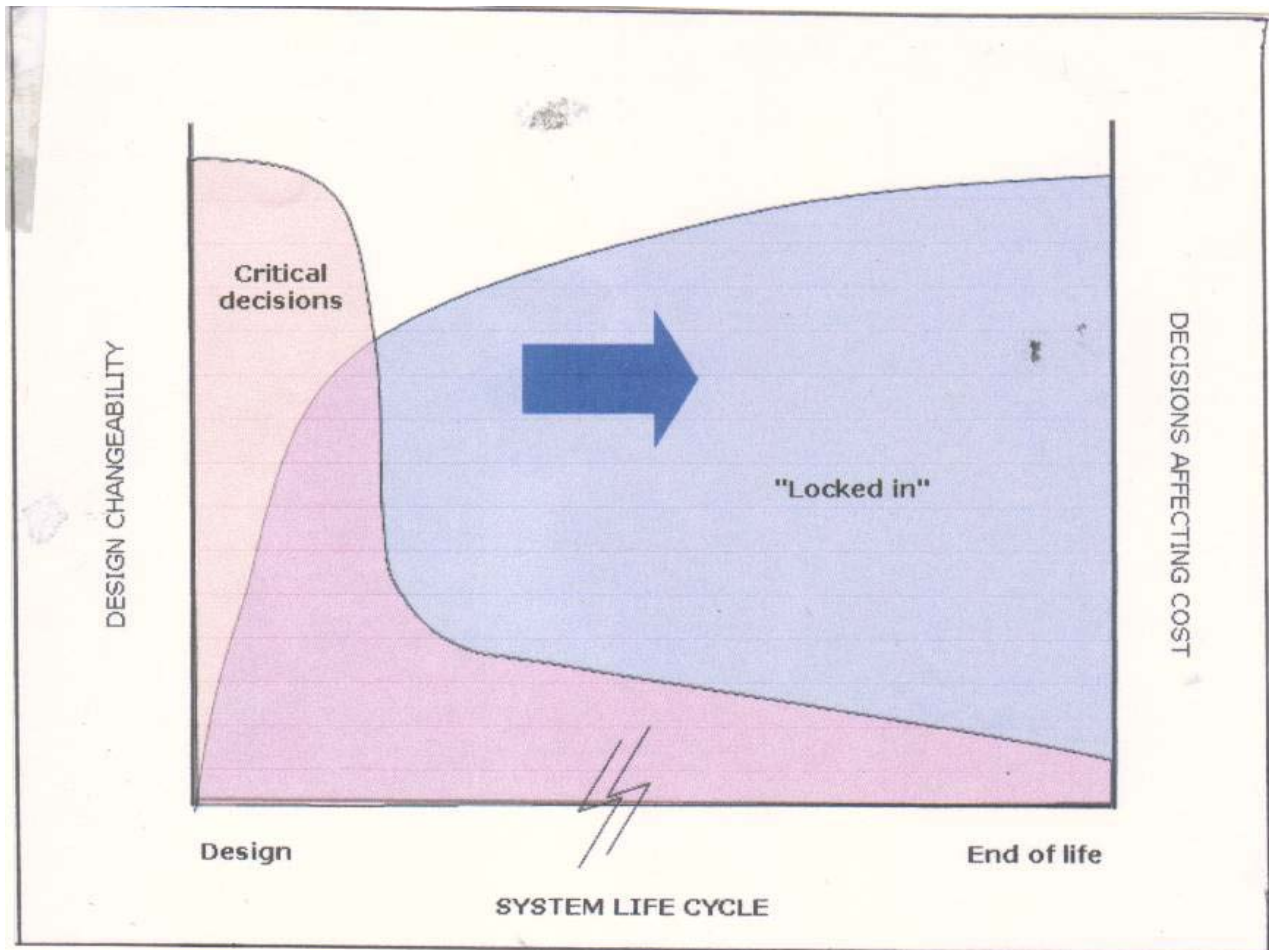
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M & S PLAY A VITAL ROLE EARLY ON IN SYSTEM DESIGN AND VERIFICATION

Source: R. Garrett, "Opportunities in Modeling and simulation to Enable Dramatic Improvements in Ordnance Design," presented to the Committee on Bridging Design and Manufacturing, National Research Council, Washington, DC., April 29, 2003.



FOUR MAJOR REASONS TO REQUIRE PRE-TEST MODELING PREDICTIONS

1. It helps in planning for needed instrumentation to gather phenomenology that may exhibit themselves.
2. It helps to sequence the shots from expected least damaging to expected most damaging to make efficient use of test assets.
3. It provides a benchmark as to how adequate current vulnerability and lethality methodology really is.
4. Yields valuable input data as to what upgrades need to be made to extant M&S.

Candid *Quotable* Quotes About M&S Reality

- “Some models are so bad they need mouse-to-mouse resuscitation.”
- “All models are wrong. Some are useful.”
- “Everyone wants commonality of models, but they want it their way.”
- “Your hydro code is not much better than my zip-code.”

**MODELS ARE EXCELLENT AT
SURFACE MODELING,
BUT BELOW THE SURFACE ARE
TYPICALLY A SET OF EMPIRICAL FITS
WITH MUCH LESS REALISM**



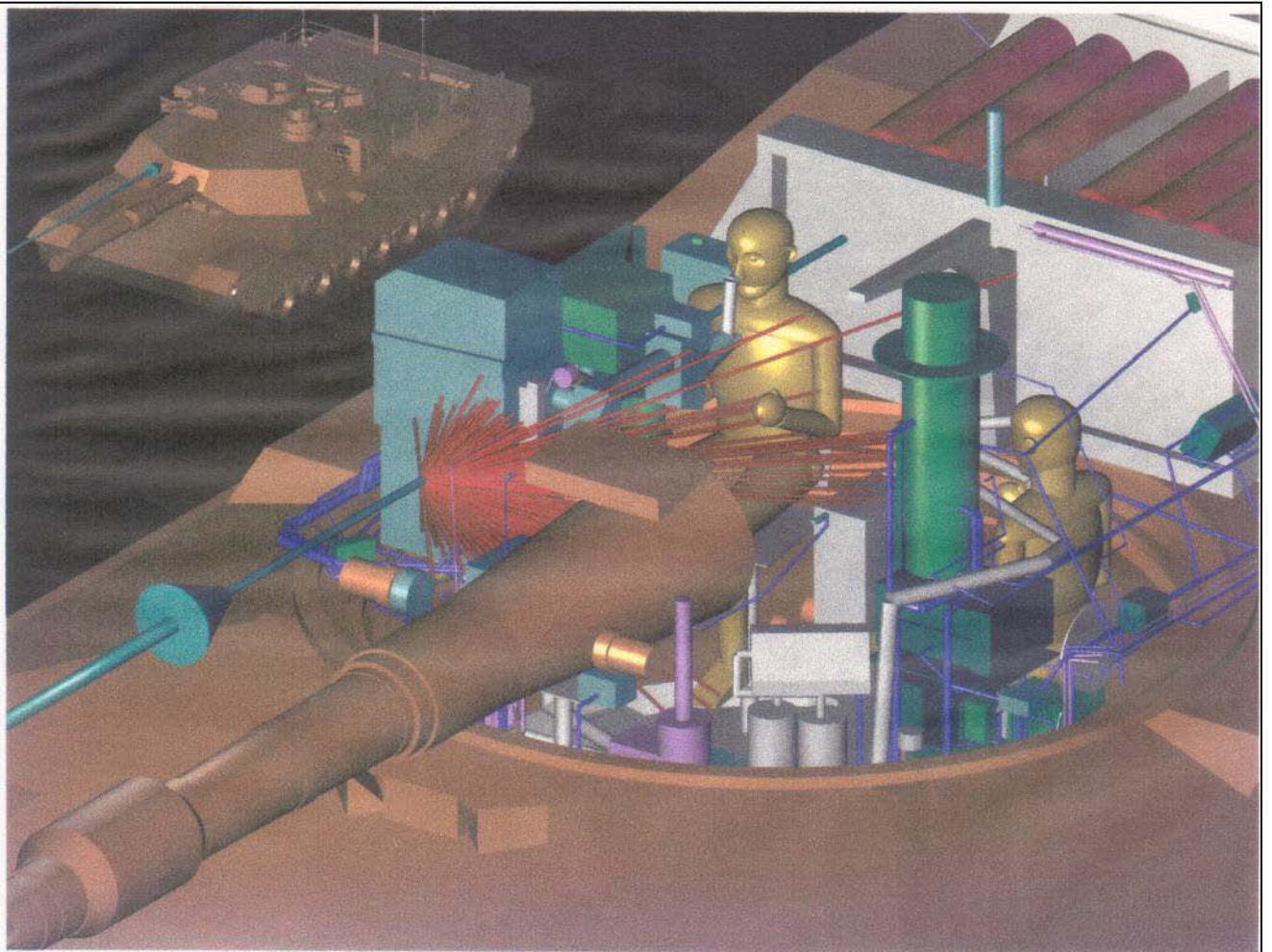
**LESS
REALISM**

MODELING AND SIMULATION EXPERIENCE TO DATE IN T&E ??

"The experience with M&S overall, has been a "major disappointment of promises undelivered," he [Christie] said. Surely expectations were unreasonable. Although some design problems can be modeled, these tend to be small changes in well-understood designs. Defense systems do not tend to be of this ilk, according to Christie.
"When the system technology is cutting edge, its real limits are probably not well understood. You cannot replace testing with modeling in that case."

"Weapon Evaluators Must Change, Or Risk Irrelevance, Warns Christie", by Sandra I. Erwin, National Defense Magazine, May 2004

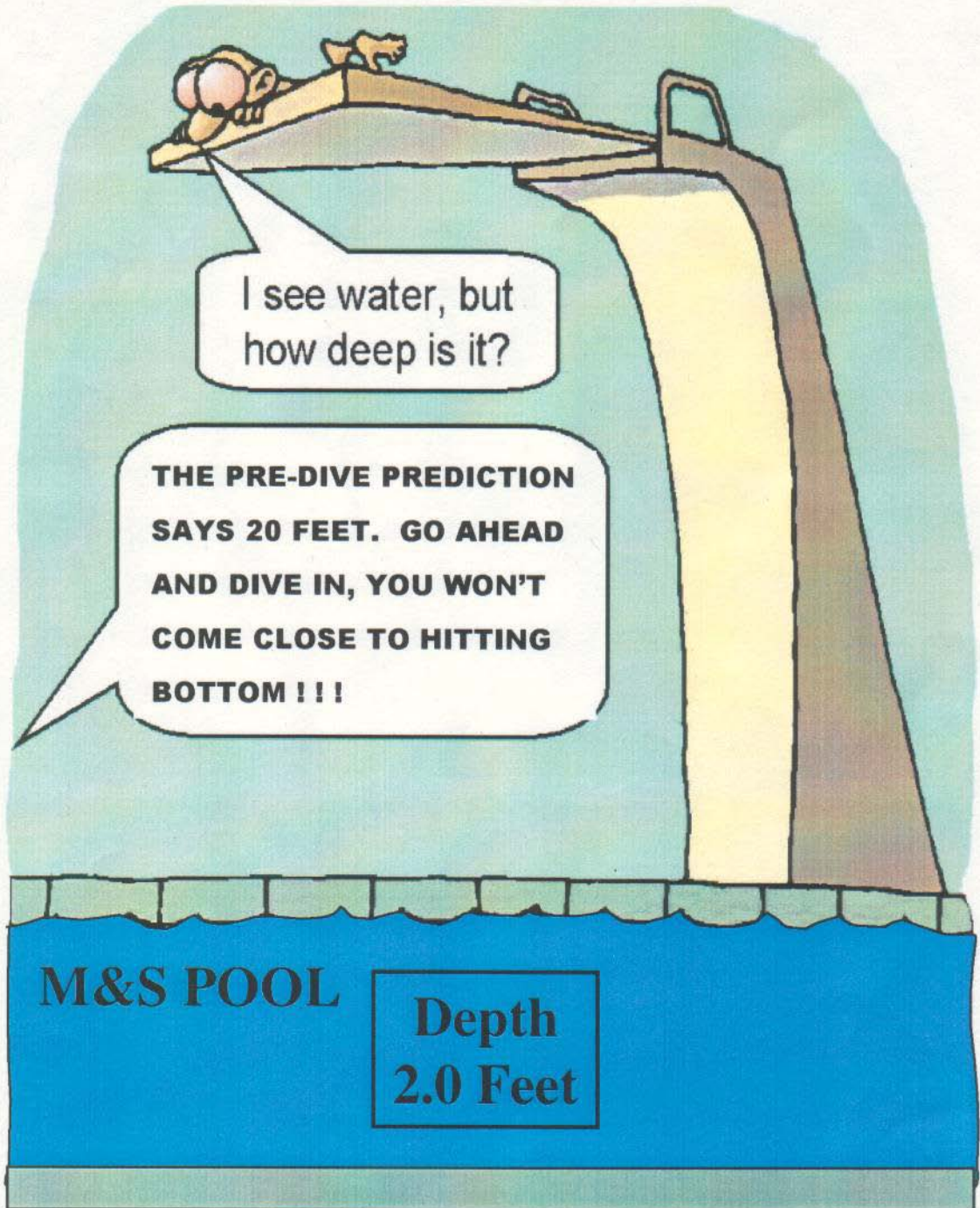
LFT&E VULNERABILITY ANALYSIS OF ABRAMS BATTLE TANK



Conclusions

- Even when model claims rigor:
- Less than 1/2 modeled critical components that were damaged were predicted to be damaged
- This is the best armor vulnerability model currently available!

WELCOME TO THE M&S CREDIBILITY POOL!



Modeling & Simulation Wisdom on Empirical Fits

“If you fit a curve through
the data, the data will fit the
curve. ”

Mr. Robert Wojciechowski, APG

It's Vital that Your Model Extrapolations Are Anchored Solidly on First Principles

Extrapolations based purely on empirical fits to data points are going to leave you hanging...

And combat lives could be at risk!

- Made major strides in and addressing M&S
- Brought the testing and communities more together
- Integrated the JTCG communities into the DOT&E mission
- Made major strides in casualty assessment & reduction
- Made industry more of a partner with T&E
- Served as the warfighter's "Underwriters Lab"

Otherwise, stay with test data and/or small interpolations from known data points.

Interoperability in Simulations

“We must make far greater use of modeling and simulation, to cut costs, as well as to shorten development cycles, and these simulations must expand to address the growing interoperability requirements of modern systems-of-systems.”

--Hon. Jacques S. Gansler, USD(AT&L), Remarks to ITEA Conference, Atlanta, GA, September 22, 1999

Observations on Aircraft Vulnerability Modeling

”Much remains to be done before one could have confidence in the predictive tools for aircraft vulnerability.

We do not have appropriate test data to support many of the relationships which the analytical models use.

Not all things that happen are modeled (e.g. heat transfer at altitude to cause material failure during fires).

Simplifications exist in the models most widely used (e.g. COVART) which prevent their realistic depiction of events.

Although the capabilities to get presented areas is good, the estimation of component damage is poor.

Concepts for vulnerability reduction in initial design are often given up (“sweated out”) when coming down to production designs.

There is next to zero data base on internally stowed missiles.

COVART does not accept many partial damages (e.g. a cracked spindle is assessed as just cracked regardless of the size and depth of the crack.”

The structural effects of an explosion are aircraft unique.

Expressions of Frustration at M&S in DoD Acquisition

“OSD is such a fragmented organization that you can find any opinion you want, maybe you’ll even find a good one.”

“Working with military instructions is like building a sauna out of ice cubes.”

“There’s no such thing as validating a model. Validation is just a failed attempt to falsify a model.”

Commercial Success of M&S

“Let me take this opportunity to firmly state my commitment to the use of M&S in the acquisition of our weapons systems. Over the past decade, the American commercial sector has undergone significant reorganization and restructuring. We have seen many examples in the commercial sector of how application of M&S throughout a program’s life cycle can help achieve these goals. Chrysler’s Intrepid and Boeing’s 777 are just two examples of M&S commercial success.”

--Memo from Dr. Jacques Gansler,
USD (A&T), March 16, 1998

Does the Department of Defense Really Have A Viable Simulation Based Acquisition Program??

“In recent years, the Department of Defense has shown great interest in what it calls simulation-based acquisition. In typical DoD fashion, it’s even created an acronym, “SBA”, for it. Using simulations in this manner isn’t new to the commercial world. Boeing developed the airframes (the wings and fuselage) for the 767 and 777 mainly with computer models, using wind tunnel tests only during the final stages of design. Not only did this save money, but Boeing could test far more designs on a computer than it could ever test in wind tunnels. Also, with wind tunnel tests, all you know is what works and what doesn’t – you don’t know why.

Quote from home.earthlink.net/kstengel1226/Software/sbacq/

M&S Could Help Avert Program Failures

“The DoD and the Services regularly make high sounding pronouncements that modeling and simulation is going to be the answer and the greatest thing since sliced bread ... but it is not easy to find examples in the DoD where M&S has really made a difference,” [Philip E.] Coyle says in a February speech to the National Defense Industrial Association T&E Conference.

By comparison, agencies such as Lawrence Livermore National Lab have proved that modeling, simulation and testing can make a “very happy marriage”. The lab, it is “literally unthinkable that you would spend millions of dollars on a test without making an equivalent effort first in M&S.”

National Defense Magazine, May 2006, p 20

--Dr. Richard Hallion, USAF History and Museums Program, ITEA Journal, September/October, 2000

Cultural Issues with M&S in DoD vs. DOE

“There is a “cultural bias at the Defense Department that views computer models as vehicles to justify programs, rather than as tools to better understand the technology.

“The focus in defense acquisition is on buying something and moving on, not on understanding for its own sake.. Detailed scientific and technical understanding is not the first priority.”

“By contrast, the culture in the development of nuclear weapons has been to achieve first-principles understanding of everything ... without those models, the Department of Energy weapons labs would be quite helpless today.”

**Honorable Philip E. Coyle, III, National Defense
Magazine, May 2006, p 20.**

Cultural Issues with M&S in DOE vs. DOD (Continued)

“Another reason why simulations are often shunned by defense PMs is that they don’t want to risk **delaying production** schedules when technical glitches pop up in computer models. The incentives are to get the system into production with as little perturbation as possible.

The goal for modeling and simulation in DOE ... is to predict with rather astonishing accuracy what will happen. This means that M&S and the evaluations that come from those models, may produce bad news.

[However] at the DOD, the tendency is to expect that test and evaluation will produce bad news and that M&S will produce good news. Thus M&S is often recommended as the better choice.”

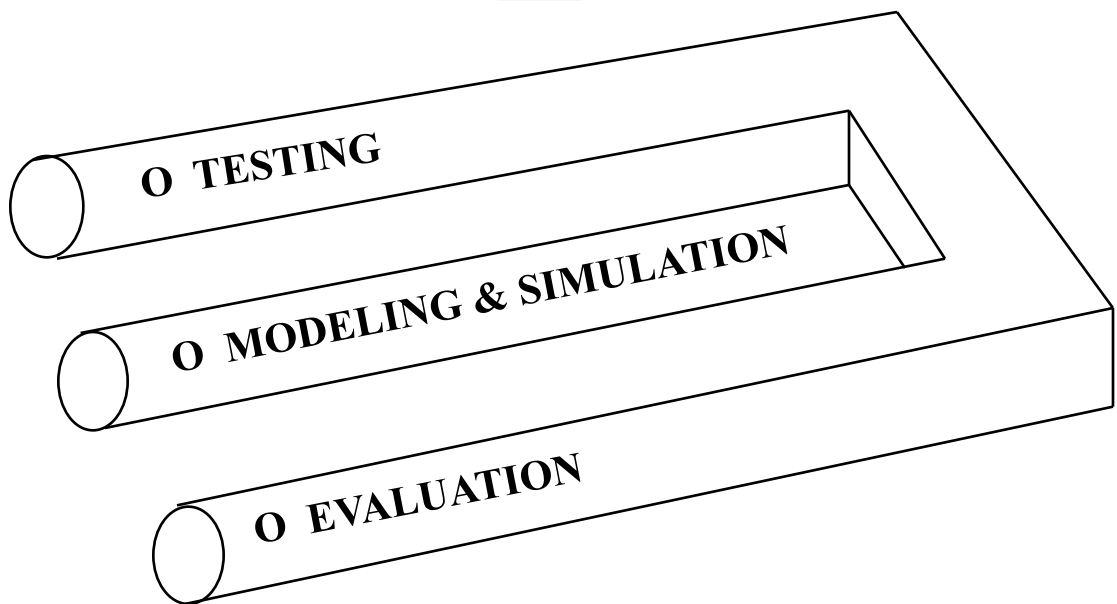
Honorable Philip E. Coyle, III, National Defense Magazine, May 2006, p 20.

Dangers of Using Modeling and Simulation as “Proof” of Performance

“Modeling and simulation offer the F-22 Program another benefit, Air Force officers said, because the Service would control the inputs into the model, the outcome – proving the aircraft’s effectiveness is much easier to shape than the outcome of an open air test with any number of unanticipated variables.”

Quote from “Inside the Pentagon”, September 1, 1995

Three Pillars of Weapons Assessment: Are they Adequate to Support Weapons Systems Acquisition???



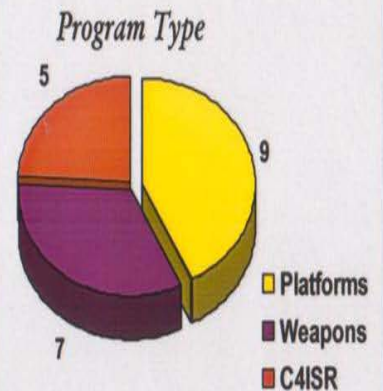
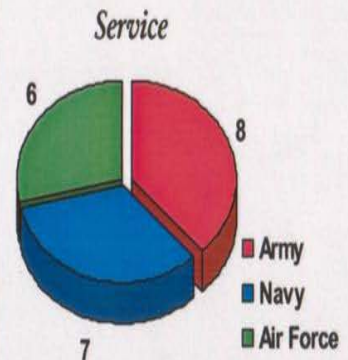
“Is it an illusion?”

Results of LFT&E-Sponsored Survey of Model Usage within the DOD Acquisition Community



Summary of Survey Respondents to Date

Program	Component	System Type	Current Status*	FRP Date*
Crusader	Army	Platform	MSII decision 2001	1QFY06
Comanche	Army	Platform	MSII decision FY02	1QFY07
M1A2 Upgrade	Army	Platform	FRP	3QFY94
ATACMS Bk II/BAT	Army	Weapon	LRIP	3QFY00
Javelin	Army	Weapon	FRP	3QFY97
SADARM	Army	Weapon	LRIP	4QFY98
FAAD C2	Army	C4ISR	FRP	3QFY95
C2 Vehicle	Army	C4ISR	LRIP	1QFY00
F/A-18 E/F	Navy	Platform	LRIP	3QFY00
V-22 Osprey	Navy/USMC	Platform	LRIP	2QFY00
LPD-17	Navy/USMC	Platform	EMD	3QFY07
AIM-9X	Navy	Weapon	LRIP	1QFY02
AN/BSY-2 (SSN-21)	Navy	C4ISR	Sea Trials on SSN-22 (USS CONNECTICUT)	N/A
UHF Follow-On	Navy	C4ISR	Completing FRP	4QFY88
SLAM-ER	Navy	Weapon	FRP	2QFY99
F-22	USAF	Platform	LRIP	3QFY03
B-2	USAF	Platform	IOC	N/A (did not enter FRP)
EELV	USAF	Platform	MSII Decision FY99	2QFY03 (MSIII decision 1QFY03)
ABL	USAF	Weapon	MSII decision FY03	2QFY05
SBIRS	USAF	C4ISR	MSII decision 1996	First GEO sat deliv. FY02; HEO FY03; LEO FY-04
SFW P3I	USAF	Weapon	FRP	3QFY96



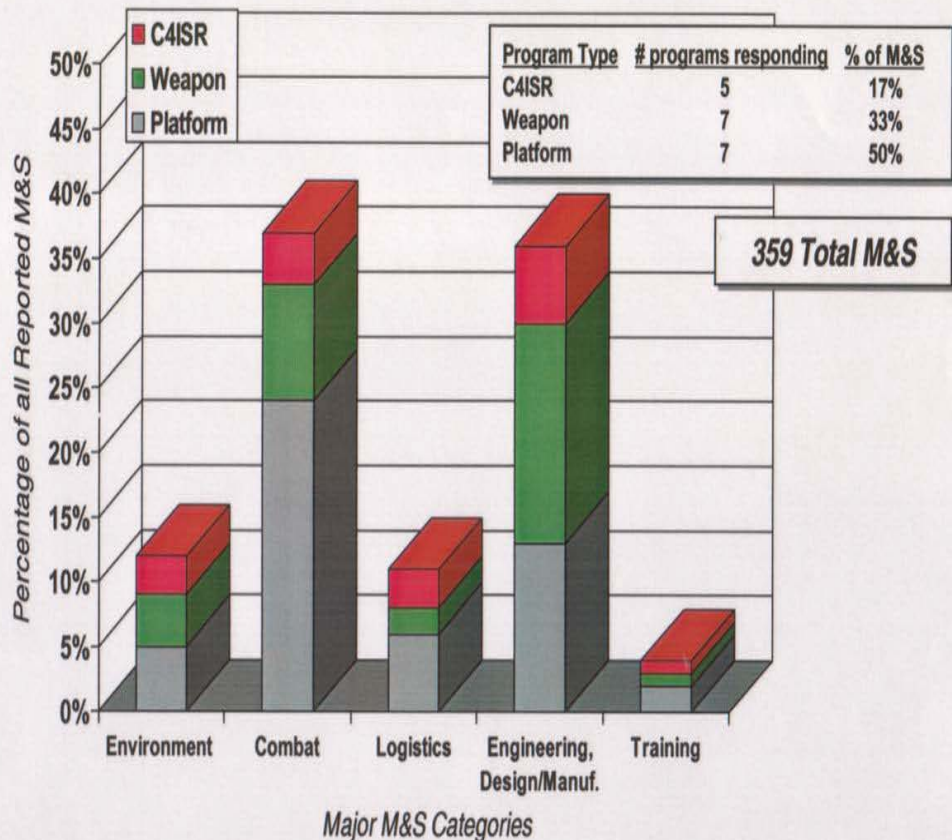
*Source: DOT&E FY98 Annual Report to Congress

Results of LFT&E-Sponsored Survey of Model Usage within the DOD Acquisition Community



M&S Characterization

By Program Type



- Types of M&S used driven partly by program type
- "Platform" programs utilized more total M&S assets and comparatively higher percentage of logistics and combat M&S types
- "C4ISR" programs utilized comparatively higher percentage of training M&S

Results of LFT&E-Sponsored Survey of Model Usage within the DOD Acquisition Community



M&S Characterization

Common M&S

- **Combat Models**
 - ALARM (2)
 - ASAP (2)
 - CASTFOREM (2)
 - SUPPRESSOR (4)
 - TRAP (3)
- **Engineering/Design/
Manufacturing**
 - ANSYS (2)
 - APART (2)
 - CATIA (3)
 - COVART (3)
 - DYNA 2D (2)
 - ESAMS (3)
 - FASTGEN (3)
 - JSEM (2)
 - Pro-E (5)
- **Logistics**
 - COMPASS (2)
 - LCOM (2)
 - RELEX (3)
 - TIGER (2)
- **Environments**
 - EOSAEL (2)
 - LOWTRAN (5)
 - MODTRAN (2)
 - NASTRAN (5)
 - PATRAN (5)
 - SINDA (3)

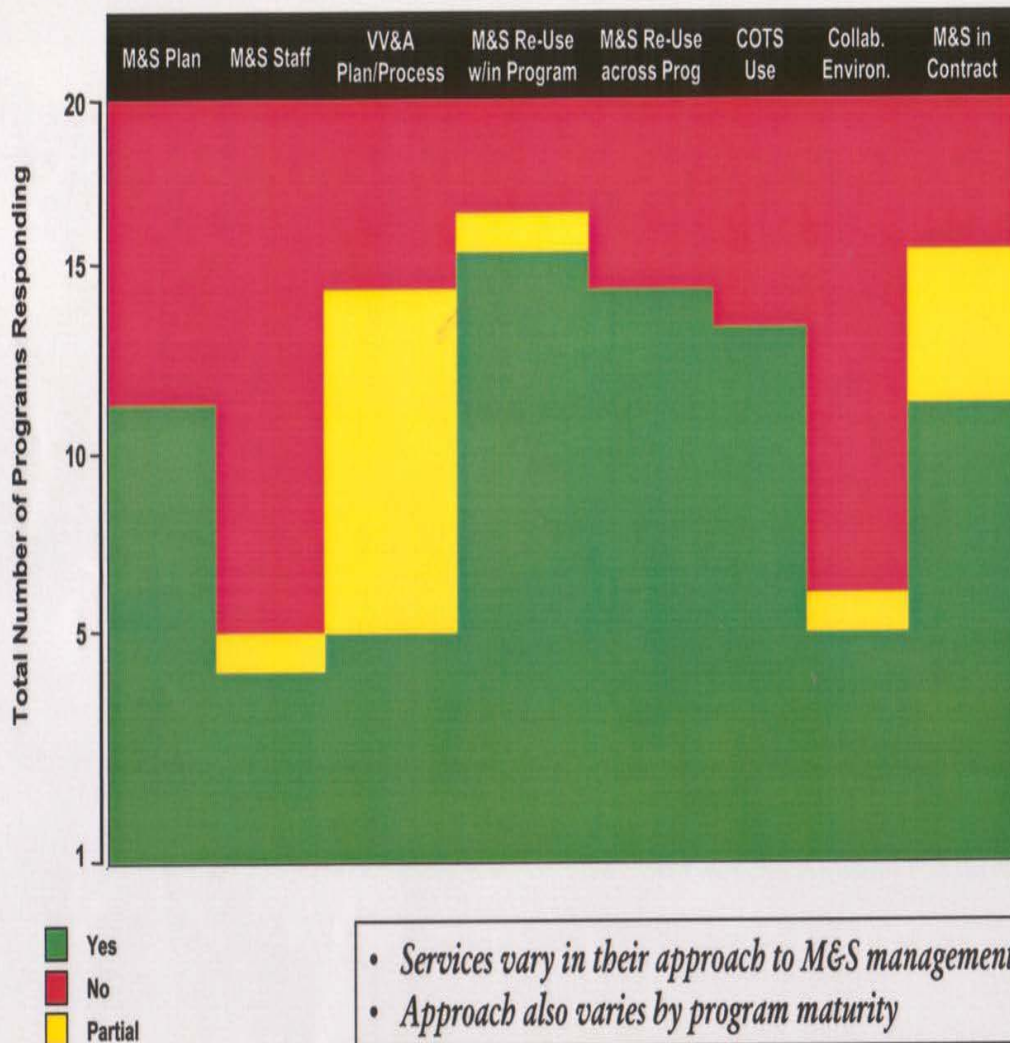
Exploiting M&S commonality:

- *Best-of-breed?*
- *Strengths/Weaknesses?*
- *Limits on extension/application?*
- *VV&A status?*

Results of LFT&E-Sponsored Survey of Model Usage within the DOD Acquisition Community



Incorporation of Selected M&S Management Activities

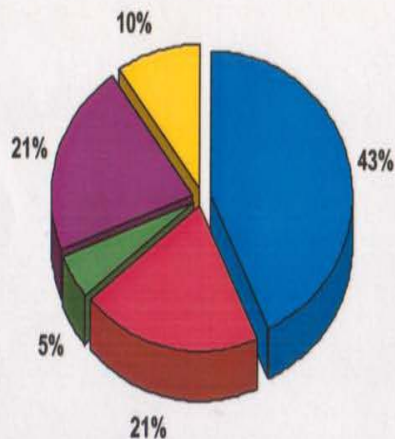


Results of LFT&E-Sponsored Survey of Model Usage within the DOD Acquisition Community



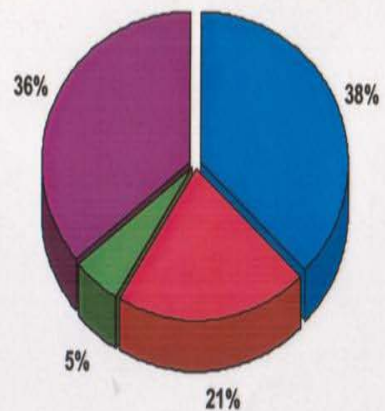
M&S Management

Developers



- 219 M&S from 13 programs
- Crusader, F/A-18E/F, Javelin, FAADC2, AIM-9X, ATACMS/BAT and Comanche did not provide data on M&S developers

Owners



- 359 M&S

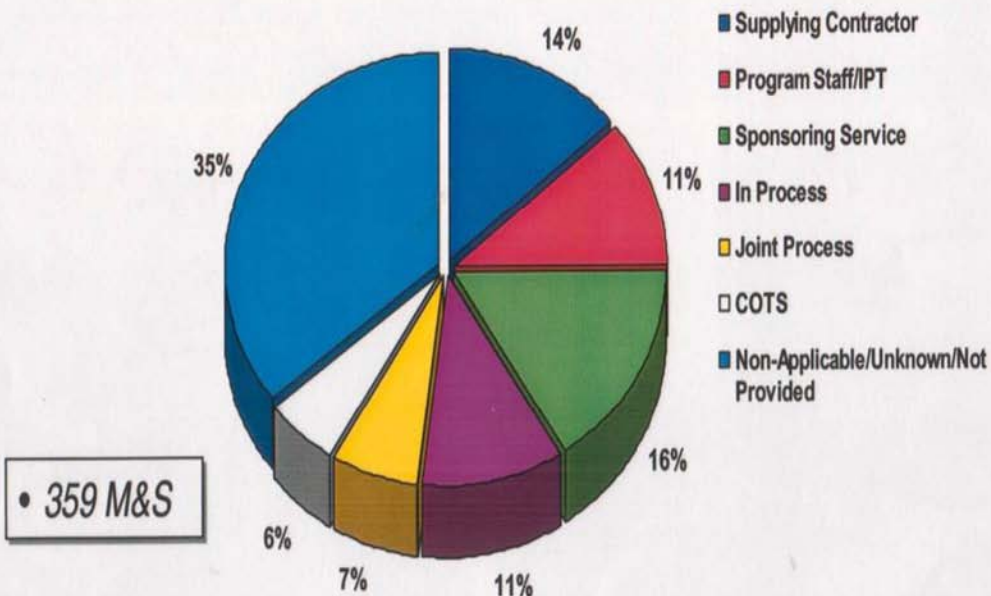
- Industry is the predominant developer/owner
- Extent of industry involvement in Service/Government-developed M&S (30%) unknown

Results of LFT&E-Sponsored Survey of Model Usage within the DOD Acquisition Community



VV&A Overview

Who Does VV&A?



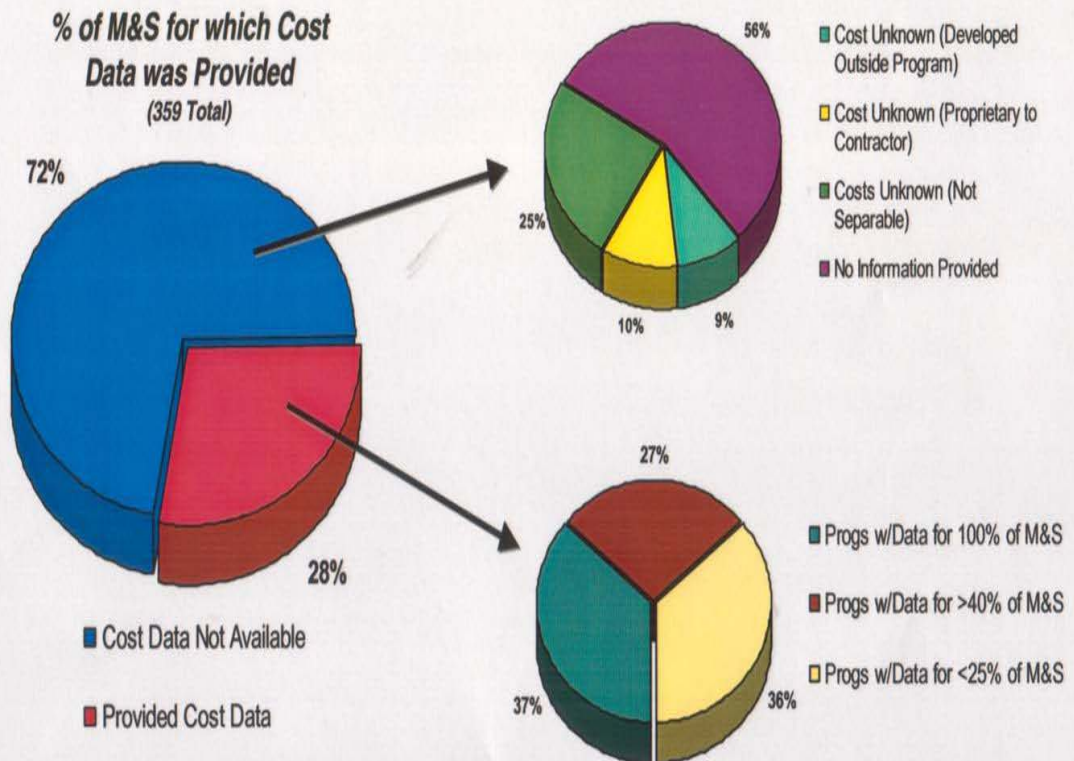
• 359 M&S

- Uncertainty about "pedigree" of M&S being used (35%)
- Potential conflicts of interest (25%)
- VV&A standards for COTS M&S?
- Use of joint/independent processes low (7%)

Results of LFT&E-Sponsored Survey of Model Usage within the DOD Acquisition Community



M&S Cost Overview



- *M&S development and application costs data are not readily available within acquisition programs*

Results of LFT&E-Sponsored Survey of Model Usage within the DOD Acquisition Community



Findings

- Only 25 of 359 M&S surveyed were used by more than one program
 - best of breed?
- Half of the programs had M&S Support Plans
 - these plans were not requirements oriented
- Less than 25% of the programs in the survey had dedicated M&S expertise
- Less than 20% of the programs surveyed were using a collaborative environment
- Only one of the programs incentivized the contractor for M&S performance
- Less than half of the programs addressed M&S activities in the contractor's SOW
- Nearly half of the M&S surveyed were developed by contractors and contractors retained ownership of the majority of these
- Cost data were not available for 72% of the 359 M&S

Results of LFT&E-Sponsored Survey of Model Usage within the DOD Acquisition Community



Recommendations to USD(A,T&L)

- **Emphasize the important role that acquisition programs must play in the development of M&S**
 - address M&S in the 5000 series
 - incentivize Program Office investment in M&S
- **Foster an improved understanding of the interrelationship of T&E and M&S**
 - Endorse pilot programs with the SAEs that examine and demonstrate the utility of M&S for T&E
- **Review and clarify roles and functions of DoD M&S organizations**
 - “who’s doing what” and “who should be doing what”
 - identify and coordinate M&S priorities and funding source
- **Examine payoff from M&S in life cycle cost**
- **Establish a forum to address industry strengths and challenges**
- **Direct the implementation of a process to identify and satisfy M&S requirements for joint, coalition and system of systems development**

Results of LFT&E-Sponsored Survey of Model Usage within the DOD Acquisition Community



Results to date

- USD(AT&L) directed that language concerning M&S development and management be included in the new DoD 5000.2-R
 - develop M&S plans, co-signed by testing community
 - use M&S to make pre-test predictions and use test results to validate the M&S
 - use M&S to validate interoperability
 - require M&S to be deliverables
 - identify M&S to be used in evaluation proposals
- DOT&E and ASN(R&D) created Pilot Project concept
 - Air Force and Army SAEs agreed to participate
 - USD(AT&L) endorsed DOT&E Pilot Projects with the Services

Brief Summary of Results from LFT-Sponsored Survey of DoD M&S in Support of Defense Acquisition

- 1. Simulation Based Acquisition is not pursued in any organized manner;**
- 2. It's more myth than reality ... a slogan ... a bumper sticker.**
- 3. Industry executives either are being disingenuous or are fooling themselves [saying that SBA is here];**
- 4. Program managers have little incentive to do SBA, because of high turnover;**
- 5. PMs often prefer to not have realistic models – since they may make the program look worse;**
- 6. There are no financial rewards for industry to cut costs;**
- 7. On the training side, they [M&S] are more organized than on the acquisition side.**

L-2

*Improving M&LS
in
LFT&E*

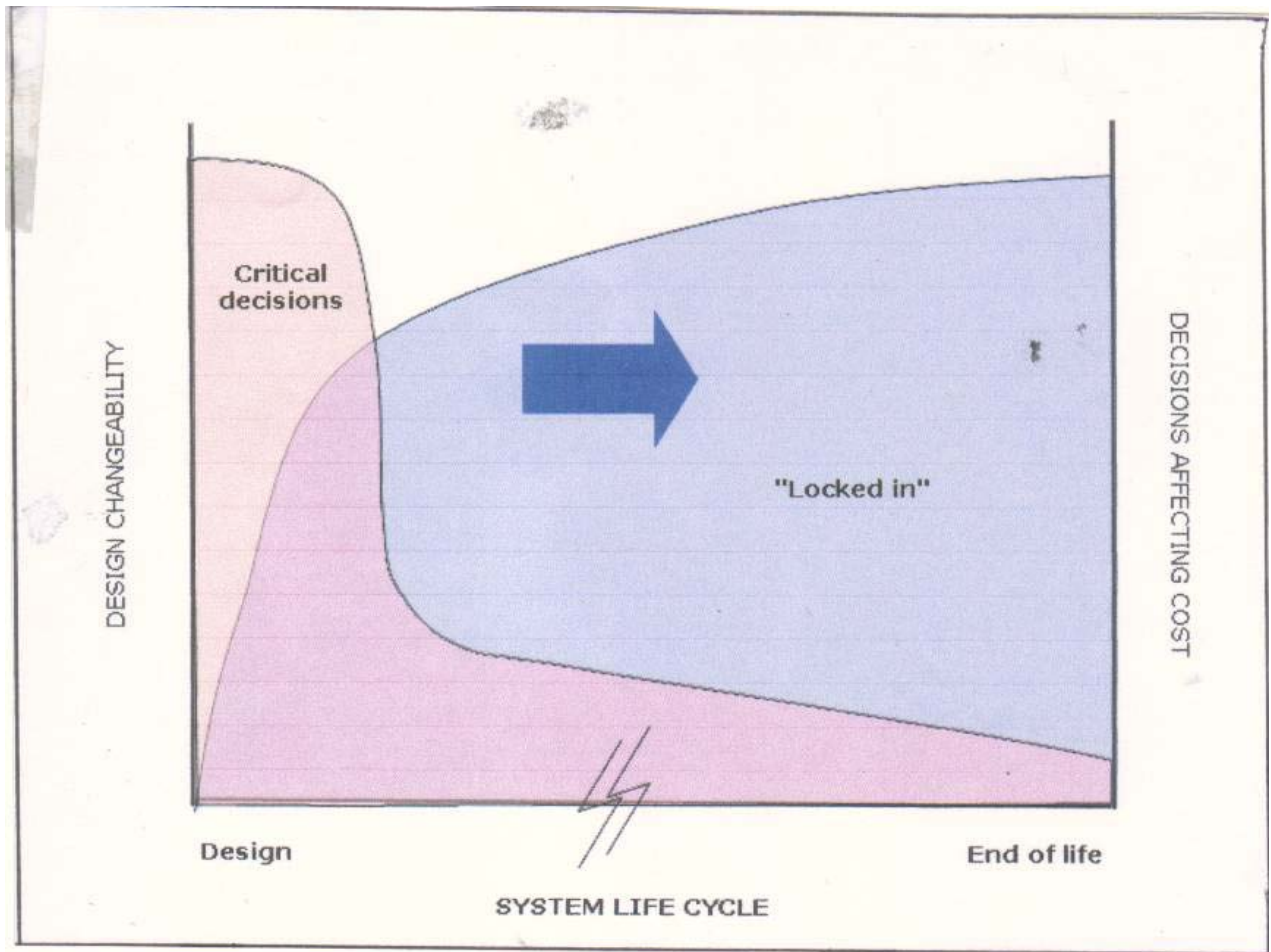
How Good Does M&S Have to Be?

**“We'll Know We're Successful In
Live Fire Testing When The
Modeling Tools We Use Are So
Successful That There Are No
Surprises.”**

**(GENERAL LARRY WELCH, PRESIDENT, IDA AND
FORMER CHIEF OF STAFF, USAF, ADPA T&E DIVISION,
LFT&E NATIONAL CONFERENCE, LLNL, JANUARY
1997)**

M & S PLAY A VITAL ROLE EARLY ON IN SYSTEM DESIGN AND VERIFICATION

Source: R. Garrett, "Opportunities in Modeling and simulation to Enable Dramatic Improvements in Ordnance Design," presented to the Committee on Bridging Design and Manufacturing, National Research Council, Washington, DC., April 29, 2003.



Ten Studies in Ten Years!

**Naval Research Advisory Committee Report
(1994)**

Naval Air Syst Command Study (1995)

**North American Tech & Industrial
Base Study (1996)**

ADPA Study (1996)

**Dir. Test Sys Engineering & Eval Study
(1996)**

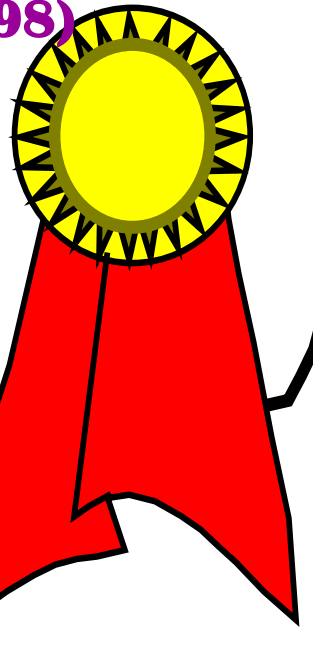
NRC Study (1997)

Joint SBA Task Force Study (1998)

DSB Task Force Study (1999)

NRC Study (1999)

MORS Study (2000)



**THE RESULT OF THESE
STUDIES AND MULTIPLE
EFFORTS HAS BEEN
TO ORGANIZE, PRIORITIZE,
REVITALIZE, FUND,
AND PROMOTE THE
DEVELOPMENT,
VERIFICATION, VALIDATION,
ACCREDITATION AND USE
AND REUSE OF MODELS
ACROSS THE DOD?**

**THE ACTUAL RESULT OF
THESE STUDIES AND
MULTIPLE
EFFORTS IN REALITY?**

**AFTER ALL HAS BEEN SAID
AND DONE, MUCH MORE HAS
BEEN SAID THAN DONE!!!!**

**THE QUESTION IS,
“WHY HAS THERE BEEN
VIRTUALLY NO ACTION
TAKEN AS THE RESULT OF
THESE STUDIES?”**

- **The recommendations were reasonable.**
- **They were consistent from one study to the next.**
- **They were based on solid honest analyses.**

It's A New World Out There!!!



**If there's no new money, where
will the money come from to
fund this ‘MASTER’ initiative?**



**If there's no new money, where
will the money come from to
fund this ‘MASTER’ initiative?**



A Proposal That Might Work: Program Manager Magazine

MODELING AND SIMULATION

Meet "MASTER" —Modeling & Simulation Test & Evaluation Reform

Energizing the M&S Support Structure

JAMES F. O'BRYON

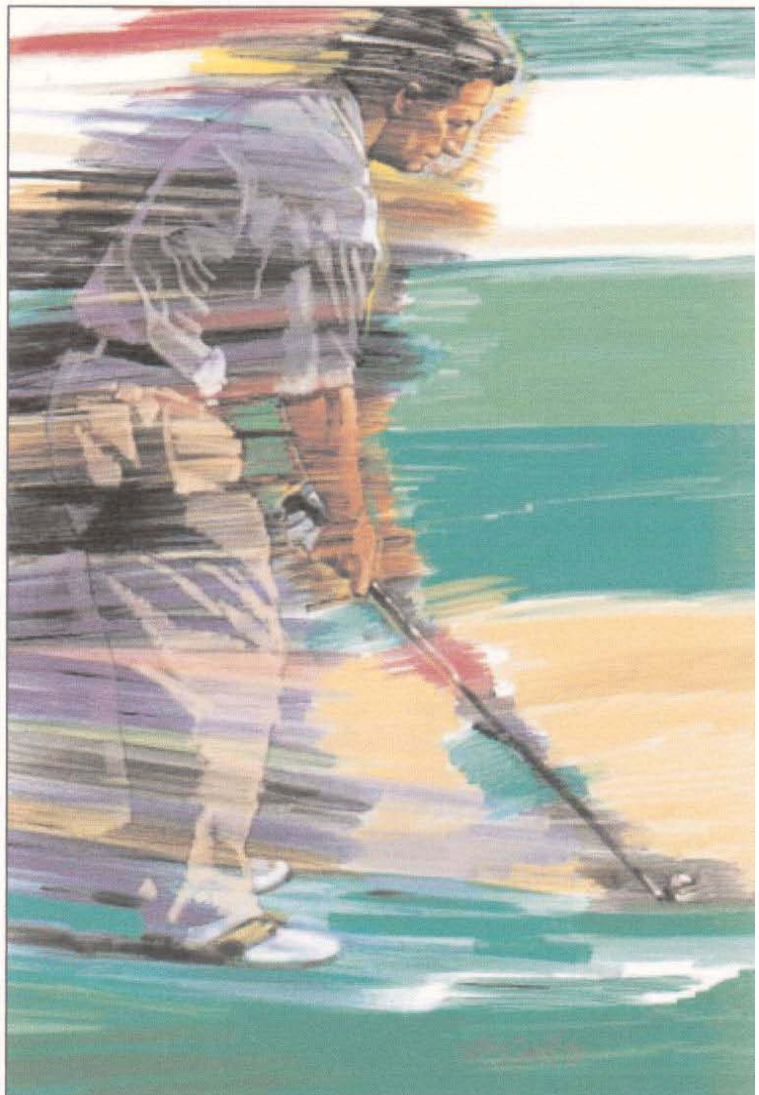
In the following few pages, I discuss my personal thoughts on an issue of paramount importance not only to the Department of Defense, but also to the nation's defense. My hope is that this article will provoke serious thought and meaningful action to resolve the issues raised.

First, A Look Back

Since arriving in the Pentagon just over 12 years ago, and for more than a decade before that serving as a weapons analyst in the Department of Defense (DoD) infrastructure away from the Washington area, I have been witness to numerous and surprisingly similar technical and management discussions about the need to get the modeling and simulation capabilities of the DoD organized, incentivized, under control, and more efficient to better serve the weapons development and acquisition process.

These discussions included such issues as a common and meaningful model architecture, model inter-connectivity, language consistency, validation, model proliferation, and configuration control. They've also covered the problems of duplication, modeling "stovepipes," the lack of meaningful and up-to-date documentation supporting M&S, and of course, the lack of model realism.

O'Bryon serves as the Deputy Director, Operational Test and Evaluation, Live Fire Testing, in the Office of the Secretary of Defense, The Pentagon, Washington, D.C. His undergraduate degree is in Mathematics, and he also holds two graduate degrees: one in Operations Research from The George Washington University, and another through the Electrical Engineering Department of the Massachusetts Institute of Technology.

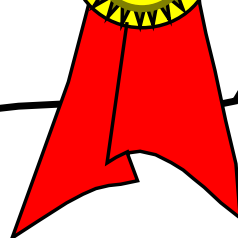
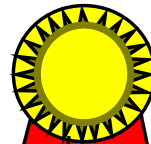


TRUTH # 1



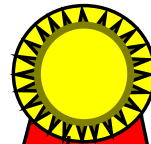
TRUTH # 2

**“PMs & PEOs
Control Largest
Funding
Blocks”**



TRUTH # 3

**“PMs & PEOs
Will Benefit
From
Realistic
M&S”**



TRUTH # 4

**“PMs Have
Short Time
Horizons And,
Hence, On
Their
Investment
Decisions”**



TRUTH # 5

**“Realistic
M&S Is Not
Necessarily
Viewed As A
Benefit By
The PM”**



TRUTH # 6

**“The Golden
Rule: Them
That Have The
Gold, Make
The Rules”**



What's Needed?

“MASTER”

**MODELING AND
SIMULATION TEST AND
EVALUATION REFORM**

What is 'MASTER'?

- MASTER is a management approach to modeling and simulation in support to the defense department's policy of simulation-based acquisition
- It will provide
 - critical-mass funding
 - add discipline to the development of modeling and simulation
 - assure that funds expended on modeling and simulation are spent to further *the state of the art*, including VV&A
 - add connectivity across various model vectors being developed
 - free up the Program Manager's time & concerns about modeling and simulation support
 - assure the most realistic models & simulations are exercised in designing testing, evaluating, training, fielding and fighting our systems.

Consortium Discussion

Program Managers would initially describe their system(s), acquisition strategy, and M&S requirements to a consortium which would then parse out these needs into vectors of M&S technical responsibility.

Consortium Members, who are charged with having knowledge of *state of the art*, as well as where it exists within and outside of their respective organizations, would make the decisions as to which M&S tools best suit the PM's needs and where the funds would be expended to meet the specific requirements of each Program Manager's system(s). They would upgrade extant models where available and originate M&S only when absolutely necessary. In many instances, these investments would be allocated to organizations external to the Consortium Membership itself.

Must Have Up-Front Investment in M&S!!

“I expect programs to make the **up-front** investment in modeling and simulation application technology, and will be looking for evidence of that investment in program planning and execution.”

*Honorable Jacques S. Gansler, Under Secretary
of Defense (Acquisition and Technology) 1998*

**If there's no new money, where
will the money come from to
fund this ‘MASTER’ initiative?**



Where Would Money to Fund the Consortium Come From?

A modest tax (“greens fee”) would be assessed upon every Program Manager’s total budget. These funds would be placed in the Consortium’s account to provide the needed M&S support to the Program Manager.

The proposed “tax” would be a percentage of the Program Manager’s budget (perhaps 2-3%). This is significantly less than what is currently spent by PM’s on a plethora of isolated M&S activities.

The tax would not be at the discretion of the Program. It would be a policy decision and implemented early on at the OSD Comptroller level.

Funds would be removed early to:

- enable sufficient time to develop the needed M&S, and,**
- avoid the tendency to cut the funding of modeling and testing programs, when problems arise and budgets get tight**

Potential Modeling Vectors Needed for the Testing and Training Communities

SOME EXAMPLES:

TERRAIN

WEATHER

CADCAM SYSTEM DESCR

AERODYNAMIC FLOW/FLIGHT

STABILITY

6 DOF FLY-OUT

TARGET SIGNATURES

SENSOR/FUZING

SMOKE/OBSCURATION

C3I

EW

ACOUSTIC

BALLISTIC

1-1 ENGAGEMENT

MxN ENGAGEMENT

VULNERABILITY

LOGISTICS

MANY OTHERS

What are Some of the Benefits of Forming a Consortium to Oversee M&S Investment Within the DoD?

- 1. It would assure that Program Managers have the best and most realistic model support for their programs.**
- 2. It would establish the necessary consortium protocols for model architecture, languages and protocols, insuring that no funds would be invested in model development or upgrades unless they meet these protocols, thereby facilitating interoperability.**
- 3. It would assure that model investments would be directed toward extending the capability of extant models and simulations rather than spending significant funds reinventing and re-buying codes which exist or exist in part.**

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Consortium Benefits?

(Continued)

- 4. The structure would provide an adequate source of funding to extend *the state of the art* in the M&S base, instead of being at the whim of the Program Manager, typically trying to maximize the short-term return.**
- 5. It would focus national expertise in each technical discipline to assure that decisions on which model investments were indeed needed in each of these disciplines.**
- 6. It would free up the Program Manager's time and attention to other management responsibilities and allow the Consortium to provide the needed M&S support for each respective program.**

**CONGRESS HAS EXPRESSED
CONCERN ABOUT LACK OF
ADEQUATE M&S MANAGEMENT
OVERSIGHT IN DOD.**

**“The Committee directs the Secretary
of Defense to develop a standard
reporting procedure for starting new
modeling and simulation efforts with a
cost threshold of \$50,000 for input to a
DoD-wide Catalog”**

**(FY94 HASC language, pp 251, based
on DoD IG Report # 93-060, dated
March 1, 1993)**

Interoperability Standards in Models

“The Inspector General found that there is great potential to use a given model across many applications and thereby reduce development effort. There is an absence of interoperability standards at the OSD level that promotes duplication and proliferation of computer models.”

--FY94 HASC Language, based
on DoD IG Report #93-060,
March 1, 1993

**“The bridge that will pull DoD
M&S together doesn’t have to be
complex or risky.”**



**Photo is of Millau Viaduct in Southern France.
http://bridgepros.com/projects/Millau_Viaduct/**

**IF YOU HAVE SOME IDEAS YOU'D LIKE
TO SHARE OR WOULD LIKE TO
CHALLENGE SOME OF THESE IDEAS,
I WOULD WELCOME YOUR IDEAS.**



**Call me at 410-515-0345 or email me at
jamesobryon@obryon**

How To Tell If There Is a Terrorist at the Airport

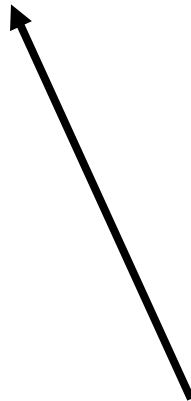


The Source of the Spinach Ebola Outbreak Has Been Narrowed



It's A New World Out There!!!





Sidewall Armor Attachment

- *Use attachment techniques*

*commensurate with
threat*