Physics-Based and Empirically - Based Modeling & Simulation in Defense T&E

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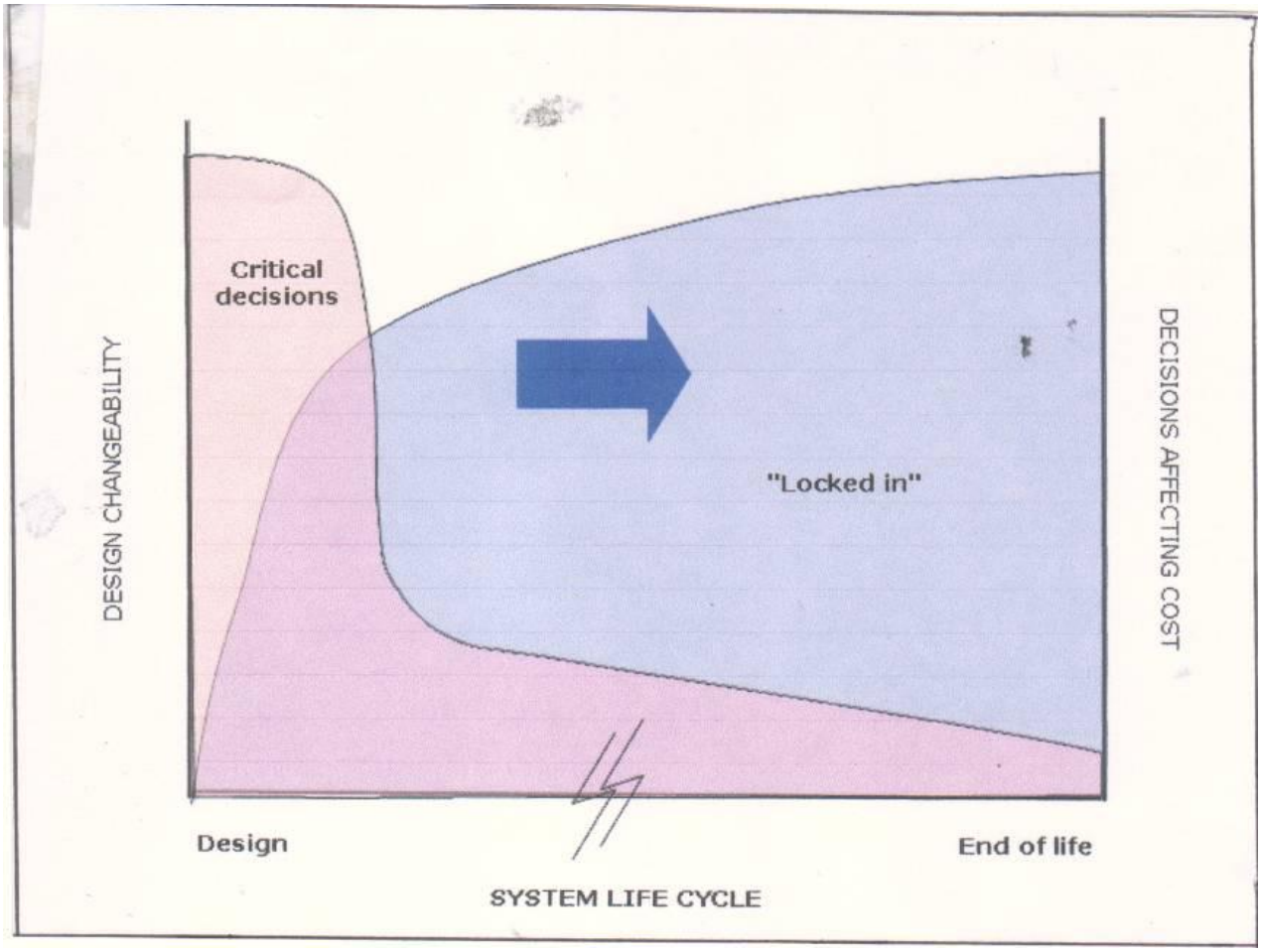
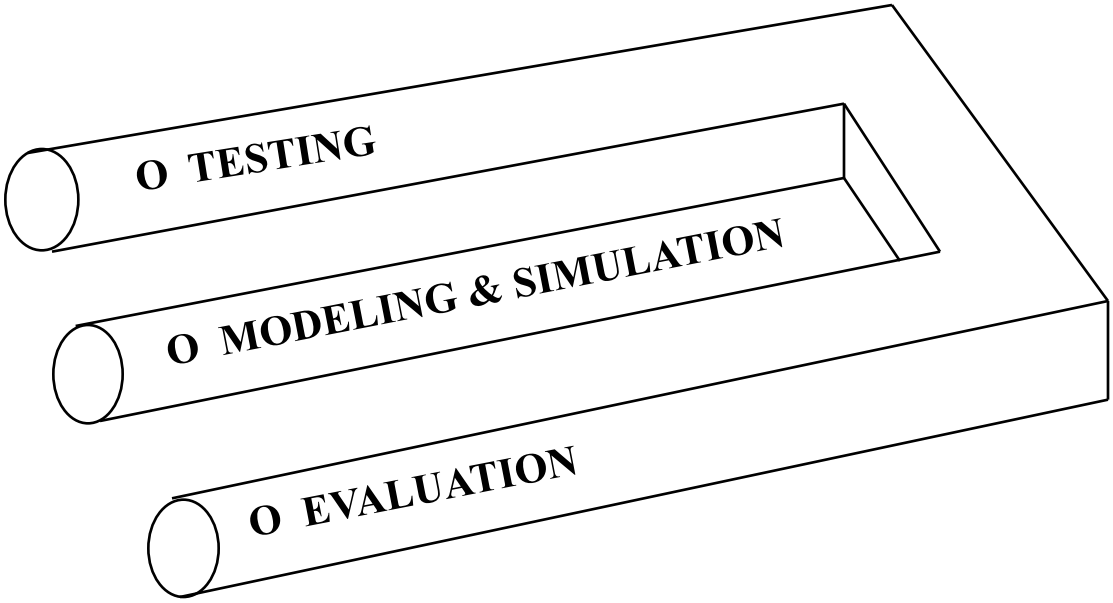
Acquisition Reform is Pushing More Reliance on M&S but Is the M&S Train Ready?

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.



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



“Is it an illusion?”

VULNERABILITY M&S

How well do we do?

M1/M1a1 LFT&E Included
48 Full-up System Level
Live Fire Shots

Modeled

- Primary Penetrator
- Primary Spall

Not Modeled

- **Fire**
- **Toxic Fumes**
- **Shock**
- **Secondary Debris**
- **Ricochet**
- **Deformation**
- **Cracking**
- **Non-nuclear EMP**
- **Crazing**
- **Other Effects**

WE HAVE A FALSE SENSE OF MODEL REALISM
MODELS ARE EXCELLENT AT SURFACE MODELING,
BUT ……

…… BUT BELOW THE SURFACE IS TYPICALLY A SET OF EMPIRICAL FITS WITH MUCH LESS PHYSICAL REALISM

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

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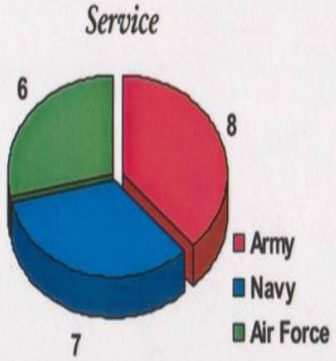
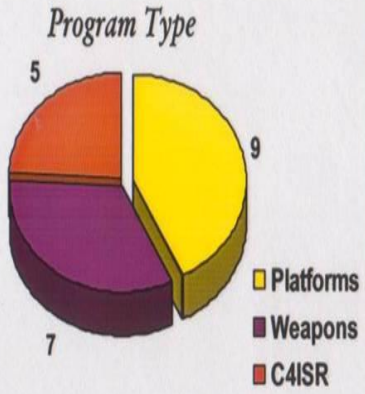
Summary of Survey Respondents to Date

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 Blk 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

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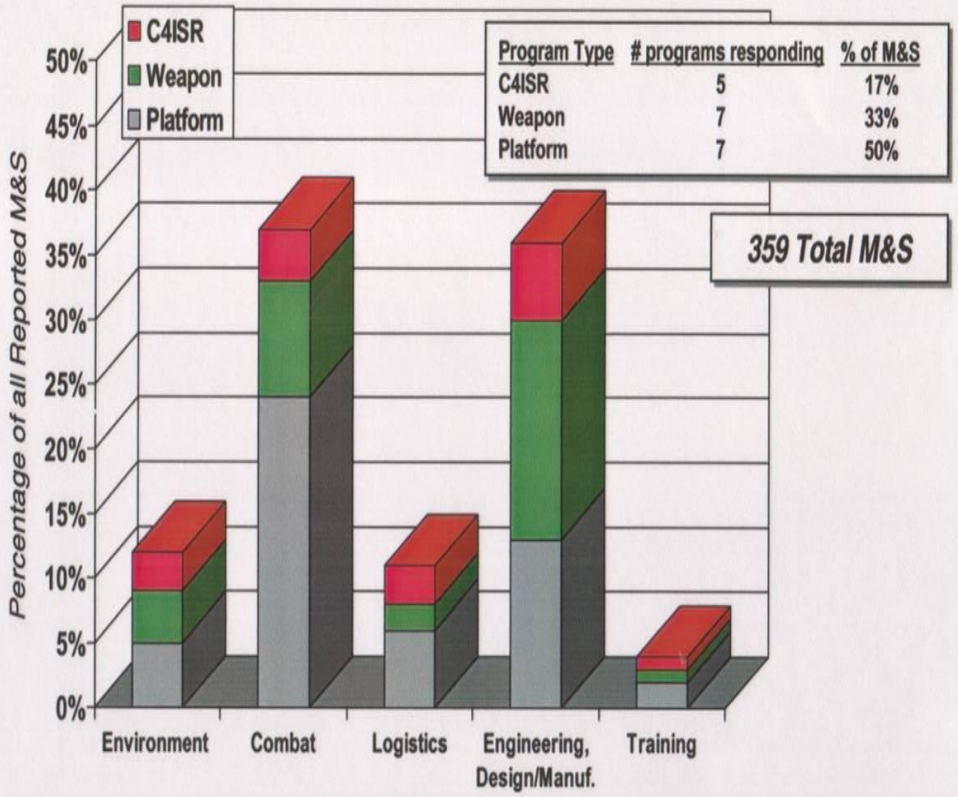
M&S Characterization

By Program Type



Program Type	# programs responding	% of M&S
C4ISR	5	17%
Weapon	7	33%
Platform	7	50%

359 Total M&S

- *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*

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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?*

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

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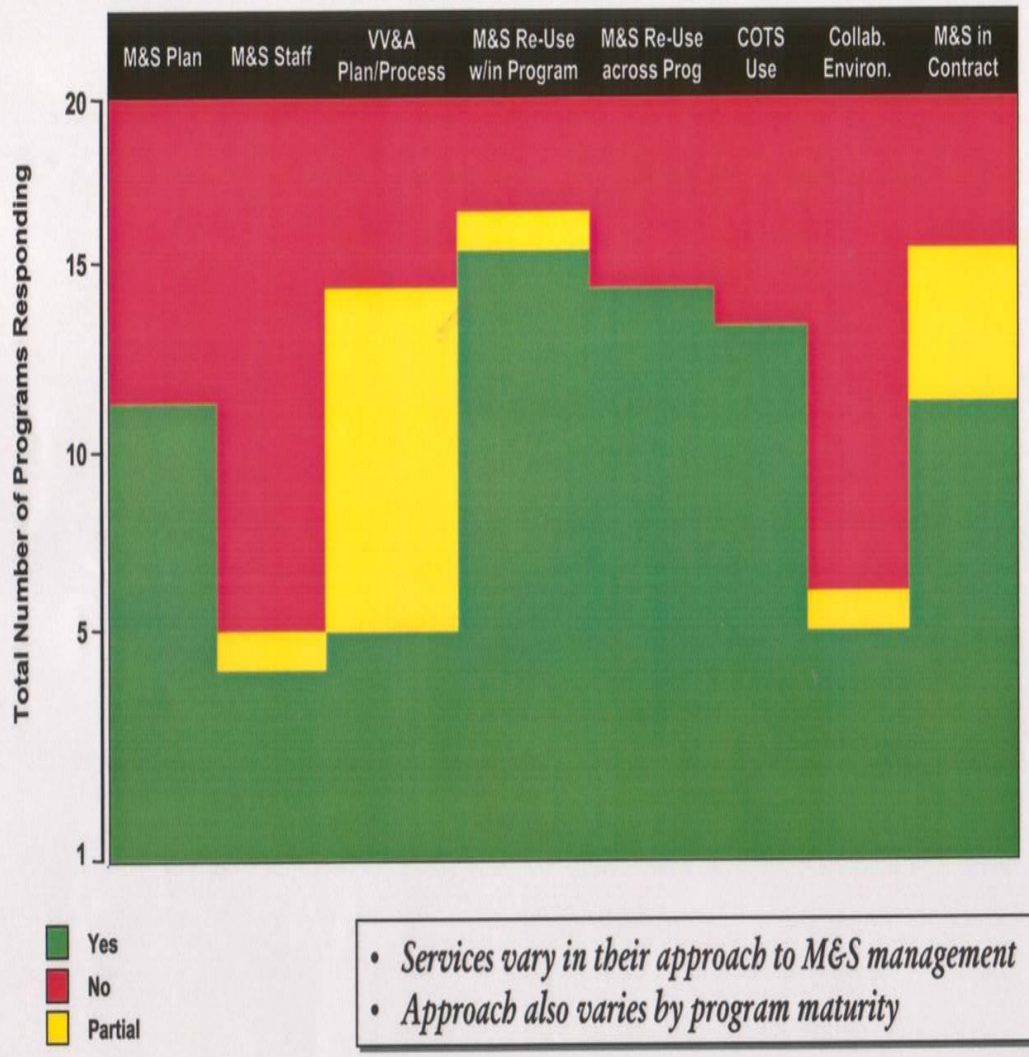
Incorporation of Selected M&S Management Activities



- *Services vary in their approach to M&S management*
- *Approach also varies by program maturity*

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

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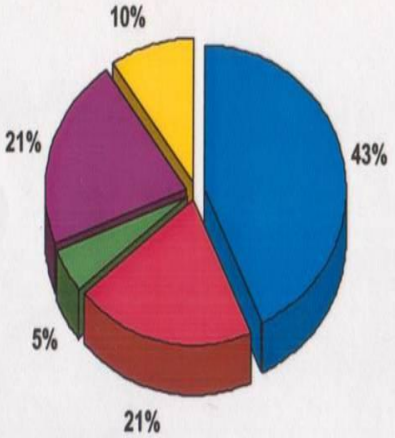
M&S Management

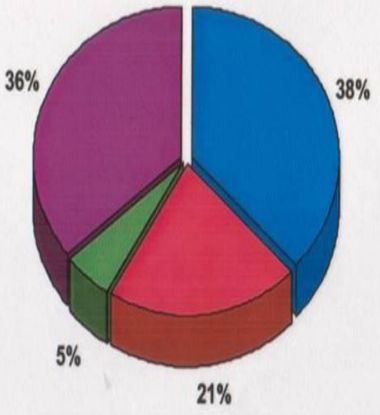
Contractor
Sponsoring Service
Other Govt Orgs
COTS
Unknown

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

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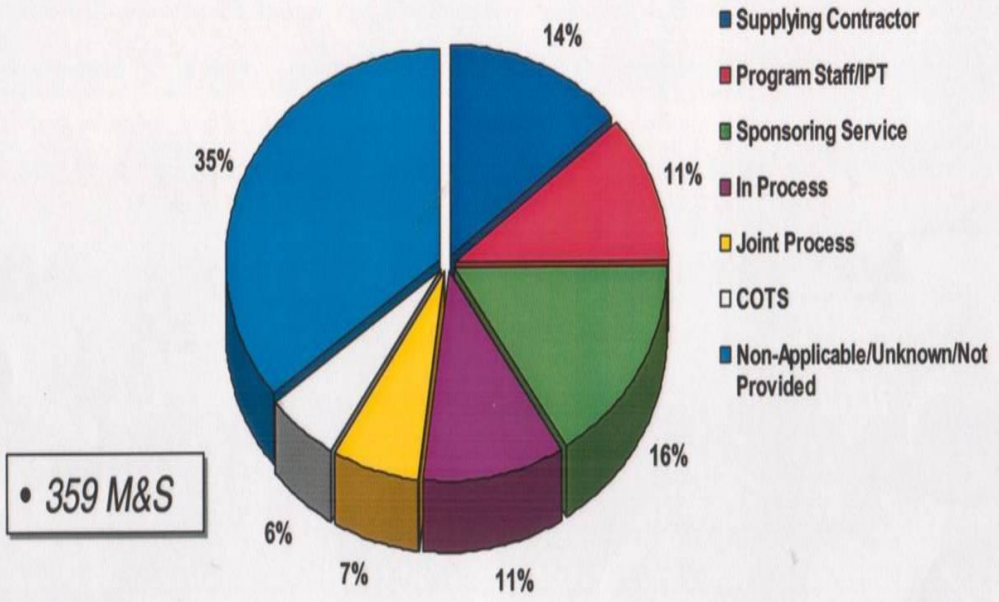
VV&A Overview

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%)*

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

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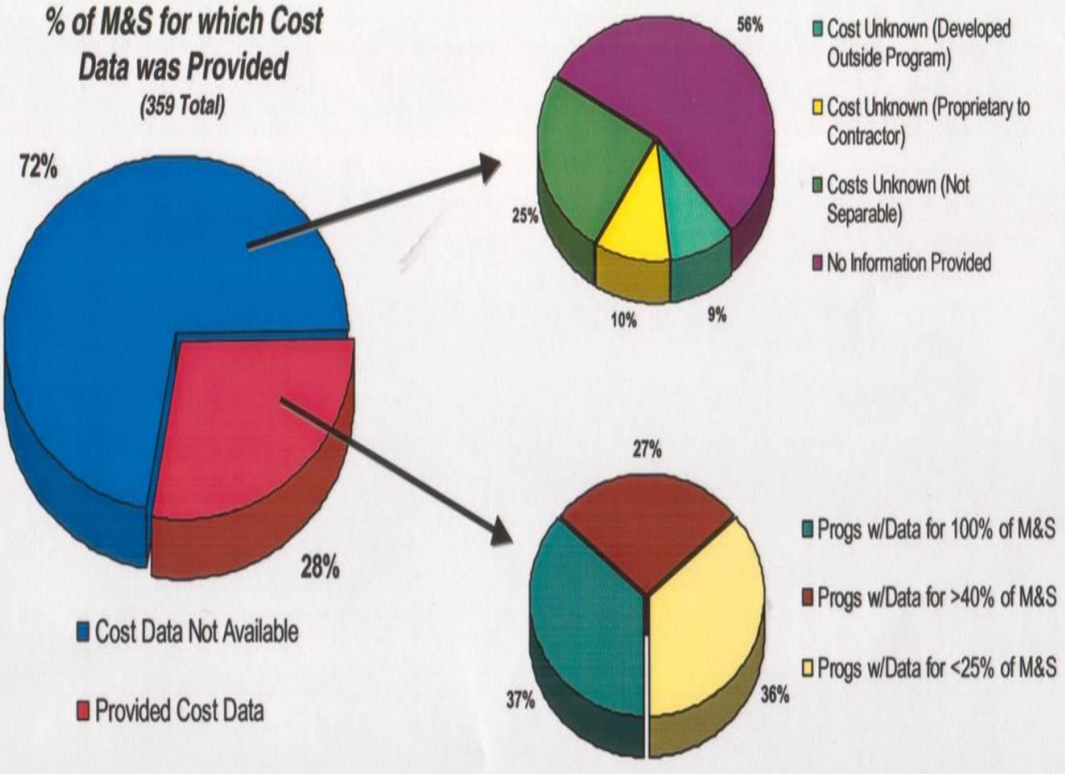
M&S Cost Overview



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

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

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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

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)

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

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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**

If the Model Didn't Predict it, Can I Just Chalk it Up as a "Random Failure?"

"There are no random failures. There are, however, some things we don't understand.

"Testers have to know more about the systems than the engineers that built them."

T.K Mattingly, VP, Lockheed Martin and Former NASA Astronaut, ITEA Conference, Orlando, FL, September 1997

"Modeling cannot replace testing but it can lead to smarter T&E."

Dr. Milton Finger, LLNL, ADPA (NDIA) LFT&E Symposium, January 1997

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.

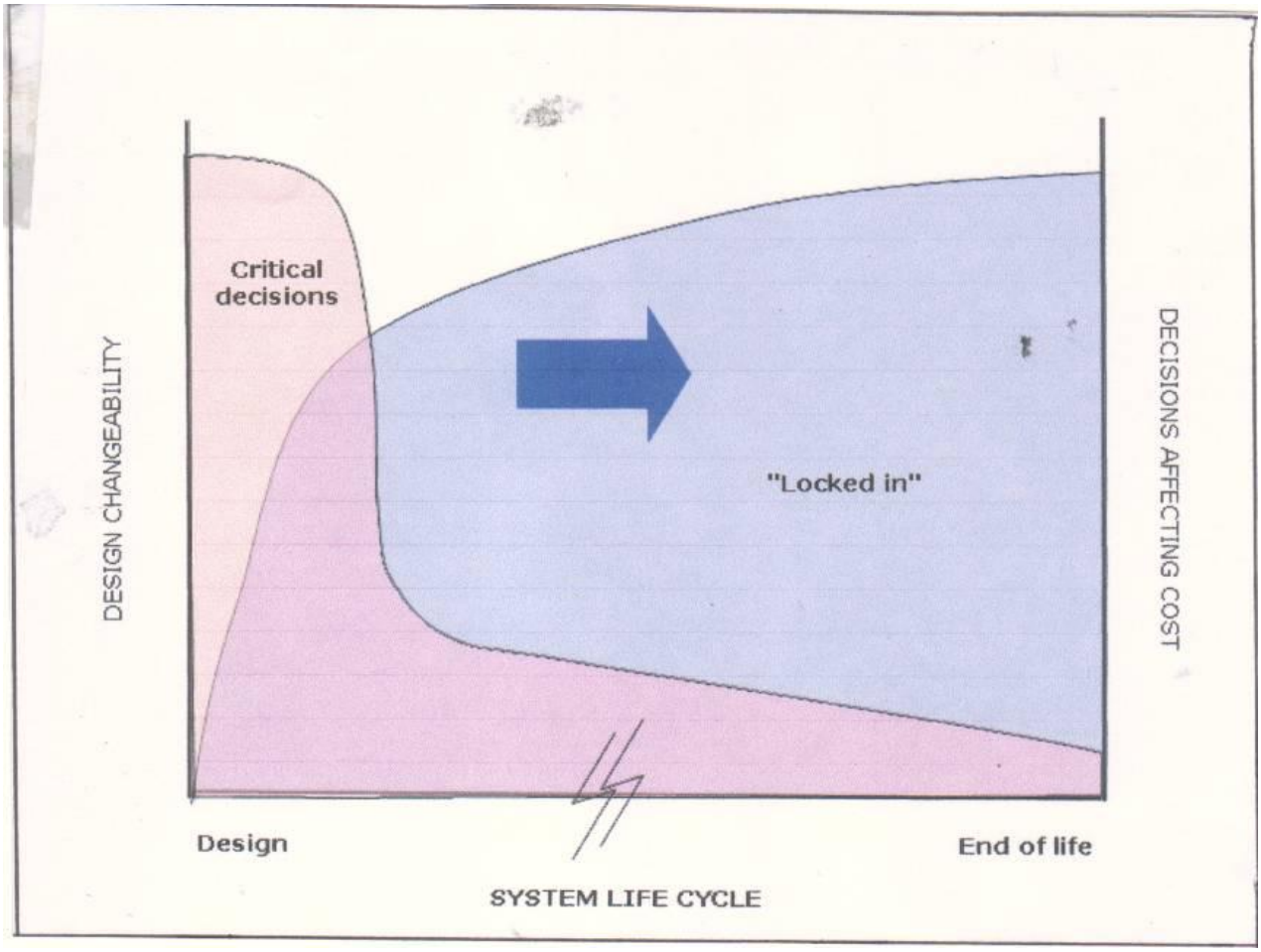
COVART does not accept many partial damages (e.g. a cracked spindle is assessed as just cracked regardless of the size and depth of the crack.”

The structural effects of an explosion are aircraft unique.

JTCG/AS Component Vulnerability Workshop, WPAFB, OH, March 1991

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.

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

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 acquistion 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 firs-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

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.**"

DoD Modeling & Simulation Verification, Validation and Accreditation (VV&A)

Instruction, 5000.61, December 9, 2009 (Ashton Carter, USD(AT&L)

"Models, simulations, and associated data used to support DoD processes, products, and decisions shall undergo verification and validation (V&V) through their lifecycles.

Models, simulations, and associated data used to support DoD processes, products, and decisions shall be accredited for an intended use.

VV&A results shall be documented and made accessible to the DoD Components, other government agencies, and non-governmental activities, as applicable and in accordance with DoD Directive 8320.02 (Reference (d)).

Each DoD Component shall be the final authority for validation of representations of its forces and capabilities in models, simulations, and associated data, and shall be responsive to other DoD Components to ensure those forces and capabilities are appropriately represented.

Heads of the DoD Components and OSD Presidentially Appointed, Senate-confirmed (PAS) officials are authorized to provide, within their areas of responsibility, VV&A procedures and guidance as appropriate and in accordance with this Instruction. This additional information shall be based on the intended use and risk of use of the models, simulations, and their associated data."

DoD Modeling & Simulation Verification, Validation and Accreditation (VV&A)

Instruction, 5000.61, December 9, 2009 (Ashton Carter, USD(AT&L)

Responsibilities

Through the DDR&E:

- **Ensure the M&S Coordination Office serves as the primary focal point for data and information on DoD and non-DoD activities as well as on DoD VV&A policies, procedures and practices, VV&A results, and accreditation documentation**
- **In coordination with DoD Components develop policies, plans, procedures, and DoD issuances for the implementation and management of VV&A for DoD models, simulations and their associated data.**

Through the M&S Steering Committee:

- **Encourage communication and coordination on VV&A activities among and between organizations and agencies using DoD models, simulations, and their associated data.**
- **Promote cooperative research, development, investment, and application of VV&A technologies.**
- **Establish standards for implementing VV&A standards for DoD models, simulations, and their associated data to promote DoD VV&A procedural commonality and foster model and simulationinteroperability. Established standards shall be reviewed periodically to ensire currency."**

DoD Modeling & Simulation Verification, Validation and Accreditation (VV&A)

Instruction, 5000.61, December 9, 2009 (Ashton Carter, USD(AT&L)

Responsibilities

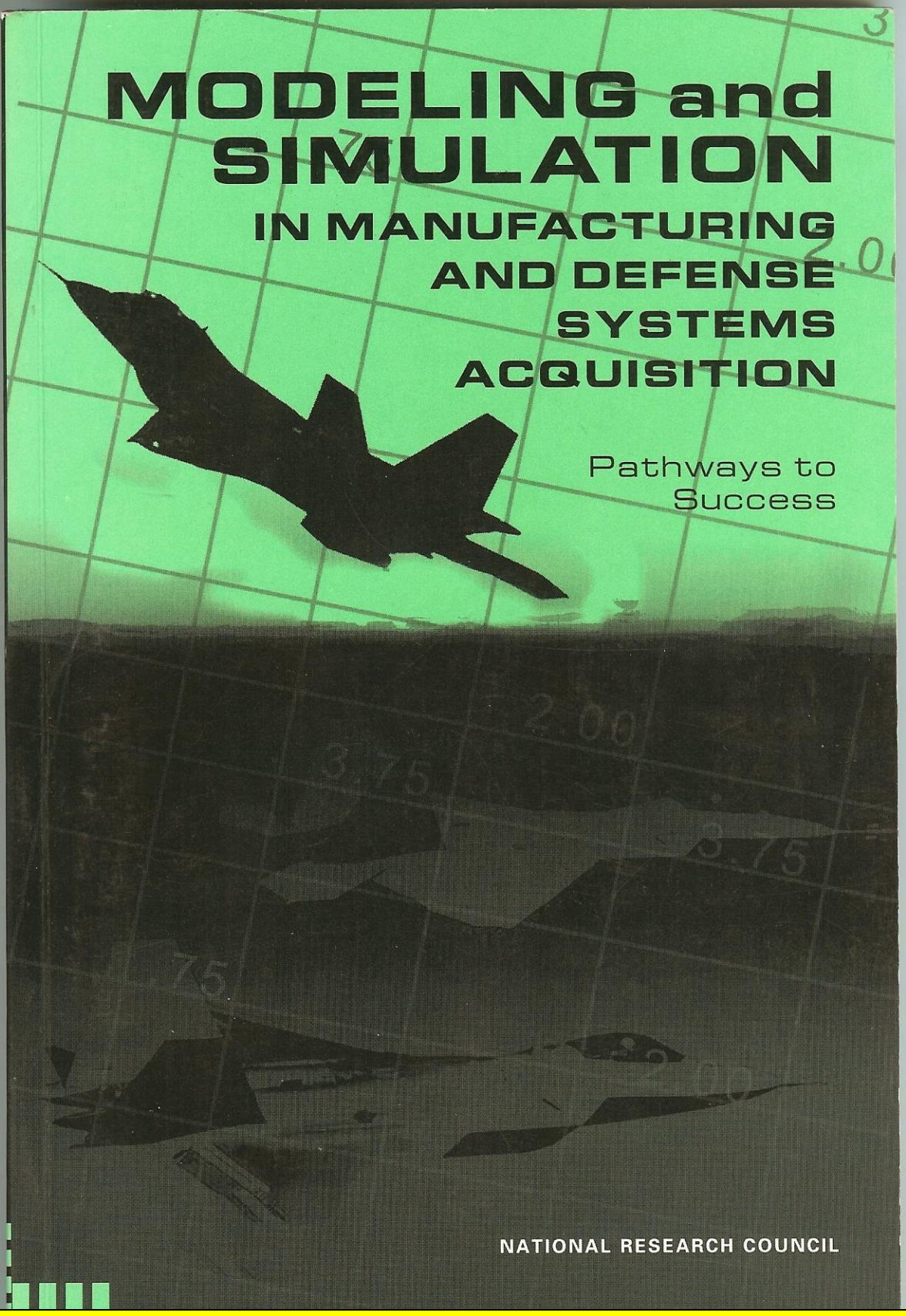
Through the Director, Operational Test and Evaluation (DOT&E)

"The DOT&E shall prescribe policies and procedures, and provide guidance on VV&A for DoD models, simulations, and their associated data used for operational test and evaluation and live fire test and evaluation."

MODELING and SIMULATION

IN MANUFACTURING AND DEFENSE SYSTEMS ACQUISITION

Pathways to Success



NATIONAL RESEARCH COUNCIL

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Stuart Starr, **Mitre Corp**
Charles Wu, Ford Research Lab
Bernard Zeigler, U of Arizona

"Modeling and Simulation in Manufacturing and Defense Systems Acquisition; Pathways to Success, p 94, National Research Council, National Academy Press, 2002"

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)

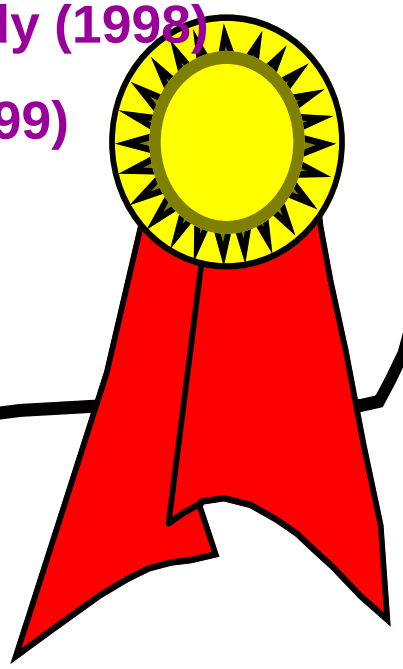
NRC Study (1997)

Joint SBA Task Force Study (1998)

DSB Task Force Study (1999)

NRC Study (1999)

MORS Study (2000)



Physics-Based Modeling

"Mathematical models in which the equations that constitute the model are those used in physics to describe or define the physical phenomenon being modeled are referred to as physics-based models.

For example, physics-based flight dynamics models use aerodynamics equations rather than look-up tables to model the flight characteristics of a simulated aircraft.
The physics of failure and assessment of a potential system's durability and operational availability is of special interest. Such assessments would greatly benefit from accurate physical models that support predictions of the modes and times of failure of physical systems.

Several studies have concluded the need for improvements in physics-based modeling (Johnson et al, 1998, Hollis and Patenaude, 1999; Starr, 1998). Physics-based modeling is arguably more important for defense manufacturing and acquisition than for other simulation activities such as training."

"Modeling and Simulation in Manufacturing and Defense Systems Acquisition; Pathways to Success, p 94, National Research Council, National Academy Press, 2002"

Model Correctness

"Model correctness is the fundamental requirement of ensuring that the predictions of a simulation tool can be relied upon (Zeigler, 1998). The vision of defense acquisition contained in SBA requires the development of accurate and reliable models of real-world systems. A prerequisite to this is an understanding of the real-world systems and objects to be modeled, their contextual domains, and the phenomenology of the operations and interactions, all at a level of detail sufficient to justify the model. Once the models have been implemented as simulations, their correctness must be rigorously evaluated."

"Modeling and Simulation in Manufacturing and Defense Systems Acquisition; Pathways to Success, p 93, National Research Council, National Academy Press, 2002"

Modeling Methods

"Lack of adequate methods is one of the most serious shortfalls in using M&S (MORS, 2000). In order to maximize the potential of M&S technologies for commercial manufacturing and defense acquisition, basic research must be undertaken to improve understanding of modeling methods and characteristics including:

Scalability
Multi–Solution Modeling
Agent–Based modeling
Semantic Consistency
Modeling Complexity
Fundamental Limits of Modeling & Computation Uncertainty

"Modeling and Simulation in Manufacturing and Defense Systems Acquisition; Pathways to Success, p 78, National Research Council, National Academy Press, 2002"

Conclusions

Naval Research Advisory Committee Report:

Although no evidence indicates that the DON implemented any of the recommendations made by the panel, the committee believes that the work of this panel had an impact on later reports."

Naval Air Systems Study:

The themes of partnership and sharing, particularly as they pertain to industry involvement earlier in the acquisition process and to the question of proprietary rights are reflected in subsequent studies.

North American Tech and Industrial Base Org. Study;

This study highlighted many more general SBA issues than the NAVAIR study had. Recommended a central government office at the level of OSD to coordinate policy and to act as a source of information.

ADPA (NDIA) Study;

No evidence indicates that specific actions were taken in response to the recommendations of the ADPA study.

"Modeling and Simulation in Manufacturing and Defense Systems Acquisition; Pathways to Success, p 94, National Research Council, National Academy Press, 2002"

Conclusions

Director, Test Systems Engr & Eval Study:
The study reinforced some of the conclusions and recommendations of prior studies.

National Research Council Study:
Infrastructure is needed in the areas of M&S theory, texts, case studies, software engineering methodologies, "Virtual centers", journals and conferences, object repositories and interface standards to enhance reusability and composability, explanation and traceability capability, and tools, such as automated scenario generation and experimental design, &post-processing and data analysis.

Joint Simulation-Based Acquisition Task Force Study;
This study was not formally adopted by the Acquisition Functional Area Council, although it remains a reference document. No DoD action has resulted.

Defense Science Board Task Force Study;
There is no evidence that any progress has been madde toward implementing the process and model improvements recommended by the task force.

"Modeling and Simulation in Manufacturing and Defense Systems Acquisition; Pathways to Success, p 94, National Research Council, National Academy Press, 2002"

Conclusions

National Research Council Study:

It is too early to assess the degree to which the recommendations of the NRC (1999a) report have been implemented by NASA. However, it is important to note that the NASA-sponsored initiative, which had objectives similar to those of DoD's SMA initiative, ceased to exist as a separate NASA program.

Military Operations Research Society Study (MORS);

Up-front investment as the norm to reduce life-cycle costs, making M&S Strategy integral to the total acquisition plan, Making M&S critical to formal acquisition decisions, provide incentives for all stakeholders to participate and DoD policy and guidance on M&S use and sharing M&S technology between government and industry and across programs. There is no evidence yet of substantive, corporate-level DoD action based on these recommendations.

"Modeling and Simulation in Manufacturing and Defense Systems Acquisition; Pathways to Success, p 94, National Research Council, National Academy Press, 2002"

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?

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.**

TRUTH # 1

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.

TRUTH # 2

TRUTH # 3

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

What's Needed?

"MASTER"

MODELING **A**ND
SIMULATION **T**EST AND
EVALUATION **R**EFORM

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?

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

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 <u>not</u> 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**

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.

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.

Defense AT&L

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DoD's Technical Information Broker

Defense AT&L Interviews R. Paul Ryan, Administrator Defense Technical Information Center

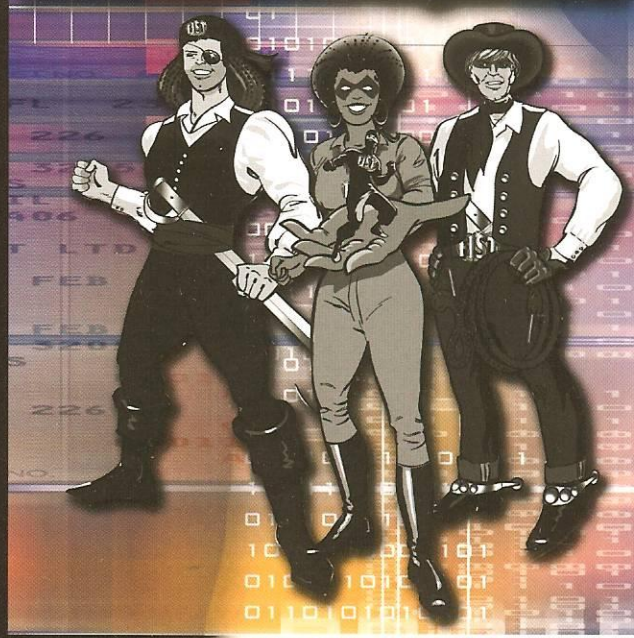
ALSO

America's Imprudent and Unsustainable Fiscal Path

David M. Walker, U.S. Comptroller General

And Introducing

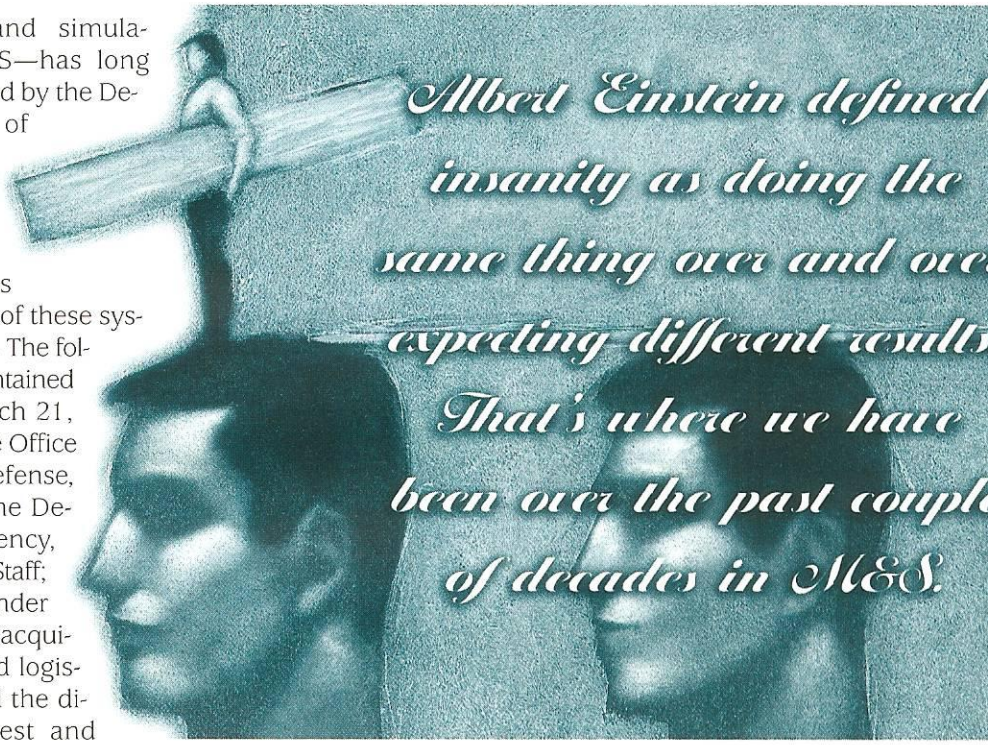
Defense AT&L's First Graphic Article



DoD's Modeling and Simulation Reform in Support of Acquisition

Stop Kicking the M&S Can Down the Road

James F. O'Bryon



Modeling and simulation—M&S—has long been touted by the Department of Defense as being among its primary methods for reducing time to market for defense systems and reducing the cost of these systems at the same time. The following statement is contained in a letter dated March 21, 2000, addressed to the Office of the Secretary of Defense, Service secretaries, the Defense Intelligence Agency, and the Joint Chiefs of Staff; it is cosigned by the under secretary of defense (acquisition, technology and logistics) (USD(AT&L)) and the director, operational test and evaluation, (DOT&E): "We have stressed that we must make better use of modeling and simulation (M&S) to improve the acquisition process, reduce costs, enhance T&E [test and evaluation], and shorten development times for our new systems. We are convinced that efficient use of M&S throughout the system life cycle will net great dividends in efficiencies."

Few people would argue that M&S is not an important element in the acquisition process. The question is this: Has there been progress within DoD to efficiently organize, fund, develop, promulgate, and maintain configuration control of the DoD's massive and diverse M&S activities to yield the efficiencies so clearly stated in the letter quoted above? Estimates for how much is spent annually on M&S in the DoD range from $5 billion to $30 billion, depending on how one defines M&S. Some of this is spent on M&S in support of training. The majority of the funds, however, are spent in support of the r development, test, and evaluation of new def quisition programs.

In an article in the July 2005 issue of *National Magazine*, David W. Duma, the Pentagon's acti tor, operational test and evaluation, wrote that fense Department needs to better manage its si programs. I think we've kind of lost our way partment with modeling and simulation. Multip cies are buying duplicate technologies, rather th dinating efforts. We are using more model simulation. But it's not focused, it's scattered. Ev is building their own."

Not a New Problem

I couldn't agree more. So why *does* the DoD co lose its way using more M&S but in a "scattered

O'Bryon *served as deputy director, operational test and evaluation in the Office of the Secretary of Defense until November 2001. He current as a consultant to ORSA Corporation, Aberdeen, Md.*

A Proposal That Might Work:

Program Manager Magazine

MODELING AND SIMULATION

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

Energizing the M&S Support Structure

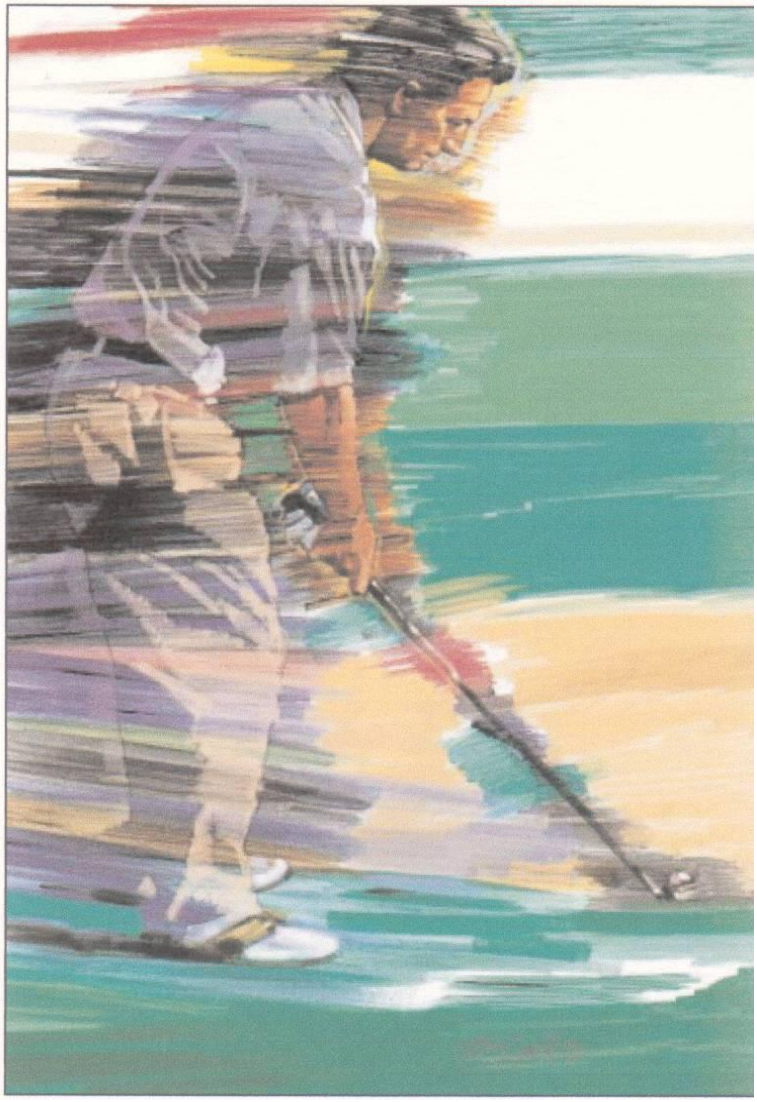
JAMES F. O'BRYON

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.

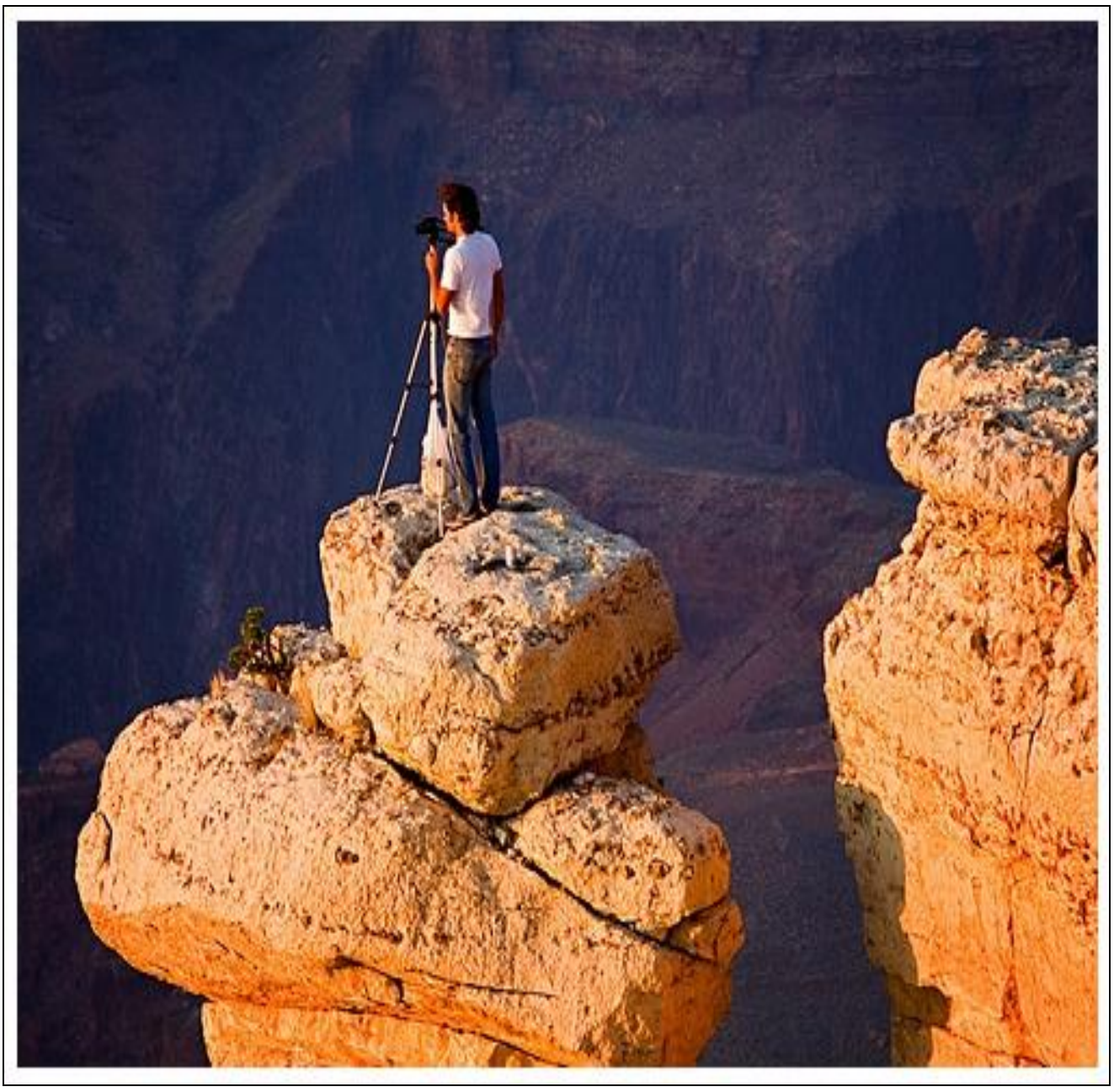
At Least Three Software Institutes Have Been Set Up

1. Insensitive Munitions, at APG, MD, Brad Forch in Charge

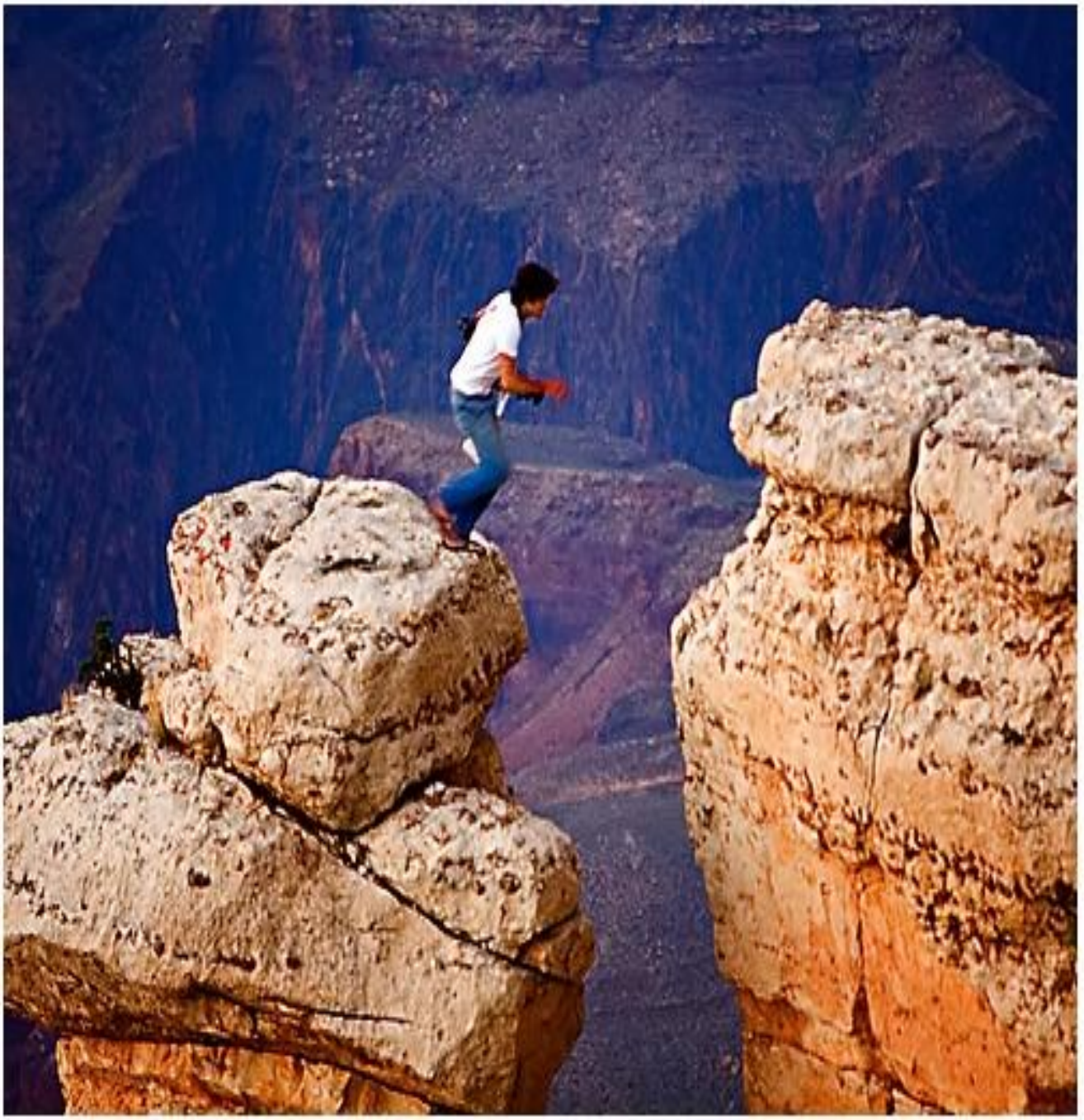
2. Blast Protection and Mitigation, at APG, Scott Kuck in Charge

3. Battlefield Network M&S

M&S: It's a Serious Leap of Faith To Jump Extrapolate from Empirically Derived Models

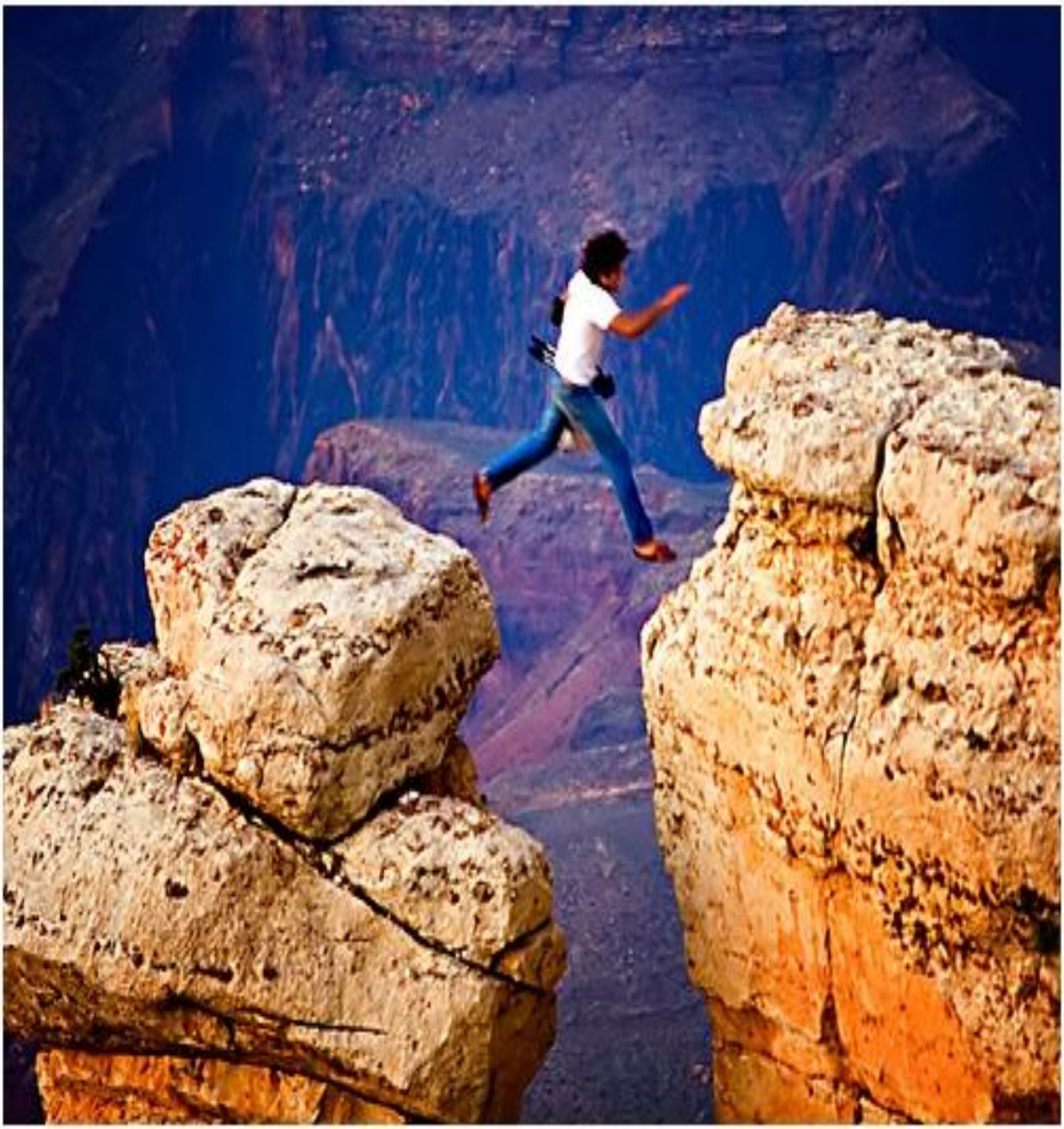


But Some People Think It's Worth a Try

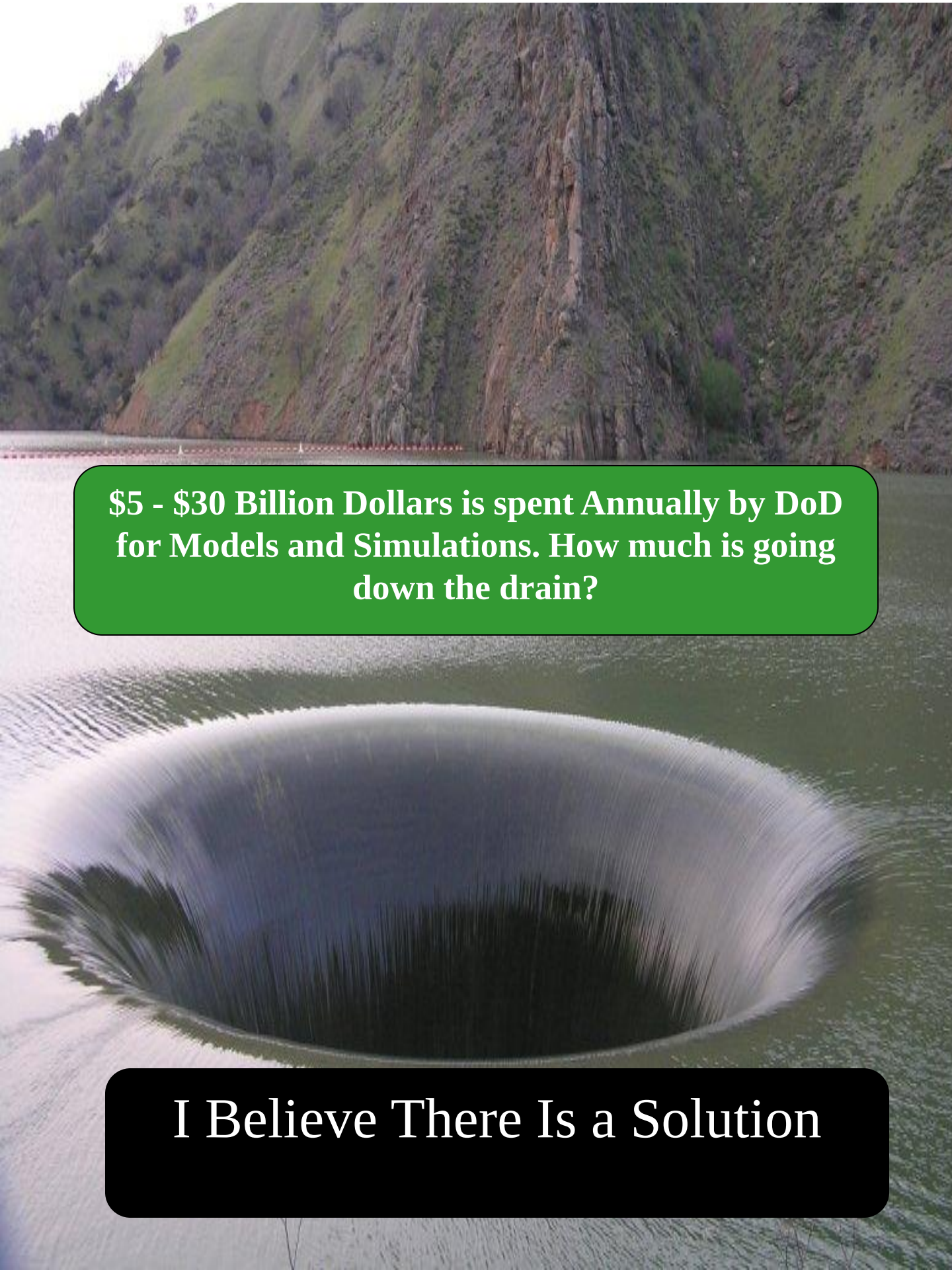


They Take the Risk

and Leap



And Sometimes They Take Their Lives and the Lives of Others into Their Own Hands !!



$5 - $30 Billion Dollars is spent Annually by DoD for Models and Simulations. How much is going down the drain?

I Believe There Is a Solution