

# ***Weapons Effects Strategic Collaboration (WESC) Nuclear Weapons Effects Accreditation Process***

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# Weapons Effects Strategic Collaboration (WESC)

- Established 19 September 2006
- Principal members are UK MOD, DTRA, NNSA, USSTRATCOM



# Terms of Reference

- **M&S Accreditation is:**

- “The official certification that a model, simulation, or federation of federation of models and simulations and its associated data are **acceptable for use for a specific purpose.**” *DMSO Recommended Recommended Practices Guide*, <http://vva.dmsso.mil/> , May 2000.

- **M&S Accreditation is not Security Accreditation**

- Which is approval of information systems to be able to operate operate with security features and other safeguards to meet a a set of specified security requirements with an acceptable level level of risk. DoD 5200.40. *DITSCAP*. December 1997



# Historical Framework for Nuclear Accreditation

- Few formal requirements for V&V, each model had its own approach to quantifying accuracy which varied over first principal, engineering, and fast running or engagement engagement models.
- While codes met the requirements of the sponsors, M&S V&V limits not clarified over over spatial and spectral regions
- Accuracy was based on trust of the scientists scientists using first principal modeling and not formally documented



# Historical Framework (2)

- Validation based on **limited field tests and first principal modeling** which yields an incomplete picture.
  - Only 11 US and 3 USSR high altitude tests that sadly were relatively poorly instrumented.
  - Underground tests were not necessarily weaponized
  - Tests on hardware in the tunnels are not the same as free field
  - Effects were isolated in simulations and tests.
  - Above ground tests were effects tests and not scientifically instrumented

ORANGE  
3.8 MT at 43 km

TEAK  
3.8 MT at 76.8 km

KINGFISH  
\_\_ kT at \_\_ km

CHECKMATE  
\_\_ kT at \_\_ km

STARFISH  
1.4 MT at 400 km





# Current State VV&A

Two models are being accredited as a “pipe  
“pipe cleaner” in the new joint (USA/UK)  
(USA/UK) approach

- DTRA’s G-VN Module (ver 1.0) for DIA use
- UK MOD’s PYREX fire module
- Target date for completion Oct 07



# Accreditation Requires Acceptability

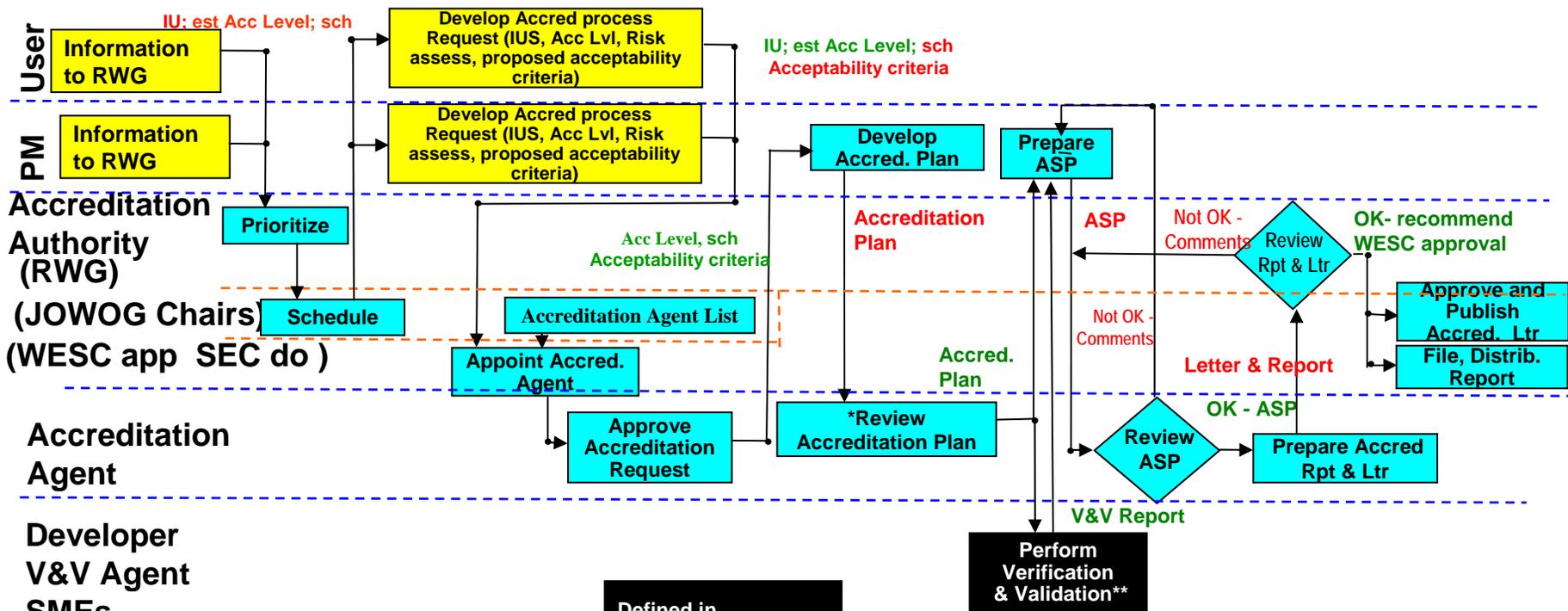
- Three types of acceptability criteria are addressed in the development of an appropriate V&V plan
  - **Functional:** system features or natural phenomena that the model must represent or simulate
  - **Fidelity:** required degree of correlation between model outputs and specified benchmark (real-world data, test results, or fidelity codes)
  - **Operational:** hardware or software compatibility or performance requirements, assistance or training requirements



# Accreditation Process Needs Levels

- Risk-based accreditation:
  - Risk assessment considers the potential for unintended unintended harm to personnel or property as well as the the potential impact (cost, schedule) to acquisition programs that will use the M&S
- Three accreditation levels based on risk assessment:
  - Level I: Highest tolerance for risk
  - Level II: Nominal tolerance for risk
  - Level III: Little/no tolerance for risk
- Process allows and encourages tailoring

# WESC VV&A Process Flow (for a given M&S)



Red: Draft  
Green: Final

If "Push" - Performed by PM  
If "Pull" - Performed by User

Defined in Organization-Specific V&V Procedures Document

\* The PM prepares the Accreditation Plan on behalf of and in coordination with the Accreditation Agent. The Accreditation Agent reviews, modifies as necessary, and approves the plan for performing VV&A for the subject M&S.

\*\* V&V is ideally performed in parallel with the development process for new M&S



# Backup Slides



# Agency Responsibilities

- Accreditation Authority. The organization that approves the use of an M&S for a particular application. This is the role of the NWE UG principals or designees, if authorized.
- Accreditation Agent. Individual or panel appointed by the NWE UG to perform an accreditation assessment (coordinate acceptability criteria, review Accreditation Support Package, etc.)
- M&S User. The end user of the M&S (e.g., USSTRATCOM, UK, DOE DOE lab, DTRA).
- M&S Program Manager. The organization with primary responsibility to manage the development and life cycle of the M&S.
- M&S Developer. The organization (often a contractor) who develops and maintains the software.
- V&V Agent. The organization that is designated to perform (or manage, in some cases) the V&V of the M&S.



# Accreditation Support

Accreditation Support Package Requirement	Level Req'd <sup>1</sup>	Typical location of information
Purpose System/process modeled Concept of operations	1 2 3	Accreditation Plan Accreditation Plan
Background References Definitions Constraints	1 2 3	All (as applicable) All (as applicable) Accreditation Plan
M&S Intended Use Intended Use Statement Objectives M&S Requirements M&S Domain M&S Exclusions	1 2 3	Accreditation Plan Accreditation Plan Accreditation Plan Accreditation Plan Accreditation Plan
M&S Description M&S Usage and VV&A History M&S Development History Conceptual Model Description M&S Variables M&S Inputs/Outputs CM Description User Support Functions	1 2 3 1 2 3 2 3 2 3 1 2 3 1 2 3 1 2 3	Accreditation Plan Accreditation Plan Accreditation Plan Accreditation Plan Accreditation Plan Accreditation Plan V&V Report

[1] These are “nominal” activities for each accreditation level. With proper rationale and approval of the accreditation agent, these activities may be tailored as necessary.



# Accreditation Support Requirements – cont.

Accreditation Support Package Requirement	Level Req'd <sup>1</sup>	Typical location of information
M&S Risk Assessment and Accred Level	1 2 3	Accreditation Plan
Acceptability Criteria	1 2 3	Accreditation Plan
Configuration Management Assessment	1 2 3	V&V Report
Documentation Assessment	1 2 3	V&V Report
Usage and VV&A History Assessment	1 2 3	V&V Report
Software Quality Assessment	1 2 3	V&V Report
Security Requirements Assessment	1 2 3	V&V Report
Sensitivity Analysis	2 3	V&V Report
Uncertainty Analysis and Assessment	2 3	V&V Report
Data Verification and Validation	2 3	V&V Report
SME Assessment (Limited scope V&V)	2 3	V&V Report
Detailed Verification	3	V&V Report
Detailed Validation	3	V&V Report
Assumptions, Limitations, Known Errors and Implications for Use	1 2 3	Accred Plan (initial) V&V Report (Final)

[1] These are “nominal” activities for each accreditation level. With proper rationale and approval of the accreditation agent, these activities may be tailored as necessary.



# Accreditation Levels

## Based on Intended Use. Excerpt from NWE UG Accreditation Procedures:

- **Accreditation Level I:** Applies when the user has a **high tolerance for risks** associated with the use of use of the M&S (**lowest required credibility**). This accreditation level requires the least evaluation, with evaluation, with minimal requirements for conducting V&V. No direct or indirect potential to cause cause unintended harm to people or property and whose failure will not negatively impact the cost, cost, schedule or performance of a system that may use the M&S. Examples of Accreditation Level I Level I M&S are those used in gaming or training.
- **Accreditation Level II:** Applies to M&S for which the user has **some tolerance for risk**, particularly particularly when the risks of using the M&S are sufficiently mitigated or consequences are not catastrophic. This accreditation level requires V&V documentation based primarily on a review by by Subject Matter Experts (SMEs) in areas relevant to the model's use in a specific application. This This level should be used for M&S that require positive measures (safeguards) to prevent software software failure from causing significant unintended harm to people or property, including hardware hardware and software. Also applicable to M&S that require measures to prevent significant negative negative impact to cost, schedule or performance of systems that will use the M&S. Examples of of Accreditation Level II M&S are those used in the design or test of operational hardware or software software used by a defensive weapon system.
- **Accreditation Level III:** Applies when the user has **little or no tolerance for risks** associated with the the use of the M&S (**highest required credibility**). This accreditation level requires documentation of of classical V&V activities. This level should be used for M&S that, with a single credible failure, could could cause catastrophic unintended harm to people or property, or a substantial impact to cost, schedule, or performance of systems that will use the M&S. Examples of Accreditation Level III M&S M&S are those used in conjunction with field operations of nuclear weaponry or M&S whose failure failure may result in loss of a satellite system.