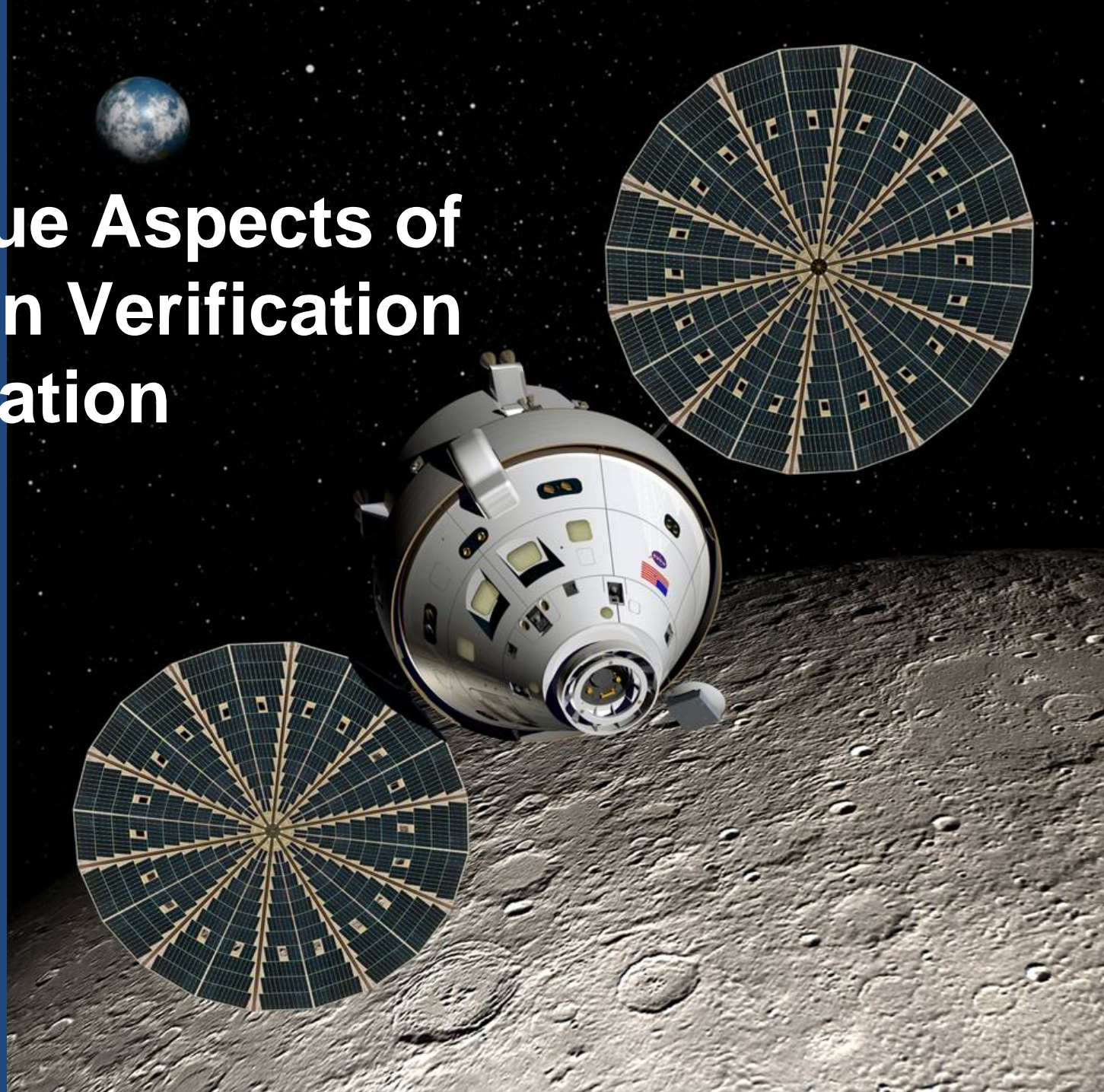




# The Unique Aspects of Simulation Verification and Validation

Alexia Joiner  
Wei Lin  
Michael Lowry  
Tom Pressburger  
Danny Thomas

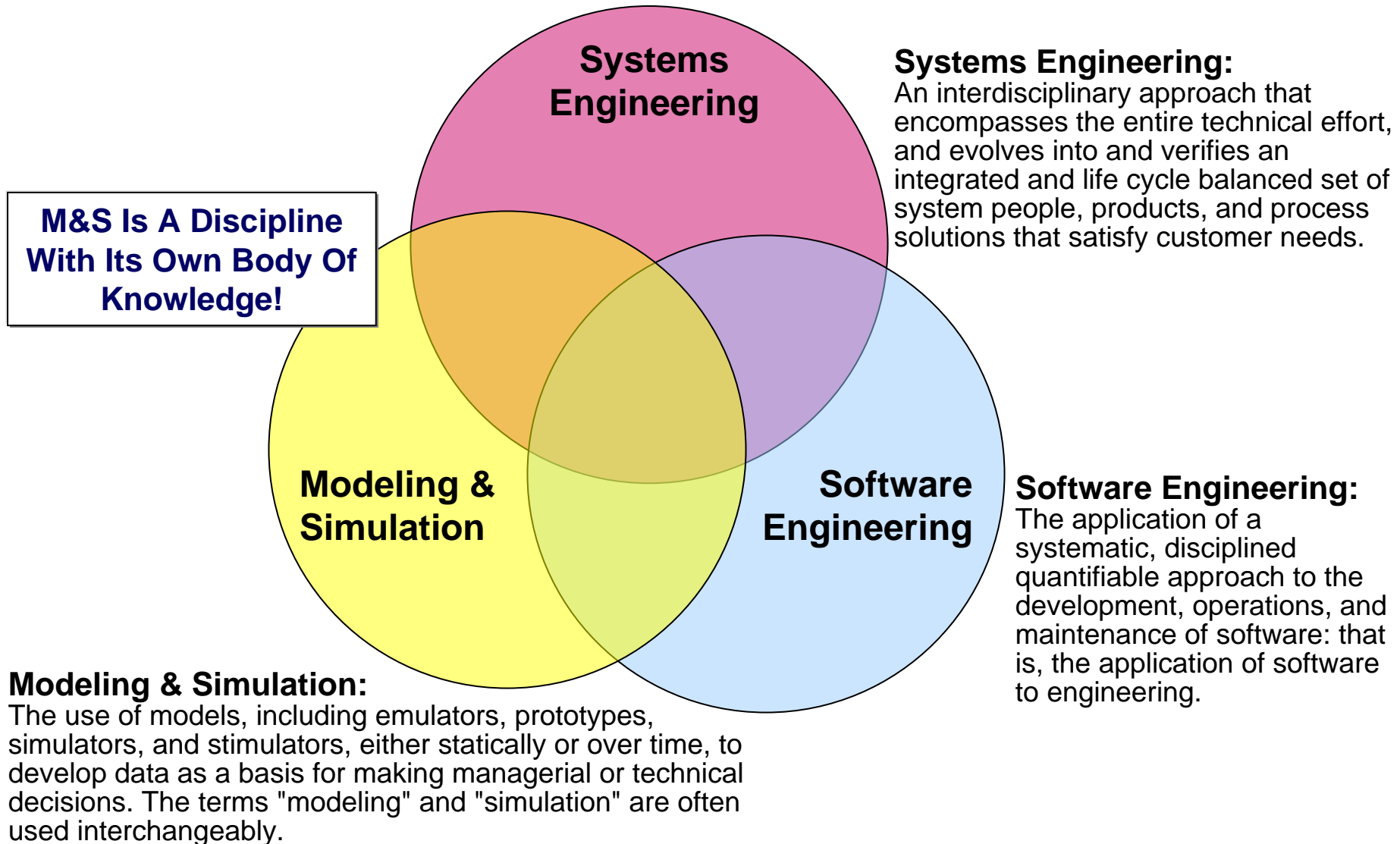
March 6, 2010





# Domain Relationships

Orion Project

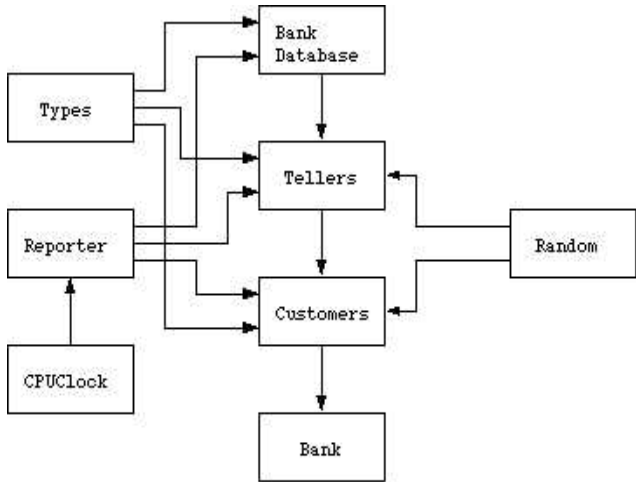






# Important Distinctions

## Banking Simulation

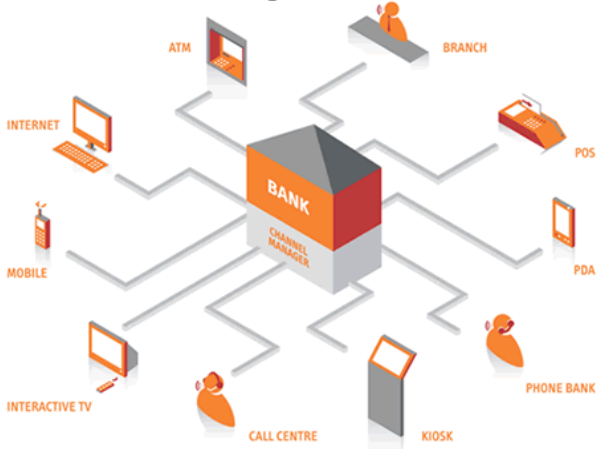


*The simulation approximates the operation of the bank. How well?*

## Bank

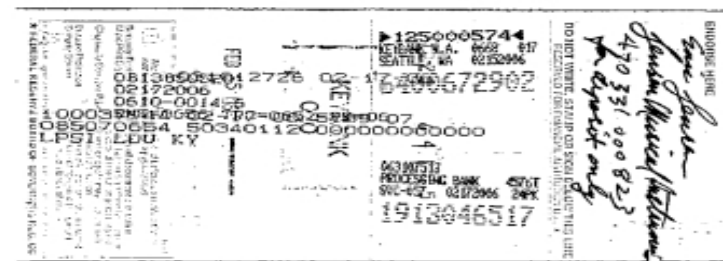
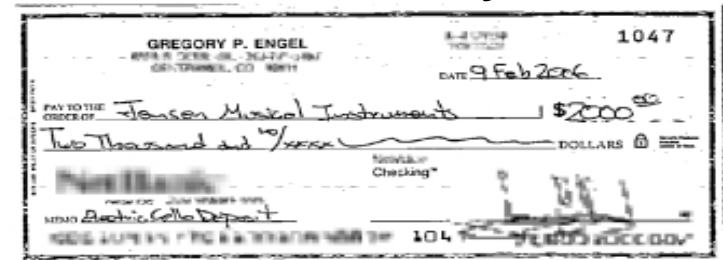


## Banking Software



*The banking software tracks your money. How accurately?*

## Your Money





# M&S VV&A Defined

Orion Project



"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.



"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.



"It suits my needs."

Requester/User  
Accreditation Agent

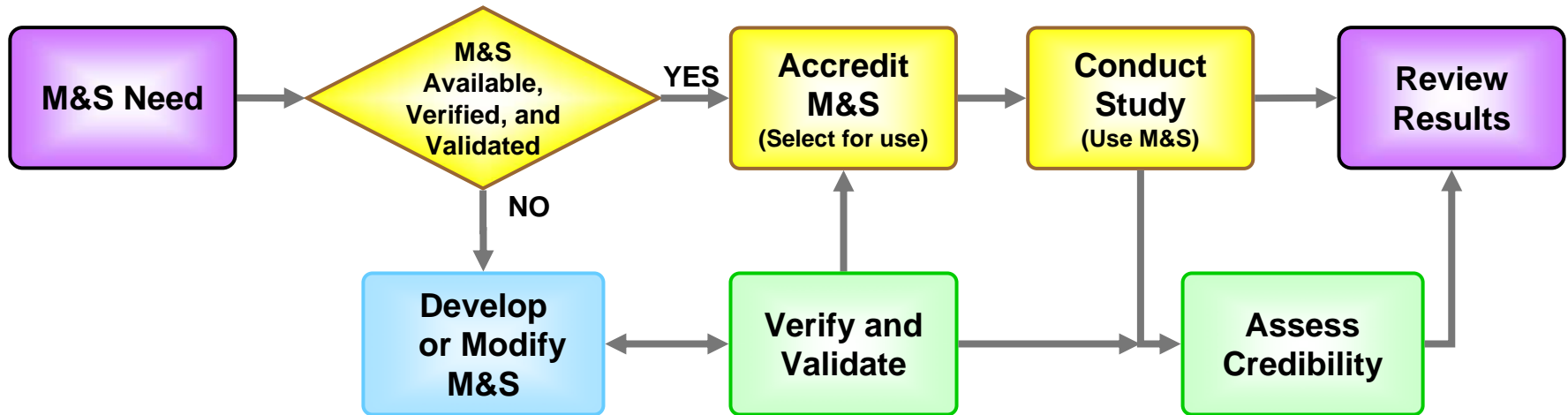
## ACCREDITATION

The official acceptance of a model or simulation or federation of models and simulations and its associated data to use for a specific purpose.

**Verification, Validation, and Accreditation (VV&A):  
A process for substantiating the credibility of models and simulations.**



# VV&A and Credibility Assessment



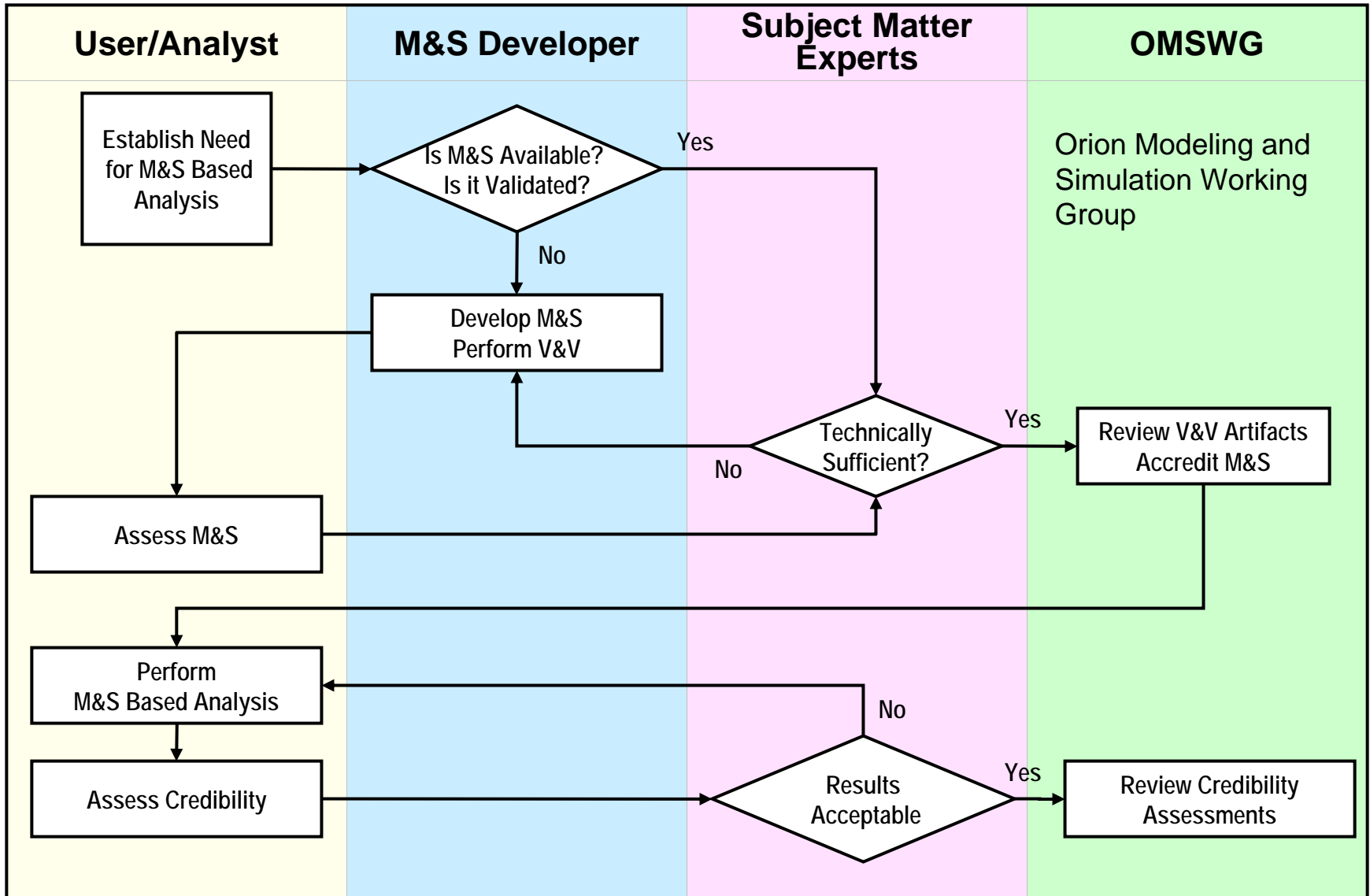
-  Decision Maker
-  M&S Developer
-  M&S User
-  VV&A Team

- *Verification and Validation starts **with** development*
- *Accreditation occurs **before** use*
- *Assessing credibility occurs **after** use*



# Orion VV&A Process

Orion Project





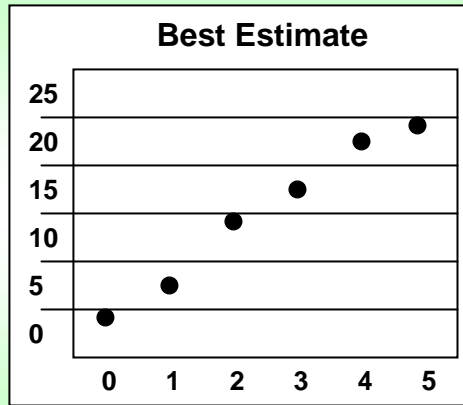
# Four Things Must Be Reported

## Best Estimate

Uncertainty Statement

Credibility Assessment Scale

Any Caveats

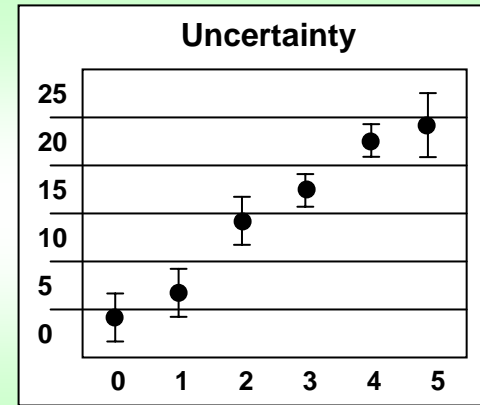


## Best Estimate

Uncertainty Statement

Credibility Assessment Scale

Any Caveats

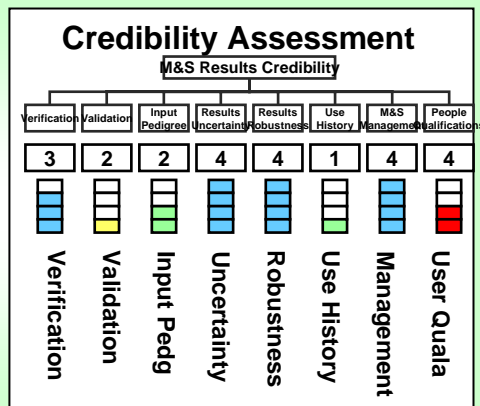


## Best Estimate

Uncertainty Statement

Credibility Assessment Scale

Any Caveats



## Best Estimate

Uncertainty Statement

Credibility Assessment Scale

Any Caveats

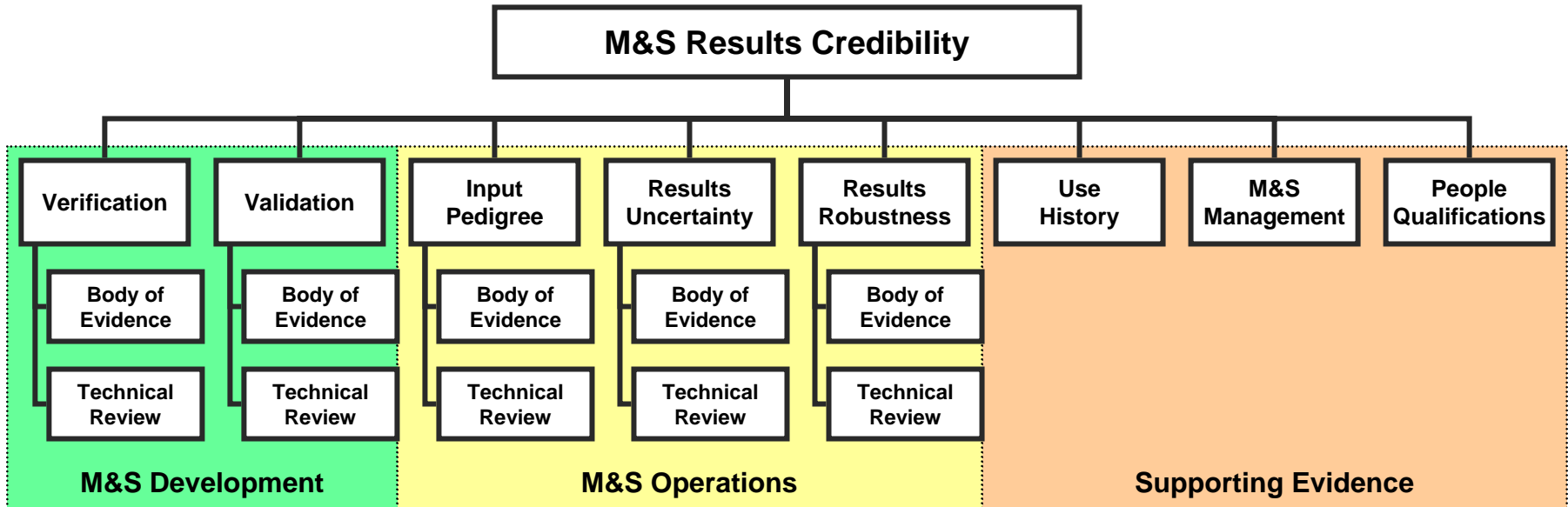
**CAUTION**

Validated for low earth orbit only



# The Credibility Assessment Scale

Orion Project







# VV&A Team for Orion

Orion Project

Orion M&S VV&A work is performed for NASA on the Constellation Technical Support Contract (CTSC).

The team includes:

Mike McFarlane/NASA JSC/ER (Orion M&S Lead)

Mike Lowry/NASA ARC

Wei Lin/NASA ARC

Tony Garza/Booz Allen Hamilton

Manette Delgado/Booz Allen Hamilton

Danny Thomas/AEgis Technologies Group

Alexia Joiner/AEgis Technologies Group

