ASSESS

ANALYSIS, SIMULATION & SYSTEMS ENGINEERING SOFTWARE STRATEGIES

ASSESS Update: Addressing the Changing Role of Simulation

Joe Walsh, intrinSIM

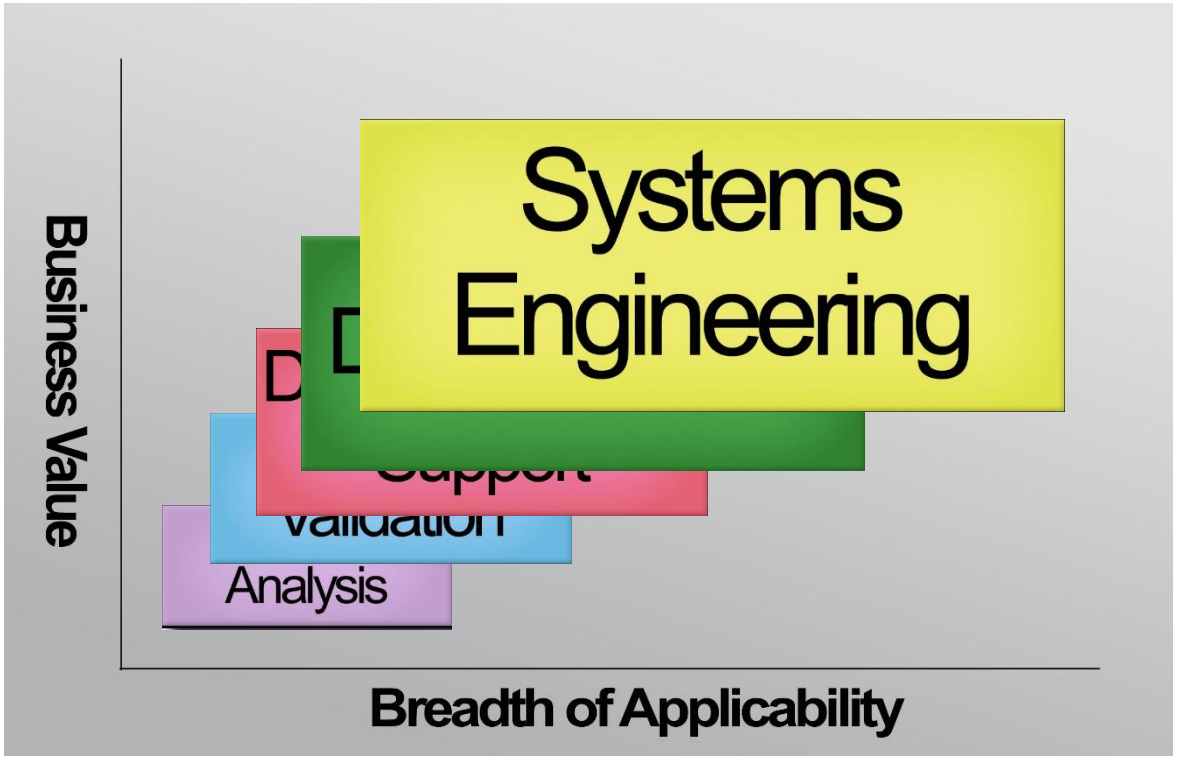
Brad Holtz, Cyon Research

The Changing Role of Simulation

- The use of Simulation has seen 10-15 % growth annually for about 30 years until 2008
- This cumulative growth now means that Simulation is a significant portion of the Engineering Software Market and a driver for future growth
- This has resulted in increased focus and investment in simulation by major PLM software vendors
- This growth is coupled with increasing awareness by end user companies that **Simulation is** the key enabler to **Increased Competitiveness**
- The changing role of simulation is more about it's role in business than the changes in technology

Technical Drivers for Simulation

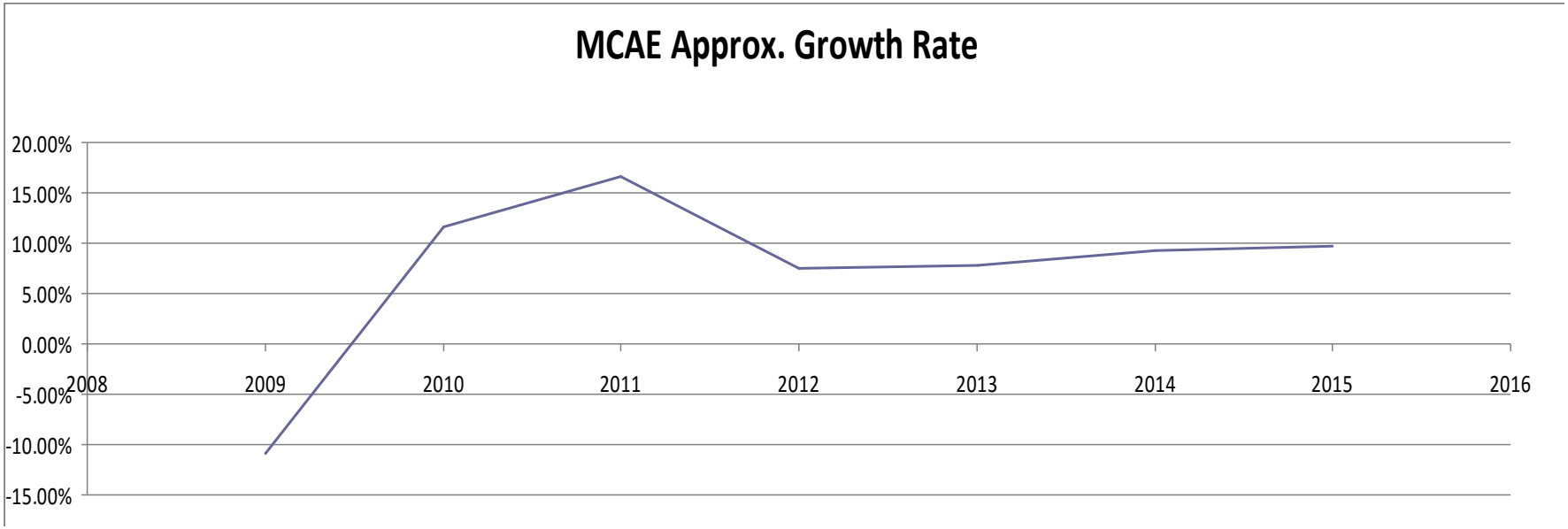
- Failure Analysis
- Design Validation
- Design Decision Support
- Design Drivers
- Systems Engineering



ASSESS ANALYSIS, SIMULATION & SYSTEMS ENGINEERING SOFTWARE STRATEGIES

Technical Drivers for Simulation

- intrinSIM looked at actual & projected MCAE Market growth since 2009 (Courtesy of Cambashi data observatories)



ASSESS ANALYSIS, SIMULATION & SYSTEMS ENGINEERING SOFTWARE STRATEGIES

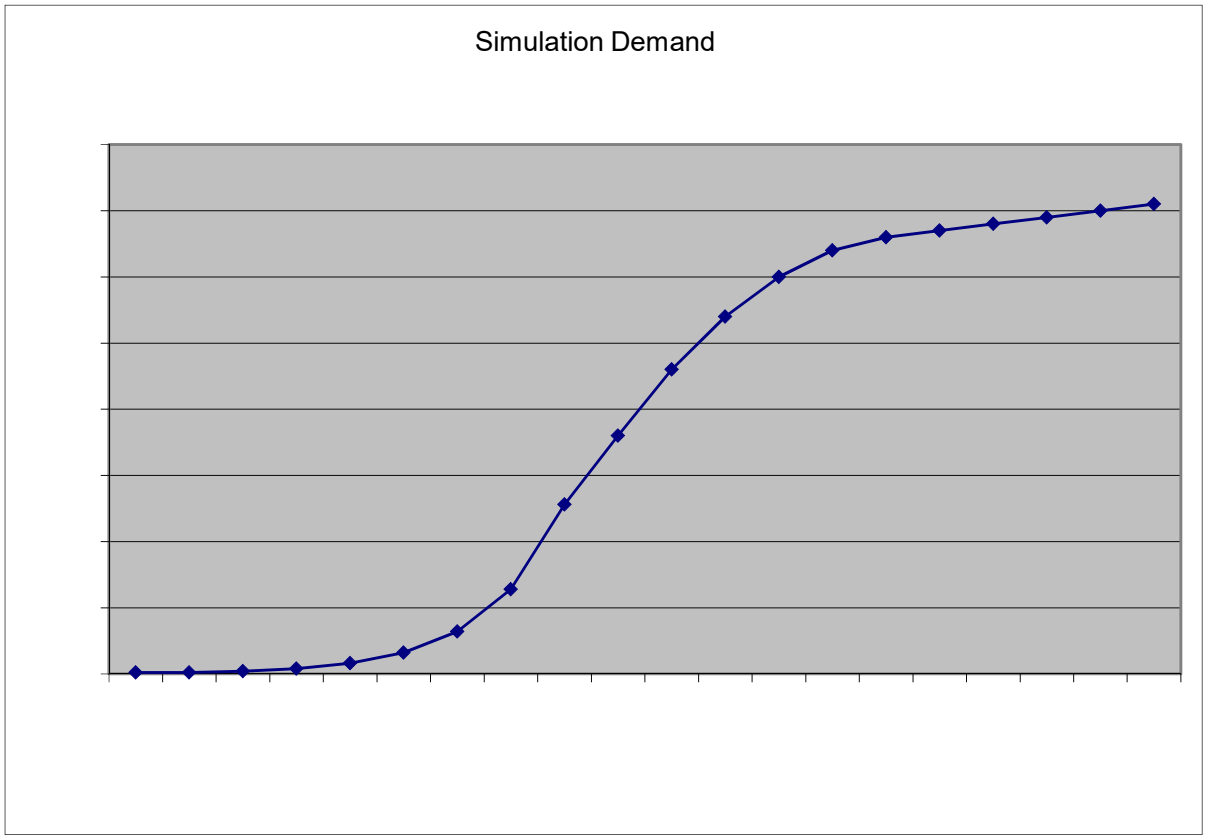
Business Drivers ➔ Business Value

The Changing Role of Simulation is really about business benefits

- **Innovation is a major key to Competitiveness**
  - Simulation is a major key to innovation
- **Risk management is a major key to Competitiveness**
  - Simulation is a major key to understanding and managing risk
- **Reducing cost is a major key to Competitiveness**
  - Simulation is a major key to reducing material, prototyping & product development cost

Business Value ➔ Broader Demand

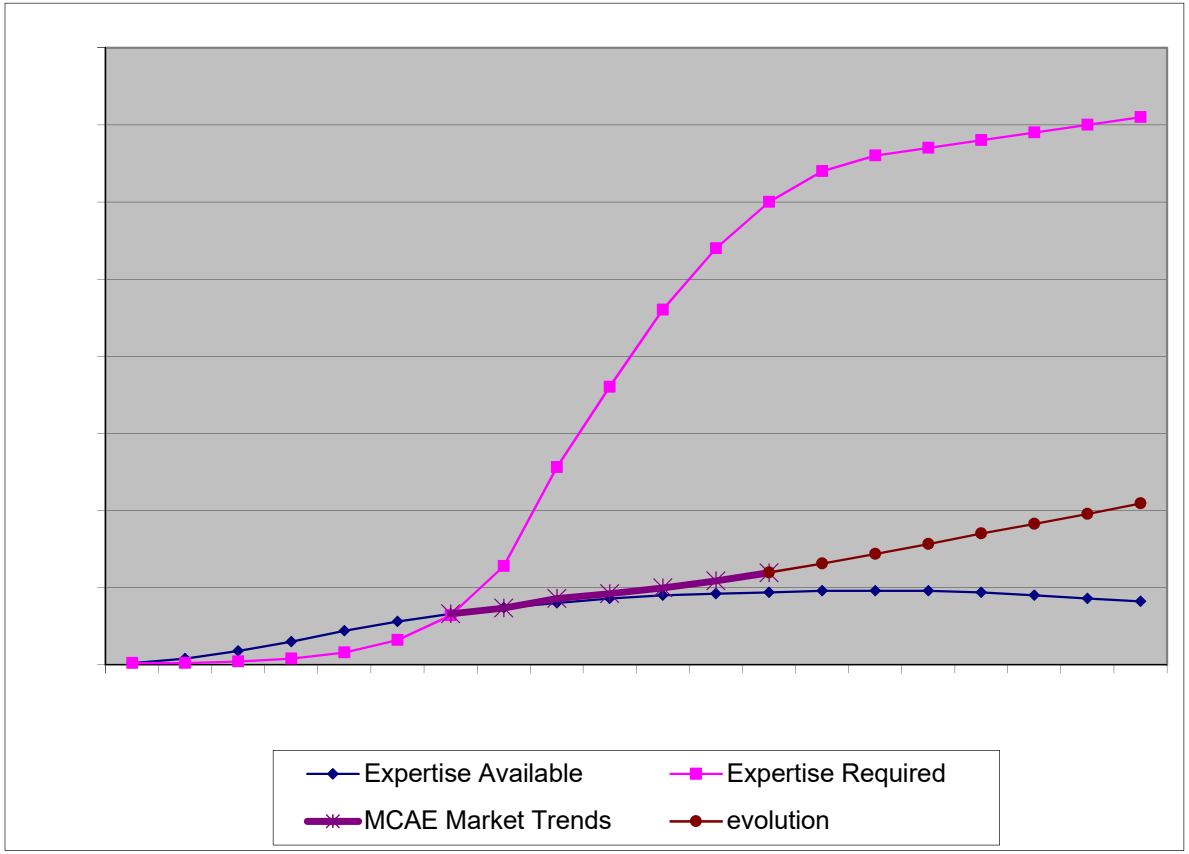
- Demand should be increasing on a classic S curve
- Is simulation at an inflection point to break through ?



ASSESS ANALYSIS, SIMULATION & SYSTEMS ENGINEERING SOFTWARE STRATEGIES

Business Value ➔ Broader Demand

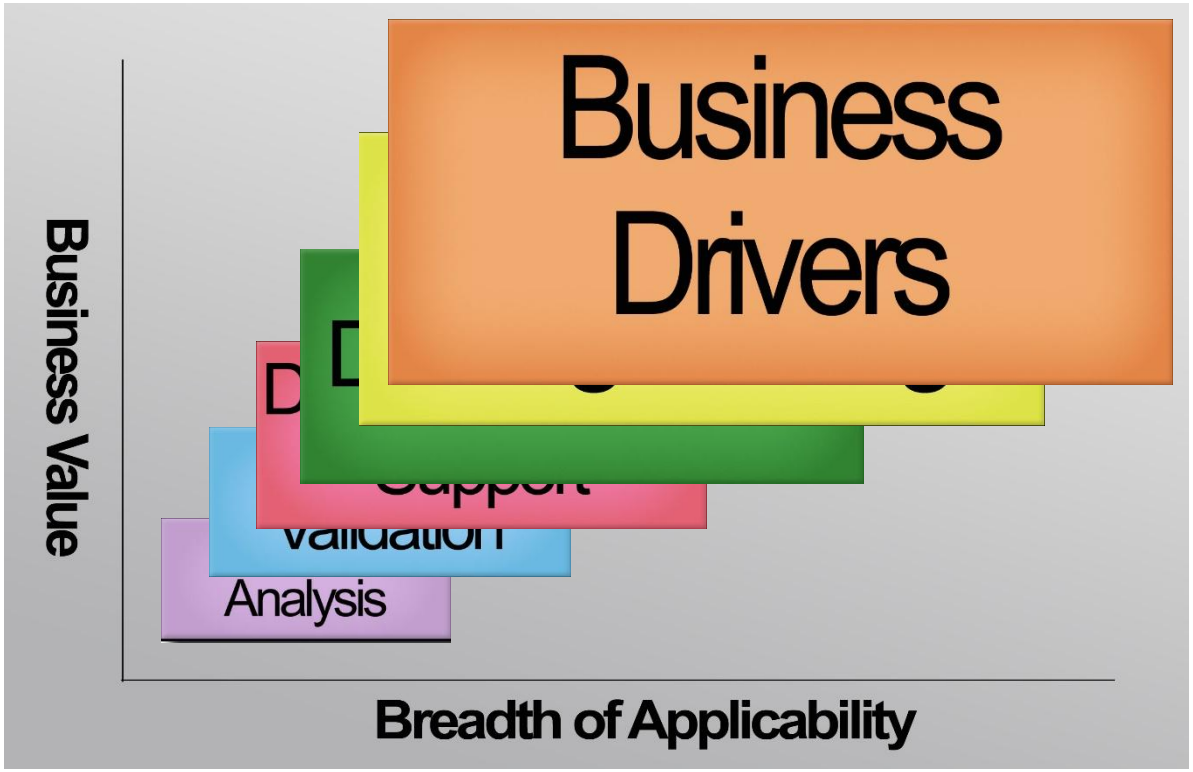
- Simulation is still done primarily by specialized Analysts
- Growth of MCAE market is tempered due to lack of expertise available



ASSESS ANALYSIS, SIMULATION & SYSTEMS ENGINEERING SOFTWARE STRATEGIES

Business Drivers for Simulation

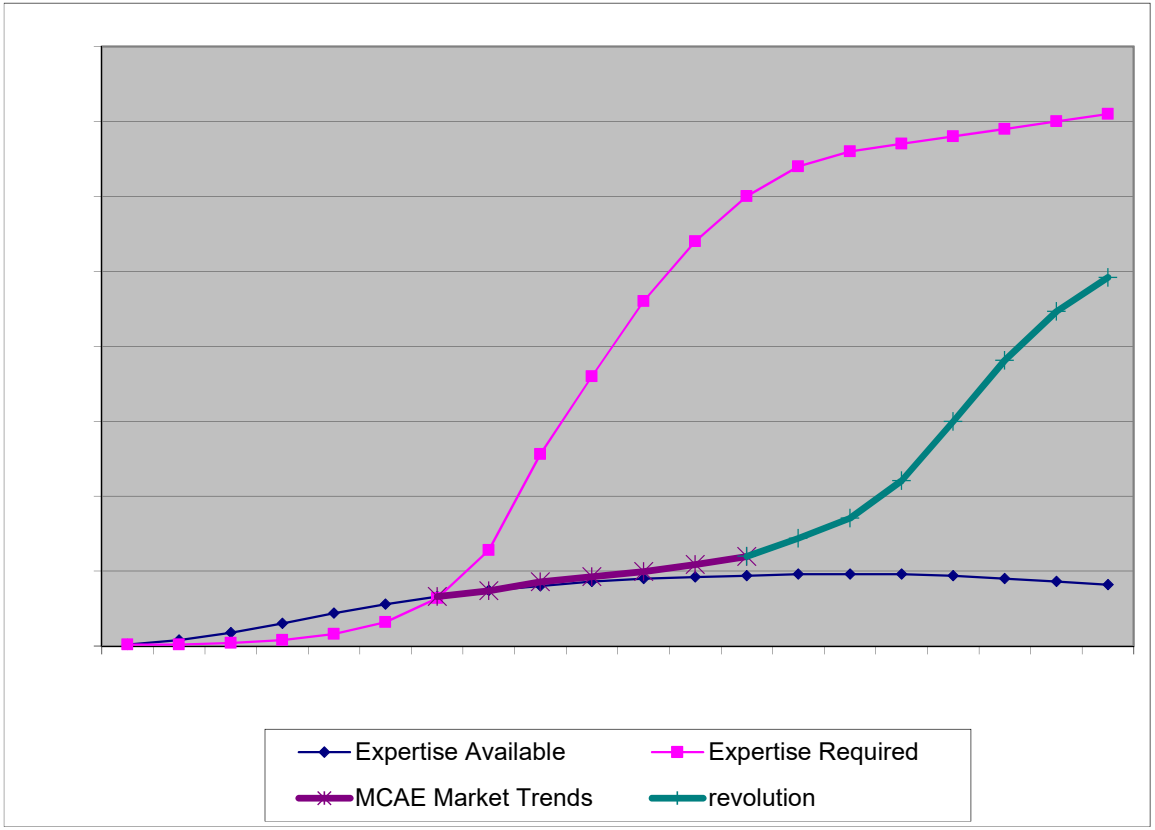
- Business Drivers are going to force a "**revolution**" to overcome the expertise based limitation
- Simulation will be forced to find a way



ASSESS ANALYSIS, SIMULATION & SYSTEMS ENGINEERING SOFTWARE STRATEGIES

Business Drivers for Simulation

- The demand is not going away
- A **Simulation Revolution** will occur:
  - "Fit for purpose"
  - "Smart"
  - "Integrated"
  - "Transparent"



ASSESS ANALYSIS, SIMULATION & SYSTEMS ENGINEERING SOFTWARE STRATEGIES

Summary of ASSESS Drivers

1. **Growing demand on "How to be more competitive"**
2. **Exponentially growing complexity of products & processes**
3. **Available computing power is rapidly removing the computing bottlenecks**
4. **New world of 3D printed objects and light weighting**
5. **Entirely new applications are creating a rapidly growing demand for simulation to enable breakthroughs**
6. **Simulation is used almost exclusively by a limited number of expert analysts**
7. **Simulation efforts have three key but disjointed vectors – Commercial / Government / Research**

ASSESS ANALYSIS, SIMULATION & SYSTEMS ENGINEERING SOFTWARE STRATEGIES

ASSESS Initiative

- The ASSESS Initiative was formed by intrinSIM and Cyon Research to bring together key players to guide and influence strategies for software tools for model-based analysis, simulation, and systems engineering.

ASSESS ANALYSIS, SIMULATION & SYSTEMS ENGINEERING SOFTWARE STRATEGIES

ASSESS Initiative

ASSESS
ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

- ASSESS is a broad reaching multi-industry initiative which will interact and collaborate with multiple activities and organizations across the complete spectrum of model-based analysis, simulation and systems engineering including: NAFEMS, INCOSE, DMSCO, IEEE, CIMdata, Revolution in Simulation, and others.

NAFEMS

DEPARTMENT OF DEFENSE M&SCO

INCOSE
International Council on Systems Engineering

IEEE SMC
Systems, Man, and Cybernetics Society

CIMdata

ASSESS
ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

ASSESS Initiative

ASSESS
ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

- The ASSESS Vision

  "To significantly expand the use and benefit of software tools for model-based analysis, simulation, and systems engineering in the engineering applications domain."

ASSESS
ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

ASSESS Previous Activities

NAFEMS Americas 2014

(May 2014– Colorado Springs, CO)

- Invited presentation on "Changing Role of Simulation" spurred creation of ASSESS Initiative

ASSESS Summit

(January 2015 – Sante Fe, NM)

- 40 attendees
- 5 Working Groups

COFES 2015

(April 2015 – Scottsdale, AZ)

- ASSESS Update Session
- ASSESS Roundtable

NAFEMS World Congress 2015

(June 2015– San Diego, CA)

- Invited presentation on "Changing Role of Simulation"

ASSESS 2016 Congress

(January 2016 – Potomac, MD)

- 85 attendees
- 7 Working Groups

ConnectPress Webinar

- Changing Role of Simulation

NAFEMS 20-20 Webinars

- CAE Democratization track – completed
- Simulation Governance track – completed

COFES 2016

(April 2016 – Scottsdale, AZ)

- ASSESS Update Session
- ASSESS Initiative advisory committee meeting

ASSESS ANALYSIS, SIMULATION & SYSTEMS ENGINEERING SOFTWARE STRATEGIES

ASSESS SUMMIT

- 1 Keynote Presentations
  - Richard Riff -- Consultant
- 5 Working Groups
- 8 key issues were highlighted
  - Design Centered Workflow
  - Ease of Use & Usability
  - Pre-CAD Analysis & Optimization
  - Impact of Web/Cloud/Mobile
  - Knowledge Capture & Reuse
  - Ability to Combine Heterogeneous Models in a Systems Approach
  - Appropriate Model Fidelity and role of Unsexy Stuff
  - Licensing Models Need to be Revisited

ASSESS ANALYSIS, SIMULATION & SYSTEMS ENGINEERING SOFTWARE STRATEGIES

ASSESS 2016 Congress

ASSESS2016
ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

- 4 Keynote Presentations
  - Jesse Citizen -- DMSCO
    - The Defense M&S Enterprise
  - Roger Burkhart – John Deere
    - Challenges of Collaboration through Shared Models
  - Zack Eckblad -- Intel
    - Democratization of Structural Analysis Using Meta-Code and Webapps
  - Rod Dreisbach – formerly with Boeing
    - Evolution, Revolution, & the Next New Generation of Engineering Simulation
      - Strong call to action for a **Unified Vision for next generation simulation**

ASSESS ANALYSIS, SIMULATION & SYSTEMS ENGINEERING SOFTWARE STRATEGIES

ASSESS 2016 Congress

- Seven(7) Working Groups each with a particular ASSESS related theme
  - 3 hours discussion and a Summary Presentation
    - Vision
    - Goals
    - Objectives
    - Issues
    - Priorities
    - Recommended Next Steps

ASSESS ANALYSIS, SIMULATION & SYSTEMS ENGINEERING SOFTWARE STRATEGIES

ASSESS 2016 Working Groups

1. Democratizing STASES
   (**S**oftware **T**echnologies for **A**nalysis, **S**ystems **E**ngineering, and **S**imulation)
   led by-- Monica Schnitger (Schnitger Corp.) / Karlheinz Peters (intrinSIM)
2. STASES Confidence
   led by-- Keith Meintjes (CIMdata)
3. Business Challenges
   led by– Marc Halpern (Gartner)
4. The Intersection of Systems Modeling and Classical Simulation
   led by– Don Tolle (CIMdata)
5. Aligning Commercial, Government & Research Interests and Efforts
   led by– Dennis Nagy (BeyondCAE)
6. Potential Game Changers
   led by– Andreas Vlahinos (AES)
7. Looking Forward
   led by– Jack Ring (Educe) / Bruce Jenkins (Ora Research)

ASSESS ANALYSIS, SIMULATION & SYSTEMS ENGINEERING SOFTWARE STRATEGIES

COFES2016

ASSESS2016
ANALYSIS, SIMULATION
& SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

Democratizing STASES

ASSESS ANALYSIS, SIMULATION
& SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

Democratizing STASES

ASSESS2016
ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

- Mission
  - Make it possible for people who could benefit from using STASES to be able to use STASES.
  - Get STASES into the hands of current non-users.
  - Address STASES' ease of use issues.
  - **Grow STASES use by 10x in 5 years**

ASSESS ANALYSIS, SIMULATION & SYSTEMS ENGINEERING SOFTWARE STRATEGIES

Democratizing STASES

ASSESS2016
ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

- Next Steps
  - Communicate STASES success stories.
    - Technical successes
    - Business successes
  - Promote the appification of STASES.
  - Consider any other idea to improve STASES ease of use.
  - Investigate real Cost issues
    - Licensing is only a small part
  - Establish ASSESS Advisory Committee Working Group

ASSESS ANALYSIS, SIMULATION & SYSTEMS ENGINEERING SOFTWARE STRATEGIES

COFES2016

ASSESS2016
ANALYSIS, SIMULATION
& SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

STASES Confidence

ASSESS ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

STASES Confidence

ASSESS2016
ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

- Scope
  - Appropriate Model Fidelity
  - Verification & Validation
  - Uncertainty Quantification
  - Risk Management
  - Deployment & Governance

  - **The UNSEXY STUFF → Simulation Governance**

ASSESS ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

STASES Confidence

ASSESS2016
ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

- Simulation Governance
  - Simulation Management as a corporate strategic asset
  - Command & control of all assets to achieve a goal
  - Goal = Business Need = Simulation Governance ROI
    - Reduce Cost
    - Reduce Time
    - Increase Quality
    - Increase Business Growth
    - Reduce Risk
    - Increase Innovation

ASSESS ANALYSIS, SIMULATION & SYSTEMS ENGINEERING SOFTWARE STRATEGIES

Democratizing STASES

ASSESS2016
ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

- Next Steps
  - Compose Industrial CxO Message
  - Establish Messengers
  - ASSESS & NAFEMS Collaboration
  - Publish Examples
  - Establish ASSESS Advisory Committee Working Group

COFES2016

ASSESS2016
ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

Business Challenges









ASSESS ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

Business Challenges

ASSESS2016
ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

- Key Factors
  - Licensing models
  - Business impact of web cloud/mobile
  - Value proposition of STASES
  - Communication with non-technical executives
  - Role of untapped SMEs

ASSESS ANALYSIS, SIMULATION & SYSTEMS ENGINEERING SOFTWARE STRATEGIES

Business Challenges

ASSESS2016
ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

- Recommendations
  - Licensing Models
    - Promote “pay as you go” and adopt services/vendors that provide “pay as you go” CAE/simulation access
  - Web cloud/mobile
    - Educate the IT organization and be patient
  - Value Proposition
    - More aggressive promotion through professional societies & other channels

ASSESS ANALYSIS, SIMULATION & SYSTEMS ENGINEERING SOFTWARE STRATEGIES

Business Challenges

- Recommendations
  - Communication with executives
    - Expose CAE/simulation value through media that executives prioritize
  - Role of SMEs
    - Further development and support of standards for data sharing (e.g. FMI)
    - Cultivate best practices and use of “certified” consultants
    - Guidelines and best practices for contextually rich apps
  - Establish ASSESS Advisory Committee Working Group

COFES2016

ASSESS2016
ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

The Intersection of Systems Modeling and Classical Simulation










ASSESS ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

Intersection of Systems Engineering & Classical

ASSESS2016
ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

- Mission/Goals/Objectives
  - Aspire to find a single, well-integrated approach
  - Ease of use
  - Good and widely accepted standards
  - VV&A, UQ (component-based)
  - Libraries of accredited components

ASSESS ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

Intersection of Systems Engineering & Classical

ASSESS2016
ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

- Major Issues
  - "**SILOS**".
    - Lack of a common understanding that makes it possible to understand different silos from a common point of view.
    - Insufficient standards for communicating required information between/among silo-specific tools and formalisms.
    - Existing standardization efforts (e.g. FMI) are good, but very far from complete.
  - Lack of funding / momentum

ASSESS ANALYSIS, SIMULATION & SYSTEMS ENGINEERING SOFTWARE STRATEGIES

Intersection of Systems Engineering & Classical

ASSESS2016
ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

- Recommendations
  - Develop & Evolve Standards
    - Evolve existing
    - Develop New standards for integrating domain-specific tools and techniques.
    - Develop candidate reference implementations to test and refine possible standards.
  - Develop & Evolve Best Practices
    - VV&A, UQ – best practices
  - Develop libraries of accredited component models
  - Establish ASSESS Advisory Committee Working Group

COFES2016

ASSESS2016
ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

Aligning Commercial, Government and Research




ASSESS ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

Aligning Commercial, Government, & Research

ASSESS2016
ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

- Issues
  - Government
    - Huge replication of effort in Commercial and Government
  - Research
    - No incentive to carry deliverables further
  - Commercial Vendors
    - Lack of resources and inclination to support Research
  - IP issues/models often block alignment

ASSESS
ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

Aligning Commercial, Government, & Research

ASSESS2016
ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

- Recommendations
  - Get all parties involved early along the chain
    - e.g. Pre-competitive consortia
  - Inventory current mechanisms for cooperation & study ongoing models
  - Establish ASSESS Advisory Committee Working Group

COFES2016

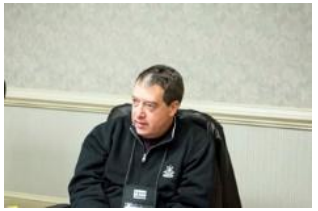
ASSESS2016
ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

Potential Game Changers







ASSESS ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

Potential Game Changers

ASSESS2016
ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

- Topology Optimization and ALM
- Elimination of CAD
- Design Process Automation that takes the human out of the loop
- Web / Cloud / Mobile
- Gaming Industry product development Model

ASSESS ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

Potential Game Changers

ASSESS2016
ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

- Digital Twins
- Model Base System Engineering
- Knowledge Capture and Reuse
- Computer Aided Innovation

COFES2016

ASSESS2016
ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

Looking Forward






ASSESS ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

Looking Forward

ASSESS2016
ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

- Vision
  - Evolve simulation tools to incorporate knowledge about themselves and their environment
  - Improve the economic and educational support infrastructure

ASSESS ANALYSIS, SIMULATION & SYSTEMS ENGINEERING SOFTWARE STRATEGIES

Looking Forward

ASSESS2016
ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

- Opportunities
  - Improve education
  - Improve economic model to fund R&D
  - Incorporate human knowledge
  - Enable systems to be higher-order
  - Evolve systems within ethical boundaries
  - Improve soundness and completeness of requirements
  - Automatically discover when rules are needed for emergent systems

Other ASSESS Related activities

NAFEMS Americas 2016 (June 16 – Seattle, WA)

- Keynote presentation for ASSESS Update
- CAE Democratization track
- Simulation Governance track
- Business Challenges track

• NAFEMS 20-20 Webinars

- CAE Democratization track - completed
- Simulation Governance track – completed
- Business Challenges track – starts June 28th

ASSESS 2017 (Preliminary target of Oct 18-20 – location TBD)

- Washington, DC
- Atlanta, GA
- Boulder, CO
- Ann Arbor, MI

ASSESS ANALYSIS, SIMULATION & SYSTEMS ENGINEERING SOFTWARE STRATEGIES

ASSESS Initiative

ASSESS
ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

- A few parting notes from Rod Dreisbach's Keynote presentation at ASSESS 2016 Congress on how each of us can help promote / enable the next generation in Simulation.

ASSESS
ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

ASSESS Initiative

ASSESS
ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

- Form alliances to develop harmonized visions for engineering simulation across industry, academia, government, professional organizations, and CAx vendors.
- **Need to implement "win-win" collaborative business scenarios for all.**

ASSESS
ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

ASSESS Initiative

ASSESS
ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

- Develop engineering simulation environments for … experiencing real-time multi-physical response simulations.
- **Realistic simulation of problems at the speed of human thought should be our vision!**

ASSESS
ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

ASSESS Initiative

ASSESS
ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

- Change our culture and enrich our pipeline of expertise in STEM domains.
- **Sexy simulation environments will define the destiny of the CAx industry!**

ASSESS
ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

ASSESS Initiative

ASSESS
ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

- ASSESS is a broad reaching multi-industry initiative …
  - …to significantly expand the use and benefit of software tools for model-based analysis, simulation, and systems engineering in the engineering applications domain.

ASSESS
ANALYSIS, SIMULATION & SYSTEMS ENGINEERING
SOFTWARE STRATEGIES

ASSESS

ANALYSIS, SIMULATION & SYSTEMS ENGINEERING SOFTWARE STRATEGIES

ASSESS Update: Addressing the Changing Role of Simulation

Joe Walsh, intrinSIM

Brad Holtz, Cyon Research