A Case Study: Using Delmia at Kennedy Space Center to support NASA’s Constellation Program

Tracey Kickbusch  
*NASA KSC - Chief, Computational Sciences Branch*

Bob Humeniuk  
*The Boeing Company - Systems Engineer*

*Dream to Life: Envision and Invent the Future*
KSC Design Visualization Group

- Ten person Civil Service and Boeing team
- Provide support to numerous NASA programs
  - Constellation
  - Launch Services
  - Space Station
  - Shuttle
- Perform simulation of ground operations leading up launch
- Use Delmia to make sure operations are feasible, efficient, and safe
KSC Design Visualization Group

- Performed ground operation simulations since the mid 1980's
  - Every few years go through a cycle to pick the software that will work best for us
- Awards
  - ITSEC
NASA's Constellation Program

- Saturn V
- Ares I
- Space Shuttle
- Ares V
NASA's Constellation Program

Heritage Vehicles: Saturn V, Shuttle

Derived Components: Capsule, J2, RS-68, SRB, ET

Constellation Vehicles: Ares I, Ares V
NASA’s Constellation Program

Typical Lunar Reference Mission

Vehicles are not to scale.

MOON

100 km Low Lunar Orbit

Low Earth Orbit

EDS, LSAM

Orion

Earth Departure Stage (EDS) Expended

Service Module Expended

Direct Entry Land Landing

Ascent Stage Expended

MARS
Ares 1 Ground Processing Preliminary Design Review Video

- SHOW You Tube VIDEO HERE!
Challenges and how we use Delmia at Kennedy Space Center

- 5 Major Challenges
  - Dealing with Large Data Sets from multiple CAD systems
  - Creating & updating exiting KSC infrastructure
  - Gathering requirements and meeting customer objectives
  - Creating realistic life-like simulations
  - Providing quick turn-around on a wide variety of deliverables
Challenge 1: Dealing with large data sets

- We are not part of the traditional design cycle
- Receive CAD models from dozens of companies
- No control of file formats and configurations
- Receive huge/complex top level assemblies
- Designs are constantly changing
Our Delmia Solution: Dealing with large data sets

- Use native CAD tools and export STEP
- Develop custom processes
- Manage data with file system/naming
- Embed meta data into top level Products
- Use CGR’s and released cache
Challenge 2: Creating & Maintaining KSC's Infrastructure

- Most buildings at KSC were built in the 60's
- Thousands of Engineering Orders..changes
- Thousands of ground support equipment
- Limited budget & resources
Our Delmia Solution: Creating & Maintaining KSC’s Infrastructure

- Utilize short range and long range scanners
- Create 3D models from scan data in Delmia
- Use point clouds in simulation
- Model only what is needed
- Use texture maps when ever possible

Scanning → Point Cloud → Point Cloud Integration into Simulation
Challenge 3: Gathering customer requirements & meeting objectives

- Way too many customers
- Way too many systems & subsystems
- Way too many ideas on how things should be done
- Extremely complex systems
- Constantly changing plans, designs, & operations
- Limited "life" of our products
Our Delmia Solution: Gathering customer requirements & meeting objectives

- Dedicated conference room for Delmia
- Real time planning session with all stakeholders
- Real time "what-if" support
- Capture all issues and email out by end of meeting
- Collaborate by streaming video to web-x server

Interactive Review

Delmia Simulations

Revise
Challenge 4: Creating Life-Like Simulations

- Engage the customer with the solution not the CAD tool
- People equate quality to accuracy
- Customers are used to seeing rich 3D environments (TV, movies)
- Our competitors use animation tools
Our Delmia Solution:
Creating Life-Like Simulations

• Invest the time in creating & applying texture maps and materials
• Utilize high end Nvidia graphics cards with 32xAA & lots of texture memory
• Utilize Real-time rendering options and shaders
• Utilize Photostudio
Challenge 5: Providing quick turn-around on varied products

- Video’s are outdated before they are finished
- Numerous still images are required
- Customers want high quality graphics at last minute
- Turning over (releasing) CAD models
- Turning over (releasing) visualization models
Our Delmia Solution:
Providing quick turn-around on varied products

- Stream HD Delmia simulation to Non-linear editor for video production
- Create still images directly from HD video
- Photostudio rendering from Processes
- Custom STEP, VRML, OBJ exporter
Summary: What has made us successful

- Dassault Systems Tools
  - Commonality in interface/file formats
  - Best of class applications
  - Wide/deep product offering
  - Support
Summary:
What has made us successful

- Placement under the IT organization
  - Leverage IT support
  - Wider reach into many programs and organizations
  - Share resources and cost across programs
  - Surge capability
Summary:
What has made us successful

- Multidiscipline, diverse, cross trained team
  - End-to-end product control
  - Implementation of "Value Stream Mapping"
  - Provides growth and learning opportunities
  - Stimulates new idea and business opportunities
    - FAST, COST EFFECTIVE PRODUCTS WITH HIGH QUALITY!