CAESAR II – Answering the Challenge of Design and Engineering Collaboration

CITY - COUNTRY
October 2010

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Regional Manager
CADWorx & Analysis Solutions
AGENDA

- Setting the Target
- What does Intergraph CAESAR II do?
- Excellence in Support and R&D
- Artificial Intelligence in CAESAR II
- Integration of Smart 3D with CAESAR II
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Alice: “Would you tell me please, which way I ought to go from here?”

Cat: “That depends a good deal on where you want to get to.”

Alice: “I don’t much care where …”

Cat: “Then it doesn’t matter which way you go.”

*Alice in Wonderland*
by Lewis Carroll
SETTING THE TARGET

- Provide an overview of CAESAR II as a definitive solution for pipe stress analysis
- Present a sneak preview of CAESAR II artificial intelligence advantages
- Discuss the substantial productivity gains that can come from allowing both engineering and design to share information seamlessly
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What does Intergraph CAESAR II do?

Source: http://www.weldreality.com
What does Intergraph CAESAR II do?
What does Intergraph CAESAR II do?
What Intergraph CAESAR II doesn’t do...
What does Intergraph CAESAR II do?

- Perhaps the first commercial, PC-based, pipe stress packages and growing ever since
- Nearly a complete range of capabilities – both static and dynamic
- Wide range of component / system modeling can address most piping situations
- Stress evaluation in accordance with 34 international piping codes to meet local requirements
- Popularity with Owner/Operators soon spread to EPCs large and small
- An Industry Standard
Piping Designer Responsibilities

Which ONE of these SUSPECTS caused your project to fail?
Piping Designer Responsibilities

- **Givens:**
  - Size based on pressure drop, low rate
  - Specification (wall thickness) based on pressure
  - Material based on service requirements

- Designer locates equipment and then routes pipe between these positions

- Designer has established rules for basic layout
  - Access
  - Hydraulic issues
  - Spans between supports (deadweight sag)
  - System stability
So what’s left for the Piping Engineer?

- Many systems require analysis to evaluate strain
- The Pipe Stress engineer models a proposed (or existing) piping system
- CAESAR II validates the acceptability of that proposed system (against the piping code, etc.)
  - Check for Primary (force-driven) Loads
  - Check for Secondary (displacement- or expansion-driven) Loads
- If there is a problem, the Pipe Stress engineer proposes a solution
USE B31.3
MATERIAL = A-106-B
50mm CALCIUM SILICATE INS.

INLET:
TEMPERATURE = 200 C
PRESSURE = 12 BAR

EXHAUST:
TEMPERATURE = 150 C
PRESSURE = 5 BAR
CAESAR II INTERFACE QUICK PRESENTATION
Four typical interests in “Pipe Stress Analysis”

1. Selecting and Sizing Supports
2. Checking Pipe Deflection under Load
3. Verifying Loads on Connected Equipment
4. Evaluating Pipe Stress
What does Intergraph CAESAR II do?

Interfaces with other analysis and data management programs to speed data transfer and reduce error.

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CAESAR II Output
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Excellence in Support and R&D

- One of the greatest strengths of the program is the staff in their interaction with the user community
  - Intergraph ICAS’s support personnel is top notch with several years of field experience
  - They are experienced engineers able to apply CAESAR II to "every-day" problems, not a sales person or a computer programmer
  - 3 code committee participants
  - Average tenure = 15 years +
- ASME and Other CODES regularly updated inside the applications
- Local Codes also often included: Wind and Seismic
- With over 25 years of engineering and commercial improvements, CAESAR II has continued to meet the increasing requirements in piping engineering and analysis
This release features many highly requested items from our user Wish List:

- Code revisions (+B31.9 added)
- Equipment/Nozzle limit check
- Line numbers
- Graphic editing improvements
- “Local Restraint” report
- Enhanced insulation specification
- Uniform load enhancement
- Transfer of API-650 displacements to model
- Ability to specify spring hardware weight
- Structural tubing
- And more!
Example: CAESAR II Nuclear Certification

- Contracting with external consultant to help fast track development of our NQA-1 procedures
- Initiating hiring of Nuclear Software Quality Assurance Manager to implement those procedures and oversee our Validation & Verification Program
- Have identified CAESAR II extensions needed to best support the nuclear industry
  - Initial constraints: ASME III, Subsections NC and ND only
- Anticipated delivery within 12 months
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Artificial Intelligence in CAESAR II

- Typical end user: Mechanical Engineer
- Many are gray...
  - Plant design personnel in US/Europe average 55+ years of age
- Others are green...
  - Plant design personnel in most of the countries have limited experience today
- In ten years, our customers will be... “less green”
- We are experiencing the bottleneck already
Pipe Stress Analysis – Some Solutions for Problems Found

- Better estimate of operating loads on pipe supports and equipment connections
- Accommodating vertical growth at support locations
- Solution to Primary Stress problems is to Add Restraint
- Solution to Secondary Stress problems is to Add Unrestrained Lengths of Pipe
  - This leads to Expansion Loops as typical Secondary Stress solutions
- Why can’t we turn CAESAR II into a solution tool, instead of just a validation tool?
ARTIFICIAL INTELLIGENCE CAESAR II MINI DEMO (AVI File)
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Current Challenges

- Obsession for cost reductions and control
- Project teams getting smaller and more mixed
- Management Level: there is almost no time for tactical analysis and business processes redesign
- Non-stop concern about productivity
  - Projects must be on time and on budget
  - Business processes between your company and the customer often ignored
  - Despite on investment in technology, there are still too many simple and repetitive processes consuming time and money
  - Data re-entry leading to more errors
  - Above all, problems with integration, collaboration and information sharing
Integration of Smart 3D with CAESAR II

- So what have we been doing since January 4?
- Survey:
  - Talk to customers to determine what they want
  - Take inventory of what we have to offer today
- Study:
  - The Smart 3D infrastructure
  - The CAESAR II infrastructure
  - What is the best means of exchanging data between the two?
- Plan:
  - Immediate – what can we do for our customers immediately
  - Near term – how can we fulfill customers’ wishes in the near term
  - Future – what is our long term vision?
What is the Need?

- Piping makes up the largest part of plant design
- A large part of the piping on typical process plants requires stress analysis
- Stress Analysis engineers generally spend 50-75% of their time building stress models
- Re-creation of piping models introduces additional opportunities for error
- Re-creation of piping models leads to non-concurrent design
- Stress Analysis tasks occur late in the project design cycle, often becoming the critical path
- A quick, accurate, easy-to-use interface between 3D Design and Stress Analysis will reduce the time between a system’s release to stress analysis and its approval, as well as eliminate errors, providing...

SIGNIFICANT PRODUCTIVITY AND ACCURACY ENHANCEMENTS
Primary Customer Requirements:

- Interface from Smart 3D to CAESAR II
  - Must be fast
  - Must be accurate
  - Must be comprehensive (attribute rich)
- Interface from CAESAR II to Smart 3D
  - Must inform the designer of changes requested by the stress analysis
  - Must provide easy access to data (output results, etc.) required by the designer
  - …but should not automatically update the Smart 3D design!
- Must be available soon so it can be put to use
- Other…
  - Access the design environment from within the engineering environment
  - Provide stress analysis capabilities inside of Smart 3D
Integration of Smart 3D with CAESAR II

What is Available Today?
- For PDS – the .N file, processed by CAESAR II’s “Intergraph” Interface Processor
- For CADWorx Plant Professional – a seamless, bi-directional interface

For Smart 3D
- PCF File “Standard Configuration”, interfaced to CAESAR II

Missing Data:
- Wall thickness
- Materials
- Temperatures
- Pressures
- Restraint data
- Bend radii
- Corrosion
- Imposed loads
- Insulation
- Fluid density
- SIF types
- Etc.

Today, PCF provides ~70% of what the stress engineer needs
Integration of Smart 3D with CAESAR II

- What is Available Today?
  - For PDS – the .N file, processed by CAESAR II’s “Intergraph” Interface Processor
  - For CADWorx Plant Professional – a seamless, bi-directional interface

- For Smart 3D
  - PCF File “Standard Configuration”, interfaced to CAESAR II
  - PCF “ISO Stress – CAESAR II” configuration provides a richer set of data attributes

Missing Data:
- Wall thickness
- Materials
- Temperatures
- Pressures
- Restraint data
- Bend radii
- Corrosion
- Imposed loads
- Insulation
- Fluid density
- SIF types
- Etc.

ISO Stress configuration provides 85-90% of what the stress engineer needs...
Integration of Smart 3D with CAESAR II

- Except that CAESAR II doesn’t do a very good job of processing much of this data!

- Inadequately processed:
  - Diameters
  - Material properties
  - Global coordinates
  - SIF type
  - Bend radius
  - Reducer diameter2
  - Insulation thickness
  - Insulation density
  - Etc.
Our Plan - Immediate

- Best use of our immediate time is to improve the CAESAR II side of the PCF interface – to take advantage of everything that Smart 3D’s PCF file can deliver.

- New, improved CAESAR II PCF processor to be delivered in October (CAESAR II 2011) or sooner.
Our Near Term Plan

- **Selected Solution: PCF file**
  - Tried and true technology
  - Already walks the line gathering piping attributes
  - Already passes those attributes to CAESAR II
  - The only drawback is lack of a full CAESAR II attribute set…
  - …but Intergraph owns both sides of the technology!

- **Next Steps**
  - PCF to be extended to full set of CAESAR II attributes
  - CAESAR II to be modified to process Extended PCF file – providing near 100% data transfer
Our Near Term Plan

- Provide Pipe Stress environment access to Smart 3D data
  - Selected Solution: SPR file (provides access to all SPR supported formats)

- Round trip changes/results from CAESAR II to Smart 3D
  - Automation functions reading directly from CAESAR II files
  - R3D graphics created from CAESAR II
Our Plan – Future

- “CAESAR II Inside”
  - Bringing basic, easy-to-implement Pipe Stress capabilities to the designer
  - Front loads much of the Pipe Stress work in the Project Cycle, thus forcing rework when changes are much less expensive
  - How much would it be worth to you to know that 90%+ of the piping systems sent to engineering during project crunch time would work the first time?
Schedule

- **Immediate** -- October 2010
  - Robust PCF processor

- **Near Term** -- April 2011
  - Extended PCF processor
  - Smart 3D graphics/data access from within CAESAR II
  - Round tripping of CAESAR II changes/results

- **Future** -- TBD
  - “CAESAR II Inside”
Webinars - CAESAR II

September 09, 2010

Intergraph CAESAR II Webinar, Sep 15th 10AM CDT:
Introduction to CAESAR II Pipe Stress Analysis for Designers
and Engineers

with Dave Diehl, Intergraph CADWorx and Analysis Solutions

VIEW WEBINAR

This webinar describes how “pipe stress analysis” satisfies the
advanced requirements of piping designers. Through proper line
specification, routing and support location, piping designers are
equipped to address the bulk of the reliability and safety issues.
We really would appreciate your Input

- Tell us your views
  - tom.van.laan@intergraph.com
- Become a CAESAR II Beta tester
  - richard.ay@intergraph.com
- Take part in CAESAR II sprint reviews
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Thank You!