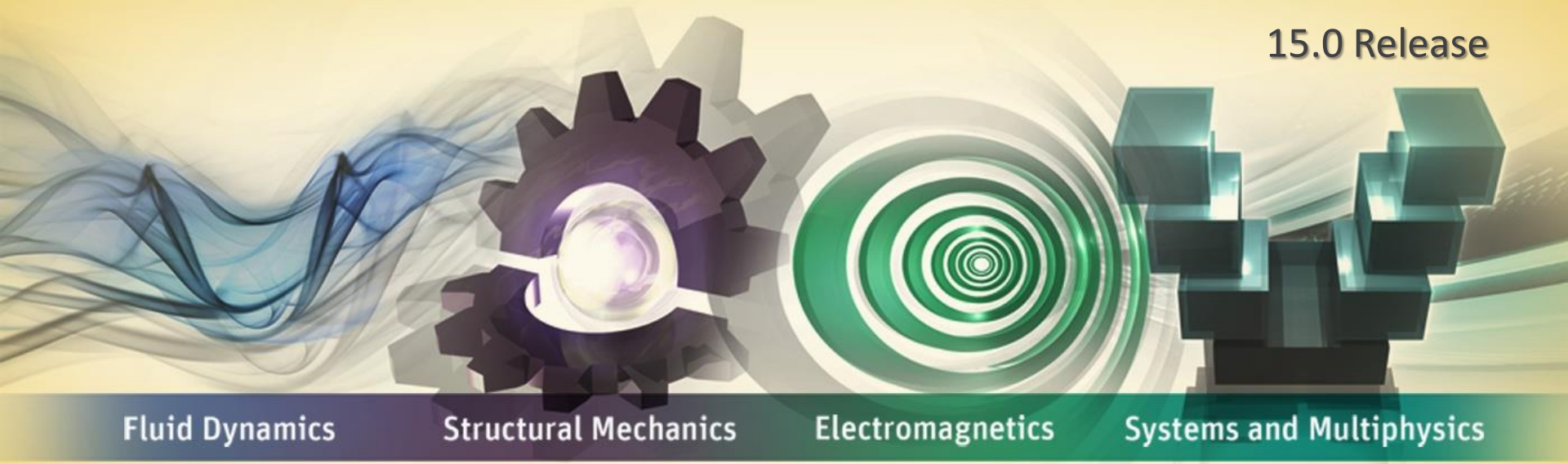
ANSYS

Realize Your Product Promise™

Rapid Engineering through Topological Optimization and Direct Modeling

15.0 Release



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About ANSYS, Inc.

More than 60 offices worldwide plus an extensive network of distributors

Over 2,200 direct employees of ANSYS and its subsidiaries worldwide

Listed on NASDAQ (ANSS)

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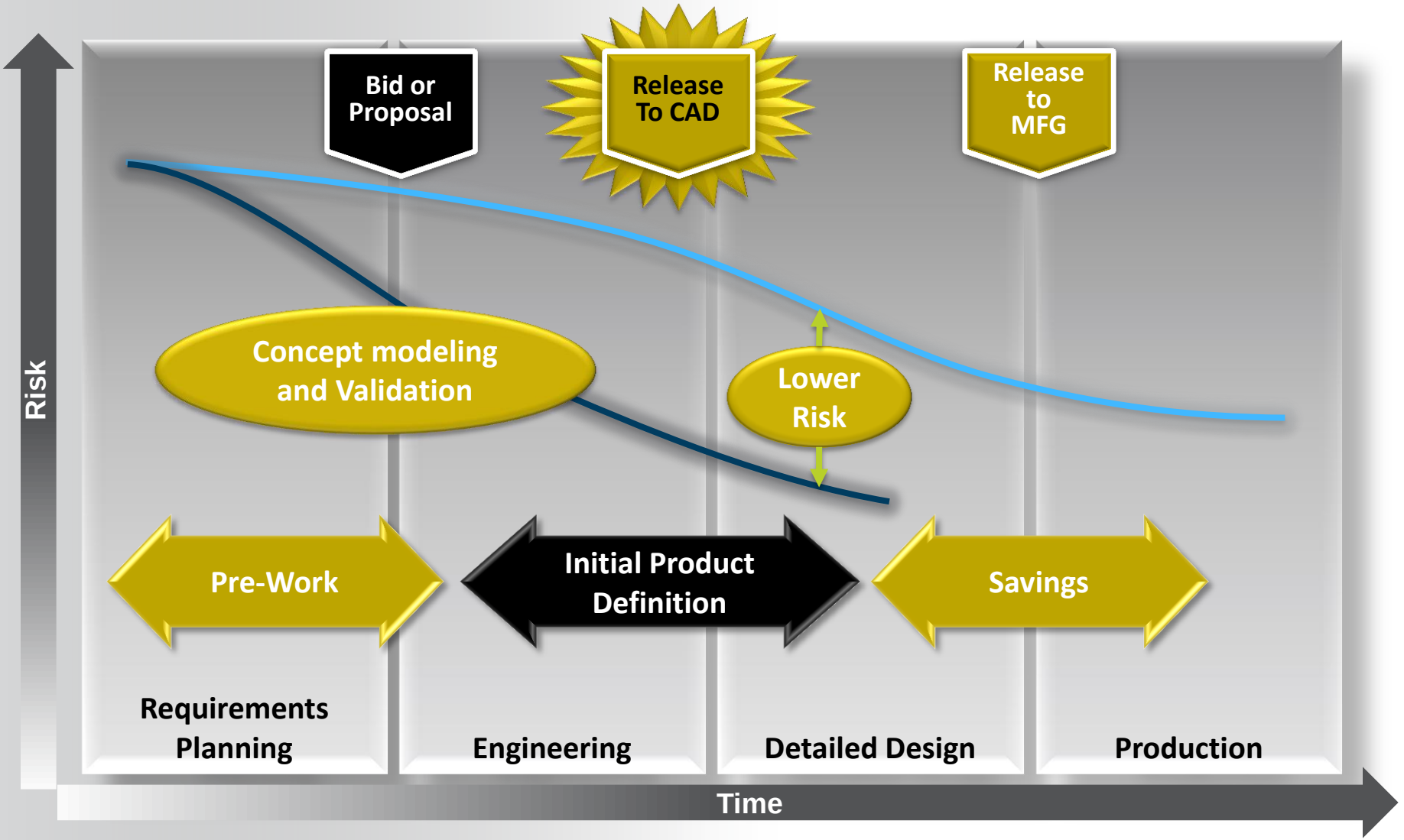
Corporate Headquarters
Canonsburg, PA

The Challenge – For Engineers

- The design stage takes a very short period in a product lifecycle however it dictates about 70-80% of lifecycle cost **WHY?**
- There are a limited set of tools available for Early Stage Design in comparison to later stages
- Design Engineers need models in the "Concepting Phase" to enable them to solve problems often and early
- Communication and feedback channels are fragmented, inefficient, or nonexistent

Rapid Engineering



Direct versus feature-based modeling

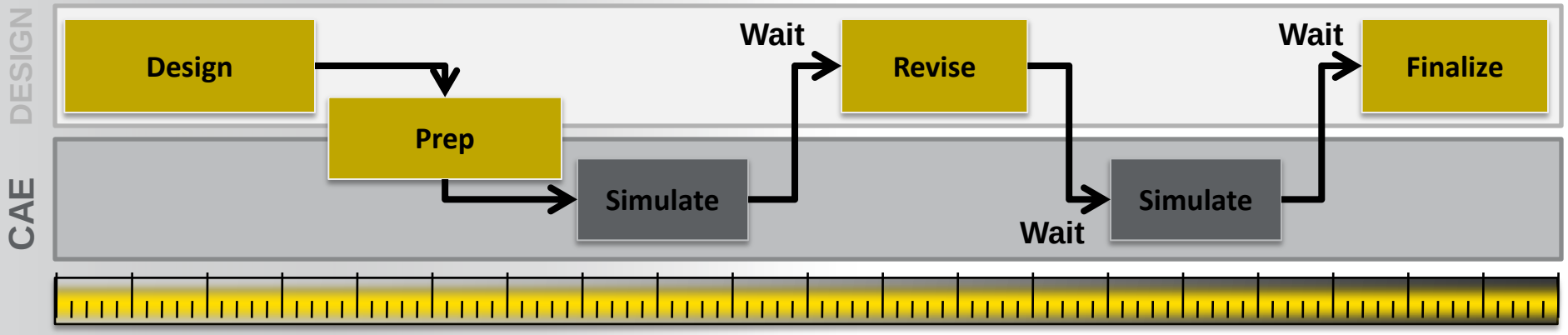
Direct Modeling	Feature Based Modeling
No Feature Tree + No Constraints	Feature Tree + Constraints
Interactive - Faster Real time changes	Recipe/order based-Slower Changes
Easy to Learn- Fast Learning Curve	Typical CAD training required
Easy to use- Built for any Engineer	Dedicated CAD specialist required
Modify ANY Geometry- Including dumb models	Modification of Current Feature CAD model ONLY
Ideal for unplanned changes	Great for planned recipe based changes

SpaceClaim for Concept Design

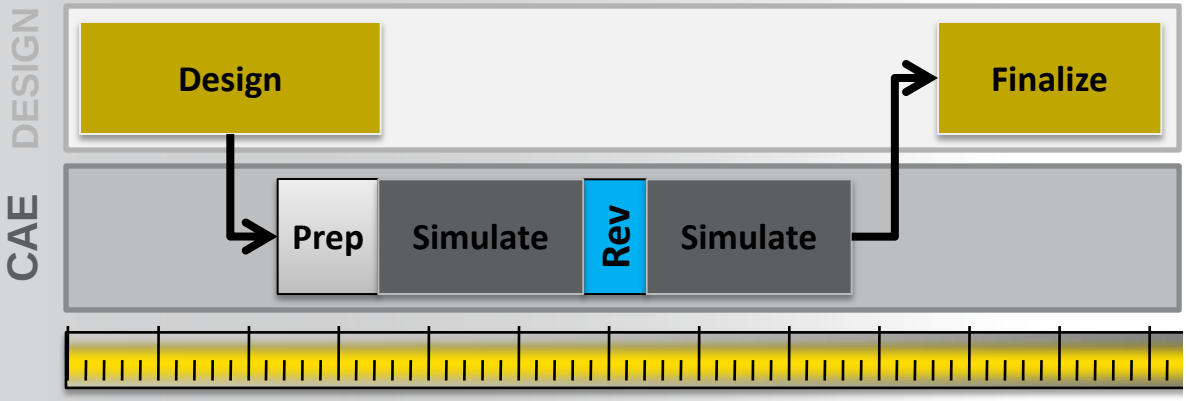
Engineering Model in SpaceClaim	Detailed CAD Model
Simple, easily-edited geometry	Precise abstract product representation
Created by engineers with specialty outside of CAD	Created by experts in CAD and manufacturing processes
Appropriate level of detail for simulation	Requires rework for simulation
Used as specification for detailed design	Used as specification for manufacturing
Multiple options managed simultaneously	**Single, correct model-based definition**

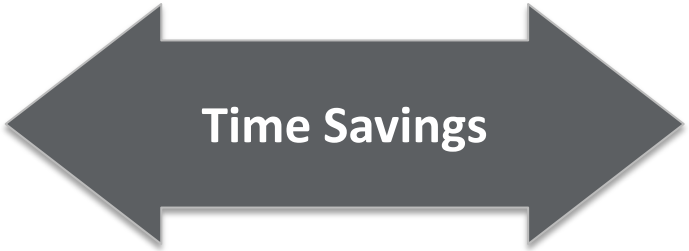
Simulation Driven Product Development

Before



After





DESIGNs | SCDM | Simulation

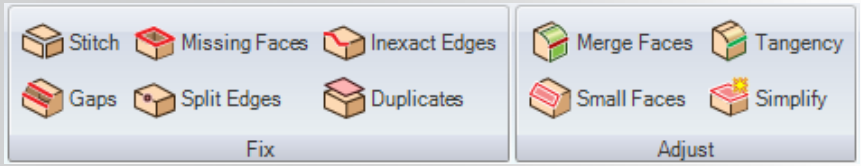
SpaceClaim Technology Overview

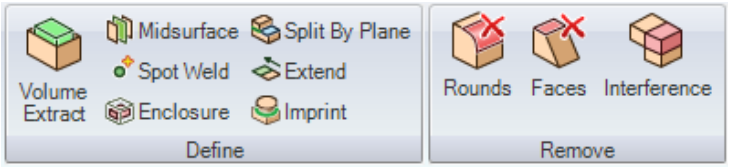
SpaceClaim is CAD Neutral

- Create 3D models from scratch-concept/upfront CAE modeling
- Modify any CAD file, including dumb models
- Direct Connection with Workbench

SpaceClaim has Best in Class Geometry tools for CAE Tasks

- Repair tools for dirty geometry (stitch, gaps, missing faces)
- Simplification tools to help reduce mesh size(merge face, delete)
- CFD and FEA Model Prep tools(mid-surface, volume, enclosure, beams)





Unbeatable at Concept Design

Advanced Engineering

– 10x to 20x faster to draw and evaluate new designs

– Data re-use is also 10X faster

Concept Development

– No constraints or rebuild errors to slow down innovation

Large Assembly Editing – Digital Change Prototyping

– Turn existing designs into new concepts without hassles

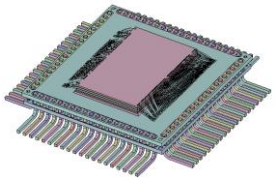
– Edits to large assemblies in minutes, not hours or days

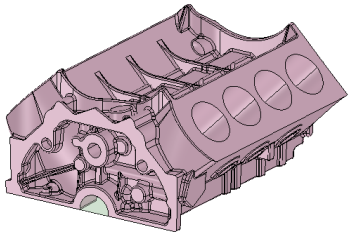
Cross-CAD Collaboration

– Works with files from any CAD system

Industrial Design

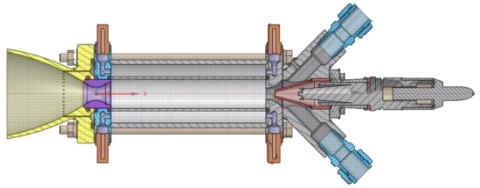
– Reuse meshes, surface models, and 2D data

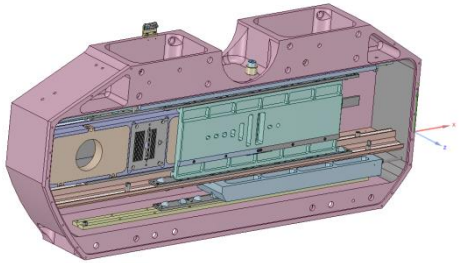




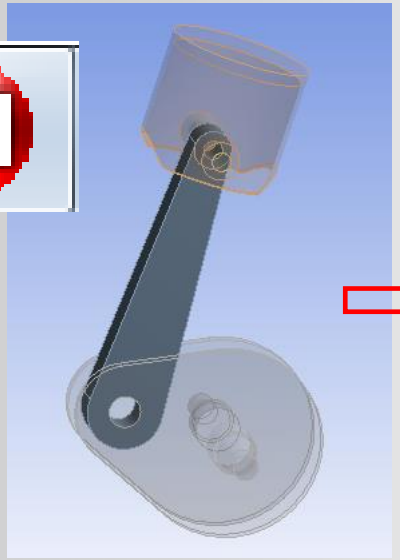
Direct Modeling Drives Simulation

- Build upfront conceptual/CAE models
- Repair and De-feature Dirty CAD files
- Extract Beams and Mid-Surfaces
- Extract internal/Create external fluid volume
- Edit and parameterize any CAD file
- Complement capabilities of Design Modeler
- Enables Topology Optimization



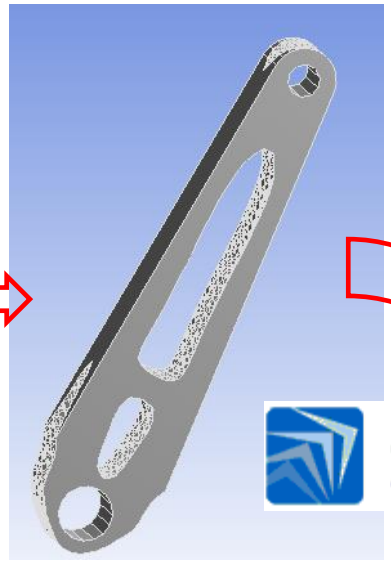


Design Cycle using Topological Optimization



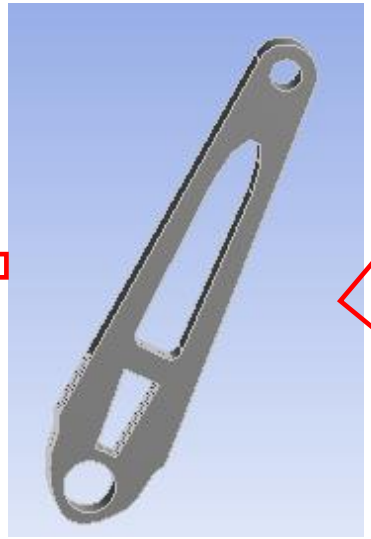
Initial Design Analysis

Topological Optimization



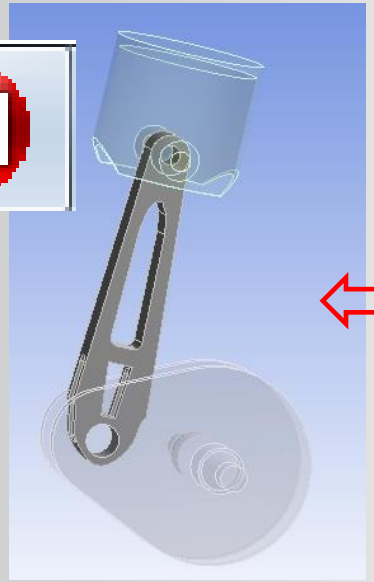
SPACECLAIM

Clean CAD Creation



Parametric Optimization

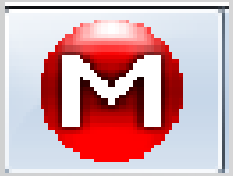
DX



Final Design Analysis

ANSYS Offers Complete Workflow

Workbench – Project management



ANSYS Mechanical – Meshing and FEA

GTAM - GENSIS Topological Optimization Solver
(powered by Vanderplaats Resarch & Development)

Direct modeler geometry tool

Design Xplorer – Parametric optimization (DOE, LSS, etc.)

Example: General Dynamics Land Systems

Redesigned hull of Stryker armored vehicle to be resistant

- **Time-to-market: 1 year versus 2-3 years without SpaceClaim**

Concept, simulation, and proposal work done in SpaceClaim

- **SpaceClaim model became the specification for CAD**
- **Extensive use of JT, Pro/E, STEP, IGES, and NX data**
- **TeamCenter and VisMockUp for collaboration**

Actual SpaceClaim concept model

GENERAL DYNAMICS

Conclusion

Rapid Engineering will:

- **Align Manufacturing with Affordability**
- **Enable companies to price compete for contracts**
- **Ensure communication between designers and manufacturing team**
- **Decrease time to market**
- **Manufacture at a minimal cost**

Direct Modeling Demonstration

- Creates geometry quickly from scratch
- Defeatures imported models for larger design space
- Works directly with STL files for reverse engineering
- Deviation comparison to compare optimization result to final model