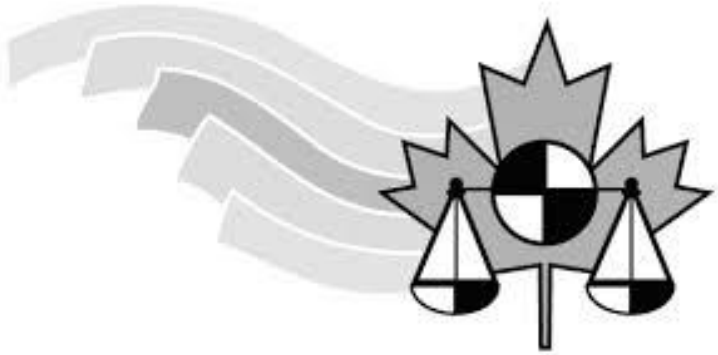


Altair

HyperWorks®

Additive Manufacturing + solidThinking Inspire: Making Lightweight, Low-Volume Designs a Reality

4 October 2014

Ujwal Patnaik
Altair Engineering Canada, Ltd.

Altair Overview

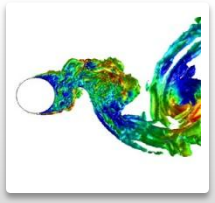
Altair

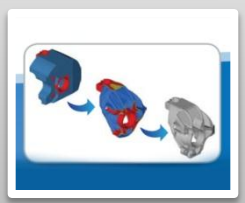
A global software and technology company founded in 1985

There are **44** offices in **22** countries and **2,200** engineers, scientists, developers and creative thinkers.

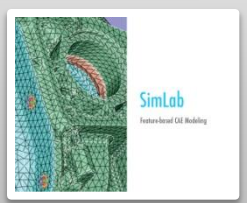




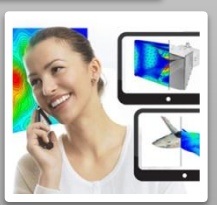










Blue Chip Customer Base

Altair

Automotive	Aerospace	Heavy Equipment	Government
Ford, Toyota, Chrysler, GM, Renault, Honda, BMW	BAE Systems, Boeing, EADS, Bombardier, Embraer, Honeywell	Alstom, John Deere, JFE, Caterpillar, Oshkosh	AIST, NASA, U.S. Air Force, Los Alamos National Laboratory, National Research Council Canada

Life/Earth Sciences	Electronics/ Consumer Goods	Energy	Architecture
BASF The Chemical Company, Bayer, Dow, Alcoa, Merck	acer, intel, IBM, LG, Bosch	ABB, Chevron, Valero, ConocoPhillips, ExxonMobil	AECOM, LIXIL, SOM, WEIDLINGER, WorleyParsons resources & energy

5,000 customers worldwide

Altair

The synergy between our **software** and **services** organizations keeps Altair close to industry challenges and uniquely positioned as a **valued, long-term partner** to support the dynamic needs of our clients.


INSPIRE
solidThinking
2014
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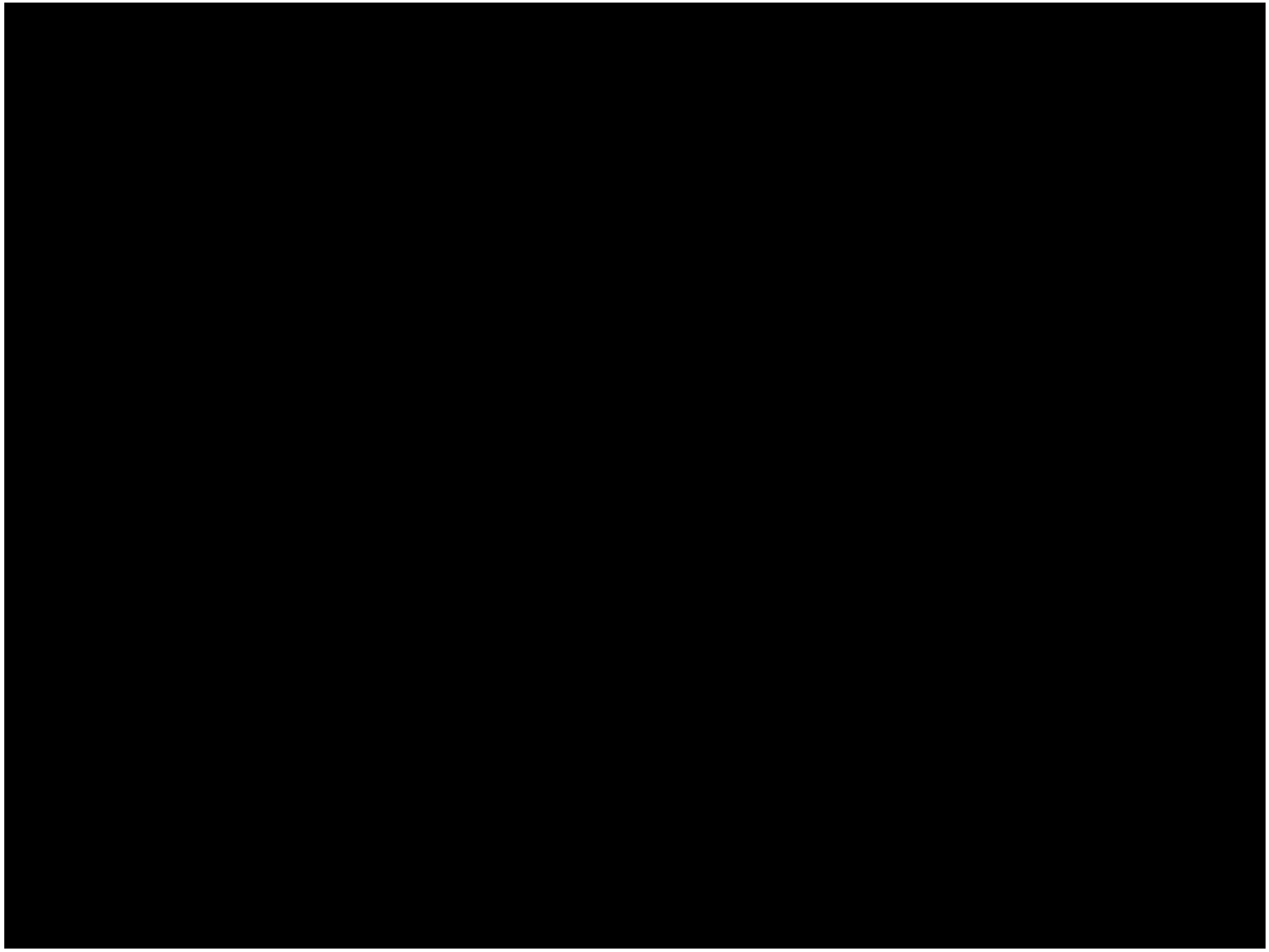
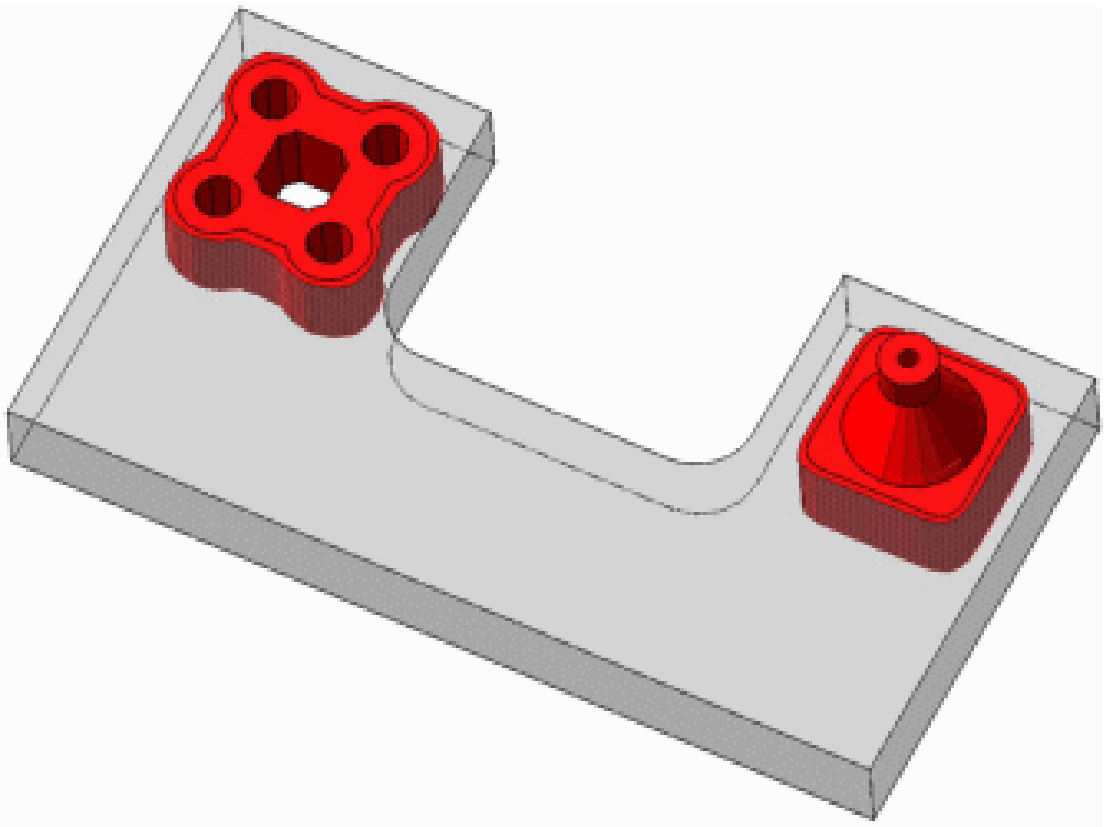
Video



What is topology optimization



- solidThinking Inspire is a tool for designers and design engineers
- provides the best material distribution for a given design space and loading

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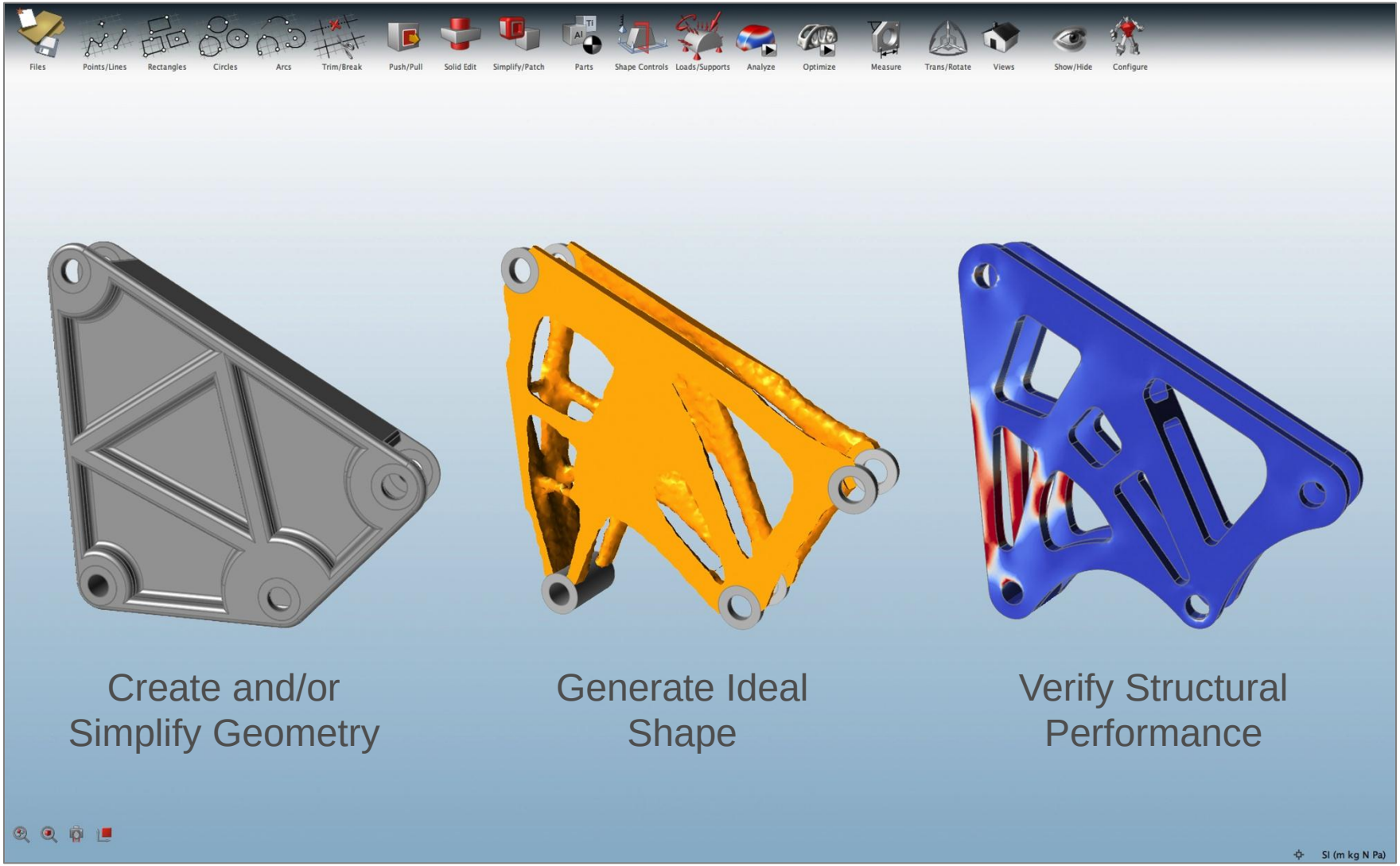
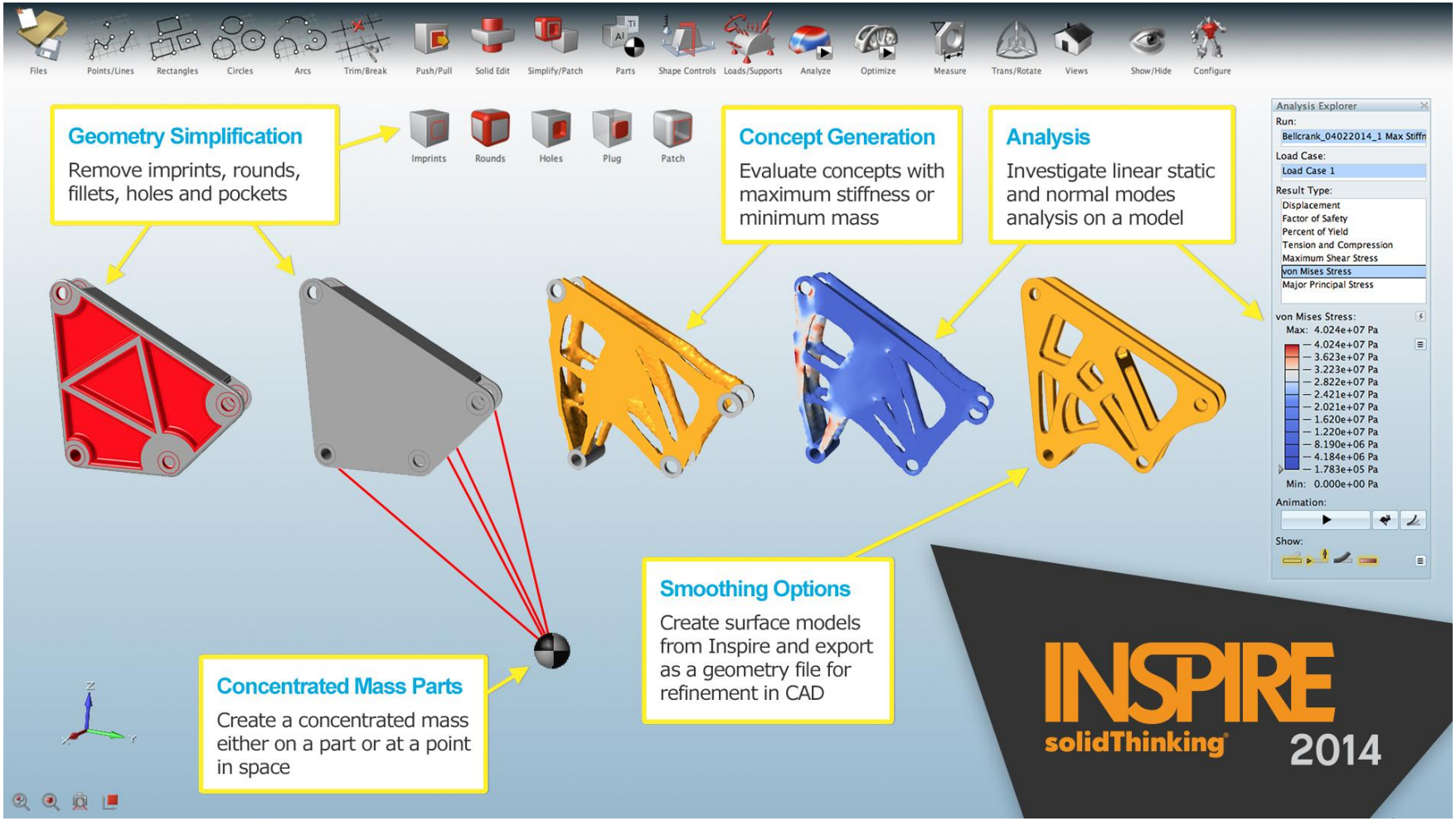
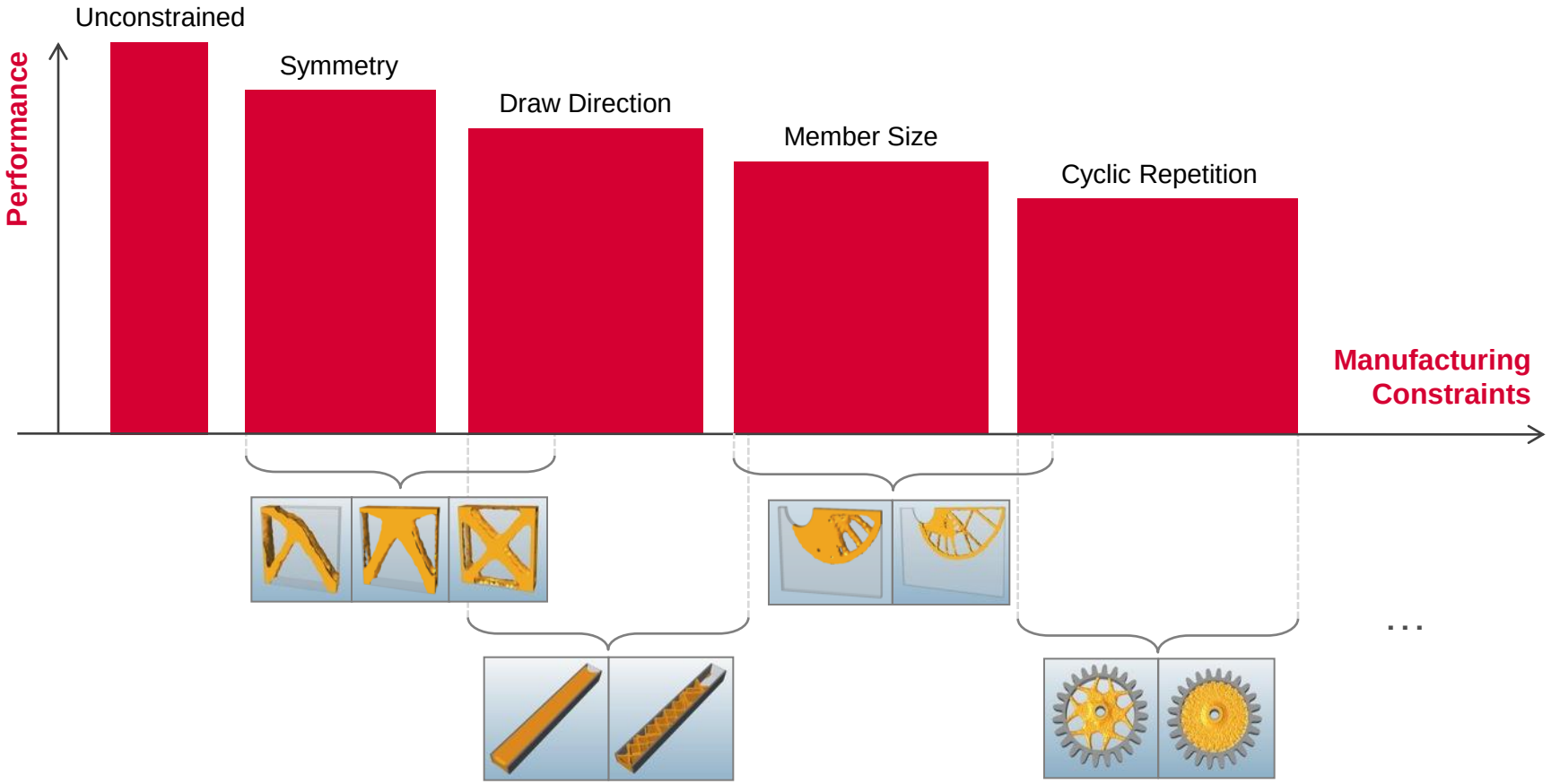


solidThinking Inspire 2014



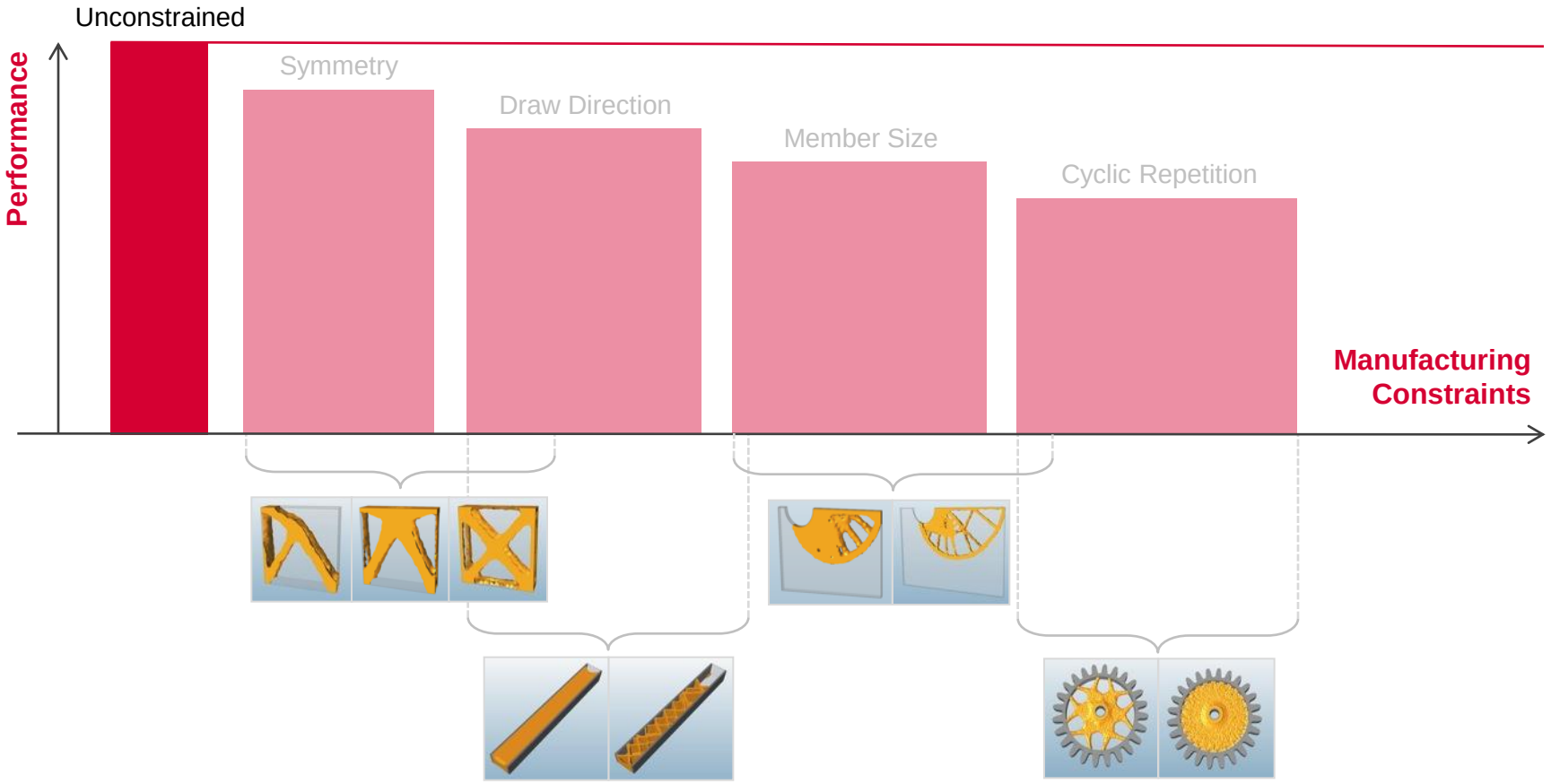
Manufacturing Constraints

Topology optimization provides the most efficient structure for a given load situation, but for traditional manufacturing designers always have to **trade performance for manufacturability**!



Additive Manufacturing - Technology Symbiosis

Additive manufacturing is lifting the constraints of traditional manufacturing processes, giving designers the ability to grow practically any shape, enabling the use of fully optimized lightweight designs that do not sacrifice performance.

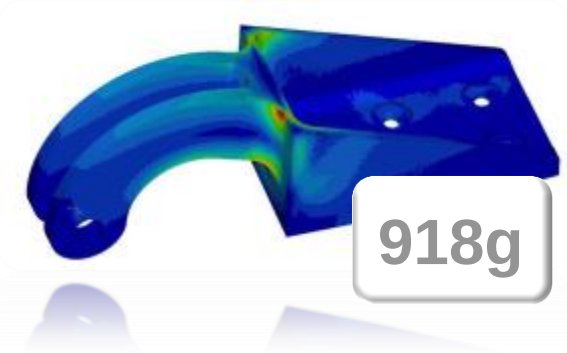


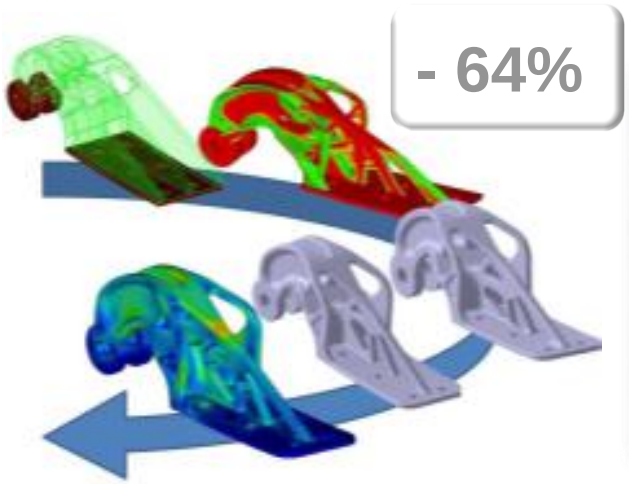
EADS – Additive Manufacturing

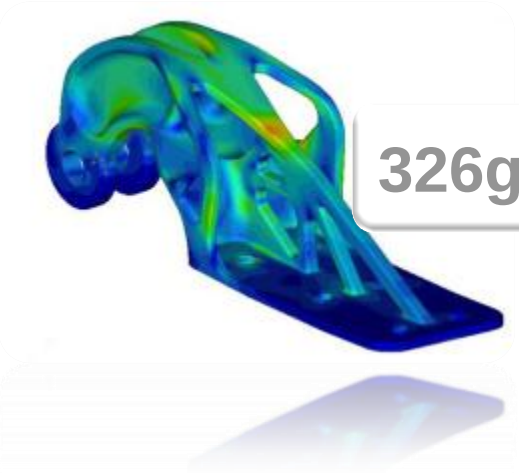
solidThinking®

EADS

"…optimized design retained the ***same characteristics*** in terms of stiffness and bolt loading, while ***reducing the stresses*** on the part…."





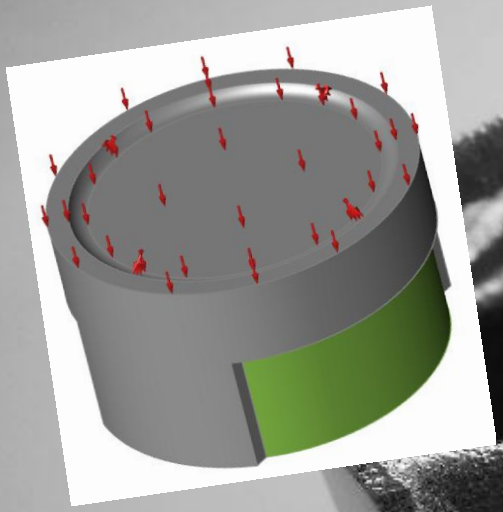


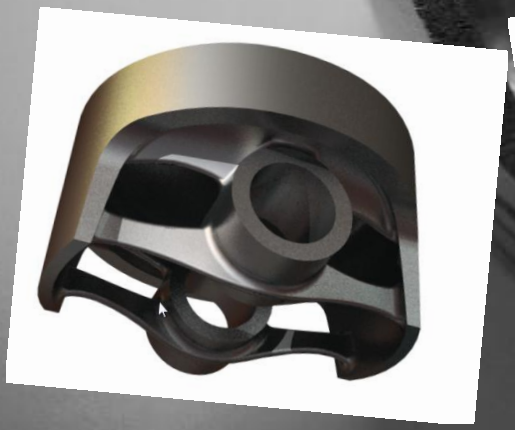
"solidThinking Inspire (with OptiStruct engine) allowed us to maximize the weight saving benefits of the ALM process."

Jon Meyer EADS Innovation Works

an Altair company

HardMarque™
UTURE FACTORIES





32% Weight Reduction

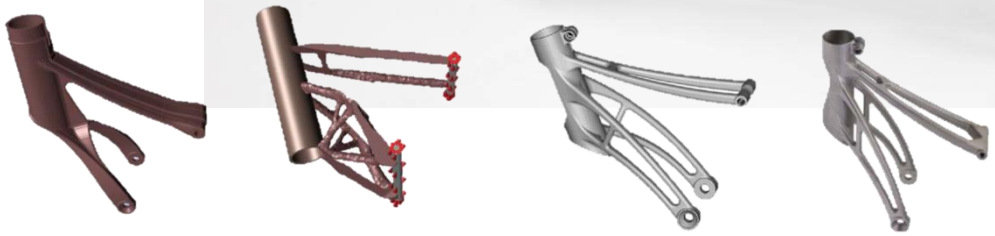
Unlock the lightweight potential of AM with concept generation and organic interpretation.

solidThinking®

RENISHAW
apply innovation™

EMPIRE

Revolutionizing the additive manufacturing design process for the world's first 3D printed bike frame



45% Lighter than Original

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solidThinking Inspire

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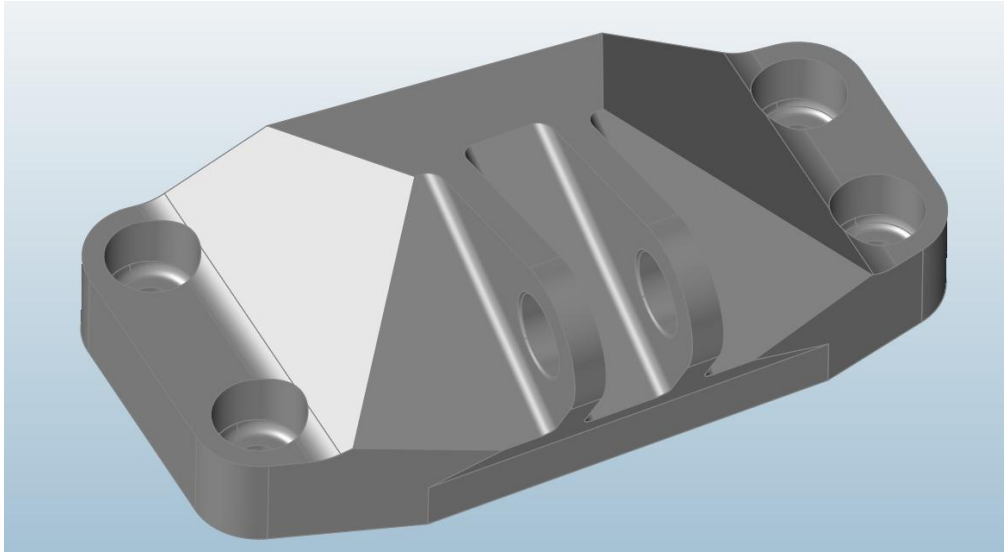
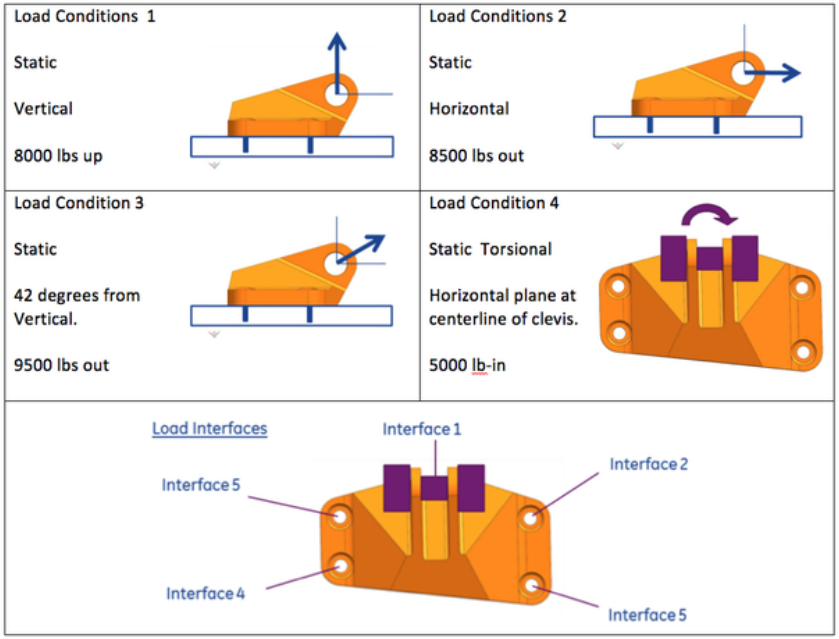


Reference: GE jet engine bracket AM challenge
http://grabcad.com/challenges/ge-jet-engine-bracket-challenge



How to find the best Design?

Load Conditions:

1. Max static linear load of 8,000 lbs vertical up.
2. Max static linear load of 8,500 lbs horizontal out.
3. Max static linear load of 9,500 lbs 42 degrees from vertical.
4. Max static torsional load of 5,000 lb-in horizontal at intersection of centerline of pin and midpoint between clevis arms.

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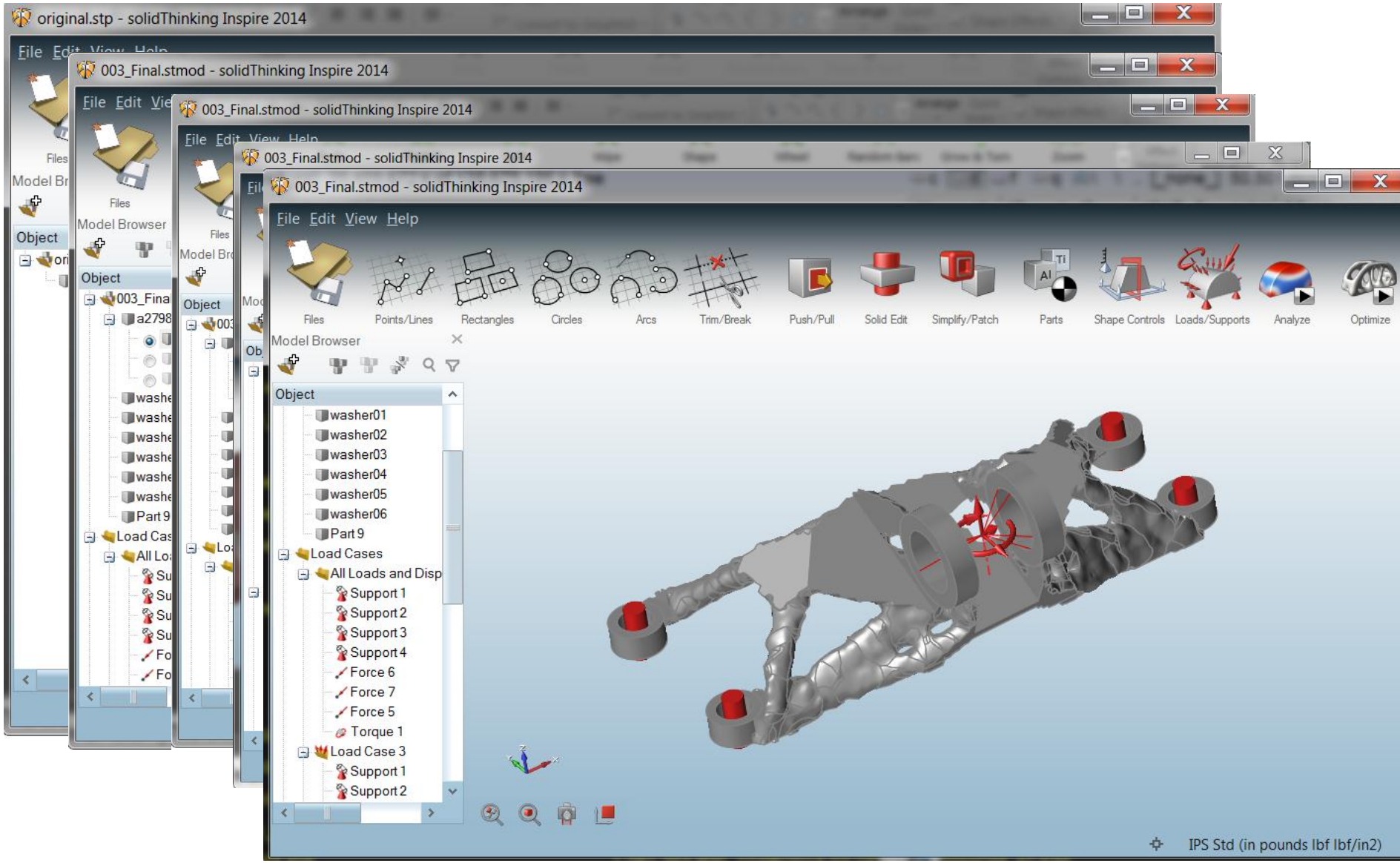
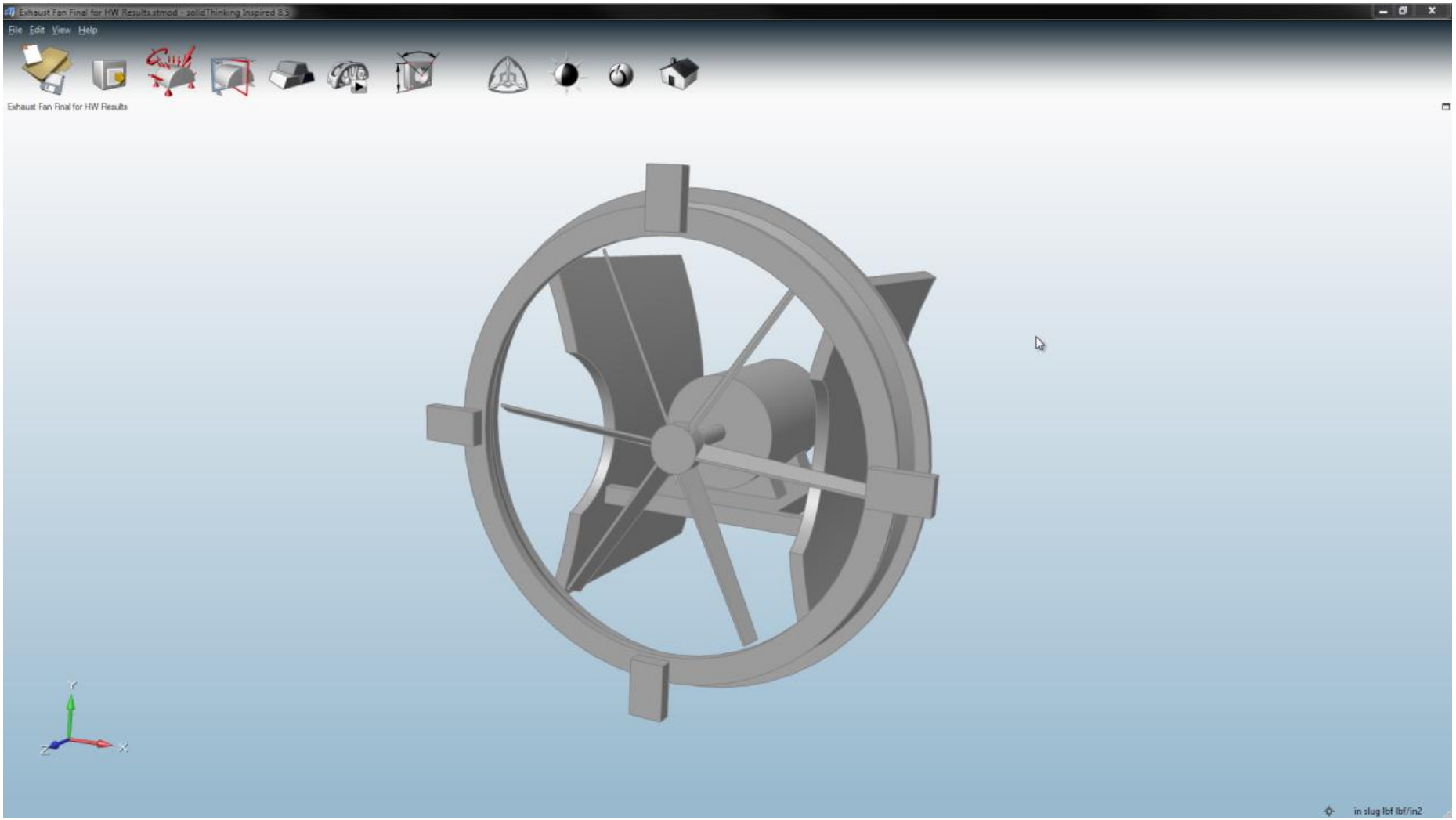


Demo



Concluding Remarks

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- **Additive manufacturing**
  - Structural freedom – complexity in shape and topology
  - Individualized product (medical applications etc.)
  - Accelerated processing – no tooling needed
- **Topology optimization**
  - Maximizing design freedom – complex free-forming ‘bionic’ structures
  - Path to optimal structures made with AM technology!
- **Altair Technology**
  - **OptiStruct** support optimization for comprehensive engineering process
  - Topology made easy for designers with **Inspire**
  - New technology creating optimal lattice structures coming soon


INSPIRE
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2014
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