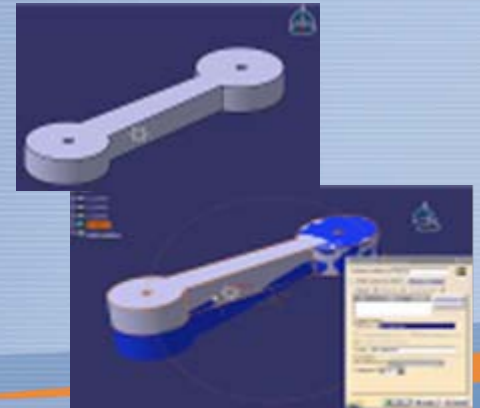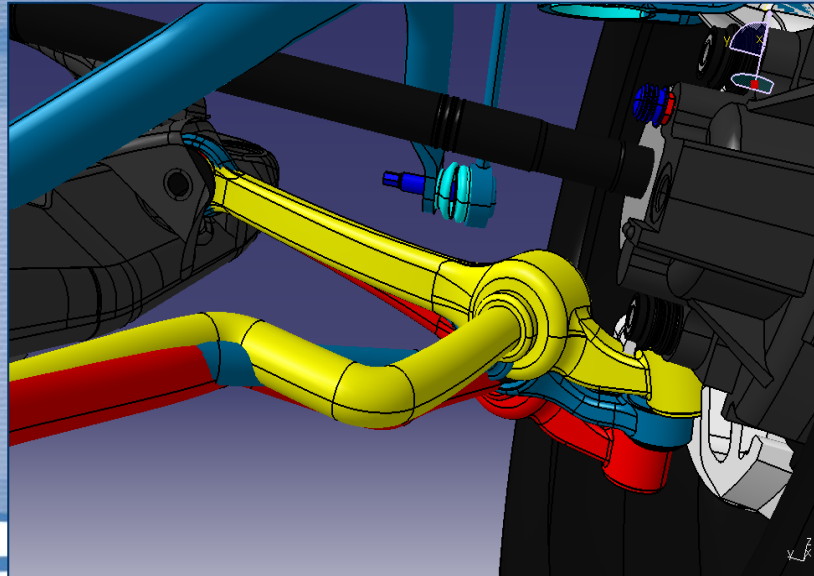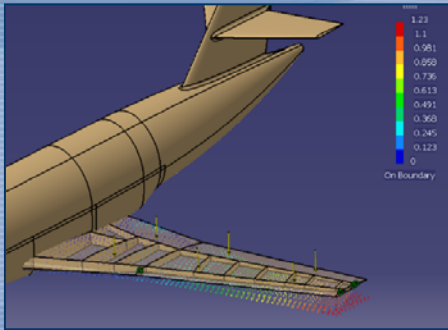# Realistic Shape Optimizer
– *Going Further with Predictive PLM* –

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Realistic Shape Optimizer : What is it ?

- **CATIA V5 Realistic Shape Optimizer (RSO) enables users to capture the actual shape resulting from simulations, or based on real-world tests of the product in operation.**

- **RSO assists users in answering key questions :**

  - Will my 3D product be the same when built ?
    - ◆ Optimize product definition
    - ◆ Connect simulation world to industrial design

  - Will my product still work under operation conditions ?
    - ◆ Check product interferences, clashes and kinematics under load conditions

  - Will my tooling fit product's shape and quality needs once built ?
    - ◆ Perform reverse analysis, reflecting physical, thermal and stress effects, to optimize tooling definition
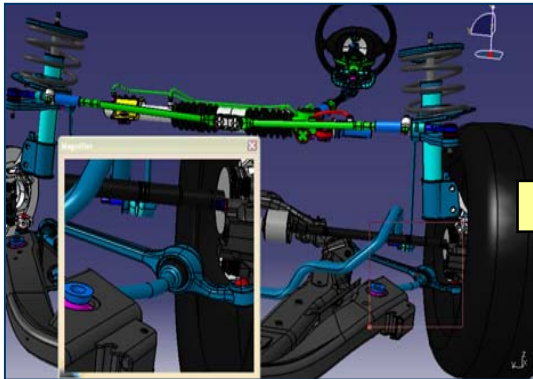
Making virtual product closer to reality

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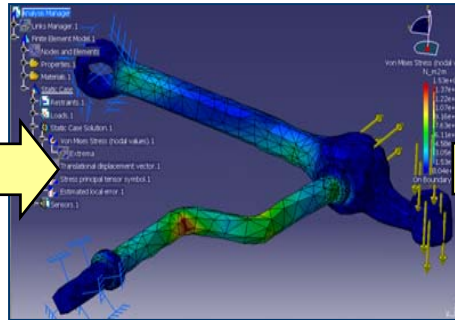
RSO : When you need to…

■ **Simulate a Mechanism under Operation Conditions :**

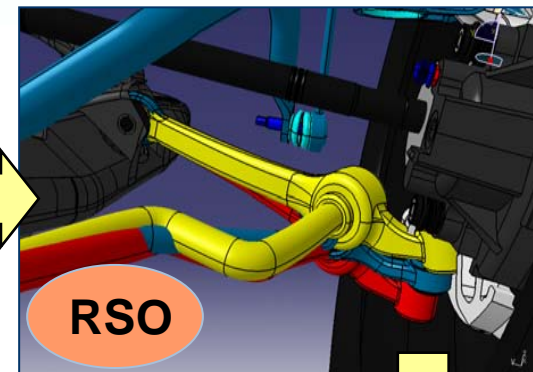→ Check kinematics and interferences in Product by representing Parts deformation
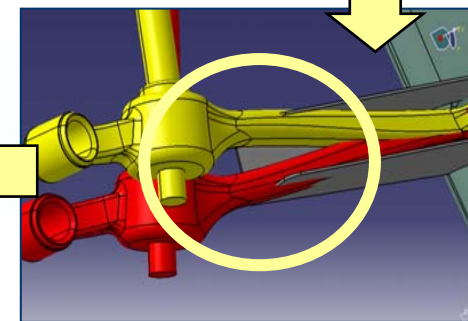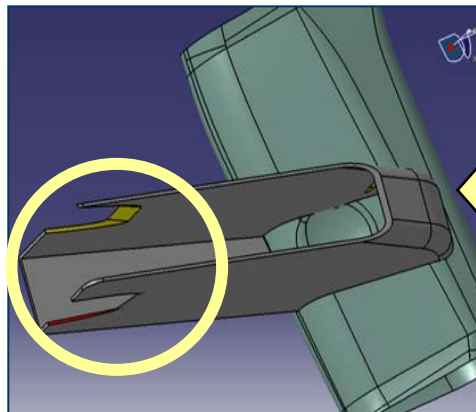
Suspension part

CATIA V5 Generative Structural Analysis

How the part will look like when "in work"

RSO

Optimize design (body removal operation)

Interferences

3

RSO : When you need to…

- **Simulate a Mechanism under Operation Conditions**

| Nominal Design → Prototyping → Inspection → Deformation vectors = displacements |

Nominal Design → **Prototyping** → Inspection → *Deformation vectors = displacements*

Nominal Design → **FE Meshing** → Simulation

Possibility to include "real" Part shapes into Digital mock-up for further control or design operations

Nominal Shape *PLUS* Deformations ← **RSO** ←
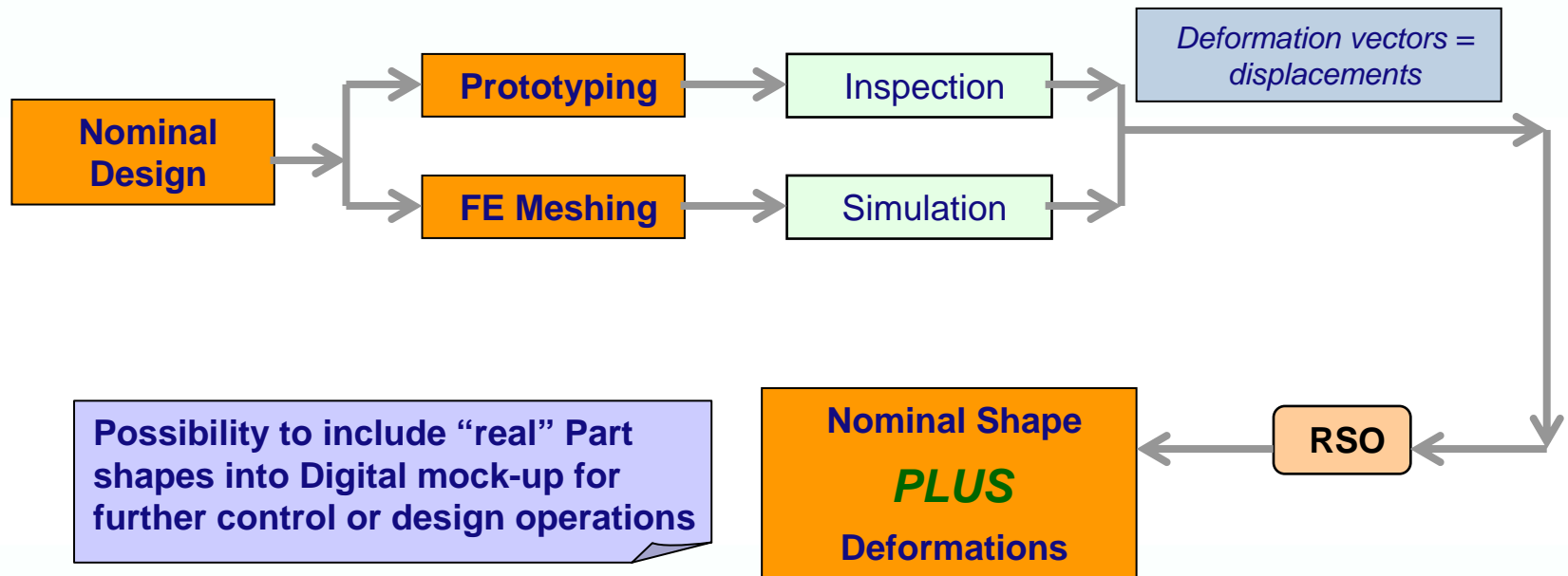
RSO : When you need to…

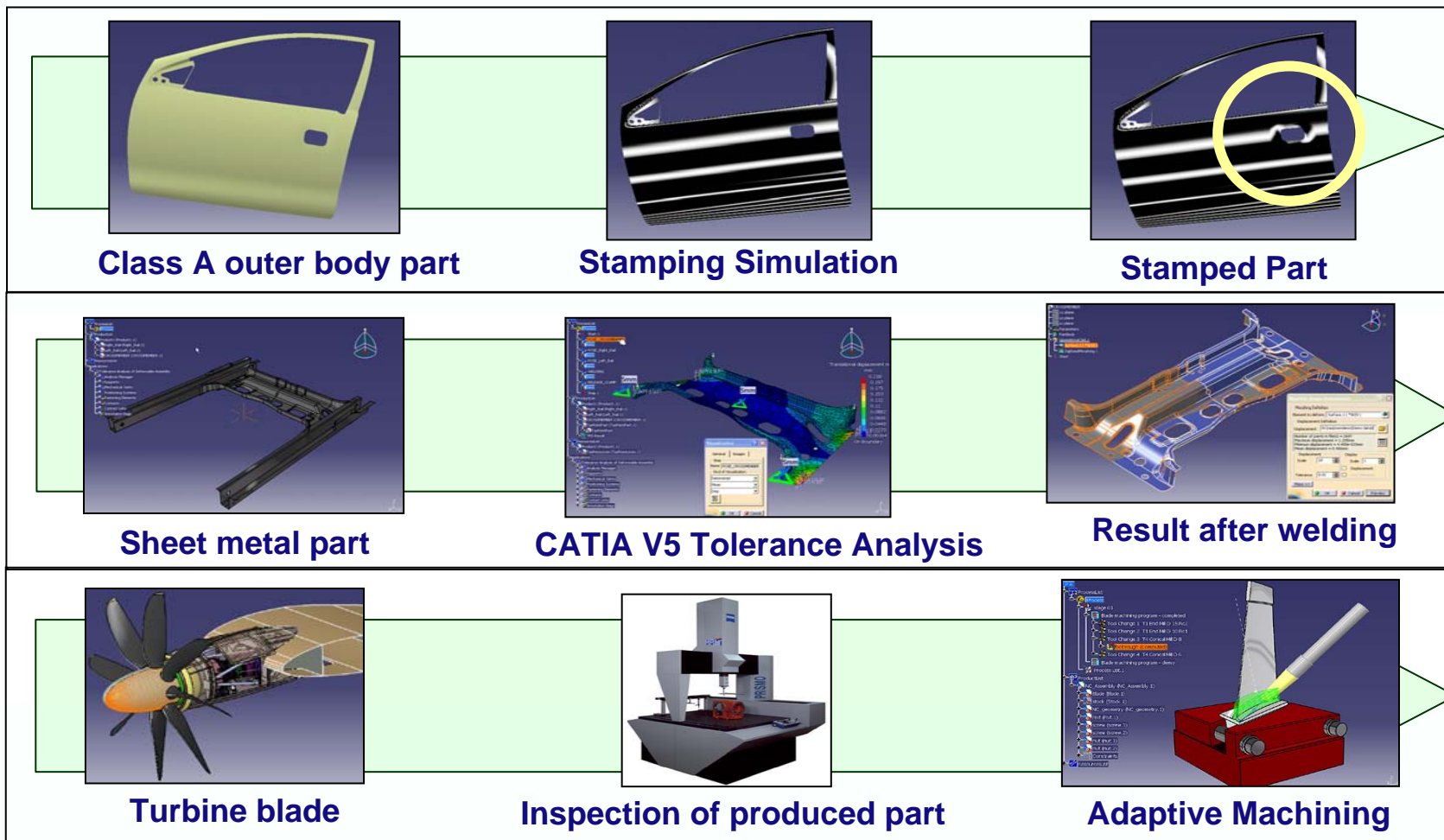■ **Assess Impact of Manufacturing Process on the Part :**

→ Part Design : optimize definition based on measurement "as built" compared to CAD initial definition

→ Tooling Design (Casting, Die, Mold) : integrate counter-deformation by anticipating physical effects (stamping springback, thermal shrinkage, mechanical stress…)

Deformation vectors = displacements

Prototyping → Inspection

Nominal Design

FE Meshing → Simulation

Nominal Shape MINUS Deformations

RSO

Possibility to counter-deform objects to compensate for measured manufacturing deformation

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Many Industrial Cases…

Class A outer body part

Stamping Simulation

Stamped Part

Sheet metal part

CATIA V5 Tolerance Analysis

Result after welding

Turbine blade

Inspection of produced part

Adaptive Machining

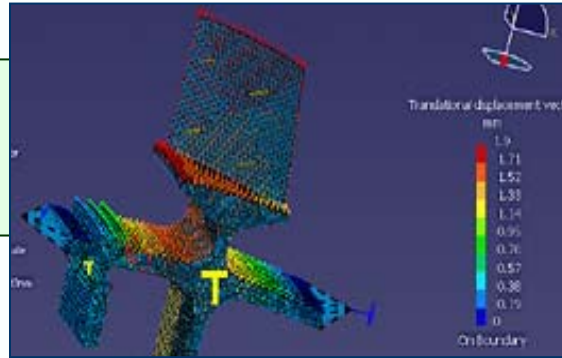**Nominal design**

Analysis / Inspection

Part "as built"

Many Industrial Cases…
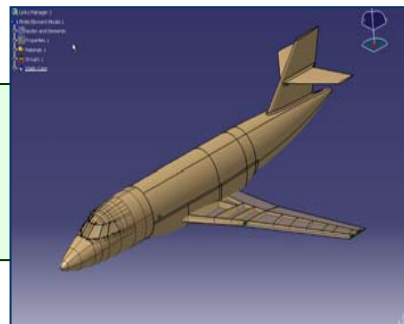

Turbine blade

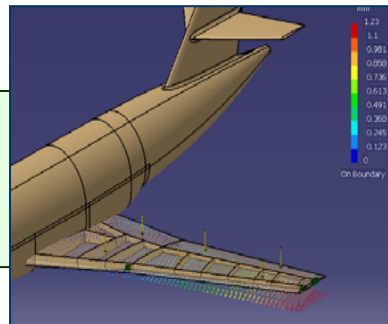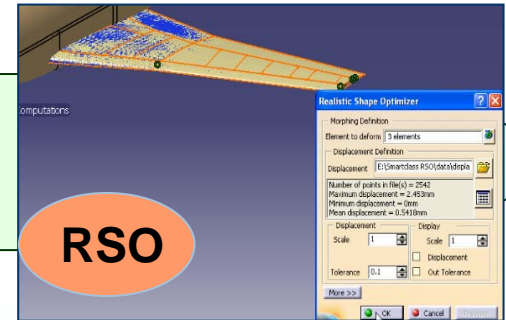**FE Analysis (CAA partners)**

RSO

How the part will look like when "running"

Aircraft wing

CATIA V5 Generative Structural Analysis
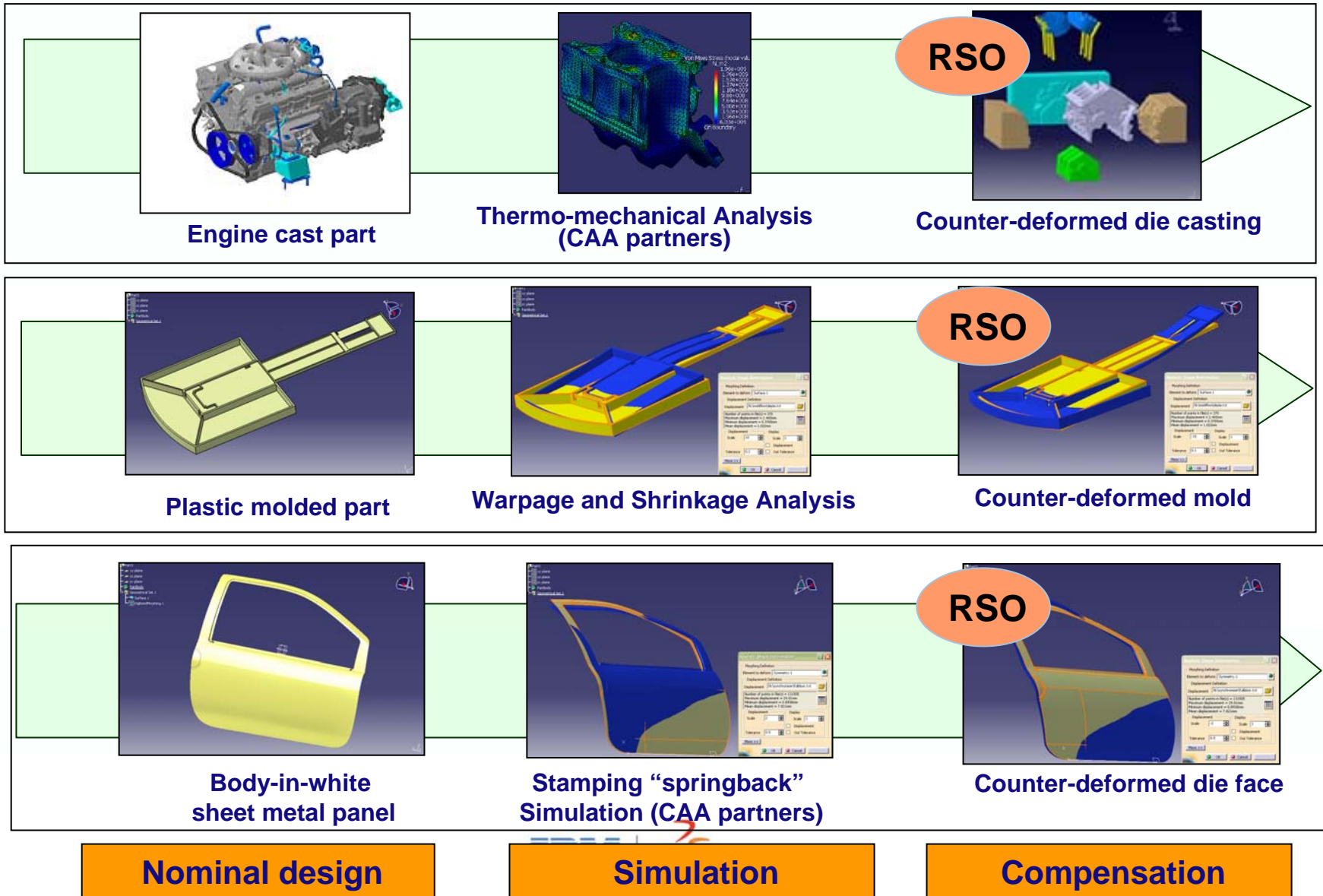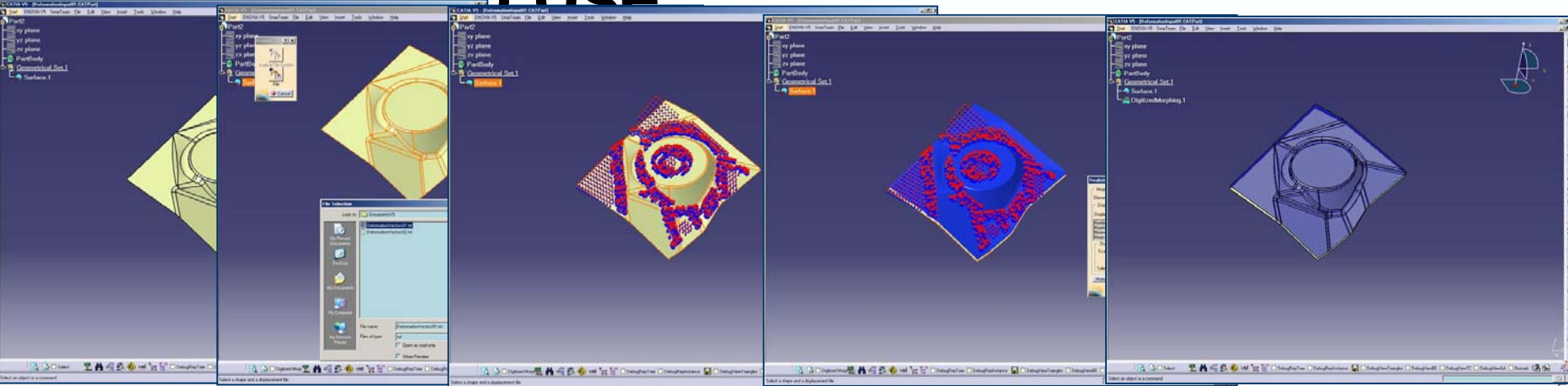
RSO

How the part will look like when "flying"

Nominal design   **Analysis / Simulation**   **Part "at work"**

Many Industrial Cases…

Engine cast part

Thermo-mechanical Analysis (CAA partners)

RSO

Counter-deformed die casting

Plastic molded part

Warpage and Shrinkage Analysis

RSO

Counter-deformed mold

Body-in-white sheet metal panel

Stamping "springback" Simulation (CAA partners)

RSO

Counter-deformed die face

Nominal design

Simulation

Compensation

8

RSO : Easy to Use

Shape to be deformed

Input Points

Display Displacement Vectors

Scaling Parameter, Tolerance Polygonal preview

Compute resulting Feature

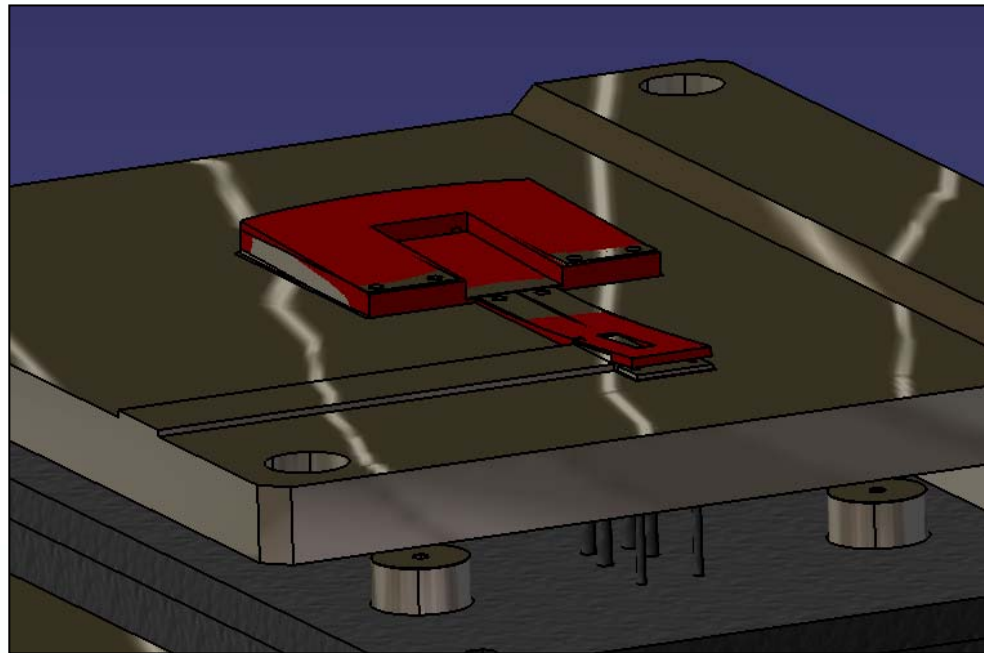**X,Y,Z,DX,DY,DZ**

X,Y,Z,DX,DY,DZ

X,Y,Z,DX,DY,DZ

X,Y,Z,DX,DY,DZ

• Any ASCII File
• From CATIA V5 Analysis: Translational displacement

Let us Have a Closer Look …

Demonstration : Generative Tooling Deformation

And the Benefits are…

- **Avoid building expensive physical mock-up**

- **Integrate Manufacturing Constraints into Design**

- **Minimize Assembly Try-out**

- **Optimize Machining Time**

- **…**

→ Increase Quality

→ Save Money

Already many success stories in Automotive, Aerospace, Consumer Goods, …

… Create your own !!!

Thank You !