

# Introducing

**ELEMENTS**

**A new groundbreaking CAE solution  
for Vehicle Design applications**

# The Players

## AUTO RESEARCH CENTER

Automotive Engineering R&D, Wind Tunnel, 7-Post & Gearbox Rig

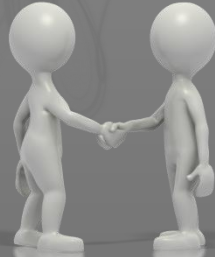


## ENGYS

CFD Engineering, Open Source Software Development, User Support



Joint  
Venture



## STREAMLINE SOLUTIONS

**ARC** and **ENGYS** unique combination of automotive engineering resources and CAE software development expertise

# The Concept

Software suite satisfying the needs of styling, engineering and management

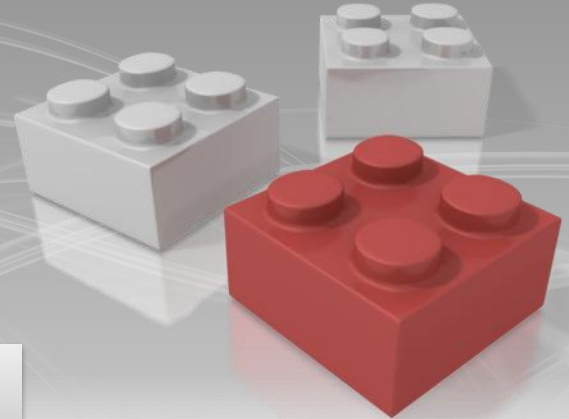
Advanced Graphical User Interface (GUI) for ease-of-use

Embedded best practices for best-in-class vehicle design simulation

First-class user support and extensive written documentation

Modular program architecture for fast expansion and development

Open Source CFD engine based on OPENFOAM® Engys Edition



# The Strategy



Best Engineering  
Simulation  
Practices

Open Source  
CFD Methods  
Development

GUI for  
Automotive  
Applications

Experimental  
Correlation &  
Validation



# The Advantages

## **Integrated Solution**

Design, simulation, optimisation & visualisation

## **Cost-effective**

Reduce software and product costs

## **Highly Scalable**

No solver license = unlimited parallel execution

## **Well Validated and Broadly Used**

Extensive use for automotive CFD simulations

## **Zero Liability**

Professional LLC setup to eliminate software liability

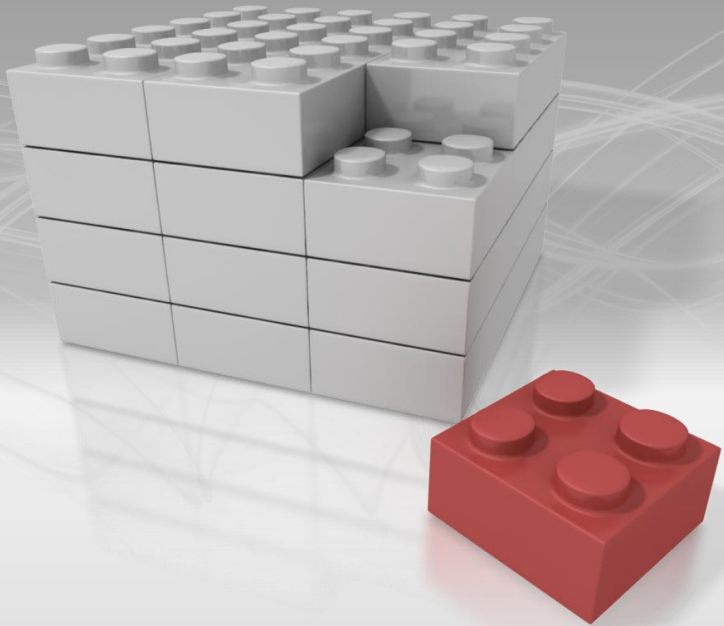
## **Customisable and Verifiable**

Fully-transparent, fast on-demand customisation

**OPEN SOURCE Software Platform**



# The Product



## **CAD, Styling and Surface Morphing**

CAD preparation, conceptual aero design

## **Case Manager**

Manage large datasets, multiple cases

## **DOE and Optimisation**

Design of experiments, advanced MDO tools

## **Automatic Parallel Meshing**

High-quality, fast, hex-dominant meshes

## **Open Source CFD Solvers**

Aerodynamic, thermal and aeroacoustic

## **Post-processing and Monitoring**

Specifically designed for automotive cases

All **ELEMENTS** incorporated into a single, advanced, easy-to-use, **GUI** environment

# The GUI

The screenshot shows the OpenFOAM GUI interface. On the left, the 'Project' tree is visible, with 'Solution Modelling' selected. Below it is a 'Patches' table listing various mesh patches. The central 'Solution Modelling' panel contains options for 'Time' (Steady, Transient), 'Turbulence' (RANS, LES/DES), and 'Select Model' (SpalartAllmaras). The right panel shows a '3D DISPLAY' of a motorcycle mesh with a rider, and a smaller rendered image below it. Handwritten red annotations include 'SELECTION TREE' pointing to the Project tree, 'OPTIONS' circling the Solution Modelling panel, and 'PATCHES' pointing to the Patches table.

**SELECTION TREE**

**OPTIONS**

**PATCHES**

**3D DISPLAY**

S	Name	Type
<input type="checkbox"/>	ceiling_Mesh.190	Wall
<input type="checkbox"/>	floor_Mesh.197	Wall
<input type="checkbox"/>	ife_power_Cube.010	Wall
<input type="checkbox"/>	ife_screen_Mesh.204	Wall
<input type="checkbox"/>	inlet_ceiling_lhs_inlet_ceiling_...	Inlet
<input type="checkbox"/>	inlet_lateral_lhs_Mesh.195	Inlet
<input type="checkbox"/>	light_Mesh.191	Wall
<input type="checkbox"/>	lining_cold_lining_cold.010	Wall
<input type="checkbox"/>	lining_lower_Mesh.194	Wall
<input type="checkbox"/>	lining_upper_Mesh.193	Wall
<input type="checkbox"/>	manikin_arm_Mesh.198	Wall
<input type="checkbox"/>	manikin_body_Mesh.199	Wall
<input type="checkbox"/>	manikin_feet_Mesh.200	Wall
<input type="checkbox"/>	manikin_head_Mesh.201	Wall
<input type="checkbox"/>	manikin_leg_...	Wall
<input type="checkbox"/>	manikin_leg_...	Wall
<input type="checkbox"/>	outlet_Mesh.196	Outlet
<input type="checkbox"/>	seat_Mesh.203	Wall
<input type="checkbox"/>	window_lhs_Mesh	Wall
<input type="checkbox"/>	back_Plane.001	Wall
<input type="checkbox"/>	front_Plane	Wall
<input type="checkbox"/>	symp_Plane.002	Symm...

# The Launch

## **JUNE 2012**

First release:

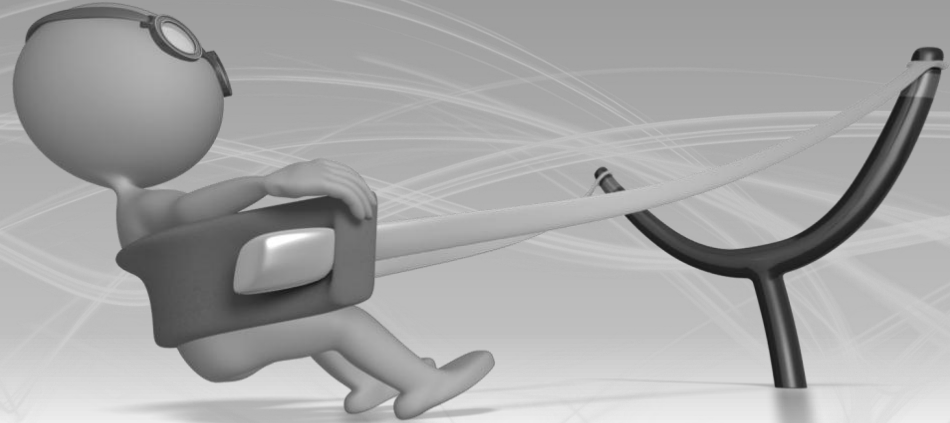
- Core GUI and CFD tools



## **SEPTEMBER 2012**

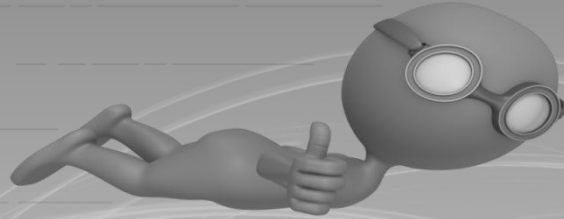
Second release:

- Meshing
- Case setup manager
- Solver execution
- Solution monitoring
- Best practices for all vehicle shapes





# The Roadmap



## **Q1-Q2 2013**

Surface morphing  
DOE case manager  
DAKOTA integration



## **Q3-Q4 2013**

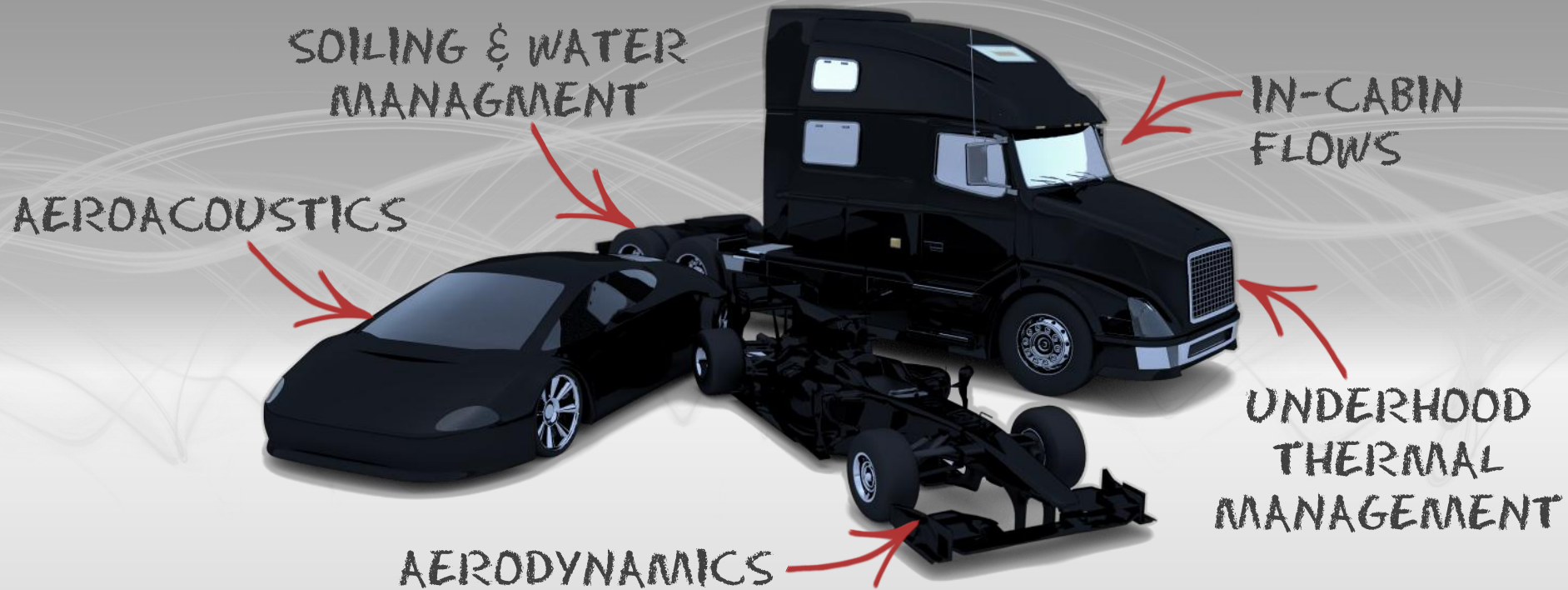
Styling tool  
Lagrangian solver  
Adjoint solver



## **Q1-Q2 2014**

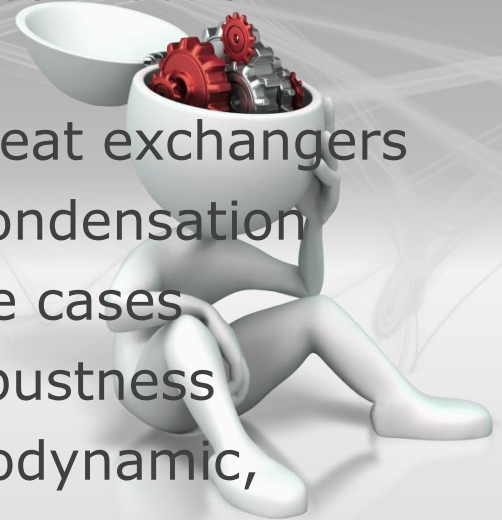
Integrated Post-processing &  
CAD preparation

# The Solution



# The Technical Stuff

- Hex-dominant, fully-conformal, body-fitted, parallel volume meshing with automatic surface wrapping
- RANS, DES and LES solvers
- Thermal solvers for natural, mixed and forced convection
- Thermal (DOM) radiation and solar radiation
- Cell zone support for MRF, porous media and heat exchangers
- Humidity transport with surface evaporation/condensation
- Specialised boundary conditions for automotive cases
- Improved numerical schemes for enhanced robustness
- Dedicated solution monitoring routines for aerodynamic, aero-acoustic and thermal calculations



# The Contacts



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