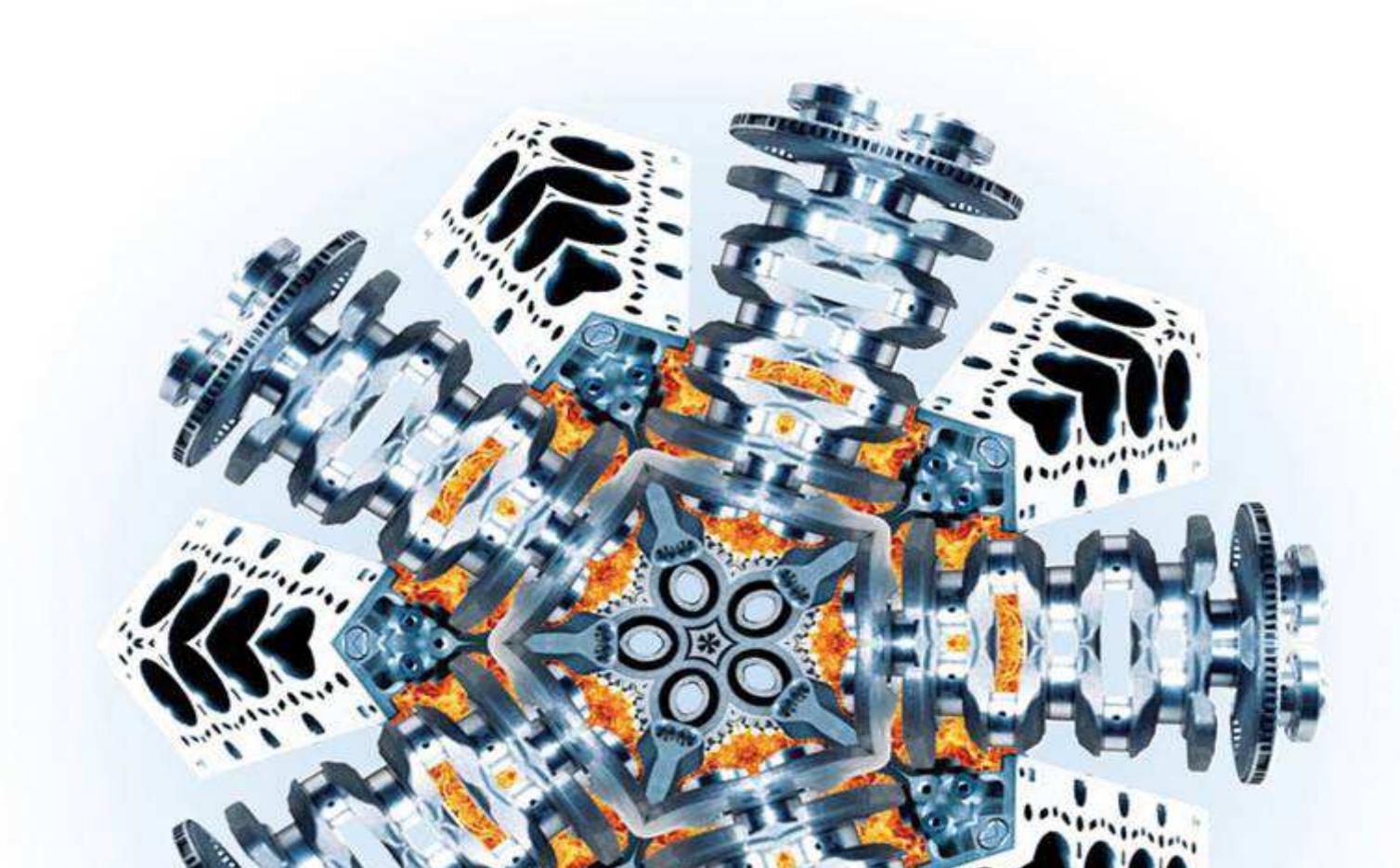


# AVL SCHRICK GmbH

Company Overview



## Agenda

- AVL Group – Brief Introduction

- AVL Schrick

# AVL VALUES AND PHILOSOPHY



Pioneering Spirit



Customer  
Orientation



Problem - Solving  
Capability



Responsibility



Independence

- We turn our visions into reality for the sake of our customers' success.
- With innovative and comprehensive solutions.

## Our Experience for Your Success



- AVL achieves unique results as regards to the development and improvement of all types of powertrains as well as in the field of measurement and test technology.
- AVL – more than 60 years' experience
- Involved in more than 1.500 engine development projects
- More than 4.000 engine test bed installations

## AVL cover all Customer Segments



Passenger Cars



2-Wheelers



Racing



Construction



Agriculture



Commercial Vehicle



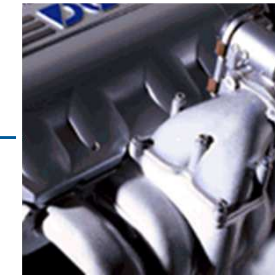
Locomotive



Marine



Power Plants



**AVL  
Powertrain  
Engineering**



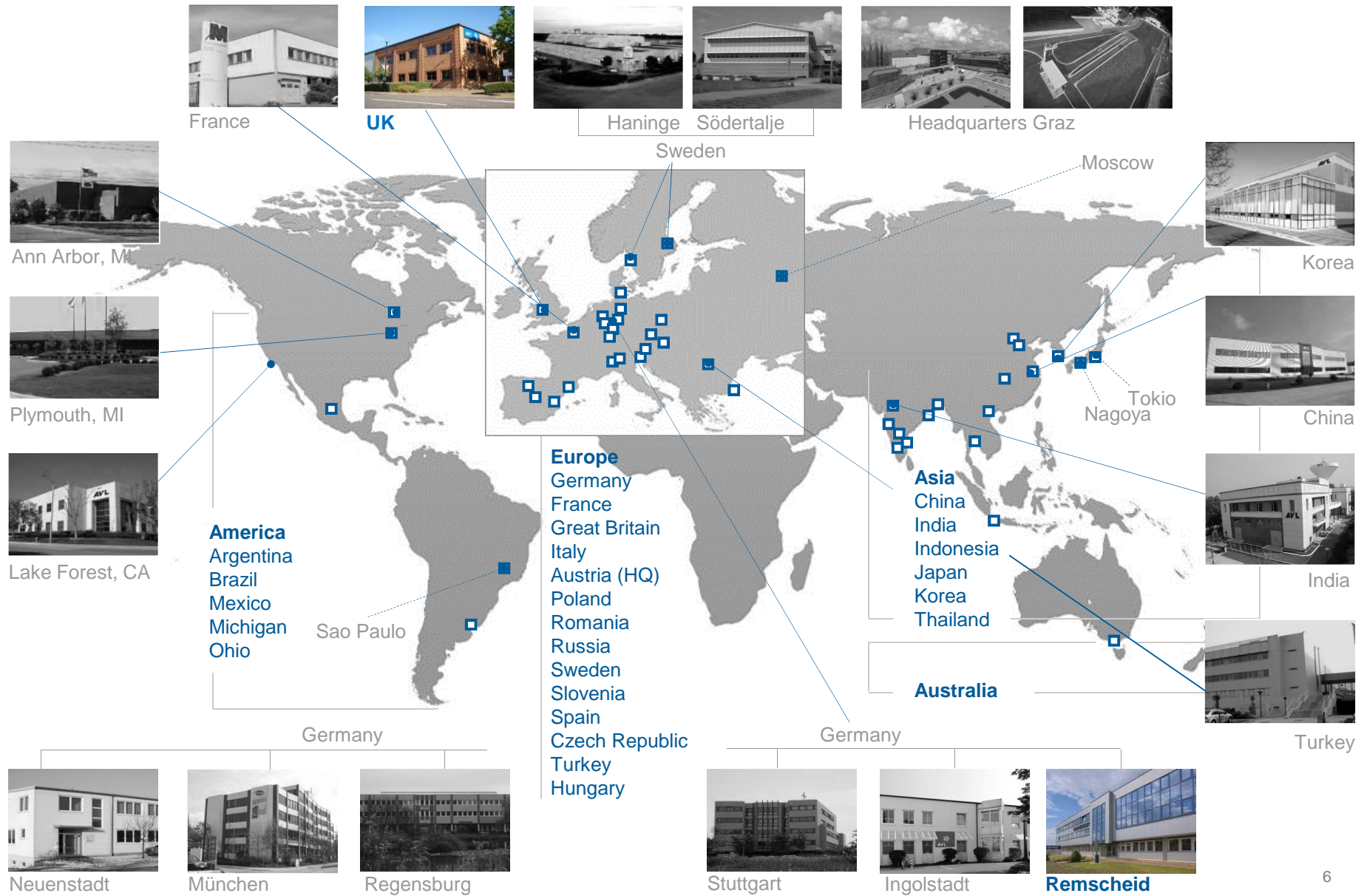
**AVL  
Advanced  
Simulation  
Technologies**



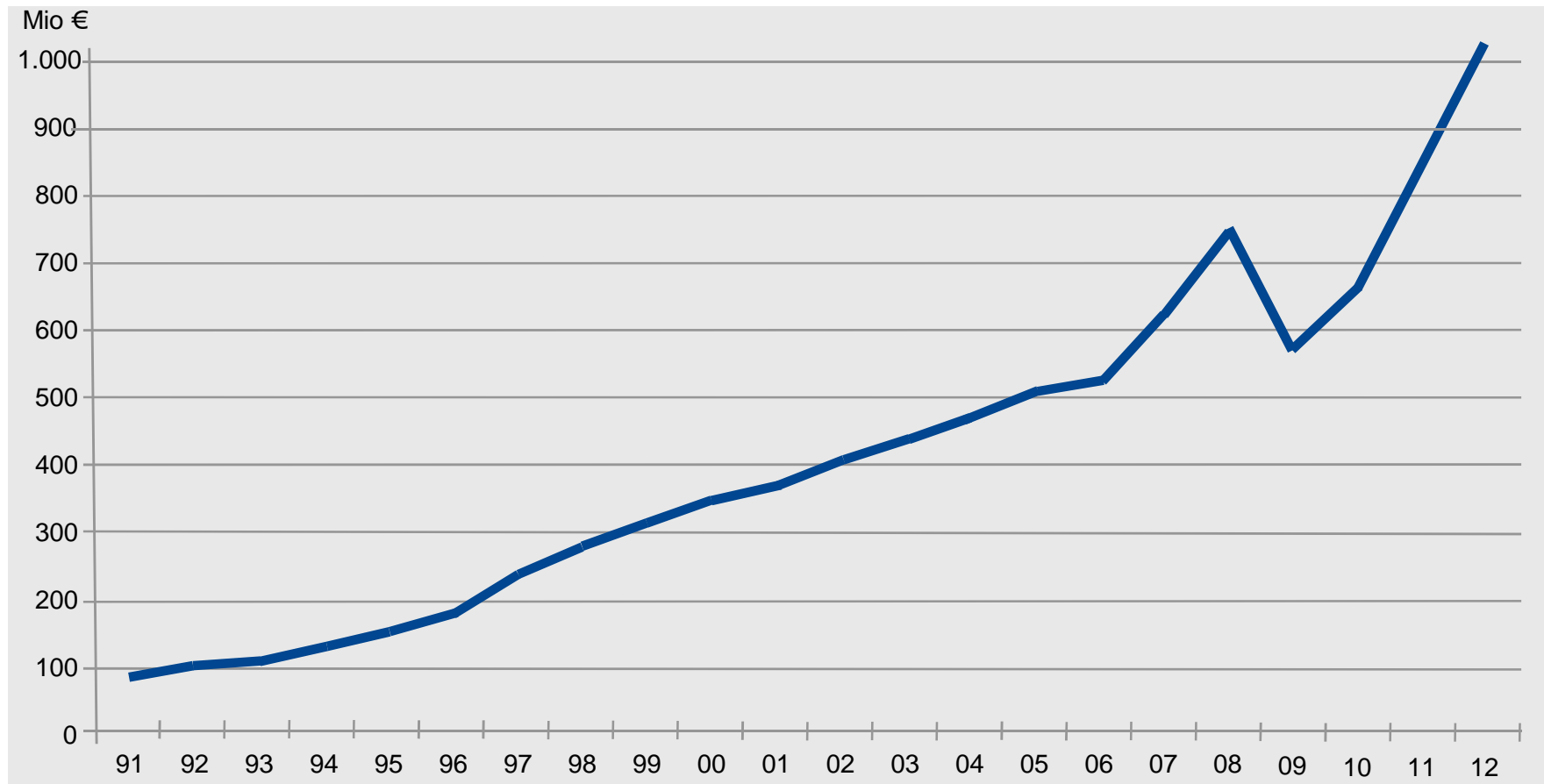
**AVL  
Instrumentation  
and Test Systems**



## AVL Global Partner



## AVL Facts



■ **Turnover**

1991: 95 Mio. €

2012: 1.007 Mio. €

■ **Employees**

1991: 950

2012: 5.500

■ **Average. R&D-Spending**

12% of turnover

## Agenda

- AVL Group – Brief Introduction

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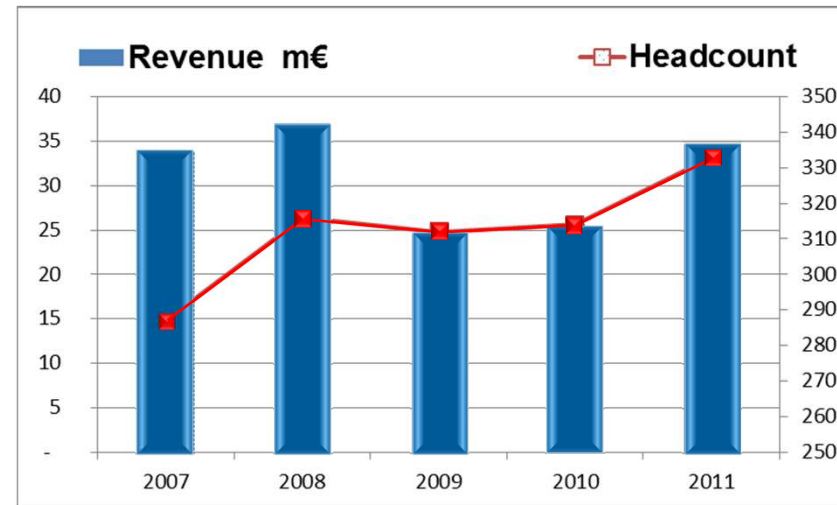
## AVL SCHRICK Overview

### Products

- Internal Combustion Engine Development
- Hybrid & Electric Vehicle
- Boosting System Development
- Combined Heat and Power Development and Manufacturing
- Prototype and Small Series Production Engines & Components

### Markets

- Passenger Car
- Commercial Vehicle
- Power Generation
- Racing
- 2-Wheelers & Compact Engines
- Aviation



Headcount including students & PhD

## History of AVL SCHRICK

**1969:** Foundation Dr. Schrick GmbH, Racing Components and Engines

**1991:** Gasoline Engine Development and Production

**1997:** Diesel Engine Development and Production

**2000:** Turbocharger Development



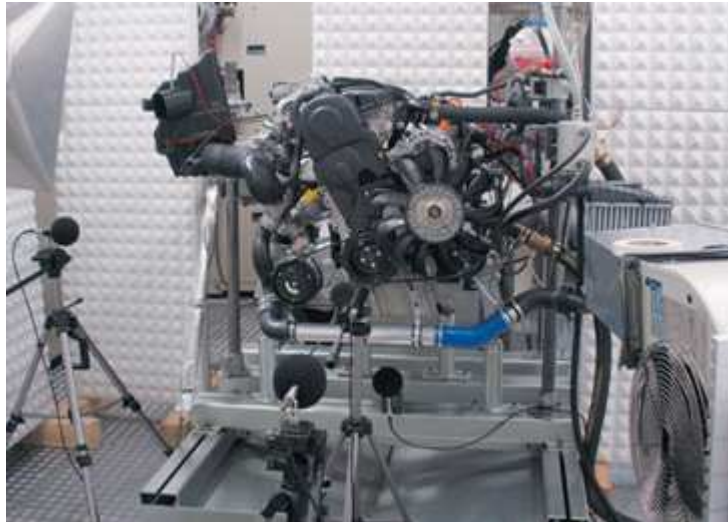
**2002:** **SCHRICK**  
MEMBER OF THE AVL GROUP

**2003:** Hybrid System Development / Vehicle Int.

**2005:** CHP Development and Production

**2007:** 

## Testing



- State-of-the-art development and durability test rigs:
  - 7 engine test beds
  - 2 drag test beds
- Special test rigs:
  - Turbo charger test bed
  - Tilt rig static & dynamic
  - Motored engine boosting
  - Cooling chamber for fired and non-fired operation
  - Flow-bench
- Engineering competence:
  - Thermo-management / -tribology
  - Engine mechanics / dynamics
  - Motored boosting technology

## Highlights: the Dynamical Tilt Rig



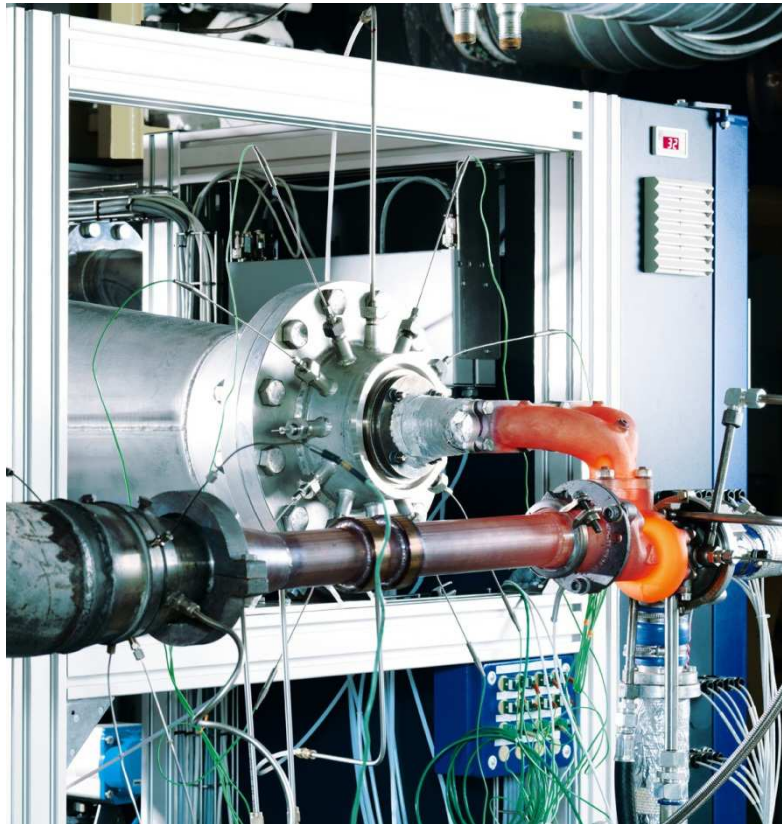
### Technical data:

- Performance: 750 kW
- Torque: 525 Nm
- Engine speed: 8.500 rpm
- Operation: fired & motored
- Online recording: various engine data incl. oil aeration
- Simulation: of dynamic test tracks
- Slewing speed: 180°/sec
- Slewing angle: +/- 70° for both axes  
( $\cong 2,7g$ )





## Highlights: the Turbo Charger Test Rig



- Diesel burner capacity approx. 380 kW
- Turbine min./max. flow 0,005 / 0,6 kg/s
- Turbine min./max. inlet temp. 250 / 1050 °C
- Turbine pressure control range 100 to 600 [kPa]

### Function & Performance Evaluation

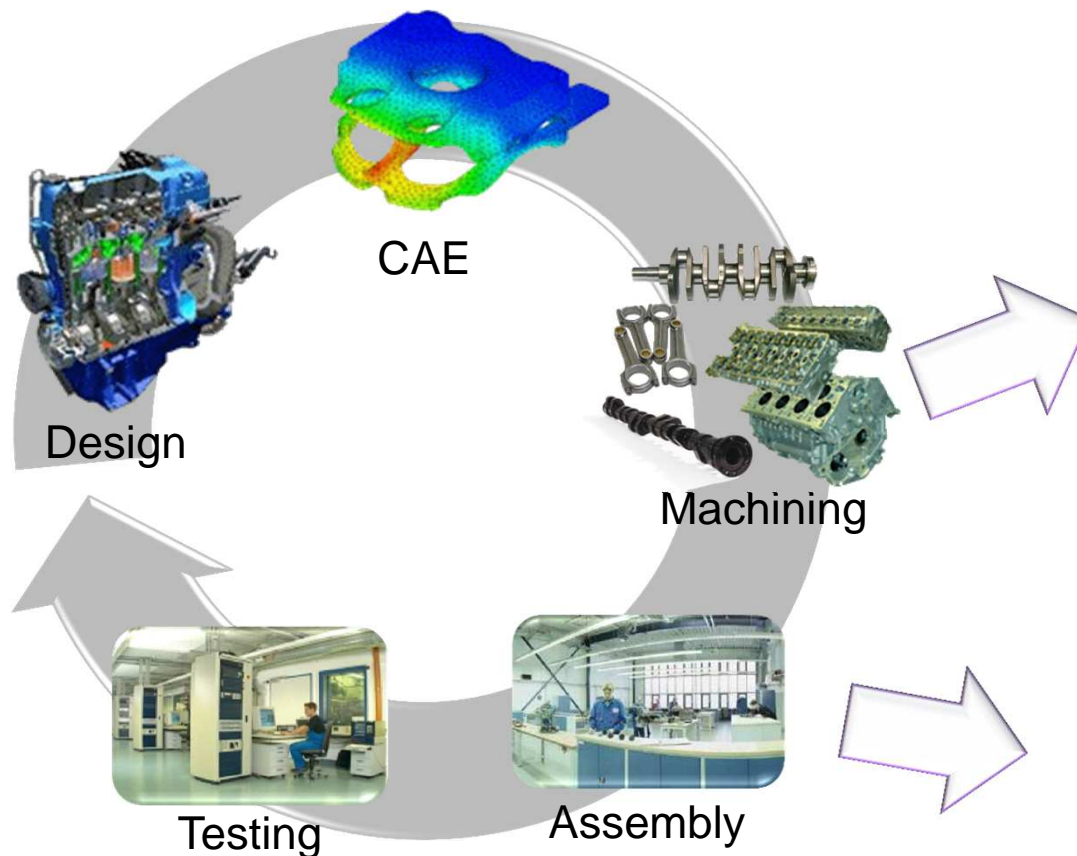
- Mapping of compressor & turbine
- Extended turbine maps
- Sequential and twin charger testing
- Crank case pressure simulation

### Endurance & Durability Evaluation

- Thermo shock cycles, Fatigue cycles
- High temperature creep testing
- Bearing endurance investigations (low oil, ..)
- Actuator durability cycles (VTG, waste gate)



## Machining & Assembly for Prototype and Small Series



### Machining

- 38 CNC cells available for engine part manufacturing
- Air conditioned workshop
- Fully implemented CIM (Computer Integrated Manufacturing)
- Complete quality assurance covered
  - 6 Coordinates measuring machines
  - Measurement of material hardness, surface quality and many items more...
  - High volume ultrasonic washing machines
  - Residual dirt analysis
- 85 employees in 3-shift with 5.000 machining jobs/year controlled by MES (Manufacturing Execution Systems)

### Assembly

- Capacity up to 5.000 engines per year
- Online part identification
- Controlled and recorded screw joints
- Automated leakage testing (coolant, lubricant, combustion)
- Fired End of Line testing



# AVL SCHRICK Production and Manufacturing



Procurement



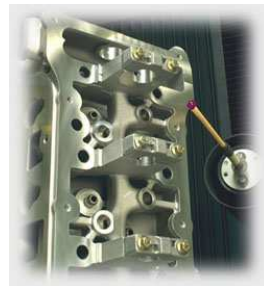
Logistics



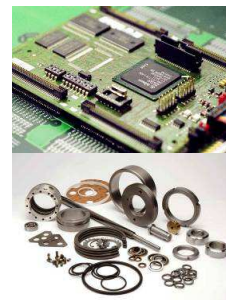
Manufacturing



Assembly



Quality Management



Spare Parts



High Performance



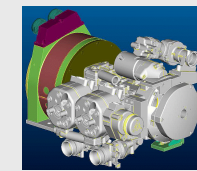
Recreational



Aviation



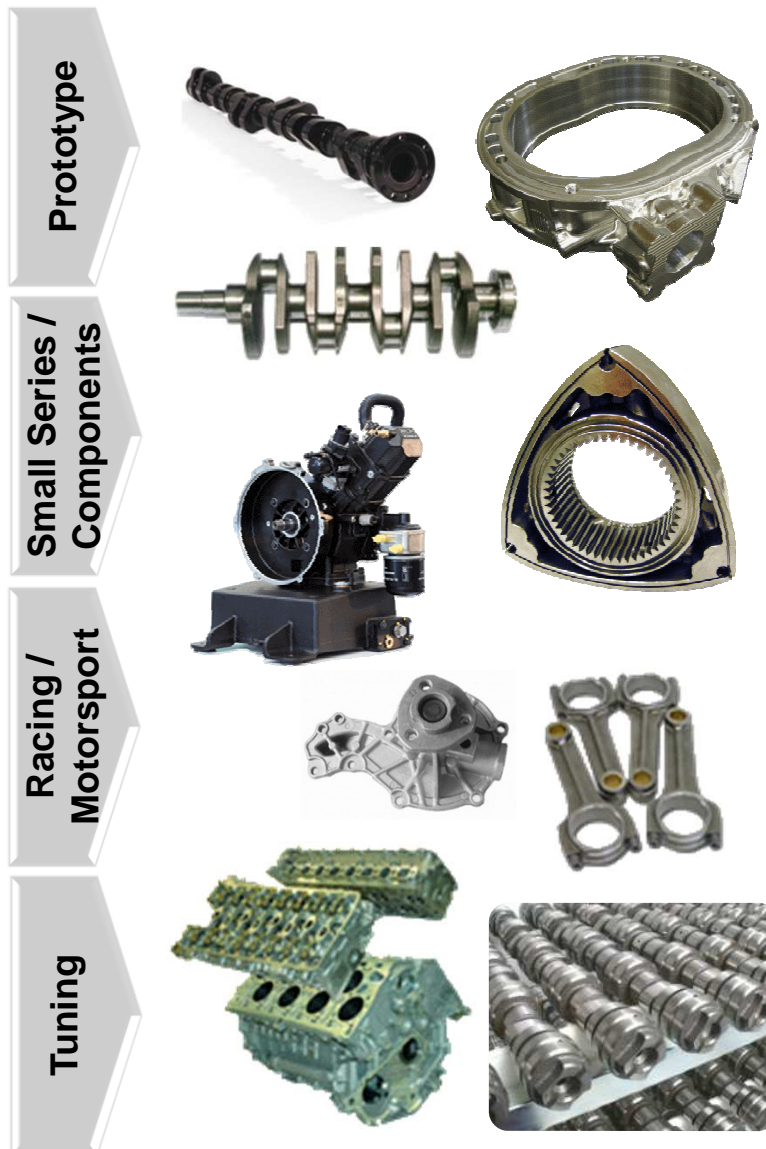
Power Gen



Combined Heat and Power



## Selection of Products



### WIDE PRODUCT RANGE

- State of the art manufacturing from 1 to 16 cylinder engines
- Batches from 1 piece up to ca. 5.000 p.a.
- Tooling design & fixture engineering
- Machining of standard and latest development materials, e.g. cast iron, aluminum alloy, magnesium, titanium

### MACHINING OF COMPONENTS

- 5 C's
- Gearbox components
- Pumps
- Turbocharger wheels
- Components for many other applications

### QUALITY

- Highest quality standards
- 100% traceability offered
- 3D measurement devices
- Measurement of material hardness, surface quality and many items more
- Supervision of external suppliers
- Established processes for series production

### CUSTOMER BENEFITS

- 35 years of top class motorsports experience
- In-house FEM, design and test beds
- Close relationship to casting & coating suppliers
- Fast reaction time, Short lead time

# AVL SCHRICK CUSTOMERS & QUALITY



## OEM



## Motorsport



## Quality

DIN ISO 9001  
DIN ISO 14001

FORD Q1 – Award  
A-Status at VW



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Proprietary