LARGE ENTERPRISE VIEW ON COLLABORATIVE PROJECTS

EFECs Conference, Helsinki, Nov 20th, 2019
TTTech – an Embedded Systems Company
Advancing safe technologies, improving human lives
With our leading technology solutions, we ensure safety and electronic robustness for a connected, sustainable and automated world.
Piloted Driving
Ensuring Reliable Networks

Reliability
High-Performance

Ensuring Reliable Networks
Robustness
Secure - Connectivity
Not a lot of words – just a few impressions

Presentations anno 2009 …

A few sketches – intended goals - now we can show series production products
10 Years Growth

TTTech Computertechnik AG

Feb 2008 ARTEMIS-JU launch

150 employees All under one „roof“

LE >1700

SME 150

1700 employees TTTech, TTTech Auto AG & TTTech Industrial Automation AG spun off in separate corporations
TTTECH GROUP | truly global – we love our partners and customers

FOOTPRINT | TTTECH PARTNERS AND OFFICES

13 COUNTRIES
AUSTRIA HQ
GERMANY 3
USA 2
SERBIA 1
CZECH REP. 1
ITALY 1
CROATIA 1
BOSNIA 1
ROMANIA 1
FINLAND 1
CHINA 1
JAPAN 1
SPAIN 1

1,700+
EMPLOYEES / SUBCONTRACTORS
R&D/ENG./ADMIN. 717
AUTO-MOTIVE 612
INDUST.-RIAL 86
OFF-HIGHWAY 127
AERO-SPACE 158

NETWORK | SELECTED MANUFACTURERS, COOPERATION PARTNERS, AND CUSTOMERS

November 19, 2019 TT Tech Confidential and Proprietary Information
More than 20 years of Experience in Fail-Operational Systems

Experts in design assurance and safety standards across multiple industries

IEC 61508
EN/ISO 13849
ISO 26262
DO 178C/254
TTTech Group Key Facts

Globally oriented group of high-tech companies, headquartered in Vienna, Austria

20 years of innovation leadership
successful transfer of ground-breaking research to high-volume production

Privately held joint Austrian stock company with solid financial base and diversified shareholder basis

More than 1700 people work for TTTech Group in 13 countries

Asset Light → Flexible supply network with leading industry partners and research institutions

Launch of TTTech Auto AG with strategic partners in June 2018

Launch of TTTech Industrial Automation AG in August 2019

TTTech Gross Performance in MEUR

CAGR: >25%

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How do we see ARTEMIS / ECSEL at TTTech Computertechnik AG?

ARTEMI/ECSEL efficiently helps Organizations to build an ecosystem including SMEs/Academia

An OEM/Lage Research Organization is like a huge tree –
It can produce an incredible number of seeds …

… but with no suitable environment like ARTEMI/ECSEL
it will never become a wood!
How do we see ARTEMIS / ECSEL at TTTech Computertechnik AG? (2/2)

ARTEMIS/ECSEL efficiently helps Organizations to build an ecosystem including SMEs/Academia

An OEM/Lage Research Organization is like a huge tree –
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… but with no suitable environment like ARTETMIS/ECSEL it will never become a wood!
TTTech – ARTEMIS & ECSEL Projects

**ARTEMIS:**
- 2008: INDEXYS
- 2009: ACROSS
- 2010: pSafeCer
- 2011: nSafeCer
- 2012: CRYSTAL
- 2013: EMC2

**ECSEL:**
- 2014: 3Ccar
- 2015: ENABLE-S3
- 2016: Autodrive
- 2017: PRYSTINE
- 2018: NewControl
- 2019: ??

(ADACORSA, ALMAe, BRAIN, HERMES-SRS, TRUST2ALL)
Introduction

ARTEMIS & ECSEL Projects
Introduction

Current Partner Network – more than 20 Countries

Austria
Belgium
Czech Republic
Denmark
Finland
France
Germany
Great Britain
Greece
Hungary
Ireland
Italy
Latvia
Lithuania
Luxembourg
Norway
Poland
Portugal
Slovakia
Spain
Sweden
Switzerland
The Netherlands
R&D Partnerships due to funded Projects

R&D cooperation with industry

- **Aerospace**: Airbus, Boeing, Diehl, Honeywell, Liebherr, Safran, Thales, UTC Aerospace Systems, NASA, ARIANE Space, etc.
- **Automotive**: Audi, BMW, Daimler, Samsung, AVL, Continental, Delphi, Denso, Valeo, Volvo, etc.
- **Industrial**: Intel, Alstom, IBM, Siemens, Sysgo, Thales Austria, etc.
- **Off-Highway**: Rosenberger, Prinoth Leitner, Claas, Palfinger, Schwing, etc.
- **Semiconductors**: ams AG, Infineon, Intel, NXP, Renesas, ST Microelectronics, etc.

R&D cooperation with universities & research organizations

- **Universities**
  - Vienna University of Technology
  - Berkeley University of California
  - Chalmers University of Technology
  - KTH
  - University of Siegen
  - University of Kaiserslautern, etc.

- **Research Organizations**
  - Austrian Institute of Technology
  - Barcelona Supercomputing Center
  - CEA
  - Technalia
  - Fortiss GmbH
  - Fraunhofer Society,
  - SRI,
  - TNO, etc.

International research network

- **EC-funded projects** in ARTEMIS, ECSEL, ITEA 1&2, Eurostars, Greencars, Cleansky, Marie Curie and other R&D Projects directly funded in FP5, FP6, FP7, H2020
- **US programs**: NASA, DARPA, NSF

Visit us at: https://www.tttech.com/company/research-projects/
Best Practice of utilizing Funding Opportunities

- **Sikorsky** 2016
- **COMAC** 2016
- **Embraer Legacy 450/500** 2013
- **Bombardier C-Series** 2013
- **Boeing 787** 2011
- **Airbus A380** 2007
- **Thales Austria Interlocking/Signalling** 2004
- **ORION** 2008
- **Data Logger** 2012
- **Switch A664** 2015
- **Vestas** 2014/15
- **Multi-Core** 2015
- **HY-eVision^2** 2016
- **HY-TTC 94** 2016
- **Ariane 6** 2015
- **ADAS** 2016
- **VOLVO C30** 2012/13
- **TTC500, TTC30XS, TTC48XS** 2014/15
- **Vestas** 2014/15
- **NXP Chip**
- **TT - NOC**
- **TTSafety**
- **TSN-OPC/UA**

**Years and Projects**
- **1996 – 2015**: TTEthernet
- **2005 – 2019**: TT - NOC
- **2002 – 2016**: TTSafety
- **2009 – 2022**: TSN-OPC/UA
- **2014 – 2022**: New Control

**Other Projects**
- **MFN 100, NFN 200, NFN 300** 2016/17
- **Thales Austria Interlocking/Signalling** 2004

**Additional Technologies**
- **Thales Austria Interlocking/Signalling** 2004
- **Switch A664** 2015
- **Vestas** 2014/15
- **ORION** 2008
- **Data Logger** 2012
- **Switch A664** 2015
- **Vestas** 2014/15

**Other Companies**
- **Thales Austria Interlocking/Signalling** 2004
- **Switch A664** 2015
- **Vestas** 2014/15
- **ORION** 2008
- **Data Logger** 2012
Idea to Product – Support by ARTEMIS/ECSEL

**Value**

**Product Steering Committee**

**Gate Review**

**Time**

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<th><strong>End of Life</strong></th>
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**Hardware**

- **Prototype**: Use in the lab / for development / design-ins
- **Preseries**: Limited number of units available
- **Series**: Limited documentation available
- **End of Life**: Limited test coverage (HW, SW, produced units)
- Major changes possible (API, pinning, housing)

**Software**

- **Prototype**: Full functionality
- **Preseries**: Not fully tested
- **Series**: Safety Manual draft
- **End of Life**: Safety Manual

**Prototype**

- Use in preseries vehicles
- EMC/environmental precompliance tests done
- End-of-line test at production facility
- API, housing and pinning stable and backward compatible
- Automotive SPICE Level 3 (series QM Quality)
- Functional Safety Audit
- Qualification documentation
- Safety Manual

**Preseries**

- Use in preseries vehicles
- SW/HW User Documentation available
- End of line test at production facility
- API, housing and pinning stable and backward compatible

**Series**

- Use in series vehicles
- All requirements and standards fulfilled
- EMC / environmental compliance tests done

**End of Life**

- Product discontinuation information at least 6 months before End-Of-Life

**Options**: replacement by new product or last-time-buy

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November 19, 2019
Introduction

TTTech – Value of funded Projects in ARTEMIS & ECSEL

❖ ARTEMIS & ECSEL are reliable Partners for funded Projects of small to large scale (there is space for every organization size!)

❖ Get parts of your R&D work funded – reduce risk

❖ But it is not only the funding:
  a) building a **substantial international network** for any kind of cooperation
  b) meet potential customers and learn about their **requirements, needs & skills**
  c) provide an **opportunity for potential customers** to learn about your skills
  d) **win customers** that will use your developments and resulting products
  e) share & **mitigate the risk** of innovation and R&D
  f) **remain well informed** about other technologies developed in the community
Introduction

Benefit for the European Society from TTTech developments (1/2)

The Network-Architectures, Control Computers, Network Components and Safety & Security products developed with Support of ARTEMIS & ECSEL provide the following benefit to European Society:

a) **Enable autonomous driving** (network-architecture, network components, central control computer Safety & Security products, tools)

b) **Support Industry 4.0** - digital manufacturing (networks, software significantly supporting the safety & security functions, edge computing computers and software)

c) **Networks for Industrial applications** like off-shore wind-power plants use TTEthernet Networks and components based on ARTEMIS & ECSEL project results

d) **Aerospace on-board components & networks** for almost all large passenger aircraft build on ARTEMIS & ECSEL project results
Introduction

Benefit for the European Society from TTTech developments (2/2)

The Network-Architectures, Control Computers, Network Components and Safety&Security products developed with Support of ARTEMIS & ECSEL provide the following benefit to European Society:

e) **Space components and networks from Europe** for NASA & ESA were researched in ARTEMIS & ECSEL projects

f) **Off-Highway applications** in the agricultural machine & vehicles sector are based on ARTEMIS & ECSEL

g) **Provides significant employment** contribution with high tech jobs in the area of industrial development and R&D

h) **Contributes to keep Europe at the leading edge** of technology and supports efforts to **keep Europe competitive & preserving European welfare an employment**.
Thank you very much for your attention!