AIT Austrian Institute of Technology

Machine Vision in Austria

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High-Performance Image Processing

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Overview

- ■ **Austria**

- ■ AIT Austrian Institute of Technology

- ■ Selected Research Projects
    - ■ Stereo Vision
    - ■ Airport Security and Border Control
    - ■ Surveillance and Protection
    - ■ High Performance Vision

- ■ Characteristics of the MV market in Austria

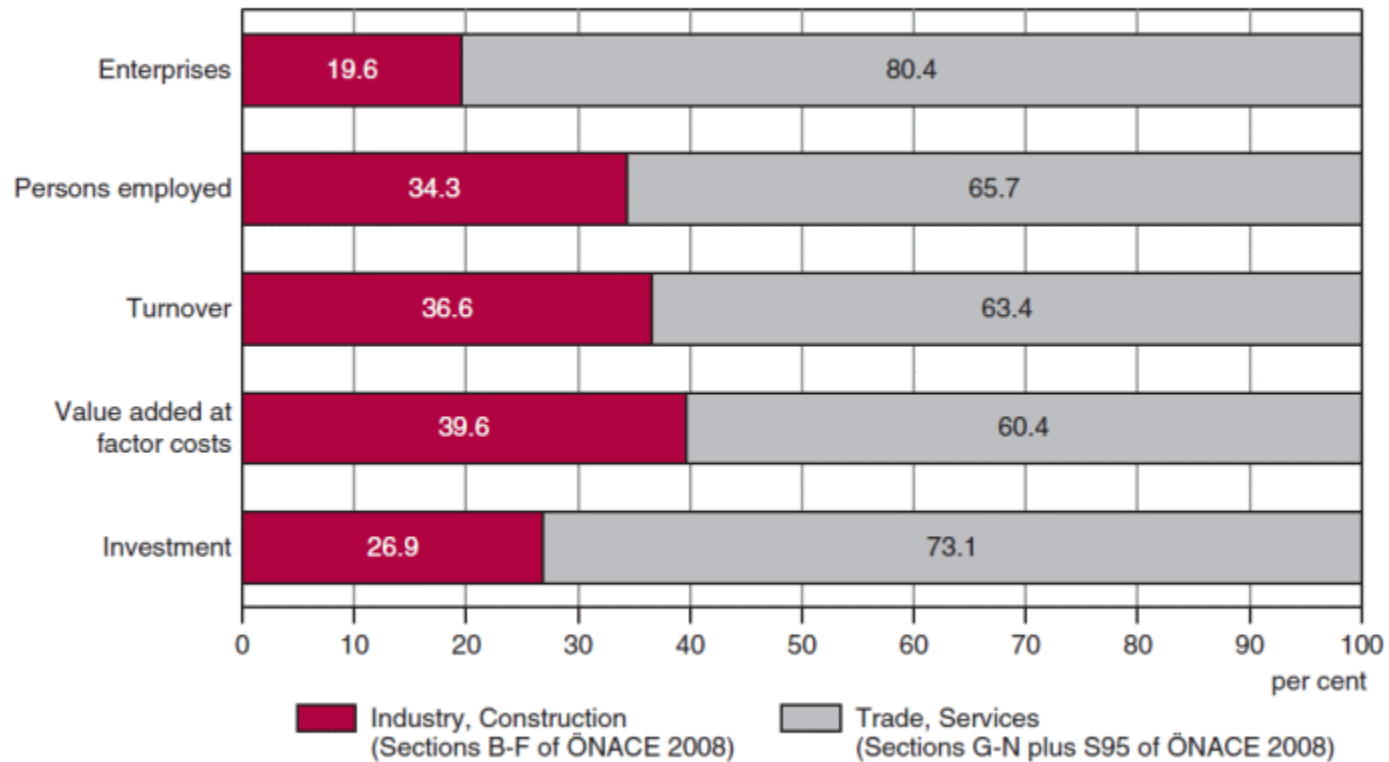# Austria - In the Middle of Europe

Austria - Data

Language: German (Deutsch)

Population: 8.5 million

Area: 83 871 km²

Largest City: Vienna (Capital, 1.8 million, 415 km²)

GDP per capita: 43 848 USD (31 650 EUR)

Real GDP growth: 0.9 % of GDP

GDP per capita ranking: 11th richest country world-wide (IMF 2013)

                                   15th richest country world-wide (World Bank 2012)

                                   2nd ranked country in EU (after Luxembourg)

Imports of goods and services: 54.0 % of GDP

Exports of goods and services: 57.2 % of GDP

Unemployment rate: 4.4 %
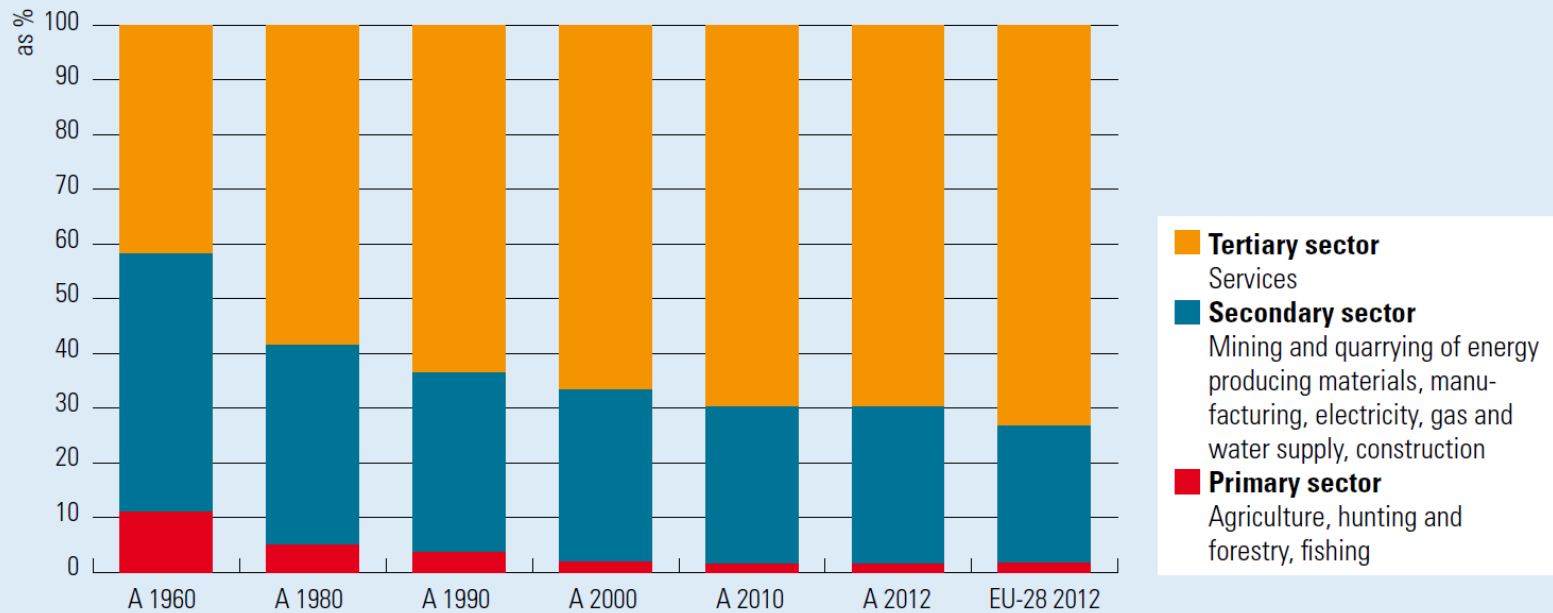
Data from 2012

Austria - Business

Industry, construction and trade, services 2011 in comparison

	Industry, Construction (Sections B-F of ÖNACE 2008)	Trade, Services (Sections G-N plus S95 of ÖNACE 2008)
Enterprises	19.6	80.4
Persons employed	34.3	65.7
Turnover	36.6	63.4
Value added at factor costs	39.6	60.4
Investment	26.9	73.1

S. STATISTICS AUSTRIA, Structural Business Statistics 2011. Compiled on June 28th, 2013.

Austria - Economy

Fraction of gross value added

Bar chart legend:
- **Tertiary sector** — Services
- **Secondary sector** — Mining and quarrying of energy producing materials, manufacturing, electricity, gas and water supply, construction
- **Primary sector** — Agriculture, hunting and forestry, fishing

X-axis categories: A 1960, A 1980, A 1990, A 2000, A 2010, A 2012, EU-28 2012

Y-axis: as %

S: STATISTICS AUSTRIA, Eurostat.

Austria – Economic Sectors

| Sections (Based on ÖNACE 2008)	Enterprises	Total persons employed 2011 (annual average)	Turnover in billion €	Value added at factor cost in billion €	Persons employed per enterprise	Value added at factor costs in € per person employed
B-F Industries and Construction	61 036	939 383	254.1	71.3	15	75 901
B-E Industries	29 463	660 595	213.6	57.0	22	86 309
B Mining and Quarrying	355	5 997	2.4	1.3	17	215 980
C Manufacturing	25 139	606 964	173.4	48.4	24	79 728
D Electricity, Gas, Steam and Air Conditioning	1 961	28 763	33.0	5.6	15	194 786
E Water Supply; Sewerage, Waste Management and Remediation Activities	2 008	18 871	4.8	1.7	9	91 409
F Construction	31 573	278 788	40.5	14.3	9	51 240

S: STATISTICS AUSTRIA, Structural Business Statistics 2011.

Sections (of ÖNACE 2008)	Enterprises	Total persons employed (annual average)	Turnover in billion €	Value added at factor cost in billion €	Persons employed per enterprise	Value added at factor costs in 1 000€ per person employed
G-N Trade and services	250 037	1 800 347	440.4	108.6	7	60
G Trade	74 765	628 922	240.6	31.0	8	49
H Transportation and storage	14 089	208 793	38.6	13.5	15	65
I Accommodation and food service activities	43 989	269 967	15.4	7.3	6	27
J Information and communication	17 207	98 552	19.5	8.3	6	84
L Real estate activities	17 862	46 236	15.5	8.2	3	177
M Professional, scientific and technical activities	60 801	215 089	26.9	12.2	4	57

S: STATISTICS AUSTRIA, Structural Business Statistics 2011.

Austria – Economic Globalization

Top 10 trade partners according to intensity of foreign trade 2012
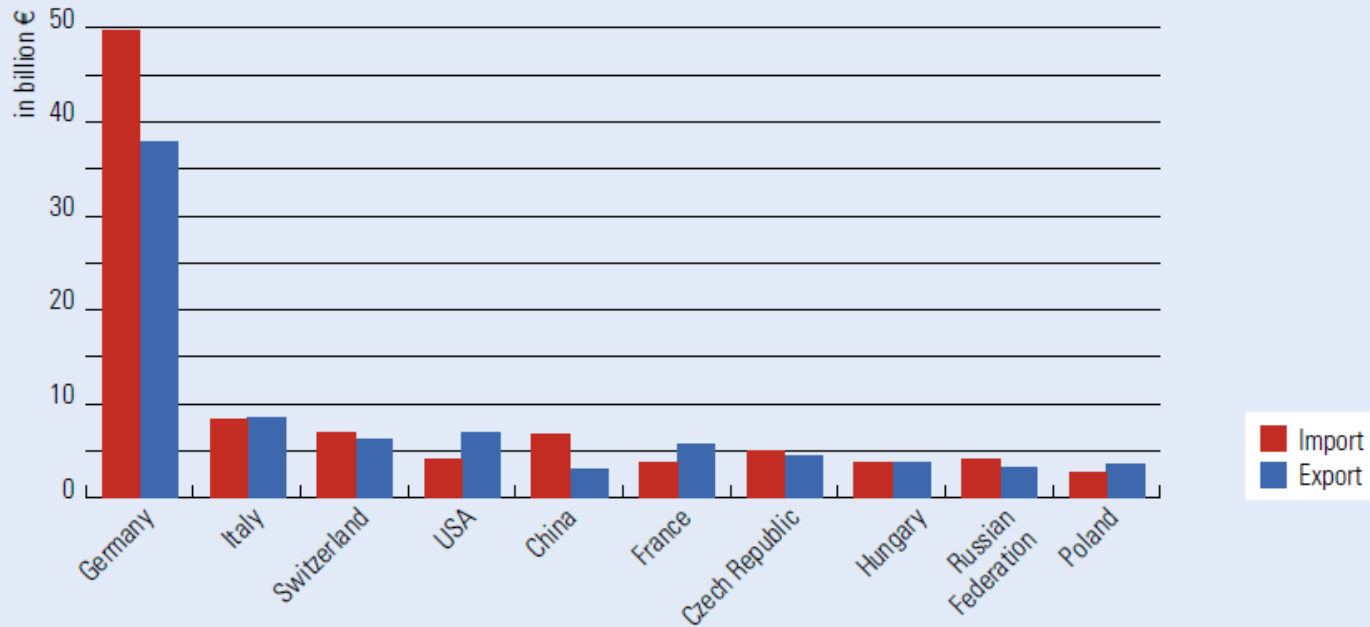
S: STATISTICS AUSTRIA, January to December 2012.

Austria - Brands

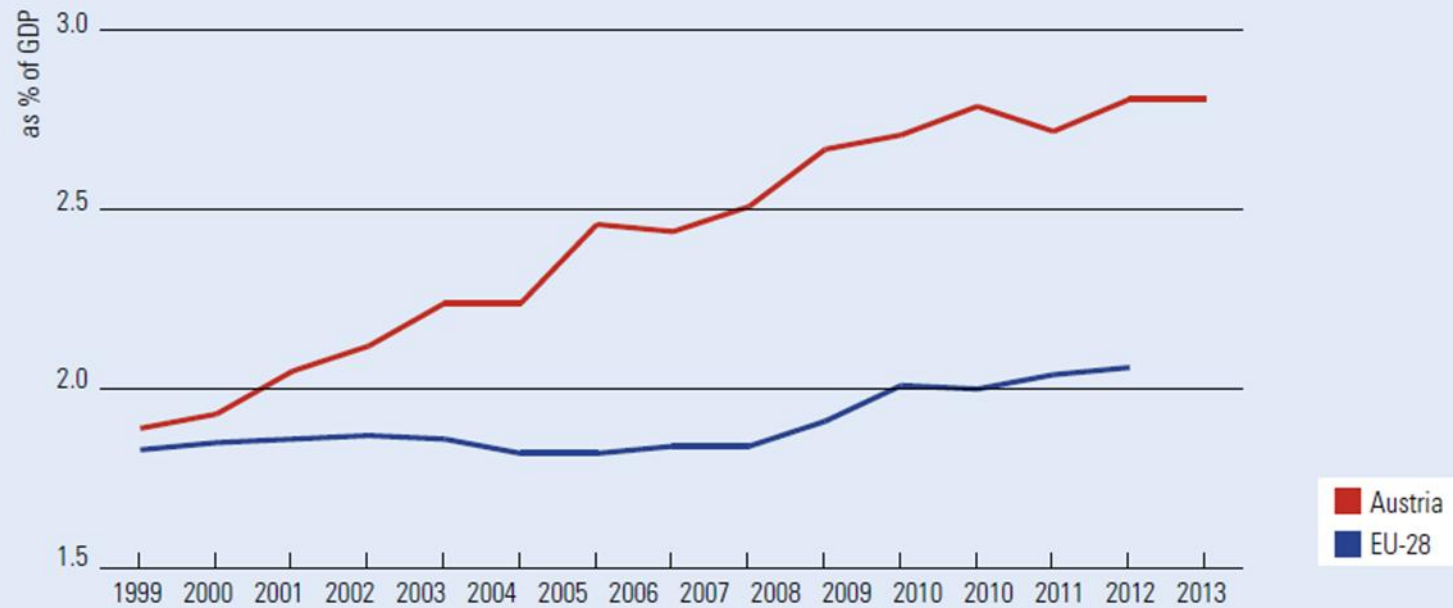Top 10 Austrian brands with a brand equity of 34.5 billion Euro:

Austria – Science and Technology

Gross Domestic Expenditure on R&D

as % of GDP; Austria and EU-28, 1999–2013

S: STATISTICS AUSTRIA, Eurostat.

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- Selected Research Projects
  - Stereo Vision
  - Airport Security and Border Control
  - Surveillance and Protection
  - High Performance Vision
- Characteristics of the MV market in Austria

Federal Ministry for Transport, Innovation and Technology
50,46%

Federation of Austrian Industries
49,54%

- ~1100 Employees
- Budget: 120 Mio €
- Business Model: 40:30:30

The Department – Human Resources – skill development

- 200+ Experts (FTE)
  - *1/3 Scientists*
  - *2/3 Engineers*
  - *36% PhD*

Computer Science Image Processing Medical Computer Scientist Electrotechnical Engineers Physics Mechatronik

TU Graz, TU Vienna, Uni Wien, Alpen Adria University Klagenfurt, Fachhochschulen, ISTA, etc.

- 2/3 of **new employees** with **international education**
  - *Stanford University (USA), University of Lancaster (UK), Zhejiang University (China), Tel Aviv University (Israel), Uni Ulm, TU Berlin, FU Berlin, TU Riga (Lettland), University of Pannonia (H), University of York (UK), Slovak Technical University (Sk)*

- IVS Research Area - **Intelligent Vision Systems**
  - *Technological competence of 70+ experts (FTE)*
  - *R&D comprises the whole image processing chain: sensor, high-performance signal processing, analytics,…, user interaction*

Bombardier Transportation
New step of Safety for Tramways

world innovation – **press conference 18.10.2013 in Vienna – presentation of a innovative driver assistance system**
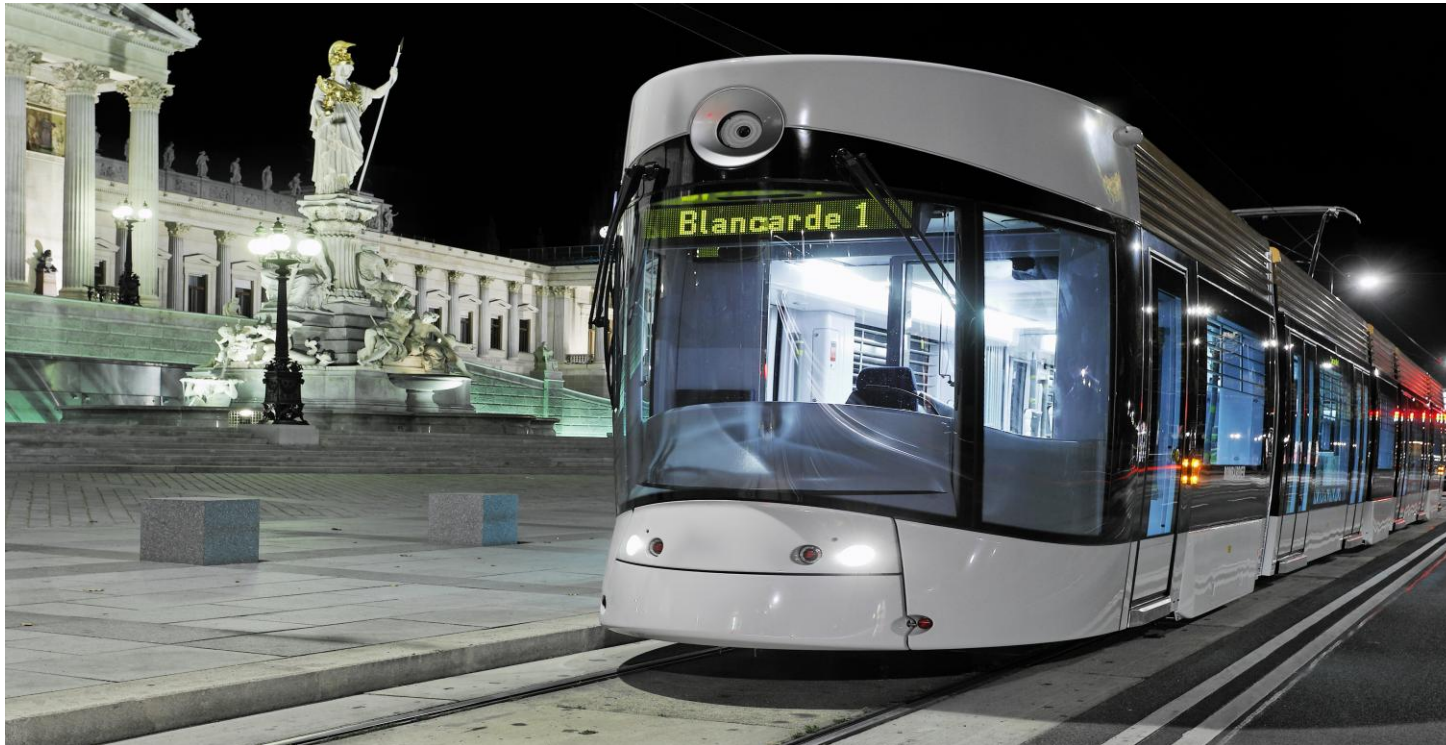
Airport Security and Border Control

- **Dramatically increasing** passenger flows
  - 700 million per year today in Europe
  - +75% at airports by 2030

- Border guards face big **challenges**
  - In-depth document checks
    (more than 2000 different documents)
  - Reliable identity checks
  - Check of entry conditions
  - Discover possible threats

- EU context: **Smart Border Package**
  (entry-exit, registered traveller programme)

Airport Security and Border Control -
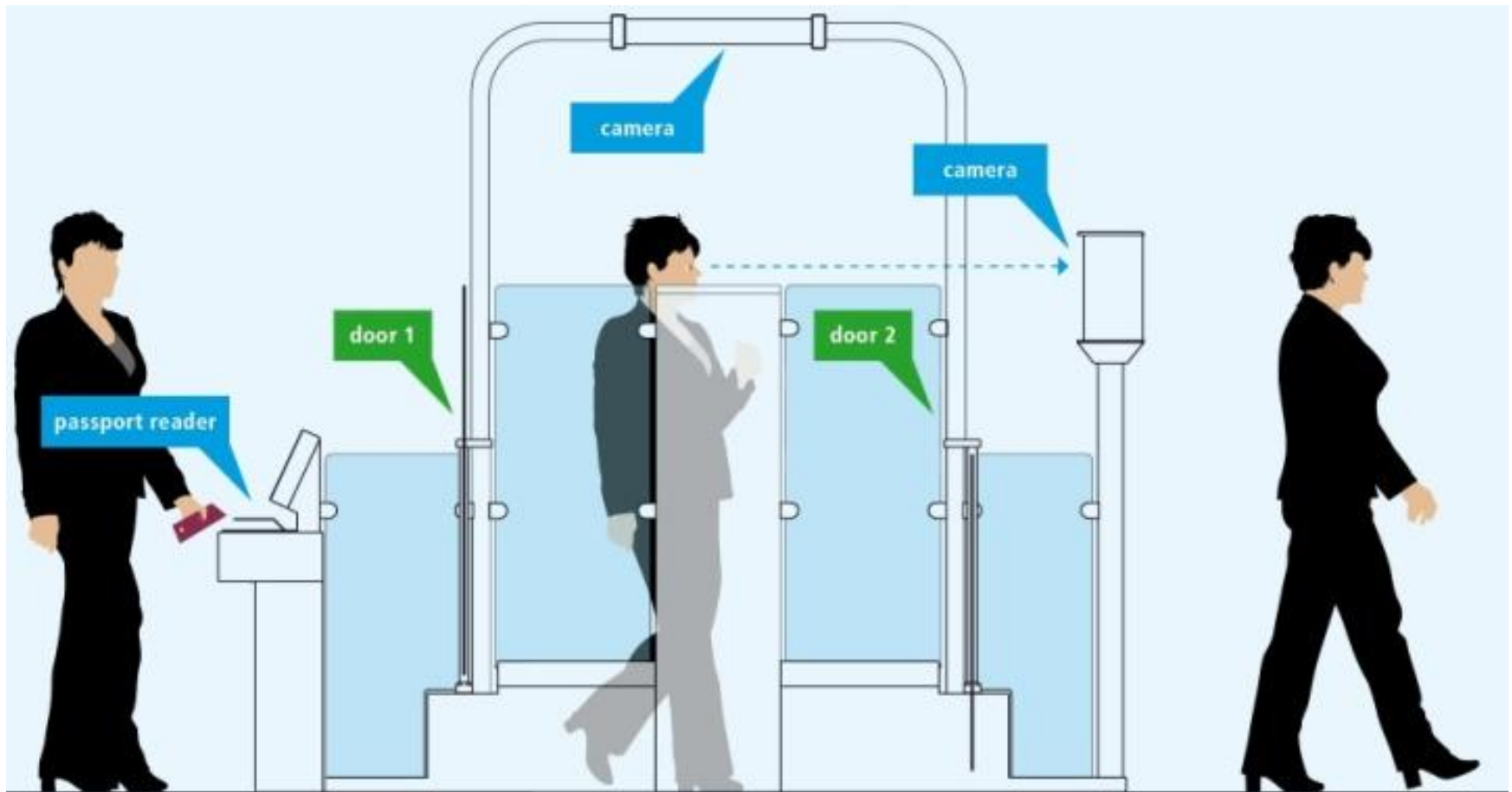## Austrian Leadership by AIT initiative

- **first IP EU Security Project with Austrian coordination**

- **27 Partner, 15 Mio Euro**
- **3,5 Mio for Austria**

A harmonized, modular reference system for all European automatic border crossing points

next gen sensors & image processing

Identification documents & solutions

Security and Infrastructure Processes

international security processes

networked IT systems

Basic and Applied Research

ICT Security

Software & System-Integration
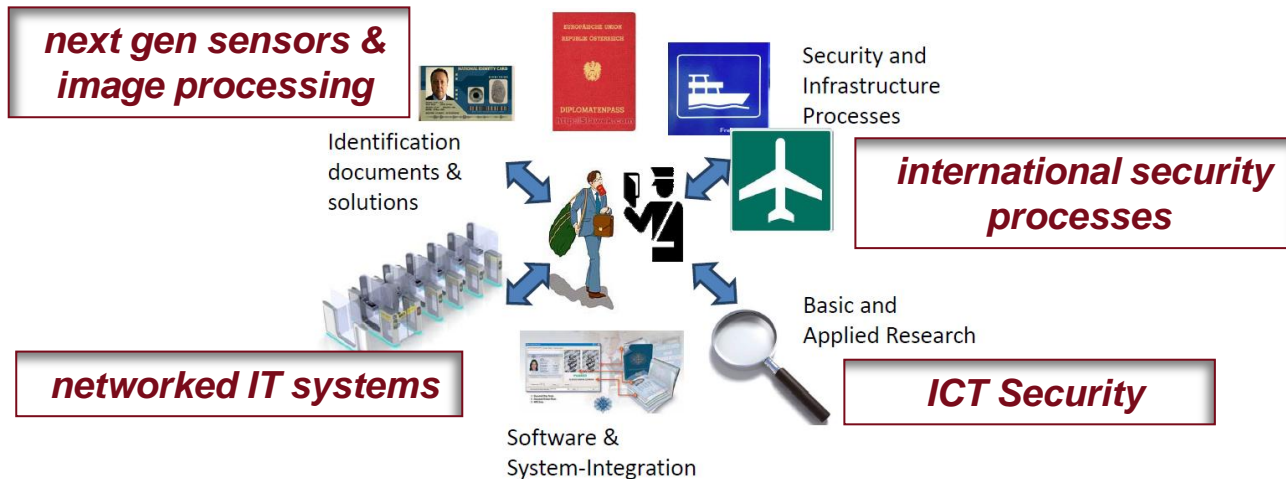
Automated Border Control

Automated Border Control

Needs:

- Passport and biometrics verification

- Person separation

- Left item detection

Approach:

- 3D-enhanced object detection,
  using AIT's stereo-camera system
    - Performance-optimized stereo matching
    - WVGA resolution (608x328), depth resolution: 2 cm

- Each algorithm exploits most suitable data
    - Person separation: depth information + head-shoulder model
    - Left item detection: fusion of separate color and depth background subtraction

- Robustness of algorithm further increased by temporal integration
  and synchronization with the eGate's door signals
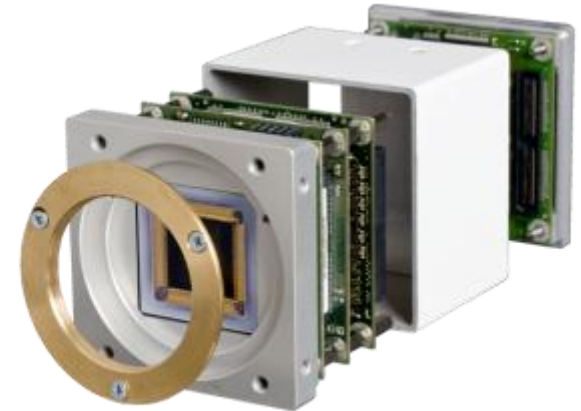
Surveillance and Protection – Increasing Challenges

What?
When?
Where?
Who?
How?

Example: Airport security

High Performance Vision – Worldwide Fastest Line Scan Sensor

- 600.000 lines per second monochrome, or
- 200.000 lines per second RGB color
- High light sensitivity
- Digital output 1,2 Giga-Pixel / second (10 bit)
  - a challenge for next generation image processing systems

illuminated Zone

Camera Lens

d

V

Conveyor

scanning in color @ **72 km/h**

with **0,1 mm** resolution
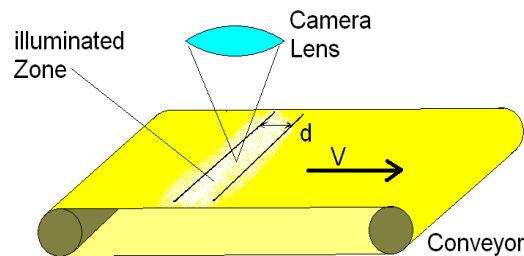
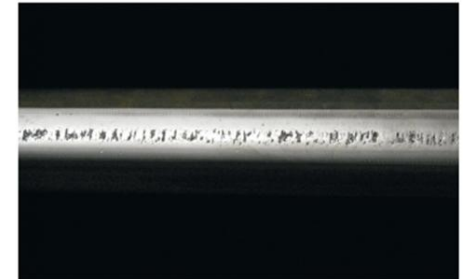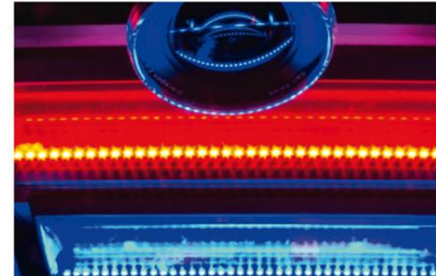enables a new dimension of high speed image processing applications

High Performance Vision – AIT Technology Leadership

Industrial Inspection & Quality Control

**Rail track
Inspection at
300km/h**

**µm-defects on
500m² polished
metal**

**40 km/h
100µm resolution**

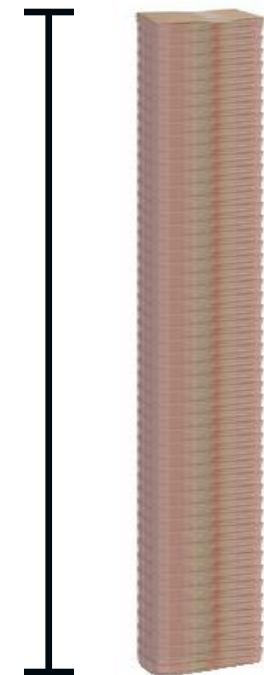*„European Innovation Partner"*
→ unique in Europe

High Performance Vision – Security Print Inspection

Quality Inspection of banknotes in multiple spectral ranges: Color, IR, UV

per second:
   44 banknotes

per 8 hours shift:
   1,15 Mill. banknotes

a stack of banknotes - height of the Viennese St. Stephen's cathedral

137 m

„Leading Technology - used world-wide"

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Characteristics of the MV market in Austria

- No suppliers with a wide range portfolio of MV components
- The market is supported mainly by German and some international companies and distributors
- There are a handful established MV Integrators
- The market is very application oriented, defragmented, no big players
- Some small Austrian companies provide very specialized MV components
- Small local IT companies provide applications for local requests (SME)
- Large industry companies are establishing in-house MV competences

Characteristics of the MV market in Austria

- The main applications in industry
    - Automation engineering,
    - Quality inspection, …

- Some non-industry applications with an international footprint
    - Traffic systems,
    - Facility management, …

- The research in the MV market is user oriented (applied research) driven by
    - Public sector (ministry of interior, ministry of defense, …)
    - Infrastructure operators (airports, trains, subways, highways, …)
    - Quality inspection in production (mainly SME, some Industry)

A brand new EMVA Country and Market report will be published end of May and will provide us with more detailed information for a deeper understanding of the future opportunities in the Austrian Machine Vision market.

Thank you for listening

… and welcome to Vienna

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Safety & Security Department