ITS Research at VTT
Contents

- VTT in brief
- Intelligent transport at VTT
- TransSmart spearhead programme
- Areas of expertise and reference projects
VTT in brief
VTT – Technology for business

- We increase competitiveness of companies by creating new technology and innovations.
- We renew industry and create new business opportunities.
- We create new knowledge for the purposes of society and political decision making.
- We help Finland to be a globally recognised innovation centre.

Biggest multitechnological applied research organisation in Northern Europe

Services and the way of work
- Cross-disciplinary technological and business expertise
- A not-for-profit and impartial research centre

Customers
- Finnish and international companies as well as public sector organisations

Business areas and VTT companies
- Knowledge intensive products and services
- Smart industry and energy systems
- Solutions for natural resources and environment
- VTT Expert Services Ltd (incl. Labtium Ltd)
- VTT Ventures Ltd
- VTT International Ltd (incl. VTT Brasil LTDA)
- VTT Memsfab Ltd

Resources
- Turnover 320 M€, personnel 2,900
- Unique research and testing infrastructure
- Wide national and international cooperation network

12/06/2014

VTT’s mission

- VTT produces research and innovation services that enhance the international competitiveness of companies, society and other customers.
- VTT creates the prerequisites for society’s sustainable development, employment and wellbeing.
Services

TECHNOLOGY PARTNERSHIP
Create business from technology

TECHNOLOGY AND INNOVATION MANAGEMENT
Leverage the technology benefits more effectively

TECHNOLOGY AND MARKET FORESIGHT
See the future

STRATEGIC RESEARCH
Be a forerunner

PRODUCT AND SERVICE DEVELOPMENT
Acquire competitiveness

IPR AND LICENSING
Exploit turnkey technologies

ASSESSMENTS, TESTING, INSPECTION, CERTIFICATION
Ensure your competitive edge
VTT Group on the map

- **VTT research units:**
  - Finland, Berkeley, VTT / MSI (USA), Seoul, (South Korea), São Paulo (Brazil).

- **Offices abroad:**
  - Shanghai (China), Tokyo (Japan), St Petersburg (Russia), Brussels (Belgium), Washington DC (USA).

- **Evaluation of new opportunities:**
  - Germany, Singapore, Australia.

- **Offices in Finland:**
  - Espoo, Helsinki, Oulu, Outokumpu, Rovaniemi, Sodankylä, Tampere, Jyväskylä, Rajamäki, Turku, Kuopio, Lappeenranta, Kajaani, Raahen.
Intelligent transport systems at VTT 2014
Intelligent transport competence at VTT

- VTT promotes the emergence of intelligent transport systems by developing transport ICT systems and services.
- VTT develops system concepts, subsystems and implements system pilots.
- VTT evaluates the acceptability, performance and impacts of the systems and prepares implementation and realisation strategies.
- In its research and development, VTT utilizes its own and its partners HTI, sensor systems, ICT, scientific research methods, transport and business know-how.
Intelligent transport competence at VTT
### VTT competences and service offering in ITS

<table>
<thead>
<tr>
<th>Societal benefits and impact assessments</th>
<th>Business ecosystems and networks</th>
</tr>
</thead>
<tbody>
<tr>
<td>User needs and requirements</td>
<td>Business and operation concepts and models</td>
</tr>
<tr>
<td>Service approaches and concepts</td>
<td>Business and impact evaluations and assessments</td>
</tr>
<tr>
<td>Application development</td>
<td>Technology and business foresight</td>
</tr>
<tr>
<td>Technology platforms</td>
<td>Project management and integration</td>
</tr>
<tr>
<td>Service and system architecture</td>
<td>Competence development</td>
</tr>
<tr>
<td>Data and sensor technologies</td>
<td></td>
</tr>
</tbody>
</table>
# Sustainable Transport Systems

**Vision**
- Sustainable mobility for all
- Smart and livable cities

**Key competences**
- Transport system analysis
  - strategies and management
  - transport modes
  - traffic flows, traffic management, and situational picture
- Intelligent transport
- Impact assessment (safety, environment, mobility, efficiency)
- Human factors (travel, traffic, driver and VRU behaviour)

**Customers**
- Other public sector organizations
- Private sector: OEM’s, Tier1’s, Traffic infrastructure organizations
Transport & Logistics Services

Vision
- Safe and secure transportation and mobility
- Competitiveness for companies and communities (growth)
- Smart and sustainable mobility (low carbon energy)

Key competences
- In ITS services and systems: large scale field trials, data management, evaluations, service concepts, business models & ecosystems (for example road weather, eCall, cooperative systems)
- In logistics; automated identification, logistics centres, electronic information exchange, transport corridors and freight flow analysis, value chain development, supply chain security, green supply chains & carbon footprint reduction

Customers
- Public authorities; Finnish Transport Agency (FTA), Finnish Transport Safety Agency (Trafi), Finnish Ministry of Transport and Communications (MinTC), City of Tampere
- Private sector; HSL, Vaisala, Foreca, Arctic Machine, Vediafi
TransSmart spearhead programme
Smart mobility integrated with low-carbon mobility
TRANSSMART

Nils-Olof Nylund
Research Professor, Programme Manager
Major global trends and challenges for mobility

- **Rapidly increasing numbers of motor vehicles**
  - Improvements of vehicles and fuels alone will not be enough to bring transport on the pathway to sustainability

- **Urbanization**
  - Urban transport cannot be handled by simply increasing the number of passenger cars

- **Grand challenges listed by EU’s Horizon 2020**
  - Health, demographics and wellbeing
  - Food security and sustainable bio-resources
  - Secure, clean and efficient energy
  - Smart, green and integrated transport
  - Resource efficiency and climate challenge
  - Secure and inclusive societies
Understanding and supporting the socio-technical transition:

Change on multiple levels is needed for smart, low carbon transport systems

Why should I be interested in owning the means of transport?
Do you know that I can manage all my travelling with my smartphone?

Smart mobility is connected services:
“Mobility as a Service” is easy-to-use and affordable mobility
Going for green energy:
VTT is working to increase renewable energy in transport

I could think of running on renewable fuel.
Cutting the energy use of vehicles in half:
A smart vehicle is efficient and clean.

It's a hybrid version, so I will help save the planet.
Legacy of transport-related research at VTT
Transsmart objectives

Bring the transport system as a whole on track to sustainability, fulfilling efficiency requirements regarding societal needs, economy and environment

- Elements in this transformation are **low-carbon energy, clean and efficient vehicles, powerful ICT solutions and smart and cooperative mobility services** combined with the management of the related socio-technical change

- TransSmart brings an integrated approach to transport, moving from subsystem optimization towards understanding and optimizing the total system

- TransSmart will boost business opportunities for Finnish industry, while simultaneously supporting public decision making in order to meet national and international energy and climate targets in the most cost-effective way
Transsmart objectives

Bring the transport system as a whole on track to sustainability, fulfilling efficiency requirements regarding societal needs, economy and environment

VTT will strive for a strong impact by:

- Fulfilling energy and climate targets of 2020 and beyond cost-effectively
- Developing efficient and fluent cooperative transport systems
- Promoting new export business opportunities
- By being an active contributor to national and European energy, climate and transport policies through new technology
Transsmart vision for 2030

The Finnish transport system successfully pursues sustainability in societal, economic as well as environmental terms:

- The transport system is mainly powered by electricity, biofuels and hydrogen. Where conventional fuels and powertrains still apply, the efficiency of using energy and other resources has improved remarkably. Energy systems for transport are well integrated into other infrastructures in terms of production, storage and delivery.

- Transport and mobility needs of people and goods are fulfilled by a wide range of transport services, characterized by advanced technologies, functionality and efficiency.

- Development and production of transport fuels, vehicles, mobile machinery, infrastructure and services generate business and profit for the Finnish entrepreneurs in the domestic as well as global markets.
Transsmart themes and contents

- Biofuels for transport
- Low-carbon fuels
- Infrastructure for EVs & FCVs
- EV fast charging & grid effects
- Energy storage for vehicles
- Efficient use of vehicles
- Vehicle technology
- Hybrids, EVs & FCVs
- Focus on commercial vehicles and mobile machinery
- Ship propulsion

- Smart cooperative systems and services
- Business ecosystems, business models and foresight
- Advanced multimodal transport management systems and services
- Service concepts, testing and technology platform demonstrations
- Transport system foresight
- Systemic policies and impact assessment
- User values, demands, intentions and acceptance
- Stakeholder networks, communities and their management

Megatrends, user demands, business opportunities, policy support, foresight
Renewable & low-carbon energy in transport
Case: Advanced Biofuels

Dr. Juhani Laurikko
Principal Scientist
"The Dream Team"

- UPM: Tall-Oil based renewable diesel
- ST1: Waste-based renewable ethanol
- Neste Oil: Multi-feedstock renewable diesel
- Gasum: Bio-methane
- Tekes: RTD&D Funding
- VTT: Research & Development Coordination
- itella: Policy & Legislation
- Vehicle Supply & Technical Support
- Vehicle Operations
Why VTT is the Key Partner?

Excellent Research Capabilities

Trucks

Buses

Cars

Engines
Technology Platforms Supported in the Piloting Programme

20% Blend in Mineral Oil Diesel

Dual-Fuel Diesel/Methane

Ethanol-Diesel ED95
Advanced vehicles

Dr. Mikko Pihlatie
Advanced vehicles – Electric Commercial Vehicles (ECV)

- The starting points for strategy are the R&D needs of Finnish component, vehicle and machinery industry
- Finland has significant industry in heavy vehicles and machinery – global market potential

→ The focus area chosen is electrification of heavy vehicles and machinery (in commercial operation / industry)
  - Battery / storage system the most expensive (risky) component
  - Charging infra & investment needed – commercial operation can commence without "nation-wide" infrastructure
  - Highest utilisation rate can be achieved in commercial operation

- Systemic view needed to justify the introduction of electric vehicle and machinery fleets
Advanced vehicles – from components to systems
Spearhead in electric mobility: Espoo electric feeder traffic system – eBusSystem

- Metro traffic in Espoo starts 2016
  → Public traffic system needs revision
- Espoo feeder traffic system currently being planned – fast track to a smarter city?
  → Electric vehicles an opportunity for Espoo
- Novel smart (city) traffic concepts and services
  → ICT and support services
- EV fleets need charging infrastructure
  → Fortum natural partner for charging service
  → Charging system supplier, synergy with existing infra
- Novel grid-connected energy storage applications emerging
  → Smart grid/city, distributed generation, grid support
- Electric vehicle technology needs to be designed and optimised for the demanding environment
  → Traction battery, powertrain, charging concepts
- VTT offers cross-cutting R&D partnership
  → EV research facilities and capabilities
The Metropolitan Helsinki eBus & eBusSystem projects

Public sector
Private sector
Bus operator
Research organization

The transport system
How do electric buses fit into the public transport system?
- Ministry of Transport
- Helsinki Region Transport
- City of Espoo
- Veolia, Aalto University

The vehicle
How do electric buses perform?
- Veolia, VTT
- Bus manufacturers (BYD, Caetano, others to follow)
- Component manufacturers (European Batteries, Vacon)
- Transport Safety Agency

Green Public E-Mobility

The energy supply
How can electric buses be charged and how is the grid affected?
- Smart grid, grid services and smart bus depot
- Utilities (Fortum), Siemens, charger manufacturers
- Rail traffic synergy, cities
- VTT, TUT, LUT
Integrated research capabilities for electric vehicle R&D

- Battery laboratory & module development platform
- Climatic chambers for component testing
- Battery simulator / power source for chassis dynamometer & heavy-duty battery pack tester
- Vehicle laboratory & eBus development platform
Smart Transport Services

Raine Hautala
Project Manager
Karri Rantasila
Key Account Manager
Smart Transport Services Roadmap

Traffic information Services

Open Data Approach

Traffic Incident management

Border-crossing Services

Freight & Logistics Services

Advanced Traffic management

Co-Modality

<table>
<thead>
<tr>
<th>Traffic information Services</th>
<th>Multimodal Traffic &amp; Traveller Information</th>
<th>Cooperative Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open Data Approach</td>
<td>DigiTraffic Warehousing and Data Integration</td>
<td>Open Data Concept, New data sources integration</td>
</tr>
<tr>
<td>Traffic Incident management</td>
<td>Incident Detection and Management, eCall Service</td>
<td>Cooperative ADAS services</td>
</tr>
<tr>
<td>Border-crossing Services</td>
<td>Border-crossing Information and management services</td>
<td>Automated Border-Crossing services</td>
</tr>
<tr>
<td>Freight &amp; Logistics Services</td>
<td>Fleet Management and Services Systems</td>
<td>Incident Detection &amp; Management</td>
</tr>
<tr>
<td>Advanced Traffic management</td>
<td>Free Flow Tolling &amp; Road User Charging, Eco Traffic Management</td>
<td>Cooperative Traffic Management</td>
</tr>
</tbody>
</table>

Smart Services key-projects 2014

EU Key-projects
- HeERo
- SATIE
- DRIVEC2X
- MOBiNET
- TEAM
- P4ITS

FI Key-projects
- FITSRUS
- FIRWE
- SMART PTS
- PROACTIVE TM
- SMART CITY ITS
- eCall
- TTPlatforms

Smart Cooperative Transport Systems and Services
ITS Services Business Ecosystems and Business models
Advanced multimodal transport management systems and services
Intelligent Transport Systems and Services in Smart Cities and Corridors

FIRWE - Finnish Road Weather Excellence

- Goal: to create an exportable service and product package combining Finnish experience and multifunctional 'snow-how' in observing traffic and weather conditions as well as in road maintenance and operation

- Benefits for road operators, maintenance decision makers, road authorities and drivers
  - better awareness and more proactive measures
  - reduced operational costs and less environmental damages
  - improvements in traffic safety and traffic management
The FIRWE platform – Finnish Road Weather Excellence
Sustainable Transport System

Anu Tuominen, Principal Scientist
Pirkko Rämä, Principal Scientist
Sustainable Transport System

Objective: To produce new knowledge and methods for strategic planning and decision making to support socio-technical change towards smart, low carbon transport systems.

The knowledge and methods will be developed in co-operation with public and private transport system actors.

Systemic, forward looking, multidisciplinary approach
Sustainable Transport System – Focus areas

- Users and stakeholders
  - Values and activities
  - Demands
  - Acceptance and intention to use
  - Networks

- Socio-technical foresight
  - Visions, scenarios, road maps
  - Socio-technical transitions

- Toolbox to support policy/concept development
  - Smart, low carbon transport systems in cities and corridors

- Strategic Planning and Decision Making for Smart Low Carbon Transport Systems

- Instruments, strategies, impact assessments
  - Policy and market instruments
  - Impact assessment of measures, instruments and strategies
Examples of research projects

- **Process development for creating prospective value chains for renewable road transport energy sources** up to 2050 in Nordic Countries in the contexts of three technology platforms: biofuels, electricity and hydrogen (NER project TOP-NEST)

- **Deployment paths of electric vehicles until 2025-2030 using a scenario based market model** which specifies consumer demand and market supply of electromobility in Finland, Germany and Poland (EU-ERA-NET project eMap)

- **Development of an integrated business model for intermodal public transport system interchanges**, contributing to the design and operation of seamless, smart, clean and safe public transport systems also to “vulnerable” users (EU-project city-Hub).
Areas of expertise and reference projects
eCall piloting in Finland

- The Pre-deployment trial for Pan European eCall based on 112
- VTT testbed, mobile eCall IVS; cross-border and aftermarket device tests
- Continuity of service across EU – also in Russia: architecture & testing
- Smart Transport Corridor between Helsinki and St. Petersburg
- Bilateral testing with European countries
VTT eCall testbed

- A modular, multipurpose software that can be easily adapted to various test cases
- User interface for configuring, administration and operation
- Based on latest eCall standards
- Software components can be easily adapted
  - for public safety and third party services (e.g., TPS eCall) as well as multiservice platforms
  - to future requirements of eCall and upcoming eCall related services
- Currently available on Linux and Windows platforms
VTT MeCall - mobile eCall client and receiver applications

- MeCall eCall client and receiver applications that constitutes a flexible, multipurpose mobile testing system with data logging
- Based on the latest eCall standards.
- Successfully tested in HeERO and eCall Testfest 2013
- Software components can be easily adapted
  - for public safety and third party services (e.g., TPS eCall) as well as multiservice platforms
  - to future requirements of eCall and upcoming eCall related services
Pan European Test Environments and ITS Deployment

- Developing a roadmap for European network of test beds to accelerate the deployment of ICT
  - Currently 15 European test beds involved
- Strong and wide cooperation with other European companies, organisations, authorities and research institutions
- The roadmap will be published in the end of 2014
Finnish Road Weather Excellence

- **Goal:** to create an exportable service and product package combining Finnish experience and multifunctional ‘snow-how’ in observing traffic and weather conditions as well as in road maintenance and operation

- **Benefits for road operators, maintenance decision makers, road authorities and drivers**
  - better awareness and more proactive measures
  - reduced operational costs and less environmental damages
  - improvements in traffic safety and traffic management

- **VTT’s role is to facilitate the integration of ITS services and ecosystems, and to evaluate impacts of services**
Real time friction monitoring and analysis during normal driving in thousands of heavy vehicles.

In vehicle detection of slippery road section. Instant warning to the driver.

- Data from vehicle’s databus (CAN).
- Localisation of a slippery road section.

Service provider

Warning to the approaching vehicles

Road authority

Real time map of slipperiness of roads (available for road users).

Maintenance register

Road maintenance vehicle

Real time friction monitoring and analysis during normal driving in thousands of heavy vehicles.

General platform for detecting road slipperiness
TeleFOT - Evaluation of nomadic and retrofitted services

- Goal: Investigate the functionality and impact of driver support services with large scale field operational tests.

- 3,000 users in 8 different countries, EUR 15 million, over 10 million driven kilometers recorded and analysed.

- Benefits: Evaluated the functionality and impact of nomadic devices and retrofitted services. TeleFOT results help faster and better implementation of services.

More information: www.telefot.eu
DRIVE C2X
Assessment of cooperative systems

- Comprehensive assessment of cooperative systems through Field Operational Tests
- With 31 partners, 15 support partners and 18.8 million Euro budget, DRIVE C2X will lay the foundation for rolling out cooperative systems in Europe.
- Leading to a safer, more economical and more ecological driving
- Supporting the European vehicle industry

The project will deploy cooperative technologies in several European test sites in Finland, France, Germany, Italy, Netherlands, Spain and Sweden. This effort will create a harmonized Europe-wide testing environment for C2X technologies.
Proactive Transport Management

- Goal: To develop concepts and tools for proactive transport management
- Result: Practical, yet effective solutions for TMCs
  - Situational picture of transport system status, situation awareness
  - Short term prediction of traffic flow status e.g. travel time
  - Incident risk assessment in real-time
- Benefits: Fluent, eco-efficient and safe traffic flow
ITS Multi-Service Model

- Intelligent transport multi-service products for the Finnish and international markets
- Development of the service concept, architecture, products and testing and impacts
- Creation of a value network
- New spinn-offs, new business
- Benefits: More ecological, safer and more economical transportation, B2B, more affordable and user-friendly services rendered by authorities and commercial services for the transport user, employment and export, improved know-how
- Company products: VEDIA
- See www.vedia.fi
TRAFISAFE - Service for feedback on driving for novice drivers

- Goal: To facilitate the development of a safe driving style for new drivers
- Result: Analysis and feedback system impact on driving behaviour
- Benefits: Learning and supporting a safe and economical driving style, monitoring the development of one's own driving style and comparing it with that of others. A new tool has been developed to include also parents to the learning process.
Advanced Driver Assistance

- Goal: To develop and evaluate advanced driver assistance systems for greener and safer traffic.

- Assess the safety and ecology impacts, co-operative systems and automated driving, cost-effectiveness and user-friendliness, and future possibilities. Field operational test managing, data handling and impact assessment.

- VTT: Systems development and integration, socio-economic impact analysis and field operational testing.

- Benefits: Improved traffic safety and economy, reduced carbon footprint, increased competitiveness of customers.
Smart logistics

- Development of logistics centers and ICT in logistics
  - Applying ICT and automated identification to logistics center environment
  - New business concepts and models

- Electronic information exchange in supply chain
  - Paperless logistics, interfaces between companies (B2B) and administrative (B2A)
  - Single window solutions and messaging frameworks

- Automated identification in supply chain
  - Tracking systems, identification technologies
  - Container management
  - RFID Privacy Impact Assessment (PIA) studies
Supply Chain Security Management

- Development of comprehensive operations models based on security solutions and services for logistic multi-stakeholder networks, as well as methods for security and safety management.

- Guidance on the use of monitoring technology to improve supply chain security

- Projects: CONTAIN, SUPPORT, LogProof
Mobinet

- “The Internet of (Transport and) Mobility”
- An Internet-based network linking travellers, transport users, transport system operators, service providers, content providers and transport infrastructure
- Connects users (people, businesses, objects) with suppliers (operators, providers, systems), and brokers (or helps to broker) their interactions
- A core “platform” providing tools and utilities to enable those interactions, with components both for users and for suppliers
FITSRUS- Smart Transport Corridor

- The Smart Transport Corridor Helsinki-St. Petersburg
- Aims to improve and pilot sustainable mobility and effective flows of goods by systematically utilising advanced ITS services
- Corridor covers all modes and addresses both personal and freight transport including also ports and terminals and border crossings
- FITSRUS project has been carried out in cooperation with the Finnish and Russian public and private organisations
- First Pilot Implementation Phase in 2013-2014
Smart Transport Corridor Concept
From vision to services

- Service continuity across countries
- Authorities
- Companies
- Service providers
- Financiers
- Financing
- Procurement
- Customer and market analysis
- Data
- Standards
- UI and APPs
- Smart corridor services for travellers and hauliers
Helsinki-St. Petersburg smart transport corridor

1. Automated weather services
2. Automated incident detection and alert system
3. Real-time traffic and travel time information service
4. Public transport information service
5. HTML5 based multi-service platform for travel chain optimization
Logistics competence at VTT

- Automated identification
- Development of logistics centres
- Electronic information exchange
- Transport corridors and freight flow analysis
- Supply chain security
- Green supply chains
TEAM
European Integrated project: Tomorrow’s Elastic, Adaptive Mobility

Elastic mobility: joining drivers, travelers and infrastructure operators in a collaborative network balancing individual and global mobility needs. Collaboration is the key to extends the vehicle-2-x cooperative concept with interaction and participation.
Traffic Safety 2025

- The VTT-coordinated research programme aims to support the strategic decision making of participating organizations and companies in the areas of road traffic, rail and maritime safety.
- The topics from 2008 to 2013 included development of safety management systems, assessment of safety culture, creation of vision for safe transport system, improvement of road-railway level crossings, tire safety, construction of road safety tests for company personnel etc.
- Publications: 32 technical reports, 5 scientific articles and 25 other articles.
- Members in 2014-2016: Finnish Transport Agency (80 k€ p.a.), Finnish Transport Safety Agency (80 k€ p.a.), Ministry of Transport and Communications (20 k€ p.a.), Nokian Tyres (20 k€ p.a.) and VTT (60 k€ p.a.)
Safety and Mobility of Vulnerable Roads Users

VRUITS: Improving safety and mobility of VRUs through ITS

- Assessment of safety and mobility impact of ITS applications on VRUs (pedestrians, cyclists, motorcyclists, special user groups)
- Improvement of usability of ITS applications for VRUs
- Testing of the integration of VRUs in cooperative traffic systems

- VTT acts as coordinator of EC-MOVE sponsored project, started at 1.4.2013
CITY-HUB

- Facilitating in best ways the links between different transport network modes in interchanges is the focus of City HUB
- Pilot cases are: Madrid (picture), Helsinki, London, Thessaloniki, Erd
- Combining Public Transport, business and services, sustainability, land use and different users are the challenges; VTT is involved especially in business models, information and evaluation
Improving Safety at Rail Crossings
Junavaro/LeCross

- Warning system for railway level crossings aims to improve safety in railway level crossings by warning road users on the approaching train
- Cost-effective implementation based on localisation and mobile communication
- Flexible, possibility to use variety of client devices
  - Mobile phones
  - ITS terminals (DSRC)
  - Information displays
  - Warning lights
TECHNOLOGY FOR BUSINESS