GNSS Applications in the Czech Republic

František Vejražka

Czech Technical University in Prague

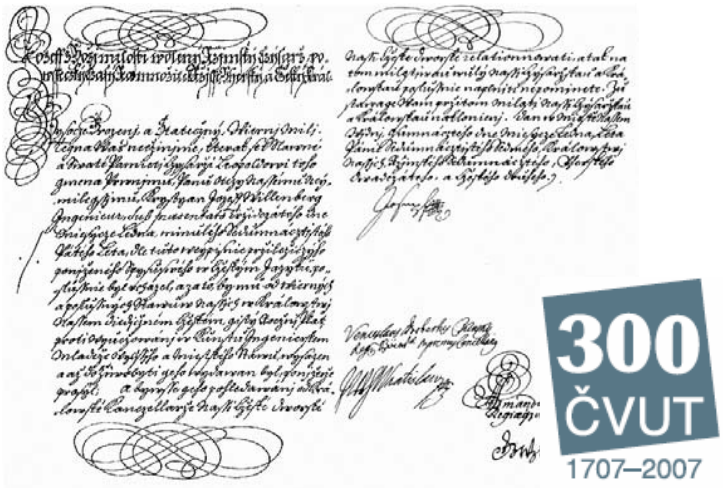
Faculty of Electrical Engineering

Agenda

- Description of Czech Technical University activities on the field of satellite navigation
- Description of main applications of satellite navigation in the Czech Republic
- Conclusions

Where am I from?

Where am I from?
Czech Technical University (CTU)



- The oldest technical university in Central Europe
- Established on January 18, 1707
- Celebrated 300-th anniversary of formation
- Modern polytechnic institute with 25 000 students
- Engaged in satellite navigation

What have we done there ?

- Omega system precision study for Czech Airlines, 1974
- Commuter and military aircrafts navigation
  - Omega receiver, 1975 - 1980
  - Transit NNSS receiver, 1980 - 1982
  - GPS receivers, improvement of their precision, 1980 -

What have we done there ?

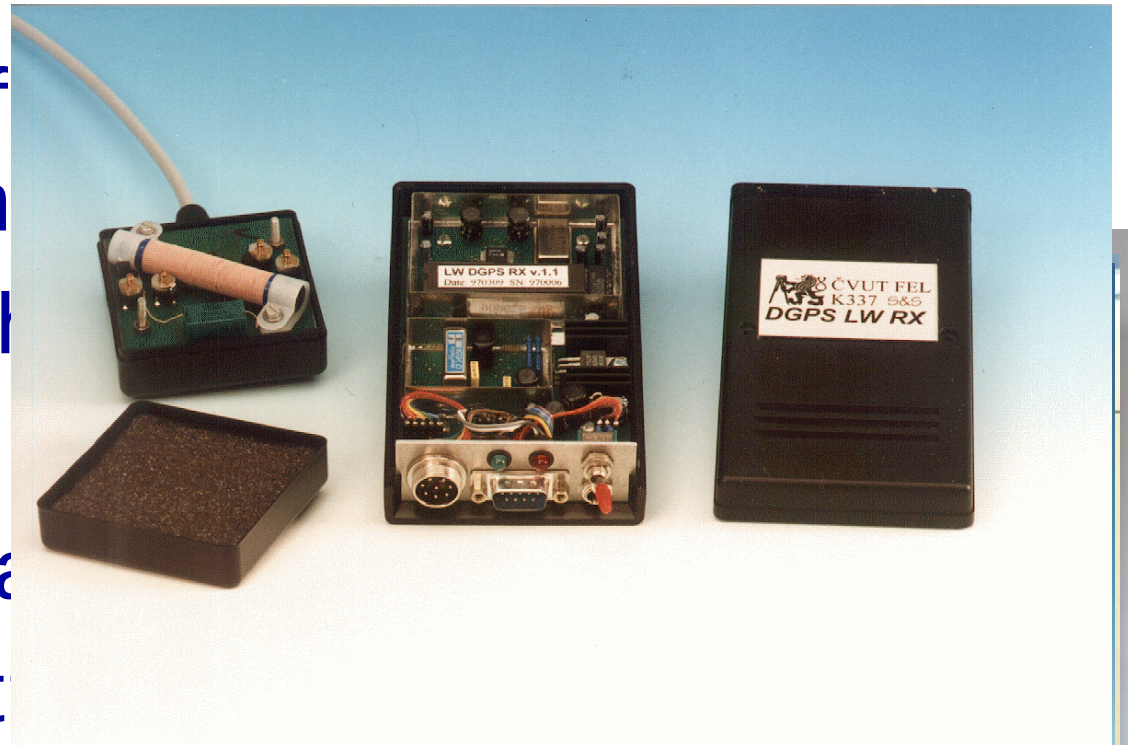
- R&D of GPS receivers for Czech
  - L410 commuters
  - L159 fighters
  - Army troops

- produced by DICOM factory 1990 - 1995

What have we done there ?

CTU is provider of
station, correction

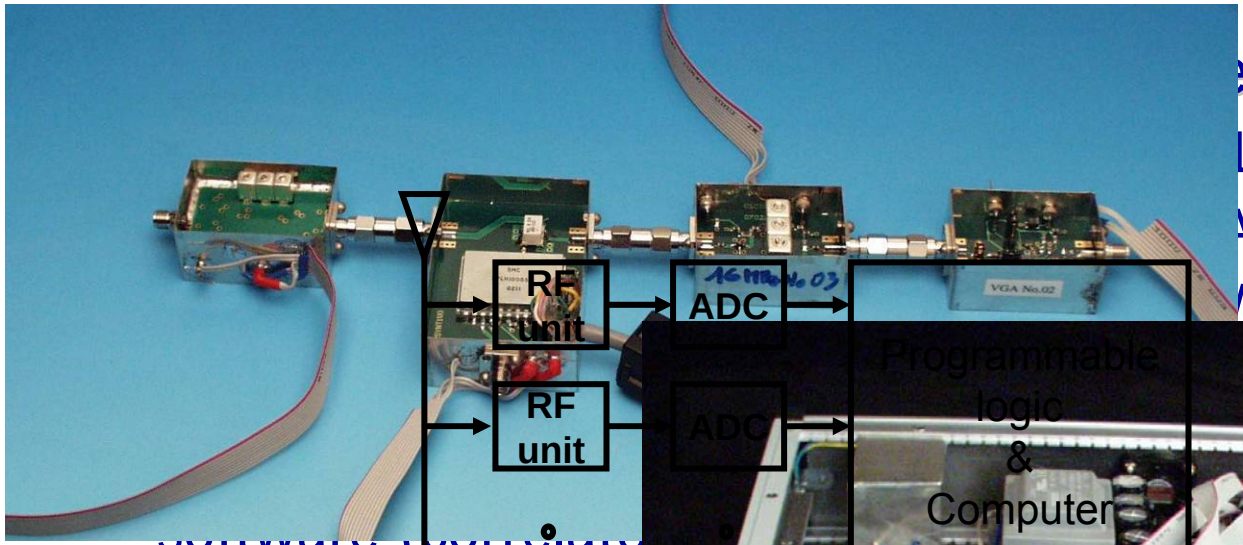
- media (CD, flash
- Internet
- VHF RDS Regina
- by VLF transmit
  - users can use our receivers



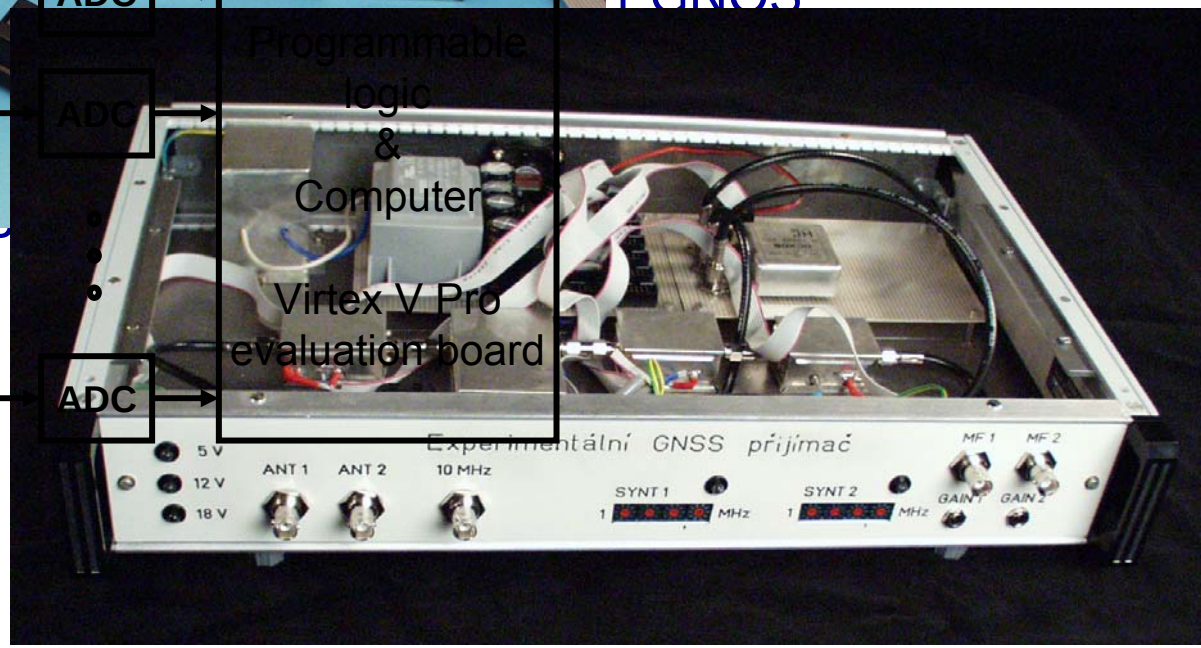
What have we done there ?

- Software receiver of GNSS signals for Ministry of Transport
- Experiments with GIOVE A/B signals reception

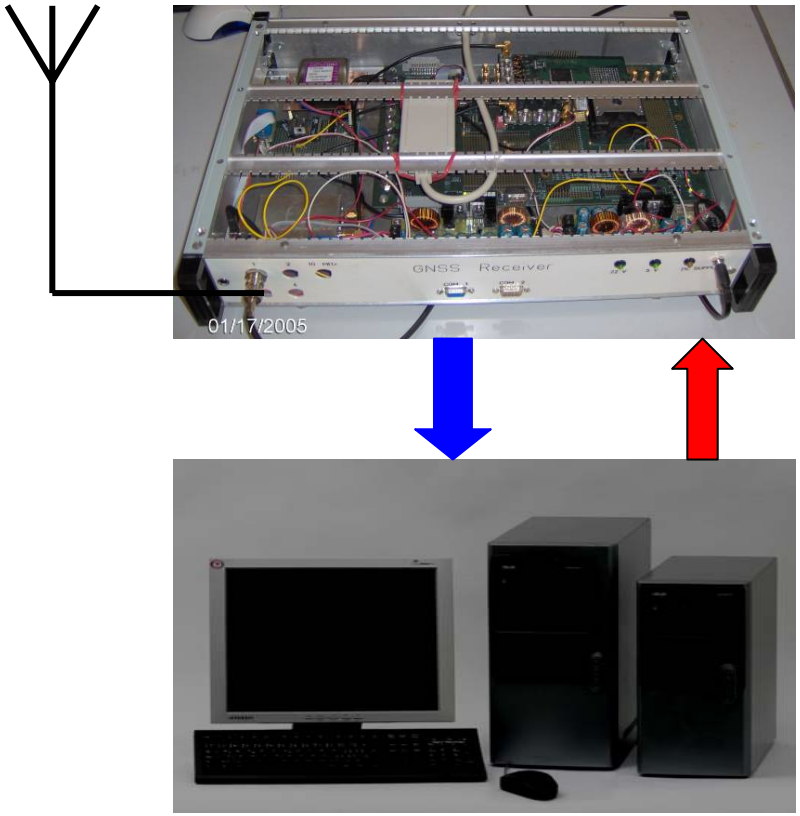
What have we done there ?
EGR - development tool for SW receivers



ed for
L, L2
ASS
/EGNOS



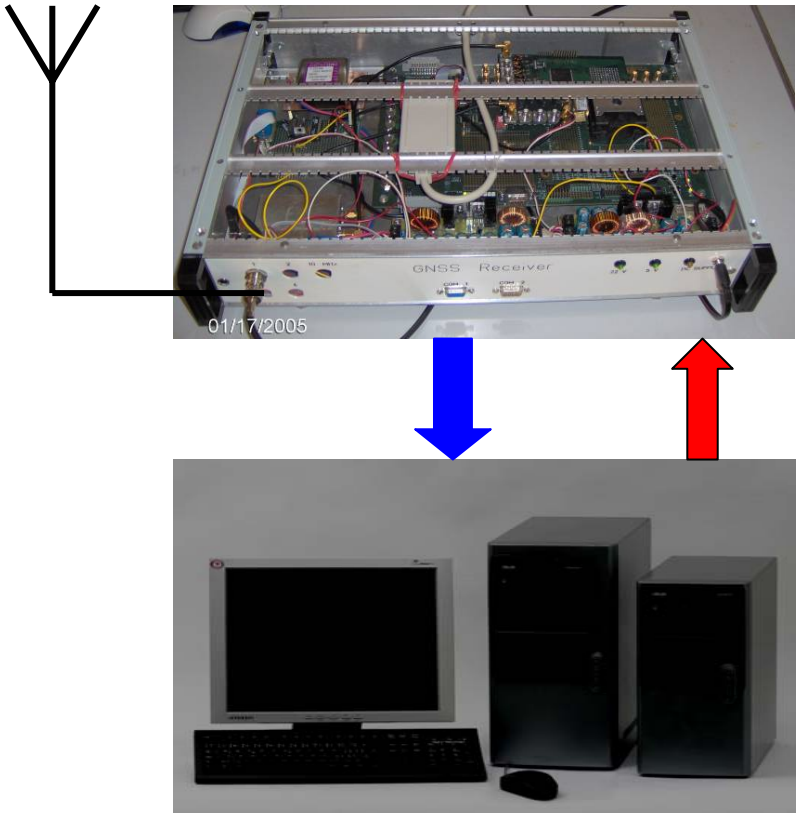
What have we done there ?
Development procedure with EGR

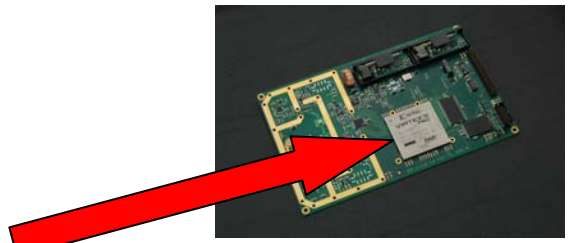


Compiled program
saved in receiver memory
Testing

Program in Simulink
Compilation
Testing, validation

What have we done there ?
Development procedure with EGR





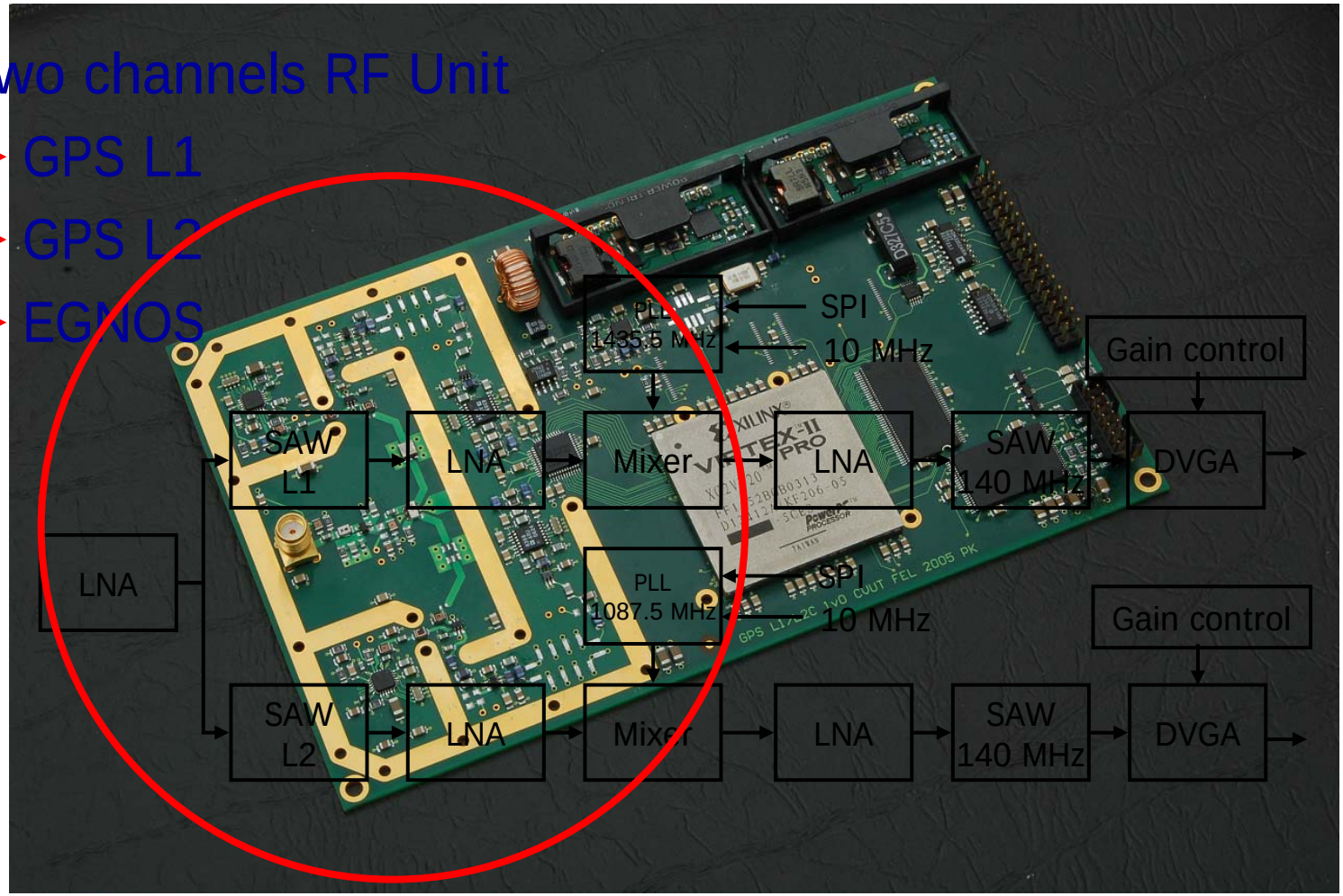
Compiled program
saved in receiver memory
Testing

Program in Simulink
Compilation
Testing, validation

What have we done there ?
PCB receiver for GPS/GLONASS/Galileo

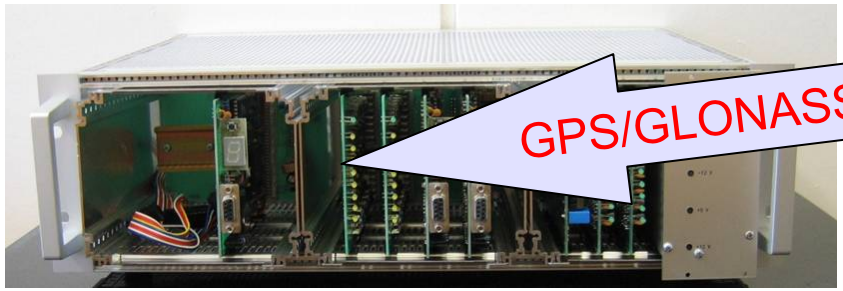
Two channels RF Unit

- GPS L1
- GPS L2
- EGNOS



What have we done there ?
Receiver applications in railway safety

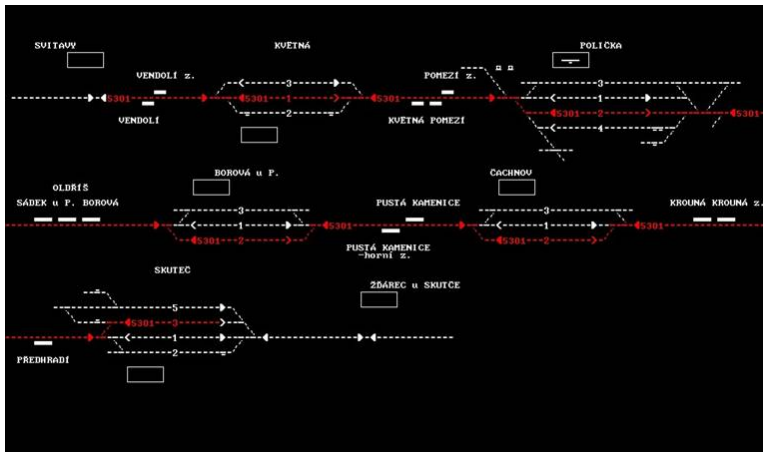
Locomotive On Board Unit



GPS/GLONASS/(GALILEO) Receiver PCB

Control Panel of Locomotive On Board Unit

Dispatcher Screen



What have we done there ?

- Czech Republic Ministry of Transport project

  „Czech Republic Participation in the Project GALILEO”

- Two activities described above
  - SW receiver
  - SW (Galileo) receiver applications in railways

  were its pilot projects

„CR participation in GALILEO” pilot projects

1. Experimental receiver for GNSS
2. Control and securing of secondary railway lines using GNSS
3. Optimization of road transport control using GNSS
4. Information system for support of danger goods transport using GNSS
5. Monitoring and control of movements on airports using GNSS

Pilot project 1
Experimental receiver for GNSS

- Described above
- Galileo isn't in the air
  - $\Rightarrow$ used
    - GPS
    - Glonass
    - Galileo
    - Compas
- More complex receiver
- EGR - powerful development tool

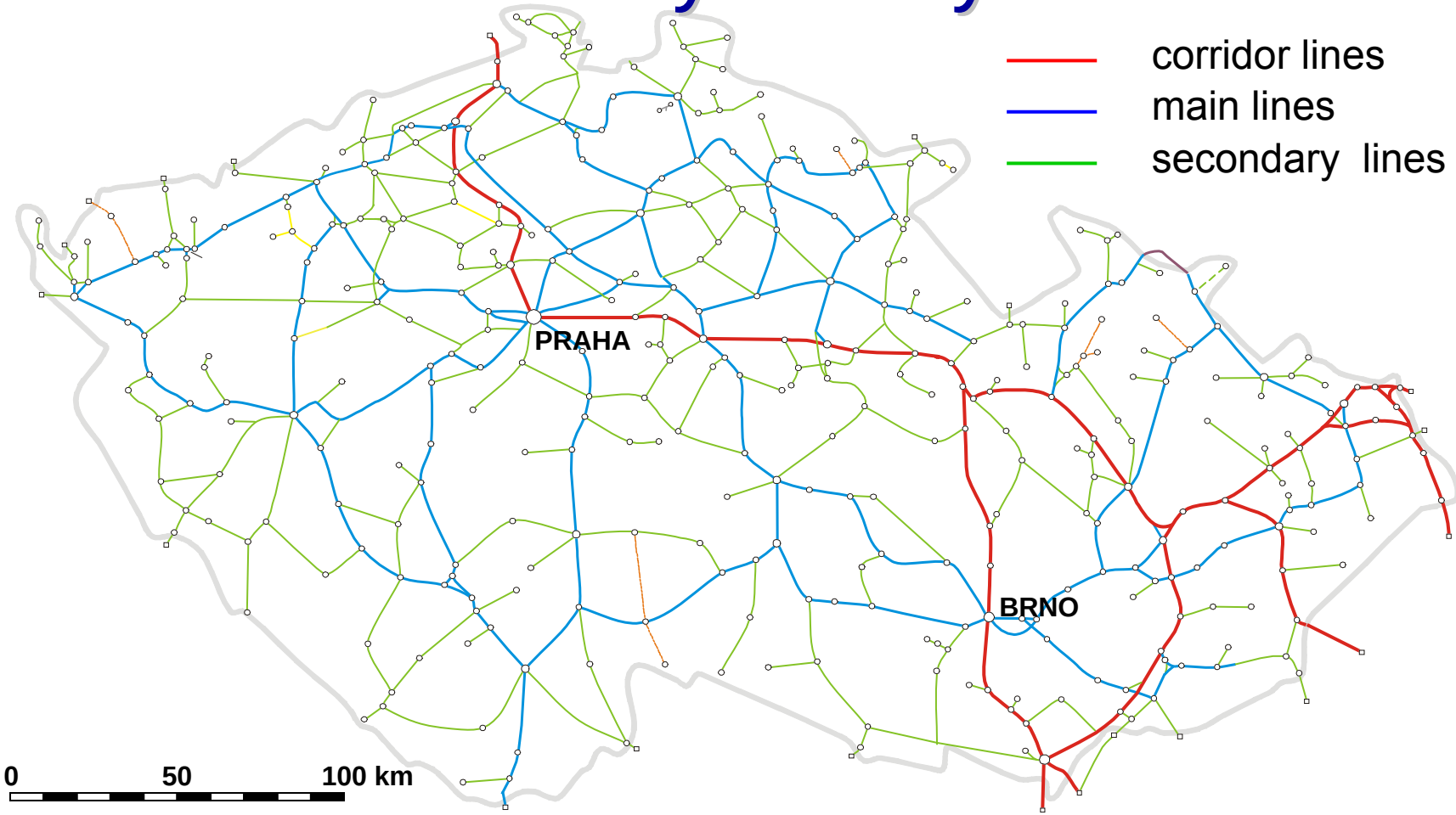
Pilot project 1
Experimental receiver for GNSS

- Described above
- Galileo isn't in the air
  - $\Rightarrow$ used
    - GPS
    - Glonass
    - Galileo
    - Compas
- More complex receiver
- EGR - powerful development tool

PILOT PROJECT 2
GNSS for secondary railway lines

- Corridor and Main Lines
  - agree with European Train Control System (ETCS)
    - very expensive
- Secondary Lines
  - density of lines is very high

PILOT PROJECT 2
GNSS for secondary railway lines

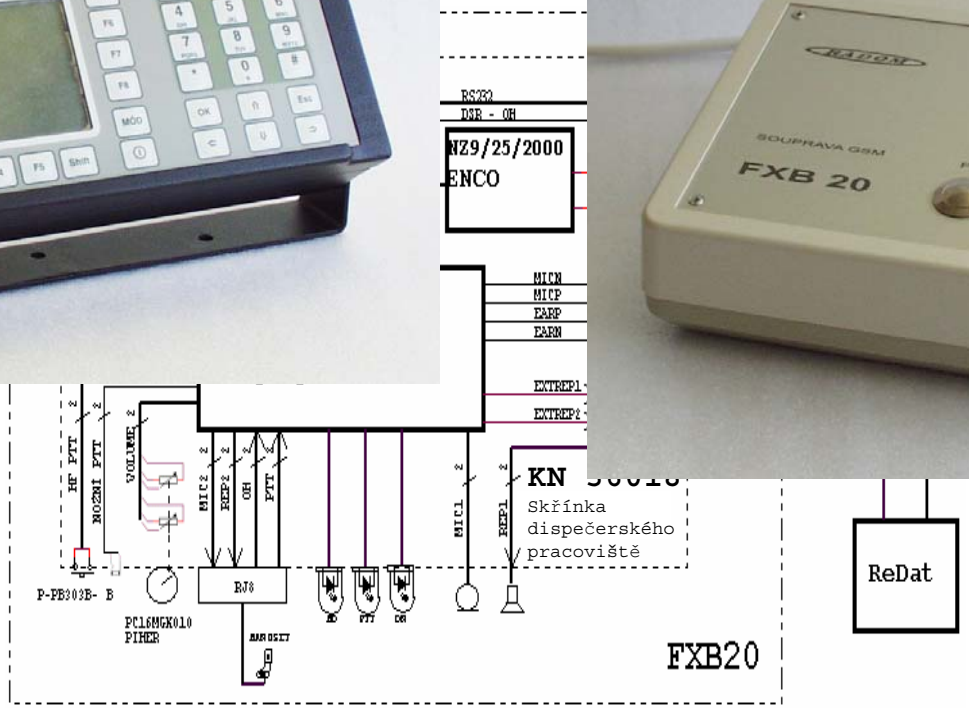


PILOT PROJECT 2
GNSS for secondary railway lines

- Corridor and Main Lines
  - agree with European Train Control System (ETCS)
    - very expensive
- Secondary Lines
  - density of lines is very high
  - national system
    - deployed along lines
      - damaged by unauthorized persons often
    - unreliable - not able to prevent accidents
    - complicated operation
    - calls for human power
    - needs modernization

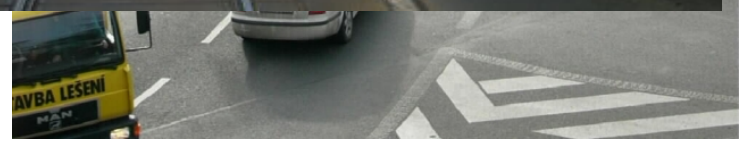
PILOT PROJECT 2
GNSS for secondary railway lines

PILOT PROJECT 2
GNSS for secondary railway lines



Pilot project 3
Road transport optimization using GNSS

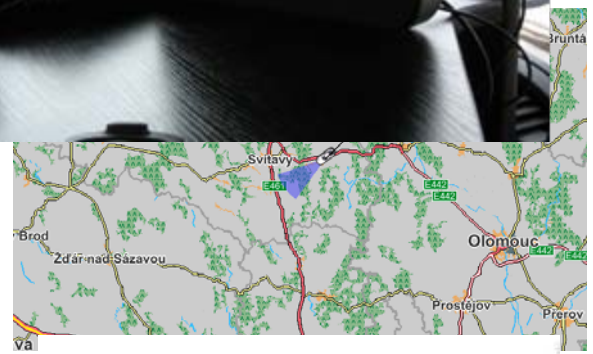
- traffic lights contr
  - density of transpo
    - detectors
      - expensive
      - not flexible
    - floating cars
  - priority of rescue t
- rescue teams support



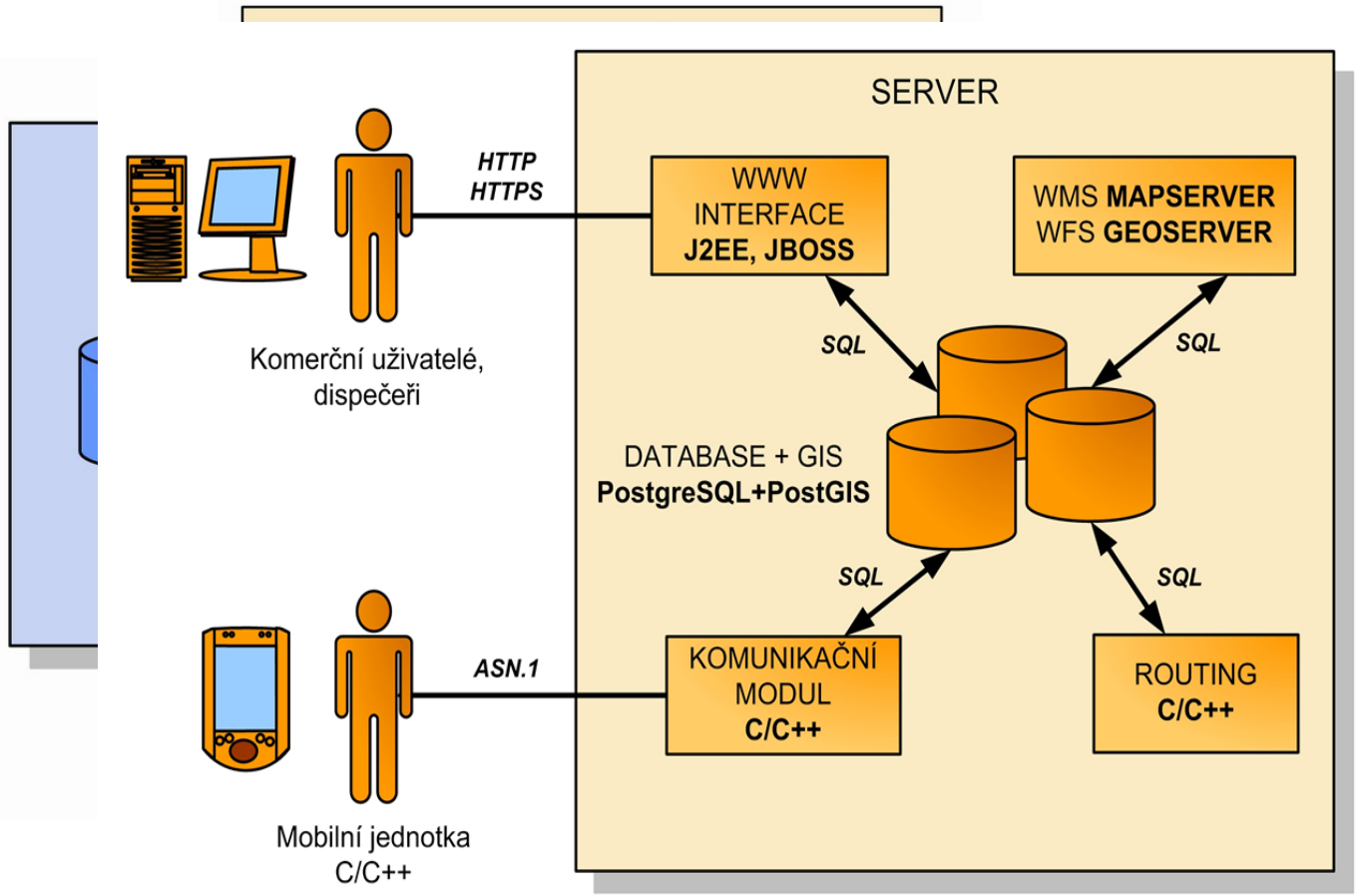
Pilot project 4
GNSS for danger goods transport

Pilot project 4
GNSS for danger goods transport

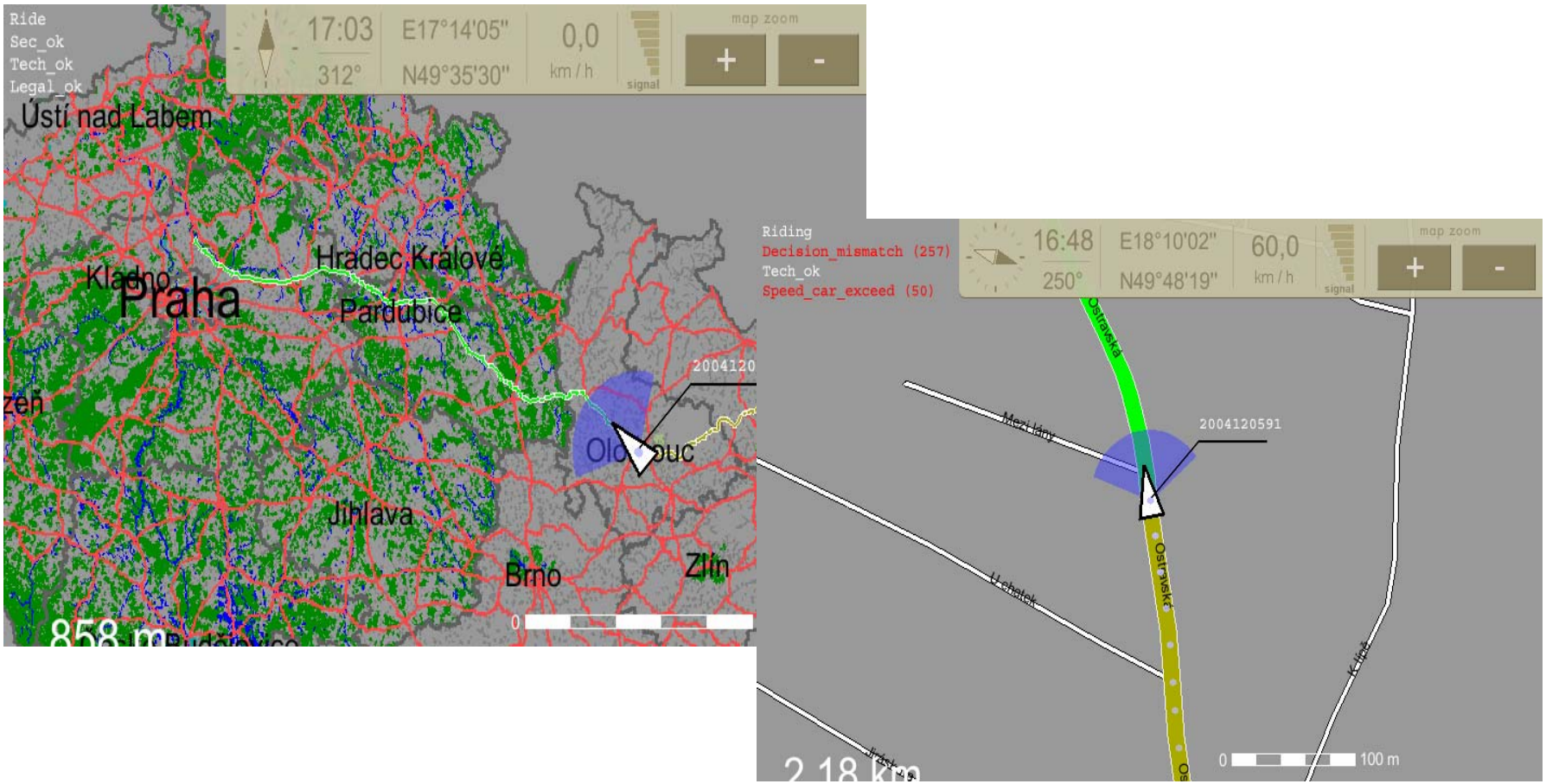
- Data sheet describing goods
- OBU Initialization
  - data sheet transfer into OBU
- Track generation
  - client SW
  - transfer into dispatcher unit
- Truck surveillance
  - alarm and goods description for rescue unit in danger situation
- Final stop
  - generation of protocol about transport



Pilot project 4
GNSS for danger goods transport



Pilot project 4
GNSS for danger goods transport



Pilot project 5
GNSS for control of movement on airport

Other activities in CR handicapped people support

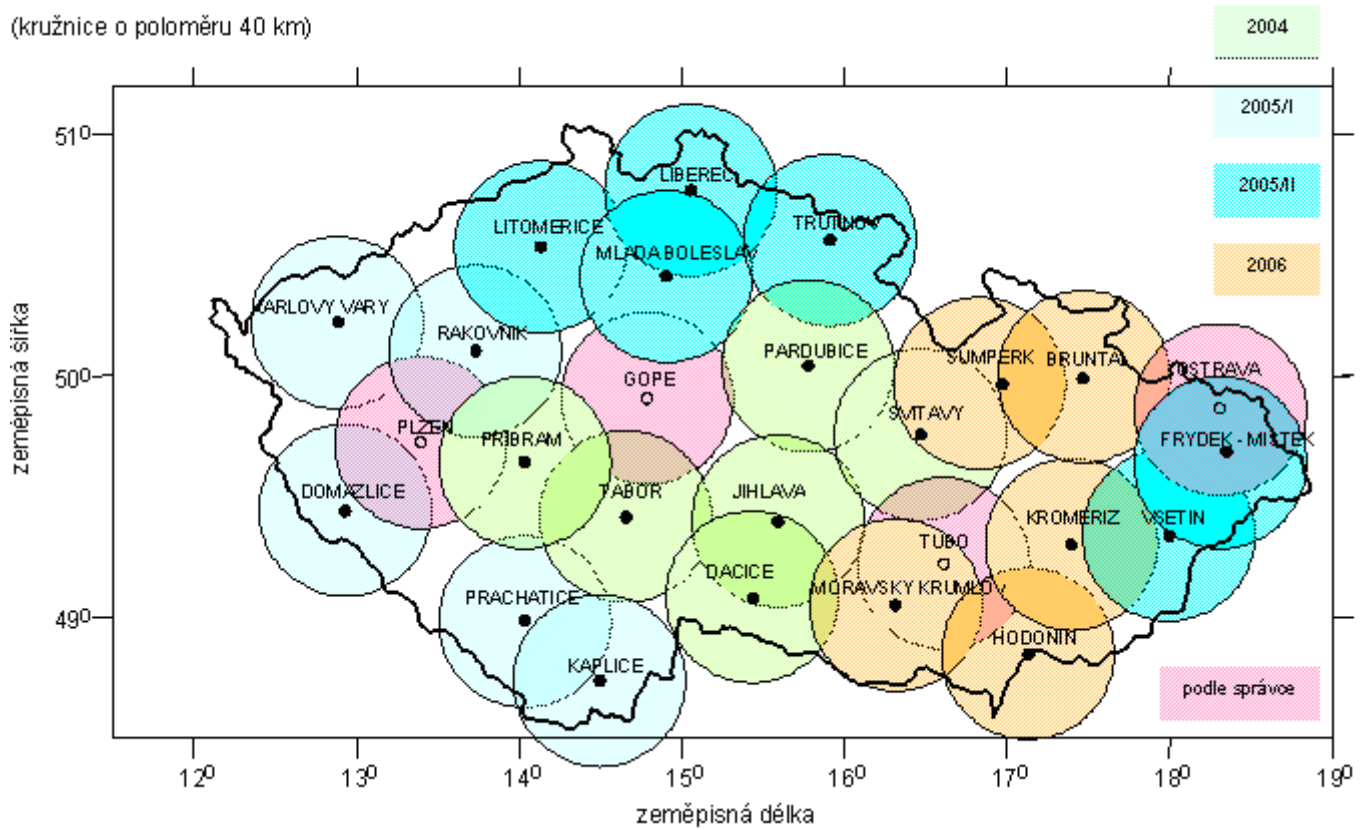
- Blind people support
  - GPS receiver combined with GPRS communicator
  - transmission of position into centre of supervision
  - TV camera connection is planned
  - backward voice channel as part of GPRS communicator

Other activities in CR
CZEPOS - network of reference stations

RESEARCH INSTITUTE OF GEODESY, TOPOGRAPHY AND CARTOGRAPHY

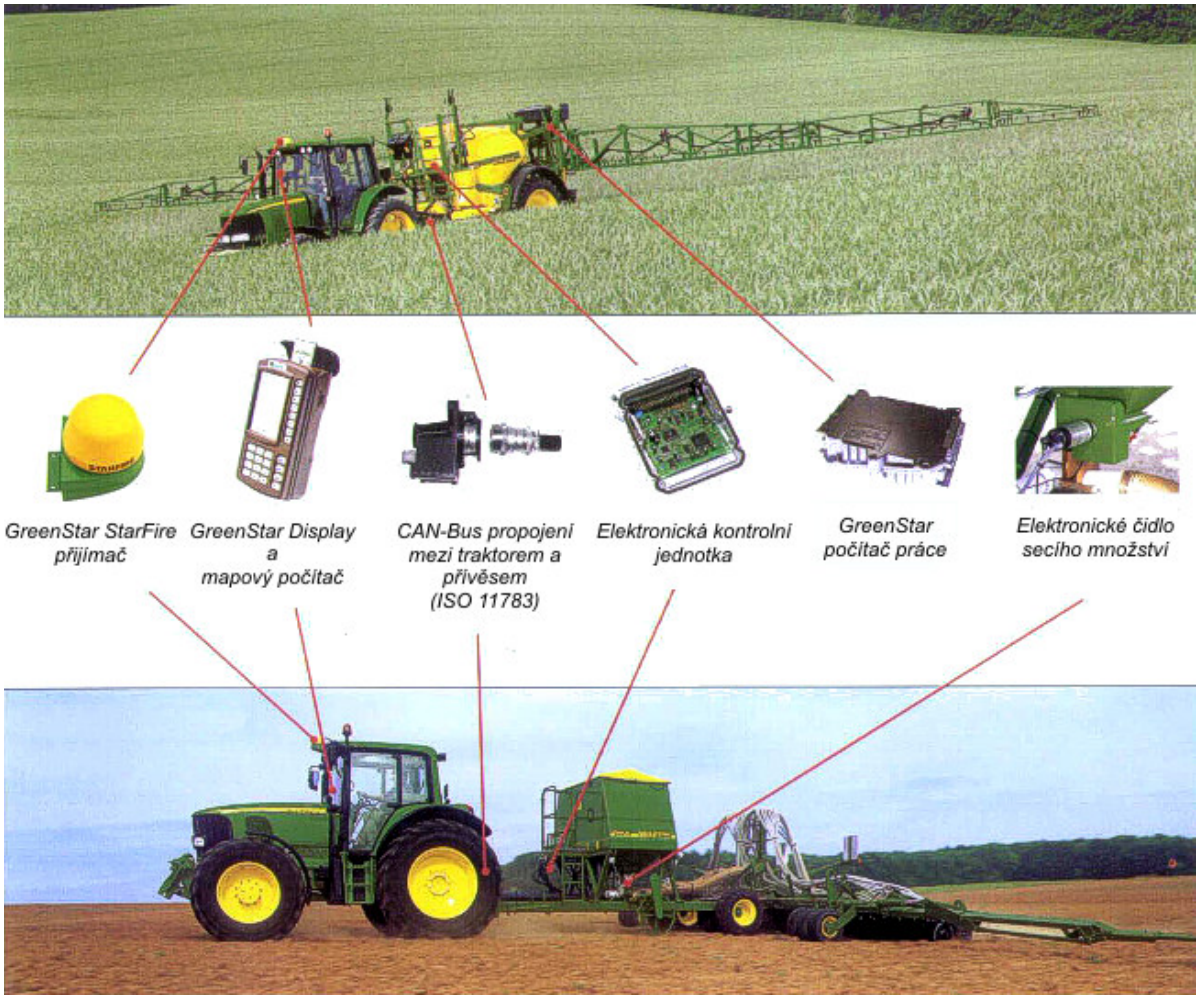
Geodetic Observatory Pecný

Other activities in CR
CZEPOS - network of reference stations



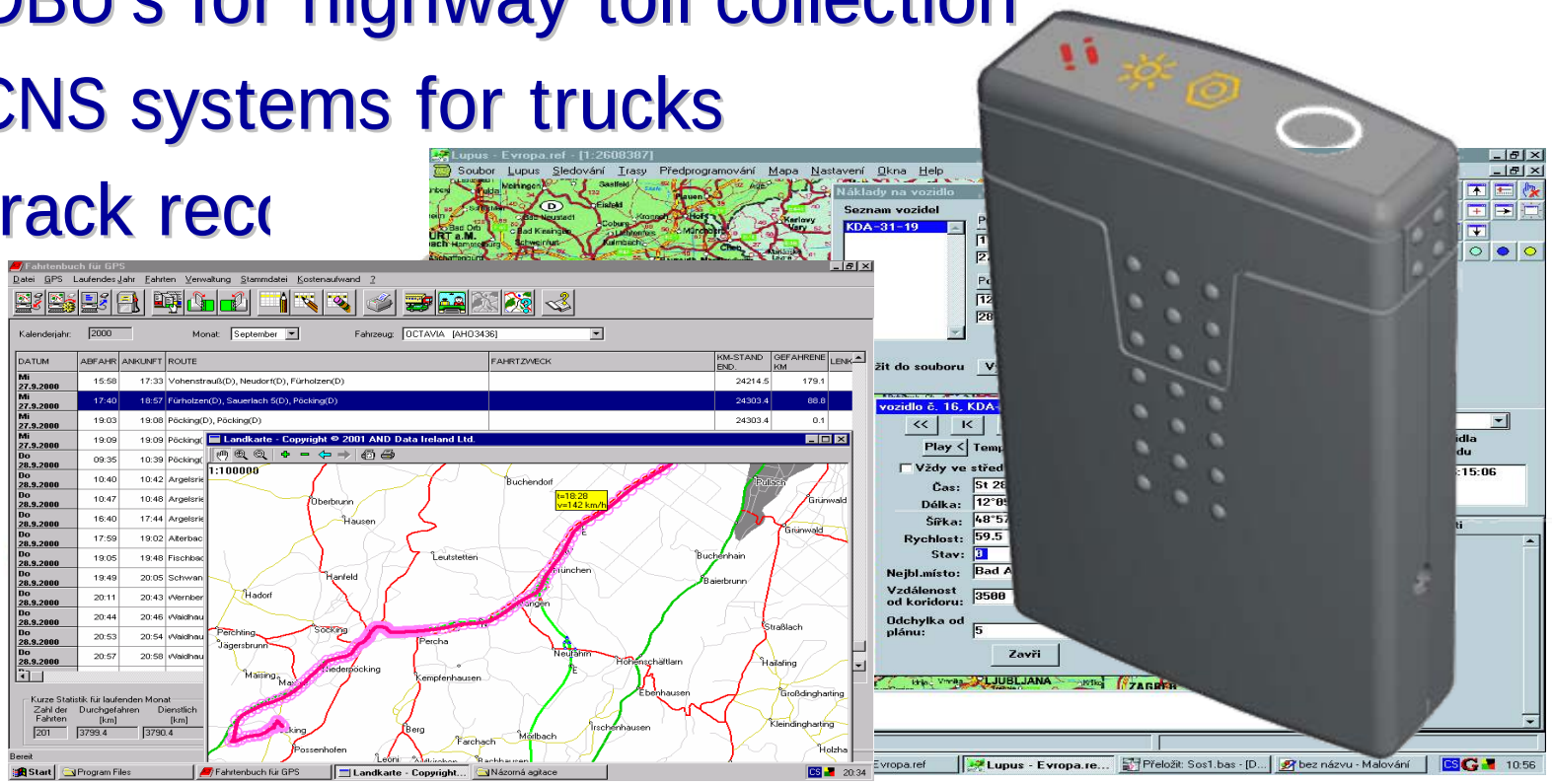
Other activities in CR
CZEPOS - network of reference stations

Other activities in CR
Precision agriculture



Other activities in the Czech Republic

- R&D and production of
  - OBU's for highway toll collection
  - CNS systems for trucks
  - track reco



CONCLUSIONS (1/4)

- Many people in the CR don't feel a need for implementation of satellite navigation in common life
  - life is well organized
  - traffic ways are simple and lucid
  - inhabitants density is reasonable
  - satellite navigation is used in mass volume in
    - geodetical works
    - car navigation
    - transmitters and communications systems synchronization
    - recreational activities

CONCLUSIONS (2/4)

- Czech Government pays attention to satellite navigation
  - to Galileo first of all
  - ministry of transport has person charged with attendance of Galileo program development
  - Prime Minister has expressed his personal interest in Galileo applications progress

CONCLUSIONS (3/4)

- Czech governmental officers should
  - have objective information concerning of technical parameters of systems compared in the same point on time scale
  - know week and strong properties of all SATNAV systems
  - recognize that SATNAV systems are not political problems but a means of life safety
  - know that it is impossible to measure given position with probability equal 1

CONCLUSIONS (4/4)

- Czech Technical University
  - is source of theoretical and practical knowledge for our
    - industry
    - users
    - Government (from time to time ☺)
  - contributed to implementation of GPS into the Czech Army

Thank you for your attention

František Vejražka
vejrazka@fel.cvut.cz
phone +420 2 2435 3406