INITIATIVES IN ESTABLISHING NATIONAL GNSS GROUPS IN STATES OF FORMER CZECHOSLOVAKIA

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UN/USA 2002 Briefing on GNSS Coordination Groups Establishing

Particular recommendations related to national/regional coordinating groups

- to establish the national and, if appropriate, regional planning and coordinating GNSS Groups
- UN will elaborate the organizational model and recommendation for particular activities
- fully functional national groups and their activities could be coordinated by regional group
- financing will be covered by UN, EC, World Bank, GNSS providers, manufactures and member states
- groups should provide qualified education on GNSS applications

BACKGROUND AND ACTIVITIES UP TO NOW IN CZECH AND SLOVAK REPUBLICS

CZECH TECHNICAL UNIVERSITY IN PRAGUE (CTU)

CTU – source of satellite navigation knowledge in the Czech Republic (1/2)

Milestones:

- 70's: governmental statement to educate experts for aircraft industry
- 1983: co-author of „Avant-project" of onboard navigation equipment of L410 aircraft
  - understood that future of navigation is satellite one
  - started GPS aircraft receiver development
- 1990: developed GPS receiver produced by DICOM
- 90's: GPS applications and precision improvement
  - DGPS CTU Reference Station
- …

CTU – source of satellite navigation knowledge in the Czech Republic (2/2)

Milestones:

- …
- 2002: project of the Ministry of Transport „Participation of the CR in the GALILEO Project“ (2.3 M€)
- 2003: participation in EU Call „GALILEO“
- 2003: initiative in coordination, information and education GNSS center (NGO – BOREAS)

EDUCATION AT THE CTU IN PRAGUE

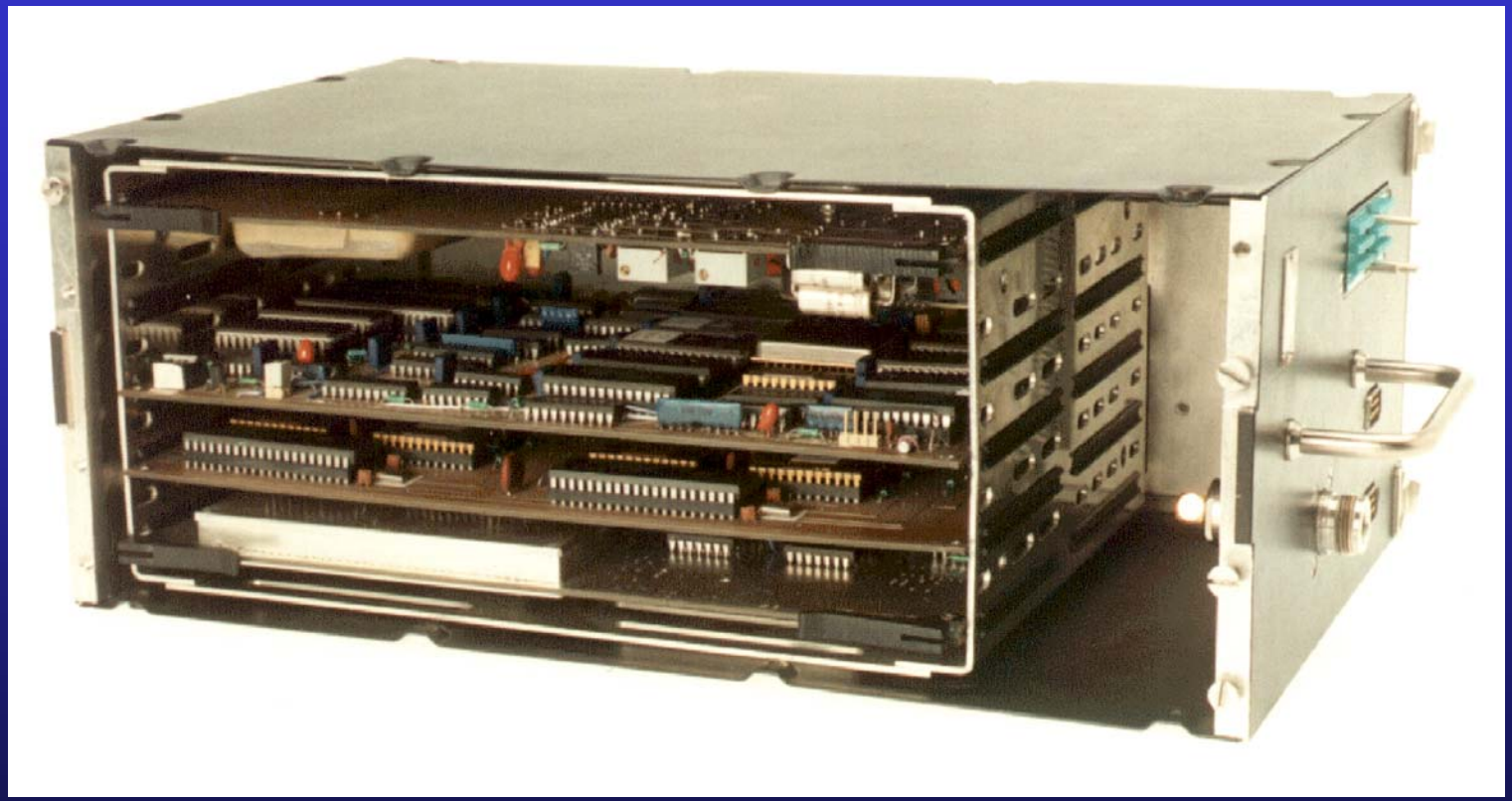
Produces experts in Satellite Navigation

- principles of systems
- theory of ranging signals
- precision
- applications
  - approx. 40 students/year
  - Czech textbooks
  - practise – diploma thesis, cooperation with industry

RESEARCH AND DEVELOPMENT AT CTU IN PRAGUE

Main results of development at CTU

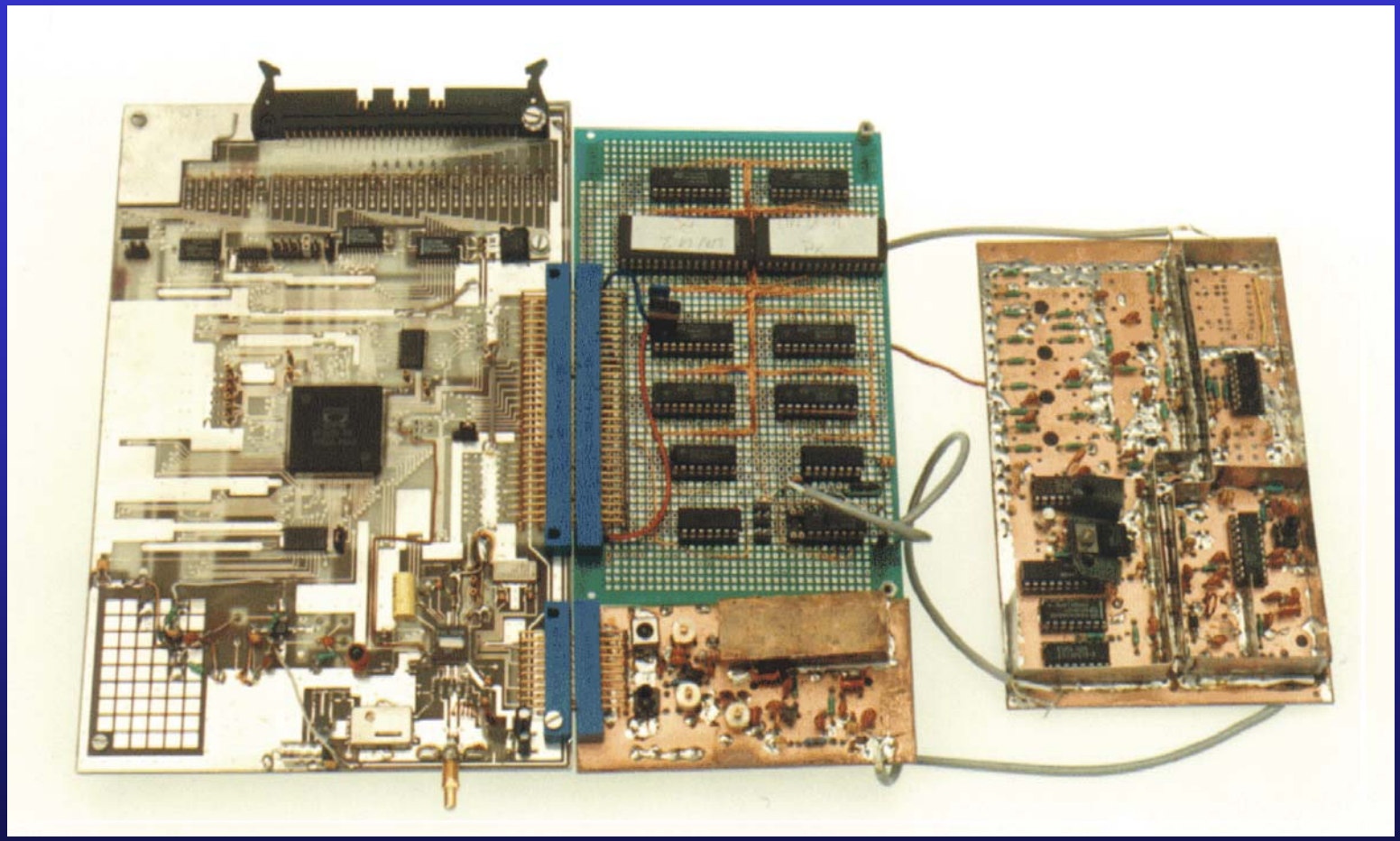
- GPS receiver for Czech Army aircraft



GPR 11 – Airborne GPS Reciver

Main results of development at CTU

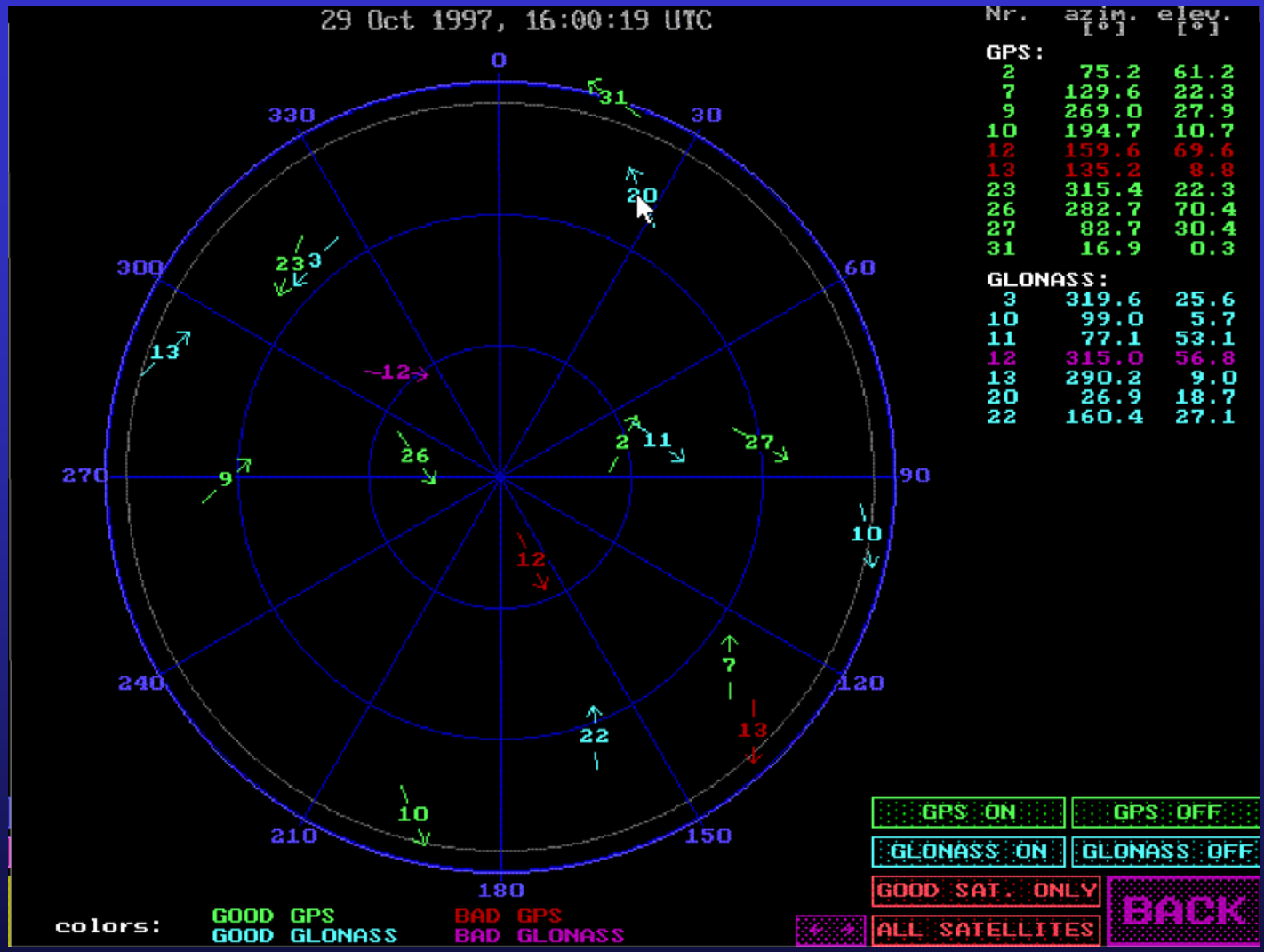
- GPS receiver for Czech Army aircraft
- GLONASS receiver development



GPS/GLONASS Receiver

Main results of development at CTU

- GPS receiver for Czech Army
- GLONASS receiver development
- Monitoring of GPS and GLONASS systems (for more than 15 years)



GPS & GLONASS Systems Monitoring

Main results of development at CTU

- GPS receiver for Czech Army
- GLONASS receiver development
- Monitoring of GPS and GLONASS systems (for more than 15 years)
- Study of GPS precision and integrity improvement
  - GPS augmentation by INMARSAT satellites

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  - GPS augmentation by another sensors
    - inertial sensor

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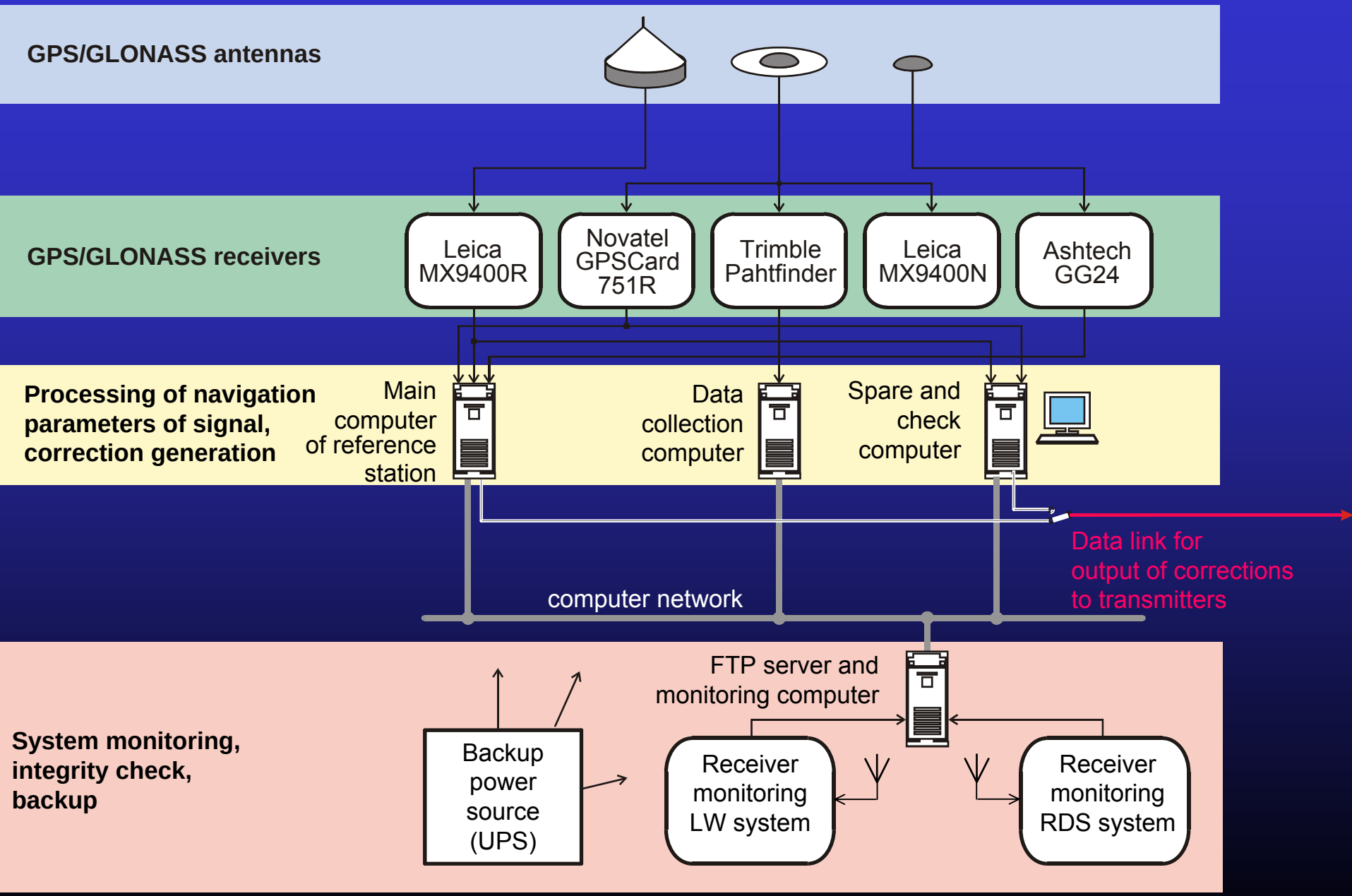
    - inertial sensor
    - DGPS
      - reference station

CTU reference station structure



DGPS REFERENCE STATION

CTU PRAHA

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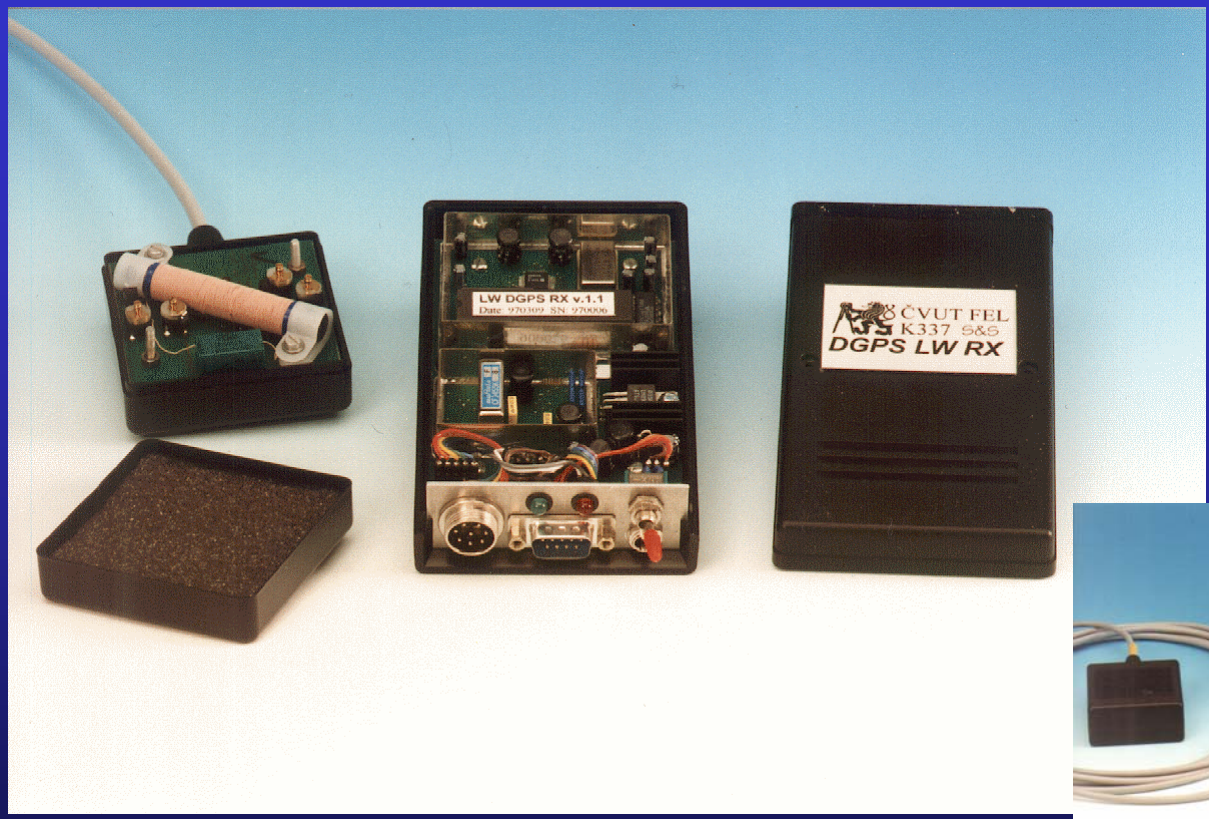
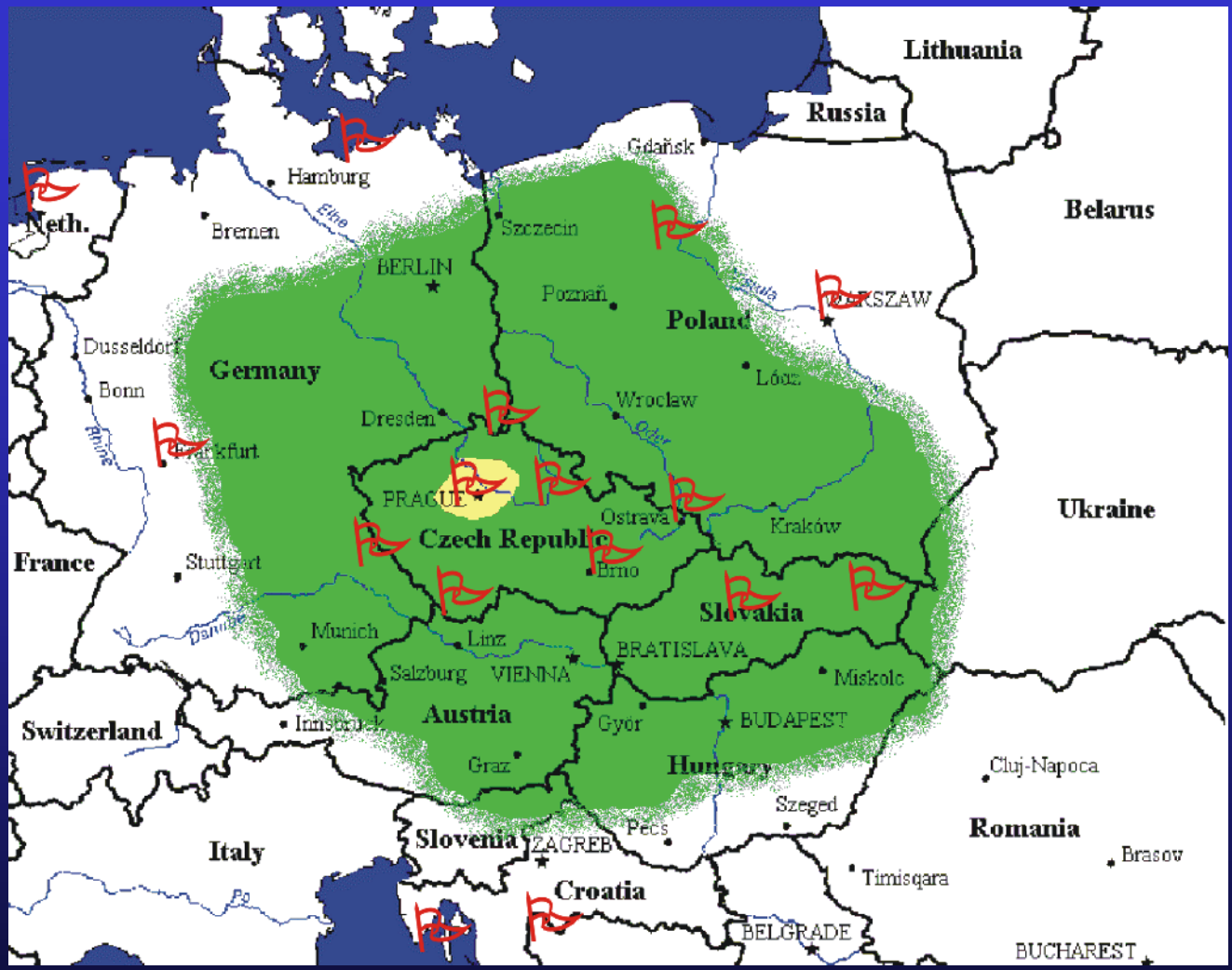
    - DGPS
      - reference station
      - receivers



DGPS corrections LW Receiver



DGPS Correction LW Signal Coverage

Other experience of the CTU on the field of GPS

- approach and landing of military aircraft and precision assessment of landing system
- determination of position of ground objects from board of police helicopters
- municipal transport control
- maintenance of riverbed of rivers Morava and Labe
- precision determination of places of excavation for gas mains repair works
- mapping and maintenance of water and gas pipelines
- onboard equipment of trucks of fire brigade for searching of hydrants under snow

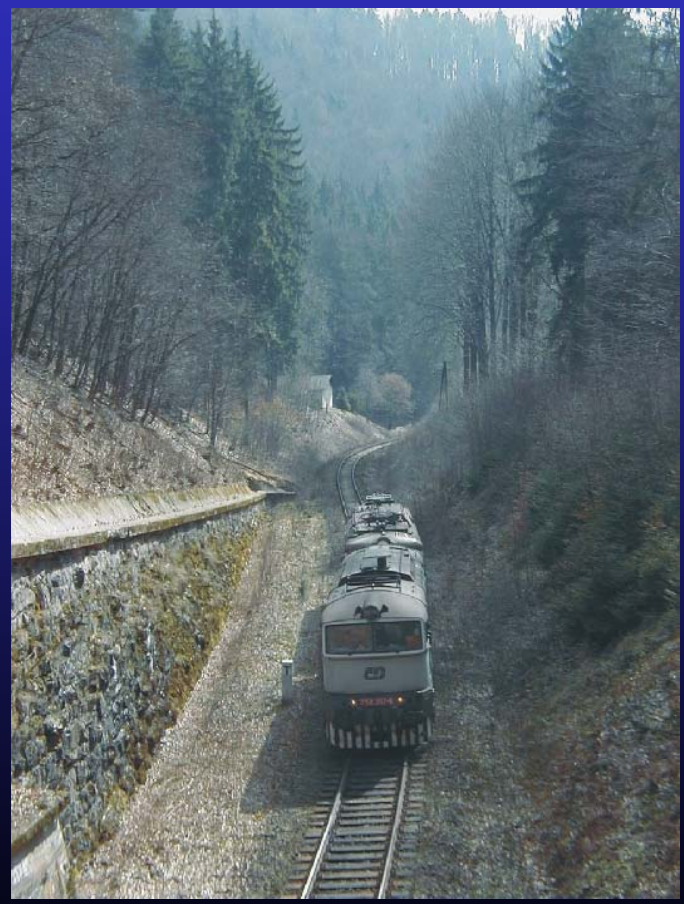
Other experience of the CTU on the field of GPS (cont'd)

- surveying of dams deformation
- surveying of road accidents
- measurement of antenna patterns of transmitters
- mobile phone base stations signal coverage
- precision time generation for synchronisation of telephone exchange
- investigation of fir-trees fertility in Beskydy Mountains
- precision agriculture – determination of fertility in place given by coordinates and corresponding fertilisers use in this point
- position sensor for electronic map onboard a car

PRESENT ACTIVITY OF CTU

Problem:
signal reception in hard conditions

- under leaves canopy
- in hollowed tracks
- in street canyons
- inside buildings
- etc.

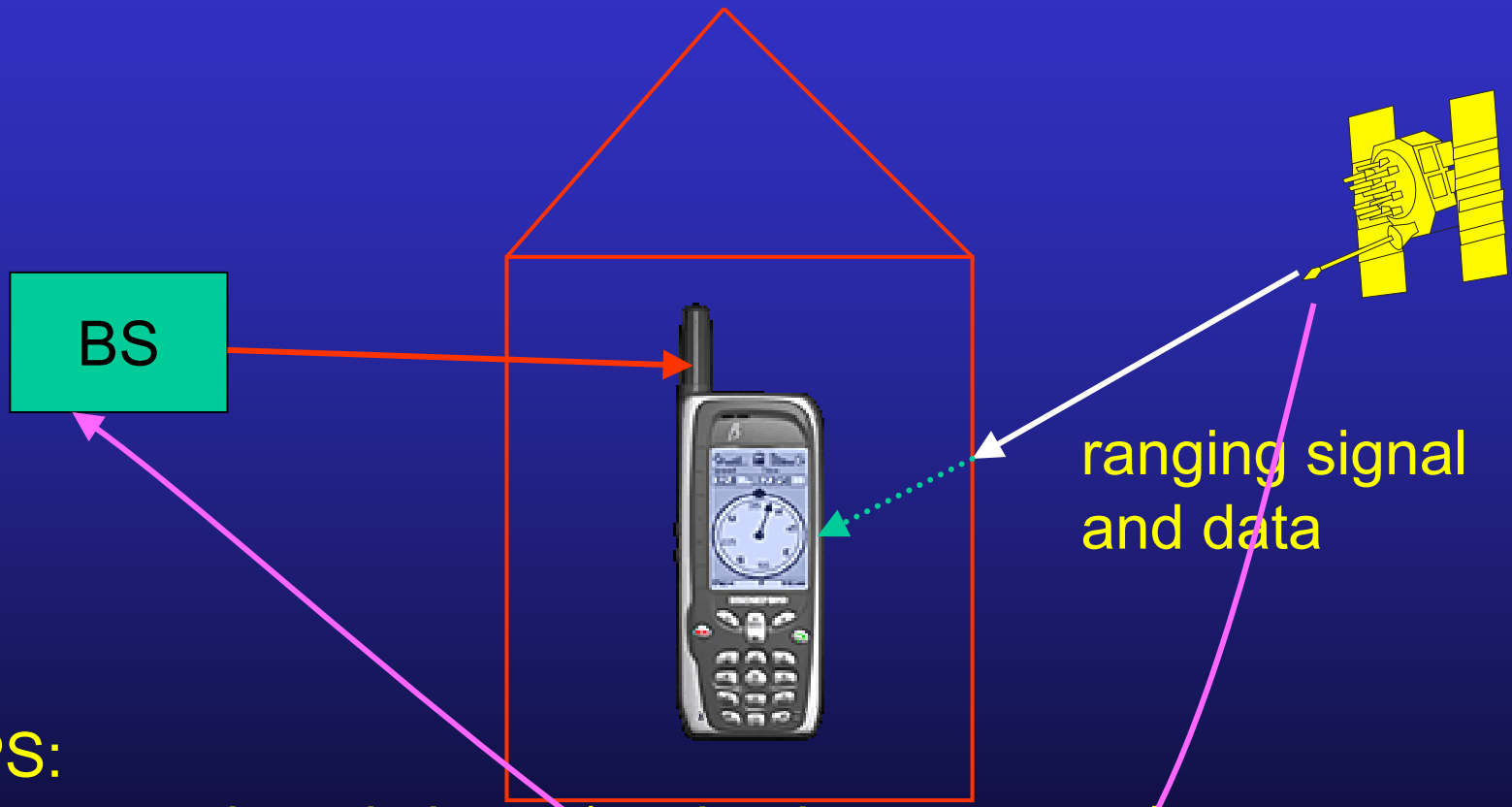


Problem:
signal reception in hard condition

Solution:

- support (augmentation) from additional sensors
  - inertial sensor
  - gyroscope
  - odometer
  - altimeter
- more sensitive GPS (GNSS) sensor
  - assisted GPS (GNSS) – AGPS/AGNSS
- support from other navigation means
  - LORAN C

Assisted GPS – AGPS



AGPS:

1) external data delivery (navigation message)
2) external timing
3) „washing“ of ranging signal

RECEIVER:

- for AGPS/AGNSS
- for experiments with powerful algorithms for processing of signals of *new SATNAV systems*
- processing of all known and planned SATNAV signals:
  - GPS L1, L2, L5
  - GLONASS
  - EGNOS, WAAS
  - GALILEO
- etc.

EXPERIMENTAL RECEIVER FOR SATELLITE NAVIGATION

- for AGPS/AGNSS
- for experiments with powerful algorithms for processing of signals of *new SATNAV systems*
- processing of all known and planned SATNAV signals:
  - GPS L1, L2, L5
  - GLONASS
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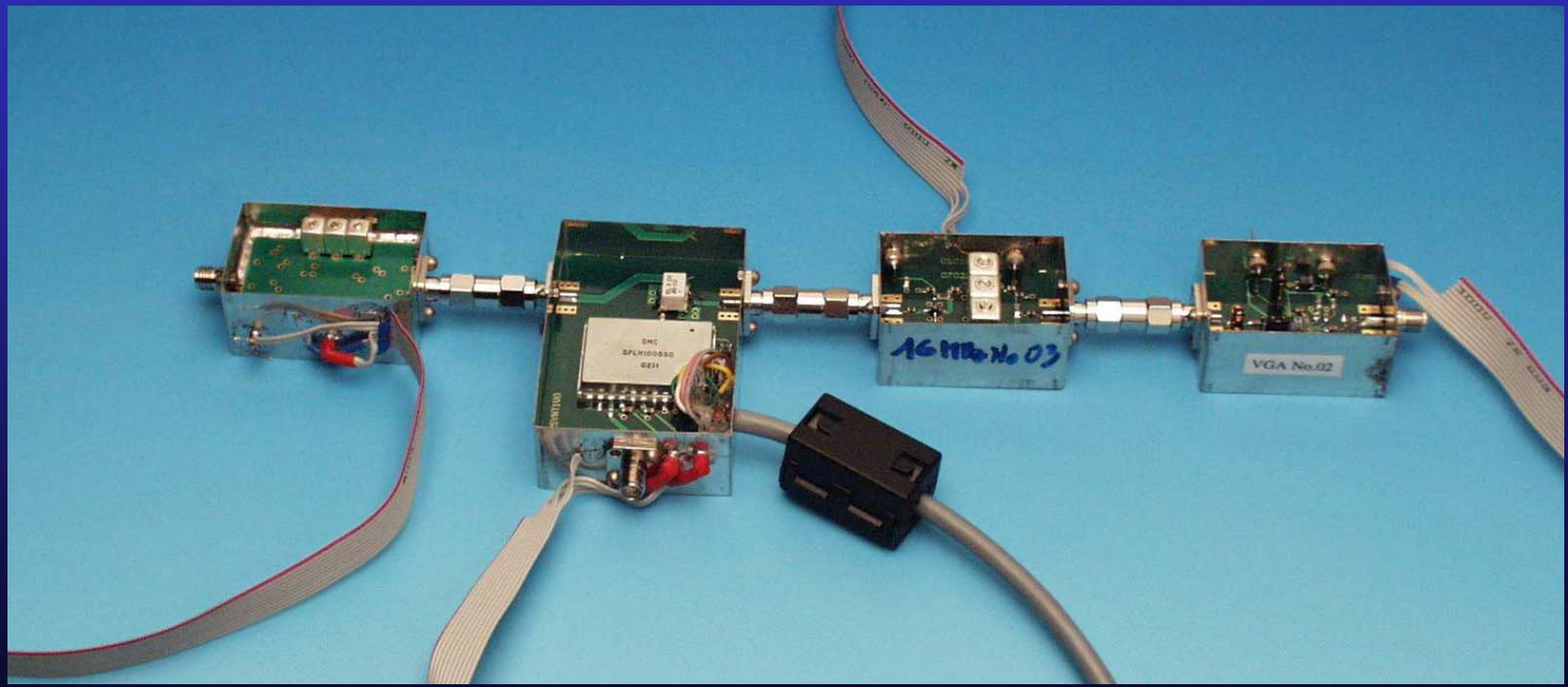
- etc.

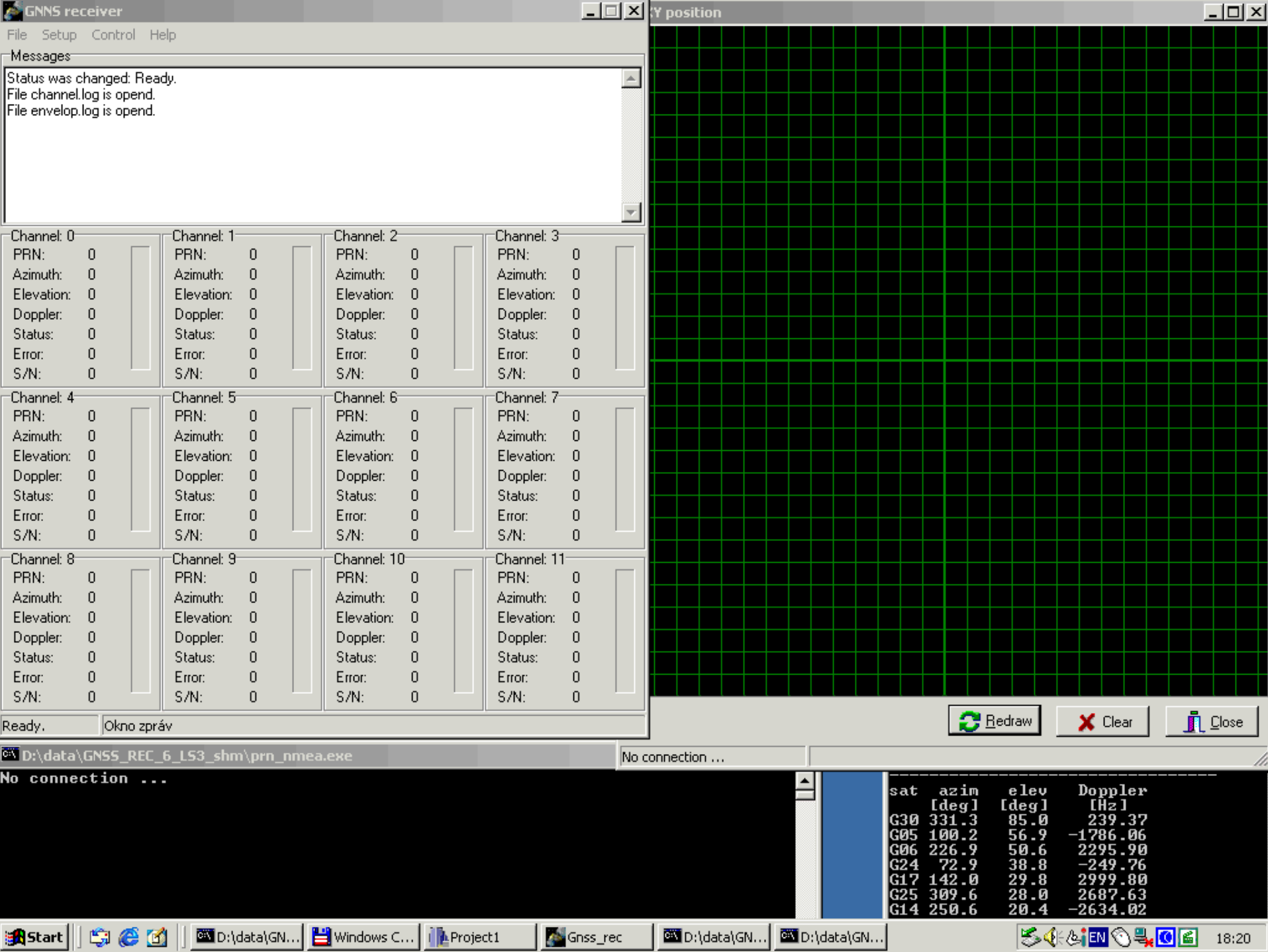
Experimental Receiver architecture: hardware

Radio Frequency Unit realization



Receiver applications

- development of algorithms suitable for specific situations, e.g. AGPS
- evaluation of them in real situations
- radio channel model investigation
- experiments with signal properties and parameters determination
- experiments with signal processing
- new signals design
- …


GNNS receiver
File Setup Control Help
Messages
Status was changed: Ready.
File channel.log is opend.
File envelop.log is opend.
Channel: 0
PRN: 0
Azimuth: 0
Elevation: 0
Doppler: 0
Status: 0
Error: 0
S/N: 0
Channel: 1
PRN: 0
Azimuth: 0
Elevation: 0
Doppler: 0
Status: 0
Error: 0
S/N: 0
Channel: 2
PRN: 0
Azimuth: 0
Elevation: 0
Doppler: 0
Status: 0
Error: 0
S/N: 0
Channel: 3
PRN: 0
Azimuth: 0
Elevation: 0
Doppler: 0
Status: 0
Error: 0
S/N: 0
Channel: 4
PRN: 0
Azimuth: 0
Elevation: 0
Doppler: 0
Status: 0
Error: 0
S/N: 0
Channel: 5
PRN: 0
Azimuth: 0
Elevation: 0
Doppler: 0
Status: 0
Error: 0
S/N: 0
Channel: 6
PRN: 0
Azimuth: 0
Elevation: 0
Doppler: 0
Status: 0
Error: 0
S/N: 0
Channel: 7
PRN: 0
Azimuth: 0
Elevation: 0
Doppler: 0
Status: 0
Error: 0
S/N: 0
Channel: 8
PRN: 0
Azimuth: 0
Elevation: 0
Doppler: 0
Status: 0
Error: 0
S/N: 0
Channel: 9
PRN: 0
Azimuth: 0
Elevation: 0
Doppler: 0
Status: 0
Error: 0
S/N: 0
Channel: 10
PRN: 0
Azimuth: 0
Elevation: 0
Doppler: 0
Status: 0
Error: 0
S/N: 0
Channel: 11
PRN: 0
Azimuth: 0
Elevation: 0
Doppler: 0
Status: 0
Error: 0
S/N: 0
Ready.
Okno zpráv
Y position
Redraw
Clear
Close
D:\data\GNSS_REC_6_LS3_shm\prn_nmea.exe
No connection ...
No connection ...
sat azim elev Doppler
[deg] [deg] [Hz]
G30 331.3 85.0 239.37
G05 100.2 56.9 -1786.06
G06 226.9 50.6 2295.90
G24 72.9 38.8 -249.76
G17 142.0 29.8 2999.80
G25 309.6 28.0 2687.63
G14 250.6 20.4 -2634.02
Start
D:\data\GN...
Windows C...
Project1
Gnss_rec
D:\data\GN...
D:\data\GN...
EN
18:20

VSB – TECHNICAL UNIVERSITY OF OSTRAVA

VSB TECHNICAL UNIVERSITY OF OSTRAVA

- Education
  - principles of SATNAV
  - applications in geoinformatics
  - approx. 60 students/year
- Activities of the Czech Association of Geoinformatics

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Milestones:

- …
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NGO BOREAS (1/2)

Czech national GNSS multidiscipline body

- aim
  - hardware recommendation for GNSS users
  - advisory service for GNSS applications
  - use of GNSS in natural processes
  - popularization of GNSS in the wide public
- establishes a platform for
  - information
  - coordination
  - education and training

NGO BOREAS (2/2)

Czech national GNSS multidiscipline body

- …
- gets together people from
  - universities
  - Academy of Sciences of the Czech Republic
  - national parks
  - Czech geological service
- active participation in UN/USA Action Team on GNSS
- cooperation with abroad

ACTIVITIES IN THE SLOVAK REPUBLIC

SLOVAK TECHNICAL UNIVERSITY IN BRATISLAVA

EDUCATION AT THE SLOVAK TECHNICAL UNIVERSITY IN BRATISLAVA

- principles of SATNAV
- approx. 60 students/year

SLOVAK NATIONAL GNSS GROUP INITIATIVES (1/2)

- to establish the working groups in accordance with the recommendations of UN/USA
- to organise meetings of Experts
- the institutions and interested parties involved are
  - Geodetic and Cartographic Institute Bratislava
  - Slovak Association of Geoinformation
  - Slovak Post and Telecommunications Research Institute and
- proposal on groups structure and activities in accordance with the UN recommendations

SLOVAK NATIONAL GNSS GROUP INITIATIVES (2/2)

- ...
- bodies above cover following activities:
  - development of infrastructure for real time positioning with high accuracy
  - development of national spatial infrastructure
  - providing communication channels for cadastre
  - harmonisation of GIS activities

CONCLUSIONS AND RECOMENDATIONS (1/3)

- common national GNSS Group activities
  - to provide continuous survey of
    - all present or emerging GNSS related activities
    - progress achieved
    - the needs of decision makers, manufactures and users community
  - to harmonize GNSS related activities with plans and recommendations of UN

CONCLUSIONS AND RECOMENDATIONS (2/3)

- …
- to collect all the information above, the summarizing it and elaborating reports for either regional groups or for UN to harmonize these activities in most effective manner
- to identify persons which should participate at UN workshops
- to establish the training center according to recommendation of UN/USA workshops

CONCLUSIONS AND RECOMENDATIONS (3/3)

- …
- UN – OOSA should *precise* three crucial points
  - the structure of national/regional groups
  - sources of funding
  - activities

Thank you for your attention

http://radio.feld.cvut.cz/personal/vejrazka