Dr Zoltán Bay  
(1900-1992)
Electronic Ground Support Equipments
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Hungary

- One of the member states of the European Union
- 10 million of inhabitants
- The GDP per capita was 6782 € in 2002 (HCSO)
- The share of expenses spent on R+D was 0.94% of the GDP
Volume indices of gross domestic product
1990-2004

(source Hungarian Central Statistical Office)
R&D

Number of employed persons in R&D and expenditure as percentage of GDP

( source Hungarian Central Statistical Office )

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Space research in Hungary

- Expense per year spent to space research is about 0.2 € / capita (HSO),
- about 2 million € per year

- Space research is conducted in about 20 scientific institutes
  - academy research institutes, universities, private companies

- The number of space researchers is about 250

- The country searches the way reinforcing it participation in co-operations in space research.

- The objective is to satisfy the requirement for the ESA membership.
Space budget in Hungary and in ESA member states
(per capita bases)

Space budget of the ESA Member States and the Hungary
(euro per capita)

(source Hungarian Space Office)
EGSE for Rosetta RPC
Hungarian participation in co-operations

- Hungary
  - participated in the Intercosmos program, since seventies
  - joined to the ESA PRODEX program in 1998,
  - joined ESA PECS program in 2003,
  - participated in several NASA’s programs,
  - tries reinforce the co-operation with IKI,
  - searches the way for co-operation with other Middle and Eastern European States
KFKI RMKI

- KFKI - Central Research Institute of Physics
- RMKI - Research Institute for Particle and Nuclear Physics

- The KFKI was founded by MTA, in 1950

- In 1992, KFKI was reorganized,
  - It was divided for several firms and research institutes
  - One of its successors is the KFKI RMKI
Fields of interest

- Particle Physics
- Theoretical Physics
- Nuclear Physics
- Space Physics
- Plasma Physics
- Biophysics
- Education
Participation in education at university level

- Options for special lectures
- Options for stages
- Options for gathering experience in frame of supervised R&D
- Options for working on PHD
Most memorable missions for KFKI RMKI

- Vega, TVS
- Phobos, CDACS
- Mars `96, EGSE for MARENF and MARIPROB
- Spectr X Gamma, BIUS
- Cassini, EGSE for MAG experiment
- VenusExpress, calibration system for Aspera experiment
- Obstanovka, BSTM, DACU1/2, EGSE
Vega, TVS
Phobos, CDACS
Rosetta, CDMS
VenusExpress, BTTS, HVAM, HVDM

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Obstanovka, BSTM, DACU1/2
Acquired competences

- designing and manufacturing charged particle detectors
- designing and manufacturing on-board computers (HW+SW)
- designing and manufacturing EGSEs (HW+SW)
What are the EGSEs for

EGSE is a tool to develop and verify the reliability of on-board instruments on the Earth during development phase.
Functional requirements

- simulate the electronic environment of on-board devices
- supply input signals and power
- send TeleCommands
- receive and visualize TeleMetry packets
- advisable to have certain kind of transparency
Solutions searched

- easy to finance
- easy to develop
- easy to maintain
- easy to extend
- easy to use
- easy to move
Typical solutions

- hardware (standard PC, PC104, custom design add-on cards)
- software (operating system, application, development environment)
- communication standard (RS232, RS422, MIL STD 1553, ethernet)
- user interface (hardware, ..., graphical)
Operating systems

- Dos
- self designed real-time multitasking operating system
- real-time linux + windows
EGSE for TUNDE experiment
EGSE for BIUS
EGSE for RPC - hardware
EGSE for RPC - block diagram

RPC Ground Support Equipment Functional Diagram

- CPU: Intel 80C188EB
- EEPROM
- SRAM
- XILINX XC3042 CONFIGURABLE LOGIC ARRAY
- MAINS POWER SUPPLY
- MAINS EXPERIMENT BUS DRIVERS
- REDUNDANT EXPERIMENT BUS DRIVERS
- EXPERIMENT BUS
- RELAY DRIVERS
- RS 232 LINK
- SERIAL INTERFACE
- CLOCK GENERATOR
- POWER-ON RESET
- NOTEBOOK COMPUTER

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Custom developed cards for BIUS EGSE

SRG MIL 1553
SRG MIL STM
SRG MIL ATM
SRG MIL CCW
SRG MIL FTM

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EGSE for Obstanovka - block diagram
EGSE for Obstanovka - hardware

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laboratory model

final version
Typical parameters

- 128 Mbyte memory
- 128 Mbyte flash disc
- serial ports (rs232, rs422, USB)
- ethernet connection (cable, wifi)
- removable discs

- operation system: real-time linux (45 Myte)
EGSE for Obstanovka - cards
EGSE for Obstanovka - user interface