Satellite Services B.V.
Next Generation TM/TC System (NTTS final presentation)
4th February 2004 - ESA-ESTEC

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Presentation Overview

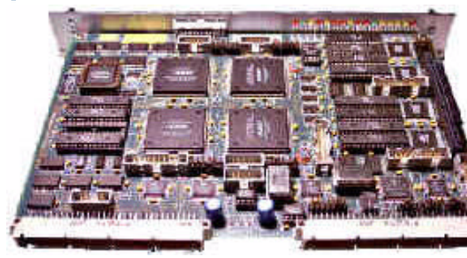
- Backgrounds to the project
- The Integration Process
- Successful system deployments
- Future and on-going developments

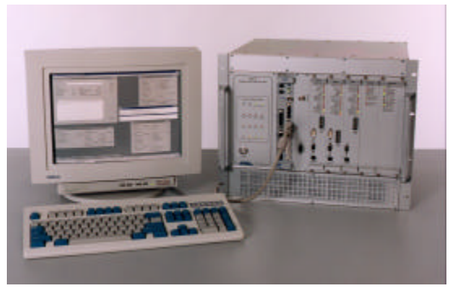
This presentation discusses the NTTS project plus subsequent additional developments by Satellite Services B.V. that fall outside the original project boundaries

TM/TC Background

- PCM systems since 1984, first modular packet TM processing systems since 1987

- 1996 => VME based Standard Packet TM/TC System: CCSDS TM/TC Workstation





- Over 16 ESA/CCSDS Packet spacecraft supported since 1996

- 1999-2004 => NTTS : Next Generation Technology TM/TC System The next step in technology, performance and flexibility

Discrete boards, modules and systems

- Physical limitations
  - PCB tracks
  - System interconnection
- Specific Developments per project
- Lack of flexibility

- EGSE required early in spacecraft development….
  Requirements change… so must the EGSE…

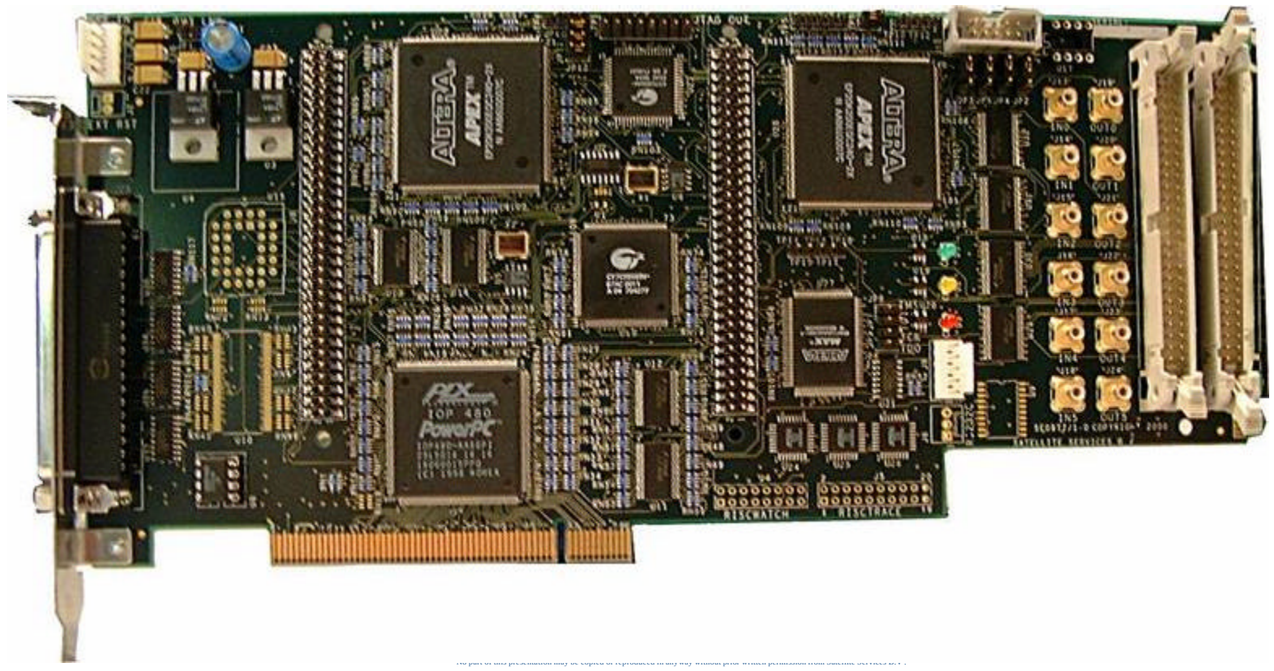
NTTS Goals

- Use of latest technologies
- Tight system integration
- Increase flexibility
- Increase performance

- To develop the Next Generation of Telemetry and Telecommand Systems for:
  - Satellite Integration and Test
  - On-Board system development
  - Ground Segment applications
- A family of products that are directly compatible / complimentary

System-On-A-Programmable-Chip

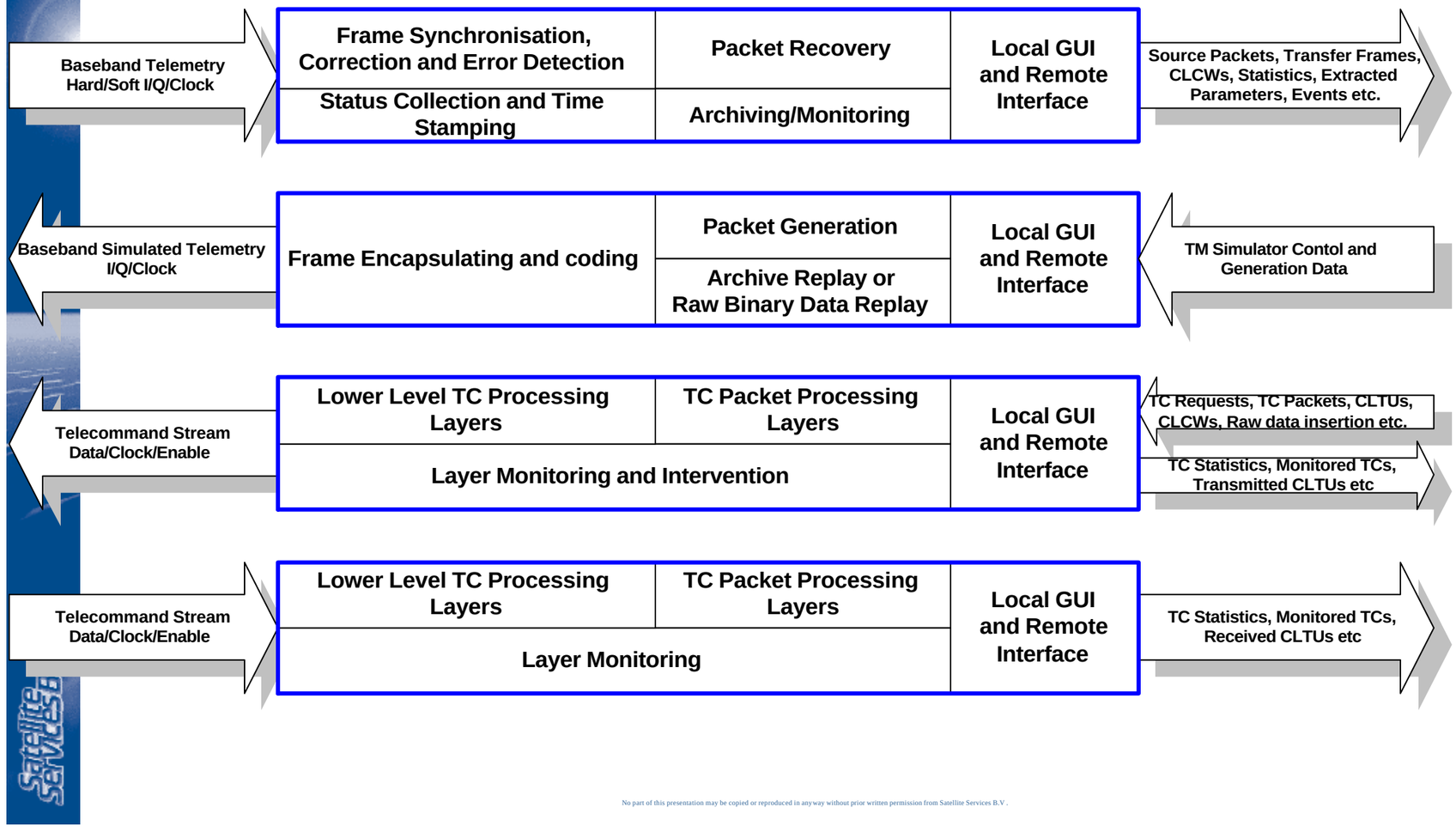
- EGSE not restricted by RAD-Hard requirements
- In circuit re-programmable SRAM based FPGAs
- FPGAs large-enough for SOPC



Modular Design Approach

- Centralised Hardware/Software Interface
- Distributed “Block Based” Processing Architecture
- Common Interfacing Techniques around “Blocks”
  - ✍ Allows efficient removal, addition and modification of blocks
  - ✍ Allows re-use of designs

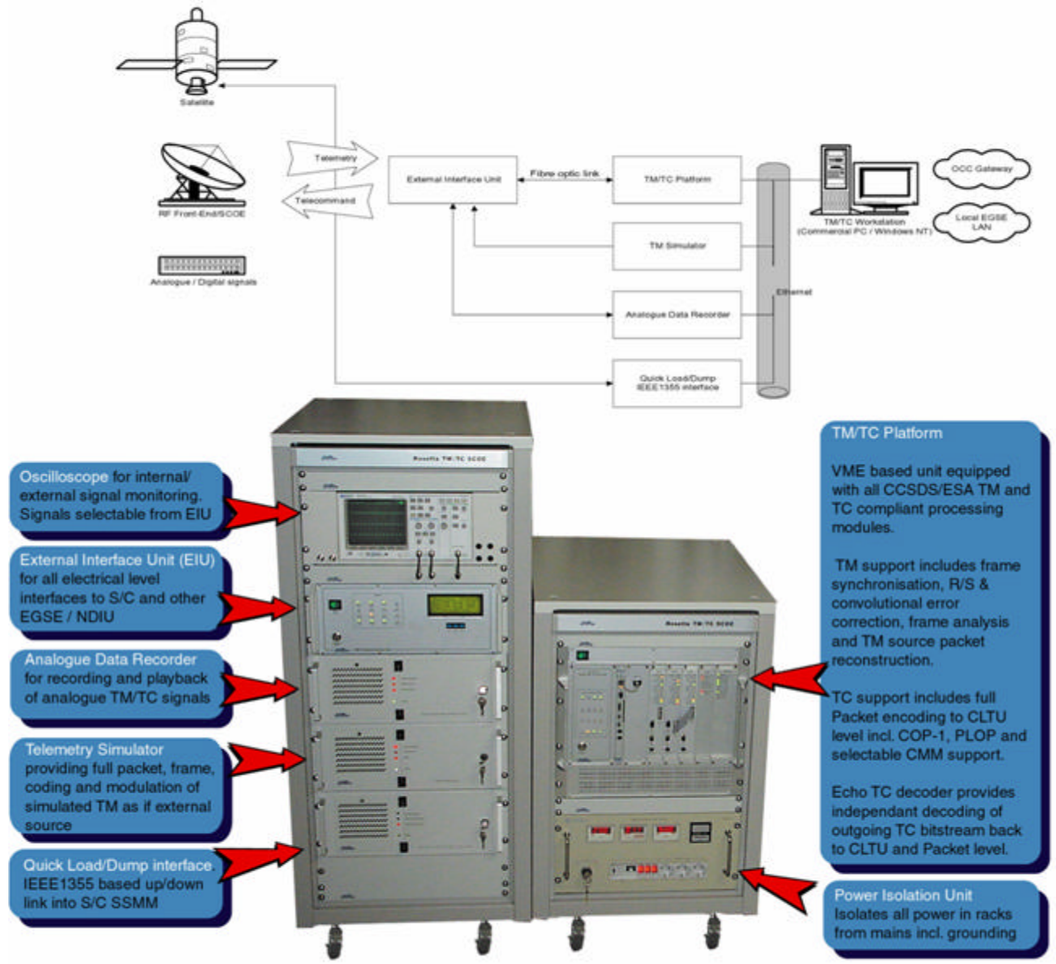
TM/TC Baseband Processor



Compact 2U/19” TM/TC Processor

- SE0985 TMTC Processor Card + Software
  - Low Level Software
  - Control and Monitor Software
  - Remote LAN Interfacing
  - Logging
- LED indications
- Monitoring Points

Satellite Level Telemetry & Telecommand Front-End (TM/TC SCOE)



TM/TC Workstation

This is a commercial PC running the Microsoft Windows NT Operating System and the Satellite Services B.V. Control, Processing & Monitoring Software (CPMS).

This distributed software environment provides all functions related to the local & remote operation, data preparation, generation and processing functions as well as an easy to use Graphical User Interface.

Built-in logging, diagnostics and TM/TC Archiving is supported as well as extensive status, analysis and TM/TC packet, frame and parameter displays.

For remote interfacing the system can be controlled and monitored via standard TM/TC packets or other specific protocols/communication links.

TM/TC data distribution & processing is supported from multiple sources and includes TM/TC packets, frames and status/error information.

User extentions and functionality can be added by means of a DLL based API.

Oscilloscope for internal/ external signal monitoring. Signals selectable from EIU

External Interface Unit (EIU) for all electrical level interfaces to S/C and other EGSE / NDIU

Analogue Data Recorder for recording and playback of analogue TM/TC signals

Telemetry Simulator providing full packet, frame, coding and modulation of simulated TM as if external source

Quick Load/Dump interface IEEE1355 based up/down link into S/C SSMM

TM/TC Platform

VME based unit equipped with all CCSDS/ESA TM and TC compliant processing modules.

TM support includes frame synchronisation, R/S & convolutional error correction, frame analysis and TM source packet reconstruction.

TC support includes full Packet encoding to CLTU level incl. COP-1, PLOP and selectable CMM support.

Echo TC decoder provides independant decoding of outgoing TC bitstream back to CLTU and Packet level.

Power Isolation Unit
Isolates all power in racks from mains incl. grounding

Satellite Services BV

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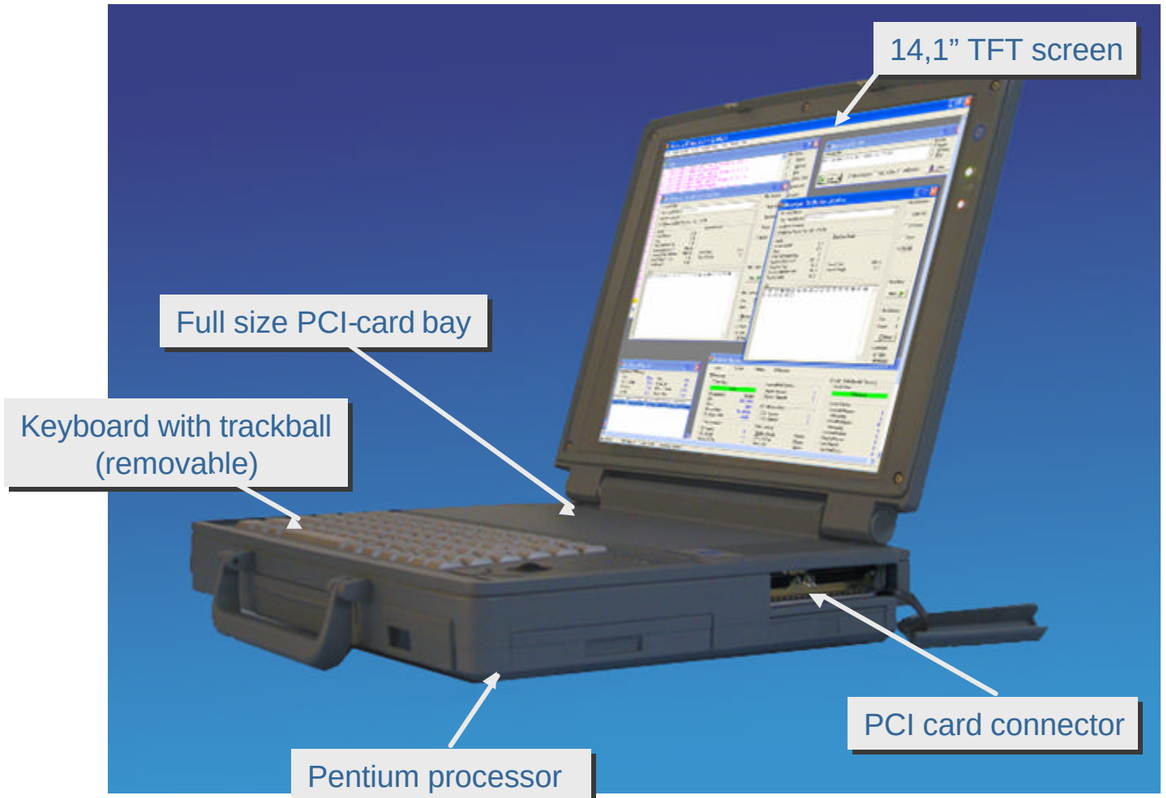
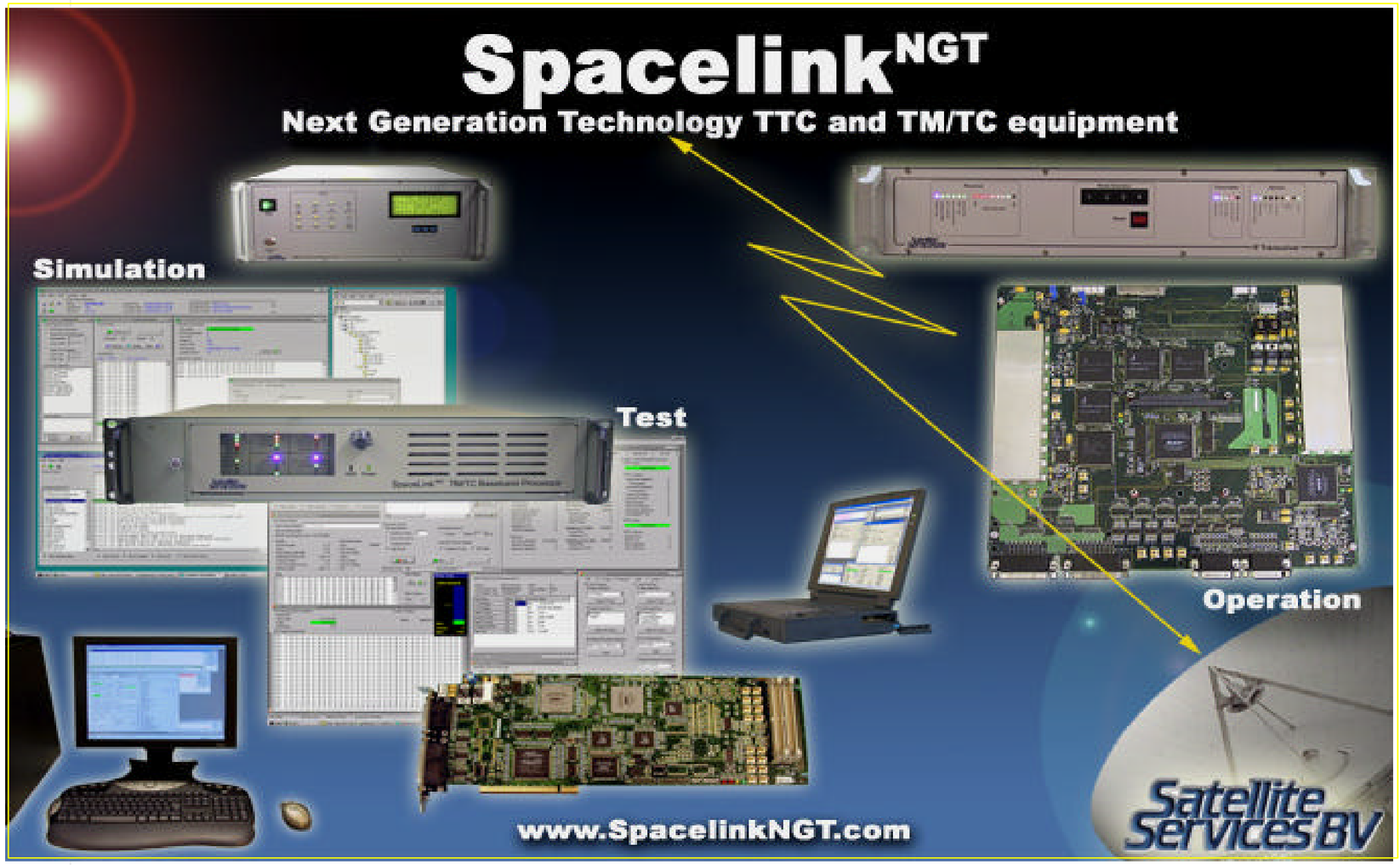
ROSSIM / MEXSIM / VEXSIM / HPSIM



Adapting to the customer's needs

- Customisations performed include:
  - ✍ Multiple TC outputs
  - ✍ Packet wire interfaces
  - ✍ "RF Available" simulation
  - ✍ Custom data encryption/decryption
  - ✍ Specific Protocols
  - ✍ "Can you acquire Turbo encoded frames?"
  - ✍ Multiple Configurations
    - runtime selectable firmware versions!
- ***Emailable Hardware***



System Deployment

- TM/TC Data Front Ends (Integral, Rosetta, Mars Express, Venus Express, MSG, GOCE, Cryosat, TerraSAR-X, Herschel, Planck, Aeolus etc etc)
- RF Suitcases
- Spacecraft Simulators
- Launch Site Support
- TM/TC Gateways
- Transponder Testing
- CDMU Testing / SVF

INTEGRAL Spacecraft TM/TC Link testing on the launch pad in Baikonur Cosmodrome in Kazakhstan.

Spacecraft and Flight equipment testing and support throughout Europe

ATV Transponder testing with TDRSS in America

Current and Future Developments

- Level-0 Processor : Autonomous (XML Acquisition Schedule driven) 140Mbps, 2 stream CCSDS-AOS TM Acquisition & Simulation
- New CCSDS / ECSS standards
- NDIU-Lite
- New Spacelink^{NGT} products
  - ERSDEM 2.5 – High Speed Demodulator and Test Modulator (240Mbps)
  - PSS Mark III – IMBU (Integrated IF Modem & TM/TC baseband)
- Continued interfacing development
  - External Interface Unit
  - IF Transceiver

DEMONSTRATION
&
DISCUSSION

Thank you for your attention

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