



CENTRE NATIONAL D'ÉTUDES SPATIALES

Future Ku/Ka Satellite Systems Use of DVB Standards

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■ Satellite Users

- ◆ Mobile & Collective Gateways
- ◆ Crisis Organizations
- ◆ Constrained Environments

►► Satellite Link Optimization

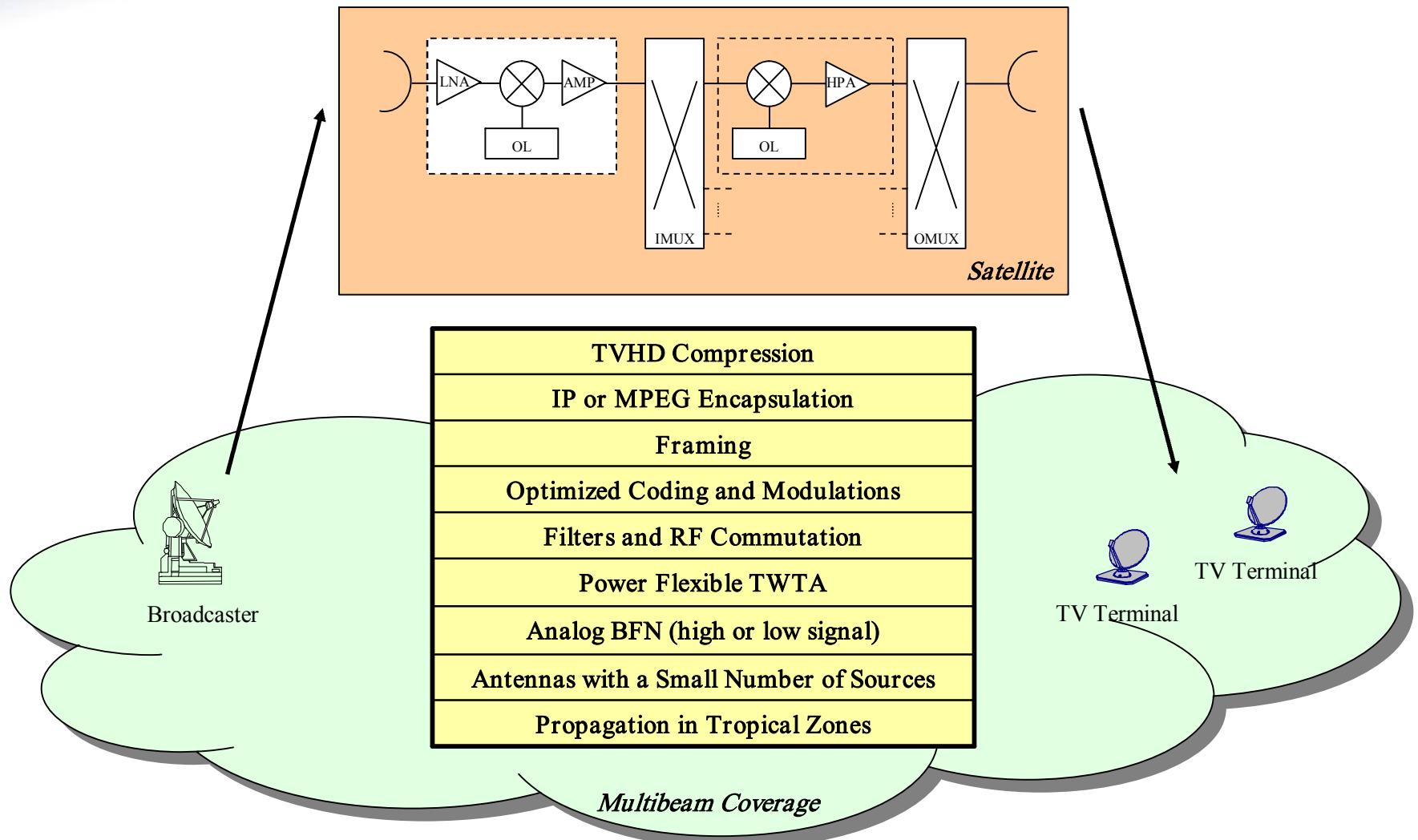
- ◆ Availability
- ◆ *Capacity*
- ◆ *Flexibility*

►► Satellite-Terrestrial Integration

- ◆ Broadcast Handheld
- ◆ *Local TV*
- ◆ *Multicast IP*

►► *Use of Localization Services in Telecom*

Satellite Link Optimization



■ Ku/Ka Multibeam Satellite

- ◆ Frequency Reuse
- ◆ Power and Antenna Footprint Flexibility

■ Standards

- ◆ DVB-S2, Satellite Air Interface
- ◆ DVB-GSE, IP Packet Encapsulation

► DVB-S2 Adaptation to Mobility

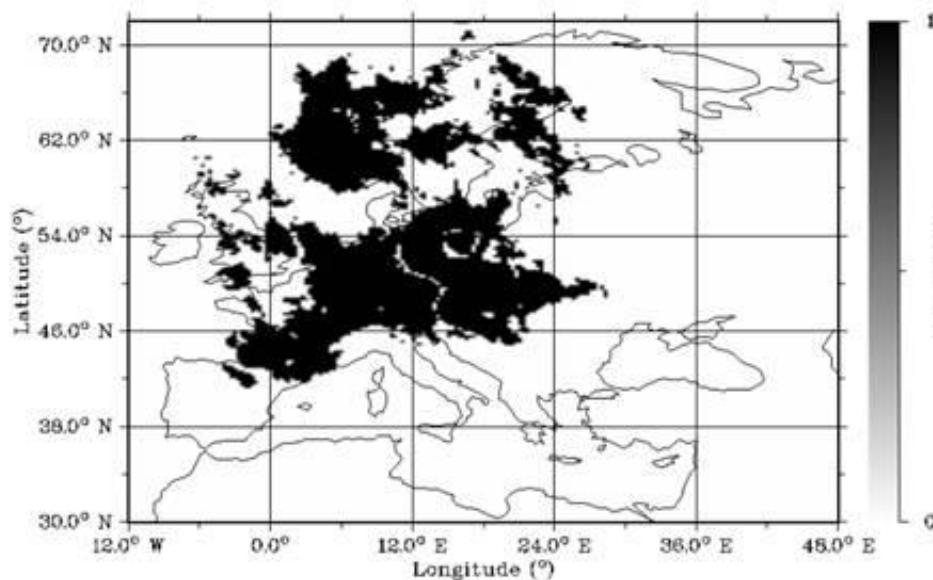
- ◆ Erasure FEC with High Order Constellations
- ◆ *Low Signal to Noise Ratio Reception*

► Solution for Low Data Rates

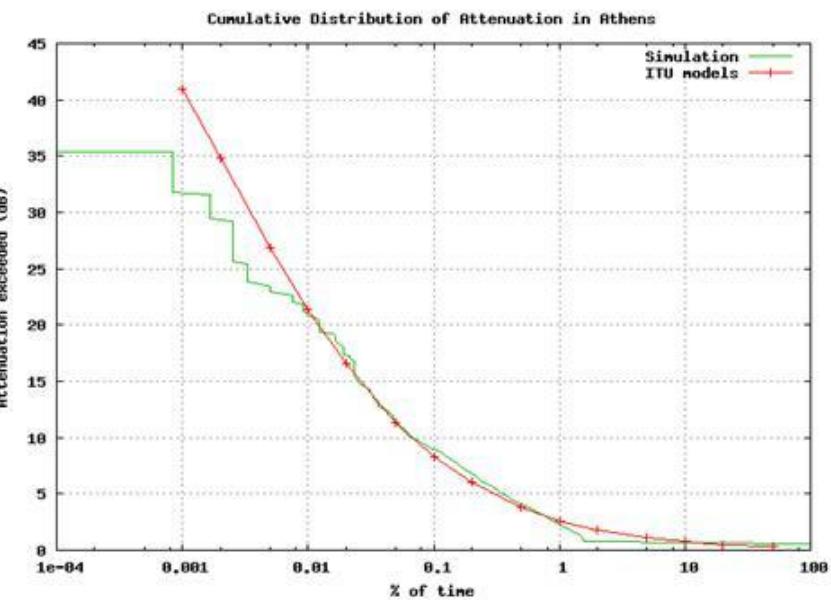
- ◆ Minimal Transmission Power in Ku or Ka band
- ◆ *Short Packet Codes*

► *Link Modeling for High Layer Analysis*

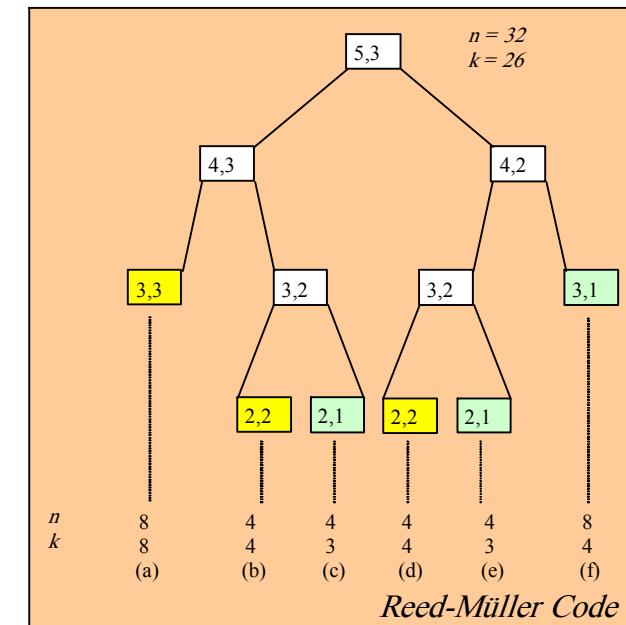
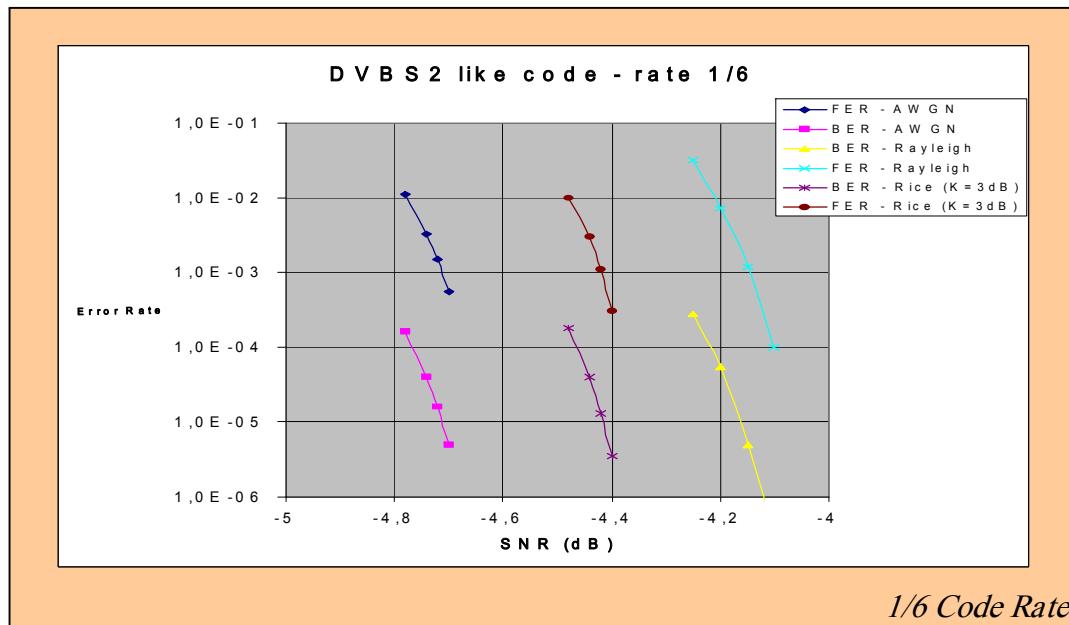
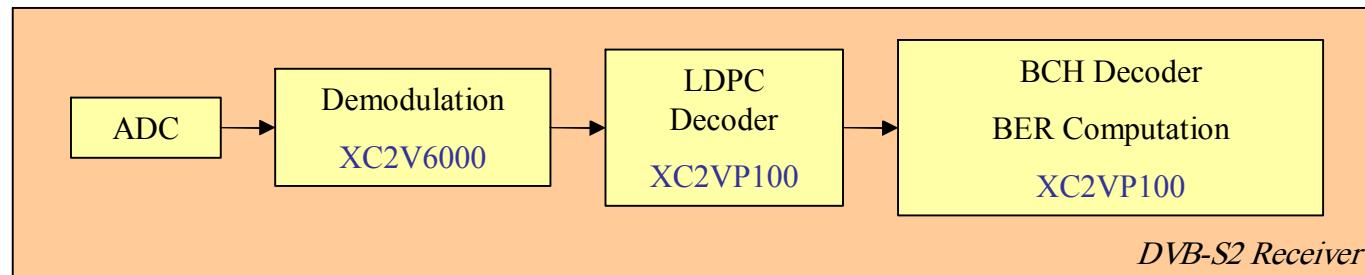
Attenuation modeling with spatial correlation at very large scale and mid scale



Bi-dimensional correlated random values
Log-normal laws derived from the ITU models

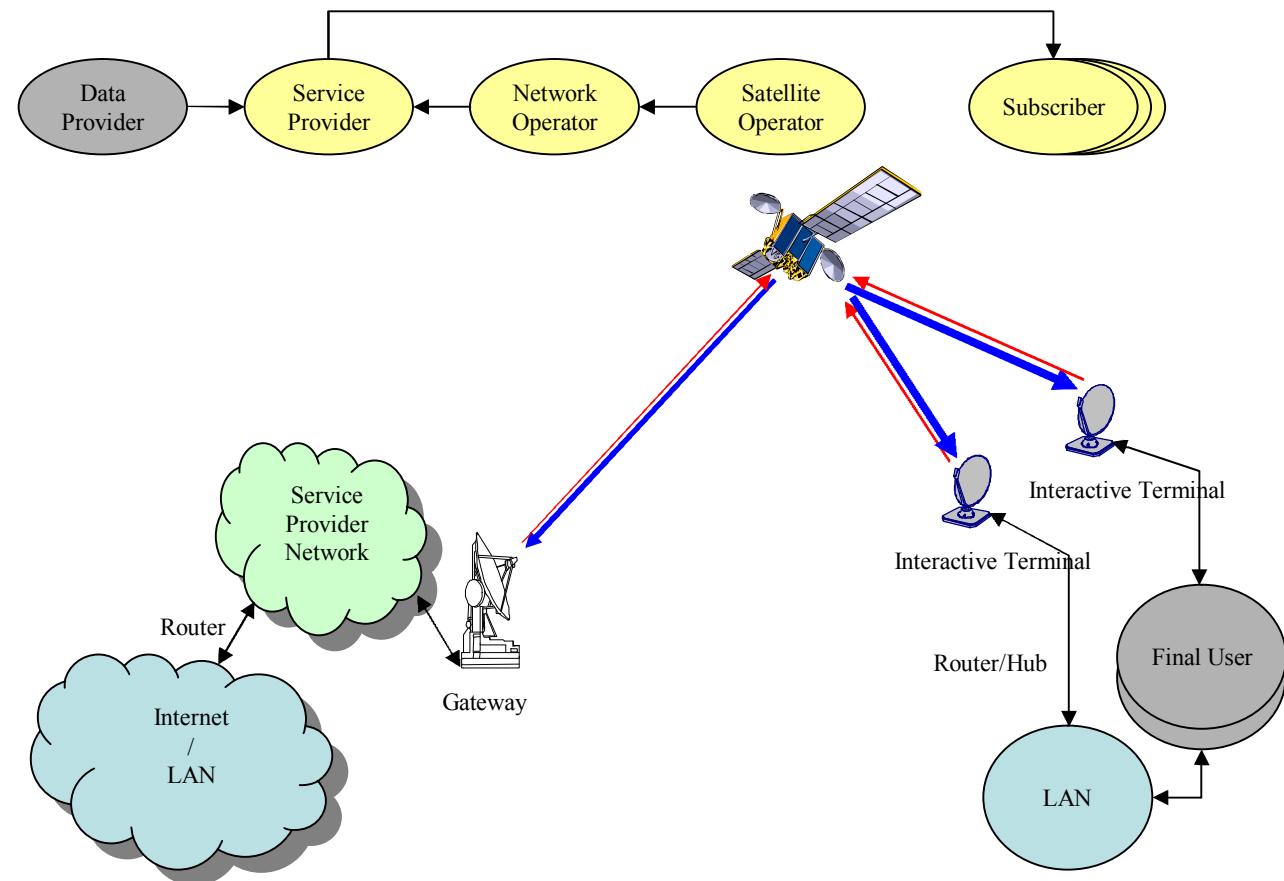


Examples of CNES R&D Studies



Satellite-Terrestrial Integration

| |
|--|
| Network Connections (PEP, IP routing, security) |
| Quality of Service |
| Resource Allocation |
| Access Techniques |
| MIMO Techniques |
| DAC and ADC Converters |
| LNA |
| On-Board Processing (transparent, regenerative) |
| On-Board Software Radio |
| SSPA |
| Digital BFN |
| Multi-Source Antennas |
| Q/V Band Propagation |



■ Ka Multibeam Satellite

- ◆ Transparent Switching
- ◆ Regenerative On-board Processing

■ Standards

- ◆ DVB-RCS, Interactivity by Satellite
- ◆ IP, Network Layer

►► Mobile DVB-RCS

- ◆ Multicast Communities with Variable Coding and Modulation
- ◆ *Return Link Based on DVB-S2 with Time Multiplexing*

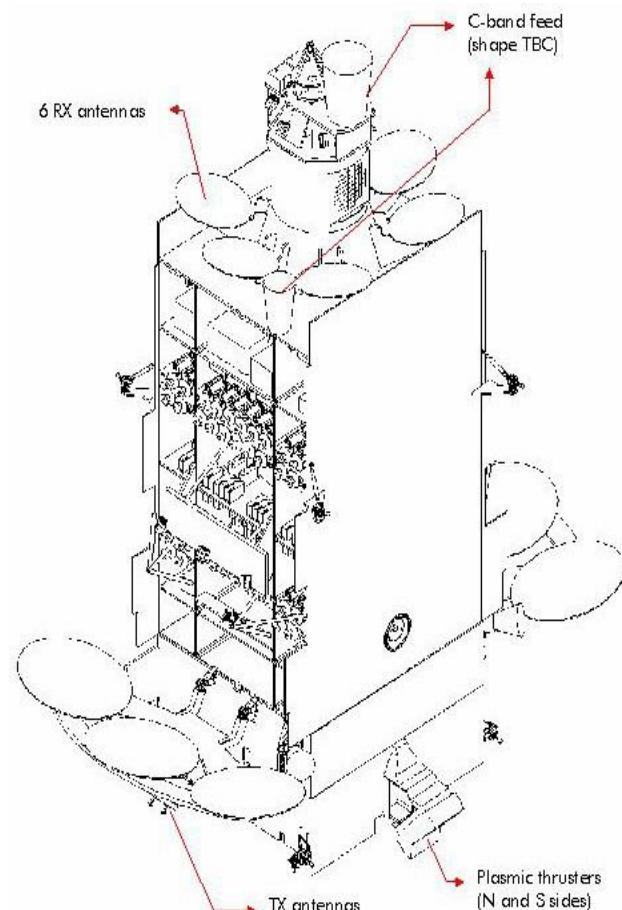
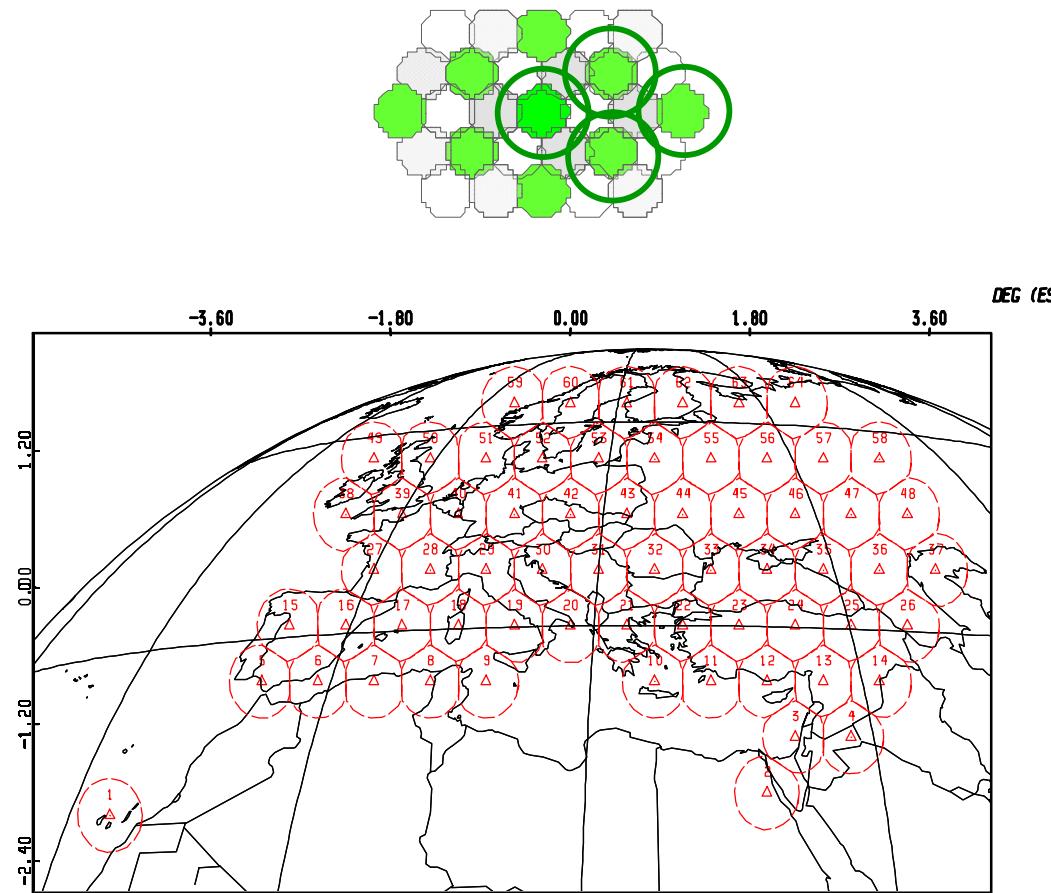
►► Global Network

- ◆ Interfacing with Terrestrial Systems
- ◆ *Hybrid Equipments*

►► *Synchronization by GPS/Galileo*

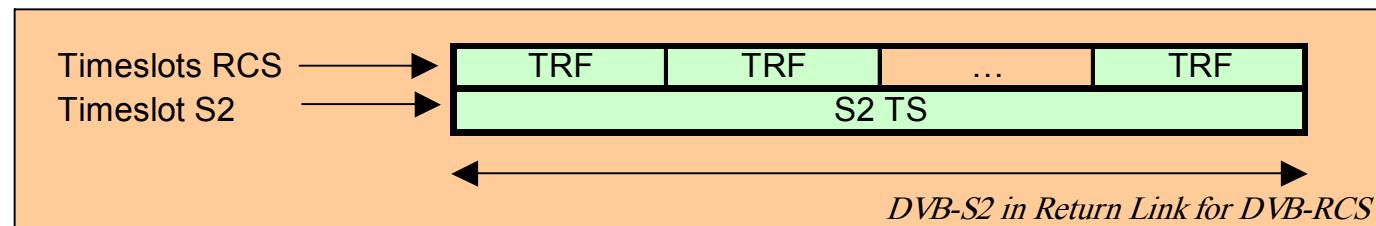
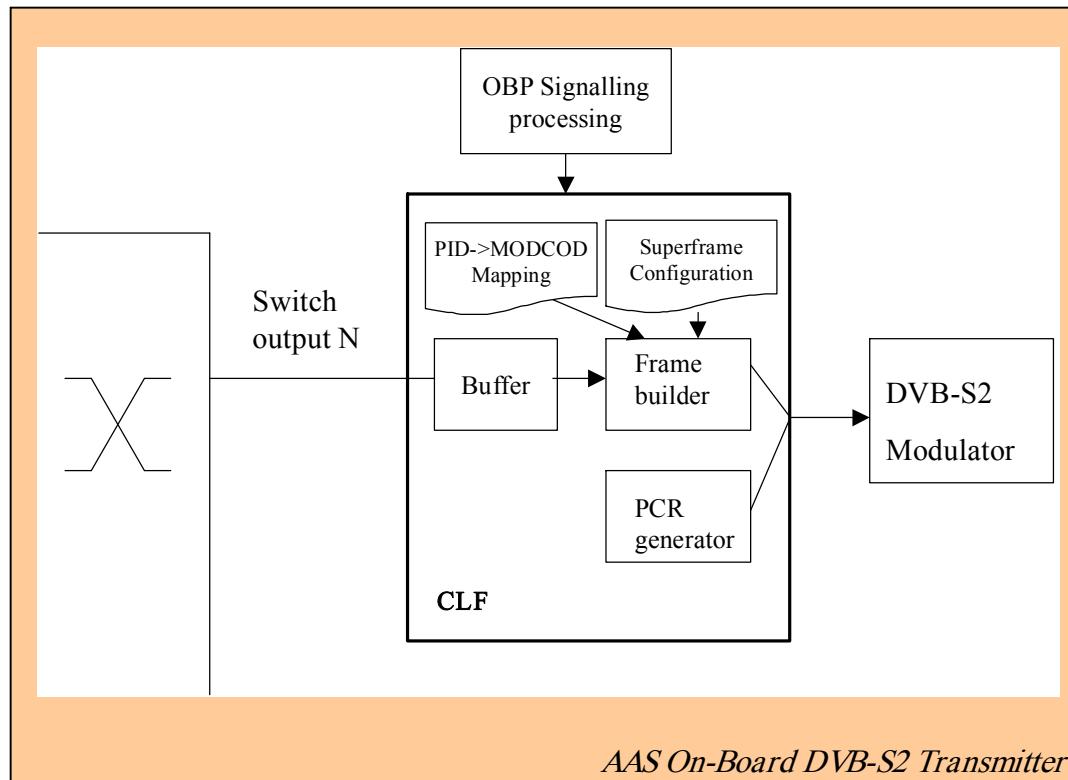
Examples of CNES R&D Studies

Ka multibeams antennas



6 passive Rx antennas
1 Feed / 1 Spot

Examples of CNES R&D Studies



- Juzzle Freeware Simulations - <http://www.juzzle.org/>
 - ◆ Physical Layer including HW/SW Co-Simulation
 - ◆ GSE Encapsulation
 - ◆ Link Budgets
- Test-beds - *Atelier Télécom du Futur*
 - ◆ Satellite Channel
 - Amplifiers
 - Filters
 - Thermal and Phase Noises
 - ◆ DVB-S2 Transmitter and Receiver
 - ◆ Turbo-Code Transmitter and Receiver
 - Continuous flow
 - Burst flow including DVB-RCS physical layer
 - ◆ Interferer Emulator
 - ◆ MAC and IP layer Emulator

►► AlphaSat

- ◆ ESA Program
- ◆ First Use of the AlphaBus Platform
- ◆ Main Payload and Piggybacks

►► ATHENA-FIDUS

- ◆ French-Italian Program
- ◆ Ka Multibeam
- ◆ Multimedia System

►► FLIP

- ◆ CNES Program
- ◆ Flexible Ku Payload
- ◆ Equipment Development

►► *Partnership between Agencies and Industries*

- ◆ *Improve the Space Segment*
- ◆ *Reduce the Cost of the Ground Segment*
- ◆ *Define and Test New Applications*