

Digital Beamforming

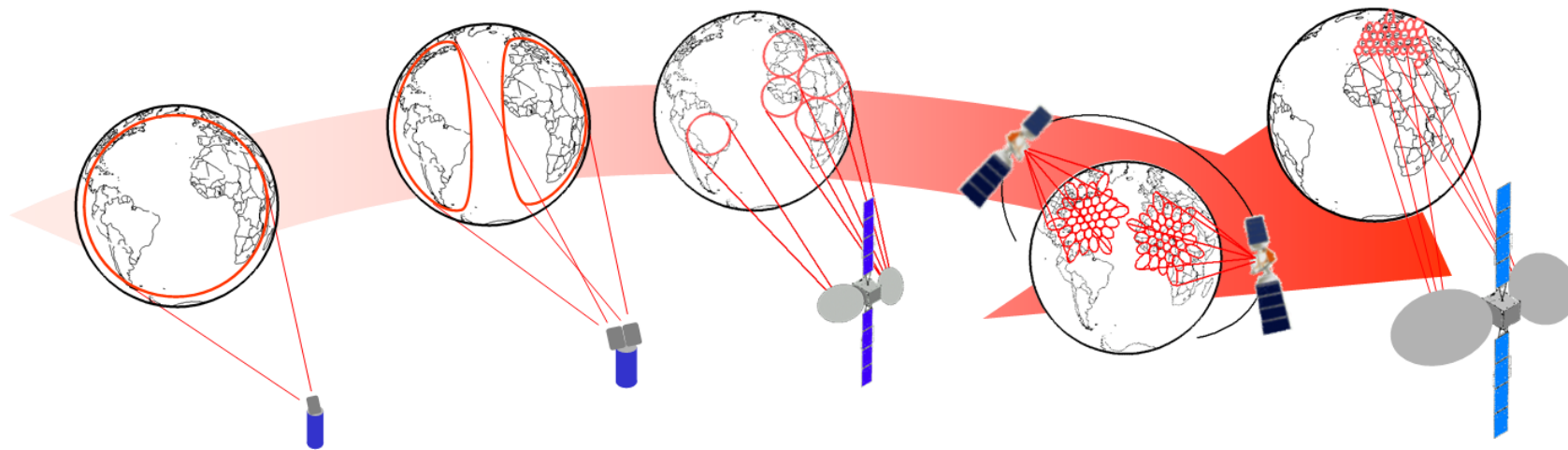
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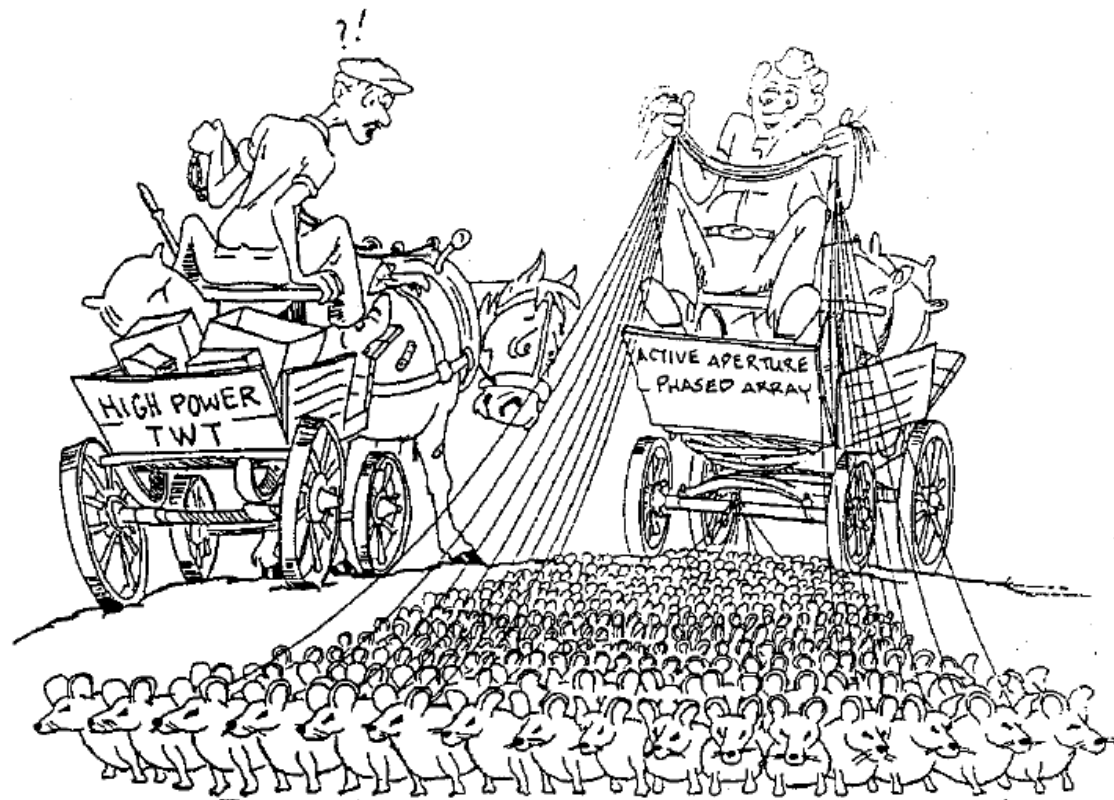
European Space Agency

SATCOM System Needs for Flexibility

- High degree of coverage and mission re-configurability during lifetime to cope with time variant commercial requirements
- Simultaneous support of multiple beams (global and regional) or large number of spot beams with high level of frequency reuse with in-flight re-configurability
- Increased request for flexibility (coverage, power, signal)



Passive vs Active Arrays



DBF can offer the following non-exhaustive list of the features

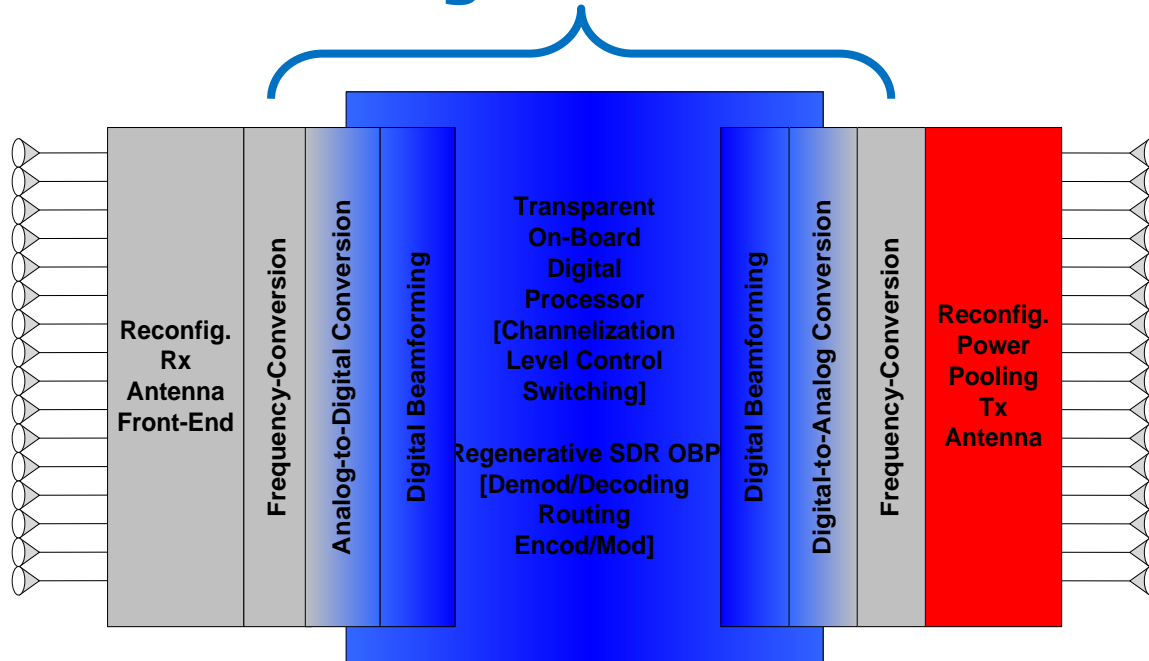
- Beams can be individually formed, steered and shaped.
- Beams can be assigned to individual user.
- Beamforming strategy can be software upgraded.
- Interference can be minimised implementing Adaptive Beamforming.
- DSP techniques (filtering, multiplexing, demodulation, signal information extraction, performance optimisation, etc.) can be integrated.

Digital Beamforming Antennas, "the Ultimate Antennas"

A.J. Viterbi

Core Digital Processor

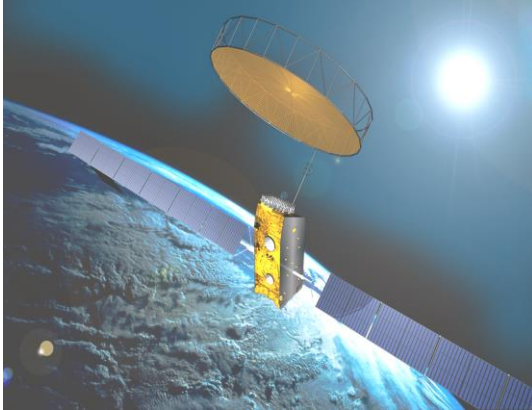
Active Rx
Antenna



Active Tx
Antenna

(AIAA ICSSC 2008)

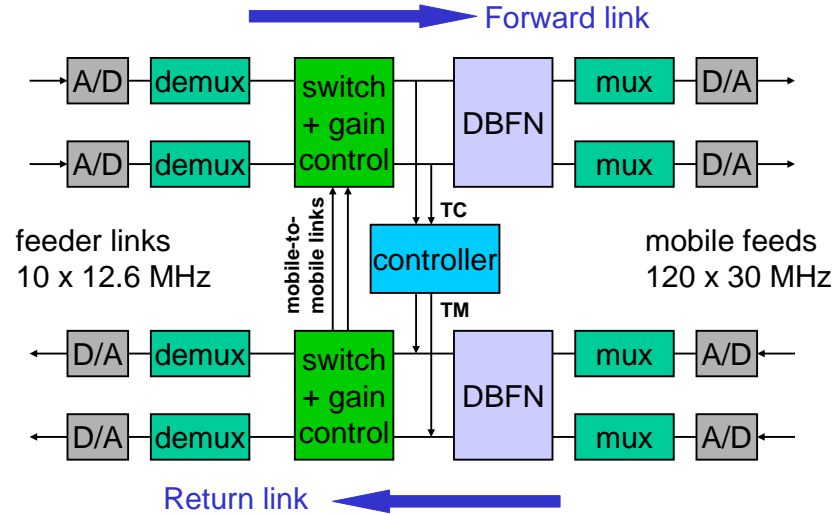
Status of On-Board DBF INMARSAT IV



- 600 channels of 200 KHz
- 200 Digitally Formed Spot Beams

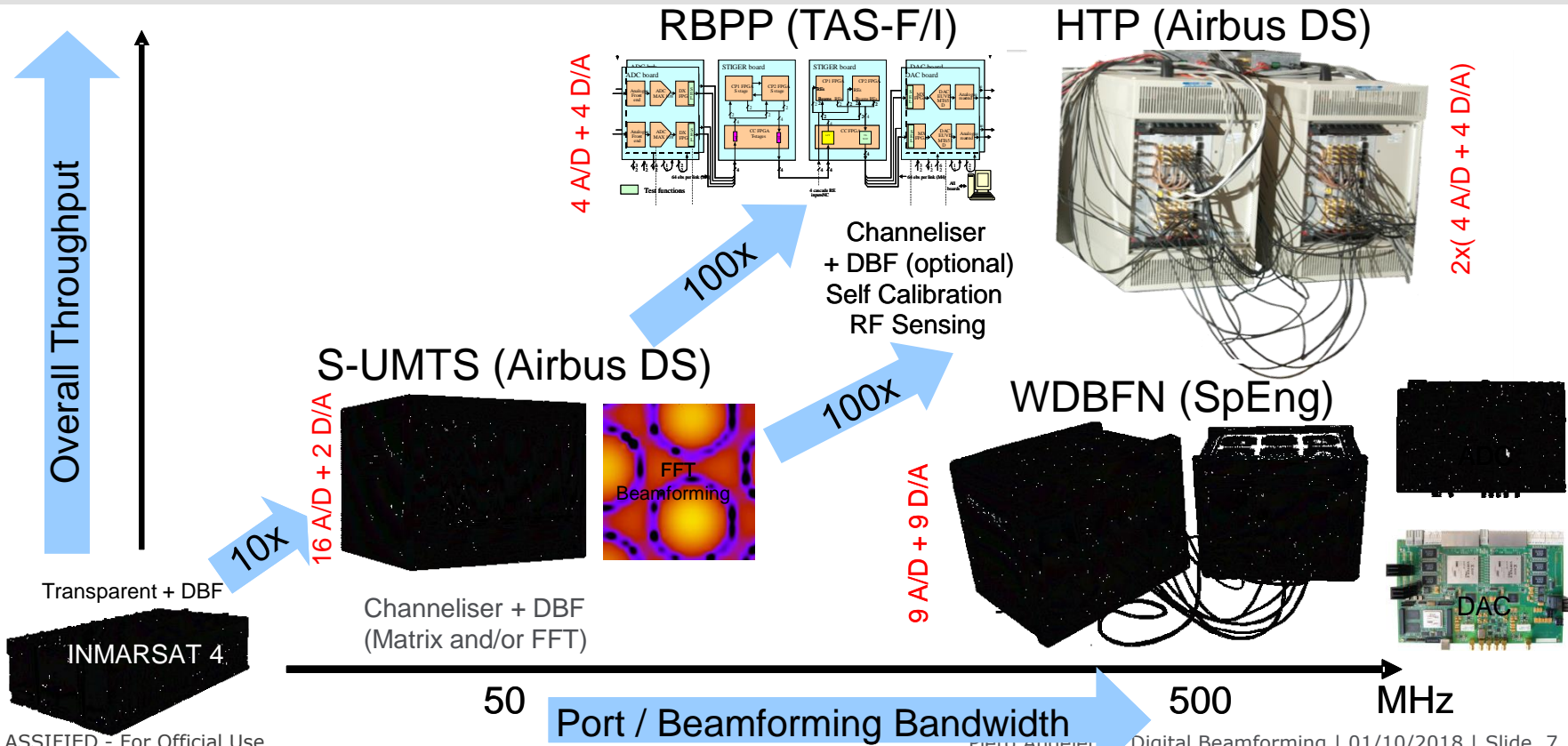


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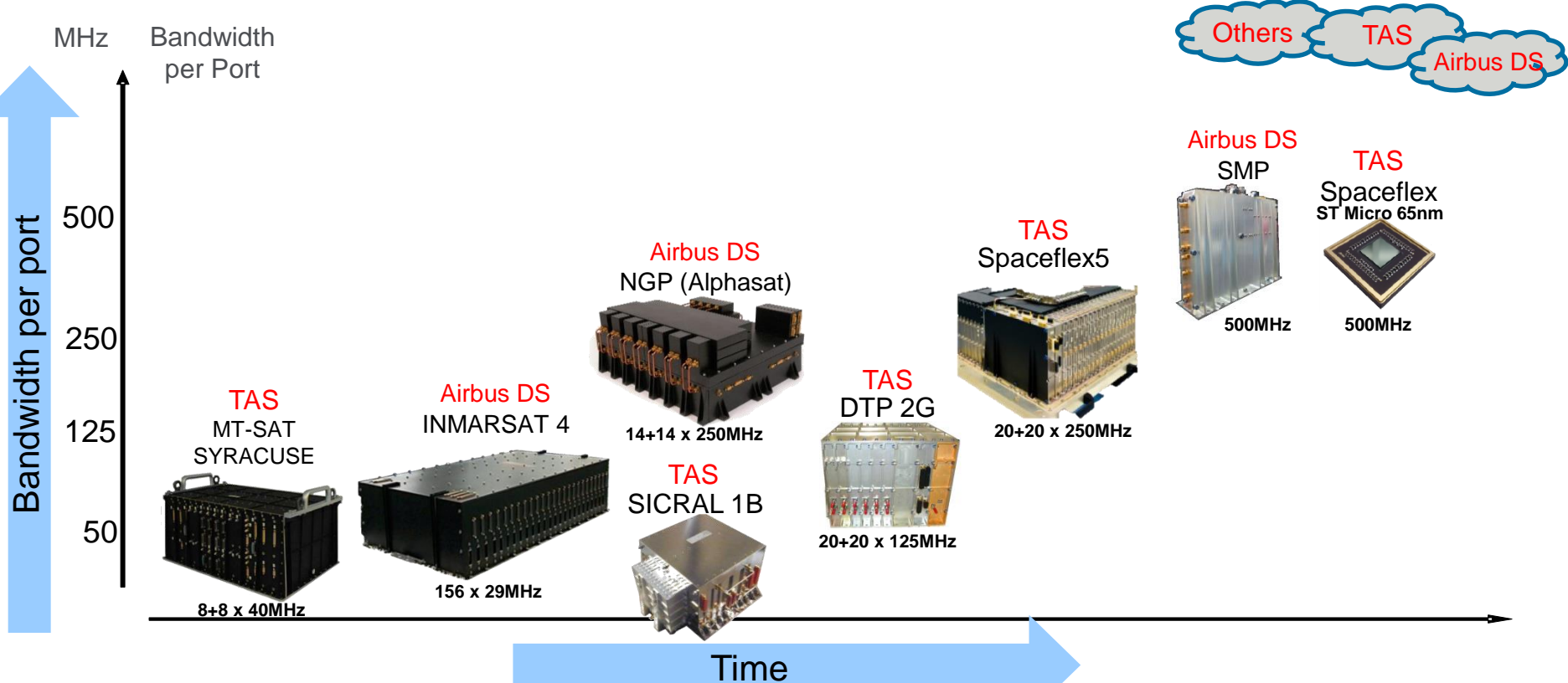


- 2 units per satellite (Forward & Return DSPs)
- 1.8 kW total power dissipation
- 160 kg total mass
- >2000 ASICs per DSP unit
 - 0.65um feature size, up to 300 kgates per ASIC
 - 8 separate ASIC designs

ESA R&D on OBPs with Digital Beamforming



European Transparent OBPs



ESA R&D on Low Complexity Beamforming



Free licensing of ESA Patents for European Industry

The collage displays several patent documents, including:

- European Patent Application EP 2 000 995 A1
- United States Patent Application Publication US 8,652,013 B2
- United States Patent Application Publication US 8,976,546 B2
- United States Patent Application Publication US 2010/0181096 A1
- United States Patent Application Publication US 8,401,172 B2
- French Patent FR 2 728 366 - A1

Continuous R&D effort on competitive and innovative Antenna/Beamforming solutions

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