HydRON-DS Phase A/B1

6th Annual ScyLight Conference / Workshop

DEFENCE AND SPACE

Airbus HydRON Team

Athens, 15 May 2023

AIRBUS

HydRON Vision

HydRON

High throughput Optical Network

ESA Vision

"Fibre in the Sky" technology integrated in terrestrial networks at Terabit capacity demonstrated by European and Canadian Industries

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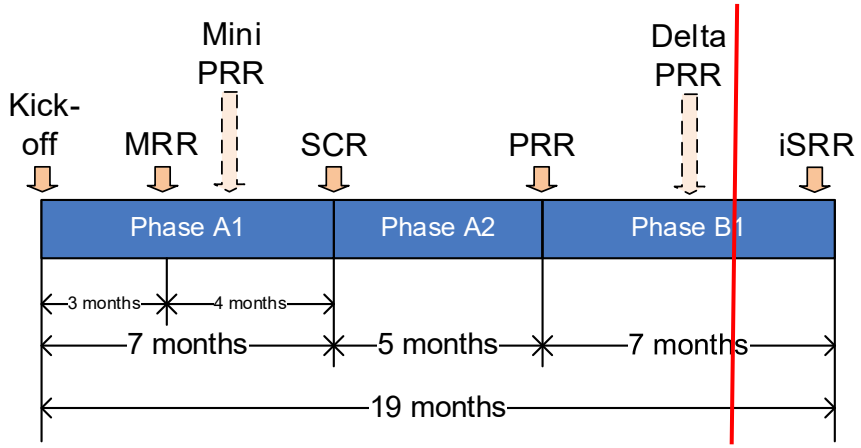
HydRON Airbus team activities

HydRON Demonstration System (HydRON-DS) Phase A/B1 study, with the objective to pave the way for an Implementation Phase (B2/C/D/E1) of the HydRON-DS in order to demonstrate HydRON networking capabilities and operational concepts in an end-to-end context



HydRON Simulator Testbed (HydRON-SimTB) development with the goal of consolidating the HydRON concept, system functionalities & end-to-end system architecture mainly by network protocol and algorithm evaluation, analysis of various network designs and to support architecture trade-offs for the HydRON-DS

… together with the team as follows:

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HydRON consortium

AIRBUS
HydRON System Prime, Operator and future Service Provider

TESAT
Optical Satellite Payload

ADVA™
Terrestrial network

colt
Terrestrial network operator

Strong expertise and dedication in optical communication and network solutions

DLR
Optical Ground Stations

KEPLER
User consultancy and LEO host opportunity

eutelsat
User consultancy

Fraunhofer FOKUS
Network management

Fraunhofer HHI
Availability simulations

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HydRON-DS – Current status

Delta PRR recently introduced by ESA as a result of CM 22 with a baseline redirection

- Updated baseline and trade-off of options
- Co-location meeting passed begin of April
- Delta PRR currently under finalisation

Next steps:

- Operator workshop
- Baseline consolidation and iSRR preparation

Two major scenarios:

- LEO + MEO (TB#2 in ESA terms)
- LEO only (TB#1 in ESA terms)

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HydRON-DS – Technical baseline

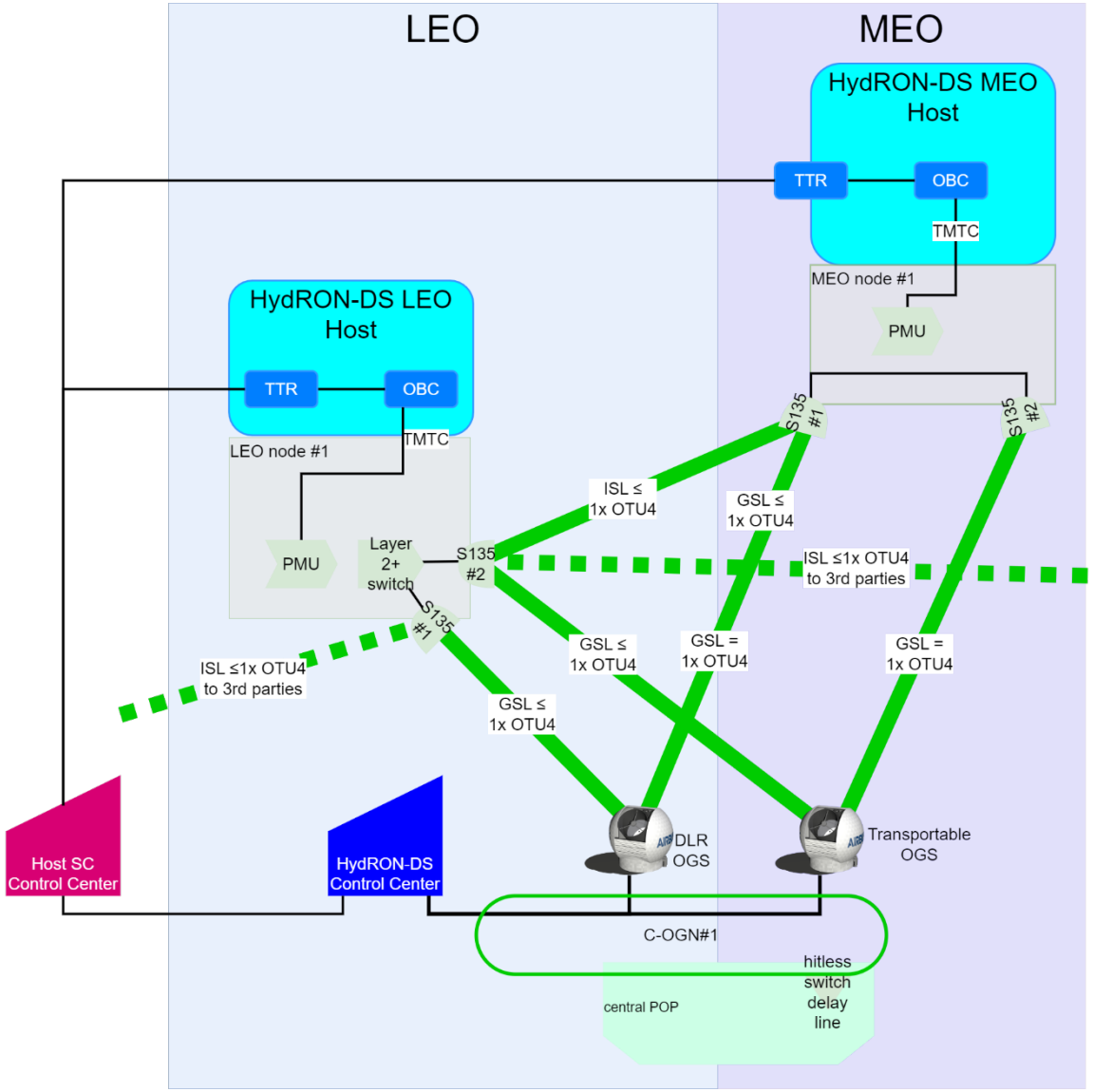
Current proposed baseline for MEO + LEO scenario:

- 2 SCOT 135 on MEO + 2 SCOT 135 on LEO
- 100 Gbps / 10Gbps / transparent ISL and GSL
- Atmos. turbulence mitigation by coding
- Packet (MPLS) switch on LEO
- Reuse of existing OGS from DLR-IKN
- Demo of hitless GSL link switch-over

- Several options (+ circuit switch on MEO, + WDM on LEO/MEO, - Multi Purpose Transceiver Module)

Outcome of trade-off and final baseline selection depends largely on:

- User needs
- Host opportunities
- Budget



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HydRON Simulation Testbed – Objectives

Performance Assessment

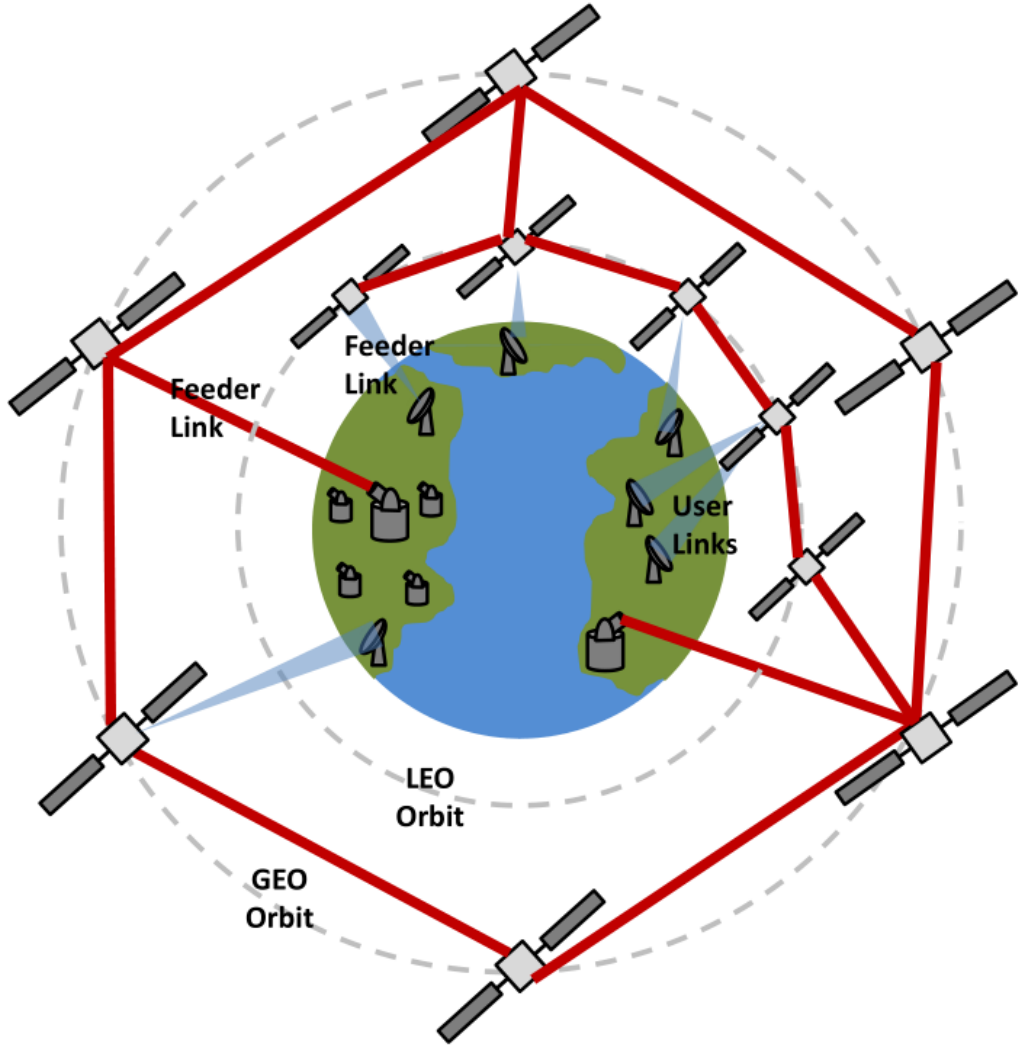
- HydRON system simulation and performance assessment
- Support trade-off of different **functional control and management protocol models** and **control plane strategies**
- Support trade-off of different key technologies (e.g. link switch-over strategies, weather/link forecasting methods, on-board switching & routing strategies)

Technology Demonstration

- Validation of different actual protocol implementations and control plane strategies
- To demonstrate the proof of concept of the hitless-switch technology

Prepare Demonstrator Mission

- Simulating the Demonstrator Mission
- Provide test bench for the hitless-switch technology to be integrated into HydRON-DS



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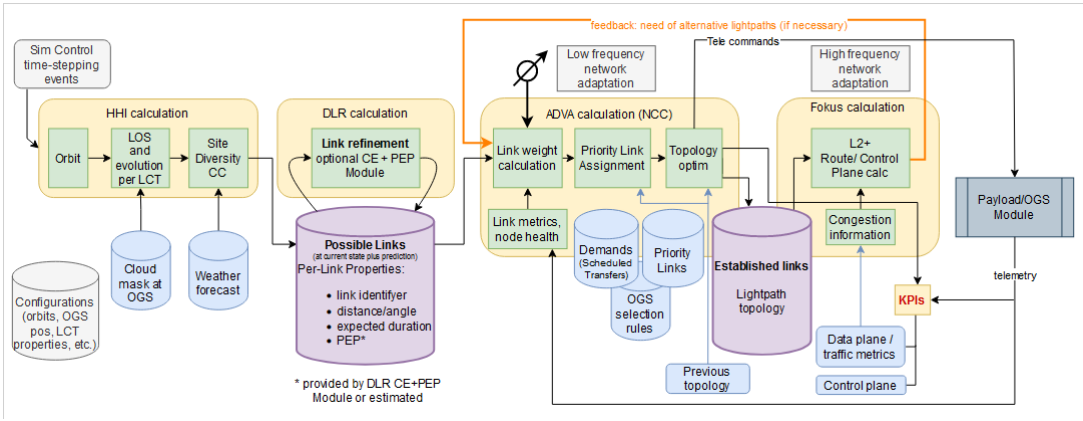
HydRON Simulation Testbed – Baseline



The SimTB Discrete Event Simulator

- Simulation of > 500 network nodes, incl. orbital positions of the satellites and OGS positions
- Simulation of atmospheric and weather conditions
- Optical inter-satellite-link/route characteristics
- Performance evaluation of routing protocols for various network scenarios

The SimTB Hardware Testbed

- Emulation of satellite optical network constellations
- Emulation of real optical propagation conditions
- Emulation of real control & management protocol implementations

The Proof-of-Concept Hitless Switching bench

- Testbed to characterize the behavior of the hitless switching unit under realistic conditions
- Standardized interfaces for interoperability at a data-rate of 100Gbps

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HydRON Simulation Testbed – Planned schedule

Cat	Group	Task	Jan 23	Feb 23	Mrz 23	Apr 23	Mai 23	Jun 23	Jul 23	Aug 23	Sep 23	Okt 23	Nov 23	Dez 23
DES	Prototye	DES												
	Environmental Simulation (ES)	Orbit												
		Weather												
		CEM												
	Control Centre	Low Frequency Control												
		High Frequency Control												
	Network Simulation	Network Model SAT												
		Networkmodel OGS												
		Routing Protocol Implementation												
		Measurement												
		ES Integration												
		CC Integration												
		Configuration												
	DES Computer	HW + SW Procurement												
HW	Prototye	HW												
	Network Simulation	Network Model SAT												
		Networkmodel OGS												
		Routing Protocol Implementation												
		Measurement												
		ES Integration												
		CC Integration												
		Configuration												
	HW Computer	HW + SW Procurement												
POC	FPGA	FPGA Development												
		FPGA Test												
		SystemTest (FPGA+CEM)												
		Comissioning PoC Testbed												
	CEM	CEM HW Procurement												
		CEM HW Developement/Test												

Procurement
Development
Unit Test
System Test

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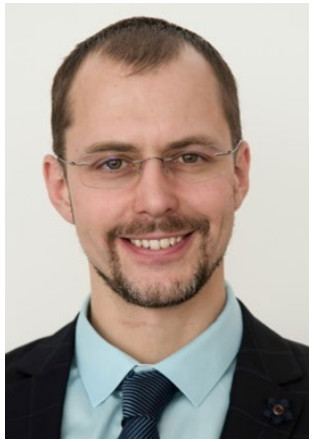
HydRON Team & Points of Contact



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and many more …

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HydRON-DS In Evolving Context

Ambition

Defend/extend/exploit European Space Lasercom leadership and system competencies

From relay to hi-capacity network

More European sovereignty

Symbiotic evolution with other game-changers (IRIS², ..)

New competitive products

Technology

Bandwidth 100Gbps per Lambda

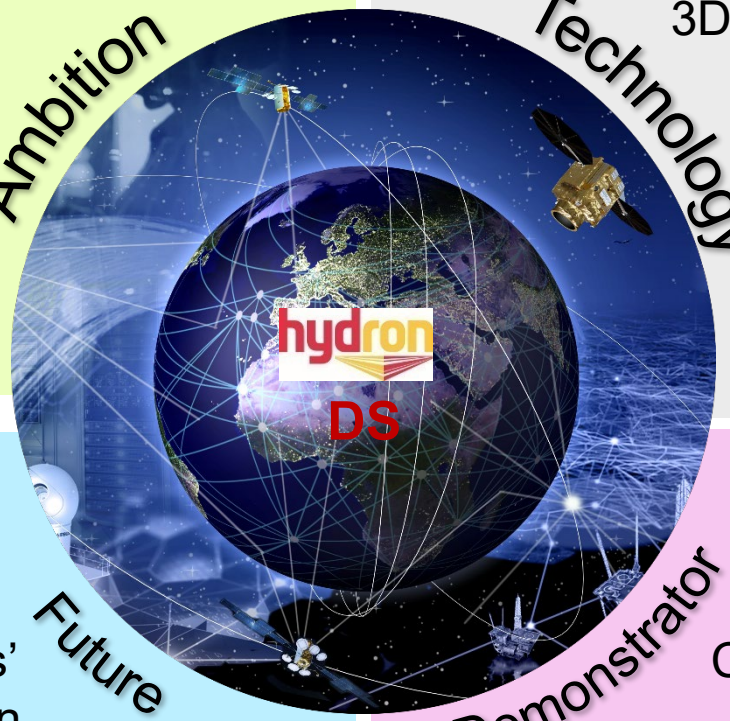
3D networks ground/Air/Leo/Geo

Highly available optical feeder links

Network management

Routing Protocols

COTS components



Future

Adapt HydRON-DS contribution to:

Lasercom payloads evolution

Multi-orbit communication networks' development, delivery & operation

IRIS² (HP's, gen1, gen2)

Demonstrator

the sooner the better

Co-Invest desirable

Combine innovative techno w. SoA

Seamless connectivity to terrestrial fibre

… to boost and support European Ambition on time

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Backup

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HydRON-DS: Towards a seamlessly interoperable overlay network

- ✓ Focus on Technology and Operational Capability Demonstrations
- ✓ Leapfrog current Connectivity Solutions towards more European Sovereignity
- ✓ HydRON Demonstration System as Technology Catalyst towards new Business Models and Partnerships
- ✓ Join a new Era of Interoperability between Space & Terrestrial Players

Share with us your expectations and needs for jointly shaping the next generation of end-to-end connectivity solutions

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