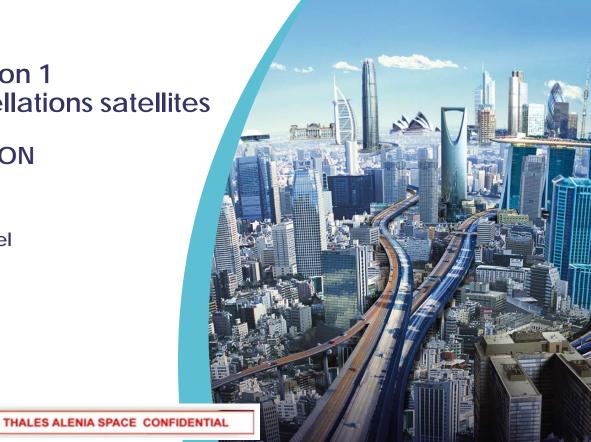


ADCSS Session 1
Avionics in mega constellations satellites

INTRODUCTION

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Agenda

- Historic view of the SATCOM constellations
- Main overall challenges of the MEGA constellations

ADCSS Session 1: Historic view of the SATCOM constellations

■ Early 1990s : Boom of the telecom constellations

- Many studies are started to develop telecom constellations
 - From tens of satellites up to 1000 satellites
- Objective: provide voice and data over the Earth's entire surface
 - Target areas without terrestrial coverage, including high latitude
 - LEO orbits offering low latency
- Race between competitors to define solution and deploy services
- Many project raised up to different stages
- ➤ Before the end of 1990s, 3 constellation s are deployed and offer telecom services
 - ORBCOMM (35 satellites) data and messaging communication services
 - IRIDIUM (66 satellites) mobile phone voice and data
 - GLOBALSTAR (48 satellites) mobile phone voice and data

ADCSS Session 1: Historic view of the SATCOM constellations

- Early 2000s: Telecom bust make a stop to the constellation development
 - ➤ GLOBALSTAR, IRIDIUM and ORBCOMM go into chapter 11 bankrupcy protection and reorganization
 - All others projects are stopped
 - ➤ The 3 in-flight constellations are maintained in operation
 - Constellations operated by new entities
 - Offered communication services find a market and viable business
- End 2000s: Need to repopulate the in-flight constellation
 - ➤ Thanks to fruitful business, operators started development of new generation spacecraft to repopulate their constellation

ADCSS Session 1: Historic view of the SATCOM constellations

- 2010s: Telecom constellations are back in vogue
 - Introduction of the MEGA constellations concept :
 - OneWeb 650 satellites
 - SpaceX up to 4000 satellites
 - ➤ And raising of new constellation projects with less than 100 satellites
 - Rationale and objectives :
 - Offer high rate data proposal where terrestrial system are not available
 - Maintain low latency to meet users needs
 - Offer alternative solutions with high level of security

ADCSS Session 1: Main overall challenges

- New challenges brought by MEGA constellations
 - Cost reduction
 - Introduction of new technologies and architecture
 - Use of COTS and change of qualification process
 - Manufacturing and testing for high volume production
 - Automated manufacturing
 - New control process for manufacturing and testing
 - Technical challenges to manage huge number of satellites
 - Operational autonomy and ground based automated process
 - Manage collision avoidance maneuvers
 - End of life disposal

ADCSS Session 1: Main overall challenges

- Need for update processes while keeping control on reliability
 - Rethink designing, manufacturing and testing approach to meet very low cost targets
 - Standards for COTS introduction, automated manufacturing, testing control
 - ➤ Maintain reliability and improve performances versus space debris management
 - Reliable and efficient collision avoidance maneuvers and post mission disposal
 - Spacecraft autonomy, reliability and performances
 - Ground monitoring accuracy and automated process
- Avionics sub-system directly impacted to meet these challenges