

# ADCSS Session 1

## Avionics in mega constellations satellites

### INTRODUCTION

P. Charbonnel

ADCSS- 19 OCTOBER 2016



- 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 constellations 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 bankruptcy 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

## ■ 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

## ■ 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

## ■ 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