Challenges and Opportunities for Ultra Precision in a Space & Aerospace Context

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Martin Agnew, Technology Domain Manager – ISM/TD#13
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AIRBUS
DEFENCE & SPACE

Introduction

(Aero)-Space, Sea & Gnd Network Challenges

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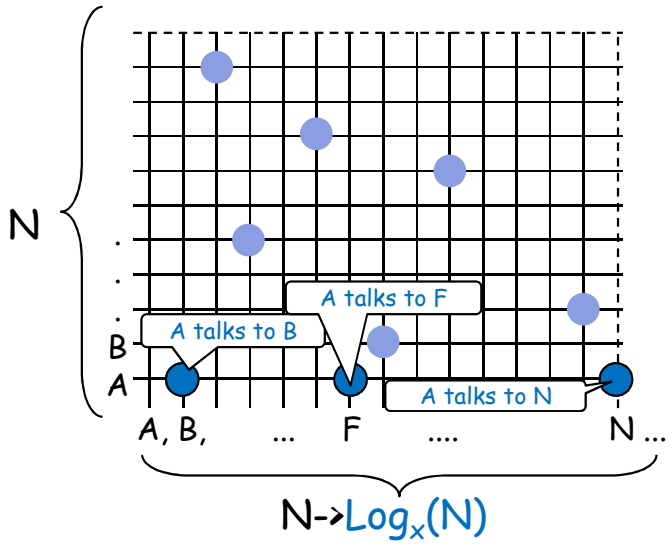
Apply ~~Moore's~~ Metcalf's Law to ... Space/Airborne Comm's Challenge

Metcalf's Law

'Usefulness of a Network is proportional to the square of the number of users (N)'

~ N^2 -> $N.Log_x(N)$ from IEEE ComSoc



MJA - 'Airborne Comm's Today ~ ARPANET (10's nodes, Point-Point, Narrow Band, Low Availability...Insecure)'

= 'Two Paper Cups connected by thread'

Platforms & Networks

(Aero)-Space, Sea & Ground Challenge Opportunities

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High Altitude Pseudo Satellites (HAPS) – is it a plane or a satellite?!

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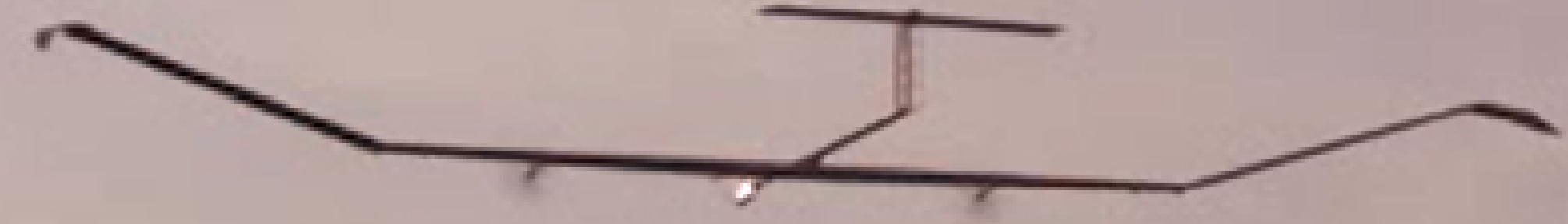

Launchers

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Sky5B Launch 8/Feb/2008

LEO Satellites – Major Industry Trend to Constellations...VHR...SAR/AIS

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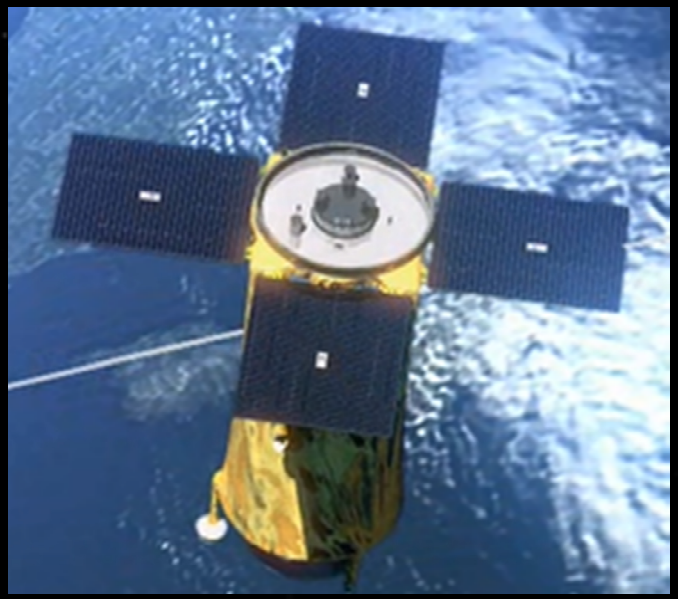

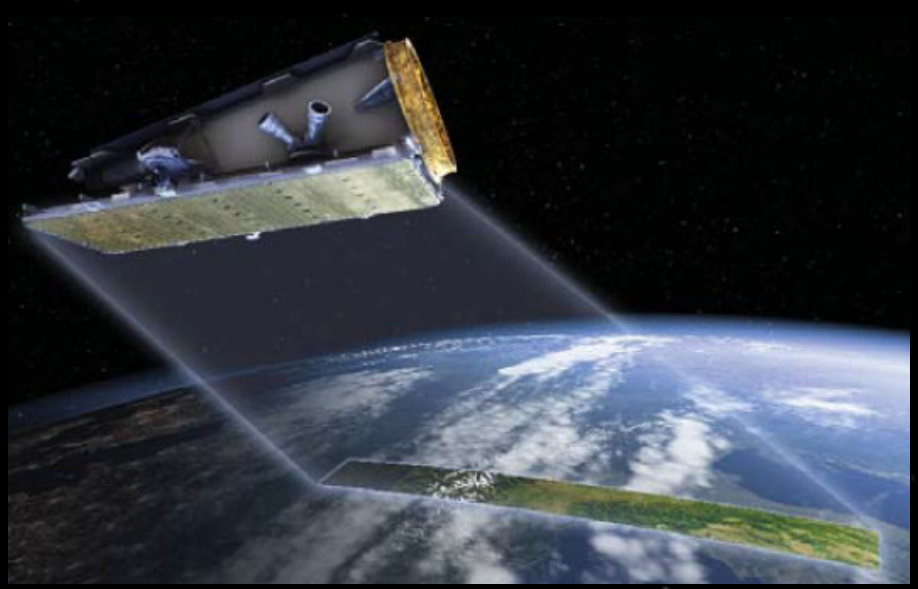

Airbus D&S Clip VFS Full.wmv

2:40-3:10 Constellations

4:30-5:51 Comm's via GEO Data Relay

HEO/MEO/GEO – ‘Fight the Radiation’ -> Live for >15yrs!

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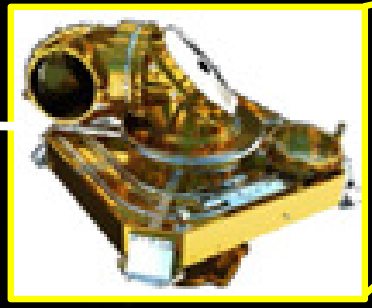
irbus D&S Clip VFS Fu..wmv

4:30-5:51 Laser Comm's

EDRS Latest General Movie

Optics /Opto-Electronics

Lasers
Receivers
Modulators
Lens/Mirrors



Laser Comm‘s

Science – LISA Pathfinder, Rosetta/Philae, ExoMars Rover, GAIA...

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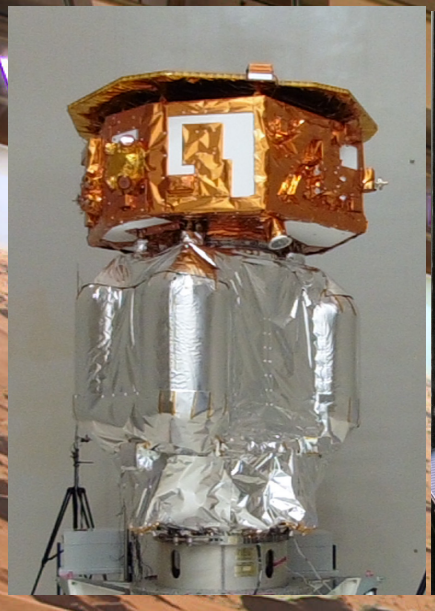
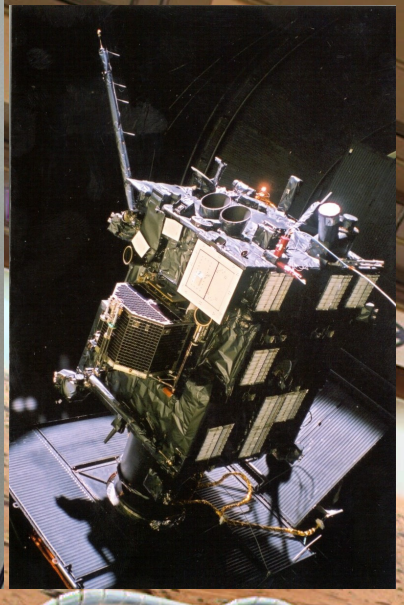
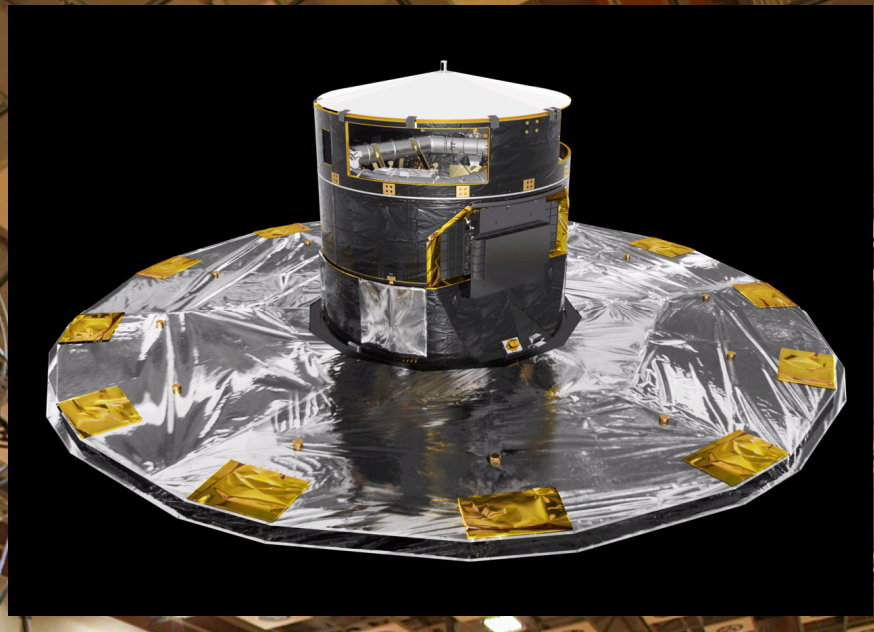






METERON

Requirements Summary Table – Martin's selection...

- Vibration
- Shock
- Temperature: Absolute temp extremes, #Cycles, thermo-elastic distortion
- Radiation: Van-Allen, CME, Solar-Wind
- Solar aging
- Interference & Jamming
- Cryo & Toxic Materials/Fuels
- Hypersonic Drag, Thermals...
- **COST!**

Problems – Martin's selection...

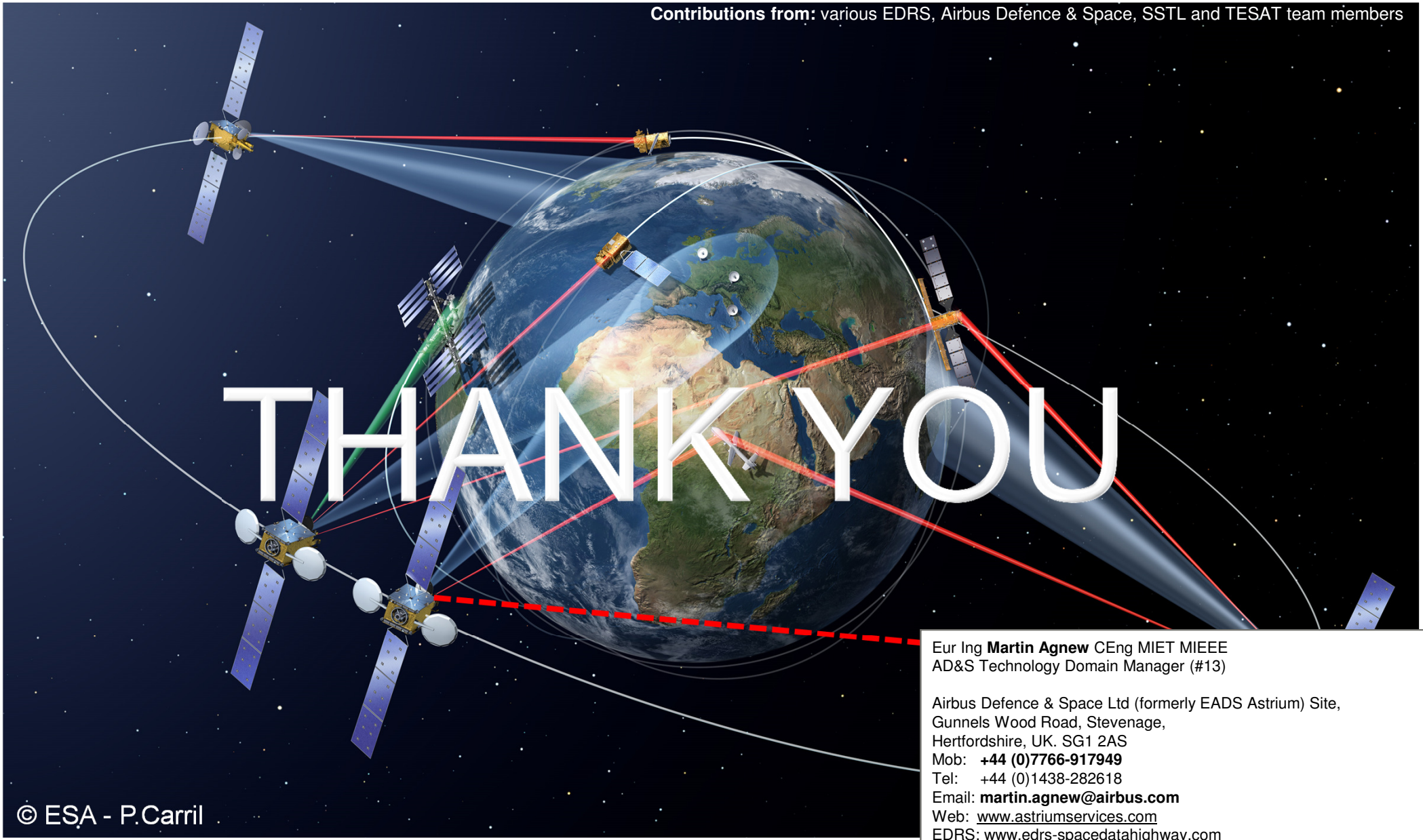
- Via breakages
- Wheel bearings – Vibration, Lifetime
- Propellant Injectors
- Mirror finishes
- Stiction
- Dendrite Growth (Temp Cycling -> Moisture Ingress -> Dendrites -> Shorts -> Pulses)
- Dust > precision => Cost
- Alignment vs Precision finish
- ....

Solutions? – Ultra Precision...

- Precision Optical Bench in Space ala GAIA...?
- Adaptive Optics...

<HELP US!!>

Contributions from: various EDRS, Airbus Defence & Space, SSTL and TESAT team members



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