



Ligado Update – GPS & SATCOM

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Scope



- ASRI and the AFC
- LightSquared/Ligado backstory
- The Spectrum Problem
- Current Ligado Proposal
- SATCOM (Iridium)
- Activities going forward
- Questions?

ASRI and the AFC



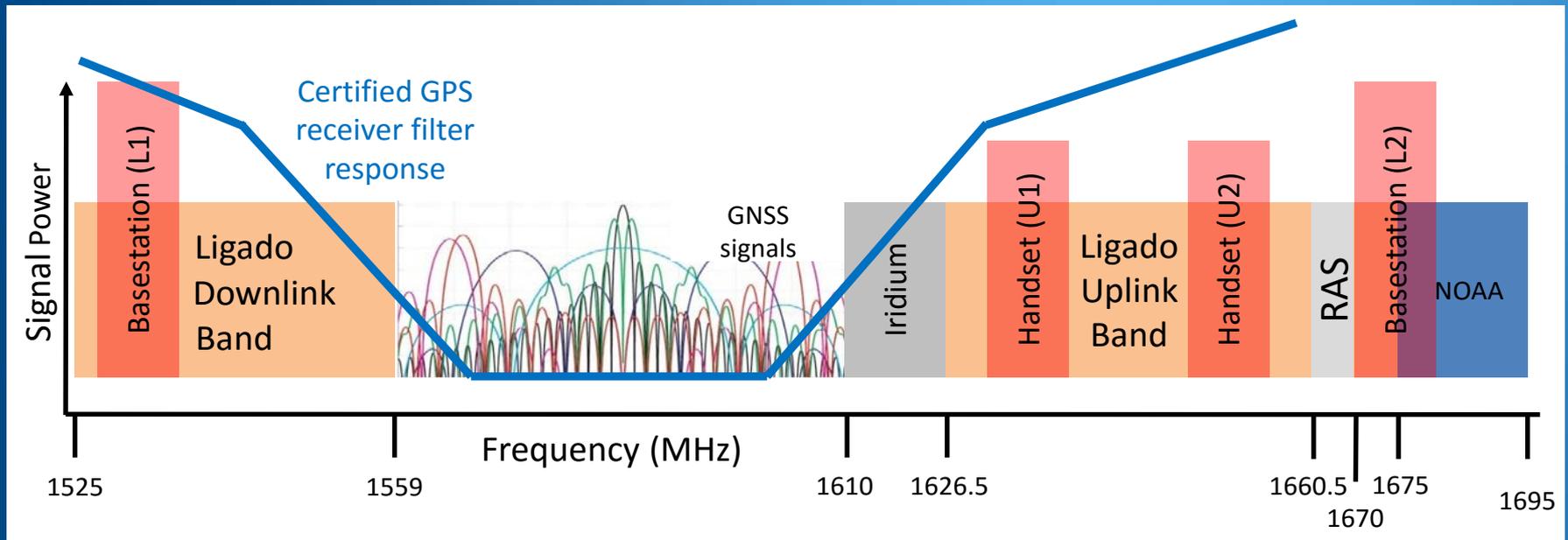
- Originally ARINC's frequency management section
 - Licenses all VHF radios for airline operational comms and ACARS/VDLM2
- Independent company after ARINC sold in 2006
 - Maintained ARINC's original aviation board members
- Act as a advisor to aviation on all other spectrum issues
 - Regulatory work in FCC, FAA, ICAO, RTCA, AEEC, and ITU-R
- Coordinates the Aeronautical Frequency Committee (AFC)
 - Comprised of airlines, helicopter operators, aviation associations and service providers
 - Industry consensus for management of VHF and other spectrum issues

LightSquared/Ligado Origin



- 1995 – Started with a small geostationary satellite constellation launched over the USA
 - Used mobile satellite spectrum bands adjacent to GPS
- 2004 – Authorized by FCC to operate dual-mode satellite/terrestrial devices
- 2010 – Request for modification to be an independent network
- 2011 – FCC issues conditional waiver
 - Federal users and GPS industry file opposition

The Spectrum Problem



- GPS (certified aviation)
- GPS (non-certified)
- SATCOM
- NOAA satellite downlinks

FAA Study on Certified Receivers



- FAA Study in 2012 on Ligado's emissions plan
 - Primary concern was emissions from the L1 frequency band
 - Still significantly affected aircraft below 300'
 - Possible aircraft GPS errors up to 1800'
- Aggregate handsets emissions potential source of interference
 - Non-definitive, but still a concern
- Summary from FAA covering letter to study:

'FAA has concluded there appears to be no practical solutions or mitigations that would permit the LightSquared broadband service, as proposed, to operate in the next few months or years without significantly interfering with GPS. As a result, no additional testing or analysis is warranted at this time.'

LightSquared/Ligado Up to Today



- 2012 – FAA study conducted worst case impact assessment on aviation's use of GPS
 - \$6 billion for unplanned aircraft retrofit costs
 - 10 years to design, develop, certify and install modified GPS equipment in the civil aviation fleet
 - Possible reversion to operations dependent upon ground-based nav aids
- 2012 – LightSquared sues GPS manufacturers and FCC over its GPS issues
 - FCC process stalls
- 2012 – LightSquared goes into bankruptcy
- 2015 – Garmin, Deere, and Trimble settle lawsuit, and action against FCC dropped
- 2016 – Company reformed in Ligado
 - New financing and board
 - Similar spectrum plan as before



AFC Actions



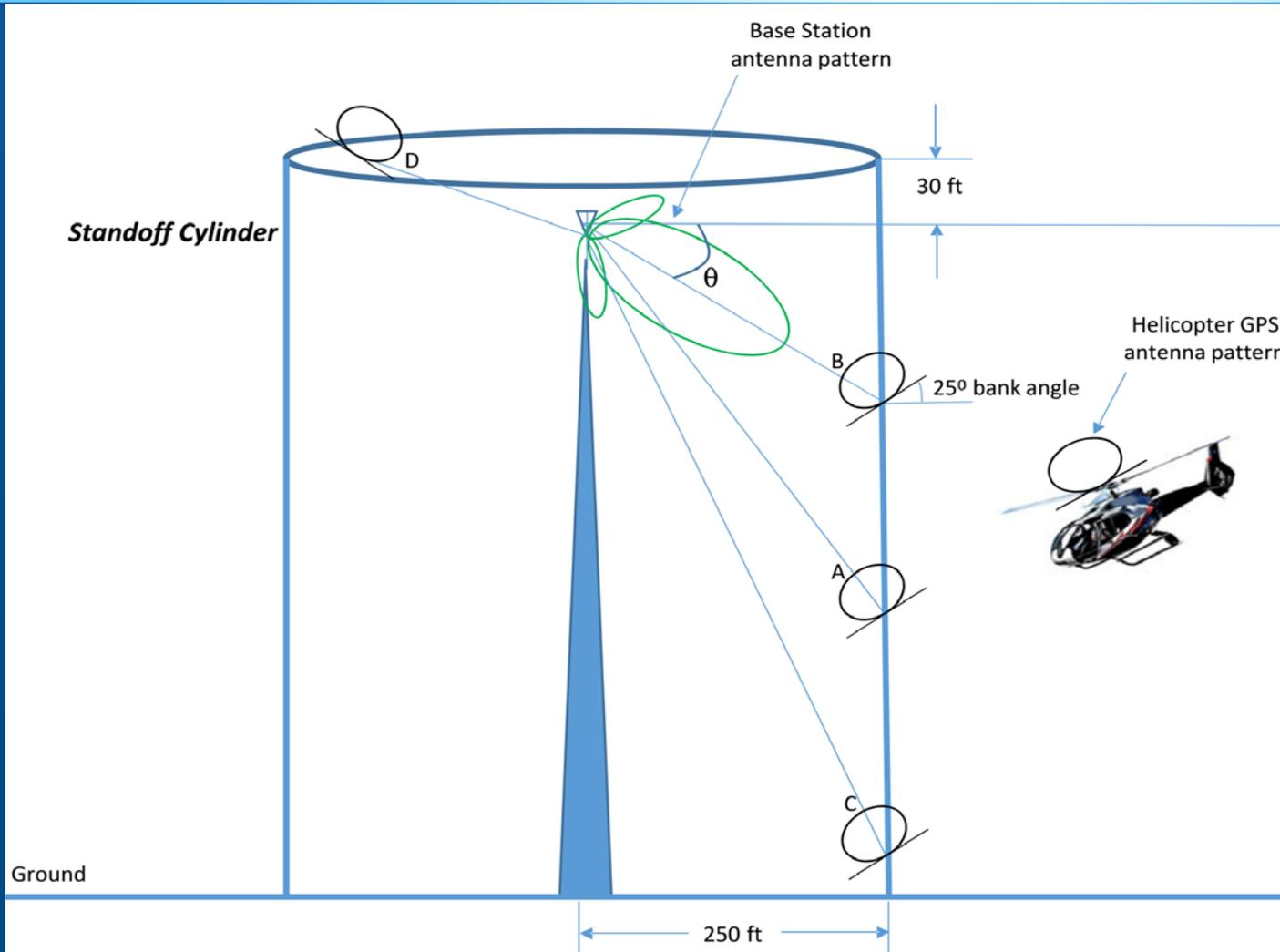
- AFC Membership has been active in opposing interference to aviation systems
 - All sectors have been jointly filing through the AFC
- Aviation one of the main opponents to the plan
 - Lack of details a big risk to aviation
 - Technical, operational and implementation
 - Concerns have forced Ligado into initial concessions with aviation
 - Still a way to go...

Ligado's New GPS Plan for Aviation



- In Sep 2016, Ligado finally released details of the plan to mitigate interference to certified aviation GPS receivers.
- Reduce power from previous levels to create a GPS standoff cylinder that does not guarantee certified aviation GPS will work within it
 - 250ft lateral and 30ft vertical separation
 - Would apply to approx. 10,000 – 20,000 basestation across US
- Use RTCA standards to determine the power limit required to ensure each base station's compliance
 - Individually assess each proposed base station prior to deployment

Ligado Plan



GPS Actions Going Forward



- Operational question for the helicopter community
 - Is 250ft standoff cylinder a realistic option?
 - Affects on other helicopter systems?
 - Applicable to UAV community?
 - Certified or non-certified GPS receivers?
- HAI has already expressed concerns
 - VP of Operations is developing an operational requirements letter for FAA
 - Would encourage all operators to provide input and support

SATCOM Concerns



- Iridium band adjacent to Ligado handset bands
 - Iridium has filed opposition to Ligado’s plans
- Iridium technical study has shown that handset will interfere with Iridium terminals when in proximity
 - A single Ligado handset resulted in emission levels nearly 100,000 times higher than the Iridium receiver’s noise floor at 10 meters
 - *‘... and still produced excessive interference at distances up to 1 km away through a significant portion of the Iridium band’.*
- Still awaiting Ligado response to Iridium study
- Further aviation action required on SATCOM
 - Need views and support from the helicopter community

Summary



- Helicopters the main focus of both GPS and SATCOM concerns
 - Need feedback from the community if it is an issue
- Ligado very aggressive in pushing their business
 - Significant amount of money involved
- Strong support from all sectors of aviation community has been key driver is pushing Ligado back
 - A unified helicopter community would be key to making its voice heard
- Still work to be done by aviation
 - Issue unlikely to be acted upon until new administration in 2017

Questions?



Future aviation spectrum questions?

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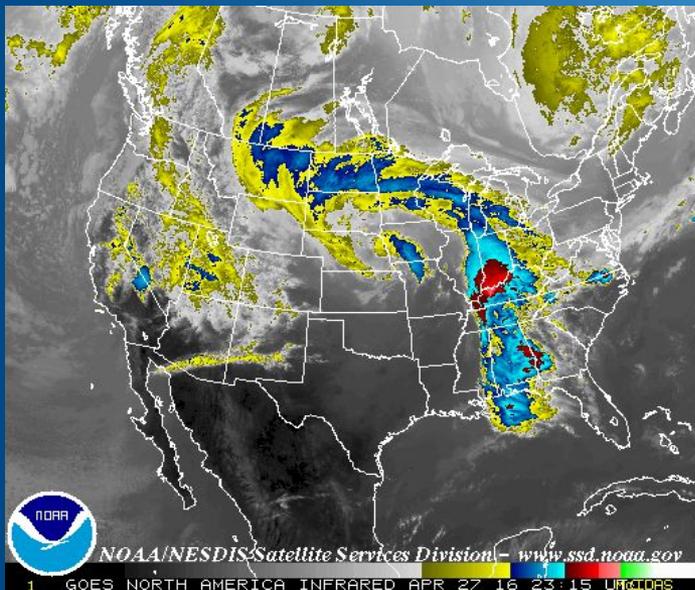
Helicopter AFC members

Bristow	James Dickens	HAI	David York
Chevron	Tim Guidry	PHI	Terry Gambill
Era	David Robinson		

NOAA Weather Satellites



- Ligado's spectrum move impacts the NOAA datalinks
 - Weather balloons reporting links
 - Geostationary Operational Environmental Satellites (GOES)
- GOES system imagery is the primary source of:



- NWS Aviation Weather Center (AIRMET, SIGMET & PROG Charts)
- NWS Volcanic ash advisories
- NWS Hurricane Center advisories
- NWS Storm Prediction Center advisories
- Polar route radiation warning system
- Flood and storm surge warnings advisories
- Cloud-to-cloud and cloud-to-ground lightning data

- Proposal to replace feeds with an internet system
- Only Ligado has conducted a technical analysis
 - Flaws in the analysis