



# Evolution Towards Digital Voice

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# Context and scope

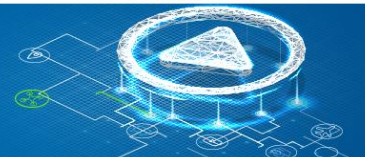
- In the context of ATM communications, “*digital voice*” can mean number of different things, with each interpretation having very different technical and operational implications.
- Purpose of this presentation is to help narrow down the discussion on the future of the digital voice within SESAR and broader industry forums.

# Motivation

- Why digital voice for continental operations?
  - Running out of VHF spectrum. (Not enough frequencies for opening new sectors.)
  - Some potentially useful features not available with analogue VHF voice.
- ...but there are some myths associated to digital voice
  - It's spectrally more efficient. (Yes, but only in some specific cases.)
  - It's needed for virtual centre. (Yes, but only ground-ground.)
  - It's needed for flight centric. (Not really – can be done with VHF.)

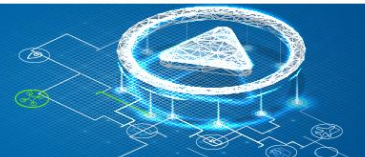
# Operational view

- From operational perspective *digital voice* can be used in several ways
  - **Point-to-point telephone calls:**
    - Existing SATVOICE services in procedural airspace.
    - Moving from voice via radio operator to direct controller-pilot communication (DCPC)
    - **Not matching the currently foreseen operational concepts for continental airspace**
  - **Teleconferencing:**
    - Aircraft join teleconferencing rooms as required.
    - Depending on ATM concept utilizing the service, this could be e.g. one room per sector, one room per ATCO, one room per ...
    - Could include VHF-like solution (e.g. for transition period)
    - Could include seamless voice handovers from one ATCO to another (driven from ground)

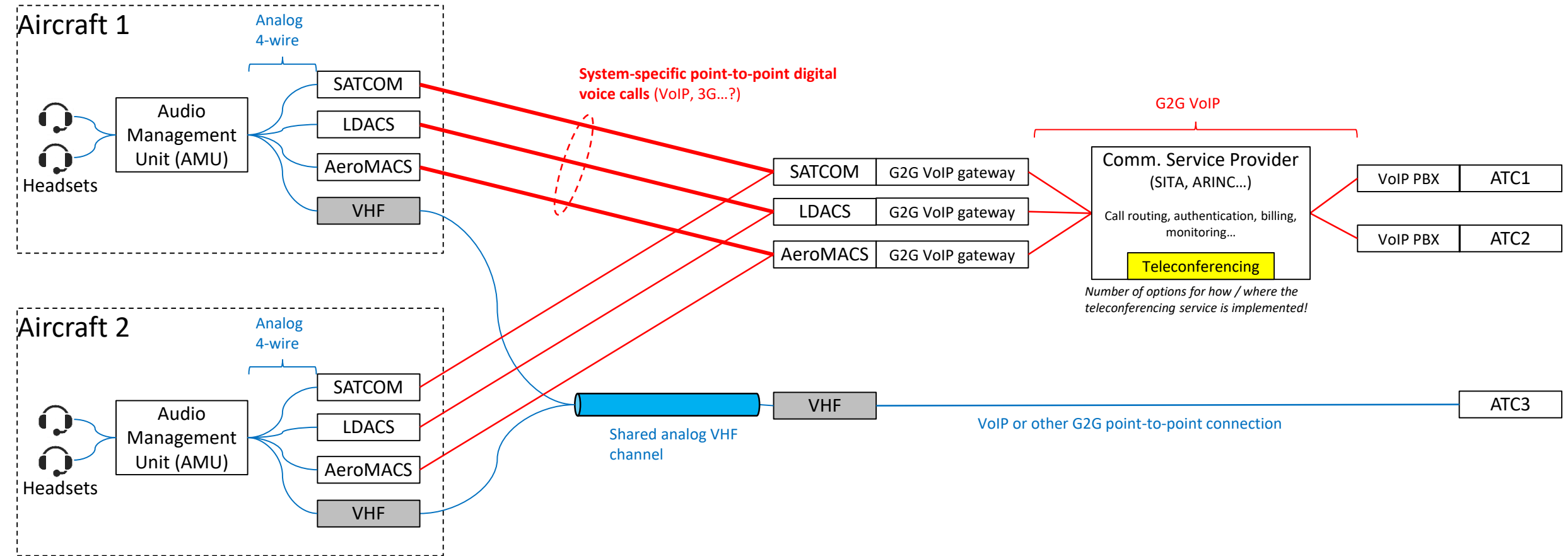


# Technical implications for air-ground link

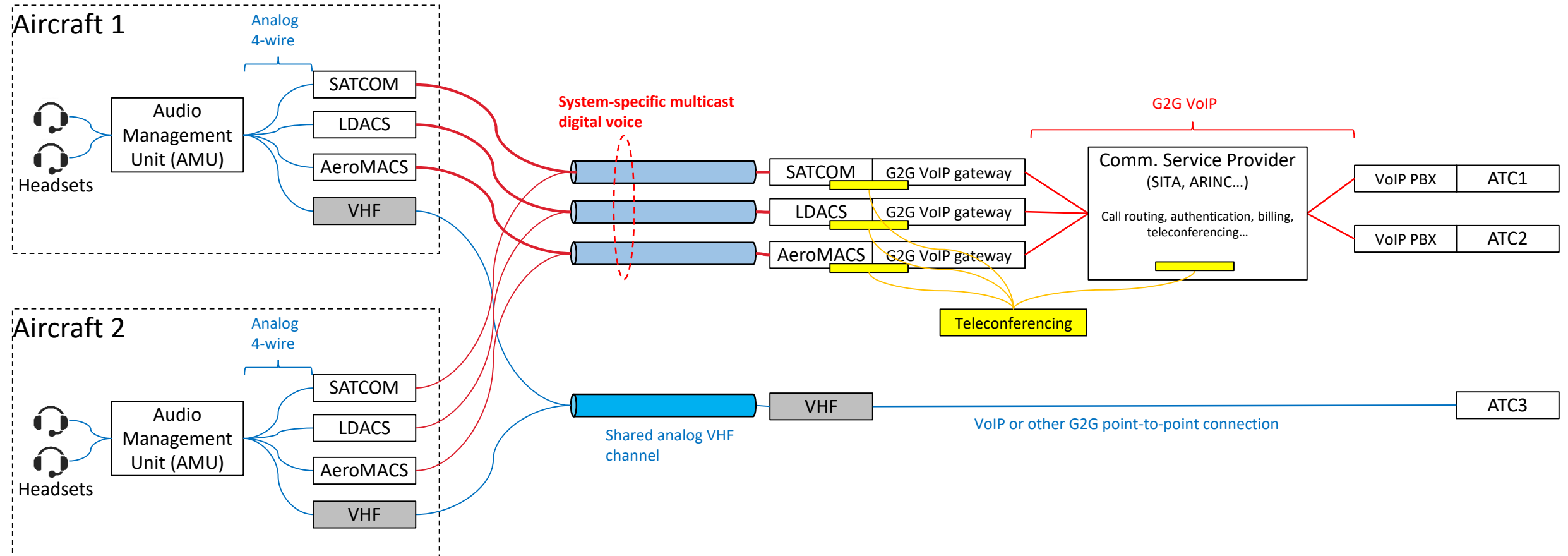
- Each has different technical implications for the air-ground link
  - **Telephone calls:**
    - Existing technology (SATVOICE) would be reproduced by other FCI links (L-DACS)
    - Call setup time is critical
  - **Teleconferencing:**
    - Always-on or long-duration teleconferencing would need a lot of bandwidth or highly optimized protocols and waveforms to support efficient over-the-air multicast.
      - Such technical concept doesn't exist in today's candidate solutions for aviation (LDACS, SATCOM) and it is very challenging to design and implement.
    - Multicast/broadcast solutions exist for 4G and are being designed for 5G. But they seem to focus on "uplink" only (point to multipoint, i.e. ATCO-aircraft).
    - For dynamic teleconference join/leave, the call setup time would be critical



# Point-to-point telephone calls



# Teleconferencing with optimized a/g links



# Technical implications – ground infrastructure

- Ground-ground is using digital voice (VoIP) already today
  - Between VHF ground station and ATC
  - Between “aeronautical station” and ATC for HF voice or SATVOICE via radio operator.
  - Between ATC and Satellite Service Provider for DCPC SATVOICE.
- For “Teleconferencing” concept a new service infrastructure would be needed
  - Likely operated by CSPs
  - Similar to ZOOM, Webex, Teams services
  - Technology exists. The main hurdle is to certify it for safety critical use while considering the business case.

# Research and Development needs

- Operational (top-down requirements flow):
  - Which digital voice operational concept is the most useful?
    - Telephone calls, teleconferencing, what flavor of teleconferencing...
    - How will digital voice combine / complement with VHF voice and Datalink Services?
    - What (if any) voice/data independency is needed?
  - What parameters are critical?
    - E.g. call setup time, voice latency, “always on” capability, number of users...?
  - Which (if any) digital voice extra-features are desirable?
    - Selective muting, caller ID, raise hand, call or participants prioritization...
  - How much are we willing to pay for the different features / parameters?
    - For VHF-like or long-running multi-user teleconferencing high CAPEX or OPEX is needed.
    - Short / infrequent telephone calls way more affordable

# Research and Development needs

- Technical (bottom-up inputs)
  - Define, evaluate and down-select candidate high-level technical solutions.
    - See technical backup slides for preliminary outline of the different options.
  - Develop, validate and deploy the winning tech. solutions



# Questions?

