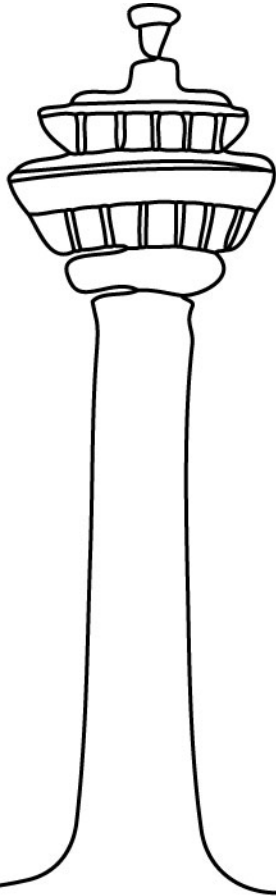# ICAO & McGill University Institute of Airspace and Law - Air Navigation Conference

CNS technology implementation options

David Russell, VP Aircraft Operations & Communications Services

Straightforward aircraft operations

SITA

CNS transition from analog to digital

- ICAO 2003 Air Navigation Conference approved CNS transition from analog to these digital technologies
  - Communications: from voice ➜ data link using VDLM2/Satcom
  - Surveillance: from Radar ➜ ADS-B using Mode S squitter

- VHF stations are being upgraded to support VDL Mode 2
  - CPDLC will share VHF links with airline communications service so VHF stations support ACARS & ATN, like Satcom.

- ADS-B will use ground stations costing 10% of radars
 - ADS-B stations will connect to upgraded radar data processors

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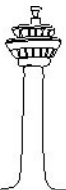
VDL/ADS-B ground station networks

- **VDL Mode 2 ground station networks**
  - VDL-M2 stations in each "ANSP territory" will connect to the ANSP's ATN routers which will be connected to the CPDLC systems in the Air Traffic Control centers.
  - ATN routers in each ANSP territory will be interconnected to neighboring ATN routers to allow seamless handovers.
  - VDL stations will connected in parallel to airline service provider systems for transport of airline traffic.

- ADS-B ground station networks
  - ADS-B ground stations will use the Eurocontrol Asterix "Radar data exchange" protocol to interface to surveillance data processors.
  - ADS-B ground stations can share existing ground network connections and sites with VHF data link stations.

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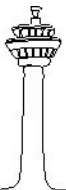
VDL/ADS-B global interoperability

- European implementation of CPDLC using ATN over VDL-Mode 2 will lead to global adoption
    - European Single Sky Implementing Rule will require aircraft & ANSP's to support CPDLC and Eurocontrol requires initial CPDLC communications use ATN over VDL Mode 2 links.
    - Aircraft equipage to comply with European CPDLC mandate will make VDL Mode 2 the best candidate to support CPDLC in other regions.

- ADS-B global interoperability will be provided by use of Mode S squitter but ANSP's may locally use other links for general aviation
    - ICAO 11th ANC Recommendation 7/1 asked that states:
        - a) note that a common element in most of the approaches currently adopted for early implementation of ADS-B is the selection of the SSR Mode S extended squitter as the initial data link; and
        - b) take into account this common element to the extent possible in their national and regional implementation choices in order to facilitate global interoperability for the initial introduction of ADS-B

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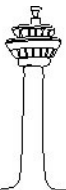
VDL/ADS-B network cost benefit equation

- CPDLC & ADS-B application benefits must outweigh the costs of avionics and ground networks.
  - CPDLC avionics cost is limited by sharing use of VDL with airline communications while ADS-B avionics cost is limited by use of existing Mode S transponder.
  - VDL Mode 2 and ADS-B ground network costs will be driven by the approach to deployment.

- ANSPs could :
  - expand their national CNS networks to provide data link services and sell their use to airlines, possibly in partnership with airline service providers ?
    - *or*
  - focus on their "core business" of running ATC centers and outsource CNS network operation to community service providers focused on CNS operation ?

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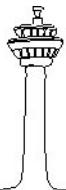
Drivers for Regional CNS Service Providers

- ANSP creation of regional organizations to operate CNS networks is driven by several factors:
  - Communications & surveillance data link technologies are complex and if each ANSP seeks to master the technology and deploy its own network, it delays implementation, results in fragmented availability and redundancy & ultimately leads to higher costs.
  - Air Traffic Management efficiency requires aircraft to use communications & surveillance data link networks that run seamlessly across entire regions without cut offs at national borders
    - Network technology is not naturally constrained by national boundaries – the Internet provides a visible example

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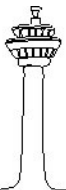
Conclusion

- ATM modernization requires implementation of digital CNS networks, which can also be shared for airline use.

- CNS modernization will be slow, fragmented and expensive, if each ANSP seeks to implement networks at a national level.

- ICAO should encourage States to create regional organizations to provide CNS network operations. Such networks can be shared with airlines, for enhancing aircraft operations.