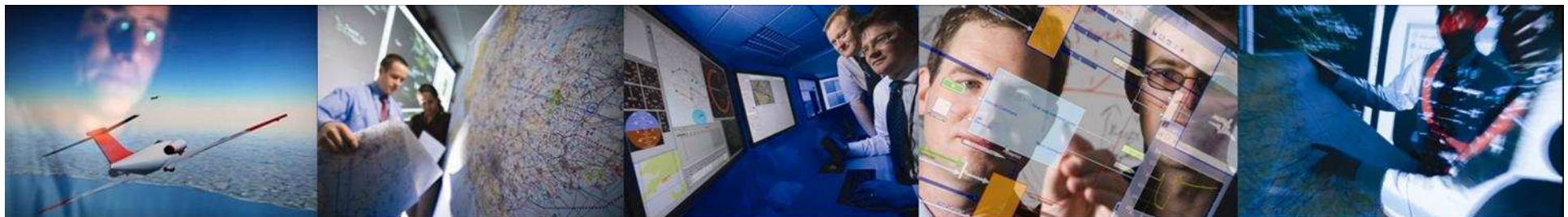




Communications

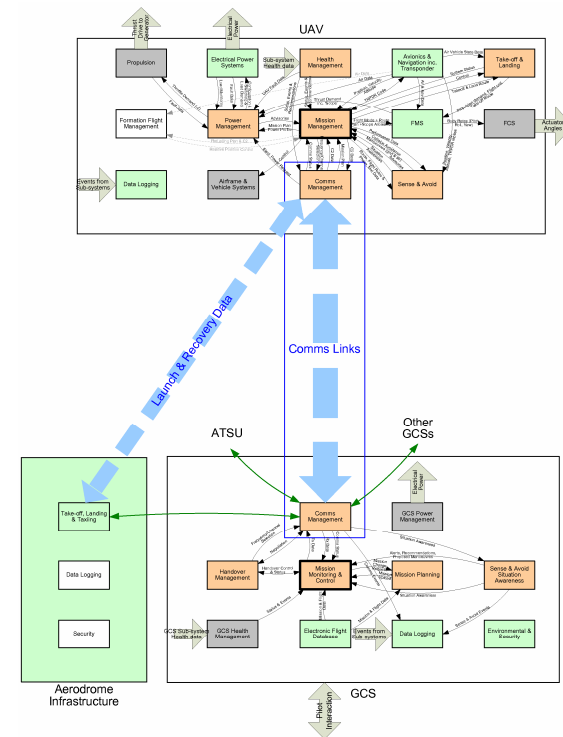
David Rees

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Communication System

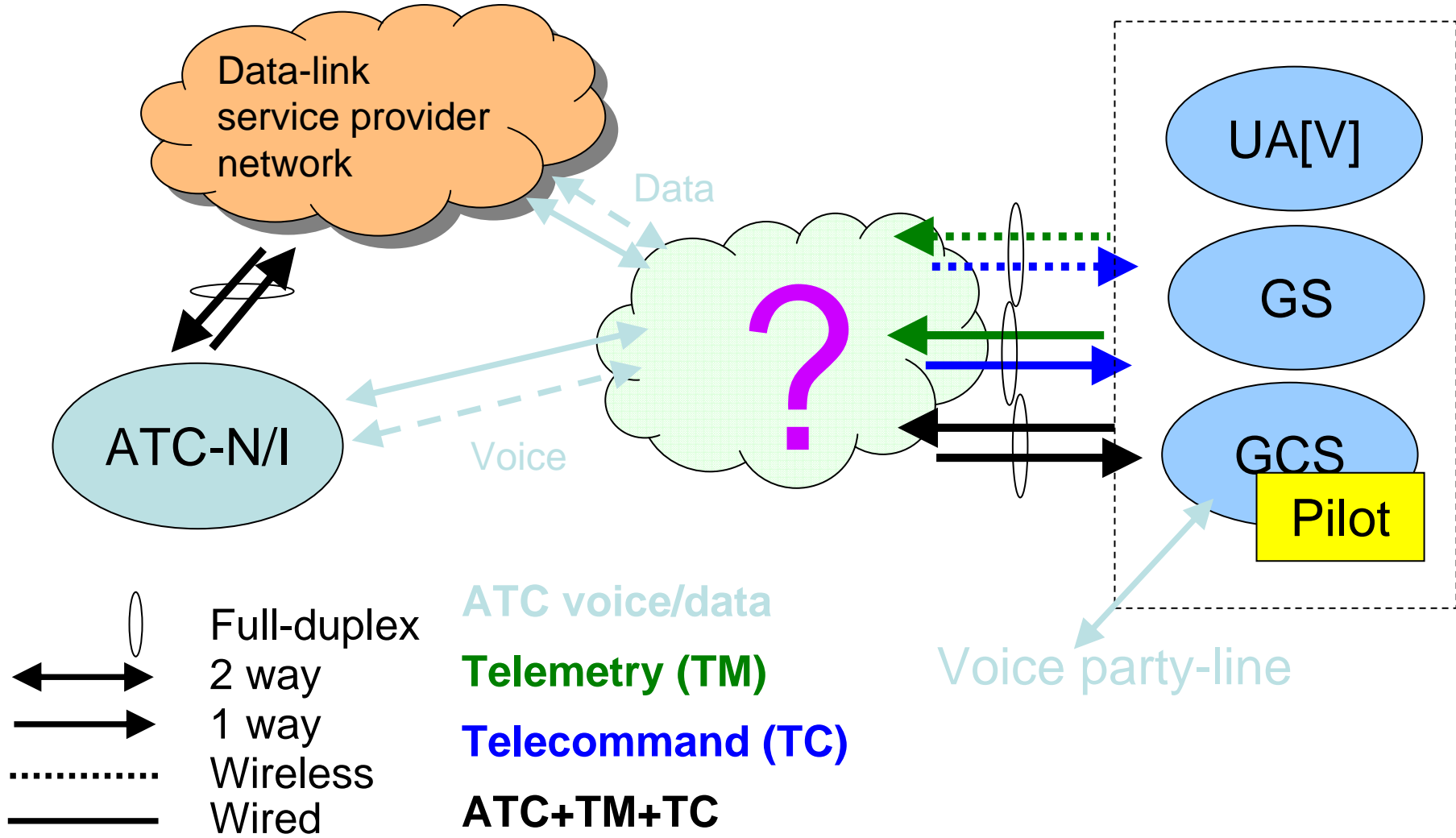
- **Communications Challenge**
- **Communications Architecture**
- **UAS Communication Manager**
- **Communication Issues**
- **Operational Context**
- **Success to Date**
- **Future Capability**



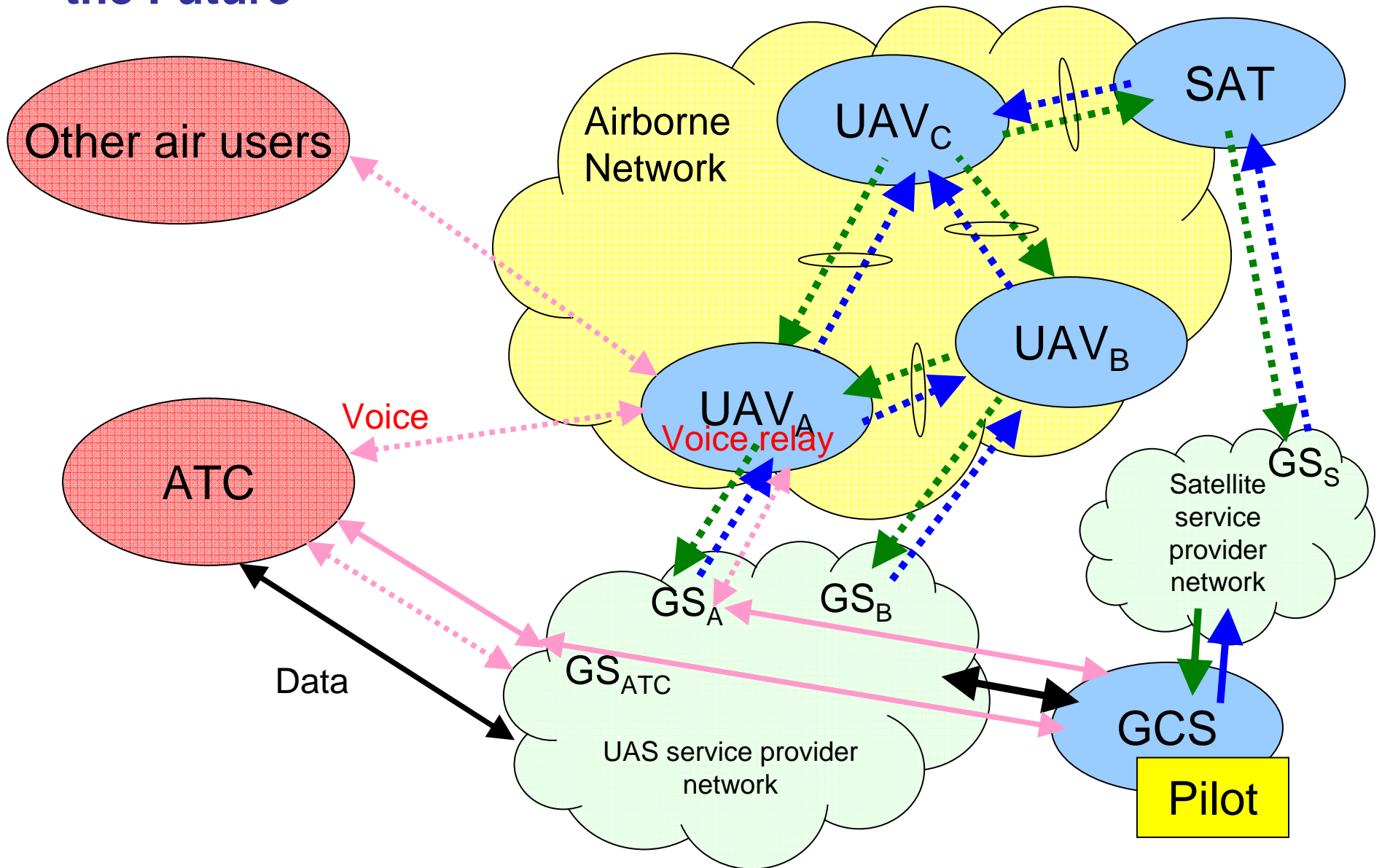
The Communications Challenge

- **Potentially small window for securing a link and sending data**
 - Negotiation and transfer window could be seconds
- **Limited ground access**
 - Handling of data when there is no ground communications available
 - Minimise the use of costly satellite communications access
- **Security**
 - Command and Control
 - Information security
 - Ensuring the identification of both the sending and receiving participants
- **Power**
 - Power that must be used effectively and efficiently

Communications Architecture – Generic Elements

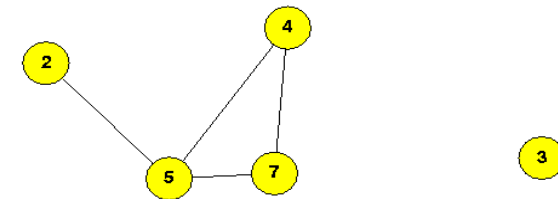


Communications Architecture – the Future



Overview of the UAS Communication Manager

- **Secure and adaptable communications platform**
- **Rapidly identify and secure a link**
 - Be aware of the link characteristics
- **Rapidly form new routes for data to a destination**
 - Identifying new nodes, both ground and air
- **Data is adapted to fit the transport medium**
 - Radio metrics supplied to application level for use
 - Allows decisions to be made for Data and Information Fusion
- **Offers efficient use of bandwidth and power**

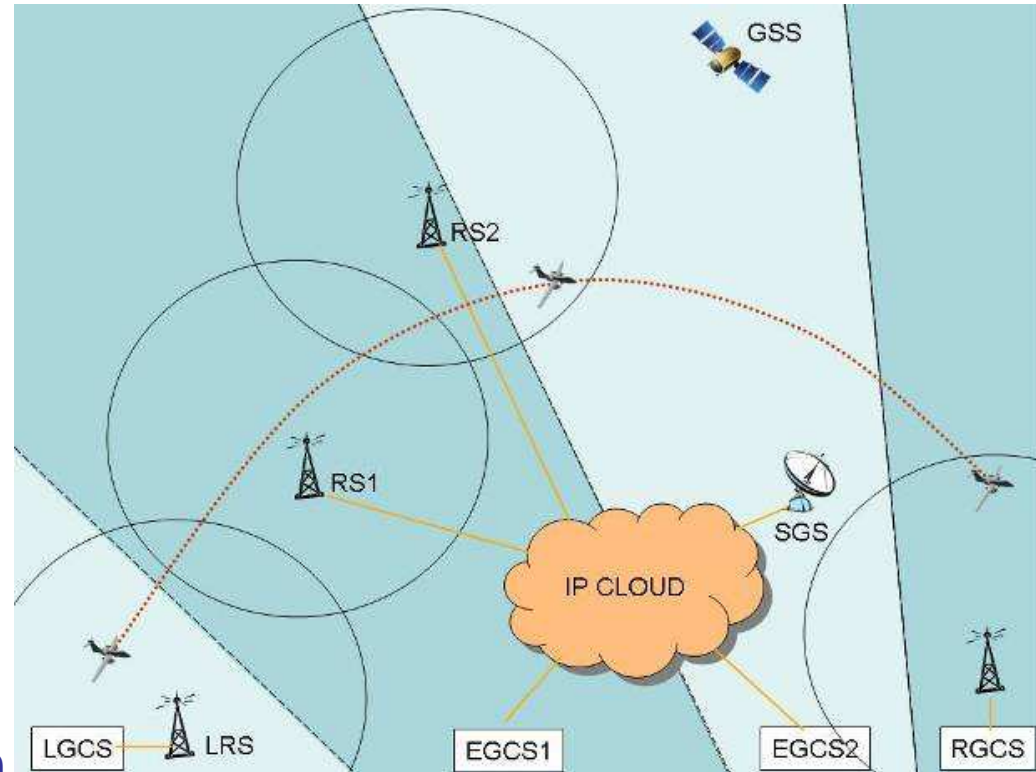


Communication Issues

- **Secure communications**
 - Cryptography
- **Data transmission must be ‘Send and Forget’**
 - Applications work with the UAS Communication Manager to arrange transmission and forwarding
 - Instantly optimising the routes for data, based on real-time radio metrics
 - Alters information to fit communication tunnel
 - Store and Forward Technology
- **Near real-time adaption to network quality**
 - Optimisation of information being sent
 - Application Quality of Service (QoS) is linked to network and radio QoS
- **Power efficiency**
 - Intelligently use radio bandwidth to minimise power impact
 - UAS Communication Manager to be a low powered device

Operational Context

- UAV flying through an airspace with intermittent ground communications
- Satellite communications used when out of line of sight of ground stations
- UAS Communication Manager advantages:
 - Minimise the traffic sent over satellite communications
 - Able to utilise other UAVs in the area
 - Utilise other networks securely



Success to Date: Communication Manager Prototype 1.0

- **Prototype 1.0 - March 2011**
- **Large form factor (19" rack mountable)**
 - 2 UAS Communication Managers over simulated wireless bearer
- **Capabilities include:**
 - Capable of forming and monitoring a single link
 - Capable of reacting to a changing link (Bandwidth, Latency, Resources)
 - Encryption in hardware
- **Applications using the UAS Communication Manager:**
 - Network monitoring tool (reporting)
 - Link cognizant video streaming application
 - Automatically adjusts video quality
 - Avoids data loss
 - Self optimizing



Success to Date: Communication Manager Prototype 2.0

- **Prototype 2.0 - September 2011**
- **Small form factor**
- **Four physical units roaming in a 3D simulated environment**
 - Real world communications reacting to the 3D environment
 - CM mounted on multiple vehicles and ground based assets
- **Capabilities:**
 - Complete end to end multi-hop route metrics
 - Units moving in real-time
 - Network state changing constantly
 - Real world applications adapting to the situation
 - **Applications:**
 - Advanced Video Streaming Application



Future Capability

- **Initial real world testing**
 - Testing in the real world on ground based vehicles (2 line of sight (LoS) and one beyond line of sight (BLoS) bearers)
- **Increase the simulation to incorporate hundreds of nodes**
 - Completely realise a simulated UAS Communication Manager
- **Decrease power**
 - Target – <30 Watts
 - Intelligent transmission of data
- **Distributed store and forward**
- **Node to node federated identification**



Summary

- **Communications Architecture developed for real world**
- **UAS Communication Manager – intelligent, optimising, adapting**
- **Information security and operational security**
- **Power efficient and effective communications**
- **Fulfils operational needs**
- **Evolving capability and reducing Size, Weight & Power**