Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of		
	)	
Rapidly Deployable Aerial	)	
Telecommunications Architecture Capable	)	PS Docket No. 11-15
Of Providing Immediate Communications	)	
To Disaster Areas	)	

COMMENTS OF OCEUS NETWORKS CORPORATION

Oceus Networks Corporation ("Oceus Networks") submits these comments in response to the Federal Communications Commission's (FCC's) Public Notice on rapidly deployable aerial telecommunications architecture that can provide immediate communications to disaster areas.[1] Oceus Networks requests that the FCC consider its comments in the above-referenced docket in light of the continued need to assess these technologies for meeting the urgent communications requirements of first responders, including in the initial period after major natural disasters or terrorist attacks, when fixed terrestrial solutions are often severely impaired.

I. INTRODUCTION

Oceus Networks commends the Commission's ongoing efforts to foster deployment of low-altitude aerial telecommunications architecture solutions that are "accessible, reliable, resilient, cost-effective and secure, and which are capable of providing public safety and

[1] Rapidly Deployable Aerial Telecommunications Architecture Capable of Providing Immediate Communications to Disaster Areas, PS Docket No. 11-15, Public Notice (rel. Jan. 28, 2012) ("Public Notice.")

emergency response personnel the ability to communicate during the critical restoration period after a major disaster."[2] Oceus Networks supports the vision for deployable aerial communications architecture (DACA) in the Public Safety and Homeland Security Bureau's 2011 White Paper, which described "an aerial capability that is deployable within the first 12-18 hours after a catastrophic event to temporarily restore critical communications, including broadband, for a period of 72-96 hours."[3]

Oceus Networks has developed a proven robust, compact 4G LTE solution providing secure high speed data communications, which, when joined with an airborne platform, creates a zone of coverage to restore critical communications in the first hours after a catastrophic event. [4] Oceus Networks has direct experience with deploying its 4G LTE solution on various platforms, including airborne systems. For example, Oceus Networks' solution for NAVAIR includes deploying a Xiphos™ 4G LTE network on a UH-1N helicopter to extend the cellular coverage from the Expeditionary Strike Group (ESG) to locations beyond line of sight of the fleet. Effectively a "moving cell tower in the sky," the helicopter provides an altitude advantage for forces within its line of sight. The LTE radio, per the specification, allows for relative movement between the user and the radio for speeds of up to 217 mph (350 kph) and distances out to 62 miles (100 km). Ground forces beyond the line of sight of the fleet will have the capability to reach back to the services of the fleet using the helicopter as a relay. Due to the

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[2] Id.
[3] "White Paper: The Role of Deployable Aerial Communications Architecture in Emergency Communications and Recommended Next Steps," Public Safety and Homeland Security Bureau, September 2011.
[4] Privately U.S.-owned and operated, Oceus Networks provides broadband solutions to governments and industry that enable them to deliver high-speed voice, video and data communications.

robust design of *Xiphos*™, ground forces will exploit communications among other users within the cellular footprint even when the helicopter is beyond line of sight from the fleet.

II. BACKGROUND

Key components of airborne-platform based aerial components to public safety networks during a disaster response include: (1) Consideration of the air mission as a communications mission; (2) Creation of well-defined integration points; (3) Construction of the network in tiers of coverage; (4) Monitoring of the operation of the network to proactively address issues; (5) Use of planning software for the incident scene; (6) Ability to swap Universal Integrated Circuit Card s(UICCs) at the incident site; (7) Moving the core to the edge of the network.

For restoration of communications immediately after a catastrophe occurs, a deployable aerial communications architecture is a critical component. As the FCC White Paper recognized: "Each DACA technology has its own particular characteristics and capabilities, but all capitalize on the unique propagation characteristics that altitude provides." An aerial component is not necessarily ideally suited to all phases of deployment, or all communications requirement scenarios for first responders, but in line with the scope of the FCC's Public Notice, Oceus Networks focuses this filing on how DACA, based on latest proven commercial-off-the-shelf technology, can be used immediately following a disaster. In addition to aerial platforms, Oceus' mobile ruggedized networks can be placed on a diverse array of platforms, including installation on light trucks, aboard ships and in tactical warfighter vehicles.

III. FRAMEWORK: PUBLIC SAFETY AERIAL COMPONENT

For a multi-tiered approach to providing communications capabilities, including airborne and mobile fixed sites,[5] the airborne layer is the first component of the network, that is the most immediately available on the incident scene. The airborne layer provides communications to large areas of operation, see Figure 1. With a very light load on the network, the area of operation could extend for tens of miles with an aircraft flying at five thousand feet above ground level (AGL). The aircraft will have a data link integrated into the public safety network but will not require a connection to provide connectivity for continuity of operation As a result, first responders on the ground have immediate access to the public safety network .

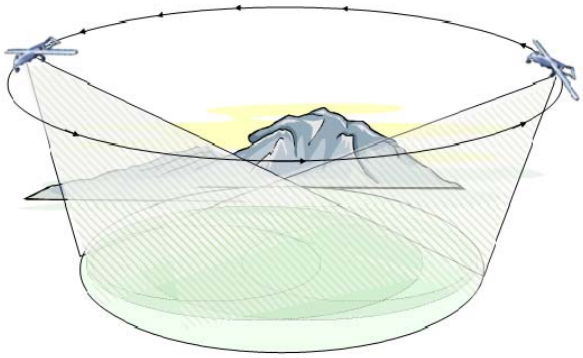

Figure 1. Mobile Airborne Layer

As the team on the ground expands, the network will expand. Self-contained network nodes will be added to the system deployed on trailers with integrated antenna, mast, generators and Wide Area Networks (WAN). WAN systems will begin with satellite backhaul due to the ease of setup and will be expanded through point to point microwave between the network nodes. Each system will be able to operate independent of its peers when disconnected from the public safety network. As with the aircraft, no dependence on connectivity will be assumed so

[5] Acknowledging the costs associated with UAVs, we will limit our discussion to small aircraft with a lifting capacity of tens of pounds and a maximum altitude of five thousand (5000) feet above ground level (AGL).

that the users on the system can continue with their jobs. Each network node provides some local application and voice support, although it may be limited. For example, queuing information may be not available until the public safety network connection is restored.

The form of the ground systems will depend on the mission each node fulfills. Tethered aerostats can be used to provide high level coverage. The lifting capacity of the aerostat would allow each to carry a small radio aloft along with a payload such as a remote control Pan, Tilt, Zoom camera. Aerostat operation at 1500 feet would augment the aircraft communication responsibilities, allowing for extra loiter time and increasing the coverage in remote areas of the incident. Trailer-mounted systems would be set up in main areas of operation, see Figure 2. This system would further offload the airborne layer and increase the quality of service for the main centers of operation.

Figure 2. Mobile Fixed Network

The first order of business is to assure that all of the devices are operational. When the fully interoperable FirstNet network is deployed, it will be possible to enable or disable devices from a command center. In the meantime, a UICC, also often called a subscriber identity module or 'SIM', can be issued to the responding public safety official when he or she arrives on scene. In either case, the identity of the device can be assured to be addressable within the incident network.

A backbone network that continually monitors the connectivity of its neighbors and adapts routing for the current moment creates the ability to quickly add or subtract radio nodes as needed from different teams. The intelligence embedded into the routing protocol supporting the

mesh network eliminates the need for first responders to also take on the role of IT professionals at an incident scene.

With regard to frequency coordination, in a lightly loaded, rural environment, there must be cooperation between the ground team and the flight team to assure continuity of coverage for the teams on the ground. On-site network planning provides capability for the ground team, with the spectrum manager using on-site planning to combine the input from the ground teams, the flight teams, and the needs of the users. Actively managing the ground systems and the flight plans assures the most effective use of the spectrum.

A. Disaster Scenario

For a large area of operation in a rural community, such as an earthquake or flood, the local communication systems are likely to be limited to narrowband radio services and limited range of their equipment relative to the size of the situation.

- Immediately after an incident, an airborne layer is deployed to the area. This system has a 4G LTE network radio installed. At a minimum, this system should provide mobile to mobile coverage for voice for the first responders on the ground. Ideally, the communication link between the aircraft and the ground is robust enough to support broadband connection to the enterprise.
- The lead ground teams arrive with 4G LTE enabled handsets that support operation in the public safety spectrum. As the team sets up the command headquarters, the frequency coordinator will set up his or her plan for improving the communications where the ground teams will need more capabilities. Planning software provides estimates on the flight pattern of the aircraft. As the ground teams create a rescue plan, the frequency coordinator helps improve the connectivity of the rescuers in their daily operations.
- As ground systems arrive on the scene, the frequency coordinator provides updates to the coverage plan—deploying the ground resources to augment the coverage area provided by the airborne platform.
- As the fixed infrastructure is brought into service, the airborne flight plan is modified to extend farther afield.

A key component of this approach is the flexibility of the frequency coordinator to assign resources where they are most needed, underscoring the need to deploy planning software to dynamically assign and visualize the deployment of the communications network. The plan will be adjusted periodically to best serve the needs of the responders on the ground to improve poor coverage areas or provide high bandwidth hot spots for communication centers. Any solution will follow the 4G LTE specifications as defined by the 3GPP, assuring interoperability and the ability to transfer profiles from one jurisdiction to another.

B. Components

To successfully incorporate an aerial component, this approach must facilitate communications for first responders that are accessible, reliable, resilient and secure:

- **Accessibility**: Initially on-scene UICCs would provide access to the airborne network. The ultimate ability to leverage the interoperable features of FirstNet would be a logistics advantage in prolonged operations.
- **Reliability**: The initial coverage with the airborne system over a large area is likely to be spotty to begin with as the system operation is studied and gradually improved. As the network engineer works with the incident commander, the system will be optimized to further the communication needs of the ground responders, bringing critical applications to improve their safety and increasing the reliability of the system. Additional network connections with microwave and satellite will be added, continually improving system reliability.
- **Resiliency**: Each critical node within the incident network should provide a full 4G LTE network core, which will be subordinate to the core public safety broadband network . When the connection between the core network and the remote node is severed, the only affected users are those who were using the link to the network core.
- **Security**: 4G LTE inherently addresses many security issues. The air interface is encrypted with AES 128. No casual user will be able to gain access to this network and monitor traffic.

IV. CONCLUSION

In light of its experience in deploying 4G LTE platforms using airborne components, Oceus Networks believes that an aerial public safety 4G LTE solution that augments a fixed terrestrial public safety network during the first 72 hours after a disaster strikes is feasible, including as part of efforts to enhance the effectiveness and coverage area provided by the FirstNet public safety network, once it is deployed. This can initially provide communications where none exists in the immediate aftermath of a disaster and fill in gaps in service and coverage areas longer-term.

Respectfully submitted,

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