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Extended MAGTF Operations Aerial Layer Communications Experimentation

Claflin, Jamie; Singh, Gurminder; Gibson, Prof. John; GSOIS; Prince, Charles

Monterey, California. Naval Postgraduate School

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EXTENDED MAGTF OPERATIONS AERIAL LAYER COMMUNICATIONS EXPERIMENTATION

by

Capt Jamie Claflin, USMC, Prof Gurminder Singh,
Prof. John Gibson, GSOIS, Research Associate Charles Prince

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Col Stephen K Heywood, USMC (Ret)

EXECUTIVE SUMMARY

Project Summary

This research explored current and emerging aerial layer communications, such as balloons or small form factor aerostats (tethered and untethered) and long-endurance UAVs, to provide high-capacity, high-availability communications support in satellite-denied terrain. Through field experiments of leveraging COTS technologies, the study investigated the feasibility of purported aerial layer architectures. The results of the study provided specific filed experiment results concerning options to equip expeditionary forces with reliable Over-the-Horizon, On-the-Move communications to the tactical end user to address capability shortfall between stated priorities of Marine Corps expeditionary strategy and the demonstrated ability to conduct distributed command and control operations.

Background

Extended MAGTF Operations require significant communications capabilities on forces that must be highly maneuverable and minimally equipped in order to satisfy the intelligence and command and control demands of fast-response forces. Several recent thesis efforts have explored possible alternatives for leveraging unmanned aircraft platforms as a means to extend communications beyond the capability of current tactical radio systems [Simmons, 2013; Everly/Limmer, 2014]. Further, emerging satellite systems, o3B [www.o3Bnetworks.com] being one such system, profess to provide near optical-fiber performance. However, mission constraints may prevent access to such systems. An aerial layer network seeks to leverage other capabilities, perhaps in conjunction or in parallel with satellite systems, to meet the demand for high throughput, on demand data service.

The USMC tactical radio inventory lacks a system suitable for supporting OTH, high data-rate communications with on-the-move distributed combat elements. Recent experimentation by the Infantry Officer Course explored the utility of the Distributed Tactical Communications System (DTCS) radios, or Netted Iridium, to support on the move forces [Waddell thesis, 2014]. As it is a satellite-based system, Push-to-Talk broadcast voice capability it received accolades for its performance in Afghanistan [http://defensesystems.com/articles/2010/01/27/c4isr1-netted-iridium-communications.aspx]. However, the on-the-move distributed combat elements require high-speed data not available from current systems and satellite based systems may be vulnerable or otherwise inaccessible to tactical edge forces. Small form factor systems, requiring low power offer opportunities to leverage aerial systems as relay platforms. Depending on the size, weight, and power (SWaP) characteristics of these systems they may be suitable for small UAV or aerostat/balloon deployment.

Virtual Private Networks and other IP-based tunneling capabilities offer means of interconnecting current tactical data systems. Leveraging aerial platforms may allow the integration of disparate and geographically separated data networks, allowing remote

combat elements to maintain critical command and control links to higher headquarters. Such integration efforts may make use of emerging commercial products to mitigate the cost and fielding-delays inherent in typical military communication systems without sacrificing the inherent security of existing military systems. Further, free space optics may provide a path to near optical-fiber data-rates between distant units. This research will explore such capabilities thorough field experimentation.

Findings and Conclusions (to include Process)

One USMC Captain took this topic up for his M.Sc. (Computer Science) thesis, being supervised by Prof. Gurminder Singh and Prof. John Gibson, and with assistance from Research Associate Charles Prince. The student completed his thesis in Jun 2015 ("High-Capacity And High-Availability Aerial Layer Network (AlN) Communications Support To The Tactical Level"). His thesis identified significant transmission range constraints for the COTS radio system employed as a payload on the Space Data Corporation SkySat high-altitude, untethered, balloon platform. Principal causes for the range issue is the available transmit power and low-gain antennas. Subsequent efforts on this project include investigation of the use of off-the-shelf tactical radios as a means of providing low bandwidth tactical chat capability to dispersed forces, as well as exploring better antennas for the Wave Relay radio system, to include an more capable radio, the 5th generation Persistent Systems Wave Relay 5100 radio. Additional field experiments, in concert with 1 MEF S&T) are planned for this FY as part of the follow-on effort to this project.

We have also been in constant communication with the sponsor of this project and have been taking his input in to account for the research.

Recommendations for Further Research

Specific recommendations for Future Research are forthcoming in the on-going follow-on project.