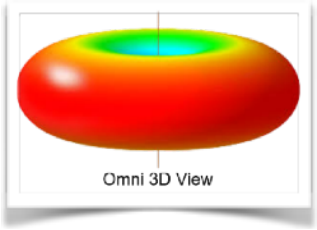
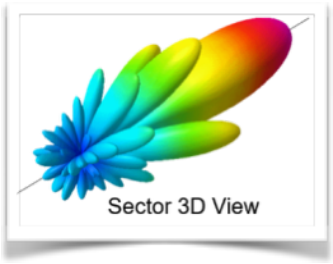
BATS WIRELESS

High Gain | High Mobility | Hi Reliability



Omni Antenna

Omni antennas have been predominately used in mobile communications for their ease of use. Ease of use has provided no protection from self and foreign interferences, nor protection from adversaries in tactical communications.

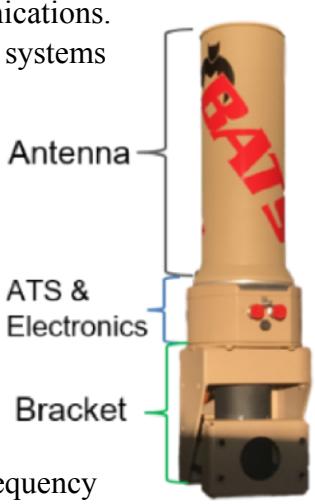


Sector Antenna

The ESA uses multiple sector elements to provide directionality as well as protection in mobile communications. This increases system gain (Tx and RX chain) while reducing unwanted interference.

Electronically Steered Antenna (ESA)

Historically in mobile tactical communications Omni antennas have predominantly been used to support mobility and fast link acquisition. Omni antennas provide a low cost, hassle free operation for mobile platforms but the antenna does nothing to isolate the RF front end of a radio from self and foreign interferers. A corrective path or a solution to the ever-rising noise floor has always been to increase power, this has benefits but also compounds the problem of an increasing noise floor. Another growing concern for sensitive networks is the ability for adversaries to intercept/detect communications. Using Omni antennas with high power systems makes it very easy for someone to locate and track a wireless link, Omni antenna signals propagate in all directions to account for the distant target movements. Adversaries can stay hidden, and remain at a distance where the signal is at its lowest level.



The BATS ESA antenna is **radio agnostic**, and can be adapted to any frequency the application requires. The ESA has multiple sectors that are individually turned on through the use of the BATS Alignment and Tracking SW (ATS) algorithm. Each sector has a vertical and horizontal polarized element, enabling a multiple input multiple output (MIMO) operation for radios that have the ability to support that function, or the two polarization's can be used

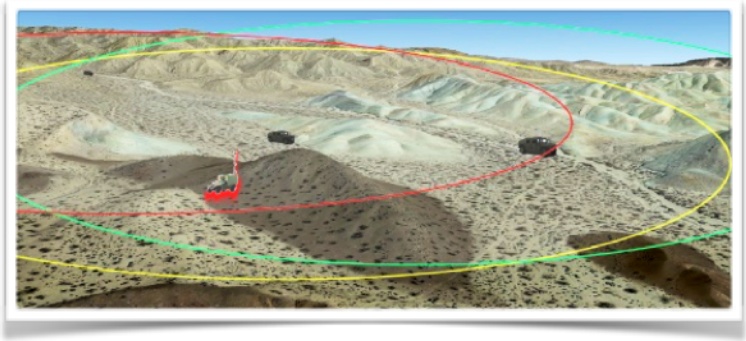
Interference Rejection

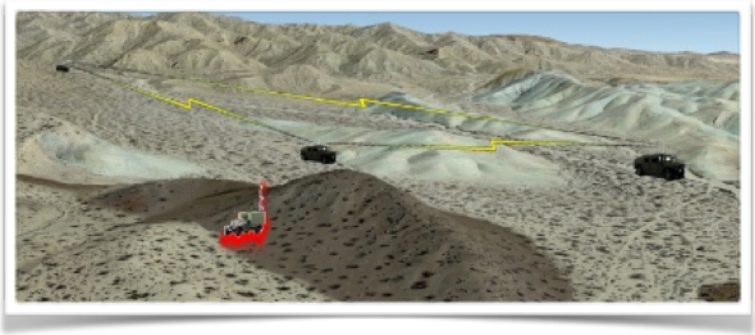
Utilizing sectors to transmit a directional beam to the desired target has great benefits to the RF channel performance above typical Omni antenna systems. The pure directionality of the element reduces signals received by the antenna outside the desired link area, unwanted signals are reduced by more than 20 dB. This function allows waveforms not specifically designed for mobile applications to have a clearer channel and operate in higher modulations, thus greater capacity in adverse environments.

Low Probability of Intercept / Detect

In tactical communications the ability to keep adversaries guessing is a much desired capability. Omni antennas are unable to hide their RF signature, whereas a directed beam causes many issues for adversaries to detect and intercept a signal unless they are directly in the line of site of the main beam, and in close proximity. This now is an unwanted position for the adversary.

by systems that transmit and received in different frequencies. The directivity of each sector provides great side-lobe attenuation, as well as offer a high back-lobe isolation. Both of these features aid in reducing unwanted interferences. In addition to a cleaner signal,





the directivity provides higher gain (~ +10 dBi) than an Omni antenna which increases the desired signal only in the direction of friendlies, but reduces the desired signal in other directions. The increase in desired signal promotes the use of higher modulations which leads to utilizing more data centric applications along with voice in tactical environments. Adversaries now cannot stay hidden or in a fixed location to detect signals, a receiver would need to be in a direct Line of Site (LOS) of the transmitter, this position would expose the threat in mobile applications. In addition, if an adversary wanted to interfere with the signal, the interference signal would have to be very high to overcome the desired signal from the friendly radio, this would be hard to achieve in mobile applications.

ESA Tested - SOCOM TE 17.3

Recently, BATS was invited to a SOCOM event, SOCOM TE 17.3, to showcase the Electronically Steered Antenna (ESA) capabilities in a mobile environment. The event was a quick two day event, with government attendees visiting all technologies and assessing claims of each technology. On the first day the BATS team spent 2 hours on the installation of the ESA, one ESA was installed on a customer furnished (CFE) 11 meter RHIB boat and one on the BATS Van (images below). On the second day the team had one hour for over the air testing to ensure the equipment was commissioned appropriately followed by a live demo later in the day in front of government assessors, as well as interested vendors.

The ESA performed exceptionally well in a very diverse environment. With one ESA installed on the RHIB boat, ~ 2 meters above water, and one ESA installed on the roof of a van, ~ 4 meters above water. Two tests were run, 1) switching speed of sector beams as the boat moved laterally in and around the fixed van location and 2) long distance while the boat is on the move.

In test 1, the boat moved in and around the fixed Van location (Google image below) from a few hundred meters to up to 6 km, at these distances we recorded data capacity speeds of over 1.2 Gbps. The ESA directional beams and switching speeds worked as expected, providing constant link while the RHIB was on the move and changing directions. In test 2, the boat reached a speed of ~ 40 knots and a distance of 15.2 Km while the two radios had a solid link with available data capacity of over 80 Mbps. Live HD video was seen in both tests, as well as VoIP.

During the demonstration, a spectrum analyzer was used to determine the RF isolation that the ESA can provide while in operation, the frequency used during the test was 5.8 GHz. Initial measurements recorded the signal strength at the front of the antenna, then spectrum analyzer was setup nearby to record the RF signals from the back side of the fixed ESA (measurements taken at ~ 20 meters), very little to no RF bleeding was recorded behind the antenna proving that no Omni mode was used and the directionality of the sectors provide low probability of intercept and detect, as well as provide isolation from interference for the radio.

In summary, the BATS ESA antenna performed exceptionally well in a highly mobile tactical scenario where broadband 5.8 GHz communications typically fail and are thus not utilized. ESA not only enabled consistent link quality at long distances but also proved to isolate the signal towards the desired target only, enhancing link quality while protecting against unwanted interference.

For further information on the ESA and the SOCOM TE event results feel free to contact:

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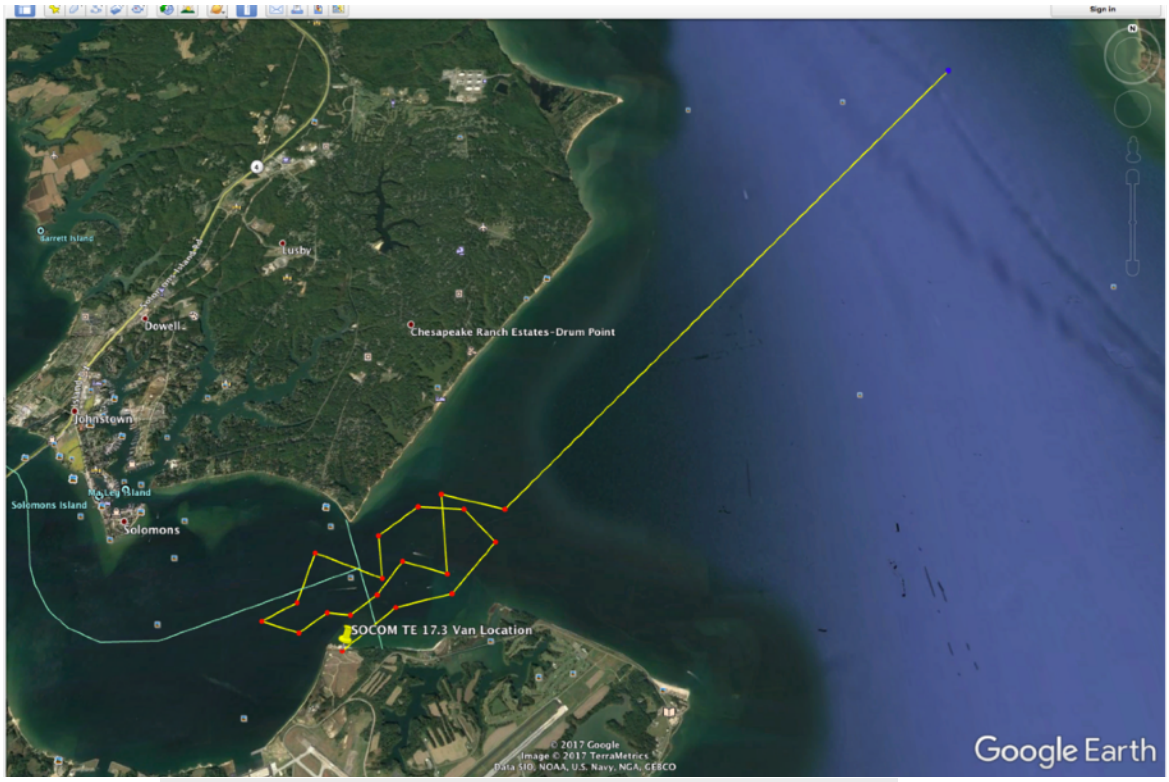
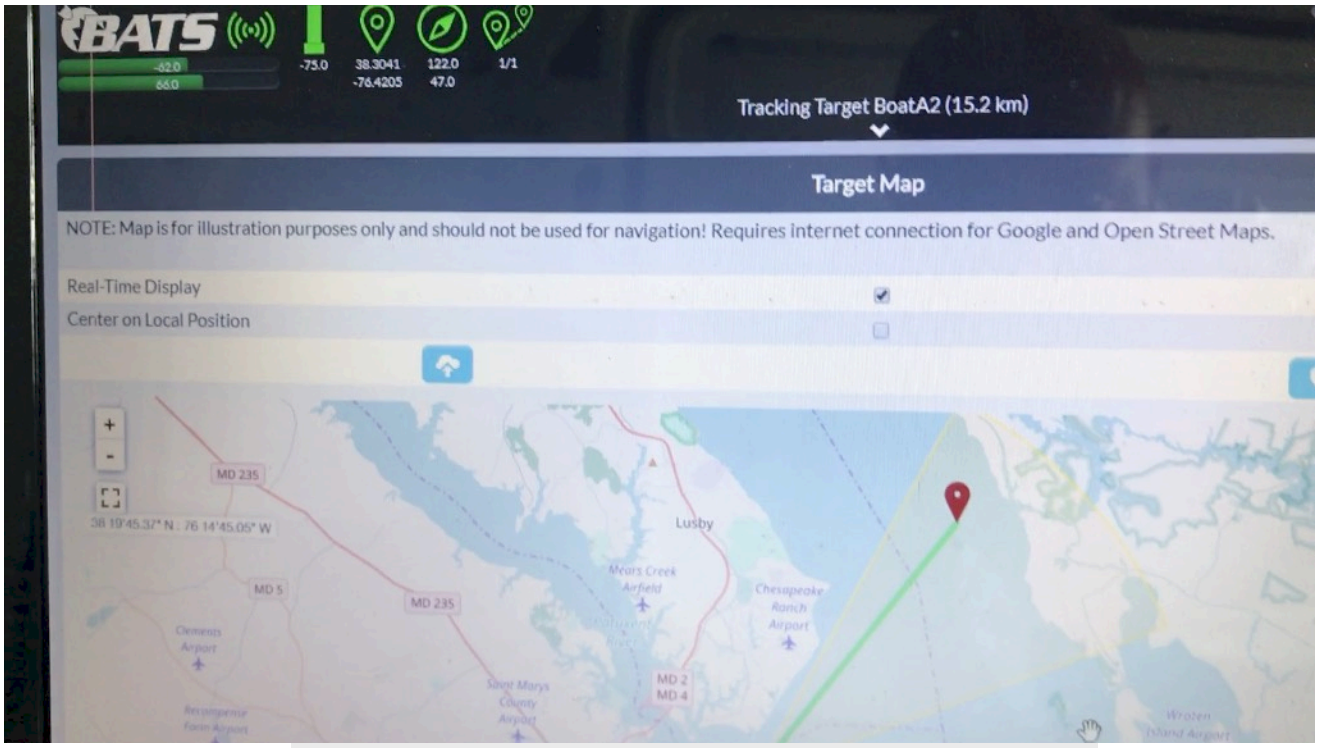
ESA Installed on RHIB

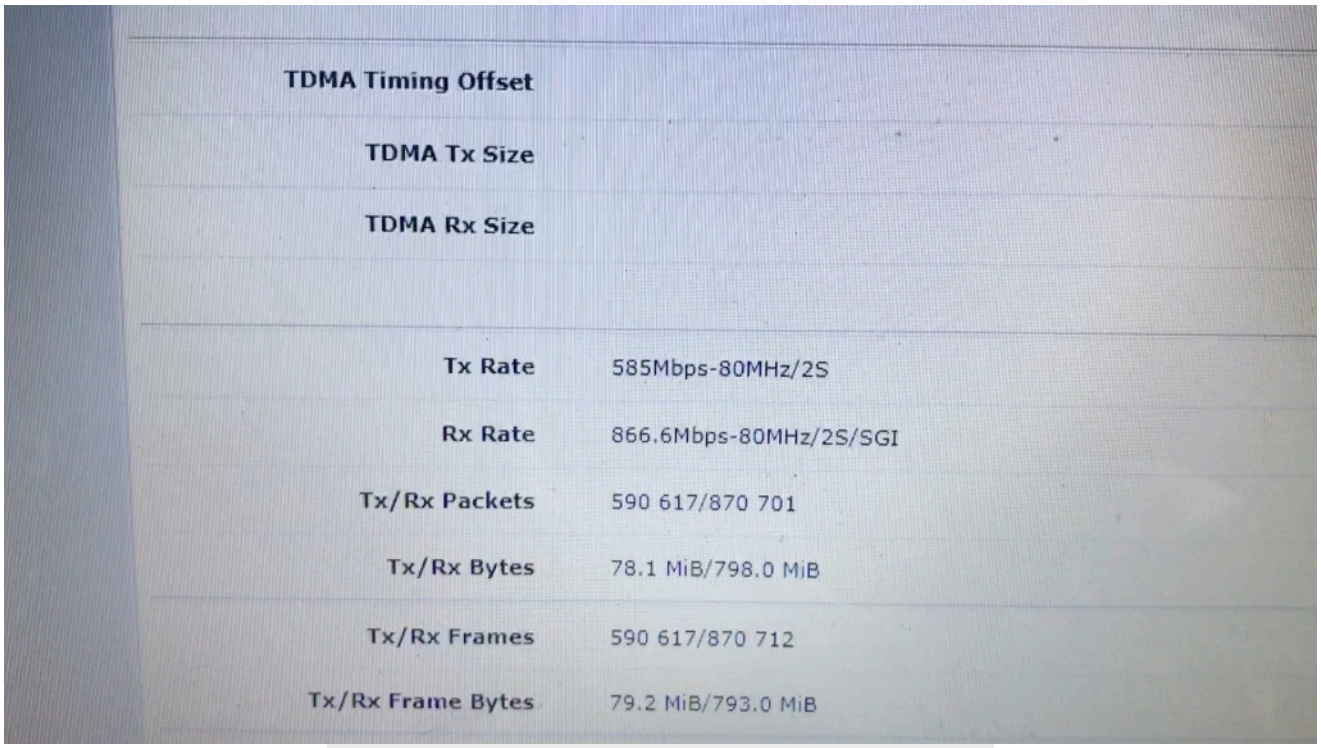
ESA by shore Installed on BATS Van



RHIB boat path profile for test 1 and 2



Longest Link measured at 15.2 Km
(Live Target Map available on every BATS Control Unit)



Radio data channel information at 5 km

Live HD Video feed from RHIB

Traditional Military

BATS open air products have been deployed in traditional military communications for High Capacity Line of Site (HCLOS) communications in domestic and international markets since 2009.

Mobility w/Broadband

The ATS algorithm couple with the ESA enables customers to utilize high capacity in smaller platforms

Ground to Air Tracking

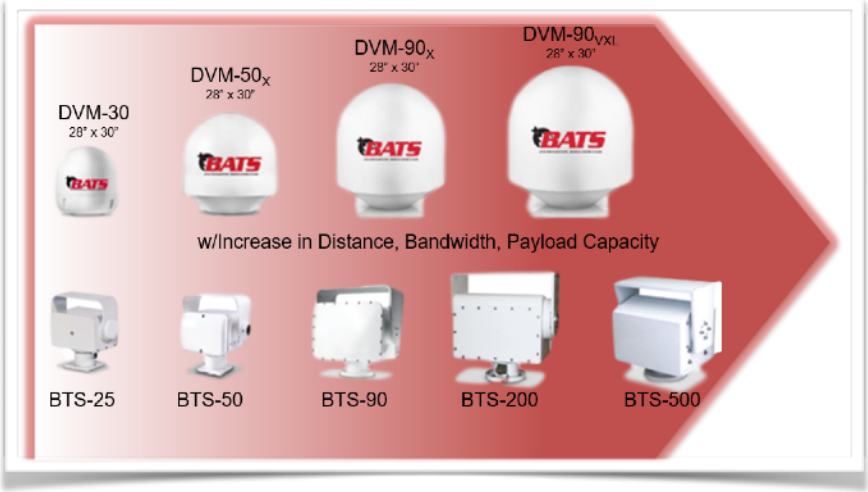
The ATS algorithm enables BATS to offer cost effective ground systems in ground to air applications for UAV's of medium to large systems.

Naval / Cruise / Oil and Gas / Energy

BATS domed products have enable ship to ship and ship to shore communications for International Naval customers as well as global Maritime, Cruise, Oil/Gas, and Energy customers in need of SATCOM cost relief during Line of Site (LOS) communication links.

BATS Product Platforms

BATS has several product lines to meet the needs of any deployment use case and to accommodate any radio and antenna combination from 1 ft. panel antennas to 8 ft. parabolic dish antennas in frequency ranges from 400 MHz to 80 GHz. Even though BATS offers COTS products that can



easily and quickly be ordered, shipped and installed by trained BATS personnel, majority of BATS customers utilize our engineering services to adapt existing products to accommodate gaps in their communication networks. As a result, BATS products have fulfilled needs in various markets spanning from Media and Cruise Line Industries to Military applications for Army, Navy and Air Force deployments. The market reach has grown from fixed tower installations to mobile ground to air tracking systems for Unmanned Aerial

System Designs

BATS wireless continually adapts it's COTS products to create solutions that best meet customer needs. In addition, BATS employs engineers with skillsets necessary for the design of wireless and wired networks, power electronics, SW applications, mechanical systems, and automation of control systems.

Manufacturing

BATS wireless has the capacity and resources to manufacture over 90 percent of the products sold, and also has the ability to manufacture high volume products through contract manufacturing (CM) locally in Indiana.

Vehicles (UAV). BATS has also developed an electronically steered antenna (ESA) for small mobile vehicular or marine platforms. The ESA/ATS is a great solution for rugged mobile applications where manually steered positioning systems would not survive the continuous abuse and vibration profiles.

Company Profile

BATS Wireless is a Small Business (SB) located in Indianapolis IN. BATS' cutting edge, proprietary ATS algorithm is designed to locate, lock and track wireless communication links. The ultimate goal of the algorithm was to **remove the human element** in antenna alignment – automate the process, and BATS has achieved this with the ATS. The algorithm has enabled BATS to develop product platforms that can be configured with any radio or frequency of operation (**radio and frequency agnostic**) to maintain broadband communications links utilizing high gain, narrow beam antennas even while sustaining motion effects from land or sea platforms. The ATS algorithm enables the use of a directional antenna in applications where only omni-directional antennas are traditionally used, such as Comms-On-The-Move (COTM) for terrestrial based Wireless Local Area Networks (WLAN) and Nomadic Wireless Wide Area Networks (WWAN).

BATS is the dominant provider of ruggedized antenna aiming and tracking products for nomadic and mobile applications servicing the military, oil and gas, mining, cruise, ferry and emergency response markets. BATS product offerings include solid-state electronically steered antenna arrays, mechanical antenna alignment, steerable and stabilized antenna platforms, and intelligent network controllers that automate IP data route decisions for mobile communications.