Island Hopping—Feet Dry!

Intelligence, Surveillance, and Reconnaissance Indications and Warning in Austere Environments

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Multi-domain operations is really about thinking through how we penetrate, where we need to penetrate; how we protect what we need to protect inside a contested space; how we persist in that environment for the period of time that we have to remain there.

—Gen David Goldfein
Goldfein's Multi-Domain Vision

With our allies and partners, we will challenge competitors by maneuvering them into unfavorable positions, frustrating their efforts, precluding their options while expanding our own, and forcing them to confront conflict under adverse conditions.

—Gen CQ Brown, Jr.
USAF/PACAF September 2018 Adaptive Basing and Agile Combat Employment Summit

The Donovian Incursion

Driving the GM Defense electric Silverado ZH2 truck onto the ramp of the C-130, SSgt Ron Jackson carefully maneuvered the vehicle to ensure the attached Silent Falcon ceramic composite trailer lined up with the aircraft's fuselage.[1] Concentrating to follow the loadmaster's hand signals, he briefly remembered the last time he did this and accidentally smacked the edge of the cargo bay. "Not going to do that this time," he thought, remembering with a wince both the "choice language" the other plane's loadmaster had used as he "significantly reviewed" the damage to the plane and the ribbing he took from his own Silent Falcon team members. "It was only some paint on the plane, and the trailer's 'clear coat' (MXene electromagnetic interference coating) DOES have titanium in it; so, the trailer wasn't even damaged . . . besides, we were jumping because of incoming Donovian missiles and that insurgent attack on the other side of the airfield anyways."[2] Carefully bringing the truck level and easing the trailer into the aircraft, Jackson brought the vehicle to a halt. Waving to the loadmaster, he went

back out of the plane to get the rest of the team so they could start securing their vehicle.

Remembering back to the Donovian forces' St. Patrick's Day attack on Otso, Jackson wondered, "Had it really only been three months since he'd arrived as part of the Combined Expeditionary Force and three weeks since the 'bumper car'" incident, as the rest of the team called it, as Donovian cruise missiles had started falling?"[3] Nice to see that the composite trailer could keep out more than just dust and bugs and the fragments flying around had not also severed the antenna links! Jackson remembered the news was all about "Donovia can defeat the United States and its allies because they have better robotics" and "their advanced AI and dedicated swarm unmanned aircraft systems (UAS) will most definitely defeat the US as their tech outstrips ours, blah, blah, blah!" Jackson remembered his uncle's response to that, when he told Jackson about the media doing the same thing during the run up to the First Gulf War. "Glad the reporters didn't ask about our vehicle weak spots like they did back then!" Of course, technology lags also plagued US forces after the terror attacks on 9/11.

(US Army photo)

Figure 1. Donovian forces. Soldiers of the 3rd Squadron, 16th US Cavalry Regiment, pose for a photo as opposition Donovian forces, 21 December 2018. Two support platoons from 3rd Squadron, 16th US Cavalry Regiment, have transformed from standard threat emulators into a thinking enemy.

While the United States seemed to turn inward on itself, the emergence of improvised explosive devices in the hands of violent extremist groups and technological advancements from the Mediterranean Sea to Russia and China hampered US technology developments. Or so the press would have people believe, Jackson snorted. Yet the United States was no slouch when it came to innovation. After all, the Silent Falcon and its "combat Tesla" prime mover was the result of a concept that came from the minds of some forward-thinking Airmen more than 12 years ago. Those same Airmen were now USAF senior leaders. Rather than relying on fixed-site Air and Space Operations Centers (AOC), which were vulnerable to missile and cyberattack, the Silent Falcons were designed to spread out across the area of operations. Their mission was to keep aircrews up-to-date with the latest intelligence and indications and warning (I&W) as the battle lines moved forward.

Back to the Beginning

Figure 2. DATE Europe. US Army Training and Doctrine Command Decisive Action Training Environment—Europe Map (ODIN, DATE Europe, https://odin.tradoc.army.mil/.)

The trip from the United States to the forward staging area in Europe was long and tiring. However, the main thought on the team's mind, that there would be

time to sample some German food and, more importantly, the outstanding German beer, became a distant dream for the team as they got closer to touchdown. Donovian cyber and malware attacks, coupled with local area launched UAS swarms to interfere with air traffic management caused chaos at Ramstein Air Base just as the Silent Falcon Team's C-17 was on final approach. Once on the ground, the focus was to shift the team into two subsections. The support section would immediately move to a waiting C-130 Super Hercules to load and head off to establish a site at the Otsoian Air Base. Meanwhile, the analytical team, under SSgt Heather Radcliff, would hook into the AOC to download the most current Donovian-related intelligence products and then head over to their own "Super Herc" to link up with the support section.

"So glad this download will go faster than setting up my playlist before we deployed!" thought Radcliff. Not having to "bin" the products into specific folders and allowing the BAE Systems advanced Geospatial eXploitaiton Products software to do it for her, making all the data instantly searchable, made her wish she could do the same thing with the songs she had downloaded into her smartphone. "Note to self, develop a proposal to do just that!" she thought. As the download completed in record time, despite the "Novians" cyberattack, Radcliff's team's next priority was getting on their waiting C-130 and getting to their Otsoian destination. She could see her team chief, TSgt Nohelani "Spam" Kalawai'a, gesturing to move faster; that meant the Hercules crew wanted to leave now. "So much for getting a jaeger schnitzel and a Hofbrau beer," Radcliff thought.

Once loaded, the analyst team had an advantage over the support team. They could ride inside their trailer as it was pressurized, and this allowed their Hercules to fly at higher altitudes to get to their first location faster. It was the nap-of-the-earth approach in the final leg that never failed to turn at least part of her team's faces green. "Snicker bar?" Radcliff asked SrA Jake Demoss. Demoss shot Radcliff a dirty look and said, "Only if you're cool with my lunch on your shirt!" Laughing, Radcliff donned her augmented reality (AR) headset, took it off power save, and asked the flight crew what the estimated arrival time and conditions were. After receiving the information, she directed her team to be ready to get out of the shelter upon landing and take the tie-downs off the vehicle and trailer. She sent an instant message (IM) to Silent Falcon driver SSgt Jackson to be ready to move once she gave the thumbs up.

As the C-130's wheels hit the ground at the Otsoian Air Base, her team became the professional, well-oiled machine she had trained them to be. Jokes were left aside as the team removed tie-down cables, got back in the trailer, and locked their chairs down for movement as SSgt Jackson drove the Silent Falcon off the plane. Radcliff's AR showed it was dark outside, and having an electric vehicle as

the trailer's prime mover helped get them into place down the flight line fast and quietly. Flight operations queried her headset, and she shifted the call to Demoss, while tasking SrA Dean Roth and newly promoted SSgt Jimmy Garfield to let the Silent Falcon "know" where it was in Otso. Radcliff then brought up the most current disposition of Donovian forces they had downloaded from the Super Hercules' inflight planning software system while en route.

"Demoss, what did flight ops want?" Radcliff asked. "Just sent it to your headset," Demoss noted. Radcliff saw the overview was an incoming flight of four 75th Fighter Squadron F-35s, designated Nova 3 through 6. Their mission was to support a larger attack on key Donovian command-and-control facilities to disable portions of their artificial intelligence (AI) infrastructure. "Airman Roth," Radcliff called out, "get ready to provide an updated situation report on those Donovian combined surface-to-air (SAM)/directed energy (DE) systems to the pilots. They've got about 90 minutes before takeoff to refuel/rearm; so, head over after they land. Garfield, you and Jackson get the external antennas set up, I want to be able to have Roth linked in to whatever is operating near the border and/or over Donovia in the next 30 minutes."

As the clock ticked down to the briefing, SrA Roth finalized his briefing, uploaded it into the trailer's detachable Surface Pro 12 tablet, and removed it from the docking station. Taking off his AR headset, Roth tapped SSgt Radcliff on the shoulder and said "all ready." Radcliff sent a quick IM to TSgt Kalawai'a noting Roth was about to head over to the fighters, "Hey Spam, Roth is on his way to Nova Flight." Kalawai'a responded, "Roger, ensure he takes his weapon; there's been reports of Donovian insurgents operating in the area, and I don't want to get folks shot just after getting here." Radcliff acknowledged the update and reminded Roth to take his weapon. "On your way out, have Garfield give me an update on setting up the . . . wait, disregard, the line-of-sight (LOS) feed just came up. Good luck with your brief."

SSgt Garfield came back in and began linking in with the U-2 that was conducting a stand-off surveillance mission to see if there was anything he needed to send over to Roth prior to his briefing. "SSgt Radcliff! Looks like we've got a hit on that Donovian Corruptor SAM/DE system. They've moved west into Otso and are setting up about 15 kilometers in!" "Roger," said Radcliff, "send Roth an update and remember to ensure the auto-encrypt is working." "Copy all," said Garfield. Just as SSgt Radcliff noted to send the Corruptor message, there was a knock at the shelter door. SSgt Radcliff got up, and TSgt Kalawai'a was standing there asking if anyone was hungry. Radcliff had completely forgotten about the possibility of food after departing Germany due to all the pre-mission tactics,

techniques, and procedures she had to accomplish and noted yes, chow would be a good thing.

Just as Radcliff completed the order for food for her team, another request for support came over the AR headset—this time for the 933 Weapons Squadron (WS). They were getting ready to conduct a convoy with missiles, rockets, and 30-mm rounds forward to rearm a flight of upgraded A-10Xs supporting Army troops attacking to displace Donovian forces from Otso. "Radcliff, new support message for the 933 WS coming your way. See if Roth is done and send the latest on Route Condor to his tablet, and then have him get it to them." "WILCO," said Garfield.

Just as Roth arrived at the 933rd, SSgt Radcliff came running up and nearly beat the incoming warning message "CRUISE MISSILES INBOUND," noting, "Hey, there are people shooting at folks around flight ops!" SSgt Radcliff notified TSgt Kalawai'a she was initiating tear down and prepping to move, noted the ground and air attacks, and directed Jackson to oversee tearing down the antennas and stowing them. "I'll retract the collapsible antennas," she said. At the same time, she sent a note to Roth to "touch transfer" the Route Condor information to the 933 WS Intelligence Section's tablet and to get back to the Silent Falcon along with watching out for insurgents. She also instructed Demoss to contact flight ops with their request for aircraft and that they were displacing.

Just as most of the equipment was stowed, Roth came running up yelling, "Hey, I think there's an attack going on over by flight ops!" Radcliff hurriedly said, "Got it; let's finish up, and I'll see if our planes are ready or if we need to 'blend' with the other containers and ride this out. Stand by to either disconnect the truck and hide it or be ready to get on a plane—I'll let you know directly." Before Radcliff could get on the flight ops link, the door flew open and Spam Kalawai'a threw in some MREs and said, "I got you a plane, we'll follow with the support team directly . . . get Jackson moving! The plane is wheels down in two minutes, and I need you ready to drive straight on; head over to the taxiway!"

Jackson called back on the truck to trailer intercom, noting, "Our plane just landed, hang on!" and the trailer lurched forward, dropping the MREs and items of equipment that had not yet been stowed onto the floor. A few minutes later there was a loud "bang!" as the trailer hit the airframe of the plane. As the first detonation of incoming cruise missiles occurred, Jackson saw the angry face of the loadmaster, backed up, and pulled in. "He can chew me out when we're airborne!" Jackson yelled.

View from Today

The above scenario is one that could quite possibly occur in the near future. As near-peer nations have been updating their combat systems across all the land, sea, air, space, and cyber domains, they seek to outmaneuver the United States. Realizing advancements over the last decade in the commercial sector have made many countries think they are unbeatable means the United States must think beyond just the technology. Innovation and initiative have always been welcomed in the US military; yet, as the twenty-first century moves into its third decade, the technological and operational advantages the United States has enjoyed have slowly eroded. Near-peer and transnational adversaries study how the United States has waged war and how they can take advantage of areas America is not focusing on; specifically, finding the seams where the United States is weakest and exploiting those seams. These adversaries are utilizing unconstrained budgets and rapid commercial technological advancements to equip their forces to achieve overmatch with the United States.

This has resulted in nation-states like Russia and China reaping the benefits of advanced technological developments. It also means transnational violent extremist organizations are using the initiative to purchase and modify technology not designed for combat and integrating these technologies into their tactics. The rapid advancements and investments made by potential, and current, adversaries' development and integration of disruptive technologies require the United States to be more creative on how to counter these advancements. Adversaries are focusing on how robotics and autonomous systems, bio-science, quantum information sciences, space-based weapons and communications, and nanotechnology and DE weapons can be used against the United States. Further, they are exploiting the advantage of not integrating ethical restrictions the United States follows. From the US perspective, initiatives focusing on innovation (technology and nonmaterial solutions), rapid prototyping and testing must rely, in parallel, on the initiatives of the younger Soldiers, Sailors, Marines, and Airmen, as well as innovators in academia, industry, and laboratories.

What's the Problem & Solution?

This article is a consolidated effort to identify a developmental, rapid prototype way ahead related to conducting intelligence, surveillance, and reconnaissance (ISR) I&W fusion in a contested, degraded, operationally limited (CDO) environment—"ISR Node" for short. The ISR Node would fall under the Air Force Chief of Staff's concept of *adaptive basing*. The goal of the ISR Node effort is to enable continued support to deployed USAF tactical war fighter, logistical, and

other organizations as a "forward-based, rapidly displaceable" capability.[4] Figure 2 depicts how USAF planners develop future operating concepts like adaptive basing to enable operational effects of three strategic documents for regional based airpower—the Office of the Secretary of Defense's Third Offset Strategy, USAF Strategic Master Plan, and Air Force Future Operating Concept looking to the anticipated 2035 environment.
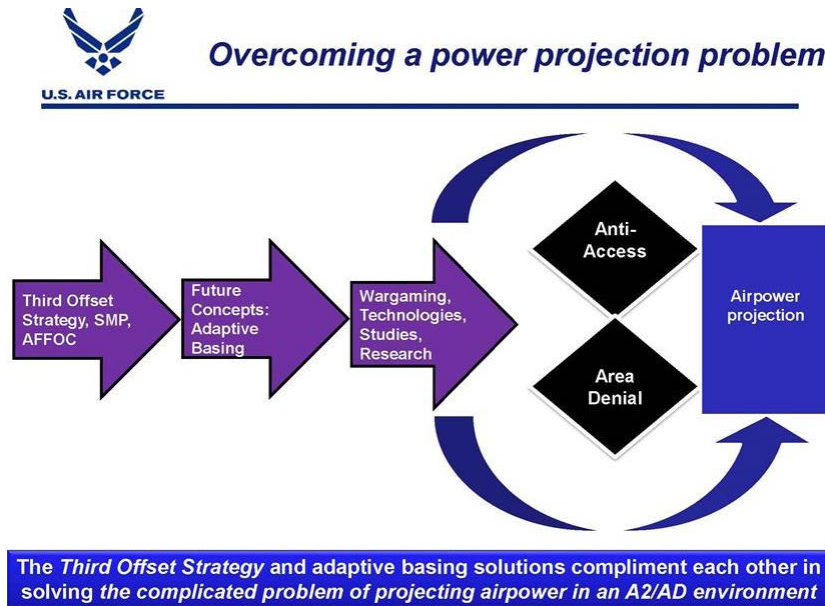

Figure 3. Projecting airpower to overcoming the antiaccess/area denial (A2/AD) problem. (Maj David Dammeier, Lt Col Meka Toliver, and Capt Logan Smith, "Overcoming a Power Projection Problem," *Civil Engineering Online*, Spring 2016, https://www.afcec. af.mil/.)

The ISR Node will move fast and conduct I&W using stored intelligence products. Once deployed in large numbers across the area of operations, these products would conduct "catcher's mitt" LOS information "pulls" from air and space ISR platforms. This aspect provides an updatable attribute, as stored products "go stale" for tactical use after several days. The ISR Node will also have the capability to execute on-site analysis of information pulled in via LOS. This supports USAF, and later coalition and Joint element, units who arrive and depart on what could be a daily basis at austere sites as the conflict occurs. This supports units operating in multiple locations with having "the

latest information" to execute their missions. It also allows the conduct of "audibles" to modify operations to survive and fight another day.

Way Ahead Aspects

As the ISR Node development and testing effort continues, how to test things that are not fully developed or fielded becomes the quandary. The answer is to use current and recently emerged technology, software, and processes as the "in lieu of" for developmental technology. This allows for testing of what will be available in 5–10 years now, enabling USAF to receive the advanced capabilities with validated concepts of operation in place. Such an approach enables a rapid prototyping effort and concept validation at a much faster pace. This takes into account that technology will advance and ideas and efforts only now emerging will be robust and usable by the middle of the next decade.

There were several efforts and fielded systems that the 526 Intelligence Squadron's Technology, Test and Integration (TTI) Flight reviewed as they moved forward with the concept of the ISR Node effort. One of the primary source links was with the US Army's Distributed Common Ground System-Army Support Activity (DSA). Discussions and a visit to the DSA to see the Army's Tactical Intelligence Ground System (TGS) provided a wealth of information of existing, fielded capabilities, emerging ideas, and concepts using newer technology. TTI Flight also realized not to overlook training on whatever system was ultimately devised to fit the ISR Node. Continuous, cross-service interaction between the Army and the Marine Corps provided an expanded knowledge base, while opening the TTI Flight's understanding of supporting subsystem and software aspects that could be incorporated into the effort.

Using a literature review and incorporating information identified from attending service symposiums and visiting commercial production facilities benefited TTI Flight for review of emerging ISR Node support system technology that could be tested in concept. These subsystems, making up the larger weapon system itself, included antennas, tactical cloud storage, prime mover vehicles, shelters and power generation, and austere location communications efforts. Visits to commercial vendors to discuss shelter design, antennas and data link integration, analytical hardware and software capabilities all with an emerging 5-10-years capability focus occurred. All the visits ended with an invitation to come to Nellis AFB, Nevada, and conduct demonstrations, which vendors accepted.

Literature reviews also identified other USAF efforts to test concepts similar to ISR Nod. This provided the benefit of not expending limited resources and funds to redo past test efforts. Instead, the flight could take lessons learned from the other test efforts, interview participants, and apply what was learned to the flight's test plan development. An example of this approach is quantified in several articles on an effort conducted by the 263 Combat Communications Squadron (CCS) in Antarctica in late 2018. As part of Operation Deep Freeze, the 263 CCS's effort focused on a proof of concept to install and validate temporary, isolated satellite communications to increase the network data rate at the South Pole.[5]

To increase technology's capabilities and how it can be used requires innovation. Identifying how to fit emerging technology into the mission construct can be viewed as limiting; however, there has to be a starting point. The TTI Flight effort to develop a way to propagate ISR I&W at tactical, austere locations in CDO environments while quickly reestablishing links to bring the conflict to a faster conclusion is paramount. "Island hopping" with multiple ISR Nodes placed forward, constantly updating the mobile, adaptive force to restrict enemy capabilities while being rapidly redeployable is a way to challenge the system. "Baking in" capabilities via innovation and rapid prototyping will enable faster integration of newer technology to support not just the war fighter but all of the integrated warfighting functions as well.

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Notes

1. Yasmin Tadjdeh, "Army Driving Forward with Electric Vehicle Plans," *National Defense Magazine*, 21 February 19, http://www.nationaldefensemagazine.org/. The Silent Falcon is a fictitious name created for this article; no such capability currently exists in USAF.

2. André Taylor, "Film Blocks Electromagnetic Interference," *Tech Briefs Magazine*, 1 Feb 19, https://www.techbriefs.com/. MXene is a carbon nanotube, titanium carbide semitransparent film.

3. The fictional countries of Donovia and Otso are used in US Army training events, manuals, and articles. These countries are part of larger operational environments (OE) broken out by region, including Africa, the Caucasus, Europe, and the Pacific. Developed by Army Training and Doctrine Command (TRADOC), these countries are included in the Decisive Action Training Environment (DATE) Knowledge Base hosted on the OE Data Integration Network (ODIN), https://odin.tradoc.army.mil/DATE.

4. Adaptive basing is a USAF concept that looks to provide new ways to deploy and maneuver assets during a crisis or conflict in order to operate in contested, degraded, and operationally limited environments.

5. TSgt Nathan Clark, "Operation Deep Freeze," 145th Airlift Wing Public Affairs, 12 January 2019, https://www.hill.af.mil/; and Oriana Pawlyk, "As Russia, China Encroach, Airmen Work to Expand Comms Network in Antarctica," *Military.com*, 22 January 19, https://www.military.com/.