# A Next Generation C5ISR CJADC2 Air/Ground System

An Existing Integrated Worldwide Air/Ground Next Generation Data Fabric based CJADC2 C5ISR System that provides U.S./NATO interoperability. It integrates data from Radars, Satellite ELINT, and data from 30 different types of Sensors and provides up and down the Chain of Command Data, Voice and Video Exchange. Furthermore, it can operate in a distributed manner to reduce the effect of RF targeting and can operate on the Move.

It is Available with Source Code to preclude Supplier Lock-in.

AGIS' LifeRing Software uses a Single Integrated Data Layer for Up and Down the Chain of Command Communications
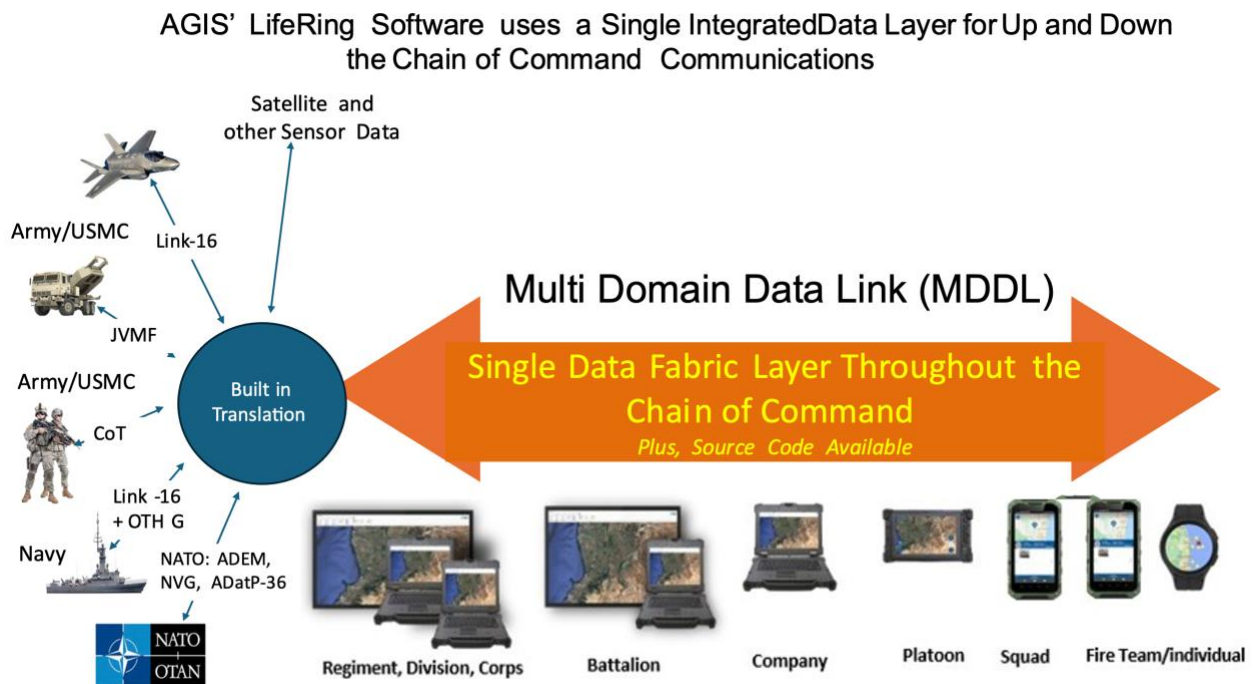
Advanced Ground Information Systems, Inc., 92 Lighthouse Dr., Jupiter, FL 33469, 561 744 3213, www.agisinc.com Cap Beyer, CEO, beyerm@agisinc.com 561 744 3213

A Data Fabric Integrated CJADC2 Air/Ground C5ISR System

Advanced Ground Information Systems, Inc. (AGIS) has been under contract for the past 16 years with the U.S. Joint Chiefs J6 Lab. In concert with the Lab, we have developed a Next Generation CJADC3 C5ISR Air/Ground system.

To provide this capability AGIS uses an integrated Data Fabric layer. Our Data Fabric provides the basis for our Multi Domain Data Link (MDDL) communications which enables integrated Command and Control information exchange from the highest level of an organization down to the individual soldier, sailor, or airman. Approximately every 6 months the software is upgraded to the most recent programming techniques and enhanced with additional capabilities.

Because of the J6 Lab's varying requirements, we developed the software using a modular approach (similar to MOSA) as if it were a bunch of Legos which can be rapidly assembled to meet varying requirements. This enables us to create operable subsets of the software in a matter of a couple of days. This has resulted in a CJADC2 C5ISR Worldwide system that operates from the Corps Command Center down to the individual Soldier/Marine. The software (LifeRing) operates in real-time at all levels of Command from a 400 console Command Center down to a data link encrypted Biometric Smartwatch and is capable of mobile operations at every level.

Here are a few key features of AGIS' LifeRing MDDL software many of which are unique:

1. Uses a Common Data Fabric up and down the Chain of Command - no data is lost.

2. Can be configured to act as either: 1. a Ground C5ISR System, or 2. an Air C5ISR system, or 3. a Combined Air/Ground C5ISR System.

3. Provides Source code availability that precludes supplier lock-in.

4. Produces a Common Operational Picture (COP) with between U.S. Services CJADC2 and NATO C5ISR Systems by receiving Link 16, JVMF, OTH Gold, CoT, NATO data links translating data to MDDL and then retranslating and retransmitting the data to the interfacing C5ISR System. Furthermore, it can operate in a distributed mode and on the move.

5. Processes data from over 25 different types of Sensors (Commercial and Military Satellites, Radars, ELINT, Ground Seismic, Sonic, Magnetic, etc.) and enables all to be part of the COP.

6. Provides automatic tracking of Radar, IFF, ELINT and other sensors.

7. Automatic Sensor translation to tactical data links i.e. ELINT, ADS-B and AIS to Link 16.

8. Has a built-in, Zoom-like capability that we call Tactically Encrypted Videoconferencing (TEV) that does not require the Internet and can use USG communications and encryption.

9. Records all data and video (including voice) for analysis.

10. Enables playback of recorded data and video for training and operational effectiveness analysis.

11. Provides a built-in but separate datalink simulation system for operator training.

12. Provides satellite tracking of U.S. and other Nations' satellites and automatic computation of Satellite overpass times.

13. Enables Touch of the other person's map symbol to make Calls and Video Calls.

14. Incorporates built-in video training for each Operator function.

15. Provides the ability to view and access data by the Chain of Command. This ability to view and access data by the Chain of Command is a feature that is almost essential when there are 1000s of symbols on the display. You need to be able to view and access data by Organization, i.e. 1st Division, 2nd Regiment, 4th Battalion, etc. AGIS' LifeRing provides this capability.

16. Provides the individual Soldier/Marine the COP on a Watch including UAV locations and processes the wearer's Biometric data.

17. Provides Automatic Server failover to another Cloud Server or to an on-premises server.

18. Enables the Server to compute the available bandwidth of the recipient. The Server then automatically adjusts the message traffic to be the most pertinent for the recipient.

19. Provides Software controls in any language, most used in English and Spanish.

20. Operates on the move and Interfaces with ATAK.

21. Evaluation Copies of the whole system or subsets are available to U.S. Military and Agencies at no cost.

Figures 1 and 2 provide a pictorial representation of these capabilities:
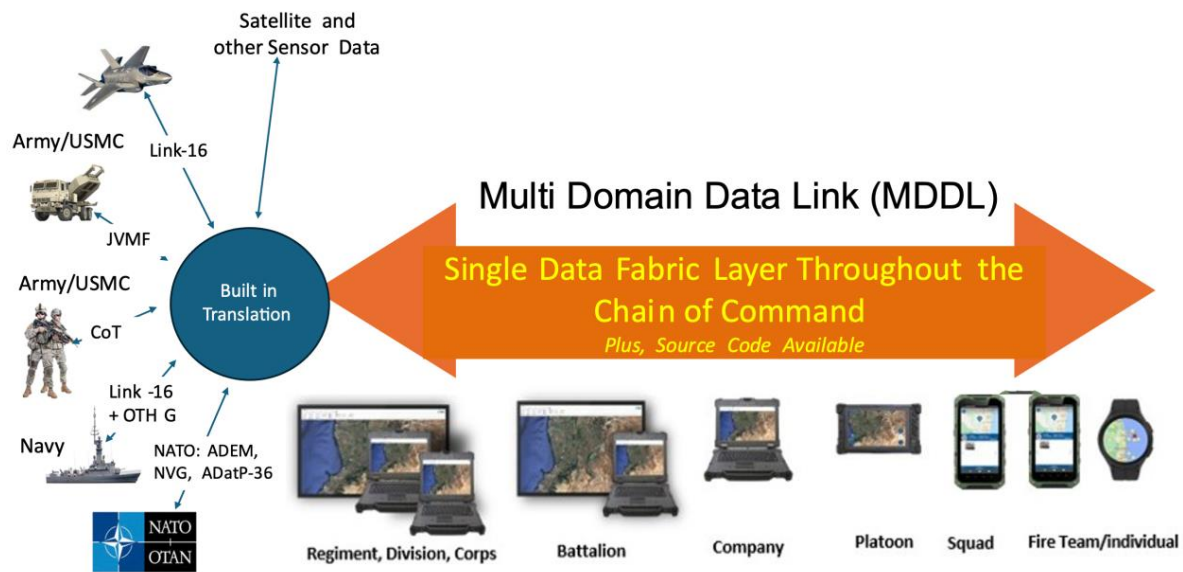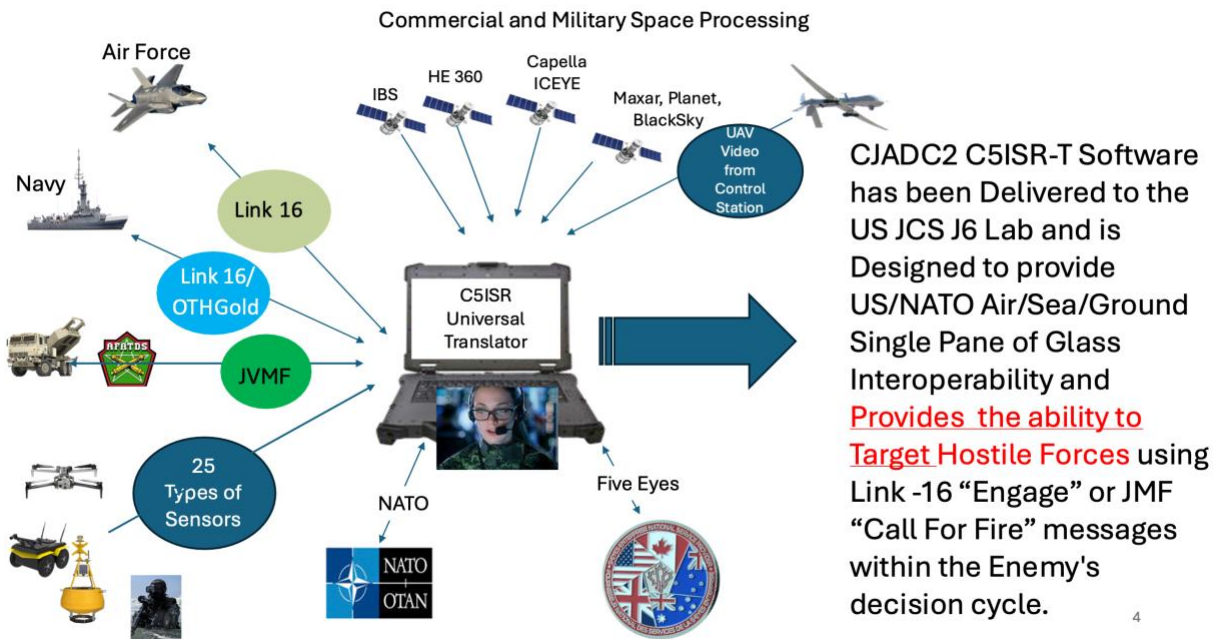

Figure 1

Figure 2

Top Level Operational use description

Ground Command and Control

A version of AGIS' C5ISR software system was enhanced under a U.S. Army contract to provide Ukraine a Command and Control (C2) system for their Ground Forces. After extensive testing by the U.S. Army, the C2 system was provided to their General Staff Headquarters in Kyiv, where the U.S. Ambassador to Ukraine turned the C2 System over to Ukraine's General Staff. We have been in contact with them throughout the war and have incorporated many of their suggestions. At their request, we added built-in video training associated with each operator function which is now standard with our software. We have also added two separate operational modes: 1. Playback of an Exercise or an actual Operational event and 2. A Simulation Mode which, when not in actual Tactical Operations, enables some of the system operators to act as a separate C5ISR system transmitting tactical data links to the system to train the system's console operators.

Air Command and Control

As a subcontractor, we enhanced our software to enable the simultaneous tracking of five U.S. Government ARSR-4 radars for the Shaw Air Force Base in South Carolina. Their associated Poinsett Electronic Combat Range system has been in use for years and provides training for the Air Force, Army, Marine Corps, and National Guard units for practicing bombing runs, strafing, and other combat scenarios with inert munitions. Our software receives ARSR-4 radar CD-2 plots and automatically eliminates weather, mountains, and sea clutter associated with them and then applies an algorithm to create air tracks with speed and heading. The software then determines if the air track data from the aircraft can be correlated with the air track from the other radars based

on speed, heading and altitude. The ARSR-4's Identification Friend or Foe (IFF) information is used as part of the correlation process and is fused with the appropriate air track. The console operator views the track's heading, speed and altitude when he "hooks" the air track's display symbol. AGIS's software has also been used to track AN/TPS 117, Furuno, and other radars.

AGIS' CJADC2 Software –
Configurable as a Ground C5ISR System or as an Air C5ISR System .

Delivered a 400 Console C5ISR System to the US Army for a Foreign Country

Delivered a System that simultaneously tracks and displays 5 long Range Radars for a fighter Training range

Figure 3

Hostile Forces Targeting

AGIS' CJADC2 System uses various Sensor data to Target Hostile Ground, Sea and Air Targets.

Ground Targeting

At the request of the JCS J6 Lab, AGIS enhanced our LifeRing CJADC2 C5ISR software system to enable Forward Observers (FOs) to transmit "Call For" Fire commands to AFATDS for a test at White Sands, NM. AGIS integrated a Vectronix PLRF 25C pocket-sized laser rangefinder with our Smartphone software through a Bluetooth interface. The FO then pointed the rangefinder at the target and pressed a button on it which caused the Target's location to be sent to our Server which sent the data to our PC display which directed the Call for Fire Command to be sent to AFATDS which sent the Command to MLRS which simulated firing at a group of Tanks. The MLRS firing data was then sent back to AFATDS which sent it to the LifeRing Server which then Broadcast the impact locations to all on the LifeRing network. The test was a resounding success.

Figure 4

Air Targeting

To verify that AGIS Life Ring CJADC2 C5ISR software can develop potential targets based on Commercial Satellite HE 360 ELINT information and transmit these targets on Link 16, the JCS J6 Lab injected the ELINT information into an AGIS Server, which then used our Data Fabric software to automatically convert the ELINT data into Link 16 reports which are shown here on the JCS Labs' test system proving that the LifeRing software can use Radar and Satellite data to provide Targeting information to Link 16. Others use our Link 16 software to send the location of Hostile and Friendly aircraft received from Ground radars to Link 16 aircraft. Recently, we have enhanced our Link 16 processing to enable operators to send Intercept Commands to selected Link 16 aircraft to engage designated Hostile Ground units, Ships and Aircraft.
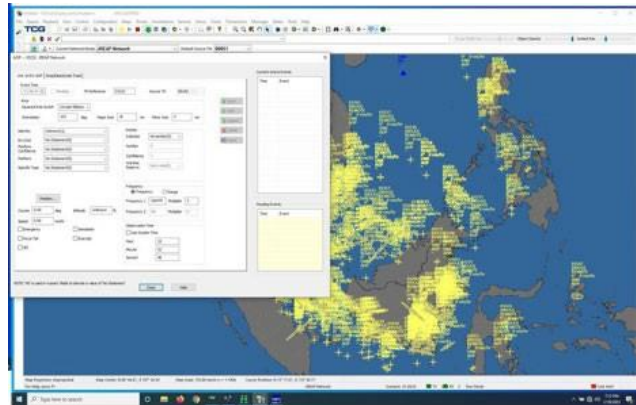

Figure 5

Operates up and down the Chain of Command

AGIS' CJADC2 C5ISR system operates on the devices appropriate to each Command Level.

Figure 6

Each of the above devices use AGIS' MDDL communications between each other. Software defined Groups enable a complete COP to be displayed and interacted with in a manner that is appropriate to their command level. The Ap runs on PCs, Smartphones and the Samsung Smartwatch. AGIS' interoperable MDDL Web client works on (Windows, macOS, Linux, Android, iOS, etc).

6

Counter UAV Processing

The war in Ukraine has made it evident that our forces need to be protected against hostile UAVs. AGIS' Laptop Windows computer software along with Echodyne Radars and the FLIR video cameras, enable AGIS to display the radar's UAV track locations and FLIR camera video. When the operator "hooks" the UAV symbol, it causes a Slew-to-Cue command to the camera to orient itself to that exact point and capture video of that UAV. Our Counter-Unmanned Aerial Vehicle (C-UAV) system also processes McQ Ranger UAV acoustic sensors and data from CACI's BEAM which uses its wide-bandwidth software-defined radio to scan the environment for the signals that are associated with UAVs and then selectively disable them.
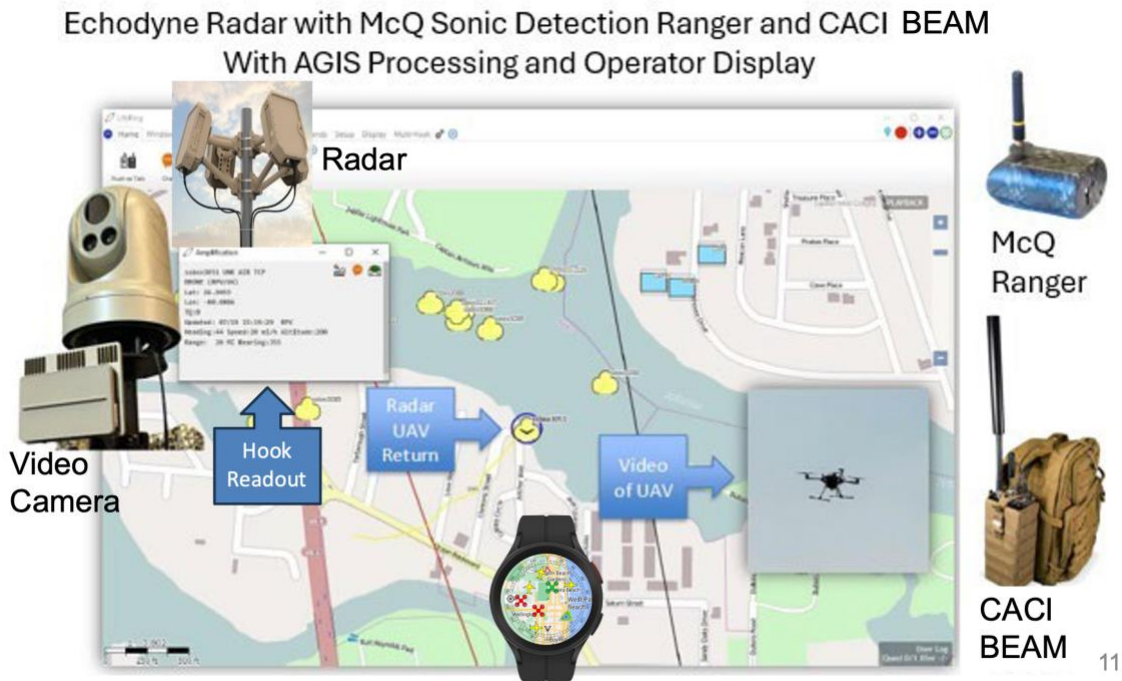

Figure 7

The MCQ Ranger is placed ahead of the radar range and provides sonic detection of the UAV so that the radar operator is aware that one is about to be detected. The CACI BEAM provides RF detection of the presence of the UAV and the line of bearing to the UAV, by using two or more BEAM devices that are connected on an integrated Mesh Network the location of the UAV is determined. This BEAM data is available at longer ranges than the radar and is displayed. When the BEAM return is in range of the radar the information is available for correlation.

Smartwatch Enables UAV Location data and the Soldier/Marine to be part of the COP

It is now evident that all personnel in battle need to be aware of the presence of hostile Unmanned Aerial Vehicles (UAVs) and the possibility of their being RF targeted when using radios. Therefore, the wearer communications equipment needs to be provided with a form of communication that both addresses the need to know when UAVs are in the area and provides a communications means that significantly reduces the probability of being RF targeted. The high level of artillery, UAV and missile attack is also

dictating dispersion of personnel. At the same time, personnel need to know the locations of their dispersed unit members and be able to coordinate their activities.

The weight and limitation of chest-mounted Smartphone Command and Control is a hinderance and requires the user to stop standup and flip down the chest-mounted Smartphone to view the COP. Furthermore, the Smartphones and their associate batteries, headsets and cables both restrict and add weight to an already overburdened Solider/Marine. All this is not required if a Smartwatch is used to display the data. While a Smartphone may be appropriate for the Platoon leader or even the Squad leader, it probably is not appropriate for the Fire Team Leader or the Fire Teams members who need to fight and maneuver a wrist watch avoids these issues.

FEATURES

- Small, light and extremely portable
- Uses very little battery
- Inexpensive and easy to distribute to all personnel
- Constant Health Monitoring data available to others
- Built in GPS
- Integrated Bezel Compass
- Map of your area adjusts as you move
- Declare yourself in an emergency and see other users Emergency Locations
- Friendly and Hostile Ground and Ship locations
- Friendly and Hostile Aircraft and UAV locations
- Sensor reports including AIS and ADS-B
- Push-to-Talk to Others on the Network
- Receive Chat messages
- Receive Worldwide Alert Notification
- Receive Must Respond to Commands

**Weight 0.1025 pounds including battery.**   Figure 8

To address this issue AGIS has developed software that utilizes a communications-enabled Smartwatch that provides much of the capabilities of the Smartphone. The COP and other data is available by simply looking at your wrist. The AGIS LifeRing enabled Smartwatch can also take Biometric health readings of the wearer and notify the Command if the wearer is wounded. The Biometric COP Smartwatch (BCS) receives and transmits MDDL communications and can selectively display the Air, Ground, Sea, Space COP on a map and, most importantly, the locations of friendly and hostile units, UAVs and aircraft near them. Additionally, the BCS supports Voice PTT, Chat and Emergency declarations with others on network and transmits the wearers' location and biometric data to others when they are wounded. The BCS software selectively displays the map, an integrated compass that is visible around the watch's bezel. The BCS transmits its biometric data to the AGIS Server, which forwards the data to AGIS PCs, Smartphones, and other BCSs. AGIS' BCS works on a worldwide basis, if the Command Center sends an alert, the AGIS enhanced Smartwatch wearer who is anywhere in the world will automatically receive it. In the future this will include providing alerting and the location of Hostile and Friendly UAVs, UGVs, Missile Attack warning, CBRN attack, etc. information. Smartwatches with Command and Control data, voice and the local COP software will be the key to future Command and Control for Soldiers / Marines at the tip of Spear. They will be required to wear them.

## Satellite locations and the ability to view Imagery and ELINT from them
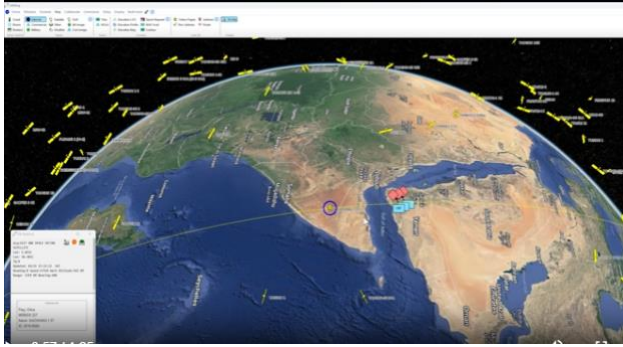
AGIS provides for the viewing of real-time satellite locations by country. System users know when hostile satellites will be passing over ships and ground positions. This early warning enables friendly units to take precautions to avoid detection.

AGIS also provides the ability to display and transmit satellite optical imagery data from Maxar, Planet Labs, and BlackSky satellite constellations and SAR imagery from Capella and ICEYE.
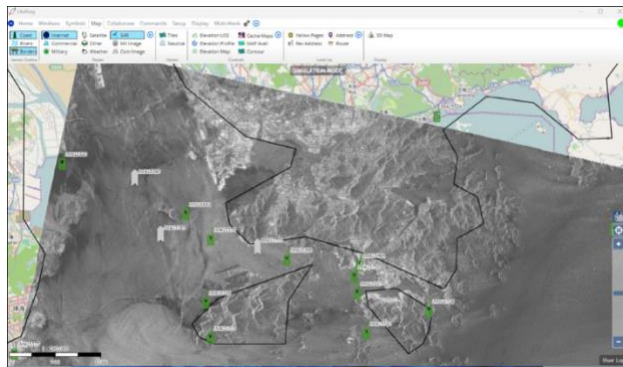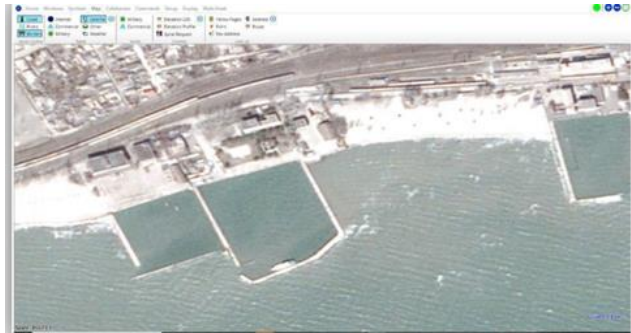

AGIS integrates Commercial Satellite ELINT data from HawkEye 360 with other types of satellite and Terrestrial intelligence data and superimposes it on the COP. See the adjacent combination Capella SAR, and HawkEye 360 ELINT, AIS and the superimposed on a Maxar map.

The C5ISR operator can selectively use the Groups function to selectively transmit the Imagery, SAR and ELINT data to others on the AGIS network and designate ELINT, AIS and ADS B to be translated and transmitted on Link 16 and other data links. The Groups function is also used to segregate data according to classification level and command levels.
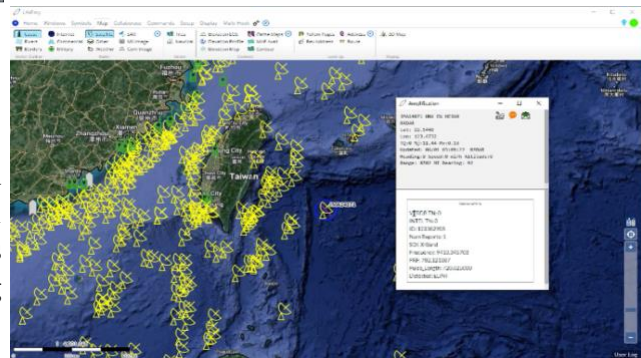
All this information is converted to the MDDL Data Fabric at and is available up and down the Chain of Command. Typically, the data would be assigned to a Group that is accessible by users that need this information. Since the AGIS Next Generation C5ISR system is designed for worldwide operations including Combatant Commands, location in addition to need to know can vary.

Massive Compacity
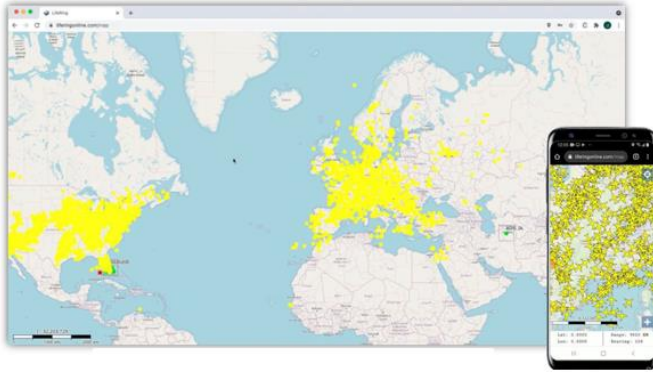
The amount of Intelligence data from satellites, Intelligence aircraft and UAVs is growing at an almost exponential rate. AGIS' CJADC2 C5ISR System can be configured to process 10,000+ Sensor reports from separate Intelligence feeds and 400 individual interfacing PC, Smartphone and Smartwatch users. AGIS' ability to accommodate loads exceeds the capacity exceeds that of almost all C5ISR systems and of Link 16. AGIS therefore provides controls to limit the amount of data being sent to the interfacing C5ISR systems. The large capacity permits us to simultaneously process data from multiple combat commands, i.e. CENTCOM AND INDOPACOM and act as a means to transfer data between them.

Ability to Coordinate and Manage Planning and Operations

Use of a Satellite GPS Tag to Track Enroute Logistics

As part of the military Operations Planning process, while the available supplies are generally known, it is essential to know the supplies that will shortly become available, and AGIS accommodates this need by enabling the Operator to view the location of the enroute supplies for his unit. There are many criteria that go into a military plan. Once the plan has been agreed upon AGIS enables the plan to be integrated into our C5ISR system in the following manner.

In this example of AGIS' Planning function, assistance, the AGIS C5ISR Operator views the Hostile forces, and the location of the opposing U.S. forces. He shares a view with a Planning Group he has established. The Operator can also start a TEV meeting (see next page) so all in the Planning Group can participate in the Plan's refinement.
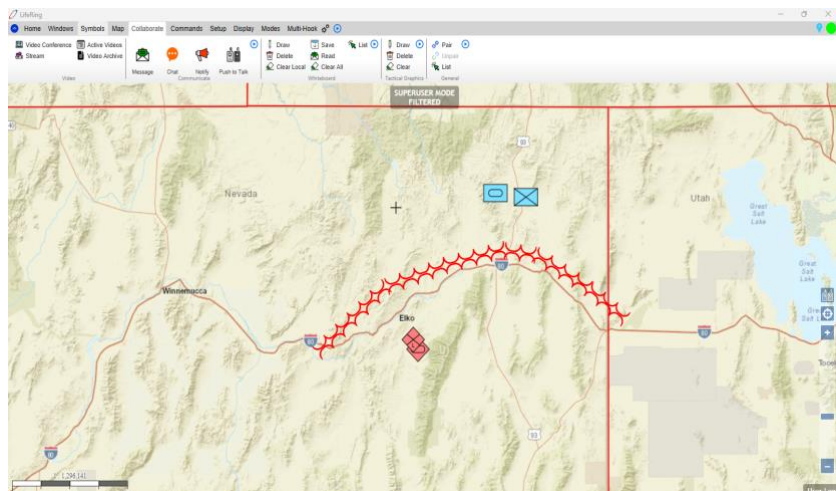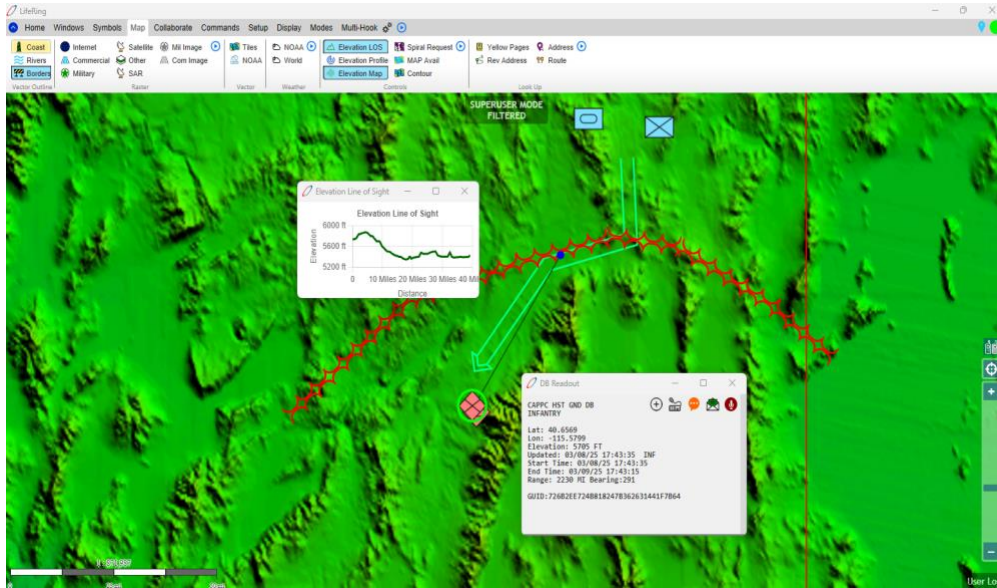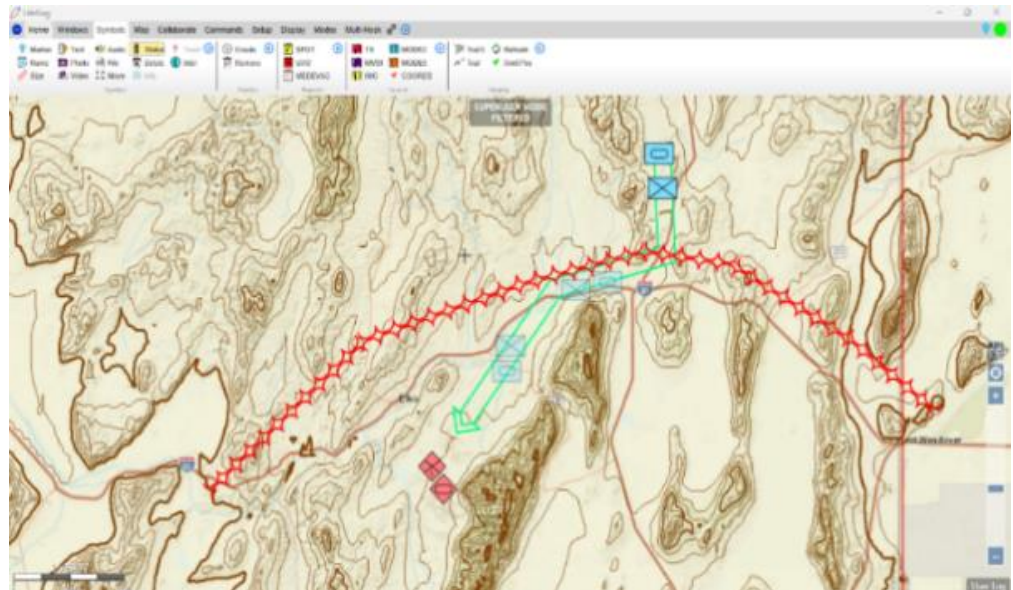
The Operator then uses the C5ISR systems' capability to automatically generate contour lines and 3D presentations of the area to determine an attack route that minimizes the hostile force's ability to view the planned attack route (note that the hostile Infantry's location blocks his viewing the planned attack.


The Operator can use a contour map and enter the locations of Friendly Infantry and Tank units along the Axis of Advance and the time they will be at that location. These symbols are displayed translucently and will appear solid at the time they are to be at the specified location. The attacking Infantry and Tank symbols turn solid at the appropriate times, and their previous location disappears at the same time enabling the Operator to see the progression of the planned attack. The Attack Plan can later be used to compare against actual Operations. Note that AGIS will enhance the planning images and symbols with a green diamond around them or use another user preferences so that it is immediately evident as to which symbols are the Plan and which are actual real during Operations.

TEV - Tactical Encrypted Videoconferencing

AGIS' Tactical Encrypted Videoconferencing (TEV) secure app is a groundbreaking secure videoconferencing software application designed specifically to work with U.S. and other countries' Military Command and Control Systems. It does not require using the Internet but rather can use tactical encrypted radios and military on site computers. TEV provides internal AES 256 bit encryption of the data and voice internally and, when used with military communications, is Type 1 encrypted. TEV enables remote commanders to view Planning and ongoing Operational Data appearing on each other's displays and to jointly develop plans and discuss the occurring tactical situation.
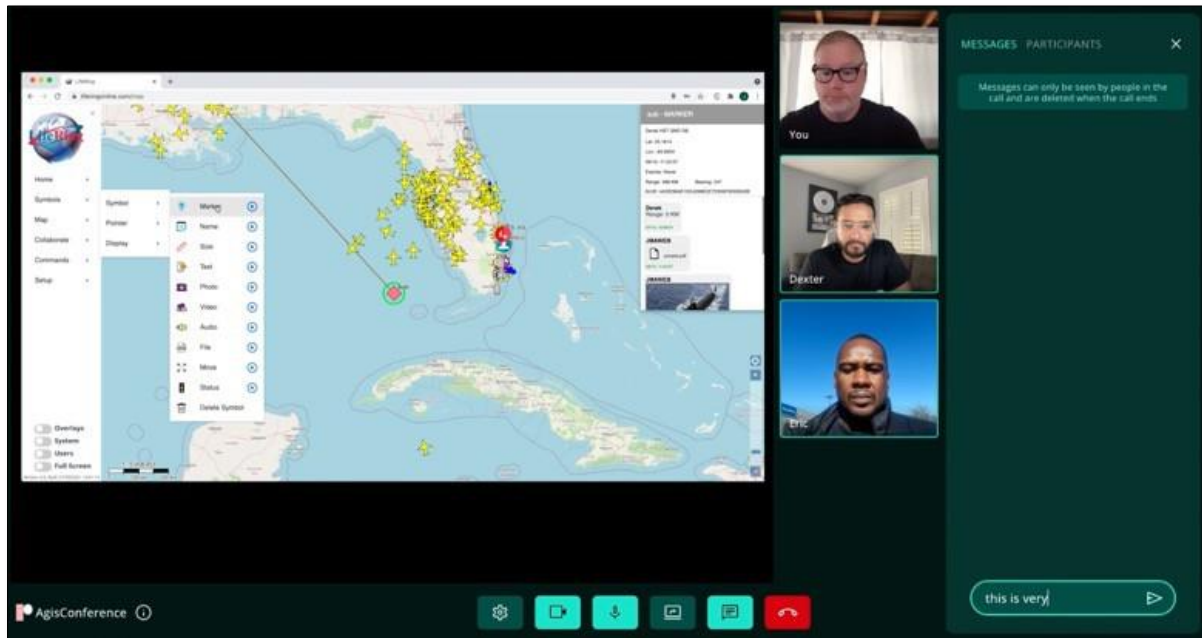
The TEV Scheduler and Calendar functionality are similar to commercial products and allow users to efficiently plan and organize video meetings and appointments. The Scheduler and Calendar features work together to streamline the process of planning and managing video conferences. Users can easily schedule meetings, invite participants, and keep track of scheduled video meetings within existing calendar systems. The Calendar feature syncs with the user's existing calendar system, such as Google Calendar or Microsoft Outlook. This integration ensures that scheduled video conferences are automatically added to the user's calendar, along with any relevant details and reminders. Users can view their upcoming video meetings alongside their other appointments and events, providing a comprehensive overview of their schedule.

AGIS' Transport Layer

To provide assured communications, AGIS utilizes various means including Cloud WAN Solutions' (CWS) Communications transport layer software to manage and optimize network performance by enabling data to simultaneously flow across multiple network paths, such as Tactical Radios, Broadband internet, LTE, 5G Cellular and Starlink satellite to ensure high performance and reliability. As this is occurring, AGIS' software monitors the data rates and

automatically adjusts the data flow to the data links when they are nearing capacity and providing automatic AGIS server fail-over if communications to the Server are lost. This combined system was most recently proven when used at Silent Swarm2024 in Alpena, MI and at Flex24 at Key West, FL to provide interoperability between the USNS Burlington and MARTAC high speed boats. The data was sent to ATAK which then sent it to the U.S. Navy's Minotaur system, showing once again how AGIS repeatedly is able to move data across multiple domains seamlessly.

AGIS' Zero Trust

AGIS uses XQ Zero Trust to meet Zero Trust NIST 800-171 advanced encryption, routing and data management compliance requirements. Since AGIS internally AES 256 bit encrypts all data, when using XQ Zero Trust all Data, PTT and Video are protected by double encryption. Furthermore, when using military radios, the data is further NSA Type 1 encrypted.

Disposable Low-Cost Mesh Radio
What is needed is a small low-cost radio (less than $100.00) that can be used at the Fire Team level that blend into the background noise when in urban environments and use such low power that make them difficult to target and are designed to deceive the enemy as to the true location of U.S. Forces when left behind.

AGIS' Implementation of this will be discussed when we have completed this task.

How to obtain AGIS's LifeRing Software
AGIS' Business model is to provide various combinations of our software from a firm, fixed price, price list. When ordered, we assemble the requested software configuration that was ordered and subject it to test first by engineering and then by personnel who were not involved in the development of the software. The software is then provided to the customer along with How to Use training videos associated with the software which also has built-in training videos for each operator function. The customer can also pay us to provide onsite training. For the first year, we guarantee to fix any reproduceable problem at no cost. We also offer the purchaser the option to receive any software enhancements that we developed during the first year after the purchase of the license. The software is also available under the GSA which permits it to be purchased at a fixed price by issuance of a purchase order without competition.