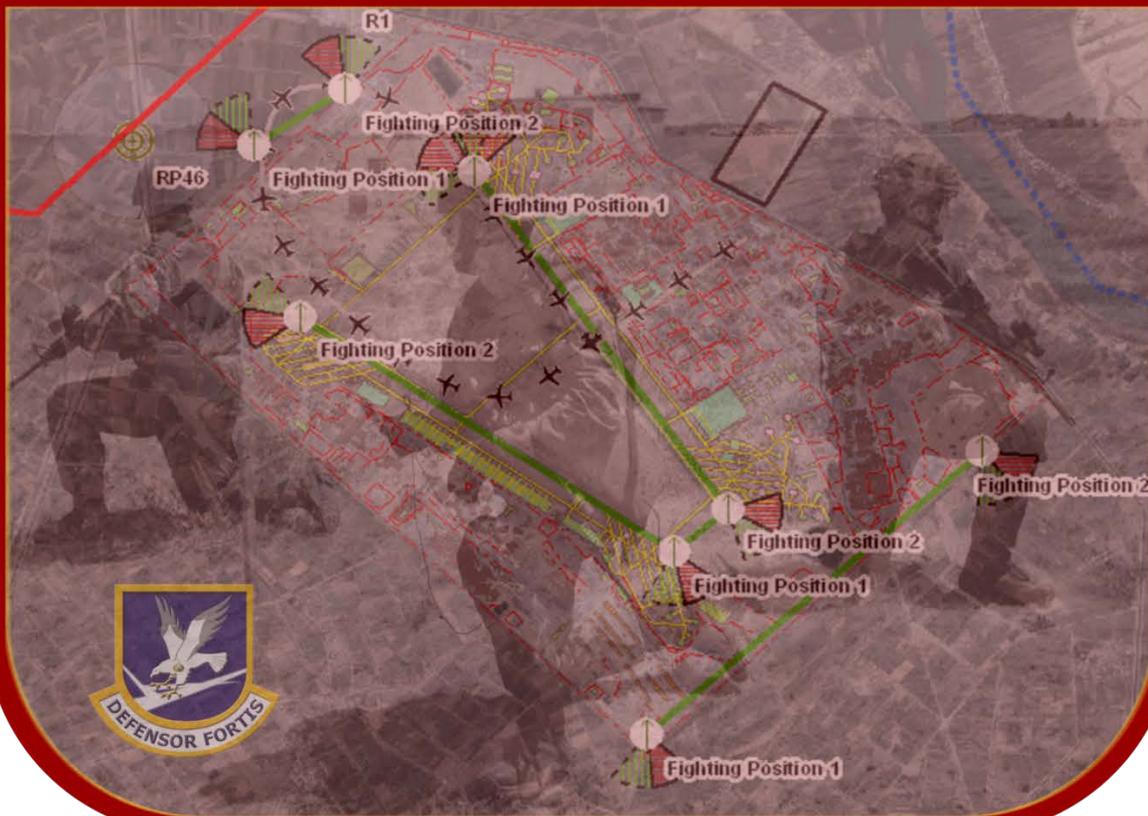


Defensor Fortis: The Next Generation of Air Base Defense



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WHAT IS DEFENSOR FORTIS?

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As the United States and the rest of the World marches further into the 21st century so must the United States Military with continuous upgrades in military hardware and software that provide both offensive and defense capabilities. The United States Air Force (USAF) operates over one hundred stateside (CONUS) and over 75 (OCONUS) bases that require constant defense and protection. In this new age of terrorism and external threats, the USAF must remain ever vigilant in the protection and defense of these military air bases.

As part of air base protection, the USAF currently uses *Defensor Fortis*, which provides Security Forces planners a set of Anti-Terrorism and Force Protection (AT/FP) tools designed to meet the needs of Air Base Defense (ABD), Law Enforcement, and Headquarters personnel who must be aware of trends and potential conflicts in incident management, planning and analysis, and tactical management. Much has changed since Defensor Fortis was developed in 2007, and as the World and technology progresses, so must Defensor Fortis.

AIR BASE DEFENSE PLANNING TOOLS

Defensor Fortis was designed to give Security Forces personnel the ability to plan and analyze required aspects of base defense and installation security plans using appropriate military standards.

There are several tools provided to assist Security Force planners in working with military installation maps, assigning staff personnel, determining Fire Team positions, and building air base defense plans; and evaluating options based on the ABD plan. Many of these tools provide the ability to render and visualize ABD plans in 3D allowing planners to look at the ABD plan from different viewpoints in order to assess the surroundings and gain better situational awareness. The 3D environment in Defensor Fortis provides this by allowing the planner to rotate and move freely, 360° within the 3D space. In addition, virtual fly-through animations can be created that will allow planners to fly/walk throughout the ABD plan from different perspectives, including the surrounding areas, and achieve a better understanding of the ABD plan.

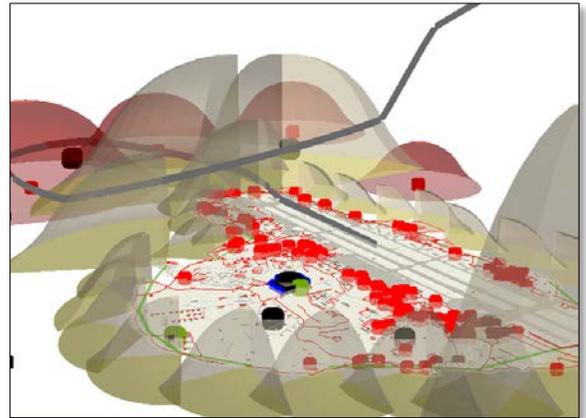
- **Staffing Profile** – Provides hierarchy of staffing assignments used to assign personnel, based on Unit Type Codes (UTC), to strategic defensive positions on the map.
- **Range Cards** – Range cards establish primary and secondary sectors of fire for an individual weapon assigned to a fighting position. Primarily for a tripod mounted M-60 machine gun with a

Defensor Fortis provides existing tools for planning and establishing air base defense

3D visualizations that realistically simulate air base defense planning

traversing and elevation mechanism, but can be used for any weapon. Range Cards also provide a snapshot of weapon information and can identify user defined obstacles or additional information affecting sectors of fire.

- **Surface-to-Air Missile (SAM) Footprint** – Provides analysis based on appropriate SIAP profile, key terrain, contour layers, and the anticipated enemy munitions to determine an outline of the SAM vulnerability area of the airfield runway (commonly referred to as the “Dog Bone”).
- **Threat Weapons Footprint** – Provides perimeter and/or boundary protection of the air base, based on threats from enemy weapons and SAM positions, and can be visualized, including display of 3D threat domes showing the vertical elevation capabilities of enemy weapons.



- **Standard Instrument Approach Procedure (SIAP)** – Provides planners the ability to implement various aircraft approach and departure plates on the ABD plan. Approach or departure paths are determined by aircraft type and flight path templates. Flight paths based on SIAP templates can be accurately shown in 3D fly-through animations. Proper defense against SAM positions is critical in ensuring aircraft safety during approach and departure from the airfield and planners are able to model different SIAP profiles in conjunction with enemy threat envelopes.
- **Feature Palette** – Provides the capability to digitize common air base defense features (e.g. barriers, obstructions, transportation, areas of influence / interest, etc.) associated with ABD planning.
- **Pack-n-Go** – Provides users with options to store a project for media distribution, archiving, or operating in a disconnected environment (i.e. no network connectivity).

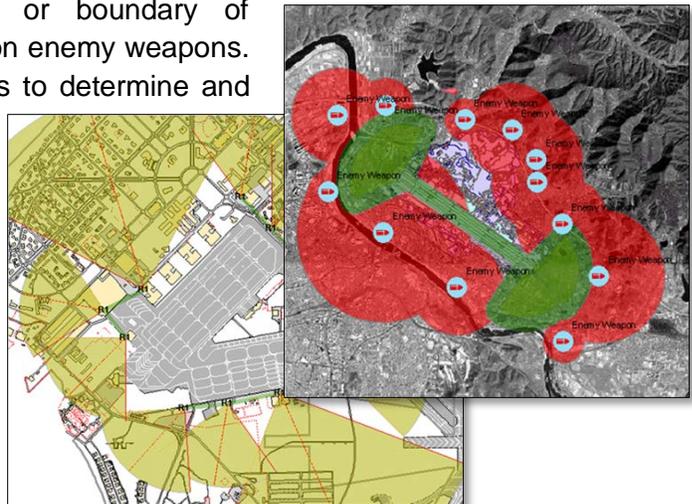
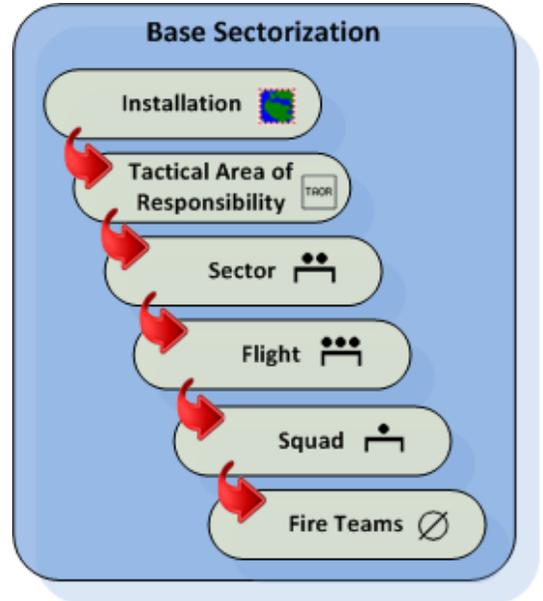
ESTABLISHING AREAS OF DEFENSE

Base Sectorization determines what area of the installation is to be defended and provides a method for dividing the base into clearly defined boundaries. Base Sectorization also defines and groups the areas where ABD forces are responsible and allows coordinated decentralized execution.

Each level of this hierarchy has unique requirements for defense, and all the levels can be integrated to provide a total ABD plan. Defensor Fortis provides this ability by allowing planners to spatially place fighting positions (depicting *firing fans*) and generate associated range cards, which help coordinate fire and maneuvers, and provide visual representations of key terrain, restricted areas, weapons, and critical resources.

By combining threat assessment information, terrain characteristics, personnel location and assigned weapons; planners can establish a Threat Weapons Footprint that defines an overall perimeter or boundary of protection based on enemy weapons. The overall goal is to determine and monitor areas of responsibility, and conduct counter-terrorism and ABD operations against any threat from enemy locations outside the base.

Defensor Fortis is not necessarily intended to provide Command and Control (C2) capability, but rather as a planning, simulation and analysis tool providing the Defense Force Commander (DFC) a means to maintain situational awareness of the Tactical Area of Responsibility (TAOR).



Planning, simulation, and analysis tools for situational awareness

FUTURE OF DEFENSOR FORTIS

Leveraging the latest technologies and Geographic Information System (GIS) frameworks

The existing version of Defensor Fortis was developed as an ESRI ArcMap (v9.x) extension in 2007. Newer versions of ArcGIS have been released since then, and as a consequence, Defensor Fortis no longer functions properly on the latest releases. Because of this, Defensor Fortis will need to be re-engineered to take advantage of today's technologies and architectures.

CHOOSING THE RIGHT PLATFORM: ESRI OR AUTODESK

By taking the required steps now to choose a platform and upgrade Defensor Fortis, Security Forces will be in a strong position to leverage the latest GIS platforms and technologies. In addition, newer technologies are now available to support the ever expanding demands for data sharing, collaboration, and visualization that will provide Defensor Fortis with additional advantages for ABD planning.

Today, there is a choice of platforms to support the re-engineering of Defensor Fortis (i.e. ESRI or Autodesk), each providing its own set of advantages and key benefits.

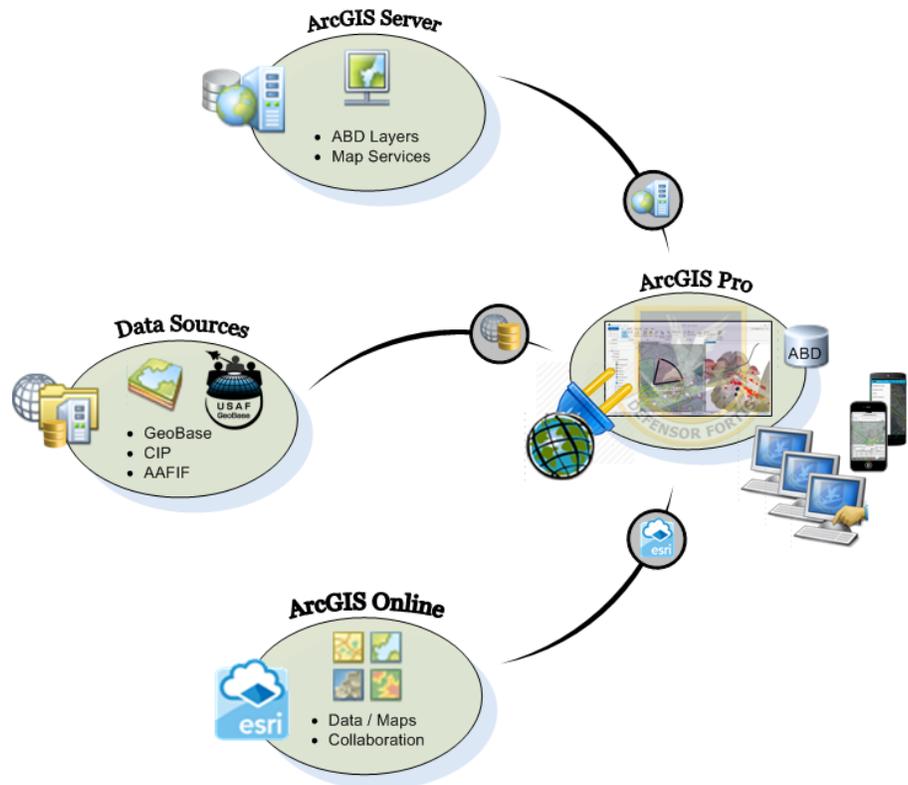
ARCGIS PLATFORM

Choosing the right platform for the right reasons

The USAF has continued the upgrade cycle on ArcGIS and version 10.x is now standard on most USAF systems. Defensor Fortis will need to be re-engineered to support this version which will provide many benefits including the ability to use the newly released ArcGIS Pro platform. The major benefit for re-developing Defensor Fortis for ArcGIS Pro would be to take advantage of the project workflows, faster speed (including map rendering engine), multiple layouts, and the ability to visualize Defensor Fortis geospatial data in 3D *within the application*. An additional benefit would be the ability to leverage and reuse some of the existing code base (ArcObjects), and migrate it to the latest ArcGIS API, *ArcGIS Runtime SDK for .NET*. This unified API provides a common framework for integration and functionality on desktop and mobile (Windows Phone) devices. It would also allow Defensor Fortis to use a common framework, thereby reducing development time and cost.

ArcGIS Pro Platform

- *Improved Performance*
- *2D & 3D Visualization*
- *Plug-In Architecture*



Benefits of using ArcGIS Pro:

- Project-based workflows for ABD plans
- Multiple plan layout support for ABD plans
- Combined 2D and 3D visualization within the same User Interface (UI)
- Interoperability/data exchange with ArcGIS Server and/or ArcGIS Online
- 64-bit, multithreaded support for faster performance

Public and/or private “Cloud” capabilities for collaboration and data sharing

ArcGIS Pro comes as part of ArcGIS 10.3 for Desktop so there are no additional costs or licensing requirements. It also provides tight integration with ArcGIS Online, allowing data sharing and collaboration in the “Cloud”. Rendering of 3D environments and ABD plans would be available within the Defensor Fortis application itself, without the requirement for extra software or extensions (i.e. ArcScene).

AUTODESK PLATFORM

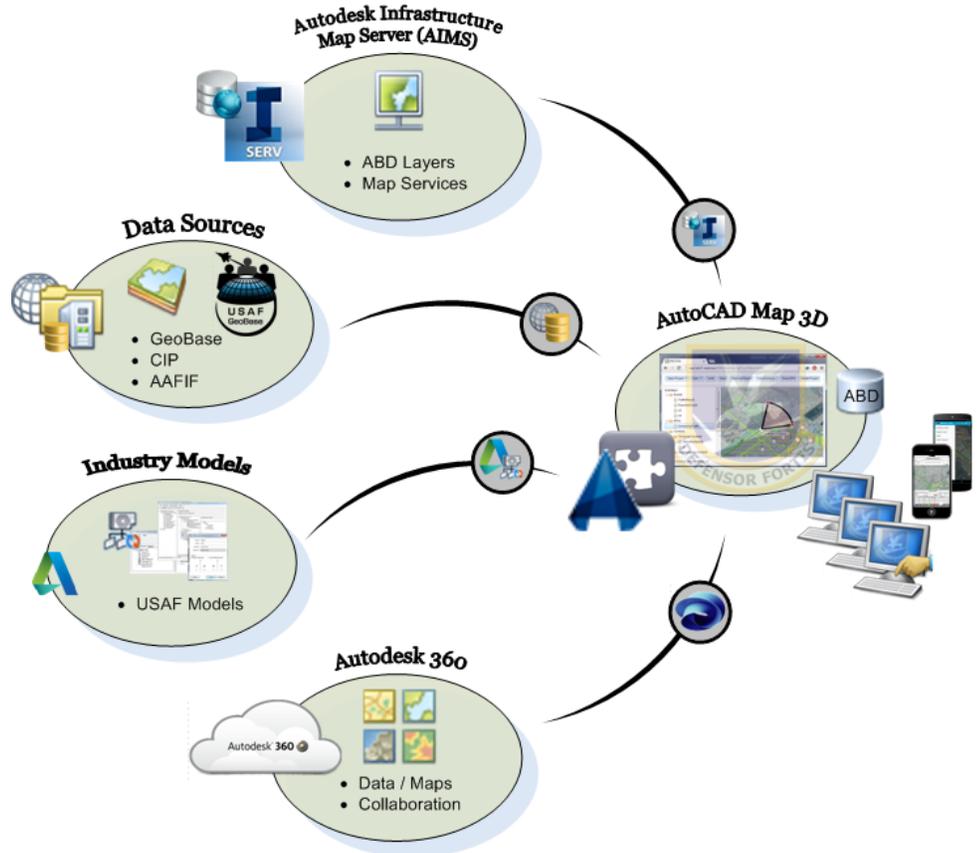
The major benefit for re-developing Defensor Fortis for the Autodesk platform would be to provide for better alignment with the approved USAF software portfolio. It would also allow for data integration with the Autodesk Industry Models, developed to provide a standard industry model for sharing data between Air Force software applications, such as

the Geospatial Expeditionary Planning Tool (GeoExPT). The industry model design allows for spatial database management, workflows, and feature rules. These capabilities, along with the ability to apply DoD standards and requirements within the industry model, will benefit planners and the Defensor Fortis user. The use of Industry Model standards further facilitates integration with other USAF applications that can work directly with these industry models.

- AutoCAD Map 3D Platform**
- Precision Drafting Tools
 - Integrated 2D & 3D
 - Industry Models
 - Geospatial Platform
 - Plug-In Architecture

Data integration with Autodesk Industry Models developed for sharing data between USAF applications

AutoCAD Map 3D software could be customized for Defensor Fortis based on the Autodesk APIs that would best support integration with other USAF applications. Also, using the Autodesk platform will help reduce cost as the AutoCAD Map 3D and Autodesk Infrastructure Map Server (AIMS) share a common API.



Benefits of using AutoCAD Map 3D

- Autodesk Industry Models for data integration (e.g. GeoExPT)
- Direct access to CAD files
- Intelligent Models for 3D model-based processes

- Interoperability/data exchange with Autodesk 360
- 64-bit support for faster performance

In addition, the use of AutoCAD Map 3D on the Autodesk platform would provide industry standard GIS capabilities for analyzing and visualizing data, including in the 3D environment.

ADDITIONAL FUTURE CAPABILITIES

The re-engineering of Defensor Fortis will provide the same geospatial capabilities and ABD planning as the original Defensor Fortis. Plus, there are additional resources available now such as ArcGIS Online and Autodesk 360, for data sharing and collaboration that were not available when Defensor Fortis was developed back in 2007.

DATA SHARING AND COLLABORATION

Both ArcGIS and Autodesk support data sharing and collaboration through a variety of methods, including the “Cloud”; public or private. By leveraging these capabilities, planners using Defensor Fortis could provide real-time data updates that are critical for situational awareness and air base defense.

It's all about the data:

Sharing and Collaborating

ARC GIS

ArcGIS Server – Defensor Fortis can be designed to consume USAF GeoBase map services hosted on ArcGIS Server, as well as other geospatial servers, to display Common Installation Picture (CIP) vector datasets and raster imagery layers.

ArcGIS Online – Defensor Fortis would be able to publish both 2D and 3D ABD content, making it available to other planners using ArcGIS Online (or for security reasons, using a USAF server portal).

AUTODESK

Autodesk Infrastructure Map Server (AIMS) – Defensor Fortis can be designed to publish and share CAD, Common Installation Picture (CIP) vector datasets, and raster imagery layers via AIMS hosted on a USAF network.

Autodesk 360 – Defensor Fortis can be designed to directly access Autodesk 360, allowing upload and sharing of ABD content with other Security Force planners.

SINGLE-USER vs. MULTI-USER

Defensor Fortis was designed as a single-user application, but with the ability to consume data from multiple data sources such as a shared network drive. It was never intended to support multi-user capabilities (i.e. multiple planners accessing the same ABD plan), either as a client or through accessing a shared common enterprise database. Because of this, planners have had difficulty when transferring and consolidating data from multiple ABD plans. In addition, Defensor Fortis was never intended to access web services or GIS map services hosted on ArcGIS Server or the Autodesk Infrastructure Map Server.

Multi-user and web-enabled capabilities for sharing air base defense plans

Developing Defensor Fortis to support multi-user and web-enabled capabilities would provide for centralized sharing of Defensor Fortis ABD plans within an enterprise database (e.g. SQL Server, Oracle). This would allow Security Forces and Base Defense Operations Centers (BDOC) to maintain situational awareness within the TAOR. Data sharing at the MAJCOM level would also allow Security Forces to conduct deployment planning, as well as track and characterize threats, by analyzing reports from individual installations and looking for possible trends.

DEFENSOR FORTIS MOBILE EDITION

Defensor Fortis is a traditional desktop application that provides a rich user interface allowing users to interact with the tools and map on a standard desktop computer system. As technologies and capabilities increase, and as Security Forces become more 'mobile' in working with systems and data, it would be ideal to apply selected 'cutting-edge' technologies currently available to a mobile version, *Defensor Fortis Mobile Edition*.

Defensor Fortis Mobile Edition will promote collaboration, improve safety, and increase situational awareness

Over the years, Dynamic Software Solutions staff worked closely with the USAF to develop the earlier version of Defensor Fortis. With DS2's additional experience in Mission Planning and Army Special Forces operations, Defensor Fortis Mobile Edition could be developed similar to the Army's Nett Warrior system, which runs on devices with an NSA-approved version of the Android operating system. By using commercially available mobile devices, Defensor Fortis Mobile Edition would be powered by the latest technology and processors, and will remain at the forefront of technology for Security Force planners.

Currently, Security Force planners gather the best available vector and raster data for an air base installation and build a 2D map. This map is then used to determine the best locations for fire team placement for base defense. With a mobile version of Defensor Fortis, fire teams could

view and provide input for range cards and positions in the field. The ability to visualize and perform light-weight editing tasks while in the field will provide an advantage in ABD planning.

RANGE CARDS AND FIRING FANS

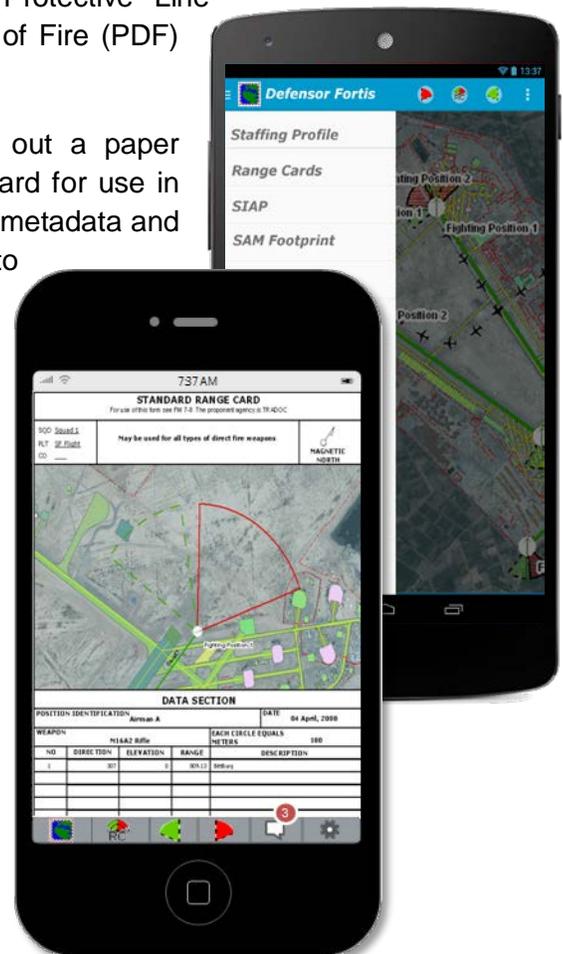
Planners and fire teams in the field could use Augmented Reality (AR) capabilities on their mobile devices to "see" fire team placements in the field and to view potential obstacles and line-of-sight scenarios, such as sniper fire. This could also provide a virtual walk-through of the environment to identify any potential conflicts or issues before establishing either a Final Protective Line (FPL) or a Primary Direction of Fire (PDF) based on range card input.

Firing Teams currently print out a paper based version of the range card for use in the field, but lose most of the metadata and planning factors that went into developing it within Defensor Fortis. Also, once in the field, adjustments and annotations are made to the range card but this information is rarely updated back in Defensor Fortis. This paper-based process for range cards quickly leads to errors and outdated information.

Paper-based processes for Range Cards in the field are inefficient and error-prone

REAL-TIME TEAM TRACKING AND LOCATION AWARENESS

BDOC and DFC need to monitor and maintain situational awareness of the TAOR by tracking the physical location of firing teams, via mobile device, on the air base. Real-time tracking information and firing team movements can be shared and displayed on maps within the desktop versions of Defensor Fortis. At the same time, firing teams in the field can view the same movements on the mobile map and can provide assistance to other teams in the vicinity, based on their current location.



INFORMATION SHARING

Sharing information amongst firing teams enhances collaboration and allows firing teams to coordinate efforts when required. Defensor Fortis Mobile Edition can provide built-in chat and Bluetooth data exchange capabilities, so that firing teams can better communicate by sending messages and sharing data between devices.

SAFETY ALERTS

Safety is always a big concern and Defensor Fortis Mobile Edition can provide real-time warnings from the BDOC as well as other firing teams. In addition, Defensor Fortis Mobile Edition can provide geotriggers to provide location-based alerts when firing teams cross buffers (i.e. firing fans thresholds, sectors of fire, etc.) that have been marked as danger zones.

SUMMARY: FUTURE OF AIR BASE DEFENSE PLANNING

The ability for Security Force planners to share and collaborate on ABD planning is critical to the defense of USAF installations world-wide. Multi-user capabilities and rendering of both 2D and 3D environments directly in Defensor Fortis, with ArcGIS Pro or AutoCAD Map 3D, will provide an additional advantage for ABD planning.

By taking the necessary steps now to take Defensor Fortis to the next level, Security Forces will be in a strong position to leverage the latest GIS platforms and technologies to provide these capabilities and offer a superior ABD tool.

In addition, Military organizations such as Security Forces and force protection agencies that embrace mobility will also likely find that their processes will become not just more efficient, but will also benefit from data sharing and collaboration. The massive growth and adaptation of mobile technologies has led to greater productivity and flexibility in the military environment and allows organizations, such as Security Forces, to have an unprecedented level of connectivity and collaboration that will increase situational awareness for ABD planning and execution.

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List of Acronyms	
Term	Definition
ABD	Air Base Defense
AAFIF	Automated Air Facilities Information File
AIMS	Autodesk Infrastructure Map Server
API	Application Programming Interface
AR	Augmented Reality
AT/FP	Anti-Terrorism and Force Protection
BDOC	Base Defense Operations Centers
C2	Command and Control
CAD	Computer-Aided Design
CIP	Common Installation Picture
COM	Component Object Model
CONUS	Contiguous United States
DFC	Defense Force Commander
ESRI	Environmental Systems Research Institute
FPL	Final Protective Line
GeoExPT	Geospatial Expeditionary Planning Tool
GIS	Geographic Information System
OCONUS	Outside the Contiguous United States
PDF	Primary Direction of Fire
SAM	Surface-to-Air Missile
SDK	Software Development Kit
SIAP	Standard Instrument Approach Procedure
TAOR	Tactical Area of Responsibility
USAF	United States Air Force
UTC	Unit Type Codes