GEOFidelis West: Establishing a Regional Geospatial Center

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Abstract

Under the GEOFidelis program the Marine Corps created two regional geospatial data centers. Known as GeoFidelis West, the west coast center hosted at Camp Pendleton, California was tasked with providing comprehensive geospatial data management, application hosting, data dissemination, and geospatial policy for nine Marine Corps installations west of the Mississippi. Challenges included determining sufficient hardware, software and licensing requirements; establishing new lines of communication and work flow; implementing new procedures for data editing and quality control; overcoming political barriers; navigating Navy-Marine Corps Intranet constraints; serving a newly-established regional command staff (MCIWEST), and coordinating policy and procedures at the Headquarters, Regional and Installation level. Organizations considering or currently struggling with establishing a regional geospatial data center can learn about the solutions implemented and find out what's next for the GeoFidelis West Coast Regional Data Center.

Background

The United States Marine Corps geospatial program, known as GEOFidelis, has regionalized its geospatial information into West and East Coast Centers. The primary goal of moving geospatial system assets away from each Installation and into one of two regional centers was to improve efficiency and realize significant cost savings through the consolidation of hardware and software inventories and centralizing systems administration and application development efforts.

The Regional Centers are chartered to provide the following seven services to Regional Commands and Installations.

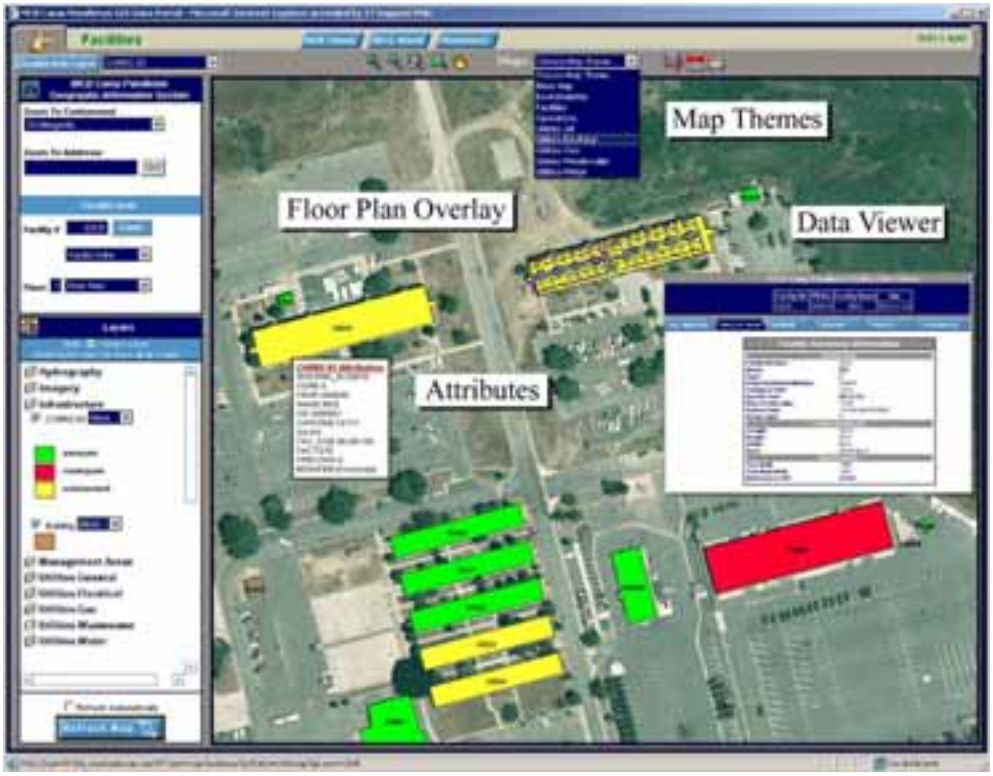
- Geospatial Program Management & Contract Support
- Centralized Data Hosting & Management
- Application Development, Hosting & Management
- GIS Product Management & Analysis Support
- Training Management
- Systems Administration, Management & Help Desk Support
- Disaster Recovery

The West Coast Regional GEOFidelis Center (GEOFi West) is located at Marine Corps Base Camp Pendleton, California. Installations and Activities throughout the Western United States and Pacific are required to collect, maintain, and manage their geospatial data assets but all assets are to be hosted at the GEOFi West Center. The GEOFi West Center took a unique approach to transitioning the Installations under its area of responsibility and successfully *regionalized* all Installations while simultaneously implementing a system architecture that has surpassed expectations.

Starting Point

Prior to receiving official tasking to become the regional data center the Camp Pendleton GIS program was already operating at what would be considered a mature and fully-capable level. It had about a dozen servers; customized desktop and Browser-based geospatial applications; long-standing, consistent, highly skilled contract support; strong support from command staff, and a very knowledgeable and savvy government GIS director. However, neither the server inventory nor the current data center location was sufficient to support eight or more additional installations. Without official tasking to become the regional data center Camp Pendleton had no additional funding to assist with the minimum improvements needed to begin preparing for regional support.

Figure 1. Camp Pendleton Browser-based Map Viewer c. 2004



Acquire Appropriate Facility, Purchase Initial Hardware and Software in Preparation for Regional Tasking with Limited Funding

Since there was not an existing environment on Camp Pendleton that was appropriate to host the regional geospatial data center the Camp Pendleton GIS office was re-located to a former Marine Corps telecommunications data center suite as part of a larger building remodeling effort initiated by the newly-formed regional command element Marine Corps Installations West (MCIWEST). With minor renovations and a new A/C unit for the building the regional data center had an adequate location for the foreseeable future, conveniently located in the same building as both the MCIWEST and Camp Pendleton command staff offices.

Camp Pendleton GIS funds were used to upgrade the existing hardware inventory and to purchase a minimum amount of additional hardware and software sufficient to initiate a basic regional GIS system. The basic GIS inventory consisted of an entry-level storage area network (SAN) devise, a

four server Citrix farm, two enterprise database servers (ArcSDE), one map services server (ArcGIS Server), and one web server. Note: other servers for file storage, backup, domain controllers, license management, etc. were included as well but are not discussed here.

Benefit: By initially implementing only a basic regional systems architecture, but one that covered all core areas of service, the Camp Pendleton GIS staff was able to establish a "mini" regional data center that was fully-functioning, tangible and ready for testing in a very short period of time (three months) with minimum investment. They were then able to test all aspects of the system against a limited but diverse user base (the Camp Pendleton GIS community), make adjustments for best performance and work flow, and were then in a position to efficiently scale the system based on production environment experience once the regional data center was officially sanctioned and provided with substantial hardware, software and staffing support through official channels. See Appendix A for excerpts of current system architecture diagrams.

Publish an Official Regionalization Transition Plan

An official transition plan explains to Command Staff, GIS Management and GIS Technical Staff, and the GIS end-user community the benefits of regionalization, how and when the transition will occur, and what is expected from both the regional center and the Installations. GEOFi West drafted a transition plan officially outlining how and when Installation GIS assets would be migrated to the Regional Data Center. The GEOFi West Transition plan included the following elements:

- Mission
- Vision
- Background
- Purpose & Scope
- Regional Services Offered
- Roles and Responsibilities
    - HQMC (I&L)
    - Regional Command / MCIWEST
    - Regional Geospatial Center / GEOFi West

    - Installations
- Transition Methodology
    - Phase 1 – Regional Data Center/GEOFi West Preparation
    - Phase 2 – Site/Installation Assessment
    - Phase 3 – Site/Installation Integration
    - Phase 4 – Installation Training
    - Phase 5 – Program Maintenance & Sustainment to FOC
- Transition Timeline POA&M
- Assumptions & Risks
- Resource Requirements

Benefit: A signed and published transition plan serves as the official roadmap and guidelines throughout the process of transitioning Installation GIS assets to the Regional Center. It clearly explains what is expected and so it can answer many questions GIS stakeholder may have without requiring a phone call or email. The transition plan can also be used, if necessary, at the command level if additional motivation is required to keep an Installation on schedule throughout the transition process.

Guiding Principles for Transitioning Installations to a Regional Architecture

The Camp Pendleton/GEOFi West staff had a long history of supporting Installation GIS communities and the Pendleton/GEOFi West contractor staff, in particular, had supported other DoD Installations as they were "regionalized". In an effort to improve upon the typical approach to regionalizing Installations an additional initiative was executed at the technical level. This "unofficial" initiative was an effort to avoid some of the less than desirable results experienced in other regional data center implementations (i.e. Installation alienation, Installations withholding data assets, Installations' lack of willingness to accept regional authority, loss of capabilities at the Installation level, Installations outsourcing their application and data hosting instead of utilizing regional data center, etc.). Therefore, the GEOFi West Center adopted the following principles when planning and executing the regional transition plan.

1. Rely on Performance vs. Policy to Motivate Regional Transition

Rather than force the GIS communities at the Installations into a regional architecture through the chain of command the Regional staff wanted to sell the regional plan based on system performance, enhanced capabilities, and superior technical support and training. In the hope of garnering legitimate support and enthusiasm from the Installations instead of feet dragging compliancy (or complete circumvention via outsourced hosting) the Regional staff took a grassroots approach by communicating and working with the Installation GIS staff at the technical level to test the regional architecture under an "early evaluation" premise. Each Installation's data was moved into the regional data center on a relaxed timeframe and in order of willingness (volunteers first). The technical staff were able to connect (via Citrix) and edit the data, receive one-on-one technical support, request changes and work out issues long before the official policy briefs and command orders were issues to officially begin transition to the regional architecture.

Benefit: The plan was a success with several Installations completing the transition process voluntarily ahead of any official orders to do so.

2. Gain Support of Installation GIS Management & Technical Staff First

Rather than contacting the Installation Commanders first and having them mandate the migration of Installation geospatial assets to the regional data center, regional staff conducted informal visits to the Installations to meet with the Installation GIS manager and GIS technical staff to discuss the benefits offered by the regional center, acknowledge the importance of Installation data ownership and autonomy, and to facilitate the loading of "a copy" of the Installation geospatial data into the regional data center geodatabase. Installation GIS staff were able to ask questions, make suggestions, utilize, and performance test the regional system. GEOFi West technical staff worked to resolve any issues and incorporate suggestions sufficient to satisfy and gain the support of the Installation GIS manager and technical staff.

Benefit: When the official order and Regional transition brief was given to the Installation command staff and GIS end-user community the local GIS

technical staff was already on-board with the regional program and proved crucial in advising the command staff, addressing questions and concerns raised by the end users they support on a daily basis, and ultimately serving as the first line of technical support for all end users at the Installation level which reduced the need for help desk resources at the regional level.

3. Ensure No Loss of Capabilities at the Installation Level

Extra effort was given to ensure the Installations did not experience any loss of application capabilities during or after transitioning geospatial data assets to the regional data center. Unique accommodations were made as-needed to ensure Installations continues their existing capabilities but they often realized greater capabilities once they fully-transitioned to the regional system. Accommodations included limited application development, additional data management procedures, and creative system configurations to support interim solutions until a long-term regional solution could be implemented.

Benefit: Although additional labor effort was required to support interim solutions, by ensuring all existing capabilities were supported throughout the transition process Installation GIS management and end-users never lost confidence in the Regional initiative which kept momentum moving forward and ultimately lead to a quicker transition.

4. Foster Continuous Participation at the Installation Level

The GEOFi West staff implemented several policies and procedures to ensure Installations would play an active role in the operations of the Regional Data Center.

a. Provide Installations Web Space

All Installations were provided their own Web space within the GEOFi West Intranet Portal and given full control over content, user access management and full administrative control to create and delete sub-sites within their Installation Web space.

Figure 2. GEOFi West SharePoint Portal with Installation Site Links

Benefit: Regionally hosted but Installation managed Web space eliminated the need for Installation hosted GIS Web Portals which would have conflicted with the regionalization goals of the GEOFidelis program. It provided a common forum for the region-wide GIS community and it promoted information storage and sharing in a Browser-based format vs. single-use, locally stored and/or inaccessible data storage format (i.e. department-level bulletin board accessible only within the Installation.

b. Establish Installation-specific Geodatabases and SDE Versions

Each Installation was given its own geodatabase instance and an SDE administrator was assigned at each Installation. They were provided one-on-one training and given full administrative rights to manage the Installation geodatabase instance to include creating SDE versions, QA/QC, post and reconciliation of all edits back to the Installation Repository version (one level

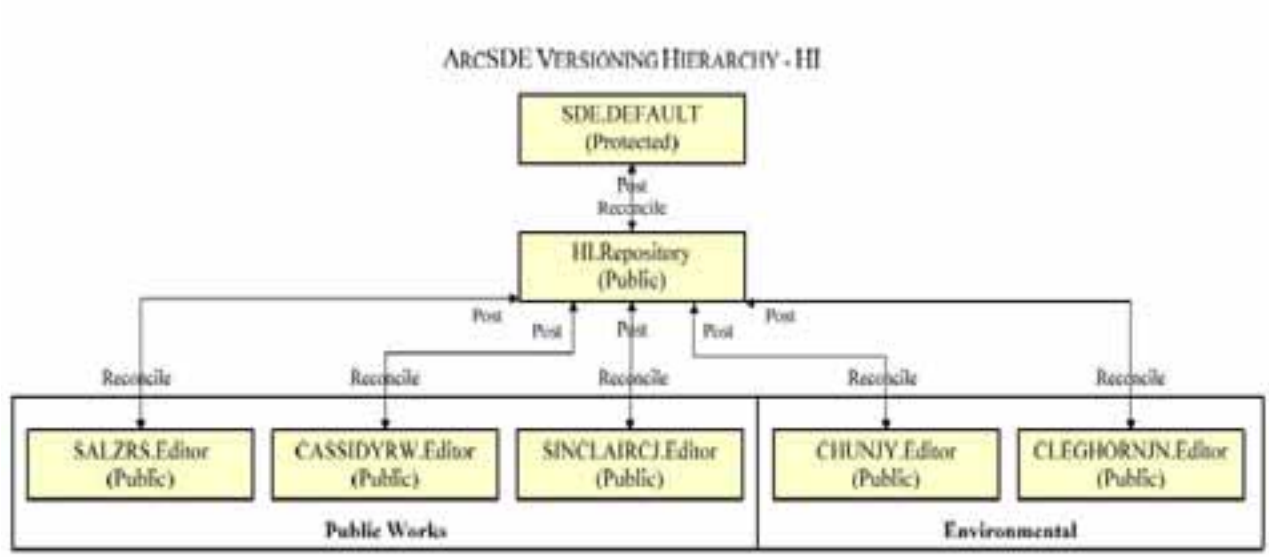
below Default version). Additional SDE versions were created below the Installation level for any other mid-level data managers or end-users as needed.

Figure 3. GEOFi West Geodatabase Architecture

Benefit: Personnel who served as Installation data managers prior to transitioning to the Regional Data Center architecture were able to continue in that role and were able have the kind of data management flexibility they might have otherwise leveraged with multiple personal geodatabases. With SDE administrative rights and version control at the Installation level, Installations were able to self-manage, relieving pressure on regional resources, and are more likely to continue to work directly in the primary database (SDE) instead of exporting and manipulating personal geodatabases that have the potential to proliferate on file servers. This

particular architecture also provides the most consistent end-user experience when browsing the database directly (in ArcCatalog for instance), requires a minimum amount of database connections, and facilitates easier back-end administration by being able to work on one Installation at a time without interrupting services to any other Installation.

Figure 4. Example of Installation Version Hierarchy



c. Conduct Visible Project Management

GEOFi West staff and several Installation GIS departments manage their project task lists posted on the Intranet Portal. Additionally, system access accounts, map and data requests and system technical issues are submitted and tracked via the Intranet Portal for all managers, end-users and other stakeholders to access.

Benefit: By conducting business in a transparent manner all personnel can view current status of projects and project tasks including data and map requests, application development priorities, data conversion and/or integration projects, manage Installation user accounts, and track help desk issue status without relying on phone calls and email messages. Over time this will significantly reduce the amount of time technical staff spend providing status reports & updates to curious stakeholders as well as foster a

greater level of communication and understanding of the priorities and responsibilities of the entire GEOFi West community.

d. Establish a Regional GIS Working Group

A GEOFi West Working Group consisting of all Regional staff, all Installation GIS technical and management staff was established and meetings were held every quarter to discuss current initiatives, raise questions and concerns, review regional priorities and plan future events.

Benefit: The establishment of a region-wide working group provided a consistent forum to disseminate and discuss GIS-related information efficiently as well as provide a sense of community as additional activities such as BBQ socials and group dinners sometimes follow.

5. Standardize Applications and Application Development Standards

The DoD has a long history of commissioning custom application development to meet its particular needs. The GIS community is no exception. In prior years, under prior contracts, various contractors have developed exceptional applications to meet the needs of the geospatial community. Such applications are referred to as Government off the shelf (GOTS) applications. Coding standards and platform types are extremely diverse and a lot of the applications are developed for a single user base and in a proprietary manner. However, problems can arise when the incumbent contract company is replaced by a different company who 1, may not have the technical expertise to continue supporting a particular platform 2, may have their own software solution they wish to implement in place of the existing solution or when the core product that was built upon or customized by the previous 3rd-party contractor is no longer supported by the primary vendor. In addition there is the constant progression in technology to keep up with including new versions of programming platforms and operating systems that may render existing applications obsolete much faster than anticipated.

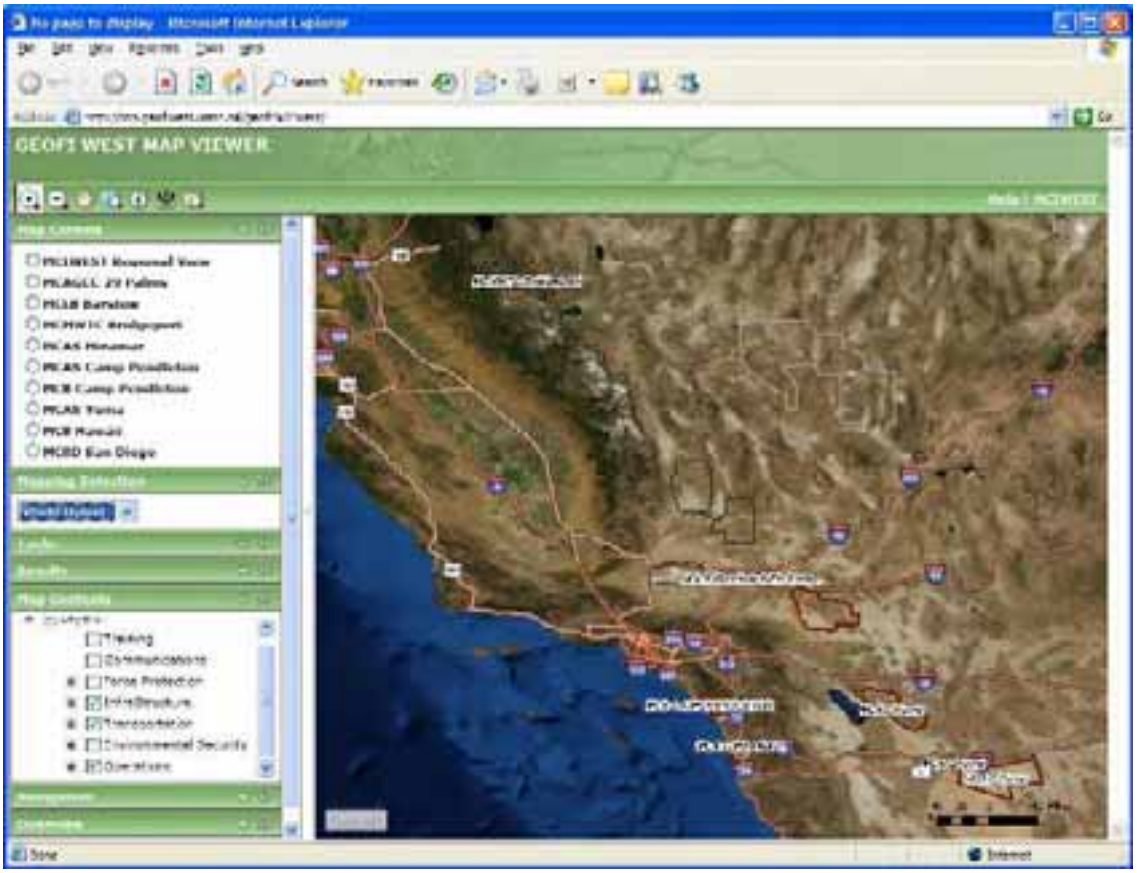
a. Focus on COTS vs. GOTS Applications

The GEOFi West Regional Data Center implemented a policy of standardizing on commercial off the shelf (COTS) applications and industry standard programming practices in an effort to 1, limit the amount of application development required 2, to provide an environment in which multiple contractors could participate in the application development process and 3, code written had the potential to be reutilized and/or shared with other Marine Corps and DoD organizations.

Currently, GEOFi West has standardized on two core applications, both from industry-leading companies: Microsoft SharePoint Portal and the ESRI Web Application Development Framework. Both applications support the same programming platform (currently ASP.NET 2.0 and MS Visual Studio), both provide significant out-of-the-box capabilities, both applications adhere to industry-standard object oriented development and web services standards, and both application vendors provide sufficient object model documentation (debated among some programmers of course). GEOFi West continuously strives to maximize the functionality inherent in the applications through configuration and business process adjustment, only resorting to custom application development when all other avenues have been exhausted.

Benefit: Requirements have been met with minimum application development. Solutions in place are industry standard and could be easily maintained by any competent contractor so the Government can issue service contracts solely based on performance and expertise vs. also having to consider prior investments in software development and custom application maintenance.

Figure 5. GEOFI West Map Viewer (ESRI Web ADF Viewer)



b. Reduce the Number of Similar Applications

To simplify portfolio management and reduce the amount of systems administration and application maintenance needed the GEOFidelis program advocates a reduction in unnecessary and/or redundant software applications. These same concerns were raised when establishing the GEOFi West systems architecture and software portfolio in reference to the number of 'versions' of a particular software as well. An example of this challenge arose with how to provide customized browser-based map viewers and tools for at least nine Installations as well as one for the MCIWEST regional command without having to maintain ten or more separate viewer

applications/code bases. The GEOFi West staff devised an application architecture based on the ESRI Web ADF that allowed for a single instance of the Web ADF map viewer that would support an unlimited number of "perspectives" for Installations, Organizations and Departments. Depending on the URL used to access the application variables would be altered to personalize viewer elements such as the Title bar, apply query filters, and load/unload various tools and/or designate tool parameters.

Benefit: By implementing software portfolio management standards that focus on reducing the number of applications as well as the number of versions of applications GEOFi West was able to significantly reduce the level of effort devoted to systems administration, application maintenance and technical support.

6. Embrace a Multi-Contractor Environment

The GEOFi West staff recognized that a regional data center supports many Installations, departments and business lines and, generally speaking, the larger an organization is the less likely it is to be able to support all of its stakeholders efficiently. Therefore, GEOFi West took the following actions to encourage and successfully function within a multi-contractor environment.

- Provided an application development architecture that supported a multiple-developer, multi-company environment.
- Issued a regional IDIQ multiple award contract that included on-site maintenance service support
- Openly shared systems architecture, application code and programming methodologies with all contractors supporting any GIS-related activities within the Marine Corps Installations and Environment community.
- Performed map services support, limited programming and software architecture evaluation services to all contractors supporting any GIS-related activities within the Marine Corps Installations and Environment community.

Benefit: Installations, departments and business lines were able to continue working with their preferred contractors. The regional center was able to leverage the work being performed outside of the immediate GEOFi West contractor staff while still ensuring the regional architecture and software

development guidelines were being followed. The IDIQ allowed the Marine Corps to realize a cost savings by not having to process and administer separate contracts and by significantly reducing the potential of investing resources into redundant development efforts since most development efforts were coordinated through open communication and cooperation.

Results

The Camp Pendleton GIS office went from a single Installation support center to a fully-operational Regional Data Center in approximately 18 months (12 months following official tasking/designation). The GEOFi West staff has an outstanding record of performance and relationships among GEOFi West support staff and the Installation community are excellent. End-users, departments and business lines are constantly being added and integrated into the regional system. Cost savings from software consolidation, Citrix application serving, and centralized systems administration has already been realized. GEOFi West serves as a good example for any organization establishing a regional geospatial data center.

Next Steps for GEOFi West

GEOFi West will continue expanding and improving the systems architecture as additional users and requirements are incorporated into the system. Current initiatives include supporting 3-dimentional geospatial viewing and analysis capabilities, additional business process integration, further personalization and customization for individual Installations, and continuing to work with the East Coast Data Center, Headquarters Marine Corps, and all Installations to provide cohesive and consolidated solutions to meet Marine Corps geospatial needs.

Acknowledgements

Mr. Bill Russell, GEOFi West Geospatial Information Officer is the government employee who oversees the Camp Pendleton and GEOFi West programs. He can be contacted at William.c.russell1@usmc.mil.

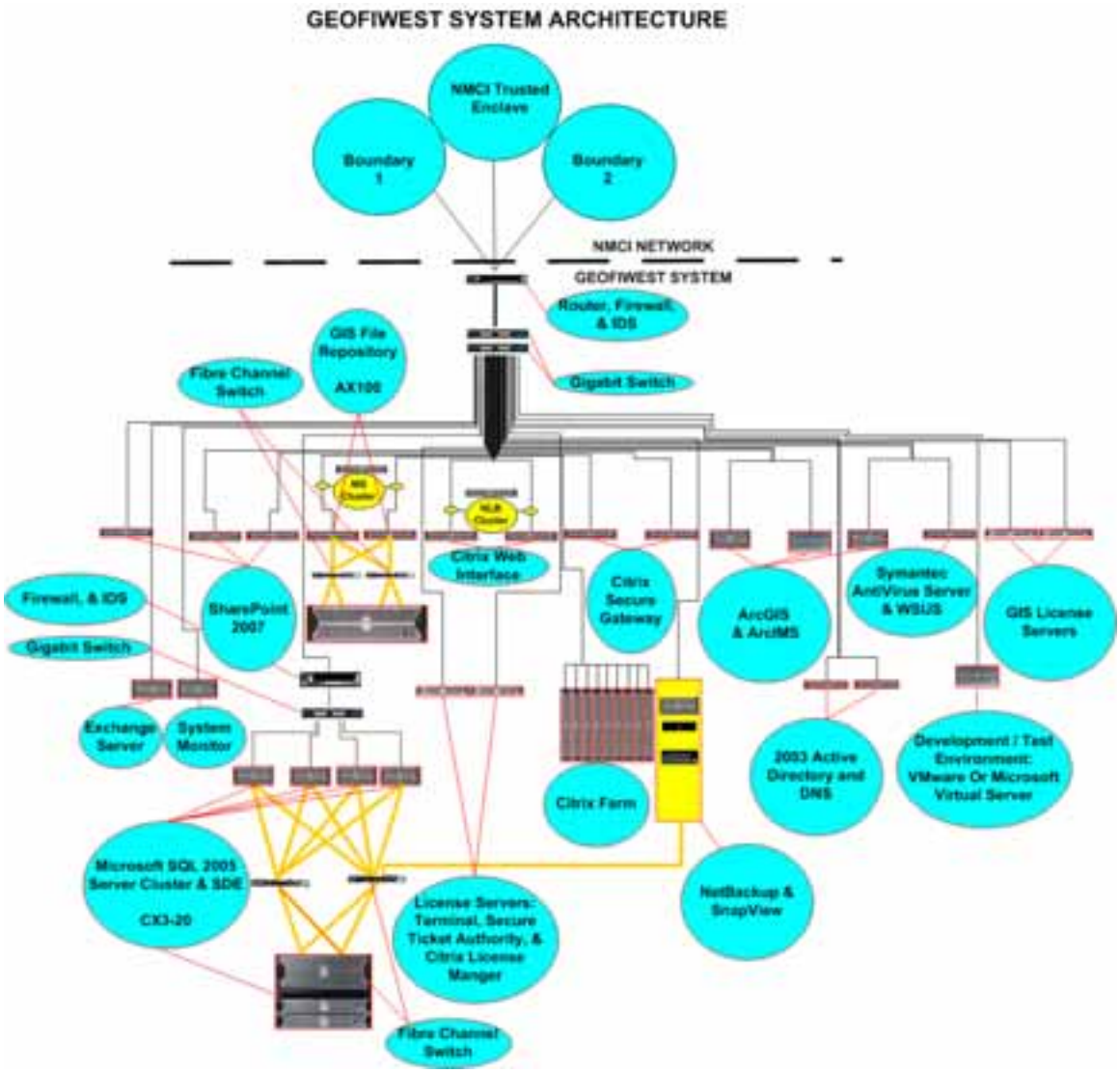
Mr. Wendell Hoskins III (senior systems administrator, Technology Associates International Corporation) and **Mr. Adam LaBorde** (senior GIS analyst & ArcSDE administrator, Technology Associates International Corporation) were primarily responsible for designing and implementing the GEOFi West system and geodatabase architecture.

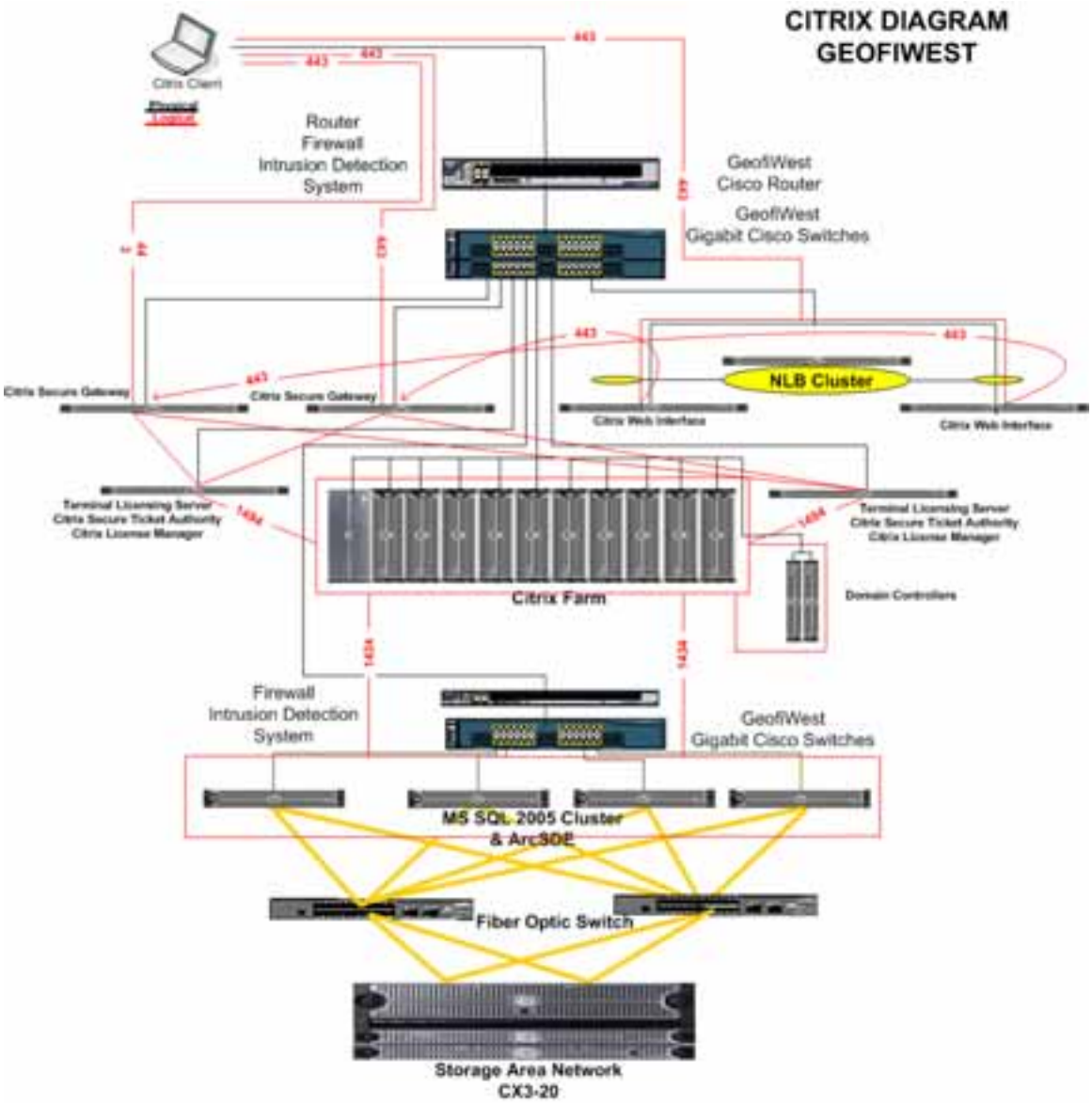
GEOFi West SharePoint graphic design provided by **Ms. Liisa Haubrich** (Technology Associates International Corporation).

ESRI Web ADF Map Viewer ArcObjects Development provided by **Mr. Hooman Mohammadpour** (Technology Associates International Corporation).

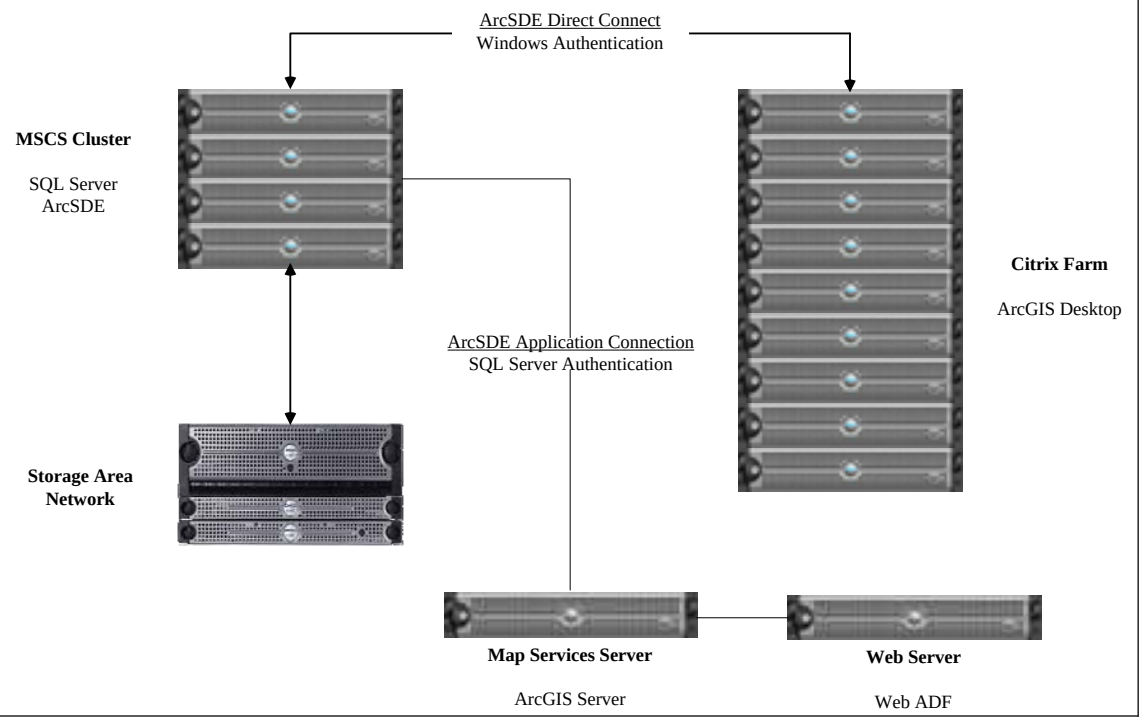
Congratulations to the rest of the GEOFi West staff for a job well done. All may be contacted via www.taic.net

Appendix A – Systems Architecture and Configuration Diagrams




CITRIX DIAGRAM
GEOFIWEST
Citrix Client
Router
Firewall
Intrusion Detection
System
GeofiWest
Cisco Router
GeofiWest
Gigabit Cisco Switches
443
NLB Cluster
Citrix Secure Gateway
Citrix Secure Gateway
Citrix Web Interface
Citrix Web Interface
Terminal Licensing Server
Citrix Secure Ticket Authority
Citrix License Manager
Terminal Licensing Server
Citrix Secure Ticket Authority
Citrix License Manager
1434
Citrix Farm
Domain Controllers
Firewall
Intrusion Detection
System
GeofiWest
Gigabit Cisco Switches
MS SQL 2005 Cluster
& ArcSDE
Fiber Optic Switch
Storage Area Network
CX3-20

GEOFI WEST GIS SYSTEM



GEOFI WEST
MSCS ACTIVE/ACTIVE CLUSTER

Server 1

SQL SERVER 2005 – INSTANCES

Active
MCAS Miramar (MI)
MCAS Yuma (YU)

Passive
MCLB Barstow (BA)
MCMWTC Bridgeport (BP)
MCB Hawaii (HI)
MCAS Camp Pendleton (PA)
MCB Camp Pendleton (PE)
Regional Repository (RG)
MCRD San Diego (SD)
MCAGCC Twentynine Palms (TP)

ARCSDE 9.1 SP2 – INSTANCES

Automatic startup
sde_mi 5155/tcp
sde_yu 5158/tcp

Manual startup
sde_ba 5150/tcp
sde_bp 5151/tcp
sde_hi 5154/tcp
sde_pa 5152/tcp
sde_pe 5153/tcp
sde_rg 5159/tcp
sde_sd 5156/tcp
sde_tp 5157/tcp

Server 2

SQL SERVER 2005 – INSTANCES

Active
MCLB Barstow (BA)
MCB Hawaii (HI)
Regional Repository (RG)

Passive
MCMWTC Bridgeport (BP)
MCAS Miramar (MI)
MCAS Camp Pendleton (PA)
MCB Camp Pendleton (PE)
MCRD San Diego (SD)
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MCAS Yuma (YU)

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sde_pe 5153/tcp
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sde_tp 5157/tcp
sde_yu 5158/tcp

Server 3

SQL SERVER 2005 – INSTANCES

Active
MCMWTC Bridgeport (BP)
MCAGCC Twentynine Palms (TP)

Passive
MCLB Barstow (BA)
MCB Hawaii (HI)
MCAS Miramar (MI)
MCAS Camp Pendleton (PA)
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sde_pe 5153/tcp
sde_rg 5159/tcp
sde_sd 5156/tcp
sde_yu 5158/tcp

Server 4

SQL SERVER 2005 – INSTANCES

Active
MCAS Camp Pendleton (PA)
MCB Camp Pendleton (PE)
MCRD San Diego (SD)

Passive
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MCMWTC Bridgeport (BP)
MCB Hawaii (HI)
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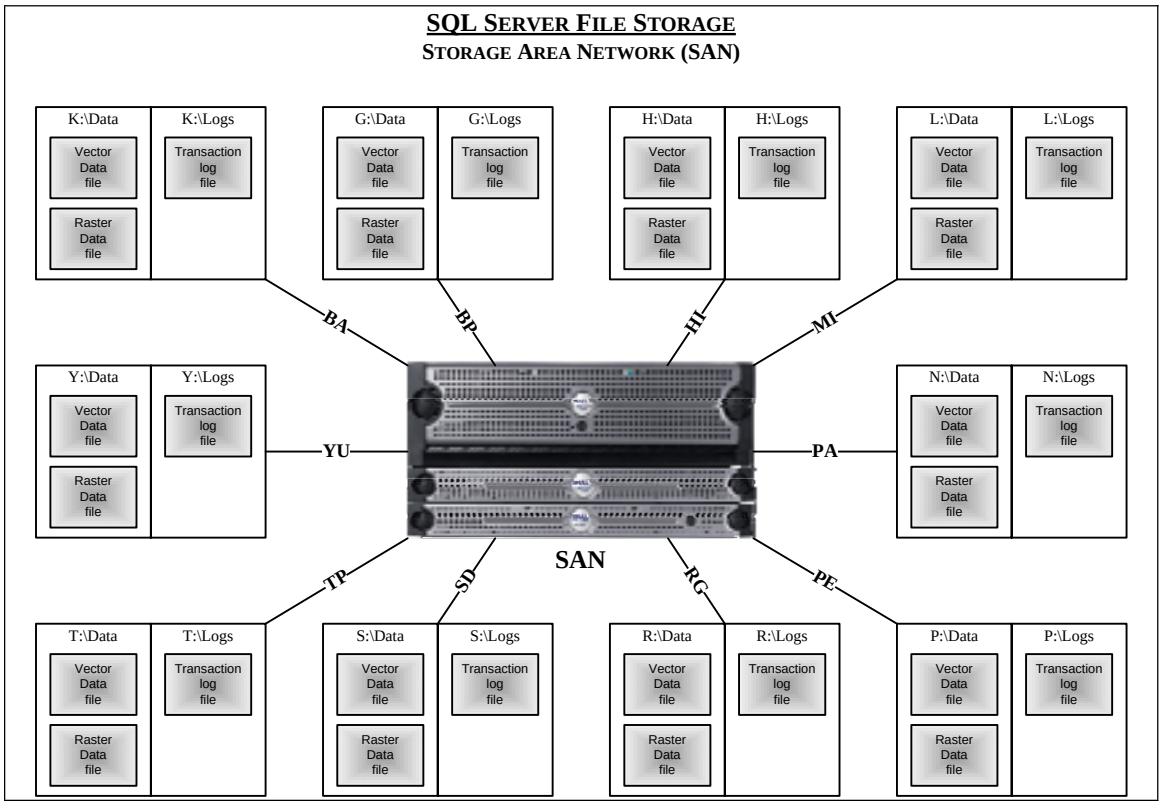
sde_mi 5155/tcp
sde_rg 5159/tcp
sde_tp 5157/tcp
sde_yu 5158/tcp



References

For Information on the GEOFidelis program see www.geofidelis.net

The GEOFi West Portal can be found at https://portal.geofiwest.usmc.mil (currently only available from within the Marine Corps Intranet)

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