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CONNECTING AMERICAN MANUFACTURERS (CAM)

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Imaginestics, LLC

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Final Report

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14. ABSTRACT *(Maximum 200 words)*

This report summarizes assessments and analyses focused on identifying the sources and criticality of manufacturing variability on high pressure turbine blade performance. Technology gaps to reduce variability and the potential cost and benefits to close those gaps were evaluated. Rolls Royce Corporation took the approach to evaluate manufacturing variability as it relates to overall engine performance, whereas General Electric Aviation focused on airflow efficiency for high pressure turbine blades through improved cooling hole fabrication. Opportunities to close the gaps and improve the digital information thread were reported.

15. SUBJECT TERMS

supply chain; e-sourcing; online portal; RFQ; online marketplace

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1.0 DoD CAM OBJECTIVE

The Department of Defense's (DoD) current approach to procurement over the internet through the Federal Business Opportunities (FedBizOpps) and DLA Internet Bid Board System (DIBBS) websites, while opening solicitations to a broad public audience, also creates a new world of challenges for small- and medium-sized manufacturers, due to the sheer number of solicitations, the broad range of needs, and the complicated and often not transparent requirements of the DoD. The intimidation factor and increased workload causes small manufacturers to turn their backs on defense work, leading to solicitations for spare parts for military systems going unfilled or creating a non-competitive environment where the same suppliers bid on parts, keeping costs artificially elevated.

In order to address these issues, DoD's Connecting American Manufacturing (CAM) initiative sought to improve participation of small manufacturers in building components for the military by seeking "e-sourcing" solutions that screen, organize and present Government spare part requirements to the industrial base thereby improving the ability to pair the right suppliers with the right parts at the right time.

The CAM objective in Phase 1 was to create a portal-based e-sourcing solution that would interface between existing DoD systems such as FedBizOpps and DIBBS and the industrial base. Additionally, the solution would organize industrial base participants based upon their manufacturing capabilities and provide matched opportunities from the DoD systems to the most relevant pools of suppliers. This solution would then enhance the industrial base's ability to access and bid on relevant business opportunities while addressing a diminishing DoD supply-base, high lead times for parts acquisitions and higher-than-needed lifecycle costs.

During Phase 1, it was intended that DoD buyers would directly post solicitations in this e-sourcing solution so they would reach a broader range of potential suppliers and provoke non-traditional DoD manufacturers to seek DoD-related business by reducing or eliminating current business and technical barriers. The intended items that would be posted would come from the Defense Logistics Agency (DLA) or from units within the services and those parts would be metallic and require typical metal manufacturing processes, such as casting, forging, milling, or grinding; however, items made of plastics and composites might also be included. Of particular interest were those items that are difficult to source, which for the CAM project were defined as having had no commercial bidders after 30 days.

However, in Phase 1, DoD buyers were reluctant to directly post solicitations in a new system, with the result that only the opportunities from FedBizOpps were matched to the suppliers. During the course of Phase 1, interviews showed that DoD buyers would often seek new suppliers through the Source Approval Request (SAR) process but that this process was not consistently applied to continuously seek new suppliers. Instead, the process was used in a more reactive manner to fulfill "hard-to-source" parts, which was often not successful. This is because the steps involved to qualify and approve a new supplier are complex and difficult to understand. In the case of hard-to-source parts, the Tech Data Package (TDP) is often of poor quality and has missing information.

As a result of these findings, Imaginestics proposed an Add Work extension in which Imaginestics would automate the SAR process and enable buyers to identify new suppliers consistently using the hard-to-source parts list with some forecasted procurement data for subsequent years to provide suppliers visibility and incentive to participate in the SAR process. During the Phase 1 Add Work extension period, the objective was to automate the SAR process, educate suppliers, and help them get qualified for parts they may be best suited to build so that when the parts come up for procurement on FedBizOpps and DIBBS, the supplier would have a high probability of winning the contract. During this period, it was also intended to provide suppliers and buyers intelligence on the quality of the TDP associated with NSNs for which DoD was seeking new sources. This would enable suppliers to make a bid/no-bid decision quickly or perhaps consider proposing a re-engineering route.

2.0 IMAGINESTICS' APPROACH

The Imaginestics solution, America's Virtual Opportunity Interchange Center (VOICe^{TM}), addressed the challenges set forth by the DoD in the CAM solicitation by putting two vital work streams into action: technological and organizational. The technological work stream was to address the technological requirements of the BAA, creating an internet social-network-based platform on Imaginestics' proprietary VizSpace platform and its foundation shape search technology, VizSeek. The organizational work stream was executed to bring new suppliers into the defense supply chain. In addition to the existing supplier base registered in VizSpace prior to launching VizSpace, Imaginestics' plan was to build upon a framework of economic development agencies across the country, capitalizing upon their years of work with manufacturers and the government, and their strong existing member bases to establish a foundation of support, outreach, and communication with national reach but a local touch.

Imaginestics built upon their existing online industrial networking platform, **VizSpace**, by establishing the America's VOICe marketplace, which small and medium U.S.-based manufacturers could join and on which they could create company profiles, including their capabilities, equipment, and products. Buyers can post their opportunities within this marketplace, and these can be sent to appropriate suppliers by Imaginestics' state-of-the-art matching engine. VizSpace's web crawlers extract opportunities nightly from various Federal, OEM and public and private sites and match and deliver them to suppliers. As a secure, hosted networking platform, the America's VOICe platform allows both buyers and suppliers to make their data and opportunities as public or private as desired and associate themselves with vetted trust networks of companies, as appropriate for their needs. The America's VOICe marketplace leverages the manufacturing capability ontology for which the VizSpace platform was built. The ontology basis, along with Imaginestics' years of work in shape and text extraction technology, made it possible for the tool to extract key data from tech data packages to derive appropriate capabilities and supplier characteristics.

The America's VOICe marketplace met most of the objectives stated for the CAM BAA, such as the speed and responsiveness of automatic matching and electronic communications, the ease of evaluating tech data packages in a neutral format, apps that allows for manipulation of drawings and models, and access to established, trusted networks of suppliers. America's VOICe brought new suppliers into the defense supply chain by making access to good, quality, applicable defense opportunities as easy as checking email, but also by leveraging the existing marketing, training, communications, and relationships of six economic development organizations located around the country.

To fulfill the organizational work stream, eight onboarding organizations (shown in **Figure 1**) reached out to small- and medium-sized (SME) suppliers to communicate about America's VOICe^{TM}, provide outreach, conduct workshops, webinars and training, and act as a first line of support for questions. Additionally, Imaginestics deployed an Anchor strategy, which allowed large companies, currently doing business with the DoD to partner with SMEs to represent their products/services to fulfill a current solicitation which they may not have the right business credentials to win. After gaining experience working as a sub-contractor, it would then enable that SME to be qualified to work with the DoD. This was not originally proposed in

Imaginestics' CAM BAA response; however, Imaginestics found that SMEs were struggling to bid on certain solicitations, so this approach allowed them to gain traction.
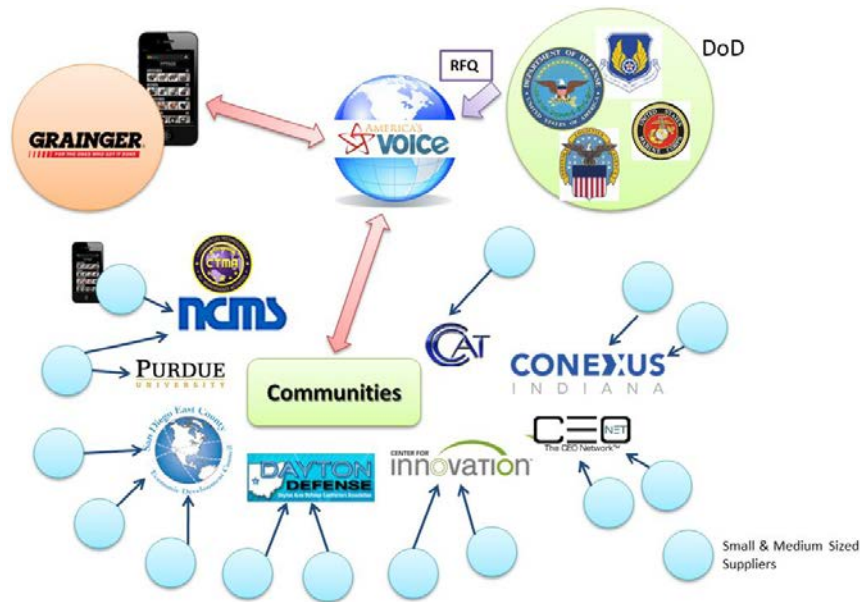

Figure 1: America's VOICe on-boarding strategy

Table 1. Highlights of America's VOICe activity from July 1ˢᵗ 2012 – September 30th, 2013

Number of Suppliers enrolled in America's VOICe	**5,779**
Number of suppliers new to DoD enrolled in America's VOICe	**467**
Total Number of Unique Opportunities scraped from FBO	**168,674**
Number of Opportunities matched to suppliers in America's VOICe	**90,534**
Total number of awards received by suppliers in America's VOICe	**1,443**
Total number of Suppliers that received awards/contracts	**43**
Total number of new suppliers to DoD that received awards/contracts	**6**
Total awards/contract value	**$40,666,543.88**

Table 2. Highlights of America's VOICe activity from January 1st 2013 – September 30th, 2013

Number of Sources Sought Opportunities received and posted from DoD	3,347
Number of Suppliers approved for Sources Sought	5

2.1 Overall Successes

- Proved that a social-network-based platform is a powerful medium to create awareness of DoD opportunities and connect them to supplier's capabilities, both the ones that have previously worked with the government and the ones that have not.
- Proved the effectiveness of internet and mobile applications that leverage powerful technology and ease of use, coupled with workshops or webinars to reinforce the understanding. Workshops and webinars add the human interaction element, which is critical to convey trust and also helps to put a human face to the online marketplace.
- Established trust with DoD buyers to provide their hard to-source parts list and post them on America's VOICe to help them identify sources to meet their current challenges.
- Engaged a significant and increasing number of suppliers with America's VOICe, as Imaginestics understood their needs, resulting in increasing number of opportunities viewed and an increased number of suggestions sent to suppliers, as shown in **Figures 2 and 3**. In addition, page views (2 – 3 page views per visit) and time spent on each page increased as well.

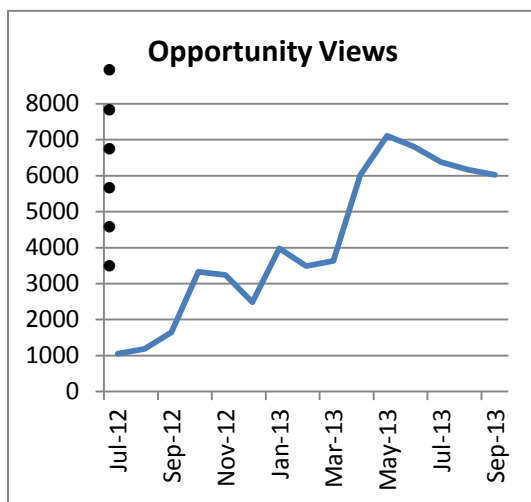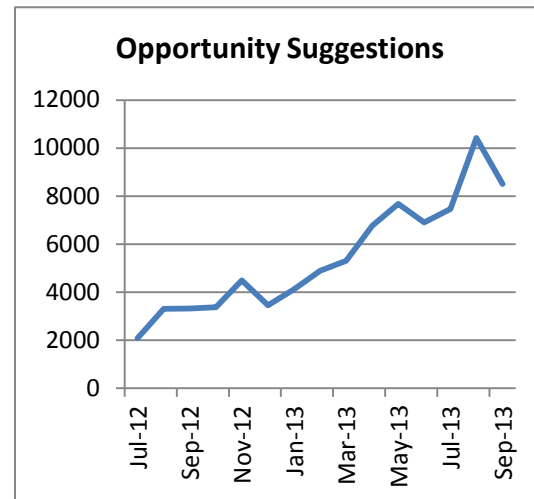**Figure 2: Number of Opportunities Viewed**

Figure 3: Number of suggestions sent

- Some of the comments shown below were captured during workshops, webinars and one-on-one sessions:

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- o "Our goal has been to become an approved source for the DoD and America's VOICe has helped us get there" - *Quality Controlled Manufacturing - Doug Grande*
- o "I've spent 5-6 years chasing alligators prior to America's VOICe" - *GMD Industries, LLC – Gene McQuinn*
- o "John, the guy that does all of our government searching, would spend as much as 4 hours a day going through just all of the places out there trying to identify which one we should even take the time to do business with and figure out if this is even going to be something we are interested in. And so, when we first started using America's VOICe, we were really of the mindset that this was just another tool for John to get in and dig through this stuff. Over the past year as we have gotten used to it, it has been our default tool that John uses every day as he doesn't have to go to any other sites. And so what used to take him 4 hours a day, now takes him maybe 45 minutes to an hour. He spends more time digging into the tech data packages and preparing bids" - *Starwin Industries - Mike Little*
- o "Since joining America's VOICe last August, searching for quality government contracts has become less complicated as matching opportunities are sent directly to our company email and VizSpace. This free service not only saves time but levels the playing field for small manufacturers, such as ours, to compete when it comes to bidding on government contracts. We had never done business with DoD until now. We finally won one, thanks to America's VOICe" – *Kreider Corporation - George Keriazes*
- o "We really like America's VOICe matching service to solicitations from FBO and DIBBS as we receive this in our inbox daily which are matched to our capabilities automatically. On average, roughly 10 to 15 hours per week were being spent searching on FedBizOpps and DIBBS looking for solicitations that align with McNally's capabilities, which is now minimized. We are very excited about Sources Sought process as we had not gone through this step with DoD prior to America's VOICe" – *McNally Industries - Trent Mulcrone*

2.2 Overall Challenges

- DoD buyers are not aware of CAM and its benefits, and this prevents buyers from fully embracing America's VOICe as they saw it as yet another system they have to deal with.
- Having *only* FedBizOpps opportunities going out to suppliers rather than having direct DoD opportunities being sent to suppliers reduces supplier trust in the system. While they appreciated having the FedBizOpps opportunities filtered for them and reducing their workload in that way, there is a perception that many FedBizOpps opportunities are already earmarked for certain suppliers and therefore a waste of time to bid upon.
- In discussions with some of the DoD buyers, it was clear to us that they did not have incentives to post opportunities in America's VOICe. They were not measured in the number of new suppliers they approved, so it is easier to continue

to fulfill the solicitation in the same old way of working with the incumbent suppliers as the risk may be lower.

- DoD buyers were reluctant to go through the long process of obtaining approval of a new supplier with the cognizant engineer.
- DoD buyers reacted negatively to the idea of creating a scoring metric of the completeness and quality of TDPs because it could be perceived that buyers were putting out solicitations that were purposely incomplete so that they could be awarded to incumbents.
- The current workflow to get further information from FedBizOpps once one is interested in a particular opportunity is quite complicated and involves multiple systems. Suppliers expressed interest in having a "one-stop shop" where they could easily access opportunity information, part information, and TDPs from one place. Imaginestics sees an opportunity here to improve supplier experience and prevent suppliers from dropping out of the process early on by interfacing with existing public systems to provide more information to suppliers.
- The major challenge that suppliers have is with the quality of TDPs associated with solicitations. Without direct access to the cognizant engineer, the buyer is unable to interpret and clarify the information in TDPs where information is missing. Therefore, suppliers choose not to bid on solicitations.
- The solicitations posted on FedBizOpps often have a very short bid deadline, and if a supplier has never done business with DoD, it is virtually impossible for them to turn around a bid, as registration in SAM and understanding the required MIL-SPECs takes time. The creation of the Sources Sought App helped with getting suppliers registered and for the suppliers to better understand the supplier approval process; however, the following were challenges noted:
  - o Due to the poor quality of the TDPs and incomplete drawing information, suppliers only completed 6.8% of the SAR packages that they initiated (Suppliers initiated 117 SAR packages, only 18 were completed).
  - o It took an average of 23 days for the DoD sourcing program office to respond to the submitted SAR packages, which resulted in 5 approvals.
  - o The DoD sourcing program office was not active in responding to questions from suppliers, which also led to the low SAR completion rate.
  - o With the government sequestration and furloughs in place during the period of performance, it has been extremely difficult for suppliers to receive timely responses from buyers or cognizant engineers, resulting in suppliers not bidding on several opportunities. This was especially challenging for new suppliers who had never done business with the DoD. Furthermore, shutdown caused this communication to come to a halt. It was difficult for us at Imaginestics to run a marketplace to help DoD, when no one was available to buy. However, Imaginestics managed to keep the suppliers engaged on America's VOICe with hope and persuasion that good things will happen. This was only possible by deploying a social-network-based platform. Despite this government setback, Imaginestics still managed to maintain the bid matching and the number of bids made by suppliers.

3.0 OUTREACH

3.1 Successes

- Successfully trained eight onboarding partners, six of whom have created their own online communities and invited their members, with two in the process of starting up:
  - Dayton Defense
  - National Center for Manufacturing Sciences (NCDMM)
  - East County Economic Development Corp (ECEDC)
  - Connecticut Center for Advanced Technology (CCAT)
  - Purdue University Technical Assistance Program (TAP)
  - Center for Innovation (CFI)
  - CONEXUS
  - CEO-NET
- The most progressive onboarders clearly understood the America's VOICe value proposition, and they were more successful in running workshops and webinars to motivate their member base to enroll, receive, and make bids on opportunities. This resulted in the organizations gaining a loyal member base and increased service revenue for additional offerings by the onboarder.
- Conducted **28** workshops around the country educating suppliers about CAM/America's VOICe with an average of 40+ supplier attendance with 89% indicating that they learned something new, and the workshop was worthwhile.
- Conducted **27** webinars to educate suppliers on various features of America's VOICe with an average of 15+ supplier attendance.
- Created **23** training modules to enable users to easily self-train.
- Participated in **26** one-on-one meetings with DoD buyers and Sourcing Program Offices, which translated to buyers sharing their hard-to-source parts lists and being actively involved in qualifying sources. The most responsive sourcing offices who were willing to share their list were Tinker AFB, Marine Corp Logistics Command and DSCC, whereas, DSCR were the most non-responsive. Although, DSCR showed us the list of their hard-to-source parts, they never sent this list to us, even though Imaginestics followed up with them repeatedly. There was interest from NAVAIR (SW) and Picatinny Arsenal to participate as well, but due to limited funding and resources, Imaginestics focused on the Sources Sought opportunities from the 3 agencies.
- America's VOICe marketplace, along with the suppliers that were successful in receiving DoD awards/contracts, was recognized in 2 TV shows and 2 Radio announcements, along with 4 articles in local newspapers.
- Successfully onboarded **5,779** suppliers (qualified with 60% and higher profile completion score) in America's VOICe that meet the qualification to bid on DoD solicitations.
- On-boarded **467** new suppliers to the DoD, of which **6** received first-time awards. About 40% of the new suppliers bid on at least one DoD opportunity; however, this information was obtained from onboarders and could not be validated directly from DoD, as the EDI feed from DoD was not made available to conduct this query.

- At Imaginestics' IndyDef Workshop, where Reggie Joslin from Crane Naval Base presented, almost 25% of the companies that attended the workshop contacted him to understand what capabilities they should add in VizSpace to match to Crane's requirements, showing that support from DoD personnel made a major impact in supplier engagement.
- The National Additive Manufacturing Innovation Institute (NAMII) also chose to use the VizSpace platform as an online community for sourcing. One of the recent successes that resulted in it was that Kansas City Plant managed by Honeywell used America's VOICe to solicit 17 parts to be produced using additive manufacturing. The access to a larger and automatically matched set of suppliers resulted in a significant (4x) cost and lead time savings.
- Successfully created an "anchor" concept within America's VOICe, which allows large manufacturers or suppliers to leverage their existing relationship and experience with DoD to partner with suppliers that have never done business with DoD. This will help small- and medium-sized suppliers develop experience working with DoD and understanding their requirements. The first anchor Imaginestics brought on board was Grainger.
- Imaginestics has approached several groups within the DoD along with DoD prime vendors as the accomplishments in America's VOICe has created interest. Honeywell realized benefits and organizations like GE wish to create their own VOICe for their internal network.

3.2 Challenges

- During workshops and webinars, it was difficult to get support from DoD buyers or sourcing program offices to come and speak at the events organized by Imaginestics and onboarders to help promote and educate suppliers. This sent a message to the suppliers that although DoD launched the CAM initiative, they were not particularly invested in its success. If the DoD buyers or sourcing program office would have come to the workshops, or even participated virtually in the webinars, participation amongst the invitees would have been higher and the number of first time suppliers in America's VOICe would have been even double. This lack of support was certainly a handicap, but despite this, Imaginestics was able to attain a fair amount of success.
- Creating outreach for America's VOICe amongst buyers was difficult and ultimately had limited success. Imaginestics tried to schedule a workshop at Marine Corp Logistics in Albany, GA, but it was rescheduled 4 times. So, although the Colonel showed interest and asked his subordinates to schedule this, it was not a high priority for them.
- Capabilities of the onboarders' personnel varied. Therefore, some of the onboarders required more training and assistance in conducting marketing and creating awareness for America's VOICe. This led to slower outreach and awareness to their member base, which led to underperforming communities.
- The motivation to promote and support America's VOICe was not aligned with some of the onboarders, as most of the organizations are non-profits and funding was challenging in a tough economic climate. Some of these organizations simply looked at it as a project and not an opportunity to develop a business model.

- Onboarders that did not clearly understand the America's VOICe value proposition languished and did not adequately market to their members, resulting in either no awards or a low number of awards amongst their members.

4.0 TECHNICAL APPROACH

Imaginestics built the America's VOICe marketplace on the existing online industrial networking platform, VizSpace. In America's VOICe, companies who wished to create an online presence were able to easily find, connect with, and organize with those they wished to do business with, allowing them to work in the manner that was easiest for them through a simple web browser. America's VOICe onboarding partners, such as economic development agencies and associations, formed online communities, which are invited collections of member companies with a common interest or cause. These online communities were automatically joined to the America's VOICe marketplace.

	Memberships	Company	Anonymous User	Registered User	Admin	Member Community	
Profile	✓	✓	✓	✓	✓	✓	
Eco-System	✓	✓	✓	✓	✓	✓	
Files	✓	✓	✓	✓	✓	✓	Remove

Figure 2: Content Security Management

The components of VizSpace (social network profile and utility management, interface to apps, and storage of indexed data) catered to the multiple levels of data security – local, hosted, and hosted secure. The Permission feature followed a security protocol that has allowed users to safely and easily choose what type of information they share on their VizSpace and in the America's VOICe marketplace. As shown in **Figure 4**, a company could choose to make their profile, files, or other information private or visible to their community and the marketplace.
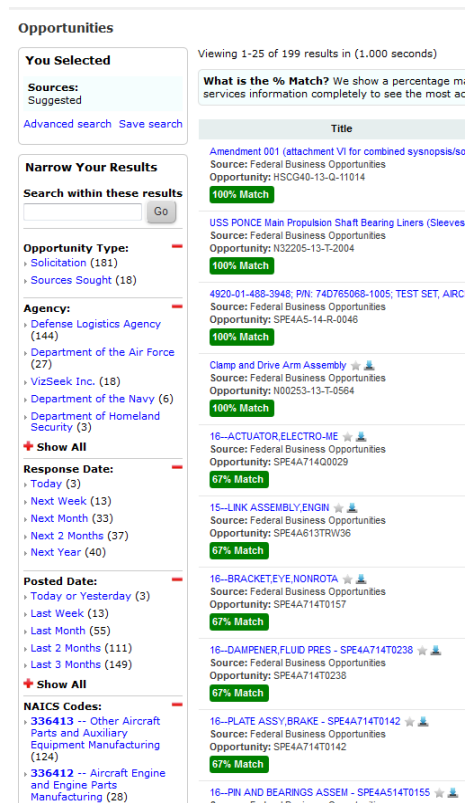
Figure 3: Match Percent

Along with the VizSpace platform, Imaginestics provided VizSeek technology to the CAM initiative. VizSeek is the back office indexing, data extraction, and rules engine that uses Imaginestics' patented shape search technology and manufacturing ontology framework. VizSeek made possible the intelligent analysis of newly posted solicitations by matching suppliers' capabilities and capacities to the needs outlined in the solicitation. Additionally, VizSeek served as a valuable tool that creates recommendation connections based on data from VizSpace profiles, manufacturing capabilities, and images, drawings, or 3D models stored in supplier profiles. **Figure 5** shows how a matched opportunity was filtered and how matches were collected according to NAICS codes, posted date, response date, agency, and opportunity type.

When a supplier had past performance data with the government, the VizSeek engine was able to capture the manufacturing process used to make the part, registering it as the supplier capability. Thus, when an appropriate solicitation was posted, VizSeek could automatically suggest the opportunity to the supplier that had the necessary capability.

Imaginestics structured the America's VOICe marketplace in such a way that the marketplace serves as a collection of communities (**Figure 6**) as well as of individual companies. The communities are themselves collections of companies. This structure meant that, as members of communities, companies had more opportunity to connect with one another and to solicit support from the onboarding organizations that ran the communities.
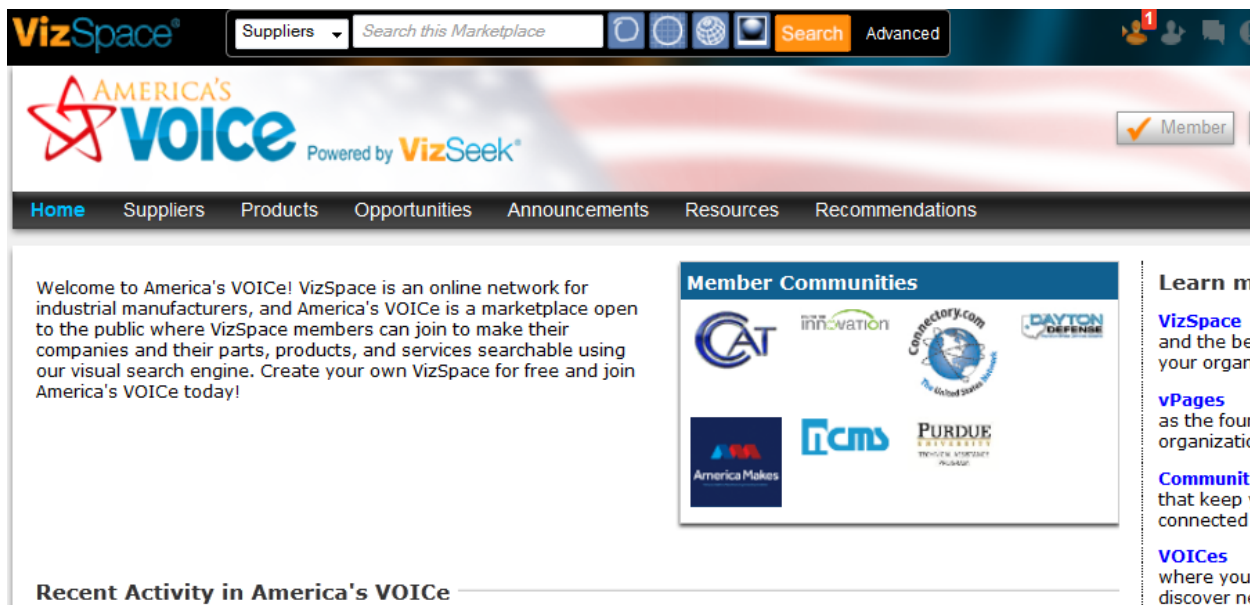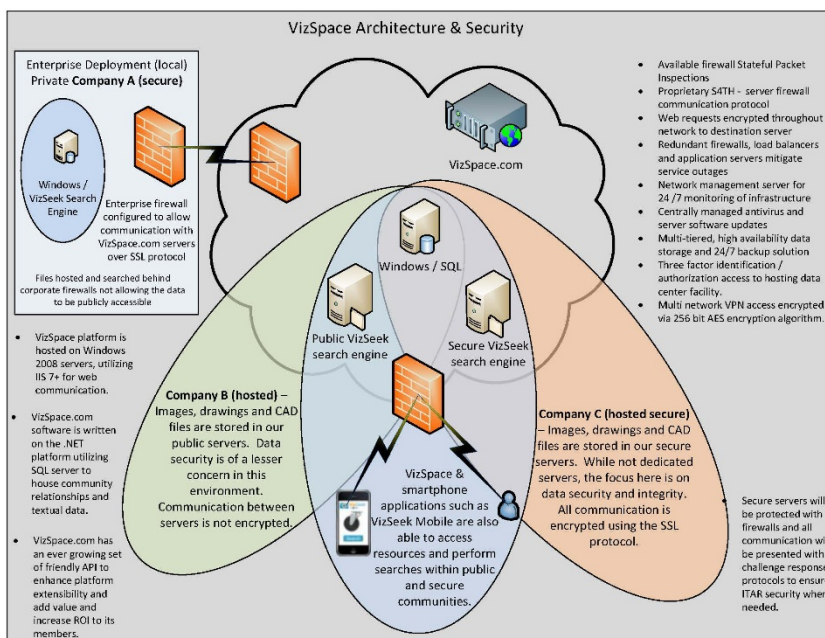

Figure 4: Member Communities

Figure 5: America's VOICe Architecture

4.1 Architecture/Infrastructure

The America's VOICe infrastructure is hosted on a robust hosting solution that minimizes downtime and maximizes data integrity. The infrastructure is illustrated in **Figure 7**. The infrastructure is hosted on Windows 2008 servers, utilizing IIS 7+ for web communication. The architecture and security includes: available firewall stateful Packet inspections, proprietary S4TH server firewall communication protocol, Web requests encrypted throughout network to destination server, redundant firewalls, load balancers and application servers mitigate service outages, network management server for 24/7 monitoring of infrastructure, centrally managed antivirus and server software updates, multi-tiered, high availability data storage and 24/7 backup solution, three factor identification / authorization access to hosting data center facility and multi network VPN access encrypted via 256 bit AES encryption algorithm. Secure servers are protected with firewalls and all communication is presented with challenge response protocols to ensure ITAR security when needed. The overall architecture of America's VOICe is scalable to support various communities and their needs, along with the needs of the buyers and suppliers.

Similar to platforms such as Apple's iOS and Google's Android, VizSpace platform is developed to enable on-demand apps. As Imaginestics developed apps in VizSpace to help organizations with decision-support applications, it became evident that opportunities existed for third party developers to develop their own apps that would be useful to various users. Some of the apps that were developed and further matured during the past year, specifically for America's VOICe, are described in the following sections.

4.2 VizOpps App

The VizOpps app is an e-sourcing app that screens, organizes, and presents government spare part requirements to the industrial base. The app has enhanced the industrial base's ability to access and bid on relevant opportunities. With this app, any user can be in the role of buyer or supplier at any time, meaning that any user can post opportunities while at the same time also receiving and bidding on suggested opportunities from buyers.

All America's VOICe members can use the app in America's VOICe free of charge, allowing them to post, search, be matched, bid upon, and receive bids for opportunities. The opportunity matches are based on the completion of required sections for a company profile, including set-aside, NAICS, classification, and CAGE codes.

For all opportunities, including those from FedBizOpps, the system extracts information attached to the opportunity to use in associating manufacturing processes with the opportunity. When a buyer creates a new opportunity, they must specify whether that opportunity should be posted publicly on the America's VOICe marketplace or emailed privately to a set of suppliers selected specifically by the buyer. In addition to notifying suppliers within the system of matched opportunities, the system also emails the matched suppliers to let them know an opportunity is suggested to them. Thus, communication between buyer and supplier could happen in near real time.
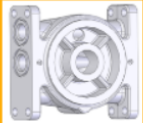
After creating a company vPage (profile) in VizSpace, the company has access to an Opportunity Center (**Figure 8**) that acts as a base of operations from which they can check on suggested opportunities, search for new opportunities, create bids, or review their outstanding bids. As buyers, they can create solicitations, review received bids, and award/decline opportunities.

Figure 6: Opportunity Center

The America's VOICe opportunity search engine allows users to perform either a broad or narrow search according to a number of filtering mechanisms, including: posting date, response date, source, buyer, required certifications, required capabilities, or required materials. Suppliers can save their searches to run repeatedly at any time. For each opportunity, the system displays in the search results screen a **Match %** between the supplier's capabilities and the opportunity's requirement.

Speed of communication proved to be a major advantage to the e-sourcing solution. Suppliers can submit questions to the buyer about the opportunity and receive answers in near real time. One avenue of communication is a discussion forum, so that questions posted by one supplier and their accompanying answers could be seen by other suppliers as well. The system notifies suggested suppliers via email when a buyer updates an opportunity, letting them know which fields have been updated.

When the supplier is interested in bidding on an opportunity, they create the bid in the system, and the buyer is immediately notified via email that a bid has been submitted. A bid comparison matrix allows buyers to compare bids across lines, including lead times, discounts, and freight costs, and this matrix can be exported to Excel. Once the response date has passed, the buyer can award the opportunity to one or more suppliers, according to how they defined the opportunity (i.e. accepting partial bids or not). All bidding suppliers are notified of their bid status (awarded or declined). Bid award history is a feature available for all suppliers in America's VOICe, and an opportunity analysis feature allows buyers to view totals for awarded opportunities and filter based on whether opportunities received bids or not.

4.2.1 Additional Features

- Content access permissions can be set both generally and also per app and per user group. For example, an entity that requires privacy might set permissions so that only registered members of their company can view the content. User groups are customizable by the company's VizSpace admin.

- The America's VOICe platform automatically translates 2D and 3D files (any CAD format) to a neutral format. For most 2D and 3D file formats, users can open a free viewer included in VizSpace that allows visual manipulation of the file.

- A news feed feature allows buyers to be proactively notified of new suppliers, changes to suppliers' capabilities, and special offers, in effect enabling DoD buyers to reach a broader range of potential suppliers.

- The notification system uses email, and a consolidated notifications panel allows buyers and suppliers to keep track of transactions that require their attention, such as suggested opportunities, awarded or declined bids, incoming bids, or upcoming response dates.

- Recommendations allow users to provide public feedback for both buyers and suppliers.

- A feature for suppliers to grade opportunities for best fit, so the system can learn, and a feature for assessing Model-Based Enterprise (MBE)-level capability of suppliers (per a NIST-sponsored questionnaire) was not implemented due to priorities and project restraints, but this feature is still on the list to be added in the near feature.

4.3 Sources Sought app

The Sources Sought app evolved from VizOpps and was successfully launched in December 2012, with buyers engaging shortly thereafter.

Although Imaginestics received a number of hard-to-source parts from DoD buyers to post on their behalf, the majority of the solicitations for those parts have not been released because it is important to validate the TDPs associated with these Sources Sought requests, as Imaginestics wishes to maintain the highest quality of matches based on quality set of data. In order to validate the TDPs, Imaginestics utilized the services of experienced consultants in the

manufacturing sector that have extensive and deep DoD procurement knowledge. Each solicitation includes a status of either "complete" or "un-reviewed" to show whether the TDP and the solicitation was reviewed for completeness by an expert. This is shown in Figure 9. The objective of evaluating the TDPs was to understand how many TDPs were complete and whether there was enough data for the supplier to put a bid package together. If the TDP was complete, could the supplier actually manufacture the part based on availability of the raw materials in the market? If the TDP was incomplete, could the supplier reverse engineer the part and in what timeframe? Unfortunately this process of utilizing the consultant to evaluate the parts was expensive and manual, thus the low number of parts actually posted in America's VOICe.

Figure 7: Opportunity with Complete TDP

To meet the needs of the DoD buyers and fulfill the requirements of the hard-to-source parts in a timely manner, Imaginestics proposed an approach to automate the validation process.

4.3.1 Source Approval Process for Air Force / DSCC / Marine Corp. Figure 10 illustrates the source approval process used for Air Force, DSCC, and the Marine Corp. The Source Approval Request app was created to enable the SAR package to be developed semi-automatically based on the information provided in the vPage and additional user input.
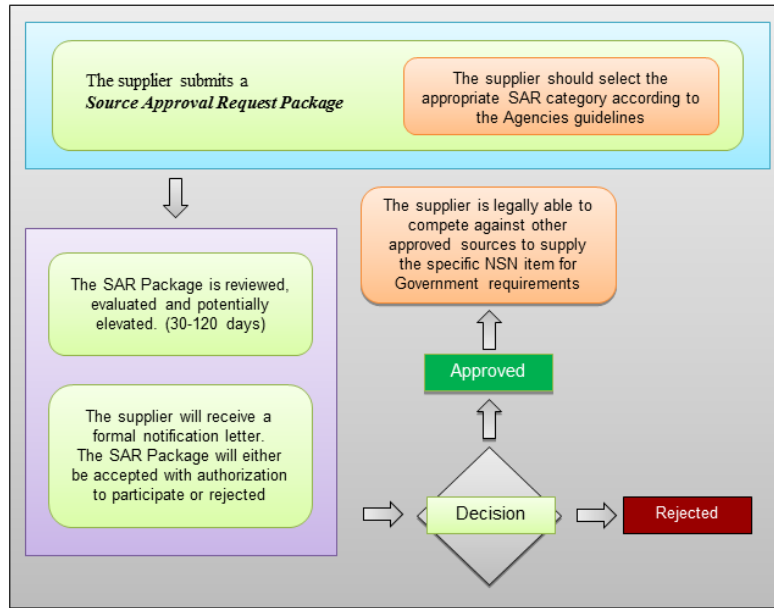
Figure 8: Source Approval Process

4.3.2 Buyer Overview. The buyer creates an opportunity when they are seeking a potential supplier that has the capabilities to manufacture a hard-to-source part. The following represents the steps the buyer takes to create a sources sought solicitation, and it is also illustrated in **Figure 11**.
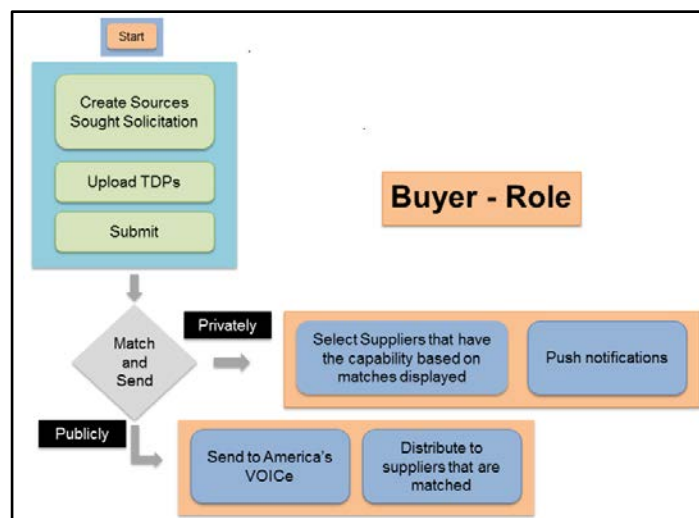
Figure 9: Buyer Role

1. Set up the app.
   a. Before creating any solicitations, the buyer sets up the categories of responses they will accept (for example, New Manufacture, Similar Part, FAA-Approved)

and what types of documents that should be included in the SAR package for each category. This was important, as each service and department has a different set of requirements for SAR packages.

2. Create a Sources Sought Opportunity.
    a. The buyer enters the opportunity header information including: Title, Description, Office, Location, Shipping Address, Response Date, and Award Date.
    b. The opportunity can either be published publicly to their ecosystem or it can be sent to selected suppliers only.
   c. The buyer enters information for each line, including Part Number, NSN, and description.
3. Add any associated files such as an image, drawing or 3D model.
4. Specify required codes (NAICS, Classification and Set-Aside) and/or certifications. This criteria will be used to match the opportunity to suppliers that have those specific capabilities
5. Add information that will let the supplier know how to submit their Source Approval Request package:
    a. Select which category or categories will be accepted as the supplier's response (i.e. New Manufacture, Similar Part, Same Part, etc.)
    b. *Recently added feature:* Enter any *MIL-SPECs* required to manufacture the part requested, illustrated in **Figure 12**.
    c. Evaluate the Technical Data Package and provide a TDP quality rating (Figure 13) based on the criteria stated earlier in the report

Opportunity Lines

Type	Category	Item Name/Part Number	NSN	Quantity	MIL-SPECS	Services	Description/ Remarks
Product	Aircraft Prime Moving Gas Turbines and Jet Engines and Components	6870409	2840004118852	35 each	MIL-I-46058, MIL-P-23377, MIL-C-83286, MIL-P-8585	Casting, Fabrication, Molding, Welding, Inspection and Testing, Surface Treating	Requirement Projections: (FY13- QTY 19) (FY14-QTY 5) (FY15-QTY 11)

Figure 10: MIL-Spec requirements

Technical Data Package Rating

Give the technical data package a rating (where 1 is low quality) to let your suppliers know the quality or completeness of the technical data, and enter a description to give more information on the package's quality.

Rating: ○1 ○2 ◉3 ○4 ○5

Description:
```
Tech Data Package description

* Drawings available
* Drawing is readable
* Detail part drawing available
* Process drawing available
* Process drawing available
* Assembly Drawing is missing
* Material Spec is missing
* Loft data is available

This is Export Controlled and may contain information
subject to the International Traffic in Arms Regulations.
```

Figure 11: TDP Rating

6. Suggest the opportunity to appropriate suppliers using both automated matches from VizSpace as well as any manual criteria they wish.
7. Receive notification of submitted SAR packages from suppliers. The buyer can download these directly from the VizSpace system.

4.3.3 Supplier Overview

The supplier responds to an opportunity for Sources Sought within their company vPage. The supplier's Sources Sought process is shown in **Figure 14**:
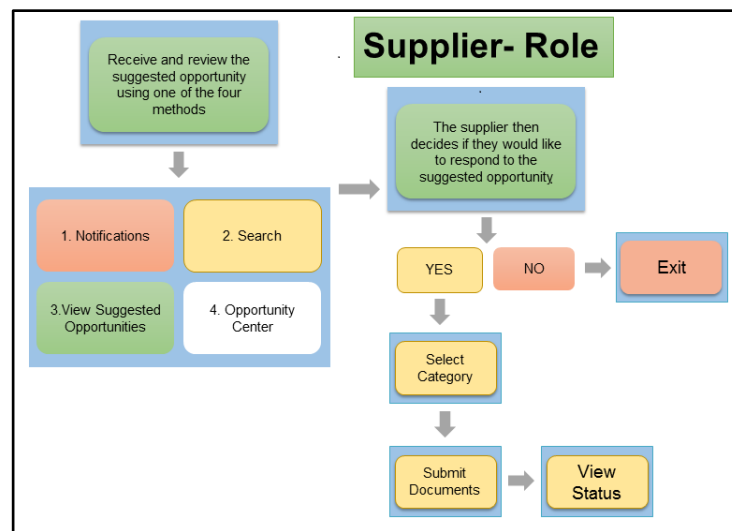
Figure 12: Supplier Role

1. Receive and view a suggested opportunity.
2. Evaluate the solicitation
   a. Technical Data Package Rating
   b. Associated files (TDP)
   c. Assessment of the Gap Analysis (**Figure 15**)
      Assemble a response package, according to the category of response and the documents required by the buyer for that category.

      For each document, the supplier can choose to submit electronically through VizSpace or by mail.

Figure 13: Gap Analysis

4.4 Manufacturer's Capability Modeling

Performing accurate solicitation matching to suppliers' capabilities and product offerings requires sophisticated manufacturing capability modeling. Despite the development of myriad models with varying levels of complexity, there was no single, universally accepted model yet developed. America's VOICe utilized a hybrid ontology by leveraging the work of Imaginestics' technology partner, XSB, Inc. XSB has developed the largest standardized database of parts in the military supply chain, using United Nations Standard Products and Services Code® (UNSPSC) and the North Atlantic Treaty Organization (NATO) Cataloging System, as well as to XSB's material and manufacturing process ontologies, to classify parts and determine their critical properties. By using standardized information in the database about parts vendors have supplied in the past, XSB was able to profile vendor capabilities. This allowed America's VOICe to pair the right suppliers with the right parts at the right time.

Imaginestics, with the help of Texas State University, further augmented VizSpace's ontology framework for America's VOICe by developing Manufacturing Service Description Language (MSDL), a service-oriented approach used for modeling a manufacturing system as standardized units of capacity and capability known as manufacturing services. Formal ontologies are well-positioned for addressing capability modeling in America's VOICe for several reasons. First and foremost, a formal ontology with explicit semantics enabled automated reasoning and inference by software agents. Therefore, suppliers can be supported by distributed intelligence automation. Furthermore, a formal ontology reduces the ambiguities in representing data semantics by reconciling different, often contradicting, viewpoints in the definition of manufacturing terms and concepts in an environment populated by heterogeneous actors, particularly in distributed scenarios.

The approach used for accurate and comprehensive representation of manufacturing capability was to decompose the capability model into five levels of abstraction, namely, the supplier-level, shop-level, machine-level, device-level, and process-level. This allowed the system to organize industrial base participants based upon their manufacturing capabilities to effectively provide matched opportunities. The supplier-level capability model dealt with the capabilities of the supplier. For example, expertise, skills, industry focus, product focus, and certifications were among the features of supplier-level capabilities.

5.0 TECHNOLOGY DEVELOPMENT

5.1 Successes

- Successfully launched America's VOICe, an online marketplace and six privately branded communities that connect manufacturing supplier capabilities to DoD opportunities based on visual/shape characteristics of parts or NSNs that they produce/have produced in the past.
- Successfully launched America's VOICe mobile app in iTunes, the first DoD opportunities match making App, and had over 214 downloads within the past 8 months. The month of September 2013 saw more than 30 downloads, and this has been trending upwards as awareness for this mobile App grows.
- Successfully mined over 2 million NSNs that DoD procured over the past 10 years and mapped the manufacturing capabilities, so they could be matched to the capabilities of suppliers in America's VOICe and immediately alert them of opportunities.
- Successfully mined over 400,000 supplier CAGE codes to identify manufacturing capabilities they registered and related capabilities that they may not have indicated and alert them of opportunities that they may have missed and/or not have otherwise found.
- Developed screen scraper for FedBizOpps to download opportunities nightly and then filter based on manufacturing-specific opportunities.
- Obtained WebFLIS data to mine NSN history, to provide suppliers advanced analytics.
- Applied social network principles to communicate and connect suppliers, buyers, news, updates and product releases. America's VOICe's powerful suggestion capability allows manufacturers to identify other suppliers with complementary services or products. This led to suppliers jointly bidding on DoD opportunities that otherwise they could not consider.
- Created a "Tack" feature to allow companies to favorite products/services. Furthermore created a "Follow" feature that allows suppliers to receive updates when the followed company has added new products, services, announcements, etc. This allows manufacturers to identify suppliers they may wish to partner or make purchases from in the future.
- Generated advertisement revenue from ads in America's VOICe, as it allowed suppliers to promote their products and capabilities.
- Successfully developed metrics to monitor page views and user behavior to increase user engagement. It was noted that suppliers who had over 80% profile completion score in America's VOICe, had higher number of awards
- Developed a Source Approval Request (SAR) process app to enable manufacturers to go through the formal process to become a DoD-approved supplier for a given part.
- Developed a percentage match score to show suppliers how close the opportunities matched to their capabilities, so the supplier can make an informed decision to bid.
- Since "good quality" Tech Data Packages has been a key concern voiced by suppliers, Imaginestics developed a quick visual to give them visibility into the

completeness of the TDP, special processes, requirements, materials, MIL-SPECs etc. that can aid in helping suppliers make the decision whether to put a SAR package together or not.

- As discovered, each buying DoD agency has their own specific requirements for SAR packages, thereby making the approval process a cumbersome experience for suppliers contemplating doing business with the government. Therefore, a semi-automated template that guides the supplier through the checklist as they create a SAR package, without burdening them with the nuances of each buying DoD agency requirements greatly alleviated frustration and allowed suppliers to put the SAR package in front of the buyer. According to statistics compiled by Imaginestics, almost 93% of suppliers launching the Sources Sought app have incomplete SAR packages.

- Most suppliers that are not familiar with doing business with the DoD do not understand or conduct historical analysis for a given NSN. This information is often vital to gain insight into any nuances pertaining to the part requirements, the number of competitors and the quantities purchased by the DoD in the past. This information could help the suppliers make the investment decision with respect to tooling or initial prototype cost, if reverse engineering were required due to unavailability of drawing. Imaginestics provided the supplier with information regarding manufacturing processes required for highly engineered parts.

- Suppliers are constantly bombarded by various sites requesting information from them. Most suppliers have filled out at least 10 – 15 company profiles on various websites that claim that they can connect them to government opportunities. Therefore, suppliers are jaded and fill out the basic information when asked and have indicated to Imaginestics that they have tried these websites, only to be disappointed. Therefore, intelligently collecting information from the suppliers of their past performance from their websites, SBA (SAM) and WebFLIS allowed us to pre-populate their profile and guide them to accept or correct the information during sign-in, as this would go a long way in matching more accurate and relevant opportunities. This helped instill more confidence in the matches received from America's VOICe and the need to have a more complete profile. Supplier registration completion jumped by almost 20%.

- During a survey conducted during a SAR workshop, a majority of suppliers indicated that they just do not have enough time in the day, nor the proper resources or expertise to respond to the items requested in the SAR packages. Although guiding them through a checklist and a semi-automated approach is helpful, some suppliers indicated that additional guidance from a consultant would be helpful. Therefore, Imaginestics created a recommendation algorithm to match consultants to opportunities presented to the supplier and display them as suggested consultants.

- Imaginestics successfully integrated a modeling and simulation app developed by Purdue University's Manufacturing HUB, called the Manifold Flow Predictor. This was made available through the VizSpace app store to all America's VOICe members.

- Enabled an opportunity for consultants to the DoD community to be involved in providing their services to suppliers to help put the SAR packages together;

however, in order to gain credibility, the consultants are asked to help review and rate the TDPs associated with the solicitations and add comments. This also allows suppliers to gain visibility into the knowledge that the consultant has.

- Developed a comprehensive Community report to allow community administrators to see the VizSpace activity of their members, such as completion percentages, numbers of opportunities received, and numbers of bids submitted by each member. This allowed each community to establish their goals and monitor their performance.
- Implemented a workflow for buyers and a comprehensive checklist to enter Sources Sought information, and for suppliers to respond to them by uploading source approval response packages.
- Due to increases in usage load, updated production servers to handle large volumes of indexing of graphical information in real time and provide users near instantaneous results.
- Developed a more comprehensive product catalog upload and manufacturing capabilities registration, both on the web and mobile, including:
- Developed mechanisms for suppliers to specify the services they use to manufacture a product and vice versa, specify products they manufacture to showcase their service offerings
- Developed a path for users to follow when they are creating products that are custom manufactured or one-of-a-kind vs. products that are sku-based.
- Added Equipment selection feature that allow users to add machines at their facility, which is then used to automatically add their capabilities.
- Created a way for buyer or evaluator to provide a **TDP quality rating.** (# of stars and description, or eventually a matrix). The rating is based on the following criteria.
    - o No drawings available
    - o Drawing is available but not readable
    - o Detail part drawings missing
    - o Process drawing missing (Example: Casting or Forging drawing – often referenced)
    - o Detail part drawings missing and parts list if NSN is an assembly
    - o Assembly drawing available but Component Drawings missing
    - o Material spec missing
    - o Loft data missing
- Developed a recommendation algorithm to suggest a list of **partners** to the suppliers when an opportunity is presented, based on the gap between services that are required for a given opportunity and the supplier's services **(based on conducting Gap Analysis)**

5.2 Challenges

- Imaginestics provided the requirements to DLA to obtain a DIBBS and FedBizOpps EDI feed so that Imaginestics could directly gain access to solicitations and other related data, including tracking of bids of individual suppliers. Although DLIS was aware that Imaginestics was part of the CAM initiative, the request did not receive attention. After many calls and conference

calls, it was given low priority within DLIS. Ten months later, it is still to be done.

- Since direct access to DIBBS, FedBizOpps and WebFLIS through EDI was not granted, Imaginestics had to develop several workarounds to scrape the information and collect market intelligence information to allow suppliers and buyers to be better consumers of the data. There remains information that was impossible to retrieve without this direct access, such as how many bids suppliers actually made.

- A majority of buyers chose to send sources sought requirements directly to us and chose not to upload it into their own DoD-agency VizSpace, which required us to develop a tool to then automatically upload the data into their VizSpace.

- An additional challenge with the buyers was that they did not regularly check their messages. The key to social network type of forum is hyper/instant communication, which many buyers seemed to be unfamiliar with and may not have been frequent Internet or social network users. However, the more "internet-savvy" engineers within DoD were active and found America's VOICe very easy to use.

- Although Imaginestics has several sets of technologies developed over the years to crawl the content of the TDP, it was important to develop a score card for rating the basics as highlighted earlier. Due to scope of CAM and lack of resources and funds to develop a comprehensive rule set to aid both the buyer and the supplier on the granularity of SAR requirements, these tasks are yet to be completed.

- Due to data rights associated with TDPs, it was difficult to access certain TDPs for the solicitations posted, which frustrated suppliers. For the TDPs that were owned by the OEMs, no drawing was associated with the solicitation; however, the supplier could reverse engineer the part if they chose. But this was not clearly stated when the solicitation were posted. In certain instances, limited data rights were granted, so the supplier was given the assembly file, but no dimensional or component details. It was impossible for the data to use this limited data for bidding.

6.0 CONCLUSIONS

Defense procurement is an immense challenge like no other, encompassing the entire gamut of goods and services from the highly technical to the very mundane. Add to that the important yet complex FAR requirements and security systems that ensure equity and data safety in such a wide-ranging system, and it comes as no surprise that both the mountain of opportunities combined with the web of requirements seems virtually impenetrable to the small- or medium-sized manufacturer. It can feel at times to them that the system is rigged against them in favor of the big guys with the time, money, and connections to get the job.

Technology can alleviate these difficulties to a degree. The CAM initiative takes a first step in this direction by seeking to tailor offerings to suppliers, easing the way to finding information, and bringing the voice of the small shop into the process. As Imaginestics' answer to the requirements of CAM, the development of America's VOICe has been both a challenge and a revelation.

In developing the America's VOICe marketplace, Imaginestics has been able to realize some long-held goals in connecting suppliers to buyers through technological means. Algorithms for matching requirements to capabilities have been improved to a significant degree, also improving the ability to provide recommendations for partners and consultants to bring business to a second tier of businesses that support manufacturing and defense – everything from manufacturing consultants to marketers and insurance providers and designers.

During the period of performance, additive manufacturing took center stage in the national conversation as well as in the defense manufacturing sector. Imaginestics has been pleased to be able to support and encourage the growth of additive manufacturing within VizSpace and America's VOICe by supporting NAMII and making additive manufacturing capabilities, equipment, and materials part of the America's VOICe ontology.

The growth in the VizSpace platform forms a foundation for future development that will create the one-stop shop for defense procurement information that suppliers need in order to navigate a complex system.

During the CAM performance period, 467 new suppliers that joined America's VOICe had never done business with DoD. The utilization of the VizSpace platform to meet the CAM solicitation objective showed that a social network based platform does work to create awareness of DoD solicitations and help engage new suppliers from the existing US industrial base, using the limited funding that was available in the project. Furthermore, by leveraging the existing communities (there were 8 across the US) to create outreach, these locally active organization had access to more tools, a larger industrial base, and it also pooled the local funds towards the CAM initiative. Certain associations that did not have stronger relationships with their existing members floundered, and perhaps their objectives were not well aligned with the CAM objective. The lessons learned from this allowed Imaginestics to identify the patterns amongst the organizations that succeed and the ones that fail in this online community model.

America's VOICe automatically extracted opportunities on a nightly basis from FedBizOpps and matched suppliers that were registered and pushed the matched opportunity notifications to their inbox or their mobile devices. This approach coupled with community outreach activities, training, webinars and workshops, resulted in 43 companies receiving awards totaling 1,443

contracts valued $40,666,543.88. In this, there were 6 new companies that won awards that had never done business with the DoD.

Although this matching approach proved successful to connect suppliers to posted opportunities, the anticipated involvement of DoD buyers to directly post RFQs was a failure, as the buyers showed very little motivation. Furthermore, there seemed to be more barriers to enabling seamless integration to existing DoD systems.

Due to road blocks posed by DoD buyers to post RFQs directly in America's VOICe, Imaginestics approached the DoD buyers from the standpoint of helping them with their Source Approval Request (SAR) process to identify suppliers for parts on their "hard to source" list. The DoD buyers were receptive to this, so Imaginestics received 3,347 Sources Sought Opportunities. However, due to the poor quality of the TDPs associated with these NSNs, Imaginestics had to deploy semi-automated process to score and qualify the TDPs to help educate the suppliers, so it wouldn't lead to frustrated supplier community. This led to 117 SAR packages being initiated, but only 18 completed, leading to 5 suppliers being approved. During the period from June – September, 2013, due to government sequestration/furloughs and shut down, it was difficult to reach DoD personnel, which also led to the low level of conversion of the initiated SAR packages to completion.

There were several technology breakthroughs achieved in America's VOICe, which fundamentally changed the negative attitude of suppliers towards bid match portals. By employing intelligence into past performance, Imaginestics was able to present new users with information on their capabilities and products. This immediately engaged the user and elevated the quality of information they provided subsequently to improve their VizSpace profile to enable better matches. There were several other notable technology achievements made during this period, so the CAM initiative was important to Imaginestics to help further its own technology and in the process help the DoD and the industrial base realize the benefits.

7.0 RECOMMENDATIONS

The goal for CAM to increase the supplier base doing business with the DoD using a social network approach was met by America's VOICe. Along the way, Imaginestics learned how to improve the initial proposed approach and how to scale the network to reach the overall goal of active participation of more than 25% US suppliers, as opposed to the current 10%. America's VOICe showed that, by deploying state-of-the-art technologies and a hands-on approach using onboarders (or existing trusted local sources), this goal can be met. More importantly, the platform can be self-sustaining within 2 years and reach active participation of 25% of the nearly 380,000 US suppliers. This would translate to savings of almost 20% to the DoD for the overall part procurement. This estimate is derived from the savings generated on the 1,443 DoD awards made to America's VOICe suppliers as compared to DoD historical purchases for those items.

Imaginestics' recommendation to DoD is to continue to support this very important CAM effort, which would allow Imaginestics to scale America's VOICe, as suppliers are quickly beginning to develop trust and also build a daily relationship with it. This is an important step to an upward trend and quick adoption amongst the supplier base.

However, real and significant growth can only happen with the active and vocal support from DoD. Together with DoD, Imaginestics can achieve the success desired must faster. Beyond the financial, support from the DoD would mean encouragement of DoD engineers and buyers to actively use America's VOICe themselves to research products and suppliers and to enter opportunities directly. DoD presence at training and information sessions would dramatically increase the trust and interest of suppliers in the system.

Imaginestics' plan is to continue hosting America's VOICe with its own funds. However, the continued development needed to improve the matching with more market intelligence, automating the completion of the SAR package for suppliers, etc. will need to be balanced amongst several other projects as Imaginestics has limited resources and funds. Imaginestics is committed to America's VOICe and will continue to keep the onboarders and existing development partners engaged, but without funds Imaginestics will lose their support. Imaginestics recently participated in the American Manufacturing Technology Showcase on October 23rd in Dayton, OH along with Imaginestics' onboarder Dayton Defense, where there were over 1,000 manufacturers. America's VOICe was center stage and Imaginestics' presentation was well-attended and enthusiastically received. Another similar upcoming event planned is in Toledo, OH on November 7th.

Imaginestics' goal, as stated in the proposal, is to make America's VOICe self-sustaining within 3 years with DoD support, but that effort will be prolonged and at risk without additional funding.