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Small Business Innovation Research(SBIR) Program - Proposal Cover Sheet

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SBIR Phase I Proposal

Proposal Number: F244-0001-0109
Proposal Title: INTERACTIVE KNOWLEDGE GRAPHS FOR SITUATIONAL AWARENESS

Agency Information

Agency Name: USAF
Command: AFMC
Topic Number: AF244-0001

Firm Information

Firm Name: Anautics, Inc
Address: 17 NW 6th Street, Oklahoma City, OK 73102-6001
Website: https://www.anautics.com
UEI: YSC7Q9EN6JD5
DUNS: 024384633
CAGE: 1V9F9
SBA SBC Identification Number: 000089554

Firm Certificate

OFFEROR CERTIFIES THAT:

- | | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 1. It has no more than 500 employees, including the employees of its affiliates. | YES |
| 2. Number of employees including all affiliates (average for preceding 12 months) | 45 |
| 3. The business concern meets the ownership and control requirements set forth in 13 C.F.R. Section 121.702. | YES |
| 4. Verify that your firm has registered in the SBAS Company Registry at www.sbir.gov by providing the SBC Control ID# and uploading the registration confirmation PDF: | SBC_000089554 |

Supporting Documentation:

- [SBC_000089554 \(3\).pdf](#)

5. It has more than 50% owned by a <u>single</u> Venture Capital Owned Company (VCOC), hedge fund, or private equity firm	NO
6. It has more than 50% owned by <u>multiple</u> business concerns that are VOCs, hedge funds, or private equity firms?	NO
7. The birth certificates, naturalization papers, or passports show that any individuals it relies upon to meet the eligibility requirements are U.S. citizens or permanent resident aliens in the United States.	YES
8. Is 50% or more of your firm owned or managed by a corporate entity?	NO
9. Is your firm affiliated as set forth in 13 CFR Section 121.103?	NO
10. It has met the performance benchmarks as listed by the SBA on their website as eligible to participate	YES
11. Firms PI, CO, or owner, a faculty member or student of an institution of higher education	NO
12. The offeror qualifies as a: <div><input type="checkbox"/> Socially and economically disadvantaged SBC <input type="checkbox"/> Women-owned SBC <input type="checkbox"/> HUBZone-owned SBC <input type="checkbox"/> Veteran-owned SBC <input type="checkbox"/> Service Disabled Veteran-owned SBC <input checked="" type="checkbox"/> None Listed</div>	
13. Race of the offeror: <div><input type="checkbox"/> American Indian or Alaska Native <input type="checkbox"/> Native Hawaiian or Other Pacific Islander <input type="checkbox"/> Asian <input checked="" type="checkbox"/> White <input type="checkbox"/> Black or African American <input type="checkbox"/> Do not wish to Provide</div>	
14. Ethnicity of the offeror:	NON-HISPANIC
15. It is a corporation that has some unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have not been exhausted or have not lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability:	FALSE
16. Firm been convicted of a fraud-related crime involving SBIR and/or STTR funds or found civilly liable for a fraud-related violation involving federal funds:	NO
17. Firms Principal Investigator (PI) or Corporate Official (CO), or owner been convicted of a fraud-related crime involving SBIR and/or STTR funds or found civilly liable for a fraud-related violation involving federal funds:	NO

Signature:				
Printed Name	Signature	Title	Business Name	Date
Mike Johnson	Mike Johnson	CEO	Anautics, Inc	05/17/2024

Audit Information

Summary:

Has your Firm ever had a DCAA review?	YES
Last Audit Date: 11/02/2018	
Was your accounting system approved by the auditing agency?	YES
Last Update Date: 01/01/2006	
Was a rate agreement negotiated with the auditing agency?	NO
Was an overhead and/or cost audit performed?	YES
Date of Overhead Audit: 11/02/2018	
Date of Cost Audit: 11/02/2018	
Are the rates from the audit agreement used for this firms proposal?	YES

Firm Information:

Agency Firm:	DCAA Witchita Branch
Address:	215 Dean McGee Ave Oklahoma City , Oklahoma 73102
Point of Contact (POC) Name:	Walter Ordonez
POC Phone:	(571) 448-7970
POC Email:	waler.ordonez@dcaa.mil

Upload a copy of the audit information:

- [F2D_12800_Anautics_ProvisionalRateLetter2023.pdf](#)

VOL I - Proposal Summary

Summary:

Proposed Base Duration (in months):	6
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Technical Abstract:

Altair Graph Studio is a complete, dynamic, scalable and proven knowledge graph platform. However, it lacks the capabilities that would qualify it to meet the definition of a dynamic knowledge graph. Specifically, a graph that continuously evolves and adapts to new information, reflecting the changing nature of the real world, based upon a dynamic schema that allows for

immediate changes to the graph as new data becomes available and/or as a user interacts with the graph. Our objective is to extend the platform to include this capability.

Graph Studio loads knowledge graphs in memory for dynamic access, so it provides the foundation necessary to allow users to make changes to loaded knowledge graphs; that is, at run time. Based upon this foundation, the integration of Artificial Intelligence (AI) and Machine Learning (ML) will aim to close the gap in reaching the dynamic knowledge graph capabilities in support of situational awareness, pattern of life analysis, threat detection, and targeting operations in a real-time capacity. Natural Language Processing (NLP) and NLP techniques, such as named entity recognition and relationship extraction, can lay the foundation to support a machine’s understanding of the underlying graph based upon its unstructured data. In turn, ML algorithms can be leveraged to predict missing links between entities in the graph, identify and merge duplicate entities, and automatically detect and adapt the graph schema to accommodate new entity types and relationships. ML can also be used to generate interactive visualizations of the knowledge graph, highlighting important relationships or insights about the graph itself. The development of an integrated recommendation system will allow for those highlights to be based upon user changes and/or personalized for individual users based upon interests and past behavior. Practically, a user represents another client to the platform, and we will implement change management, provenance tracking, and apply access control policies to users in different roles in these cases.

Anticipated Benefits/Potential Commercial Applications of the Research or Development:

The anticipated benefits include highly curated knowledge graphs, more effective situational awareness, and improved accuracy of outputs from downstream applications. Commercial applications of interactive knowledge graphs include improved analysis, decision making and trust. The ability to dynamically curate knowledge graphs adds a new dimension to the current platform and increases our overall capabilities offerings. For example, dynamically changing knowledge graphs allows our customers to more easily optimize their generative AI applications that rely on high quality knowledge graphs. In addition, applications of a dynamic knowledge graph extend to include real-time decision-making, IoT data analysis, event tracking, anomaly detection, and social network analysis.

Attention:

Disclaimer: For any purpose other than to evaluate the proposal, this data except proposal cover sheets shall not be disclosed outside the Government and shall not be duplicated, used or disclosed in whole or in part, provided that if a contract is awarded to this proposer as a result of or in connection with the submission of this data, the Government shall have the right to duplicate, use or disclose the data to the extent provided in the funding agreement. This restriction does not limit the Government's right to use information contained in the data if it is obtained from another source without restriction. This restriction does not apply to routine handling of proposals for administrative purposes by Government support contractors. The data subject to this restriction is contained on the pages of the proposal listed on the line below.

Addition:

Enter the page numbers separated by a space of the pages in the proposal that are considered proprietary:
List a maximum of 8 Key Words or phrases, separated by commas, that describe the Project:

VOL I - Proposal Certification

Summary:

1. At a minimum, two thirds of the work in Phase I will be carried out by your small business as defined by [13 C.F.R Section 701-705](#). The numbers for this certification are derived from the budget template. To update these numbers, review and revise your budget data. If the minimum percentage of work numbers are not met, then a letter of explanation or written approval from the funding officer is required.
- Please note that some components will not accept any deviation from the Percentage of Work (POW) minimum requirements. Please check your component instructions regarding the POW requirements.
- | | |
|-------------------|-------|
| Firm POW | 67.3% |
| Subcontractor POW | 32.7% |
2. Is primary employment of the principal investigator with your firm as defined by [13 C.F.R Section 701-705](#)? YES
3. During the performance of the contract, the research/research and development will be performed in the United States. YES
4. During the performance of the contract, the research/research and development will be performed at the offerors facilities by the offerors employees except as otherwise indicated in the technical proposal. YES
5. Do you plan to use Federal facilities, laboratories, or equipment? NO
6. The offeror understands and shall comply with [export control regulations](#). YES
7. There will be ITAR/EAR data in this work and/or deliverables. YES
8. Has a proposal for essentially equivalent work been submitted to other US government agencies or DoD components? NO
9. Has a contract been awarded for any of the proposals listed above? NO
10. Firm will notify the Federal agency immediately if all or a portion of the work authorized and funded under this proposal is subsequently funded by another Federal agency. YES
11. Are you submitting assertions in accordance with [DFARS 252.227-7017](#) Identification and assertions use, release, or disclosure restriction? NO
12. Are you proposing research that utilizes human/animal subjects or a recombinant DNA as described in [DoDI 3216.01](#), [32 C.F.R. Section 219](#), and [National Institutes of Health Guidelines for Research Involving Recombinant DNA](#) of the solicitation: NO
13. In accordance with [Federal Acquisition Regulation 4.2105](#), at the time of proposal submission, the required certification template, "Contractor Certification Regarding Provision of Prohibited Video Surveillance and Telecommunications Services and Equipment" will be completed, signed by an authorized company official, and included in Volume V: Supporting Documents of this proposal. YES

NOTE: Failure to complete and submit the required certifications as a part of the proposal submission process may be cause for rejection of the proposal submission without evaluation.

14. Are teaming partners or subcontractors proposed?	YES
15. Are you proposing to use foreign nationals as defined in 22 CFR 120.16 for work under the proposed effort?	NO
16. What percentage of the principal investigators total time will be on the project?	57%
17. Is the principal investigator socially/economically disadvantaged?	NO
18. Does your firm allow for the release of its contact information to Economic Development Organizations?	YES

Partners:

Partner Name	Partner Type	Point of Contact
Altair	Large Business	Coats

VOL I - Contact Information

Principal Investigator

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Corporate Official

Name: Mike Johnson

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Authorized Contract Negotiator

Name: Mrs. Angela Wilson

Phone: (405) 417-7718

Email: dee.wilson@anautics.com

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RESPONSE TO:
AF244-0001 SBIR PHASE I:
INTERACTIVE KNOWLEDGE GRAPHS
FOR SITUATIONAL AWARENESS

Anautics, Inc.

17 NW 6th Street

Oklahoma City, OK 73102-6001

November 6, 2024

This proposal contains information that shall not be disclosed outside the Federal Government and shall not be duplicated, used, or disclosed in whole or in part for any purpose other than evaluation of this proposal, unless authorized by law. The Government shall have the right to duplicate, use, or disclose the data to the extent provided in the resulting contract if award is made as a result of the submission of this proposal.

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2.0 Glossary

AFRL	Air Force Research Laboratory
AFSC	Air Force Sustainment Center
AI	Artificial Intelligence
ALC	Air Logistics Complex
API	Application Program Interfaces
AR/VR/MR	Augmented Reality/Virtual Reality/Mixed Reality
ARL	Army Research laboratory
BOM	Bill of Materials
CAGR	Compound Annual Growth Rate
CCA	Circuit Card Assembly
COTS	Commercial-Off-The-Shelf
DA	Data Analytics
DARPA	Defense Advanced Research Projects Agency
DoD	Department of Defense
ELT	Extraction, Loaded and Transformation
FEA	Finite Element Analysis
HPC	High Performance Computing
IR&D	Internal Research and Development
M&S	Modeling and Simulation
ML	Machine Learning
MPP	Massive Parallel Processing
NASA JPL	National Aeronautics & Space Administration– Jet Propulsion Laboratory
NCMS	National Center for Manufacturing Science
NDAA	National Defense Authorization Act
NIPR	Non-classified Internet Protocol (IP) Router
NIST	National Institute of Standards and Technology
NLP	Natural Language Processing
NSF	National Science Foundation
OCR	Optical Character Recognition
ODNI	Office of the Director of National Intelligence
OEM	Original Equipment Manufacturer
PaaS	Platform as a Service
PCB	Printed Circuit Board
PDM	Product Data Management
PLM	Product Lifecycle Management
POC	Point of Contact
PoP	Period of Performance



R&D	Research, Development
RDT&E	Research, Development, Test, & Evaluation
SaaS	Software as a Service
SBIR	Small Business Innovation Research
SIPR	Secret Internet Protocol Router
SOA	Software Open Architecture
SOW	Statement of Work
STTR	Small Business Technology Transfer
TITAN	Trusted Intelligence for Technology, Analytics, and Networks
TM	Technical Manual
TO	Technical Order
TPOC	Technical point of Contact
TS/SCI TK	Top Secret/ Sensitive Compartmented Information Talent Keyhole
USAF	United States Air Force
VTC	Video Tele-Conference
W3C	World Wide Web Consortium

3.0 Identification and Significance of the Problem or Opportunity

The increasing volume, velocity, and variety of big data have led to the need for efficient data processing and analysis. Knowledge Graphs enable real-time data processing, helping organizations make quick, data-driven decisions on the most up-to-date information available. With advances in NLP, there is a growing need for more sophisticated data models that can understand and process human language effectively. Knowledge Graphs play a crucial role in enhancing NLP capabilities by enabling machines to comprehend the context and relationships between words and phrases.

Of interest to the USAF are Knowledge Graphs that enable situational awareness, pattern of life analysis, threat detection, and targeting operations that will allow for user modifications to a dynamic knowledge graph and predict additional necessary changes to the graph based on the user's input. Dynamic knowledge graphs are well-suited to these applications due to the changing nature of an operational environment. Previous AFRL/RI research has shown the added value to analysts in capabilities that allow a user to interact with stored data, especially when the data was structured and stored by ML and AI based capabilities. AI/ML approaches for identifying, structuring, and storing data are not 100% trusted by analysts, so there is a requirement to enable the analyst to make corrections to the data as needed and manually add additional data. Currently, these modifications are all entered by manual methods and are not utilized to further improve the overall data store and analysis capability, making it a time-consuming task that will not be feasible



in a time-constrained environment, such as a peer fight. Existing approaches for interacting with a knowledge graph have focused on visualization techniques and query mechanisms, but additional user interaction is required for such graphs to be useful and trusted by users in USAF applications, especially when time of the essence.

Knowledge Graphs capture information about entities and the relationships between those entities, represented as nodes and edges within a graph. Entities can be comprised of objects, events, situations, or concepts. Knowledge Graphs are typically constructed from various data sources with diverse types of data, creating a shared model and context for formerly disparate pieces of data. As such, Knowledge Graphs provide a rich source of information, enabling capabilities like question and answering systems, information retrieval, and intelligent reasoning.

4.0 Phase I Technical Objectives

The Anautics Team will explore techniques that allow a user to interact with a dynamic knowledge graph by making changes and additions to the knowledge graph, and then utilize that user input to suggest additional updates to surrounding nodes/edges in the graph. This will be accomplished through detailed reviews of available literature and then determinations made on where in Graph Studio we can apply these modifications to address the topic author's request. Specifically, we will execute the feasibility study to address the below Technical Objectives and have identified the key results for accomplishment through the project. Ultimately, we will develop an initial prototype design and document all work completed in this feasibility study for submission to our Final Report.

Technical Objective 1: Leverage Natural Language Processing (NLP) techniques to enhance the construction and refinement of knowledge graphs	
Key Results: NLP techniques, like named entity recognition, and relationship extraction can automatically extract entities and relationships from unstructured text data to support a machine’s understanding of the underlying knowledge graph and its data.	6 Months
Key Results: Text mining algorithms can analyze large volumes of text data to identify relevant information and extract knowledge as a basis for recommending changes to the model.	
Technical Objective 2: Utilize AI/ML techniques and technologies to automate the construction, maintenance, and enhancement of knowledge graphs	
Key Results: Machine Learning algorithms can predict missing links between entities in the knowledge graph, helping to complete the knowledge base.	6 Months
Key Results: Machine Learning techniques can help identify and merge duplicate entities, ensuring data consistency and accuracy.	
Key Results: Machine Learning can be used to automatically detect and adapt the	



knowledge graph ontology to accommodate new entity types and relationships.	
Technical Objective 3: Enhance the user experience of interacting with knowledge graphs and personalize the interface based on user behavior and data insights	
<p>Key Results: Machine Learning can be used to generate interactive visualizations of the knowledge graph, highlighting important relationships and insights.</p> <p>Key Results: A recommendation system can recommend modifications based upon data or user changes and/or highlight conflicts or information gaps within the model.</p> <p>Key Results: Machine Learning can be used to personalize the user experience by recommending relevant information / modifications based upon the user's interests and past behavior.</p>	6 Months

5.0 Phase I Statement of Work

5.1 Scope

The Phase I effort will be to conduct a feasibility study to research state-of-the-art techniques for enabling a user to interact with a dynamic knowledge graph and suggest additional necessary changes to the graph in support of faster, more effective situational awareness, pattern of life analysis, threat detection, and targeting operations in time-constrained environments. Our Team will use our own unclassified datasets during the project. We intend to identify a planned prototype design that would significantly reduce the current time required to complete analytic tasks such that less time would be spent manually correcting the results of AI/ML data structuring, correlation, and storage.

The goal of the feasibility study research will be to identify techniques that target dynamic knowledge graph capability to enable AI assistance and/or machine learning algorithms to modify the model by suggesting additional updates to surrounding nodes/edges in the graph based upon user input or new data that becomes available. This may include, but is not limited to, aspects such as: updating the graph's underlying ontology/schema, inferring additional edges between nodes, highlighting conflicting information in the graph, highlighting information gaps, and suggesting additional changes to the graph because of the user's modifications.

5.2 Task Outline

Task 1: Anautics shall finalize customer requirements including the identification of candidate(s) for the TPOC use case.

Description: Finalize the set of requirements to which the project must align; identify all representative candidate(s) with related data to use as a basis for development and testing throughout the project; identify any applicable standards to be adhered to during project execution; update milestones and the work plan to align with this finalized set of inputs.



Measurable Performance Standard: All parties agree to the requirements, candidate data, standards, and alignment to milestones / work plan.

Key Results: The shared understanding of the technical goals to be achieved over the 6-month period of performance including how those technical goals align to schedule and expectations of delivery to the customer. The resulting deliverable acts as the 'north star' vision for the team to work towards achieving.

Location: Government site and/or contractor facility

Performance Period: From award through end of week two

Task 2: Anautics Shall Conduct Literature Review and Technology Assessment (Feasibility Study)

Description: Conduct a comprehensive literature review to identify relevant research and development in the field of dynamic knowledge graphs and adjacent technologies. Assess technology capabilities leveraged from related work, including decades of applied experience and proven knowledge graph technology, for fits and gaps in meeting customer requirements / overall vision.

Measurable Performance Standard: Measurable standards shall be developed specific to the technology and its assessment as part of this task within the context of dynamic knowledge graphs and the aspects mentioned above, such as highlighting conflicting information and information gaps in the graph. These goals will be used to develop objectives and relevant metrics by which the candidate technology approaches shall be measured against.

Key Results: A weighted scoring of candidate technology approaches based upon the results of the objectives and metrics developed as part of the overall technology assessment, including a recommended technology path forward for the prototype design for the dynamic knowledge graph approach.

Location: Contractor facility

Performance Period: From award through end of month six

Task 3: Anautics Shall Develop Prototype Design

Description: Design an overall dynamic knowledge graph architecture based upon the current architecture of the knowledge graph capabilities inherent within the Graph Studio product, addressing key requirements identified within Task 1 combined with the highest scoring technology approach identified within Task 2.

Measurable Performance Standard: The application of the best practices systems engineering approach shall determine how the design of the prototype architecture meets the requirements captured from stakeholders by demonstrating where and how the proposed technological approach meets those requirements.

Key Results: The prototype design for the dynamic knowledge graph, a key input into future prototype development and validation activities.

Location: Contractor facility

Performance Period: From award through end of month six

Task 4: Anautics Shall Deliver Prototype Design

Description: Package and deliver the resulting prototype design from the output of Task 3 to Gov POCs as applicable.

Measurable Performance Standard: Government review and acceptance of the delivered prototype design.

Key Results: The Government accepted prototype design for dynamic knowledge graph architecture. This provides a path forward for development and validation in a future SBIR effort.

Location: Contractor facility

Performance Period: From award through end of month six

5.3 Milestone Schedule

TASK NO.	TASK	EPECTED DELIVERY	DELIVERABLE	LOCATION
Task 1	Finalize Requirements / Standards	Award + 2 weeks	Updated Milestones/Work Plan; Complete list of requirements and standards to be used	Contractor Site/VTC
Task 2	Feasibility study	Award + 1-6 months	Intermittent status reports on progress of literature review and technology assessment	Contractor Site
Task 3	Prototype Design	Award + 6 months	Final Prototype Design	Contractor Site
Task 4	Final Report	Award + 6 months	Final Report on activities taking place during the 6-	Contractor Site

			month PoP inclusive of Task 3 information	
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5.4 Deliverables

5.4.1 General

- Updated Milestone / Workplan will be delivered within 2 weeks.
- Conduct Feasibility Study to determine best option for prototype (Months 1 – 6)
- Final Prototype Design will be delivered at the end of the PoP (6 months after award)
- Final Report will be delivered at the end of the PoP (6 months after the award)

5.5 Progress Reports

Progress reports will be provided monthly, at a minimum. These will be concise documents describing progress in meeting the project TPOCs.

5.6 Final Report with SF 298

A draft will be provided 30 calendar days after completion of the Phase I technical effort. The first page of the final report will include a single-page project summary identifying the purpose of the work, providing a brief description of the effort accomplished, and listing potential results applications. DoD may publish the summary. Therefore, it will not contain proprietary information. It will also contain project objectives met, work completed, results obtained, and technical feasibility estimate. The Report will be sent to the awarding DAF organization based on the instructions provided in an awarded contract.

5.7 Additional Reporting

In addition to the standard federal and DoD procurement certifications, the SBA SBIR Policy Directive requires collecting certain information from firms at the time of award and during the award life cycle. Anautics is aware of these additional requirements as laid out in the Lifecycle Certification Form (at the time of the Phase I award, prior to receiving 50% of the total award amount for a Phase I award, and prior to final payment on the Phase I award). We anticipate providing high level architecture process diagrams and workflows as part of our deliverable to the Customer/End-User.

6.0 Related Work

Since 2000, Anautics has been successfully executing research and development projects across the Department of Defense (DoD). Our track record of commercializing SBIRs is built upon the backbone of our digital innovation framework: the continuous discovery, framing, integration, and deployment of digital solutions, transforming the way the DoD operates. The Principal Investigator proposed on this project, Mr. Garrett W. Alderson, has been a key person involved in the Air Force Sustainment Center's (AFSC) Trusted Intelligence for Technology, Analytics, and Networks (TITAN) program.

One such initiative under TITAN is Materiel Insights, a system of engagement designed to bring together data within context to equip users to meet their daily mission(s) through data-driven decision-making. A key foundational capability for Materiel Insights is the underlying data fabric architecture which serves up the data in a way that is necessary for the system to deliver on this vision.

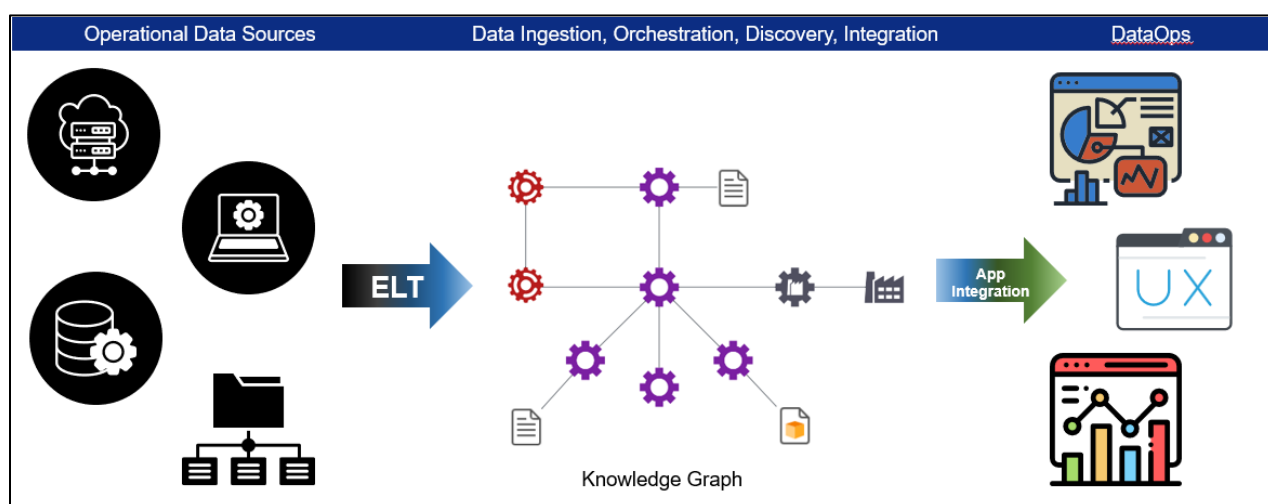


Figure 1. Conceptual Data Fabric Architecture

As pictured above, a vital component of the data fabric architecture is a knowledge graph. In working the digital innovation framework from discovery through framing, the team introduced Altair's Graph Studio product to connect to source system data, conduct ELT through the in-memory MPP graph database (providing a high-performance, large-scale knowledge graph), thus providing a means for RESTful API endpoint connectivity for data accessibility for Materiel Insights in addition to data visualization applications.

Structured data from a representative system of record was used in the framing of Graph Studio. This data set included part information, bills of material (BOMs), related supply chain information where those parts had OEMs responsible for manufacture and procurement, as well as service data specific to the parts that were at a serviceable level within the BOM structure, including identifiers such as serial numbers and if/where those serviceable parts were used in a higher-level serviceable

part assembly. Similarly, a related set of unstructured data (i.e., file-based data, MS Word, MS Excel, PDFs, etc.) was also ingested through Graph Studio's unstructured pipeline.

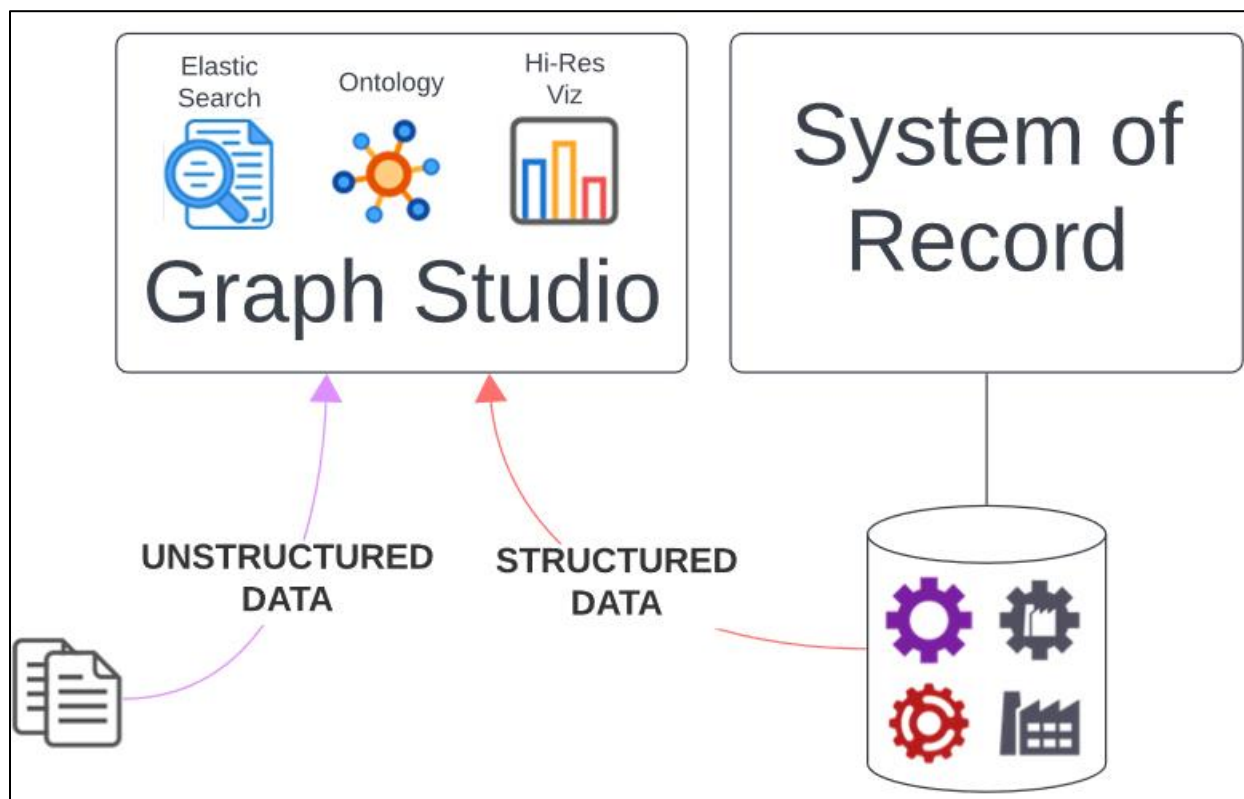


Figure 2. Framing of Graph Studio

As data was incrementally introduced, Altair's key personnel led by Mr. Samuel G. Chance (Senior Data Engineer and Technical Manager), were able to train key personnel from Anautics, including Mr. Garrett W. Alderson (Chief, Digital Services), on the metadata capture and design of the ontologies in support of populating the knowledge graph. The iterative development of data ingestion, discovery, and ontology design supported by Graph Studio provided the dynamic means to accomplish the eventual end state knowledge graph central to the success of this implementation.

The nature of the knowledge graph within Graph Studio allows for an analyst to create new nodes and edges over time as additional disparate and diverse data sets are ingested and data discovery leads to new findings on how the data connects. Data discovery is supported natively by the platform through the direct querying of data within the integrated interface. As needed, separate ontologies can be designed in isolation within their own data layers and later integrated as key data becomes available for integration across the models. Data layers are eligible to be configured for REST API connectivity through configuration within the platform.

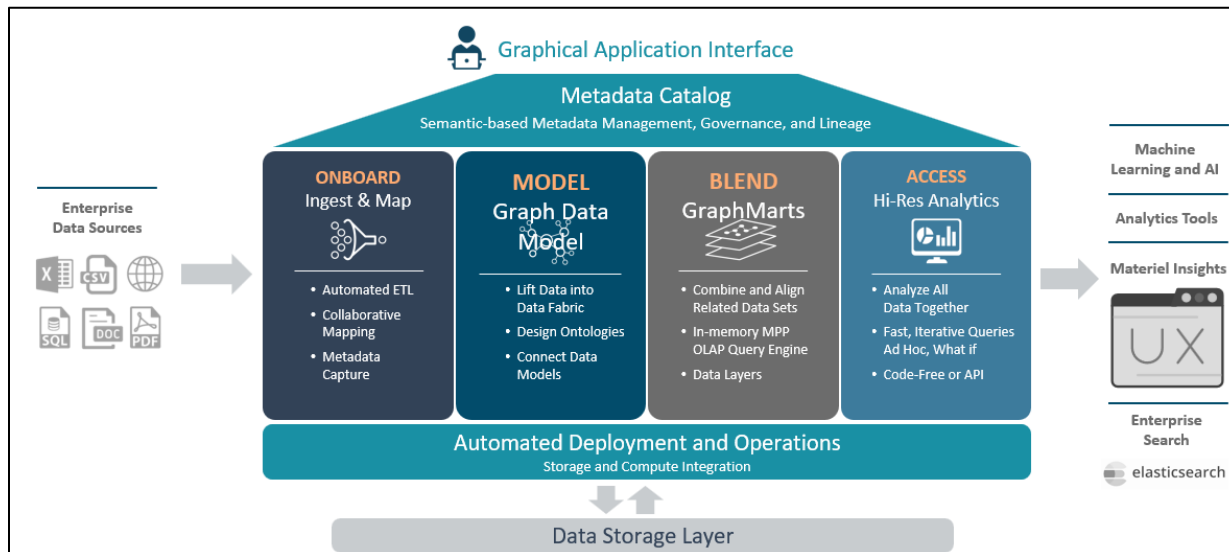


Figure 3. Graph Studio Conceptual Architecture

One additional point of interest in the framing of this technology was the ability of the Graph Studio platform's inclusion of elastic search of unstructured data within the knowledge graph. This extension of the model allowed for full text search capability across the unstructured file data and allowed for specific key indicators in the structured data set (i.e., part number) to be configured as an annotator to be searched across the text and used as a filter within the full text search results. The blending of elastic search within the context of the structured data sets allows for an analyst to continue to discover information and further refine the knowledge graph for greater value within the resulting data fabric.

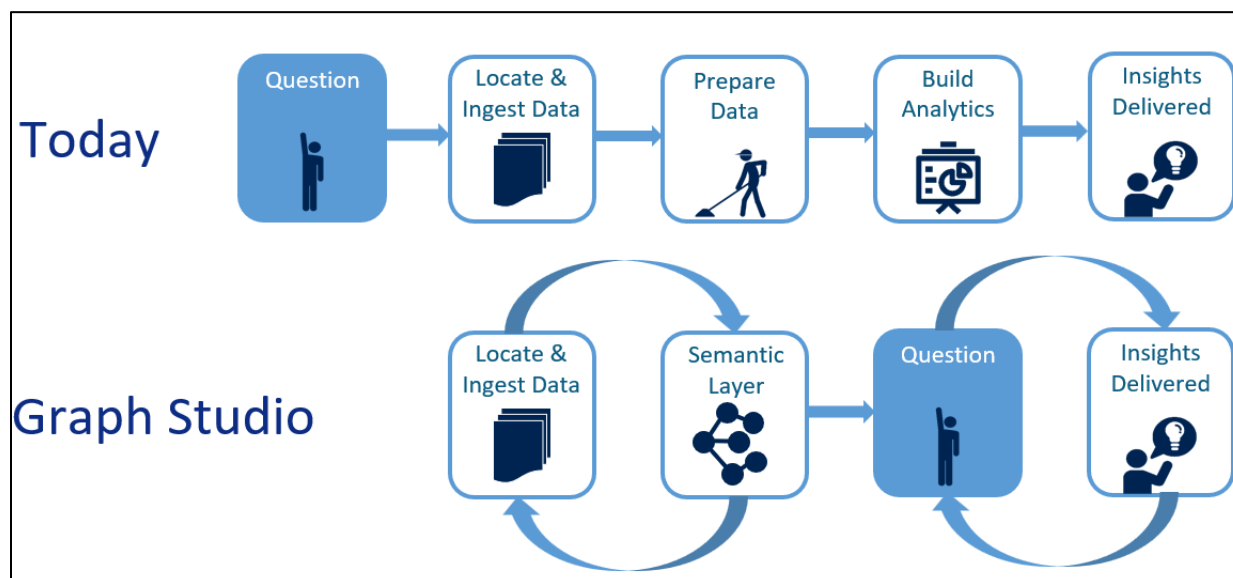


Figure 4. Data Fabric (Graph Studio) Value Proposition



The realized value proposition is depicted above. In today's work within AFSC, a data analyst initiates their work from a question proposed by Air Force leadership. They locate, ingest, and prepare data, build analytics outputs, and present the insights within a very serial process, isolating the knowledge gained through data integration and insights to the analyst themselves. If similar questions are proposed in the future, reuse of this knowledge requires the same analyst and data to be available. If not, rework cannot be avoided. With a knowledge graph in place using the Graph Studio platform, the data engineering and iterative building of the knowledge graph can be done within its own cycle, providing greater value over time and democratizing the ability for insights to be delivered more quickly.

The results of this effort were presented at a Program Management Review (PMR) event for the TITAN program on 24 October 2024 in Austin, Texas.

For additional information on the TITAN program and the presentation of this effort, please contact the Government Program Manager: Lt Joseph Way, joseph.way.7@us.af.mil.

7.0 Relationship with Future Research or Research and Development

After successful completion of the research proposed within this Phase I SOW, the Anautics team would position Altair with a design recommendation for a Phase II research and development effort targeting dynamic knowledge graph capability that extends the current knowledge graph offering of their existing Graph Studio product. The design recommendation would aim to incorporate maturing the knowledge graph to allow continuous updates and adaptation to new information in real-time as new data becomes available, ideally accomplished through the use of AI assistance and machine learning algorithms. This would directly assist users by predicting additional necessary changes to the graph based upon their input.

In general, this improved dynamic knowledge graph approach would enable use cases to include real-time decision-making, event tracking, IoT data analysis, anomaly detection, and/or social network analysis. More specifically, DoD use cases such as situational awareness, pattern of life analysis, threat detection, and targeting operations become highly feasible with this newly dynamic capability. In addition, continued integration and maturity with NLP via the Altair Copilot feature will allow this design approach to meet the growing need for sophisticated models that can understand and process human language effectively.

In turn, Anautics would be able to leverage these advancements in Altair product design within the TITAN program to bring the same real-time decision-making value to Materiel Insights, as well as other AFSC initiatives whose goal is to achieve real-time IoT data analysis within the test labs and on the shop floor, driving digital transformation across the Air Logistics Complexes (ALCs) and delivering on the Digital Depot vision. This is a direct fit of this SBIR proposal in positioning dynamic knowledge graph technology as a well-suited solution for the changing nature of the depots' operational environment. Ultimately, this would allow continuous improvement of the dynamic



knowledge graph capability to continue through considerations of how to effectively apply visualization techniques and query mechanisms to yield the highest value output from the information within the model efficiently and effectively for end users.

Phase II testing could continue with the use of non-sensitive, open data sets avoiding the need for specific clearances, certifications, or approvals.

8.0 Commercialization Strategy

8.1 Company Information

8.1.1 Company Description

Anautics architects and delivers adaptive, secure, and flexible solutions that enable digital transformation supporting both operational and analytical digital outcomes. Anautics provides a standards-based approach to data management practices and principles that work in the cloud, on-premises, and on edge devices. Enabling data visibility and insights, data access and control, and data protection and security is at the heart of everything Anautics builds.

8.1.2 Company Profile

Provide appropriate company information below:

2. Small Business Concern (SBC) Name: Anautics, Inc.
3. Address: 17 NW 6th Street, Oklahoma City, OK 73102
3. POC: Garrett W. Alderson
4. POC Email: garrett.alderon@anautics.com
5. POC Phone #: (405) 594-3965
6. UEI#: YSC7Q9EN6JD5
Cage #: 1V9F9
8. SBC Control ID#: SBC_000089554

8.1.3 Customer and Competition

This technology holds significant potential for a wide range of users, including Intelligence and Defense agencies, OEMs, and suppliers. By enabling unprecedented collaboration, it allows users to create, share, and access complex, diverse, and often isolated data sources, breaking down traditional silos that limit data utility. Across both commercial and defense sectors, there is an increasing need for solutions that empower end-users to perform data engineering and analytics independently, improving speed and flexibility.

By employing a knowledge model that adds semantic depth to intelligence data and assessments, analysts and AI working together are positioned to extract far greater value from existing information. This approach not only enables them to identify previously hidden patterns and insights but also facilitates the integration of machine learning and artificial intelligence tools,



significantly enhancing analytical precision and predictive capabilities. As a result, organizations can stay responsive to rapidly evolving operational challenges, leveraging predictive insights to anticipate and respond to shifts in the operational environment with greater agility. Through this fusion of knowledge models, advanced analytics, and self-service access, organizations can ensure that critical intelligence flows seamlessly to those who need it, enabling more informed decision-making at every level. As it relates to the TITAN program, a complex weapon system of today can be managed more efficiently, innovated more quickly, and sustained more effectively within a secure technology that reduces cost and time over competing approaches. Generally, teaming humans with AI supports digital transformation initiatives more broadly.

The graph database market includes solutions from major providers like AWS, IBM, and Microsoft, as well as specialized options from Neo4j, TigerGraph, Stardog, and GraphDB. These databases are often developer-focused, transactional, and designed to handle specific graph workloads, typically requiring significant technical expertise. Data integration and transformation tasks are commonly managed outside of the graph database itself, usually through ETL processes or pipelines. Visualization of the knowledge graph as well is typically handled by 3rd party tools like Linkurious, Bloom, Keylines, Jupiter/ Zeppelin notebooks.

In contrast, Altair Graph Studio offers an integrated platform designed to be accessible to both developers and non-technical users, such as business analysts. It provides tools that make graph data more approachable for a broader audience and is built on W3C standards like RDF, OWL, and SPARQL, ensuring compatibility and futureproofing.

Unlike many competing solutions that focus solely on graph databases or AI frameworks, Altair Graph Studio brings together diverse data sources into a unified, comprehensive knowledge graph. Its intuitive interface enables users to build and manage knowledge graphs with minimal technical background. Additionally, Graph Studio is unique in its ability to overlay and virtualize data from existing sources without requiring a full data load into a central database. With Kubernetes-based architecture, it scales dynamically to meet organizational data demands, supporting just-in-time loading and seamless data integration across the enterprise. The Anautics solution seeks to provide a unified, full-featured platform for creating, managing, and applying knowledge graphs to drive actionable insights.

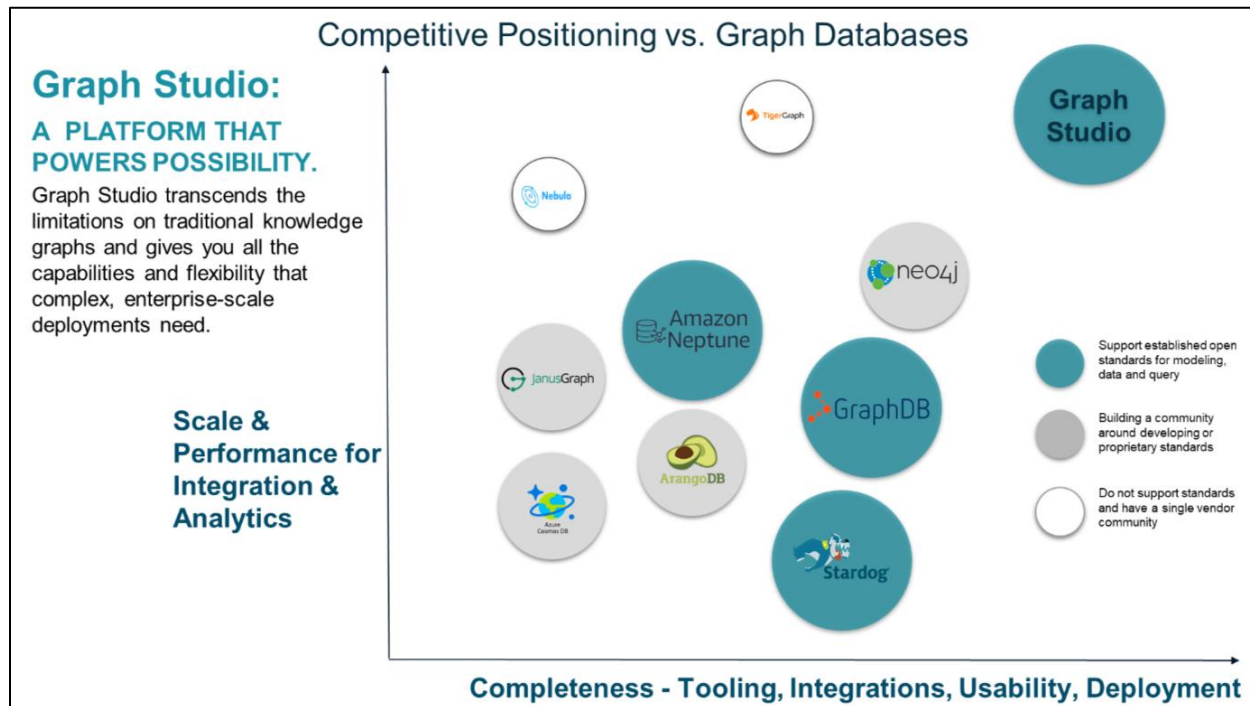


Figure 5. Graph Studio (formerly Anzo) vs Competition

8.1.4 Market

The Knowledge Graph market size was reasonably estimated at \$0.9B USD in 2023. It is anticipated to grow at a CAGR of 21.8% between 2023 to 2028 to a valuation of \$2.8B USD.

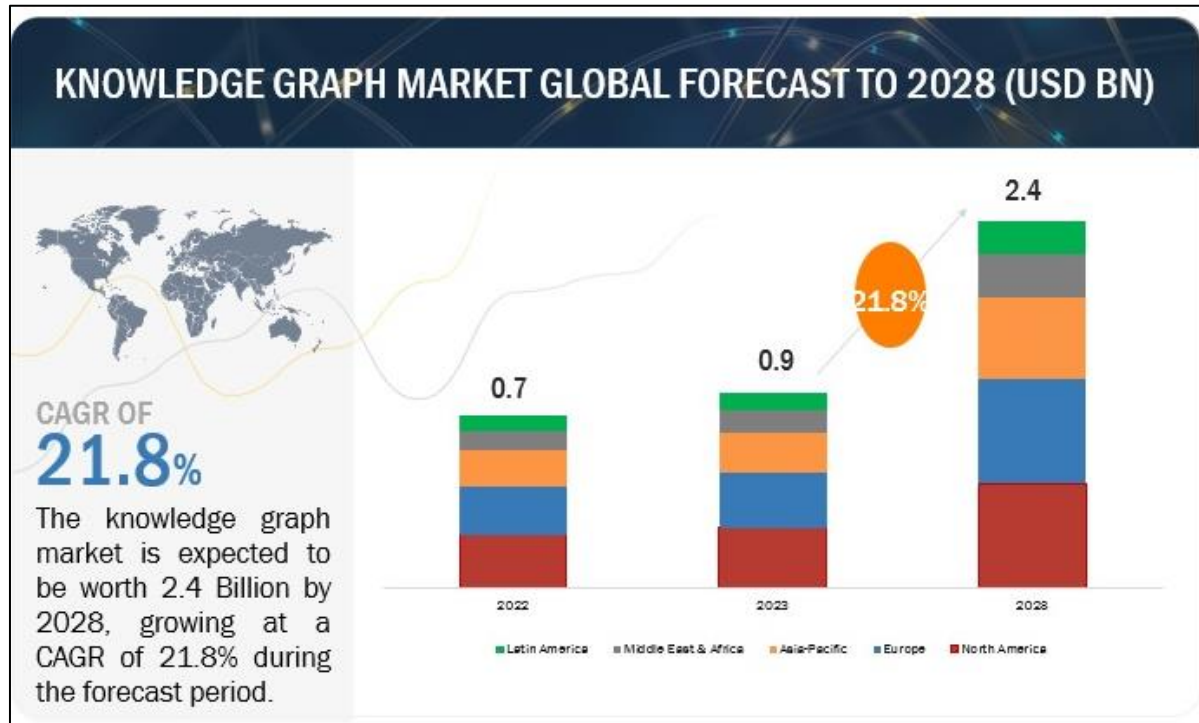


Figure 6. Global Knowledge Graph Market Size

8.1.5 Intellectual Property

Our project is novel. There are no patents registered with respect to the solution we intend to develop here. SBIR data rights that would come with an award and project completion will remain for the next 20 years based on current NDAA language.

8.1.6 Financing

Anautics' current revenues and investments, along with the funds listed in this Phase I proposal will be sufficient to successfully produce a feasibility study at the completion of the effort. Anautics has been in business for 24 years. We have self-funded IR&D solutions currently in progress. We typically budget \$440K per year for advancing R&D efforts and partner with Industry leading software providers who budget millions of dollars annually for advancing R&D efforts. We have financial relationships in place that would allow us to secure funding if deemed necessary, such as \$200M+ annual IR&D from our teaming partner, Altair Engineering Inc.



8.1.7 Assistance and Mentoring

The Anautics Team has transitioned prior SBIR/STTR efforts to Phase III contracts 8 times over the past three (3) years. Additionally, we have created relationships with mentors and consultants who hold expertise in RDT&E projects and possess a deep understanding of the past and current contracts with the DoD. Our team partners for this effort have an additional 13+ SBIR/STTR awards with a conversion rate of 100%. Our mentors/consultants have assisted small businesses, former small businesses that have transitioned to large businesses, and large business purchasers of SBIR/STTR IP and data rights transition projects to SBIR/STTR Phase III commercialized contracts throughout the DoD more than 20 times since 2018. Anautics, our teaming partners, and our consultants have marketed company capabilities to other industry entities and government organizations (Program Managers, Deputy Program Managers, TPOCs, and other personnel) in obtaining contracts for execution.

8.2 Commercialization of This Solution

The commercialization of Knowledge Graph technology will target industries leveraging data-driven decision-making, including technology companies, research institutions, government agencies, and enterprises in sectors such as healthcare, finance, and retail. By offering a unified platform for capturing and integrating diverse data sources into cohesive knowledge structures, the product will enable advanced capabilities like intelligent question-answering, personalized information retrieval, and enhanced reasoning. We will offer flexible pricing models, including subscription-based and licensing options, to cater to organizations of all sizes. Marketing efforts will focus on demonstrating the technology's ability to transform data into actionable insights through webinars, digital campaigns, and strategic partnerships with AI, ML, and data analytics firms. Continuous development and user feedback will drive product enhancements, ensuring the solution remains relevant to evolving industry needs.

Market Opportunity:

- **Target Market:** Organizations and industries involved in data analytics, AI, ML, and knowledge management, including tech companies, research institutions, and government agencies.
- **Market Size:** The global AI and data analytics market is rapidly growing, with the knowledge graph market alone projected to reach \$6.9 billion by 2025, as enterprises increasingly adopt knowledge graphs to enhance their data-driven capabilities.

Product Overview:

- **Features:** Knowledge Graphs provide a structured representation of entities (objects, events, situations, or concepts) and their interrelationships, captured as nodes and edges. They integrate data from multiple diverse sources into a unified ontology, enabling organizations to connect previously disparate pieces of information.
- **Benefits:** Knowledge Graphs enable advanced capabilities such as question answering, personalized information retrieval, and intelligent reasoning, driving insights from complex



datasets. They improve decision-making, enhance data accessibility, and allow for more accurate, context-driven AI and ML model training.

Competitive Landscape:

- **Competitors:** Major players like Google, Microsoft, and IBM offer knowledge graph solutions, but often focus on specific use cases or individual aspects of knowledge management. These solutions may include graph databases or AI frameworks but often lack the holistic integration of various data sources and the advanced reasoning capabilities of a comprehensive knowledge graph platform. This solution seeks to provide a unified, full-featured platform for creating, managing, and applying knowledge graphs to drive actionable insights.

Go-to-Market Strategy:

- **Direct Sales:** Engage with large enterprises, AI and ML-focused tech firms, and government organizations involved in data-driven research to showcase the benefits of using knowledge graphs for improved decision-making.
- **Partnerships:** Develop collaborations with tech companies, academic research institutions, and government agencies like DARPA, ARL, and AFRL to explore joint research and application of knowledge graph technology.
- **Marketing:** Utilize targeted marketing strategies, including webinars, content marketing, and participation in industry conferences, to raise awareness about the power of knowledge graphs in transforming data analytics and AI.

Revenue Model:

- **Subscription-Based Pricing:** Offer flexible pricing models, including subscription-based and usage-based structures, to cater to both large enterprises and smaller businesses.
- **Licensing:** Provide licensing options that include both one-time fees and recurring licensing for long-term enterprise clients, along with free trials to encourage initial adoption.

Customer Support and Training:

- **Training:** Provide educational resources, tutorials, and certification programs to help clients effectively implement and leverage knowledge graph technology.
- **Support:** Offer dedicated customer support teams for troubleshooting, optimization, and assistance with integrating knowledge graphs into existing data systems.

Continuous Development:

- **Feedback Loop:** Continuously enhance the platform by incorporating user feedback, technological advancements, and new market trends, ensuring the knowledge graph solution remains at the cutting edge of data analytics and AI integration.

9.0 Key Personnel

Principal Investigator: Garrett W. Alderson, Digital Lead (Enterprise Architect), US Citizen

Education:

- Purdue University, MS Computer and Information Technology, 2018
- PennWest California, BS Applied Computer Sciences, 2002

Experience:

- 2021 – Present, Chief, Digital Services. Collaborates with DoD leadership to define digital strategy and leads strategic implementation initiatives with key DoD personnel. Evaluates and selects technologies and tools that maximize delivery of value to DoD. Delivers organizational change through management and leadership of DoD contractor support services
- 2019 – 2021, Chief, Technology. Lead development, deployment, and integration of IT applications and systems across DoD customer initiatives. Led overall strategic direction of technology and platform architecture
- 2018 – 2019, Enterprise Support Manager. Established, executed, and managed global processes for internal/external communication for key customers and their issues
- 2015 – 2018, Sr. PLM Consultant. Led and participated in several digital transformation initiatives, including the design of solution architecture, integration of enterprise systems, and facilitation of customer workshops across automotive, aerospace, defense, and industrial verticals
- 2012 – 2015, IT Project Lead (PLM). Led PLM and PDM initiatives to implement, enhance, and upgrade capabilities for enterprise IT systems extending global adoption
- 2011 – 2012, Business Programmer Analyst
- 2008 – 2011, Programmer Analyst
- 2004 – 2008, Computer Programmer

Relevant Awards or Patents:

- None

Relevant Publications:

- None

Key Personnel: Samuel G. Chance, Sr. Data Engineer (Technical Manager), US Citizen

Education:

- Naval Postgraduate School, MS Information Systems Technology, 2003
- Florida A&M, BS Electronic Engineering Technology, 1995
- Pensacola Jr. College, AS Electronic Engineering Technology, 1992



Experience:

- Active TS/SCI TK (Mar 2011) with current full scope polygraph (Mar 2014)
- Completed Masters Thesis in Semantic Technologies for Military Applications, 2003
- Recognized thought leader in the fields of Semantic Web, distributed computing.
- 2016 – Present, Technical Consultant. Works closely with the Sales and Engineering teams to accurately define and communicate the value of the company's Anzo Knowledge Graph platform to the marketplace and customers, while also architecting customized solutions for their environments
- 2011 – 2015, Director, Special Programs. Established and led IR&D program. Won, led, and delivered numerous applied R&D contracts using semantic technologies for government and commercial customers. Applied Anzo knowledge graph platform in production for ELINT data portal.
- 2014 – 2016, Principal Investigator for Phase I & II SBIR called MatOnto, a semantic technology platform for distributed data publishing, discovering and consuming. The product is commercially available for advanced ontology management.
- 2008 – 2011, Chief Solutions Architect. Conceived, designed, developed semantic and geographic technology capabilities to support critical intelligence needs.
- 2008 – 2010, Lead SETA system engineer for ODNI program. Provided extensive, diversified knowledge of advanced data integration technologies, scientific principles and theories contributing to design and development of new processes, methods and concepts.
- 2006 – 2007, Senior Enterprise Architect. Provided system engineering and software development support on a DoD unstructured information management program using semantic technologies. Conceived and led a funded IR&D project that designed and prototyped a semantic technology-powered autonomic, distributed cloud "Platform as a Service" (PaaS) system.
- 2004 – 2006, Technical Director for a DoD large-scale Knowledge Systems program with an approximate annual budget of several tens of millions of dollars. Managed technical risk reduction and Technology Thrust Initiatives program including management, project plans, technical architecture, and technology selection. Proposed and won three innovative, advanced commercial software technology integration projects; conceived, designed, and led each. Two programs were (Semantic) SOA systems; the third was a Semantic Metadata Repository

Relevant Awards or Patents:

- None

Relevant Publications:

- Co-authored "Rule Languages for Interoperability Workshop" position paper for the World Wide Web Consortium (W3C)



- Co-authored “Environmental Data Exchange Network for Inland Water” Mr. Chance co-authored Chapter 15, Environmental Data: Edge Issues and the Path Forward. (<http://tinyurl.com/louzjil>)

10.0 Foreign Citizens

No foreign citizens or individuals holding dual citizenship will be involved in this project.

11.0 Facilities and Equipment

Contractor facilities planned for use in conducting the feasibility study for this project meet environmental laws and regulations of federal, state (Oklahoma, Michigan, Massachusetts, Florida, Utah and Pennsylvania), and local Governments for, but not limited to, airborne emissions, waterborne effluents, external radiation levels, outdoor noise, solid and bulk waste disposal practices, and handling and storage of toxic and hazardous materials.

12.0 Subcontractors/ Consultants

12.1 Altair Engineering Inc.

Altair is a large US business based in Troy, MI. but has a global presence. With a 25+ year successful relationship with the government community, we provide over 180+ software tools addressing multi-physics-based M&S, HPC and DA software tools to address the most complex problems. We fully embrace an agnostic, open architecture and modular philosophy that virtually eliminates vendor lock. Altair has tools being used across all the government agencies meeting stringent software security requirements for both NIPR and SIPR networks and are currently working on cloud security requirements. Our customers can push and pull tools within workflows based on their individual needs yet can fully integrate via APIs.

Our patented SaaS-like, consumption-based licensing model (Figure 7) with non-perishable units ensures affordable software applications and solution integrations all while giving access to all our tools all the time; our “All-in, Always-on” philosophy, supplying freedom, flexibility, and value.

This model allows users to access the entire Altair product portfolio, access to over 180 products by purchasing Altair Units instead of individual software application licenses. Users can share units, so they only need to buy what they use, and units are returned to the pool when not in use. This model can help organizations avoid buying licenses for every user and can also help with cost efficiency across a range of Altair products.

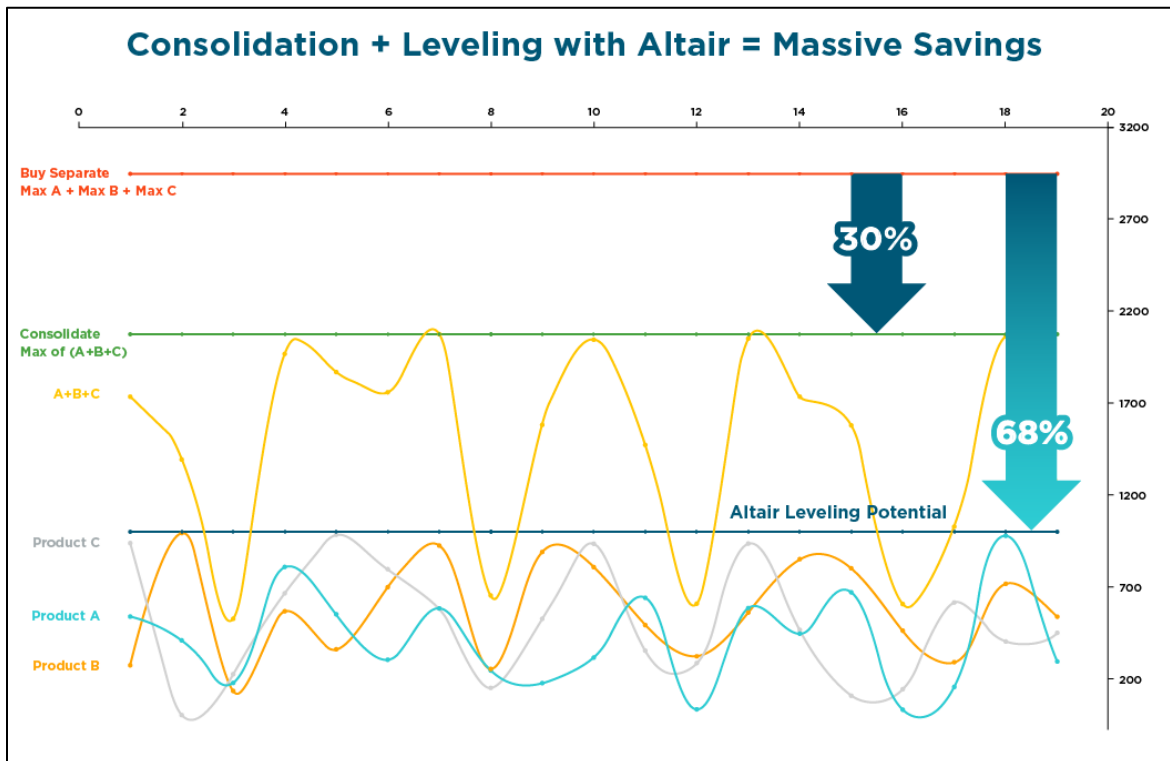


Figure 7 - Altair Licensing Model Can Save a Company as Much as 68% on software costs.

Altair's Enterprise Solutions Group is a team of solution architects, creative thinkers and software engineers that focus on providing efficiency to our customers. This includes workflow automation, enterprise integration solutions, custom applications and system integrations in engineering and data science. They provide trusted consulting services to our customers starting from inception to final solution delivery fully embracing an agile development methodology.

13.0 Prior, Current, or Pending Support of Similar Proposals or Awards

No prior, current, or pending support of similar proposals or awards has been submitted for proposed work.



SBIR Phase I Proposal

Proposal Number	F244-0001-0109
Topic Number	AF244-0001
Proposal Title	INTERACTIVE KNOWLEDGE GRAPHS FOR SITUATIONAL AWARENESS
Date Submitted	11/06/2024 09:23:26 AM

Firm Information

Firm Name	Anautics, Inc
Mail Address	17 NW 6th Street, Oklahoma City, Oklahoma, 73102
Website Address	https://www.anautics.com
UEI	YSC7Q9EN6JD5
Duns	024384633
Cage	1V9F9

Total Dollar Amount for this Proposal		\$139,996.30
	Base Year	\$139,996.30
	Year 2	\$0.00
	Technical and Business Assistance(TABA)- Base	\$0.00
	TABA- Year 2	\$0.00

Base Year Summary

Total Direct Labor (TDL)	\$87,233.30
Total Direct Material Costs (TDM)	\$0.00
Total Direct Supplies Costs (TDS)	\$0.00
Total Direct Equipment Costs (TDE)	\$0.00
Total Direct Travel Costs (TDT)	\$0.00
Total Other Direct Costs (TODC)	\$0.00
G&A (rate 0%) x Base ()	\$0.00
Total Firm Costs	\$87,233.30
Subcontractor Costs	
Total Subcontractor Costs (TSC) 1	\$42,392.90
Total Subcontractor Costs (TSC)	\$42,392.90
Cost Sharing	-\$0.00
Profit Rate (8%)	\$10,370.10
Total Estimated Cost	\$139,996.30
TABA	\$0.00

Year 2 Summary

Total Direct Labor (TDL)	\$0.00
--------------------------	--------

Total Direct Material Costs (TDM)		\$0.00
Total Direct Supplies Costs (TDS)		\$0.00
Total Direct Equipment Costs (TDE)		\$0.00
Total Direct Travel Costs (TDT)		\$0.00
Total Other Direct Costs (TODC)		\$0.00
G&A (rate 0%) x Base ()		\$0.00
Total Firm Costs		\$0.00
Subcontractor Costs		
	Total Subcontractor Costs (TSC) 1	\$0.00
Total Subcontractor Costs (TSC)		\$0.00
Cost Sharing		-\$0.00
Profit Rate (0%)		\$0.00
Total Estimated Cost		\$0.00
TABA		\$0.00

Base Year

Direct Labor Costs						
	Category / Individual-TR	Rate/Hour	Estimated Hours	Fringe Rate (%)	Fringe Cost	Cost
	Engineers, All Other/ Principal Investigator	\$226.58	385			\$87,233.30
Subtotal Direct Labor (DL)						\$87,233.30
Labor Overhead (rate 0%) x (DL)						\$0.00
Total Direct Labor (TDL)						\$87,233.30

Subcontractor Costs

Subcontractor- Sam Chance	
Sam Chance	\$42,392.90
Total Subcontractor Costs (TSC) 1	\$42,392.90
Total Subcontractor Costs (TSC1)	\$42,392.90

G&A (rate 0%) x Base ()	\$0.00
Cost Sharing	-\$0.00
Profit Rate (8%)	\$10,370.10
Total Estimated Cost	\$139,996.30
TABA	\$0.00

Year 2

Direct Labor Costs						
	Category / Individual-TR	Rate/Hour	Estimated Hours	Fringe Rate (%)	Fringe Cost	Cost
	Engineers, All Other/	\$226.83	0			\$0.00

Principal Investigator					
Subtotal Direct Labor (DL)	\$0.00				
Labor Overhead (rate 0%) x (DL)	\$0.00				
Total Direct Labor (TDL)	\$0.00				

Subcontractor Costs

Subcontractor- Sam Chance					
Sam Chance	\$0.00				
Total Subcontractor Costs (TSC) 1	\$0.00				
Total Subcontractor Costs (TSC1)	\$0.00				

G&A (rate 0%) x Base ()	\$0.00				
Cost Sharing	-\$0.00				
Profit Rate (0%)	\$0.00				
Total Estimated Cost	\$0.00				
TABA	\$0.00				

Explanatory Material Relating to the Cost Volume
 The Official From the Firm that is responsible for the cost breakdown
 Name: Mike Johnson
 Phone: (405) 594-3965
 Phone: mike.johnson@anautics.com
 Title: Proposal Owner

If the Defence Contracting Audit Agency has performed a review of your projects within the past 12 months, please provide: Yes
 Audit Agency Name: DCAA Witchita Branch
 Audit Agency POC: Walter Ordonez
 Address: 215 Dean McGee Ave, Oklahoma City, Oklahoma,73102
 Phone: (571) 448-7970
 Email: waler.ordonez@dcaa.mil
 Select the Type of Payment Desired: Partial payments

Cost Volume Details

Direct Labor
Base

Category	Description	Education	Yrs Experience	Hours	Rate	Fringe Rate	Total
Engineers, All Other	Principal Investigator	Master's Degree	20	385	\$226.58		\$87,233.30

Are the labor rates detailed below fully loaded? YES

Please explain any costs that apply.
Rates derived from buy.gsa.gov 2024 rate schedule

Provide any additional information and cost support data related to the nature of the direct labor detailed above.
Rates derived from buy.gsa.gov 2024 rate schedule

Direct Labor Cost (\$): \$87,233.30

Year2

Category	Description	Education	Yrs Experience	Hours	Rate	Fringe Rate	Total
Engineers, All Other	Principal Investigator	Master's Degree	20	0	\$226.83		\$0.00

Are the labor rates detailed below fully loaded? YES

Please explain any costs that apply.
rates derived from buy.gsa.gov 2024 rate schedule

Provide any additional information and cost support data related to the nature of the direct labor detailed above.
rates derived from buy.gsa.gov 2024 rate schedule

Direct Labor Cost (\$): \$0.00

Sum of all Direct Labor Costs is(\$): \$87,233.30

Overhead
Base

Labor Cost Overhead Rate (%)	0
Overhead Comments: Fully burden rates used	
Overhead Cost (\$):	\$0.00
Year2	
Labor Cost Overhead Rate (%)	0
Overhead Comments: Fully burden rate used	
Overhead Cost (\$):	\$0.00
Sum of all Overhead Costs is (\$):	\$0.00
General and Administration Cost Base	
G&A Rate (%):	0
Apply G&A Rate to Overhead Costs?	NO
Apply G&A Rate to Direct Labor Costs?	NO
Apply G&A Rate to Subcontractor Costs?	NO
Please specify the different cost sources below from which your company's General and Administrative costs are calculated. Fully burden rates used	
G&A Cost (\$):	\$0.00
Year2	
G&A Rate (%):	0
Apply G&A Rate to Overhead Costs?	NO
Apply G&A Rate to Direct Labor Costs?	NO

Apply G&A Rate to Subcontractor Costs?

NO

Please specify the different cost sources below from which your company's General and Administrative costs are calculated.

fully burden rate used

G&A Cost (\$):

\$0.00

Sum of all G&A Costs is (\$):

\$0.00

Subcontractor/Consultants

Base

Subcontractor/Consultant:

Sam Chance

Budget Contact Name	Budget Contact Title	Budget Contact Phone	Budget Contact Email
David Coates	Military and Defense BD Director	(248) 321-4550	dac@altair.com

Do you have a letter of commitment from the subcontractor/consultant?

YES

Document uploaded for the letter of commitment:

- [F244_0001_0109_Anautics_LOC.pdf](#)

Are you able to provide detailed budget information for this subcontractor/consultant?

NO

Total Cost(\$):

\$42,392.90

Do you provide the authority to the Government to contact this Budget Contact?

YES

Year2

Subcontractor/Consultant:

Sam Chance

Budget Contact Name	Budget Contact Title	Budget Contact Phone	Budget Contact Email
David Coates	Military and Defense BD Director	(248) 321-4550	dac@altair.com

Do you have a letter of commitment from the subcontractor/consultant?

YES

Document uploaded for the letter of commitment:

- [F244_0001_0109_Anautics_LOC.pdf](#)

Are you able to provide detailed budget information for this subcontractor/consultant?	NO
----------------------------------------------------------------------------------------	----

Total Cost(\$):	\$0.00
-----------------	--------

Do you provide the authority to the Government to contact this Budget Contact?	YES
--------------------------------------------------------------------------------	-----

Total Subcontractors/Consultants Cost (\$):	\$42,392.90
---------------------------------------------	-------------

**Profit Rate/Cost Sharing
Base**

Cost Sharing (\$):	-\$0.00
--------------------	---------

Cost Sharing Explanation:

Profit Rate (%):	8
------------------	---

Profit Explanation:

Total Profit Cost (\$):	\$10,370.10
-------------------------	-------------

Year2

Cost Sharing (\$):	-\$0.00
--------------------	---------

Cost Sharing Explanation:

Profit Rate (%):	0
------------------	---

Profit Explanation:

Total Profit Cost (\$):	\$10,370.10
-------------------------	-------------

Total Proposed Amount (\$):	\$139,996.30
-----------------------------	--------------



SBIR Company Commercialization Report

ANAUTICS, INC.

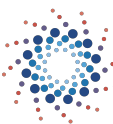
Total Investments:	Total Sales:	Total Patents:	* CAI:
\$8,753,827.00	\$5,072,882.00	0	80
*This CAI is calculated at the time of submission. CAI is calculated 1st of every month for all the organizations. This might change your firms CAI. Please visit our company dashboard on SBIR.Gov to view the most recent CAI for your organization.			

Company Information			
Address:	116 E SHERIDAN AVE STE 100, OKLAHOMA CITY, OK, 73104-2446		
SBC Control ID:	SBC_000089554	Company Url:	http://www.anautics.com

Company POC		Commercialization POC	
Title:	Brian Bendele	Title:	CEO
Full Name:	Brian Bendele	Full Name:	Michael Johnson
Phone:	4053923012	Phone:	(405) 392-3012
Email:	brian.bendele@anautics.com	Email:	mike.johnson@anautics.com

Additional Company Information	
% Revenue for last fiscal year from SBIR/STTR funding:	Total revenue for last fiscal year:
0.0%	
Year Founded:	# Employees Currently:
2001	41
Year first Phase I award received:	# SBIR/STTR Phase I Awards:
2003	10
Year first Phase II award received:	# SBIR/STTR Phase II Awards:
2004	11
# Employees at first Phase II award:	Mergers and Acquisition within past 2 years:
3	No
Spin-offs resulting from SBIR/STTR:	IPO resulting from SBIR/STTR Year of IPO:
No	No N/A
Patents resulting from SBIR/STTR #Patents:	List of Patents:
No 0	SMARTY-ii
Woman-Owned:	Socially and Economically Disadvantaged:
N	N
HUBZone-Certified:	SBC majority-owned by multiple VCOC, HF, PE firms By what percent (%):
N	No N/A

Additional Investment From (Year over Year)			
	2019	2020	2021
DoD contracts/DoD subcontracts	\$45,000.00	\$45,000.00	\$4,246,396.00
Angel Investors	\$0.00	\$0.00	\$0.00
Venture Capital	\$0.00	\$0.00	\$0.00
Self Funded	\$0.00	\$0.00	\$0.00
Private Sector	\$259,212.00	\$259,212.00	\$3,712,431.00
Other Federal Contracts/Grants	\$385,000.00	\$385,000.00	\$770,000.00
Other Sources	\$25,000.00	\$25,000.00	\$25,000.00
Additional Investment	\$0.00	\$0.00	\$0.00
Total Investment	\$714,212.00	\$714,212.00	\$8,753,827.00



Phase III Sales To (Year over Year)			
	2019	2020	2021
DoD or DoD prime contractors	\$321,486.00	\$321,486.00	\$5,072,882.00
Private Sector	\$0.00	\$0.00	\$0.00
Export Markets	\$0.00	\$0.00	\$0.00
Other Federal Agencies	\$0.00	\$0.00	\$0.00
Additional commercialization by 3rd Party Revenue	\$0.00	\$0.00	\$0.00
Other Customers	\$0.00	\$0.00	\$0.00
Additional Sales	\$0.00	\$0.00	\$0.00
Total Sales	\$321,486.00	\$321,486.00	\$5,072,882.00

Commercialization Narrative

Over the last two years Anautics has gone through a reorganization that has directly impacted our SBIR efforts. Some of our achievements include 1) Digital Engineering Platform for B-52 & B-52 Commercial Engine Replacement Program (CERP) and 2) Digital Greenhouse Phase III award. We anticipate another Phase III award in the next 6 months.

Commercialized Awards

Digital Greenhouse 1 of 9

Agency/Branch:	Department of Defense/Air Force	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase II/2019	Subsidiaries	N/A
Topic #:	AF112-208	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	FA8650-19-C-5083	Used in Federal or acquisitions program?	No
Achieved a cost saving or cost avoidance?:	No		
Additional Investment From		Phase III Sales To	
DoD contract/subcontract:	\$0.00	Dod or DoD prime contractors:	\$0.00
Other Federal contract/grants:	\$0.00	Other Federal Agencies:	\$0.00
Angel Investors:	\$0.00	Private Sector:	\$0.00
Venture Capital:	\$0.00	Export Market:	\$0.00
Self-Funded:	\$0.00	3rd Party Revenue:	\$0.00
Private Sector:	\$0.00	Other Customers:	\$0.00
Other Sources:	\$0.00		
Investment Total:	\$0.00	Sales Total:	\$0.00

Non-Destructive Inspection Data Capture 2 of 9

Agency/Branch:	Department of Defense/Air Force	Manufacturing related	Yes Systems Level Manufacturing
Program/Phase/Year:	SBIR/Phase II/2017	Subsidiaries	Digital Greenhouse Corporation
Topic #:	AF151-162	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	FA8100-17-C-0019	Used in Federal or acquisitions program?	Yes
Achieved a cost saving or cost avoidance?:	Yes		
a. Agency/End user:	USAF	a. Primary Agency:	Air Force
b. System/Program:	AFSC	b. System/Program:	Air Force Sustainment Center (AFSC)
c. Cost Savings:	\$1,500,000.00	c. Phase III Contract #:	FA8117-10-C-0023
d. Cost Savings Type:	Annual savings		
e. Explanation:	Anautics developed an innovation framework under the Digital Greenhouse used for discovery, prototyping and		



SBIR Company Commercialization Report

continuous delivery and operation of software. This is an agile process that has saved the Air Force time and money by going away from old approach to software development.

Additional Investment From		Phase III Sales To	
DoD contract/subcontract:	\$0.00	Dod or DoD prime contractors:	\$550,000.00
Other Federal contract/grants:	\$0.00	Other Federal Agencies:	\$0.00
Angel Investors:	\$0.00	Private Sector:	\$0.00
Venture Capital:	\$0.00	Export Market:	\$0.00
Self-Funded:	\$0.00	3rd Party Revenue:	\$0.00
Private Sector:	\$0.00	Other Customers:	\$0.00
Other Sources:	\$0.00		
Investment Total:	\$0.00	Sales Total:	\$550,000.00

Government Phase III awards				
Funding Agreement / Contract #	Agency	Project Title	Year Awarded	Awarded Value
FA8117-10-C-0023	USAF	AFSC Digital Greenhouse	2021	\$550,000.00

Multi-Attribute Reliability and Maintainability Engineering

Assessment Methodology

3 of 9

Agency/Branch:	Department of Defense/Air Force	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase II/2012	Subsidiaries	N/A
Topic #:	AF093-193	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	FA8117-12-C-0001	Used in Federal or acquisitions program?	No
Achieved a cost saving or cost avoidance?:	No		

Additional Investment From		Phase III Sales To	
DoD contract/subcontract:	\$0.00	Dod or DoD prime contractors:	\$0.00
Other Federal contract/grants:	\$0.00	Other Federal Agencies:	\$0.00
Angel Investors:	\$0.00	Private Sector:	\$0.00
Venture Capital:	\$0.00	Export Market:	\$0.00
Self-Funded:	\$0.00	3rd Party Revenue:	\$0.00
Private Sector:	\$0.00	Other Customers:	\$0.00
Other Sources:	\$0.00		
Investment Total:	\$0.00	Sales Total:	\$0.00

Decision Support System Based On Collaborative-orientated

System Engineering Capabilities

4 of 9

Agency/Branch:	Department of Defense/Air Force	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase II/2010	Subsidiaries	N/A
Topic #:	AF083-229	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	FA8117-10-C-0023	Used in Federal or acquisitions program?	No
Achieved a cost saving or cost avoidance?:	No		

Additional Investment From		Phase III Sales To	
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SBIR Company Commercialization Report

DoD contract/subcontract:	\$0.00	Dod or DoD prime contractors:	\$0.00
Other Federal contract/grants:	\$0.00	Other Federal Agencies:	\$0.00
Angel Investors:	\$0.00	Private Sector:	\$0.00
Venture Capital:	\$0.00	Export Market:	\$0.00
Self-Funded:	\$0.00	3rd Party Revenue:	\$0.00
Private Sector:	\$0.00	Other Customers:	\$0.00
Other Sources:	\$0.00		
Investment Total:	\$0.00	Sales Total:	\$0.00

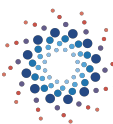
Advanced MRO Multi-Echelon Planning and Scheduling5 of 9

Agency/Branch:	Department of Defense/Air Force	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase II/2008	Subsidiaries	N/A
Topic #:	AF06-330	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	FA8103-08-C-0071	Used in Federal or acquisitions program?	No
Achieved a cost saving or cost avoidance?:	Yes		
a. Agency/End user:	GCLS		
b. System/Program:	Air Force		
c. Cost Savings:	\$421,000.00		
d. Cost Savings Type:	Annual savings		
e. Explanation:	On this project we provided the algorithms, processes and data schema free of charge for th use by the air force.		

Additional Investment From		Phase III Sales To	
DoD contract/subcontract:	\$0.00	Dod or DoD prime contractors:	\$171,486.00
Other Federal contract/grants:	\$0.00	Other Federal Agencies:	\$0.00
Angel Investors:	\$0.00	Private Sector:	\$0.00
Venture Capital:	\$0.00	Export Market:	\$0.00
Self-Funded:	\$0.00	3rd Party Revenue:	\$0.00
Private Sector:	\$0.00	Other Customers:	\$0.00
Other Sources:	\$0.00		
Investment Total:	\$0.00	Sales Total:	\$171,486.00

Next Generation Aircraft Depot Maintenance Management Technologies6 of 9

Agency/Branch:	Department of Defense/Air Force	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase II/2008	Subsidiaries	N/A
Topic #:	AF05-265	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	FA8103-08-C-0070	Used in Federal or acquisitions program?	No
Achieved a cost saving or cost avoidance?:	No		
Additional Investment From		Phase III Sales To	
DoD contract/subcontract:	\$0.00	Dod or DoD prime contractors:	\$0.00
Other Federal contract/grants:	\$0.00	Other Federal Agencies:	\$0.00
Angel Investors:	\$0.00	Private Sector:	\$0.00
Venture Capital:	\$0.00	Export Market:	\$0.00



SBIR Company Commercialization Report

Self-Funded:	\$0.00	3rd Party Revenue:	\$0.00
Private Sector:	\$234,212.00	Other Customers:	\$0.00
Other Sources:	\$25,000.00		
Other Sources Description:			
N/A			
Investment Total:	\$259,212.00	Sales Total:	\$0.00

Pattern Recognition for Aircraft Maintainer Troubleshooting 7 of 9

Agency/Branch:	Department of Defense/Air Force	Manufacturing related	Yes Systems Level Manufacturing
Program/Phase/Year:	SBIR/Phase II/2007	Subsidiaries	N/A
Topic #:	AF05-263	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	FA8103-07-C-0003	Used in Federal or acquisitions program?	No
Achieved a cost saving or cost avoidance?:	Yes		
a. Agency/End user:	EN		
b. System/Program:	ECSS/GCSS		
c. Cost Savings:	\$3,500,000.00		
d. Cost Savings Type:	Annual savings		
e. Explanation:	Smarty application is used to save man hours for building cross reference tables between to -4 and -6. The application on average saves over 500 hours when building Bill of Materials (BOM).		

Additional Investment From		Phase III Sales To	
DoD contract/subcontract:	\$45,000.00	Dod or DoD prime contractors:	\$150,000.00
Other Federal contract/grants:	\$0.00	Other Federal Agencies:	\$0.00
Angel Investors:	\$0.00	Private Sector:	\$0.00
Venture Capital:	\$0.00	Export Market:	\$0.00
Self-Funded:	\$0.00	3rd Party Revenue:	\$0.00
Private Sector:	\$0.00	Other Customers:	\$0.00
Other Sources:	\$0.00		
Investment Total:	\$45,000.00	Sales Total:	\$150,000.00

Graphical Indexes for Aircraft Legacy Data Systems 8 of 9

Agency/Branch:	DOD / AF	Manufacturing related	Yes Systems Level Manufacturing
Program/Phase/Year:	N/A/N/A/2004	Subsidiaries	N/A
Topic #:	AF03-274	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	FA8103 -04-C-0152	Used in Federal or acquisitions program?	No
Achieved a cost saving or cost avoidance?:	No		
Additional Investment From		Phase III Sales To	
DoD contract/subcontract:	\$0.00	Dod or DoD prime contractors:	\$0.00
Other Federal contract/grants:	\$385,000.00	Other Federal Agencies:	\$0.00
Angel Investors:	\$0.00	Private Sector:	\$0.00
Venture Capital:	\$0.00	Export Market:	\$0.00
Self-Funded:	\$0.00	3rd Party Revenue:	\$0.00
Private Sector:	\$25,000.00	Other Customers:	\$0.00



SBIR Company Commercialization Report

Other Sources:	\$0.00		
Investment Total:	\$410,000.00	Sales Total:	\$0.00

Graphical Indexes for Aircraft Legacy Data 9 of 9

Agency/Branch:	Department of Defense/Air Force	Manufacturing related	Yes Systems Level Manufacturing
Program/Phase/Year:	SBIR/Phase II/2004	Subsidiaries	N/A
Topic #:	AF03-274	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	FA8103-04-C-0152	Used in Federal or acquisitions program?	No
Achieved a cost saving or cost avoidance?:	No		
Additional Investment From		Phase III Sales To	
DoD contract/subcontract:	\$4,201,396.00	Dod or DoD prime contractors:	\$4,201,396.00
Other Federal contract/grants:	\$385,000.00	Other Federal Agencies:	\$0.00
Angel Investors:	\$0.00	Private Sector:	\$0.00
Venture Capital:	\$0.00	Export Market:	\$0.00
Self-Funded:	\$0.00	3rd Party Revenue:	\$0.00
Private Sector:	\$3,453,219.00	Other Customers:	\$0.00
Other Sources:	\$0.00		
Investment Total:	\$8,039,615.00	Sales Total:	\$4,201,396.00

CERTIFICATE OF COMPLETION

THIS CERTIFICATE IS PRESENTED TO

Mike Johnson, Anautics, Inc

FOR SUCCESSFULLY COMPLETING FRAUD, WASTE AND
ABUSE TRAINING AND MEETING ALL REQUIREMENTS SET
FORTH BY THE OFFICE OF SMALL BUSINESS PROGRAMS



Oct 31, 2024

COMPLETION DATE

Oct 31, 2025

EXPIRATION DATE