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

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SBIR Phase I Proposal

Proposal Number:	F244-0001-0093
Proposal Title:	WEAVER: An Intelligent System For Interactive Knowledge Graph Maintenance

Agency Information

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

Firm Information

Firm Name:	Kitware
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UEI:	DK6LPWMS5LP5
DUNS:	010926207
CAGE:	1DKA7
SBA SBC Identification Number:	000001978

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)	200
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_000001978

Supporting Documentation:

- [SBC_000001978.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:	
<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	
13. Race of the offeror:	
<input type="checkbox"/> American Indian or Alaska Native <input type="checkbox"/> Native Hawaiian or Other Pacific Islander <input type="checkbox"/> Asian <input type="checkbox"/> White <input type="checkbox"/> Black or African American <input checked="" type="checkbox"/> Do not wish to Provide	
14. Ethnicity of the offeror:	DO NOT WISH TO PROVIDE
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
Charles Weatherford	Charles Weathe rford	Contracts Administrat or	Kitware	12/17/2019

Audit Information

Summary:

Has your Firm ever had a DCAA review?	YES
	Last Audit Date: 11/13/2012
Was your accounting system approved by the auditing agency?	YES
	Last Update Date: 11/13/2012
Was a rate agreement negotiated with the auditing agency?	YES
	Last Update Date: 01/03/2024
Was an overhead and/or cost audit performed?	YES
	Date of Overhead Audit: 06/29/2021
	Date of Cost Audit: 06/29/2021
Are the rates from the audit agreement used for this firms proposal?	YES

Firm Information:

Agency Firm:	Defense Contract Audit Agency
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Point of Contact (POC) Name:	Matthew Fischer
POC Phone:	(571) 448-4685
POC Email:	matthew.d.fischer5.civ@mail.mil

Upload a copy of the audit information:

- [FinalDODReport_Kitware_2020.pdf](#)

VOL I - Proposal Summary

Summary:

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

As the size of these modern dynamic knowledge graphs grows, new methods are needed to facilitate analyst's upkeep of these data structures. Kitware is proud to propose this Phase 1 SBIR for the development of a system to achieve dynamic knowledge

graph management. Our system, WEAVER, studies user interaction with a dynamic knowledge graph and suggests 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. We build upon extensive ongoing work with graph convolutional neural networks, foundational models, and LLMs for the creation, search, and maintenance of knowledge graphs. Our approach decomposes the problem into two main tasks. First, we conduct a coarse-grain search of the knowledge graph for areas that are relevant to recent user interaction. We then use an LLM to make fine grained recommendations to nodes and edges in both the graph and schema, leveraging the prioritized sub-graph queue. The WEAVER system will incorporate a UI that works with users in a human-machine teaming paradigm to adjudication system suggestions. These suggestions will be leveraged to refine future system behavior and align the WEAVER models with the goals of the analyst.

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

Our research will deliver a prototype system for rapidly curating updates to large, dynamic knowledge graphs through human-machine collaboration. This innovation will enable warfighters to maintain realtime situational awareness, analyze patterns of life, detect threats, and make targeting decisions in timesensitive environments by keeping intelligence graphs tactically relevant. A Phase I feasibility study will guide our Phase II development and beyond. With government feedback, we will refine our methods and establish a framework for expanded validation in Phase II. Open source release, pending permission, will occur at the appropriate security level. Beyond Phase II, our work will move toward commercialization, with initial applications for the intelligence community and eventual expansion into the civilian market. Kitware's experience in technology transition supports our commitment to bring this solution through the full commercialization process, making it a pivotal addition to our defense systems portfolio.

Attention:

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Addition:

Enter the page numbers separated by a space of the pages in the proposal that are considered proprietary:

1 2 3 4 5 6 7 8 9 12 13 14 15 16 17 18

List a maximum of 8 Key Words or phrases, separated by commas, that describe the Project:

Knowledge Graphs, Large Language Models, Graph Neural Networks, Human-Machine Teaming, Iterative Prompt Refinement, ATR, UIUX

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 .	YES
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	100%
Subcontractor POW	0%
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?	NO
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?	15%
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

VOL I - Contact Information

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1 Identification and Significance of the Problem or Opportunity

In modern Air Force analyst workflows, accurate Knowledge Graphs (KGs) play a key role in intelligence product development. For example, in target development, analysts rely on large knowledge graphs to analyze enemy disposition of forces, critical capabilities, and other factors that feed into targeting and strike decision-making. As the situation on the ground is ever-changing, these graphs must be meticulously maintained by the warfighters to provide up-to-date situational awareness regarding both friendly and enemy status. This process is already time-consuming, but exacerbating the problem is the complexity of modern knowledge graphs underpinning these systems. A modern Knowledge Graph (KG) can have many millions of nodes and edges [1,2]. Each of these is an instantiation of a vast collection of fundamental data types defined by the schema. Through the course of analyst workflows, they may update nodes and edges in the graph, but also the schema itself. Tools are needed to ensure that, as these updates take place the warfighter is equipped to rapidly introduce downstream changes related to the initial update. However, we cannot expect a user to manually sort through every possible node in order to check that there are no implied secondary or tertiary updates to the graph. Automation is needed to isolate graph components of relevance to the user's objectives and then present the user with a prioritized list of updates to adjudicate, thereby maximizing the value of precious analyst time on task.

Kitware is proud to propose WEAVER, a system for rapidly curating updates to knowledge graphs based on user interactions. Figure 1 shows our concept of operations. We will use Artificial Intelligence (AI) to automatically compare user activity on specific nodes of the graph to other areas of the data structure. WEAVER will automatically identify other candidate nodes and edges that may also need updating and suggest appropriate updates. These updates include 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.

In order to reason about the massive number of edges and nodes, we decompose the problem into two parts. The first is a CNN-based sub-graph ranking module which implements coarse-grained search of potential regions that may require updating or may inform future user edits. This module encodes features on relatively small subgraphs in a way that we can later use this encoding to rapidly align user activity in one area of the graph with elements elsewhere in the structure. Once this coarse-grained alignment is achieved, our LLM system will make fine-grained suggestions to updates on nodes and edges within both the graph and schema.

A limiting factor in modern LLMs is their general lack of introspective ability, they don't know what they do and do not do well. Additionally, LLMs have limited context windows with which they can operate. We cannot rely on the LLM to accurately self-moderate its confidences in this task. Given these limitations, the key to our approach is an Interactive Prompt Refinement (IPR) module, which will accomplish two things. First, it will study user adjudication decisions in order to learn, in real time, which areas of refinement the LLM is getting correct and which should not be trusted. This will enable us to calibrate LLM suggestion confidence and ensure that valuable analyst cycles are spent looking at the high-probability graph updates first. Second, it will produce refinements to the LLM prompts in order to better align the LLM performance with the user's goals and values.

Kitware is uniquely positioned to achieve the objectives laid out in this proposal. We've tackled some of industry's toughest AI problems, including those dealing with generating, manipulating, and searching graphical data using deep learning methods. We build off an extensive portfolio of LLM research [3–5] and knowledge graphs [6]. Recently, we have gained particular experience in automated knowledge graph generation and management for DoD/IC use cases. We have active work in this area with customers in the Air Force (AFRL Wingman - Section 4.1), Army (SBIR Tech Marketplace - Section 4.2), and NIH (KG Generation for Metabolomics - - Section 4.4). The Kitware AI team has a heritage in developing and transitioning systems for analysts and warfighters, with many systems deployed to end users today and maintained by

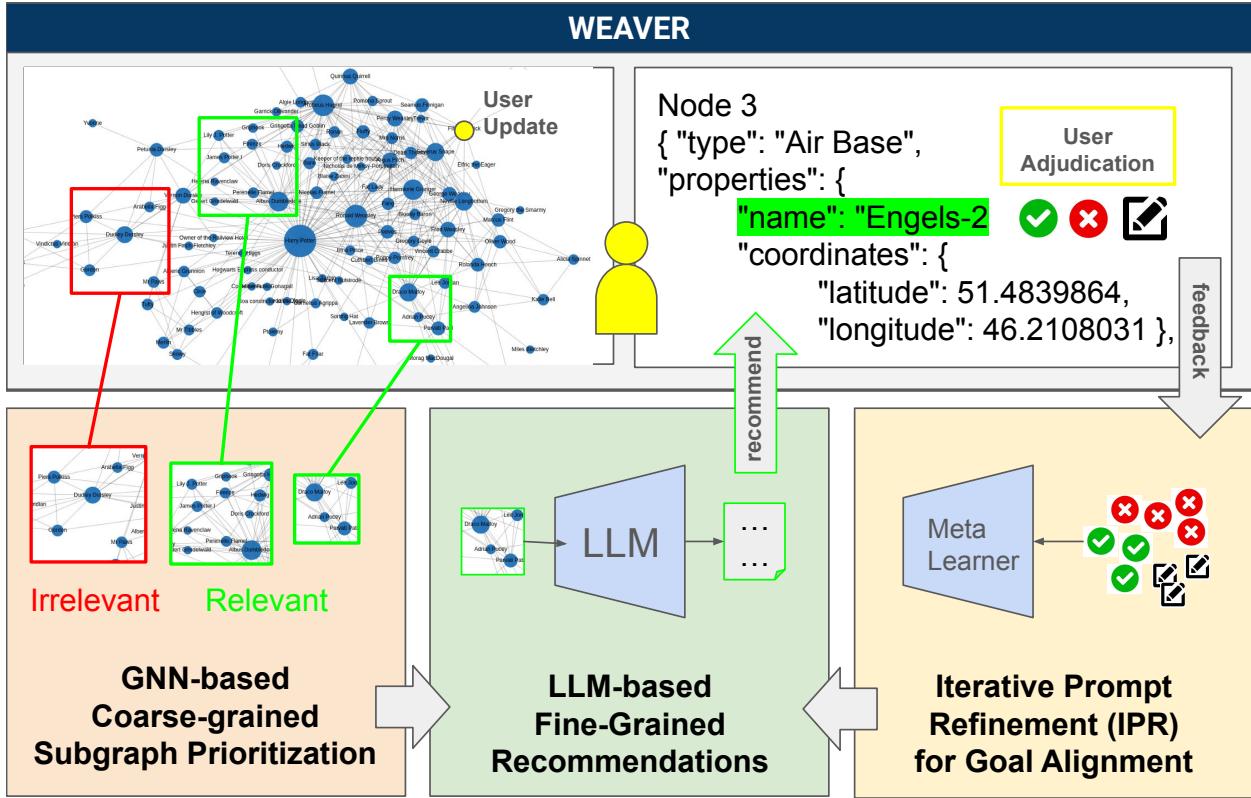


Figure 1: Concept of Operations for the WEAVER system. We propose using a 2-tiered approach to solving the problem of taking user graph edits and suggesting updates to relevant nodes elsewhere in the graph. First, we recognize that production DoD/IC graphs are too large for any single model to fully reason over. This includes both graph CNN and Large Language Models. Our first step is to extract features on subgraphs, using a combination of node-level embeddings and local subgraph embedding models, to form a vector search space over our graph. When a user updates nodes or schema elements, we will use this set of features to rank order the subgraphs that are most relevant to the user update (bottom left). Once we have these, a Graph LLM will be employed to perform fine-grained reasoning about specific fields and elements that should be updated at the node level (bottom middle). These are provided to the user via the WEAVER UI (top right), which enables the user to rapidly accept, reject, or modify suggestions. These user decisions are captured by the system and then used for iterative prompt refinement, influencing future LLM behavior when assigning node priority (bottom right).

Kitware engineers and researchers. We have a deep heritage of **open source software and open architecture design** [7–12]. We will provide **all software with unlimited rights** to the government. With permission, we will release this software as open source into our existing open source repositories. Releasing open source software promotes greater adoption and commercialization of our work under Kitware’s business model, which results in further investment in software benefiting the government.

1.1 Challenges and Innovations

Figure 1 summarizes our proposed approach, which addresses the following challenges through key innovations:

Challenge 1: When editing a production graph, manually checking graph and schema elements for potential updates (as is currently done in many CONOPS) is an inefficient use of warfighter time.

Innovation: We propose WEAVER, a system which **accelerates graph editing by learning which nodes and subgraphs align with the intent of a user as they interact with the graph**. It then provides the user a rank ordered list of recommended changes in a UI which allows them to quickly accept, reject, or edit the recommendations. Our method **combines the best of classical search methods (based on CNN encoders**

and graph neural networks) with the power of fine-grained reasoning capabilities from large language models (LLMs). See Section 3.1.

Challenge 2: Production-grade knowledge graphs in the DoD//IC are extremely large. It is computationally intractable to directly perform user queries against these entire graphs. The breadth of the graphs is beyond the receptive field of even deep graph neural networks and well outside the context window of current LLMs.

Innovation: We decompose our recommendation engine into two stages- related sub-graph search, and edit recommendation. In the first stage, we will **extract coarse node and sub-graph level features using language embedding and graph neural network models**. This compresses the large graph into a set of encoded vectors that can be used to search semantic concepts related to the user interaction. In stage two, **fine-grained sub-graph edit suggestions** can then be made on more computationally tractable, limited but related sub-graphs using LLMs. See Section 3.1.3, Section 3.1.4.

Challenge 3: The scale of production graphs means that there will likely be many suggested updates across the nodes and edges when a user interacts with the graph. Even with machine guidance, the user may be overwhelmed by a prioritized list of potential edits.

Innovation: Our system will **continuously re-prioritize graph and schema update suggestions** based on edits the user has already made. We will include the user adjudication history in our LLM prompt which suggests the next most relevant edits. This will ensure we **maximize the impact of analyst time on task**. See Section 3.1.5.

Challenge 4: Fine tuning or prompt engineering an LLM to produce prioritized graph graph and schema update suggestions requires training data related to the particular graph being processed. Systems that require training data ahead of time for each kind of graph a user may edit will not readily generalize to new kinds of graphs or new user preferences.

Innovation: WEAVER will **adapt to each new graph type and user through use of Iterative Prompt Refinement (IPR)**. We will model, quantitatively, LLM success and failures across different areas of the knowledge graph according to user feedback on its suggestions. IPR will automatically tune our LLM prompts [13] to improve the LLM's graph edit suggestions and suggestion relevance predictions. As the user works with WEAVER they will naturally create training data which drive continuous system improvement. This virtuous cycle will **make ever more efficient use of limited analyst adjudication time the more WEAVER is used**. See Section 3.1.6.

2 Phase I Technical Objectives

Since Phase I is a feasibility study, our objective in Phase I is to study the practicality, accuracy, and failure modes of our proposed approach. We will focus experiments in Phase I on proving out the algorithmic components of our architecture. Phase I will not involve human subjects research due to the Phase's limited budget and duration. Simulated human oracles will be used to make edits and curate WEAVER suggestions in Phase 1. Experimentation plans are discussed further in Section 3.2. By running these experiments in Phase I, we aim to answer the following questions:

1. **How effectively will classical CNN and GNN approaches propose coarse-grained sub-graphs which relate to user graph edits?**

We will use measures such as graph edit distance to compare our retrieved sub-graphs to an exhaustive scan. Using this approach we can also compare the time complexity of an exhaustive search vs. our GNN based related sub-graph suggestions.

2. **How effectively will off-the-shelf LLMs prioritize fine-grained graph edits using graph agnostic hand-engineered prompts?**

We will compare suggested additional graph edits to ground-truth graph edits made in response to user interaction. We will measure how frequently the suggested additional graph edits match ground truth edits.

3. **How much will Iterative Prompt Refinement improve fine-grained graph edit suggestions over graph agnostic hand-engineered prompts?**

We will compare IPR and hand-engineering for suggesting graph edits by executing the graph edits

in priority order and measuring the resulting graph edit distance to ground-truth final graphs. This will provide an objective measure of the performance of IPR over baseline approaches.

4. How much will the full WEAVER system improve final graph quality vs. an LLM or other method working only on the local region near the user's graph edit?

We will set up an experiment where we have simulated users make suggestions on a large graph and adjudicate responses. We will look to measure rates of convergence (in terms of iterations) on key metrics such as graph completeness, suggestion accuracy, suggestion ranking, and more.

3 Phase I Work Plan

Phase I work required to achieve the stated objectives is described below. Section 3.1 covers the technical details of the proposed approach. Section 3.2 describes the data to be used and methods for evaluating performance. Section 3.3 explains our use of and contribution to open source software. Section 3.4 is a work plan that outlines specific tasks, milestones, and deliverables, and provides a schedule for their completion.

3.1 Technical Approach

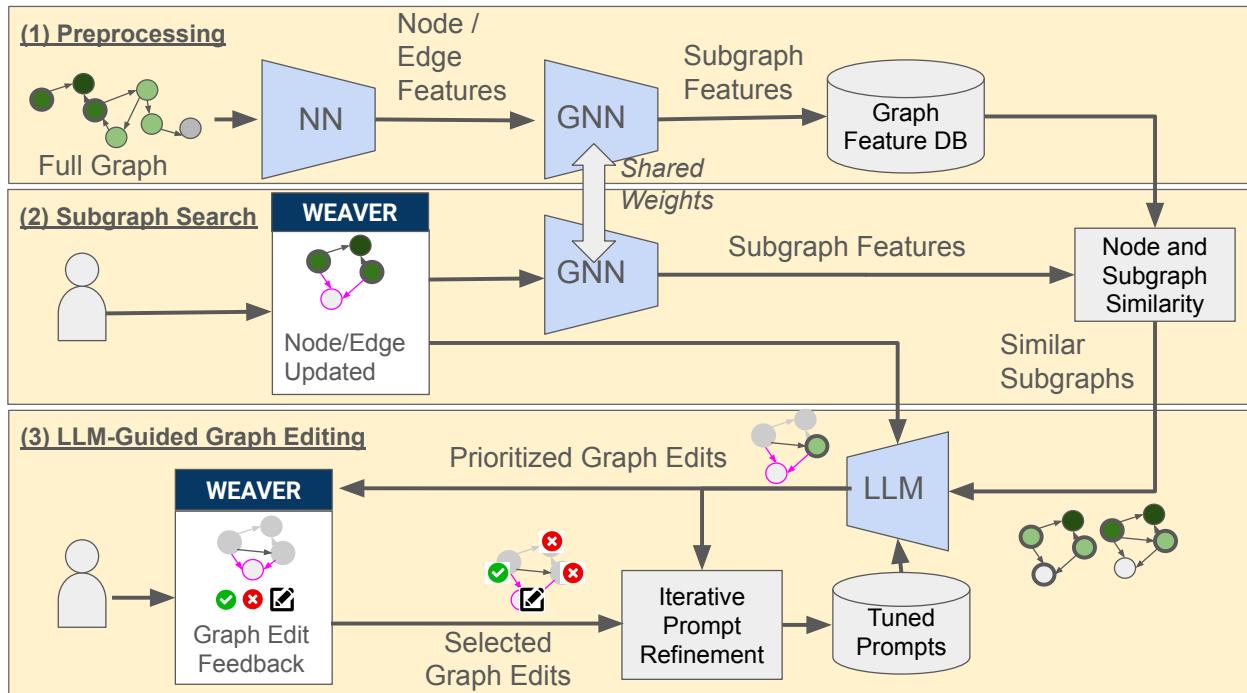


Figure 2: System architecture of WEAVER. (1) We begin by processing the full graph at the sub-graph level (possibly down to the single node) in order to build up a compressed, searchable, vector database representing the graph. (2) We encode sub-graphs edited by the user to our database of sub-graph signatures. This produces a rank order list of sub-graphs for the LLM to consider when budgeting decision capacity for update suggestions. (3) We use an LLM to recommend fine-grained updates to the sub-graphs, down to fields of individual nodes. We pass these recommendations to the user via the WEAVER UI, which allows them to quickly accept, reject, or modify the changes. This user feedback is integrated into future LLM prompts via Iterative Prompt Refinement to align the LLM with the user goals.

Our technical approach follows the flow chart in Figure 2. First, we solve the problem of representing very large production-grade knowledge graphs in a compressed and semantically searchable format. We achieve this by partitioning the graph into sub-graphs, from which we extract descriptor vectors using node-level encoders and sub-graph level Graph Neural Networks (section 3.1.2). When a user later modifies a node or edge, we compare the features for the local sub-graph with all the signatures in our database in order to rank-order other sub-graphs in terms of similarity to the modified content (section 3.1.3). From this list, we have a starting point to explore fine-grained node and edge updates. We accomplish this with the

use of an LLM, which reasons about the exact fields and values updated by the user and suggests node and edge modifications elsewhere in the graph, working its way through the ordered list of related sub-graphs (section 3.1.4). The priority LLM outputs are presented to the user via the WEAVER UI, which will enable them to rapidly curate the recommended graph operations, focusing on their limited time on task to the high priority updates first (section 3.1.5). Lastly, we propose a novel method of aligning the LLM behavior to the goals of the user in the loop. We do this via Interactive Prompt Refinement (IPR), which is achieved by feeding information about the user adjudication results back to the LLM to influence future inferences (section 3.1.6). To achieve our feasibility assessment, each of these methods will be validated against a large, representative graph structure using the appropriate baseline performance metrics (section 3.2).

3.1.1 Prior Results

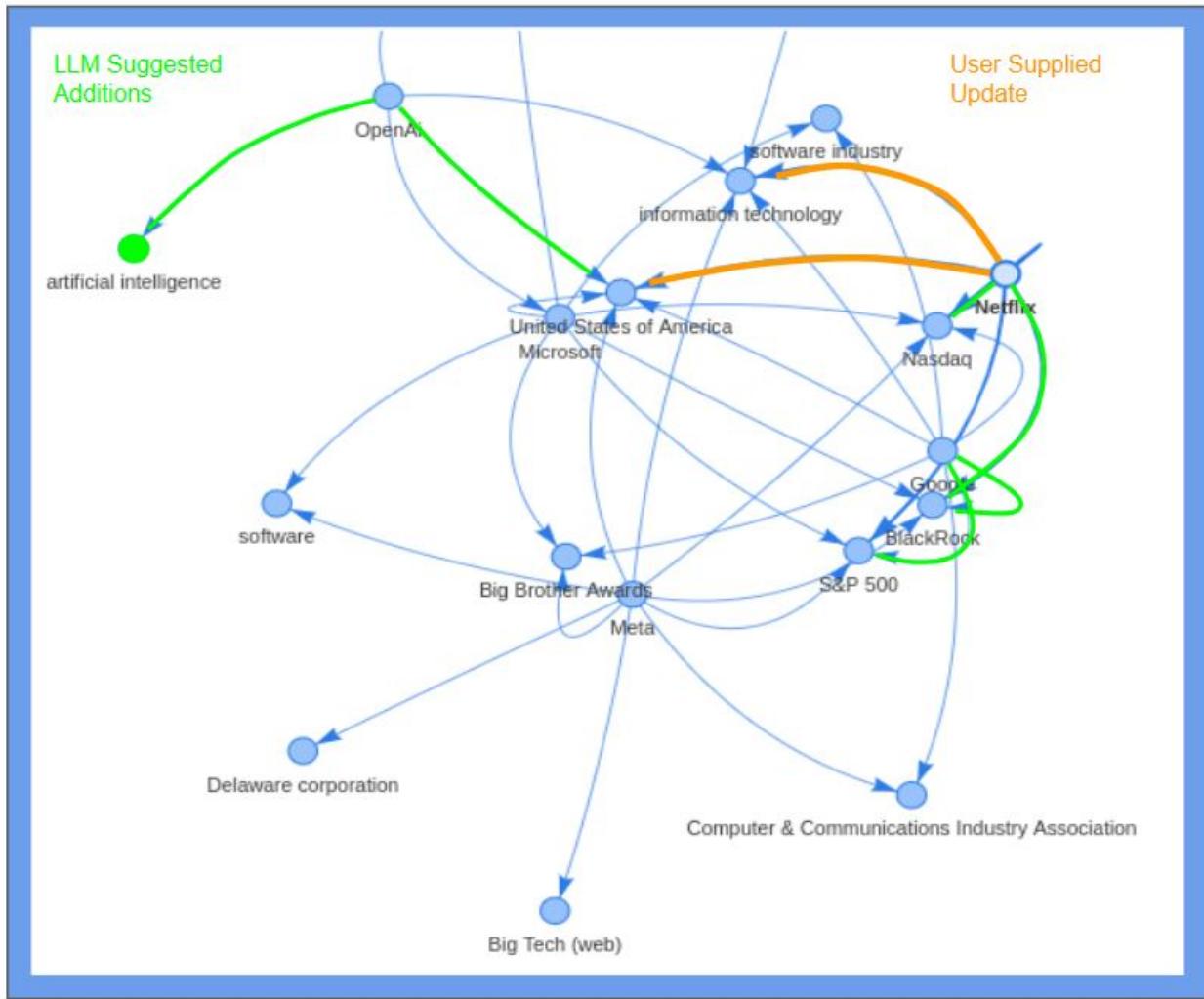


Figure 3: Real result from prototype capability showcasing SOTA LLM-based graph maintenance. Here we show a graph that has been updated by a user (shown in orange) and then presented to an LLM which makes recommendations on further updates (shown in green). This prototype was built on the Army Tech Marketplace program.

Kitware is currently working on multiple efforts which sit at the intersection of Knowledge Graphs and deep learning systems. In an effort with the Army SBIR office (see section 4.2), we are building a system to prompt LLMs from unstructured text sources to create knowledge graphs. In Figure 3, we conduct a quick experiment with our prototype WEAVER system to demonstrate the capabilities of LLMs with simple prompts (not optimized via IPR for the task of update suggestion). This graph contains 10 nodes

and 50 edges detailing several technology companies. In our experiment, we add a single node for the company Netflix and then connect several edges to nodes "Information Technology" and "United States of America". With a simple prompt to an LLM, we elicit the recommendations to add connectivity between the pre-existing "OpenAI" node and the node "United States of America". The LLM inferred that the user was interested in tracking country of incorporation, based on the recent interaction adding this relationship to the "Netflix" node, and appropriately recommended that this relationship also be created from the "OpenAI" node. We also see that the LLM suggested that we create a relationship between "OpenAI" and "artificial intelligence", the latter of which is a novel node in the graph. This demonstrates an example of the LLM inferring that the user cares about product offerings, and suggesting new information that is baked into the internal world model of the LLM itself, rather than existing in an authoritative source. Both these recommendations, in the WEAVER system, will be passed to a user for adjudication. We can learn via study of user feedback which of these types of updates to trust more in the future. Additionally, we can modify future prompts to bias for or against each kind of suggestion. The following sections detail our plan for achieving this behavior.

3.1.2 Sub-graph Representation

When a user makes updates to a particular node or edge of a graph (or schema), we want to search the rest of the graph for similar nodes that might also need updating. Due to the very large nature of production graphs, using any machine learning method directly on the graph to perform node relevance classification / regression is computationally intractable. Classic deep learning methods, such graph CNNs and GNNs, will be incapable of fitting the entire graph into its receptive field. LLM methods are bound by token limits, which will be far exceeded by the amount of information in a graph. Instead, we propose to decompose the problem of update recommendations into two main parts.

First, we compute multi-level features of the full graph. Figure 4 shows the proposed workflow. We extract node-level features by encoding field-value information with a classical text embedding network, such as BERT [14]. We could also use the encoder stage of LLM methods that are specialized on structured, json-like data. Ultimately, each node is converted to a feature vector which encodes the semantic meaning of the fields and relationships (inclusive of edge connections) for that node. Then, we agglomeratively combine node features across local sub-graphs using a graph convolutional network (GNN), such as GCNN [15], which results in a single vector encoding features for the many sub-graphs that comprise our global graph. We will use the graph convolutional kernels to aggregate features over a pyramid of graph distances. This is due to the fact that we cannot know *a priori* how many adjacent nodes of features are informative to the coarse graph search. With these node-level and sub-graph-level feature vectors, we now have an efficiently searchable representation of our graph that can be used to compare nodes across vast distances for semantic similarity. This will be critical when we are searching for nodes and edges that align with user graph interactions, detailed more in section 3.1.3 below.

3.1.3 Sub-graph Similarity Searching

When users manipulate a node, edge, or other element of the graph or schema, we want to identify related elements of the global graph that may also require updates or could inform updates and then make recommendations to the user accordingly. In the last section, we detailed how we can represent the global graph as an efficiently searchable vector space, within which we encode semantic meaning of different sub-graphs. We can exploit these representations to prioritize sub-graphs over which we run LLM-driven, fine-grained search for node-level updates. In this manner, we perform slew-to-cue between the coarse-grained sub-graph similarity search and the fine-grained LLM node update recommend.

We will take the sub-graph embeddings of user-edited nodes and search for similar sub-graphs within the vector database. This search often uses a simple distance measure, such as euclidean or cosine distance, between vectors. The distance in this vector space relates directly to the semantic overlap of two sub-graphs. There is a design tradeoff related to the size of sub-graph that we encode for this vector search. Choosing smaller graph sizes will increase the specificity of our result and likely yield better matches, at the cost of increased compute in terms of vectorization and search time. On the other hand, encoding larger sub-graphs results in less embedding compute costs and lookup time, while degrading the specificity of each vector. This is due to the embedding vector having to encode in feature space a much larger amount of data for larger sub-graphs. We will explore this tradeoff as part of our investigation.

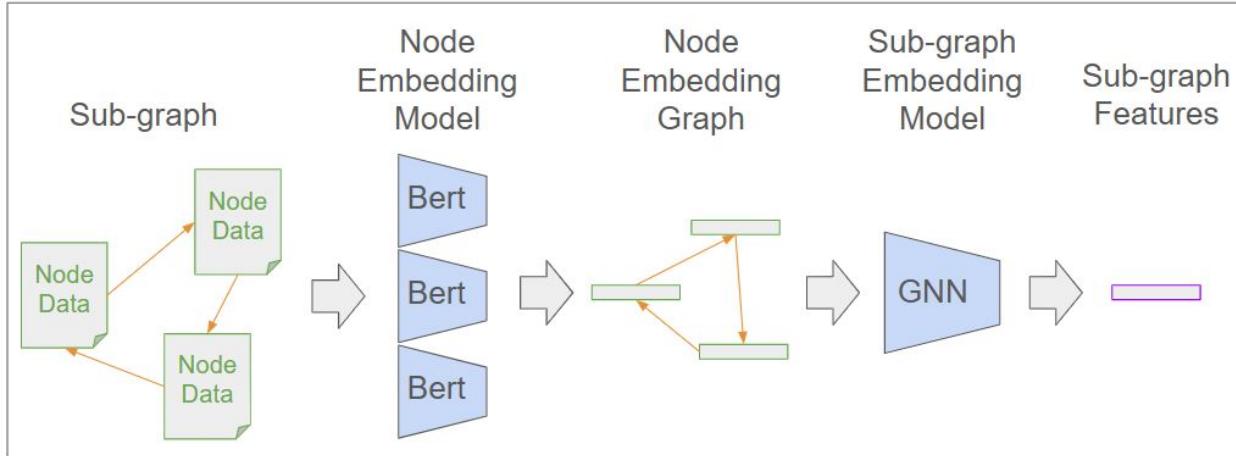


Figure 4: Workflow to convert sub-graphs into multi-level vector representations. These representations will be compared to one another via simple vector space distance measurements to assess semantic similarity between nodes and sub-graphs. This is critical to enable quick lookup of related sub-graphs as we attempt to limit the scope of decisions that the fine-grained graph update module (powered by LLMs) has to make.

What results from this sub-graph similarity search is a ranked list of sub-graphs, ordered by their semantic relevance to the node which was originally updated by the user. With this list, we can now run very focused prompts against our LLM to recommend updates to these related sub-graphs, given the fine-grained user-generated updates to their node. This is detailed in section 3.1.4 below.

3.1.4 LLM-Driven Sub-graph Update Recommendation

The previous sections detailed how we take user activity on a graph and produce a rank-ordered list of related sub-graphs that should be investigated for updates or may inform updates. These modules solved the problem of drilling down into the massive production graph for smaller areas that are semantically related to the original node update. We still need to go the final step and recommend specific modifications to nodes, edges, and schema elements based on the specific user interaction. For this, we propose to use an LLM, which excels at finding complex relationships between entities in the text domain. Given the user updates a specific sub-graph that is identified as a candidate for fine-grained search, we will prompt an LLM to make specific field-value recommendations to the sub-graph. We can prompt the model in such a way that it produces recommendations for additions, removals, and modifications of nodes or schema elements. This can happen in a single prompt to the LLM. Figure 5 shows what a typical prompt for such a complex task looks like. This prompt is what was used to produce the result shown in our prior work demonstration in Figure 3.

3.1.5 WEAVER UI for Rapid Recommendation Adjudication

While not the primary focus of this investigation, a bare-bones UI/UX will be implemented which allows us to prototype user interaction with the system. As shown in our concept figure, this UI will enable users to inspect the node prioritization queue. They can quickly move through node update recommendations and adjudicate the suggestions made by the modules described above. Potential actions could include accepting a recommendation, rejecting, or modifying a recommendation in place before confirming. These adjudications will be stored and exploited over time to modify the behavior of the system, as detailed in section 3.1.6 below. This interface will likely be implemented in a low-code open source UI mock-up tool, such as Gradio [16] or Trame [17].

3.1.6 Interactive Prompt Refinement

As observed in our experiment in Figure 3, the LLM will tend to make recommendations on the graph that are valid according to its own internal world model, but perhaps uninteresting or irrelevant to the entities and relationships being captured in our mission-specific knowledge graph. In order to filter these nuisance

```

-Instruction-
You are an expert on knowledge graphs. You will be given a graph, an update in the graph, and sets of relevant and irrelevant nodes. Suggest further edits to the graph.
1
2 The graph will be listed as triplets (representing edges) in the following form:
3 [1, [HEAD] start_node [RELN] relation_type [TAIL] end_node
4 where 1 is the index of the triplet;
5 There are no edges in the graph outside the listed triplets and no nodes outside of those
6 that appear at least one time.
7
8 There are three possible updates to be performed on the graph: ADDITION, DELETION, and
9 UPDATE.
10 - ADDITION means to add a new triplet to the graph, and should be listed as
11 [1, [HEAD] start_node [RELN] relation_type [TAIL] new_end_node
12 - DELETION means to delete an existing triplet from the graph and should be listed as
13 DELETION: Triplet <#>
14 Here <#> refers to the index of the triplet to be deleted.
15 - UPDATE means to change the information in an existing triplet and should be listed as
16 UPDATE: <#> [HEAD] head_node [RELN] relation_type [TAIL] end_node
17 Here <#> is the index of the triplet to be updated and the following information is the
18 new updated triplet.
19 The user update will be tasked as one of the three update types.
20 Your task is to suggest updates that should additionally be performed on the given graph.
21 Your update may either be similar to the updates given by the user or may involve
22 correcting errors that already exist in the graph.
23 Additionally, a list of nodes will be provided for user defined relevant and irrelevant
24 nodes. You should try to focus on relevant nodes and ignore irrelevant nodes.
25 Note that the relevant and irrelevant nodes are user-defined and not necessarily 100%
26 correct, and thus you may want to ignore a relevant node or pay attention to an irrelevant
27 node in certain circumstances.
28
29 Finally, you should give your answer as a list of updates as written above. Note that you are
30 allowed to make many updates as you think are necessary and you can use all of the three
31 types (ADDITION, DELETION, UPDATE).
32 You may perform any number of any of the three operations and you are not required to use
33 all three operations if none of them are necessary.
34 You should try to output as many updates as possible.
35 You should also list all of your updates in order of importance, with the first update
36 written being the most important and the last update being the least important.
37
38 Make sure your output only contains the updates to be made and no other text.
39
40 -Example-
41 Graph:
42 1. [HEAD] Fred [RELN] WORKS_AT [TAIL] TechWorld NY
43 2. [HEAD] Michael [RELN] LIVES_IN [TAIL] New York
44 3. [HEAD] Michael [RELN] MEMBER_OF [TAIL] Computer & Communications Industry Association
45 4. [HEAD] Fred [RELN] LIVES_IN [TAIL] New York
46 5. [HEAD] TechWorld [RELN] INVENTED_BY [TAIL] Samuel Ruckus
47 6. [HEAD] Michael [RELN] WORKS_AT [TAIL] TechWorld NY
48 7. [HEAD] TechWorld NY [RELN] HAS_SERVICED [TAIL] AI Oven
49 8. [HEAD] Samantha [RELN] WORKS_AT [TAIL] TechWorld CA
50 9. [HEAD] TechWorld CA [RELN] MEMBER_OF [TAIL] Computer & Communications Industry Association
51 10. [HEAD] TechWorld CA [RELN] BORN_IN [TAIL] TechWorld NY
52 11. [HEAD] TechWorld CA [RELN] HAS_PRODUCED [TAIL] Techbook
53 12. [HEAD] George [RELN] LIVES_IN [TAIL] California
54 13. [HEAD] Samuel Ruckus [RELN] LIVES_IN [TAIL] Ontario
55 14. [HEAD] TechWorld NY [RELN] OWNS [TAIL] TechWorld NJ
48 14. [HEAD] TechWorld NY [RELN] OWNS [TAIL] TechWorld NJ
49 Update:
50 ADDITION: [HEAD] Alice [RELN] WORKS_AT [TAIL] TechWorld NY
51 Relevant Nodes:
52 1. Fred
53 2. Michael
54 3. Samantha
55 4. George
56 5. TechWorld NY
57 6. TechWorld CA
58 7. California
59 8. New York
60 Irrelevant Nodes:
61 1. Techbook
62 2. AI Oven
63 3. Michael Ruckus
64 4. Ohio
65 5. TechWorld NJ
66 Suggestions:
67 ADDITION: [HEAD] Alice [RELN] LIVES_IN [TAIL] New York
68 UPDATE: 9. [HEAD] George [RELN] WORKS_AT [TAIL] TechWorld CA
69 DELETION: 18.
70
71 -real Data-
72 Graph:
73 1. [HEAD] Google [RELN] PART_OF [TAIL] Big Tech (web)
74 2. [HEAD] Google [RELN] STOCK_EXCHANGE [TAIL] Nasdaq
75 3. [HEAD] Google [RELN] INDUSTRY [TAIL] information technology
76 4. [HEAD] Google [RELN] INDUSTRY [TAIL] software industry
77 5. [HEAD] Google [RELN] INDUSTRY_PRODUCT_MATERIAL_OR_SERVICE_PRODUCED_OR_PROVIDED
78 [TAIL] search engine
79 6. [HEAD] Meta [RELN] MEMBER_OF [TAIL] Computer & Communications Industry Association
80 7. [HEAD] Google [RELN] LOCATION_OF_FORMATION [TAIL] Menlo Park
81 8. [HEAD] Google [RELN] DESCRIBED_BY_SOURCE [TAIL] Lentapedia
82 9. [HEAD] Google [RELN] COUNTRY [TAIL] United States of America
83 10. [HEAD] Google [RELN] INSTANCE_OF [TAIL] public company
84 11. [HEAD] Google [RELN] INSTANCE_OF [TAIL] business
85 12. [HEAD] Google [RELN] INSTANCE_OF [TAIL] technology company
86 13. [HEAD] Google [RELN] AWARD RECEIVED [TAIL] big brother awards
87 14. [HEAD] Google [RELN] AWARD RECEIVED [TAIL] bigbrotherawards
88 15. [HEAD] Meta [RELN] PART_OF [TAIL] SAP 500
89 16. [HEAD] Meta [RELN] PART_OF [TAIL] Big Tech (web)
90 17. [HEAD] Meta [RELN] STOCK_EXCHANGE [TAIL] Nasdaq
91 18. [HEAD] Meta [RELN] INDUSTRY [TAIL] information technology
92 19. [HEAD] Meta [RELN] MEMBER_OF [TAIL] Computer & Communications Industry Association
93 20. [HEAD] Meta [RELN] PRODUCT_MATERIAL_OR_SERVICE_PRODUCED_OR_PROVIDED [TAIL]
94 software
95 21. [HEAD] Meta [RELN] LEGAL_FORM [TAIL] Delaware corporation
96 22. [HEAD] Meta [RELN] COUNTRY [TAIL] United States of America
97 23. [HEAD] Meta [RELN] INSTANCE_OF [TAIL] public company
98 24. [HEAD] Meta [RELN] INSTANCE_OF [TAIL] business
99 25. [HEAD] Meta [RELN] INSTANCE_OF [TAIL] technology company
100 26. [HEAD] Meta [RELN] OWNED_BY [TAIL] BlackRock
101 27. [HEAD] Meta [RELN] HEADQUARTERS_LOCATION [TAIL] Menlo Park
102 28. [HEAD] Meta [RELN] MEMBER_OF [TAIL] big brother awards
103 29. [HEAD] Microsoft [RELN] PART_OF [TAIL] SAP 500
104 30. [HEAD] Microsoft [RELN] STOCK_EXCHANGE [TAIL] Big Tech (web)
105 31. [HEAD] Microsoft [RELN] STOCK_EXCHANGE [TAIL] Nasdaq
106 32. [HEAD] Microsoft [RELN] STOCK_EXCHANGE [TAIL] Hong Kong Exchanges And Clearing Ltd
107 33. [HEAD] Microsoft [RELN] INDUSTRY [TAIL] software industry
108 34. [HEAD] Microsoft [RELN] PRODUCT_MATERIAL_OR_SERVICE_PRODUCED_OR_PROVIDED [TAIL]
109 software
110 35. [HEAD] Microsoft [RELN] DESCRIBED_BY_SOURCE [TAIL] Lentapedia
111 36. [HEAD] Microsoft [RELN] COUNTRY [TAIL] United States of America
112 37. [HEAD] Microsoft [RELN] INSTANCE_OF [TAIL] public company
113 38. [HEAD] Microsoft [RELN] INSTANCE_OF [TAIL] business
114 39. [HEAD] Microsoft [RELN] INSTANCE_OF [TAIL] information technology company
115 40. [HEAD] Microsoft [RELN] OWNED_BY [TAIL] BlackRock
116 41. [HEAD] Microsoft [RELN] AWARD RECEIVED [TAIL] big brother awards
117 42. [HEAD] Tencent [RELN] COUNTRY [TAIL] People's Republic of China
118 43. [HEAD] Tencent [RELN] INSTANCE_OF [TAIL] business
119 44. [HEAD] Tencent [RELN] STOCK_EXCHANGE [TAIL] Hong Kong Exchanges And Clearing Ltd
120 45. [HEAD] Tencent [RELN] INDUSTRY [TAIL] information technology
121 46. [HEAD] Tencent [RELN] MEMBER_OF [TAIL] World Wide Web Consortium
122 47. [HEAD] Alibaba [RELN] COUNTRY [TAIL] People's Republic of China
123 48. [HEAD] Alibaba [RELN] INSTANCE_OF [TAIL] public company
124 49. [HEAD] Alibaba [RELN] INSTANCE_OF [TAIL] business
125 50. [HEAD] Alibaba [RELN] STOCK_EXCHANGE [TAIL] Hong Kong Exchanges And Clearing Ltd
126 51. [HEAD] Alibaba [RELN] MEMBER_OF [TAIL] World Wide Web Consortium
127 52. [HEAD] OpenAI [RELN] COUNTRY [TAIL] United States of America
128 53. [HEAD] OpenAI [RELN] FIELD_OF_WORK [TAIL] search engine
129 54. [HEAD] OpenAI [RELN] LEGAL_FORM [TAIL] Delaware corporation
128 Updates:
129 ADDITION: [HEAD] Netflix [RELN] PART_OF [TAIL] SAP 500
130 ADDITION: [HEAD] Netflix [RELN] INDUSTRY [TAIL] information technology
131 ADDITION: [HEAD] Netflix [RELN] COUNTRY [TAIL] United States of America
132 UPDATE: 41. [HEAD] Microsoft [RELN] AWARD RECEIVED [TAIL] big brother awards
133 DELETION: 10.
134 DELETION: 11.
135 DELETION: 12.
136 DELETION: 24.
137 Relevant Nodes:
138 1. Computer & Communications Industry Association
139 2. SAP 500
140 3. Google
141 4. business
142 5. information technology
143 6. Nasdaq
144 7. Microsoft
145 8. software industry
146 9. big brother awards
147 10. openai
148 11. software
149 12. blackrock
150 13. united states of america
151 Irrelevant Nodes:
152 1. big brother awards
153 2. alibaba
154 3. menlo park
155 4. hong kong exchanges and clearing ltd
156 5. menlo park
157 6. public company
158 7. search engine
159 8. met
160 9. meta
161 10. technology company
162 11. lentapedia
163 12. delaware corporation

```

Figure 5: Example prompt from our prototype system described in Section 3.1.1 using a modern LLM for a complex task such as Knowledge Graph generation and node update recommendation. Results from this prompt are show in our prior work demonstration Figure 3.

recommendations over time, we propose a novel Iterative Prompt Refinement (IPR) module. We will aggregate user adjudications of our system recommendations and take several steps to align the recommender with the user objectives. First, we will feed user activity directly into the prompt in order to influence future decisions. This feedback can be injected as shown in our example prompt in Figure 5. Several methods will be explored in order to incorporate user feedback in this prompt. One option is to inject, explicitly, every point of user feedback into the prompt as shown in our example. Likely, a middle step of feedback summarization will benefit the model performance. For example, we might use an LLM as a middle step to encode the user feedback into a much more concise summary of the types of updates the user is making. We could also take a classical approach, using topic density representations to encode user decision history.

An additional feature we propose to explore is training a meta-learner that sits on top of the LLM and decides which recommendations to trust. This can be achieved with our node and sub-graph level features that we extracted for our coarse-grained graph search. Using user adjudications as labels, we can train this meta learner which types of recommendations the LLM is getting wrong according to the user, even despite consecutive rounds of prompt refinement. We can also learn whether there are entire areas of the global graph that the LLM struggles with, which could be the case for out of distribution topics. Identifying these areas will inform efforts to fine-tune the LLM over time, or to develop other methods of making recommendations on these hard topics.

3.2 Data and Evaluation

In Phase I, we will focus on existing data sets which are well-suited to support the various aspects of our feasibility study. Specifically we will consider the data sets in the table below. These data will allow us to stand up a low-side equivalent to production grade knowledge graphs used in the intelligence communities, particularly in terms of size and complexity. Also present in these graphs are very large amounts of highly esoteric data, which will allow us to quantify WEAVER performance on knowledge bases that are far outside of the distribution for the everyday data that NLP and LLM methods tend to be trained on. This will be critical in order to assess the degree to which we should expect our methods to struggle on the jargon present in production military and intelligence community ontologies.

Knowledge Graph	Millions of Nodes	Millions of Edges	Size	Last Updated
Wikidata [18]	114	1570	1.4 TB	2024
Freebase [19]	72	306	250 GB	2015
DBpedia [20]	60	850	374 GB	2024
YAGO 4.5 [21]	49	109	142 GB	2023

Table 1: Available open-source large knowledge graphs.

To evaluate the recommendations provided by our LLM system, we will compare the graph constructed via the application of the LLM recommendations to a known ground-truth graph. We will obtain these ground-truth graphs by taking sub-graphs of an existing knowledge graph and modifying it through some sequence of updates, thus obtaining both the complete ground truth graph and the modified graph to feed to the LLM. This will yield both a suggested set of edits made by the LLM that can be compared to the ground-truth chosen updates to produce the modified graph, as well as the updated graph constructed from the LLM edits that can be compared to the original ground-truth graph.

For comparison of the LLM suggested edits to the ground-truth updates, we can evaluate the LLM’s efficacy using precision (to measure how often a suggestion is correct) and recall (to measure the frequency that ground-truth edits are suggested). Measuring both precision and recall for the LLM’s suggestions allows us to prioritize a system that is both consistently correct in its suggestions without recommending superfluous edits. Additionally, we can further evaluate the ranking of the LLM suggestions against the ground-truth edits via ranking metrics such as Normalized Discount Cumulative Gain (NDCG) [22], which prioritizes recommending highly relevant graph edits.

For the evaluation of the graph produced by the LLM’s edits, we can compare this graph to the original unedited ground-truth graph via graph-theoretic similarity metrics. These include metrics such as adjacency spectral distance [23], which measures the vector distance between the spectra of the adjacency matrices of the two graphs, which decreases with similarity in graph topology. Another graph-theoretic metric to use is the graph edit distance [24], which measures the minimal amount of edits that must be made to one graph to transform it into another one. This metric would serve as a proxy of calculating the number edits that must be removed and added to the LLM’s suggestions. Additionally, as we will have a sub-graph vector representation model (Section 3.1.3), we can encode both the ground-truth and LLM generated graphs as vectors and then directly compare them through our chosen vector similarity metric.

3.3 Open Source

Kitware is a company with deep roots in building, using, and customizing open source software [7,8,12,25]. We prosper by applying our expertise in scientific and software development to create and enhance open source software for our customers and then share these enhancements when possible, thus creating new collaborations and new customers. Our open source model provides us key benefits such as sustainability and credibility. It makes sure that the government investment is well utilized, well tested, and recognized by the wider community. To this end, all software, datasets, models, and other artifacts resulting from the work on this effort will be released to the government with unlimited rights. This will allow our customers to re-use the products of this SBIR in follow-on work, as well as other benefiting efforts and programs. If permitted by the government, Kitware typically requests an effort be made to open source the products of our work to the wider community outside of the DoD/IC.

In the DoD/IC space, our open source policy translates into a business model where we deliver R&D services to produce capabilities that we then deliver to a restricted community in an open source manner. Typically all work done is delivered to the government with unlimited rights, and we strive to provide the source data, model, code, and seek publication of our results at the appropriate security level.

3.4 Statement of Work

3.4.1 Scope

Kitware will research 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. As part of this investigation, methods will be explored and evaluated for their ability to solve the problem of traversing large production knowledge graphs for key nodes and subgraphs of relevance to recent user interaction. Kitware will investigate methods of suggesting specific changes to these relevant nodes based on user feedback. The investigation will span methodologies for both knowledge graph and schema management. A feasibility assessment will be compiled which documents the performance of these methods against the appropriate baseline performance metrics, as well as documentation of the developed techniques.

3.4.2 Task Outline

Task 1: Investigate methods for compressed sub-graph representation.

Kitware will research methods to perform feature encoding of individual nodes and edges in a graph and schema, as well as sub-graphs. Methods such as BERT encodings and graph convolutional neural networks, or similar methods, will be considered.

Task 2: Investigate LLM-based graph update recommendation system.

Kitware will research various methods of using LLMs to recommend graph updates. These may include approaches such as processing user activity logs, as well as identifying relevant sub-graphs to enable making recommendations on nodes, edges, and schema elements to update.

Task 3: Investigate interactive prompt refinement.

Kitware will research methods on the efficacy of iterative prompt refinement for the task of presenting the user with relevant graph nodes, edges, and schema elements to update. These may include methods such as dynamic prompt refinement in order to align LLM behavior with user goals.

Task 4: Obtain baseline performance metrics.

Kitware will evaluate the methods under investigation against the appropriate baseline evaluation metrics. The results will be included in the feasibility study. Performance metrics may include graph edit distance to ground truth graph edits created as part of this study or gathered from existing datasets.

Task 5: Management and reporting.

Kitware will manage project execution in an iterative, agile manner. Status reports will be prepared quarterly (or as required) as well as a final report with which details the findings of our investigation.

3.4.3 Milestone Schedule

In Figure 6 we show the anticipated schedule and deliverables for this effort. Any software and models developed to support Phase 1 research will be research prototypes and not production-ready code.

AF233_0001 Gantt Chart

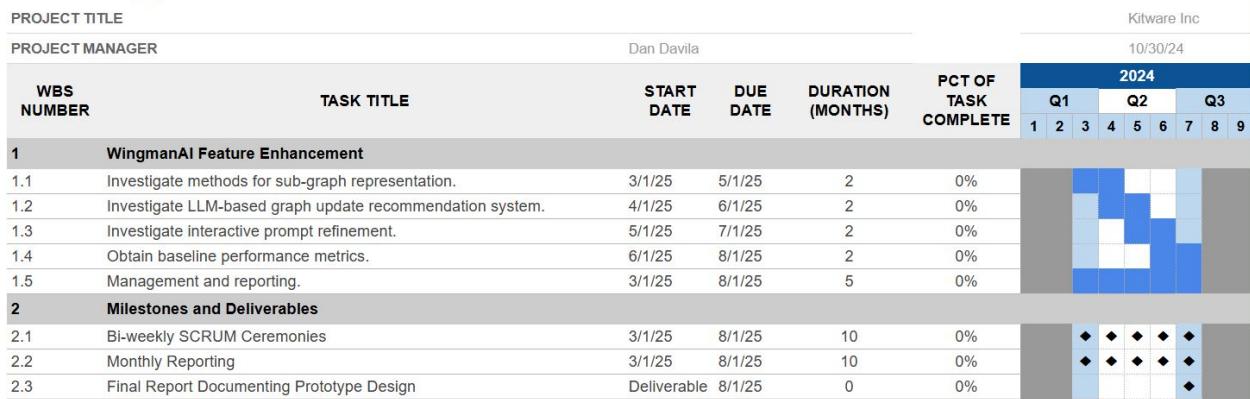


Figure 6: Program Schedule.

3.4.4 Deliverables

1. Final written report documenting our feasibility assessment and developed prototype software and models.

4 Related Work

The following sections discuss our related work. A table of contact information and end dates for programs discussed below is provided in Section 4.5.

4.1 AFRL Redforce

Kitware is a long time performer on the AFRL RI red-force program, which deals generally with productionizing deep learning models within an ecosystem of apps, including FuelAI (a data annotation platform) and WingmanAI (an MLOps platform). We have deployed dozens of models to IL5, SIPRnet, and JWICs over the course of this effort in support of warfighter and researcher needs. Recently, the team deployed the first open source LLM model to the high side via WingmanAI [26]. This model supports AF DCGS operations and ships many modern features of an LLM system including chat history, RAG, and more. We have gained extensive experience in manipulating the prompts of LLMs and VLMs to elicit the desired behavior from these models.

4.2 Army Tech Marketplace

On the Army Tech Marketplace program, we are part of a team that seeks to build a platform for enhancing government PM situational awareness around research topics of interest. The primary goal is to support program planning activities, networking, and learning. Kitware is working to exploit the capabilities of modern LLM models to ingest highly unstructured data and compute a Knowledge Graph of entities and relationships. This can then be used to inform PM searches of certain topics, enabling them to make informed decisions about resource allocation, deconflict program overlaps, enable connectivity between participants on the platform (including PMs, vendors, requirements shops), and more. We are also exploring methods supporting direct search against large knowledge graphs containing data related to performer history, state of the art research, and other topics.

4.3 DARPA Learning with Less Labeling

Under the DARPA Learning with Less Labeling (LwLL) effort, we solved DoD-relevant, supervision-denied problems with our Label-Efficient Active Resilient Network (LEARN) framework. Prof. Trevor Darrell was the PI of the project with Kitware subcontracting. We employed unsupervised and self-supervised learning on unlabeled [29–31] data to develop optimal base representations, which were refined by fine-tuning related tasks (“transfer learning”) [32]. Related tasks were found based by training data similarity (with or without labels), and/or available metadata or task specifications [33–36]. See 9 for our few-shot detection results.

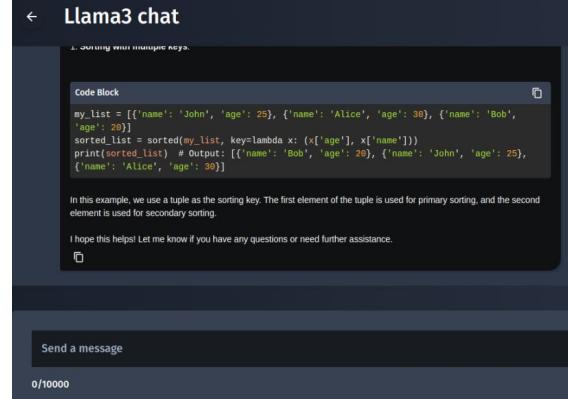


Figure 7: Our open source LLM chat engine which we have deployed to operations throughout the AF DCGS.



Figure 8: We are building a backend system for the Army Tech Marketplace program which ingests unstructured data (such as contracts, news articles, papers, etc...) and produces Knowledge Graphs. This is done with promptable LLMs.

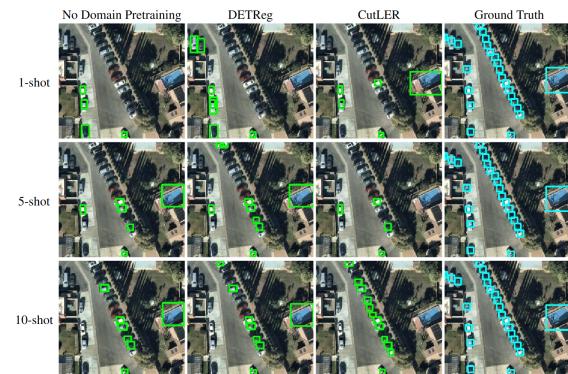


Figure 9: Our LwLL few-shot results showing how two of our unsupervised pertaining algorithms (DetReg [27] and CutLER [28]) improve detection.

An independent evaluator measured success by accuracy or mAP score on multiple unknown datasets. These same methods, which generally exploit foundational models to extract feature-rich vectors, will be used on WEAVER to characterize nodes and sub-graphs for efficient graph compression and search.

4.4 KG Generation for Metabolomics

Under the NIH KG for Metabolomics program, Kitware is working to apply Knowledge Graphs to the task of automatic extraction of SME knowledge from authoritative sources such as text books, papers, and lecture notes. This information is encoded into a Knowledge Graph via direct prompt of a Large Language Model. We achieve this via Retrieval-Augmented Generation (RAG), which enables the LLM to pull directly from the source material when extracting and linking entities into the Knowledge Graph, according to a schema of possible relationships which is also provided. The goal is to use this knowledge graph to provide timely SME-level advice for researchers and practitioners, accessible via a natural language interface provided by an additional LLM that can reason about the KG and answer user questions. There is no current plan to investigate fine-tuning the graphs on in-domain data, but this may be a focus on Phase 2 and beyond.

4.5 Related Work Contacts

Individual contacts and end dates for the programs discussed above are found in the table below.

Program	Program Manager	Contact	End Date
AFRL redforce	Mr. Morgan Bishop	(315) 795-6290	Oct 2025
Army Tech Marketplace	Mr. Paul Reid	-	Nov 2025
DARPA Learning with Less Labels	Bruce Draper	-	Oct 2022
NIH KG for Metabolomics	Wiriya Rutvisuttinunt	-	Sep 2025

5 Relationship with Future Research or Research and Development

The anticipated result of the proposed approach, if successful, is a proof of concept prototype of a system that can generate graph and schema update suggestions and allow a user to rapidly curate these changes in support of a highly dynamic mission. The experiments in Phase I and feedback from the government will help revise the directions for Phase II research. We will determine which approaches are most promising to continue and establish an experimental framework for validating results into Phase II. The software we develop in Phase I will directly lay the foundation for improvements in Phase II. We will use the results of the Phase I study to design and implement a larger scale, more integral system in Phase II.

Further development beyond Phase II will lead directly to the commercialization of our system, initially for the DoD and intelligence community and subsequently for the civilian market; this is detailed further in Section 6. Kitware has a history of technology transition, and is committed to seeing this program move through the commercialization process as a central product within our defense systems portfolio. Kitware has successfully transitioned software for Angel Fire to the Air Force Research Laboratory (AFRL), which was deployed operationally. In addition, Kitware's full-frame, frame-rate WAMI tracker was operationally deployed to Afghanistan as part of the Air Force's Blue Devil system. Other systems like TeleSculptor and VIGILANT are currently being evaluated and approved for transition into operation. We have also transitioned multiple algorithms to deployment via the FuelAI and WingmanAI platforms.

Should Phase II and beyond require algorithm evaluation on classified data. Kitware is fully prepared for this. We have classified processing facilities (Section 9) and cleared personnel (Section 7).

6 Commercialization Strategy

Kitware's commercialization strategy is built on a service-based, open source business model. Open source software attracts customers who prefer applications tailored to their needs. With permission, we will release all general-purpose software developed for this SBIR under permissive BSD licenses, and we plan to generate revenue via customization, support, training, and research contracts. Kitware has extensive experience customizing existing technology for government, research, and commercial organizations and will leverage existing relationships and software deployments. Our business model, refined over two decades, has enabled us to serve as prime contractor and project lead on numerous federally and commercially funded endeavors, as illustrated in the Company Commercialization Report (Volume 4).

6.1 Overview and Value Proposition

Our solution, WEAVER, will have immediate military applications for situational awareness, pattern of life analysis, threat detection, and targeting operations in time-constrained environments. The same software will be equally useful for a variety of commercial domains including health care, finance, banking and manufacturing. With the government's permission, Kitware intends to work with a variety of commercial companies to offer the framework as part of their product packages to end users. The costs for implementing the software portion of this commercialization strategy are absorbed into the development of the technology and Kitware's operating expenses; no additional costs will be incurred to commercialize the software. The project will be developed and produced with SBIR funding. The actions necessary to implement the commercialization strategy are primarily networking and business development, conference attendance to promote the technology, and additional marketing and communications efforts provided by Kitware's highly experienced in-house Business Development Team, which are covered in Kitware's operating expenses.

6.2 Market and Competitive Advantage

The demand for technologies such as WEAVER is anticipated to grow as organizations seek advanced tools for data integration and analysis. The defense sector, in particular, is investing in solutions that enhance operational efficiency and decision-making capabilities. Companies developing interactive dynamic knowledge graph technologies are well-positioned to meet these needs, offering significant opportunities in both defense and cybersecurity markets. In cybersecurity, knowledge graphs are employed to model complex relationships between entities, aiding in threat intelligence and situational awareness. They enable the integration of diverse data sources, facilitating advanced analytics and decision-making [37].

Beyond defense and cybersecurity, interactive dynamic knowledge graphs are increasingly adopted across various commercial sectors to enhance situational awareness, pattern-of-life analysis, and decision-making in time-sensitive environments [38]:

- **Healthcare:** In healthcare, knowledge graphs integrate diverse medical data, facilitating real-time patient monitoring, anomaly detection, and personalized treatment plans. They support rapid decision-making by providing comprehensive views of patient histories and potential health risks. The global healthcare analytics market, which includes knowledge graph applications, was valued at approximately \$44.83 billion in 2024 to \$133.19 billion by 2029, reflecting a compound annual growth rate (CAGR) of 24.3% [39]. This growth is driven by the increasing need for data integration and real-time analytics to enhance patient care and operational efficiency.
- **Finance and Banking:** Financial institutions utilize knowledge graphs for fraud detection, risk assessment, and compliance monitoring, and are investing in advanced analytics to navigate complex regulatory environments and mitigate risks effectively. By mapping complex relationships between transactions and entities, they can identify suspicious patterns and respond swiftly to potential threats. The global financial analytics market was valued at \$8.78 billion in 2023 and is projected to grow from \$9.68 billion in 2024 and reach \$23.04 billion by 2032, with a CAGR of 11.5% [40]. Increasing adoption of pervasive computing devices, rising advanced storage capabilities, and growing innovation of new analytical tools are providing new opportunities to market participants, which is driving the growth of the global financial analytics market.
- **Manufacturing:** In manufacturing, knowledge graphs assist in monitoring production processes, predicting equipment failures, and optimizing maintenance schedules. They enable quick responses to operational anomalies, reducing downtime and improving productivity. The global manufacturing analytics market, leveraging knowledge graphs for process optimization and predictive maintenance, was valued at \$12.8 billion in 2023. It is projected to grow to \$60.5 billion by 2032, with a CAGR of 18.2% [41]. The adoption of Industry 4.0 practices and the emphasis on operational efficiency contribute to this expansion.

The adoption of interactive dynamic knowledge graphs across these sectors underscores their versatility in enhancing situational awareness and decision-making in complex, time-constrained environments. The competitive landscape features key players such as Neo4j, Stardog, Ontotext, Linkurious, and DataWalk.

All of these commercially oriented competitors offer closed-source products with licensing and subscription costs (with the exception of Neo4j; however its advanced features and enterprise-level support are available only in their commercial editions). Kitware's open source business model provides many competitive advantages: free and open source software accessible on any budget; local data processing for higher security; technology that is optimized for military applications; and highly modular software that is swappable and plug-in friendly for maximum customizability.

Kitware has successfully commercialized similar tools in the past. Based on an assessment of current contracts for our services and a historical analysis of projects similar in scale and duration, we anticipate revenue from the following sources:

- **Collaborative Research Contracts:** Our close ties to the research community typically lead to numerous opportunities to collaboratively pursue research funding.
- **Custom Solutions Contracts:** Federal and commercial organizations often approach Kitware to provide custom software and R&D services to more efficiently tailor our solutions to their specific needs.
- **Support Contracts:** Dedicated resources for answering questions, customized training courses, and debugging assistance.

Our business model sets us apart from competing offerings, as it provides the ability to improve the platform in-house and promotes partnerships and collaborations freely with no licensing or maintenance fees. These elements will give Kitware a competitive advantage in the targeted markets.

6.3 Commercialization Schedule

We expect yearly revenues from the developed technology to start at \$190K upon completion of this effort and grow to approximately \$1.56M per year over the next 5 years, as shown in Table 2.

Revenue Source		2027	2028	2029	2030	2031
Research Contracts (\$50K-\$500K each)	# Revenue	0 \$0K	1 \$250K	1 \$250K	1 \$250K	2 \$500K
Custom Solutions Contracts (\$50K-\$500K each)	# Revenue	1 \$150K	2 \$300K	4 \$600K	5 \$750K	6 \$900K
Support Contracts (\$10K-\$20K each)	# Revenue	2 \$40K	3 \$60K	4 \$80K	6 \$120K	8 \$160K
Gross Revenues		\$190K	\$610K	\$930K	\$1.12M	\$1.56M

Table 2: Anticipated revenues.

7 Key Personnel

Daniel Davila, PI, U.S. Citizen, TS/SCI

Daniel Davila is a Technical Leader at Kitware, joining in 2019. A career research engineer, he has over 8 years of experience in the Energy, Space, and Defense Industries. Mr. Davila's expertise lies applied deep learning systems development and deployment, systems engineering, and project leadership. He serves as Principal Investigator on multiple ongoing Air Force Research Laboratory (AFRL) programs including FuelAI, redforce, Wingman, and TAKML. On FuelAI and Wingman, his team focuses on the AI lifecycle considerations within the MLOPs platform, as well as the development and deployment of LLMs and VLMs to the WingmanAI chat feature. This project team recently deployed the first open source high side model to analysts within the AF DCGS. On another program, Mr. Davila leads the development of a LLM-based knowledge graph generation tool for the Army SBIR office. This work is focused on improving the quality of literature review for government PMs in the program planning stage. During his time at Kitware, Mr. Davila has also served as PI or tech lead on various programs related to distributed ATR and tracking systems, including for the C5ISR MMP program, the DARPA URSA tracking program, and efforts for customers at NGA, Air Force, Navy, DARPA, and IARPA. Mr. Davila received his master's and bachelor's degrees in Electrical Engineering from the Georgia Institute of Technology. **Recent Publications:** [4], [5], [42], [43].

Brian Clipp, Artificial Intelligence SME, U.S. Citizen, TS/SCI

Brian Clipp, Ph.D. is an Assistant Director on the Computer Vision Team. He leads R&D projects across a range of areas including fine-grained attributed-based object classification; zero-shot object detection; and satellite image segmentation. He has led projects for NGA, DARPA, AFRL, IARPA, and C5ISR. Dr. Clipp has published over 20 articles in peer-reviewed artificial intelligence, computer vision and robotics conferences and journals [44, 45] and holds three U.S. patents. He has served as workshop chair for CVPR 2025, on organizing committees for WACV 2024 and 2025, as an area chair (CVPR, ECCV, and WACV) and as a reviewer for numerous top-tier computer vision conferences and journals. Dr. Clipp earned his Ph.D. in 2010 from UNC Chapel Hill.

8 Foreign Citizens

There will not be any foreign nationals working on this effort.

9 Facilities and Equipment

Kitware's offices in Clifton Park, NY, Carrboro, NC, Minneapolis, MN, and Arlington, VA all meet federal, state, and local environmental laws and regulations. The proposed work will be performed primarily in the Clifton Park, NY office, with support from staff in other offices. Kitware has a mixed environment of personal and shared computing platforms. Employees average three computers per person (desktop, laptop, and/or home system), with each computer typically equipped with multiple multi-core processors, high-performance graphics cards, and dual monitors. Personal systems run a mix of Windows, MacOS, and Linux operating systems. Shared resources include compilation and testing farms as well as workstations running a variety of alternative operating systems for testing purposes (e.g. Windows, CentOS, and Ubuntu). Kitware hosts several special-purpose, high-end workstations and GPU systems, and maintains several servers to provide public access to the open source systems (VTK, CMake, etc.), as well as supporting internal software development efforts. Kitware has both a Secret and a Top Secret facility clearance, with certification for storage and processing at the Secret level. Over 50 members of the team have clearances, with over two dozen members of the vision group have TS clearances, and several of them have SCI clearances. We have access to TS level processing facilities at two of our four offices, including the Clifton Park and Carrboro locations. Where applicable, the proposed performance locations meet environmental laws and regulations of Federal, state, 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.

There is no requested hardware budget on this program. We anticipate that all compute and data storage needs are covered by our existing infrastructure.

10 Subcontractors/Consultants

There will be no subcontractors on this effort.

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

No prior, current, or pending support for proposed work.

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Daniel Davila daniel.davila@kitware.com

Technical Leader - AI Group

Core Skills

-
- AI, Machine Learning, Deep Learning
 - Large Language Models, Graph Neural Networks, Knowledge Graphs
 - Automated target recognition, reid, tracking
 - Project Management & Business Development
 - Leadership, Team Development
 - Torch, Keras, Caffe
 - Python, C++
 - Docker, Distributed Computing, AWS
 - TS/SCI Cleared

Experience

Technical Leader

July 2019 - Present

Kitware, Inc - Carrboro, NC

Working within the core computer vision team as a principal investigator, product owner, and applied researcher.

Developing cutting edge AI systems for customers in Defense and the Environmental Sciences.

- Principal Investigator for multiple deployed ATR and tracking systems
- Lead developer on multi-sensor, multi-person detection & tracking algorithms for multi-platform RGB/IR sensing
- Lead remote and drone sensing AI/ML efforts, typically involving real-time edge sensing
- Serve as SCRUM master and product owner for several low-to-high TRL development efforts

Research Engineer

June 2015 - May 2019

Southwest Research Institute - San Antonio, TX

Worked alongside industry leaders in the Oil & Gas, Space, and Aerospace industries to integrate modern intelligent algorithms into legacy and cutting-edge systems.

- Lead engineer and project manager for \$3MM Smart Leak Detection Program, a multi-platform (ground and SUAS) edge sensor for automated crude oil and methane gas leak detection
- Program manager for spaceflight analytics component
- Principal Investigator on effort to develop spacecraft embedded AI algorithms for sensor exploitation
- Promoted analytics capabilities through conference publications and presentations

Education

BS, MS, Electrical Engineering, Georgia Tech, Atlanta Ga

2009-2015

Recent Publications

J. Anderson, M. Bernstein, **D. Davila**, "Large Pretrained Models (LPTM) for Unstructured Data Search and Data Annotation," in Naval Applications of Machine Learning (NAML), 2024.

A. Romlein, A. Lynch, B. Clipp, **D. Davila**, A. Barricelli, C. Yang, N. Jerles, B. Burns, M. Aeillo, "Long-Term Tracking and Re-Identification for Threat Quantification in Unmanned Aircraft System Video," in Military Sensing Symposium (MSS), 2024.

D. Davila, D. Melamed, D. Depauw, and J. Anderson, "Multi-ATR Fusion and Ontological Deconfliction for Geospatial Imagery," in Proceedings of the National Security Sensor and Data Fusion Committee (NSSDF), 2023.

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SBIR Phase I Proposal

Proposal Number	F244-0001-0093
Topic Number	AF244-0001
Proposal Title	WEAVER: An Intelligent System For Interactive Knowledge Graph Maintenance
Date Submitted	11/05/2024 10:41:32 PM

Firm Information

Firm Name	Kitware
Mail Address	1712 Route 9 Suite 300, Clifton Park, New York, 12065
Website Address	http://www.kitware.com
UEI	DK6LPWMS5LP5
Duns	010926207
Cage	1DKA7

Total Dollar Amount for this Proposal	\$139,999.58
Base Year	\$139,999.58
Year 2	\$0.00
Technical and Business Assistance(TABA)- Base	\$0.00
TABA- Year 2	\$0.00

Base Year Summary

Total Direct Labor (TDL)	\$92,682.12
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 36.7%) x Base (TDL+TOH)	\$34,014.34
Total Firm Costs	\$126,696.46
Subcontractor Costs	
Total Subcontractor Costs (TSC)	\$0.00
Cost Sharing	-\$0.00
Profit Rate (10.5%)	\$13,303.13
Total Estimated Cost	\$139,999.58
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 (TDL+TOH)	\$0.00
Total Firm Costs	\$0.00
Subcontractor Costs	
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	
Computer and Information Research Scientist/ Principal Investigator (Daniel Davila)	\$85.08	156.60			\$13,323.53	
Computer and Information Research Scientist/ Other Key Personnel (Brian Clipp)	\$112.54	52.20			\$5,874.59	
Computer and Information Research Scientist/ Research and Development Engineer 1	\$55.12	550.88			\$30,364.51	
Subtotal Direct Labor (DL)					\$49,562.63	
Labor Overhead (rate 87%) x (DL)					\$43,119.49	
Total Direct Labor (TDL)					\$92,682.12	

G&A (rate 0%) x Base (TDL+TOH)	\$34,014.34
Cost Sharing	-\$0.00
Profit Rate (10.5%)	\$13,303.13
Total Estimated Cost	\$139,999.58
TABA	\$0.00

Year 2

Direct Labor Costs						
Category / Individual-TR	Rate/Hour	Estimated Hours	Fringe Rate (%)	Fringe Cost	Cost	
Computer and Information Research	\$85.08	0			\$0.00	

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

G&A (rate 0%) x Base (TDL+TOH)	\$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: Mary Key

Phone: (518) 371-3971

Phone: mary.key@kitware.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: Defense Contract Audit Agency

Audit Agency POC: Matthew Fischer

Address: 375 Saratoga Road, Glenville, New York,12302

Phone: (571) 448-4685

Email: matthew.d.fischer5.civ@mail.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
Computer and Information Research Scientist	Principal Investigator	Master's Degree	9	156.60	\$85.08		\$13,323.53
Computer and Information Research Scientist	Other Key Personnel	PhD	16	52.20	\$112.54		\$5,874.59
Computer and Information Research Scientist	Research and Development Engineer 1	Bachelor's Degree	0	550.88	\$55.12		\$30,364.51

Are the labor rates detailed below fully loaded?

NO

Provide any additional information and cost support data related to the nature of the direct labor detailed above.

Labor mix is based on skill set and expertise required by the project. Rates are in line w/ industry standards and reflect actual rate where applicable. Supporting information available upon request.

Direct Labor Cost (\$):

\$49,562.63

Year2

Category	Description	Education	Yrs Experience	Hours	Rate	Fringe Rate	Total
Computer and Information Research Scientist	Principal Investigator	Master's Degree	9	0	\$85.08		\$0.00

Are the labor rates detailed below fully loaded?

NO

Provide any additional information and cost support data related to the nature of the direct labor detailed above.

N/A - no Year 2. Topic duration is 6 months.

Direct Labor Cost (\$):

\$0.00

Sum of all Direct Labor Costs is(\$): \$49,562.63

Overhead

Base

Labor Cost Overhead Rate (%): 87

Overhead Comments:

Direct Labor

Overhead Cost (\$): \$43,119.49

Year2

Labor Cost Overhead Rate (%): 0

Overhead Comments:

N/A - no Year 2. Topic duration is 6 months.

Overhead Cost (\$): \$0.00

Sum of all Overhead Costs is (\$): \$43,119.49

General and Administration Cost

Base

G&A Rate (%): 36.7

Apply G&A Rate to Overhead Costs? YES

Apply G&A Rate to Direct Labor Costs? YES

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

Direct Labor, Overhead, Travel, Other Direct Costs, Materials and Subcontractor Administration

G&A Cost (\$): \$34,014.34

Year2

G&A Rate (%): 0

Apply G&A Rate to Overhead Costs? YES

Apply G&A Rate to Direct Labor Costs? YES

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

N/A - no Year 2. Topic duration is 6 months.

G&A Cost (\$): \$0.00

Sum of all G&A Costs is (\$): \$34,014.34

Profit Rate/Cost Sharing

Base

Cost Sharing (\$): -

Cost Sharing Explanation:

Profit Rate (%): 10.5

Profit Explanation:

Kitware's fee is based on risk factors including technical challenges, performance, cost, and administrative.

Total Profit Cost (\$): \$13,303.13

Year2

Cost Sharing (\$): -

Cost Sharing Explanation:

Profit Rate (%): 0

Profit Explanation:

N/A - no Year 2. Topic duration is 6 months.

Total Profit Cost (\$): \$13,303.13

Total Proposed Amount (\$): \$139,999.58

DISCLAIMER: Information provided herein is privileged and confidential, and not subject to disclosure, pursuant to 15 U.S.C. 638 (k)(4) and 5 U.S.C. 552. This information shall only be used or disclosed for evaluation purposes.

Privileged and confidential and not subject to disclosure pursuant to 15 U.S.C. 638 (k)(4) and 5 U.S.C. 552.



SBIR Company Commercialization Report

Total Investments:	Total Sales:	Total Patents:	Government Designated Phase III Funding:
\$59,756,184.00	\$41,927,674.00	0	\$0.00

Company Information

Address:

1712 ROUTE 9 STE 300
HALFMOON, NY 12065-3104
United States

SBC Control ID: SBC_000001978 Company Url: <https://www.kitware.com>

Company POC		Commercialization POC	
Title:	CEO	Title:	Senior Contracts Administrator
Full Name:	Lisa Avila	Full Name:	Adrien Beaudet
Phone:	5188814903	Phone:	(518) 371-3971
Email:	contracts@kitware.com	Email:	proposals@kitware.com

Additional Company Information

% Revenue for last fiscal year from SBIR/STTR funding:	Total revenue for last fiscal year:
23.7%	\$20,000,000 - \$99,999,999
Year Founded:	# Employees Currently:
1998	195
Year first Phase I award received:	# SBIR/STTR Phase I Awards:
1998	119
Year first Phase II award received:	# SBIR/STTR Phase II Awards:
2003	71
# Employees at first Phase II award:	Mergers and Acquisition within past 2 years:
12	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 N/A	
Woman-Owned:	Socially and Economically Disadvantaged:
No	No
HUBZone-Certified:	SBC majority-owned by multiple VCOC, HF, PE firms By what percent (%):
No	No 0.00%

Additional Investment From

	Last Submitted Version (10-10-2023 12:03 PM)	Current Version
DoD contracts/DoD subcontracts	\$24,089,081.00	\$24,089,081.00
Angel Investors	\$0.00	\$0.00
Venture Capital	\$0.00	\$0.00
Self Funded	\$0.00	\$0.00
Private Sector	\$2,270,480.00	\$2,270,480.00
Other Federal Contracts/Grants	\$33,042,367.00	\$33,042,367.00
Other Sources	\$354,256.00	\$354,256.00
Additional Investment	\$0.00	\$0.00
Total Investment	\$59,756,184.00	\$59,756,184.00

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SBIR Company Commercialization Report

Phase III Sales To

	Last Submitted Version (10-10-2023 12:03 PM)	Current Version
DoD or DoD prime contractors	\$18,857,988.00	\$18,857,988.00
Private Sector	\$7,281,319.00	\$7,281,319.00
Export Markets	\$640,935.00	\$640,935.00
Other Federal Agencies	\$14,972,078.00	\$14,972,078.00
Additional commercialization by 3rd Party Revenue	\$0.00	\$0.00
Other Customers	\$175,354.00	\$175,354.00
Additional Sales	\$0.00	\$0.00
Total Sales	\$41,927,674.00	\$41,927,674.00

Government Phase III Contracts

	Last Submitted Version (10-10-2023 12:03 PM)	Current Version
Funding Obligated	\$0.00	\$0.00

Commercialization Narrative

Note that our percentage for STTR commercialization is 100%, and the university partner is listed as 0% due to the open-source nature of our collaborative work. Each team independently commercializes the technology (and has equal access to it through the open source code base). Hence the numbers we report are for Kitware only.

Commercialized Awards

- Listed below are the sales revenue and investment details resulting from the technology developed under these SBIR/STTR awards.

TeleSculptor:Semantic 3D Scene Modeling From High Zoom Reconnaissance Video

1 of 67

Agency/Branch:	Department of Defense/Air Force	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase II/2018	Subsidiaries	N/A
Topic #:	AF161-151	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	FA8650-18-C-1149	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:	Dod or DoD prime contractors: \$1,920,481.00
Other Federal contract/grants:	Other Federal Agencies: \$1,716,385.00
Angel Investors:	Private Sector: \$0.00
Venture Capital:	Export Market: \$0.00
Self-Funded:	3rd Party Revenue: \$0.00
Private Sector:	Other Customers: \$0.00
Other Sources:	
Investment Total:	Sales Total: \$3,636,866.00

Multimodality Image-Based Assessment System for Traumatic Brain Injury

2 of 67

Agency/Branch:	Department of Health and Human Services/National Institutes of Health	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase II/2015	Subsidiaries	N/A

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SBIR Company Commercialization Report

Topic #:	101	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	2R44NS081792-03A1	Used in Federal or acquisitions program?	No
Achieved a cost saving or cost avoidance?:	No		
Additional Investment From			
DoD contract/subcontract:	\$227,621.00	Phase III Sales To	
Other Federal contract/grants:	\$723,540.00	Dod or DoD prime contractors:	\$227,621.00
Angel Investors:	\$0.00	Other Federal Agencies:	\$0.00
Venture Capital:	\$0.00	Private Sector:	\$0.00
Self-Funded:	\$0.00	Export Market:	\$0.00
Private Sector:	\$0.00	3rd Party Revenue:	\$0.00
Other Sources:	\$0.00	Other Customers:	\$0.00
Investment Total:	\$951,161.00	Sales Total:	\$227,621.00

Generating Labeled Voxelizations for Numerical Simulation

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Agency/Branch:	Department of Defense/Air Force	Manufacturing related	Yes Systems Level Manufacturing
Program/Phase/Year:	SBIR/Phase II/2007		
Topic #:	AF06-034	Subsidiaries	N/A
Contract/Grant #:	FA8650-07-C-6756	Other contributing SBIR/STTR awards	N/A
Achieved a cost saving or cost avoidance?:	No	Used in Federal or acquisitions program?	No
Additional Investment From			
DoD contract/subcontract:	\$252,283.00	Phase III Sales To	
Other Federal contract/grants:	\$1,744,261.00	Dod or DoD prime contractors:	\$417,882.00
Angel Investors:	\$0.00	Other Federal Agencies:	\$163,840.00
Venture Capital:	\$0.00	Private Sector:	\$70,295.00
Self-Funded:	\$0.00	Export Market:	\$0.00
Private Sector:	\$4,085.00	3rd Party Revenue:	\$0.00
Other Sources:	\$156,128.00	Other Customers:	\$0.00
Other Sources Description:	combination of domestic non-profit and foreign government		
Investment Total:	\$2,156,757.00	Sales Total:	\$652,017.00

Collaborative Visualization for Large-Scale Accelerator Electromagnetic Modeling

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Agency/Branch:	Department of Energy	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase II/2009	Subsidiaries	N/A
Topic #:	N/A	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	DE-FG02-08ER85143	Used in Federal or acquisitions program?	Yes
Achieved a cost saving or cost avoidance?:	Yes	a. Primary Agency:	Department of Energy
a. Agency/End user:	DOE, DOD	b. System/Program:	NNSA ASC, ASCR
b. System/Program:	NNSA ASC, ASCR, DOD PETTT	c. Phase III Contract #:	N/A
c. Cost Savings:	\$2,000,000.00		
d. Cost Savings Type:	Annual savings		

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SBIR Company Commercialization Report

e. Explanation: This SBIR developed and enhanced collaborative and remote data analysis and visualization on the desktop and the web. This capability enabled DOE and DOD laboratories to avoid purchasing high end graphical workstations for their scientists and engineers. We estimate that there are roughly 2,000 ParaView users benefiting from this technology. This technology will save \$1,000 per user per year in their purchase of workstations.

Additional Investment From	Phase III Sales To
DoD contract/subcontract:	\$1,237,130.00
Other Federal contract/grants:	\$2,068,815.00
Angel Investors:	\$0.00
Venture Capital:	\$0.00
Self-Funded:	\$0.00
Private Sector:	\$70,520.00
Other Sources:	\$0.00
Investment Total:	\$3,376,465.00
	Sales Total:
	\$1,344,934.00

Open Source Visualization and Analysis Platform for 3D Reconstructions of Materials by Transmission Electron Microscopy

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Agency/Branch:	Department of Energy	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase II/2017	Subsidiaries	N/A
Topic #:	05a	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	DE-SC0011385	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:	\$32,500.00
Other Federal contract/grants:	\$200,250.00
Angel Investors:	\$0.00
Venture Capital:	\$0.00
Self-Funded:	\$0.00
Private Sector:	\$20,000.00
Other Sources:	\$0.00
Investment Total:	\$252,750.00
	Sales Total:
	\$122,223.00

General Online Object Deep (GOOD) Tracking Phase 2

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Agency/Branch:	Department of Defense/Air Force	Manufacturing related	No N/A
Program/Phase/Year:	STTR/Phase II/2019	Subsidiaries	N/A
Topic #:	AF17A-T027	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	FA8650-19-C-1011	Used in Federal or acquisitions program?	No
Achieved a cost saving or cost avoidance?:	No		

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SBIR Company Commercialization Report

Additional Investment From		Phase III Sales To	
DoD contract/subcontract:	\$0.00	Dod or DoD prime contractors:	\$159,882.00
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:	\$159,882.00

STTR Specific Information

Who initiated the collaboration?:	Small Business Concern	Number of months taken to negotiate the Allocation of Rights agreement:	9
Who initiated the technology?:	Small Business	Percentage of proceeds going to the small business:	70%

Percentage of proceeds going to the research institution:

Approach-specific, multi-GPU, multi-tool, high-realism neurosurgery simulation

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Agency/Branch:	Department of Health and Human Services/National Institutes of Health	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase II/2013	Subsidiaries	N/A
Topic #:	100	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	9R44OD018334-03A1	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:	\$586,212.00	Other Federal Agencies:	\$0.00
Angel Investors:	\$0.00	Private Sector:	\$83,813.00
Venture Capital:	\$0.00	Export Market:	\$0.00
Self-Funded:	\$0.00	3rd Party Revenue:	\$0.00
Private Sector:	\$27,938.00	Other Customers:	\$0.00
Other Sources:	\$0.00		
Investment Total:	\$614,150.00	Sales Total:	\$83,813.00

Vision with a Purpose: Inferring the Function of Objects in Video

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Agency/Branch:	Department of Defense/Air Force	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase II/2014	Subsidiaries	N/A
Topic #:	SB082-021	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	FA8650-14-C-1798	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:	\$22,500.00	Dod or DoD prime contractors:	\$189,898.00
Other Federal contract/grants:	\$0.00	Other Federal Agencies:	\$452,439.00

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SBIR Company Commercialization Report

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:	\$22,500.00	Sales Total:	\$642,337.00

MAP-Tk: Motion Imagery Aerial Photogrammetry Toolkit

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Agency/Branch:	Department of Defense/Air Force	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase II/2014	Subsidiaries	N/A
Topic #:	AF131-151	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	FA8650-14-C-1820	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:	\$21,610.00	Dod or DoD prime contractors: \$2,663,059.00
Other Federal contract/grants:	\$0.00	Other Federal Agencies: \$755,125.00
Angel Investors:	\$0.00	Private Sector: \$12,927.00
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:	\$21,610.00	Sales Total: \$3,431,111.00

GoBig: A Unified Interface to Big Data Systems

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Agency/Branch:	Department of Energy	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase II/2016	Subsidiaries	N/A
Topic #:	01c	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	DE-SC0013252	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:	\$295,615.00	Dod or DoD prime contractors: \$205,590.00
Other Federal contract/grants:	\$1,033,922.00	Other Federal Agencies: \$337,060.00
Angel Investors:	\$0.00	Private Sector: \$285,951.00
Venture Capital:	\$0.00	Export Market: \$0.00
Self-Funded:	\$0.00	3rd Party Revenue: \$0.00
Private Sector:	\$60,317.00	Other Customers: \$0.00
Other Sources:	\$0.00	
Investment Total:	\$1,389,854.00	Sales Total: \$828,601.00

Vision with a Purpose: Inferring the Function of Objects in Video

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SBIR Company Commercialization Report

Agency/Branch:	Department of Defense/Defense Advanced Research Projects Agency	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase II/2010	Subsidiaries	N/A
Topic #:	SB082-021	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	W31P4Q-10-C-0262	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:	\$3,424,128.00	Dod or DoD prime contractors:	\$1,004,802.00
Other Federal contract/grants:	\$0.00	Other Federal Agencies:	\$174,203.00
Angel Investors:	\$0.00	Private Sector:	\$136,010.00
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:	\$3,424,128.00	Sales Total:	\$1,315,015.00

Visual Global Intelligence and Analytics Toolkit (VIGILANT)

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Agency/Branch:	Department of Defense/Air Force	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase II/2016	Subsidiaries	N/A
Topic #:	AF153-001	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	FA8650-16-C-1717	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:	\$57,810.00	Other Federal Agencies:	\$788,599.00
Angel Investors:	\$0.00	Private Sector:	\$8,904.00
Venture Capital:	\$0.00	Export Market:	\$0.00
Self-Funded:	\$0.00	3rd Party Revenue:	\$0.00
Private Sector:	\$2,968.00	Other Customers:	\$0.00
Other Sources:	\$0.00		
Investment Total:	\$60,778.00	Sales Total:	\$797,503.00

High Throughput web-base Image Analysis of Mouse Brain MR Imaging Studies

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Agency/Branch:	Department of Health and Human Services/National Institutes of Health	Manufacturing related	No N/A
Program/Phase/Year:	STTR/Phase II/2009	Subsidiaries	N/A
Topic #:	N/A	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	2R42NS059095-03	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

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SBIR Company Commercialization Report

Other Federal contract/grants:	\$402,667.00	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:	\$402,667.00	Sales Total:	\$0.00

STTR Specific Information

Who initiated the collaboration?:	Research Institution	Number of months taken to negotiate the Allocation of Rights agreement:	2
Who initiated the technology?:	Research Institution	Percentage of proceeds going to the small business:	54%

Percentage of proceeds going to the research institution: 46%

Open Source Scalable Data Services and Data Fusion for Biological and Environmental Sciences

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Agency/Branch:	Department of Energy	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase I/2019	Subsidiaries	N/A
Topic #:	01c	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	DE-SC0019541	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:	\$5,500.00	Other Federal Agencies:	\$0.00
Angel Investors:	\$0.00	Private Sector:	\$60,750.00
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:	\$5,500.00	Sales Total:	\$60,750.00

Image guided Planning System for Skull Correction in Children with Craniosynostosis Phase II

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Agency/Branch:	Department of Health and Human Services/National Institutes of Health	Manufacturing related	No N/A
Program/Phase/Year:	STTR/Phase II/2016	Subsidiaries	N/A
Topic #:	NICHD	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	2R42HD081712-02	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:	\$726,862.00	Other Federal Agencies:	\$0.00
Angel Investors:	\$0.00	Private Sector:	\$403,636.00
Venture Capital:	\$0.00	Export Market:	\$6,540.00

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SBIR Company Commercialization Report

Self-Funded:	\$0.00	3rd Party Revenue:	\$0.00
Private Sector:	\$70,574.00	Other Customers:	\$0.00
Other Sources:	\$7,000.00		
Other Sources Description: Foreign Government			
Investment Total:	\$804,436.00	Sales Total:	\$410,176.00

STTR Specific Information			
Who initiated the collaboration?:	Research Institution	Number of months taken to negotiate the Allocation of Rights agreement:	4
Who initiated the technology?:	Research Institution	Percentage of proceeds going to the small business:	51%
		Percentage of proceeds going to the research institution:	49%

Open Interactive Data Analytics Platform for Chemical-Physics Simulations and Experiments

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Agency/Branch:	Department of Energy	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase II/2018	Subsidiaries	N/A
Topic #:	13a	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	DE-SC0017193	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:	\$156,547.00	Other Federal Agencies:	\$0.00
Angel Investors:	\$0.00	Private Sector:	\$306,760.00
Venture Capital:	\$0.00	Export Market:	\$0.00
Self-Funded:	\$0.00	3rd Party Revenue:	\$0.00
Private Sector:	\$306,760.00	Other Customers:	\$0.00
Other Sources:	\$0.00		
Investment Total:	\$463,307.00	Sales Total:	\$306,760.00

Graphical HPC Application Suite for Supporting the Product Simulation Lifecycles

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Agency/Branch:	Department of Energy	Manufacturing related	Yes Unit Process Level Manufacturing
Program/Phase/Year:	SBIR/Phase I/2012	Subsidiaries	N/A
Topic #:	02 a	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	DE-FG02-12ER90221	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:	\$730,820.00	Dod or DoD prime contractors:	\$617,902.00
Other Federal contract/grants:	\$0.00	Other Federal Agencies:	\$0.00
Angel Investors:	\$0.00	Private Sector:	\$80,463.00
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

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SBIR Company Commercialization Report

Other Sources:	\$0.00
Investment Total:	\$730,820.00

Sales Total: \$698,365.00

Web-Based Infrastructure for Comparison and Validation of Image Computing Methods

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Agency/Branch:	Department of Health and Human Services/National Institutes of Health	Manufacturing related Subsidiaries	No N/A
Program/Phase/Year:	STTR/Phase II/2014	Other contributing SBIR/STTR awards	N/A
Topic #:	101	Used in Federal or acquisitions program?	N/A
Contract/Grant #:	9R42MH106302-02		No
Achieved a cost saving or cost avoidance?:	No		

Additional Investment From

	Phase III Sales To	
DoD contract/subcontract:	\$133,208.00	Dod or DoD prime contractors: \$90,156.00
Other Federal contract/grants:	\$339,210.00	Other Federal Agencies: \$262,050.00
Angel Investors:	\$0.00	Private Sector: \$904,897.00
Venture Capital:	\$0.00	Export Market: \$480.00
Self-Funded:	\$0.00	3rd Party Revenue: \$0.00
Private Sector:	\$652,599.00	Other Customers: \$0.00
Other Sources:	\$0.00	
Investment Total:	\$1,125,017.00	Sales Total: \$1,257,583.00

STTR Specific Information

Who initiated the collaboration?:	Research Institution	Number of months taken to negotiate the Allocation of Rights agreement:	0
Who initiated the technology?:	Research Institution	Percentage of proceeds going to the small business:	0%

Pan3D: Open Source Scalable and Reproducible Scientific Workflows for 3D Data Analytics

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Agency/Branch:	Department of Energy	Manufacturing related Subsidiaries	No N/A
Program/Phase/Year:	SBIR/Phase II/2023	Other contributing SBIR/STTR awards	N/A
Topic #:	C53-01a	Used in Federal or acquisitions program?	N/A
Contract/Grant #:	DE-SC0022365		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: \$35,475.00
Venture Capital:	\$0.00	Export Market: \$0.00
Self-Funded:	\$0.00	3rd Party Revenue: \$0.00
Private Sector:	\$4,875.00	Other Customers: \$0.00
Other Sources:	\$0.00	
Investment Total:	\$4,875.00	Sales Total: \$35,475.00

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Quantitative Ultrasound Analysis of Vascular Morphology for Cancer Assessment

Agency/Branch:	Department of Health and Human Services/National Institutes of Health	Manufacturing related	Yes Systems Level Manufacturing
Program/Phase/Year:	SBIR/Phase II/2015	Subsidiaries	N/A
Topic #:	102	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	2R44CA165621-03	Used in Federal or acquisitions program?	No
Achieved a cost saving or cost avoidance?:	Yes		
a. Agency/End user:	SonoVol and its customers		
b. System/Program:	SonoVol		
c. Cost Savings:	\$840,000.00		
d. Cost Savings Type:	life-cycle		
e. Explanation:	Reduced manual processing time from 8 hours to 1 hour; operations performed 1,000 times per year per unit. Average unit lasts 5 years. Average annual salary is \$50,000. Approximate savings is therefore \$840,000 over the lifetime of each unit.		

Additional Investment From		Phase III Sales To	
DoD contract/subcontract:	\$351,747.00	Dod or DoD prime contractors:	\$151,747.00
Other Federal contract/grants:	\$1,806,984.00	Other Federal Agencies:	\$0.00
Angel Investors:	\$0.00	Private Sector:	\$95,250.00
Venture Capital:	\$0.00	Export Market:	\$7,700.00
Self-Funded:	\$0.00	3rd Party Revenue:	\$0.00
Private Sector:	\$31,250.00	Other Customers:	\$0.00
Other Sources:	\$0.00		
Investment Total:	\$2,189,981.00	Sales Total:	\$254,697.00

Human-Machine Teaming with Machine Learning Algorithms

Agency/Branch:	Department of Defense/Special Operations Command	Manufacturing related	No N/A
Program/Phase/Year:	STTR/Phase II/2020	Subsidiaries	N/A
Topic #:	SOCOM18B-001	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	H9240520C0003	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:	\$63,381.00	Dod or DoD prime contractors:	\$128,683.00
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:	\$63,381.00	Sales Total:	\$128,683.00

STTR Specific Information

Privileged and confidential and not subject to disclosure pursuant to 15 U.S.C. 638 (k)(4) and 5 U.S.C. 552.



SBIR Company Commercialization Report

Who initiated the collaboration?:	Small Business Concern	Number of months taken to negotiate the Allocation of Rights agreement:	3
Who initiated the technology?:	Small Business	Percentage of proceeds going to the small business:	70%

SBIR Phase II: The Visual Database: Portable, Extensive Markup Language (XML)-Based Middleware For Media Representation, Interaction and Exchange

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Agency/Branch:	National Science Foundation	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase II/2005	Subsidiaries	N/A
Topic #:	N/A	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	0450513	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:	\$1,670,218.00	Dod or DoD prime contractors:	\$13,985.00
Other Federal contract/grants:	\$379,998.00	Other Federal Agencies:	\$0.00
Angel Investors:	\$0.00	Private Sector:	\$392,858.00
Venture Capital:	\$0.00	Export Market:	\$0.00
Self-Funded:	\$0.00	3rd Party Revenue:	\$0.00
Private Sector:	\$131,000.00	Other Customers:	\$0.00
Other Sources:	\$156,128.00		
Other Sources Description: combination of domestic non-profit and foreign government			
Investment Total:	\$2,337,344.00	Sales Total:	\$406,843.00

HiDyVE: Hierarchical Dynamic Video Exploitation

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Agency/Branch:	Department of Defense/Air Force	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase II/2017	Subsidiaries	N/A
Topic #:	AF151-042	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	FA8750-17-C-0048	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:	\$683,453.00
Other Federal contract/grants:	\$0.00	Other Federal Agencies:	\$38,475.00
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:	\$721,928.00

Privileged and confidential and not subject to disclosure pursuant to 15 U.S.C. 638 (k)(4) and 5 U.S.C. 552.


SBIR Company Commercialization Report
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Hardening DOE R&D Software Tools for Web-based Visualization

Agency/Branch:	Department of Energy	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase II/2021	Subsidiaries	N/A
Topic #:	02a	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	DE-SC0020504	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:	\$300,000.00	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:	\$0.00	Other Customers:	\$0.00
Other Sources:	\$0.00		
Investment Total:	\$300,000.00	Sales Total:	\$0.00

Open-Source Visualization and Analysis Platform for 3D Reconstructions of Materials by Transmission Electron Microscopy

Agency/Branch:	Department of Energy	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase II/2015	Subsidiaries	N/A
Topic #:	05a	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	DE-SC0011385	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:	\$32,500.00	Dod or DoD prime contractors:	\$32,500.00
Other Federal contract/grants:	\$75,750.00	Other Federal Agencies:	\$0.00
Angel Investors:	\$0.00	Private Sector:	\$10,670.00
Venture Capital:	\$0.00	Export Market:	\$80,000.00
Self-Funded:	\$0.00	3rd Party Revenue:	\$0.00
Private Sector:	\$0.00	Other Customers:	\$0.00
Other Sources:	\$0.00		
Investment Total:	\$108,250.00	Sales Total:	\$123,170.00

ClimatePipes: User-Friendly Data Access, Data Manipulation, Data Analysis and Visualization of Community Climate Models

Agency/Branch:	Department of Energy	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase II/2012	Subsidiaries	N/A
Topic #:	30 a	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	DE-FG02-11ER90026	Used in Federal or acquisitions program?	Yes
Achieved a cost saving or cost avoidance?:	No		
a. Primary Agency:		Defense Threat Reduction Agency	
b. System/Program:		BSVE	

Privileged and confidential and not subject to disclosure pursuant to 15 U.S.C. 638 (k)(4) and 5 U.S.C. 552.



SBIR Company Commercialization Report

Additional Investment From		c. Phase III Contract #:	N/A
DoD contract/subcontract:	\$2,171,934.00	Phase III Sales To	
Other Federal contract/grants:	\$1,501,925.00	Dod or DoD prime contractors:	\$92,311.00
Angel Investors:	\$0.00	Other Federal Agencies:	\$207,101.00
Venture Capital:	\$0.00	Private Sector:	\$0.00
Self-Funded:	\$0.00	Export Market:	\$0.00
Private Sector:	\$0.00	3rd Party Revenue:	\$0.00
Other Sources:	\$0.00	Other Customers:	\$0.00
Investment Total:	\$3,673,859.00	Sales Total:	\$299,412.00

Graphical HPC Application Suite for Supporting the Product Simulation Lifecycles

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Agency/Branch:	Department of Energy	Manufacturing related	Yes Unit Process Level Manufacturing
Program/Phase/Year:	SBIR/Phase II/2013		
Topic #:	02a	Subsidiaries	N/A
Contract/Grant #:	DE-FG02-12ER90221	Other contributing SBIR/STTR awards	N/A
Achieved a cost saving or cost avoidance?:	No	Used in Federal or acquisitions program?	Yes
		a. Primary Agency:	Department of Defense
		b. System/Program:	US Army Engineering Research & Development Center Information Technology Laboratory
		c. Phase III Contract #:	N/A

Additional Investment From

DoD contract/subcontract:	\$885,598.00	Phase III Sales To	
Other Federal contract/grants:	\$0.00	Dod or DoD prime contractors:	\$772,680.00
Angel Investors:	\$0.00	Other Federal Agencies:	\$0.00
Venture Capital:	\$0.00	Private Sector:	\$395,462.00
Self-Funded:	\$0.00	Export Market:	\$0.00
Private Sector:	\$0.00	3rd Party Revenue:	\$0.00
Other Sources:	\$0.00	Other Customers:	\$0.00
Investment Total:	\$885,598.00	Sales Total:	\$1,168,142.00

Danesfield Courier: 3D Models from Point Clouds for Efficient Transmission and Rendering

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Agency/Branch:	Department of Defense/National Geospatial-Intelligence Agency	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase II/2021	Subsidiaries	N/A
Topic #:	NGA183-002	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	HM047620C0065	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:	\$150,000.00	Dod or DoD prime contractors:	\$203,514.00
Other Federal contract/grants:	\$0.00	Other Federal Agencies:	\$0.00

Privileged and confidential and not subject to disclosure pursuant to 15 U.S.C. 638 (k)(4) and 5 U.S.C. 552.



SBIR Company Commercialization Report

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:	\$150,000.00	Sales Total:	\$203,514.00

Calibrated Methods for Quantitative PET/CT Imaging Phase II

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Agency/Branch:	Department of Health and Human Services/National Institutes of Health	Manufacturing related	No N/A
Program/Phase/Year:	STTR/Phase II/2015	Subsidiaries	N/A
Topic #:	102	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	2R42CA167907-02	Used in Federal or acquisitions program?	No
Achieved a cost saving or cost avoidance?:	No		

Additional Investment From

DoD contract/subcontract:	\$0.00
Other Federal contract/grants:	\$117,674.00
Angel Investors:	\$0.00
Venture Capital:	\$0.00
Self-Funded:	\$0.00
Private Sector:	\$29,405.00
Other Sources:	\$7,000.00

Other Sources Description:

Foreign Government

Investment Total:	\$154,079.00	Sales Total:	\$144,763.00
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STTR Specific Information

Who initiated the collaboration?:	Research Institution	Number of months taken to negotiate the Allocation of Rights agreement:	2
Who initiated the technology?:	Research Institution	Percentage of proceeds going to the small business:	53%
		Percentage of proceeds going to the research institution:	48%

Web-based Techniques for Remote Scientific Visualization

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Agency/Branch:	Department of Defense/Army	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase II/2003	Subsidiaries	N/A
Topic #:	N/A	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	DAAD17-03-C-0020	Used in Federal or acquisitions program?	No
Achieved a cost saving or cost avoidance?:	No		

Additional Investment From

DoD contract/subcontract:	\$1,099,473.00
Other Federal contract/grants:	\$861,201.00
Angel Investors:	\$0.00
Venture Capital:	\$0.00
Self-Funded:	\$0.00
Private Sector:	\$124,136.00

Phase III Sales To

Dod or DoD prime contractors:	\$0.00
Other Federal Agencies:	\$0.00
Private Sector:	\$180,758.00
Export Market:	\$86,451.00
3rd Party Revenue:	\$0.00
Other Customers:	\$0.00

Privileged and confidential and not subject to disclosure pursuant to 15 U.S.C. 638 (k)(4) and 5 U.S.C. 552.



SBIR Company Commercialization Report

Other Sources:	\$0.00
Investment Total:	\$2,084,810.00

Sales Total: \$267,209.00

GoBig: A Unified Interface to Big Data Systems

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Agency/Branch:	Department of Energy	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase I/2015	Subsidiaries	N/A
Topic #:	01c	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	DE-SC0013252	Used in Federal or acquisitions program?	No
Achieved a cost saving or cost avoidance?:	No		

Additional Investment From

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

Enhanced Software Tools for Detecting Anatomical Differences in Image Data Sets

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Agency/Branch:	Department of Health and Human Services/National Institutes of Health	Manufacturing related	No N/A
Program/Phase/Year:	STTR/Phase II/2020	Subsidiaries	N/A
Topic #:	105	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	2R42MH118845-03	Used in Federal or acquisitions program?	No
Achieved a cost saving or cost avoidance?:	No		

Additional Investment From

DoD contract/subcontract:	\$0.00	Dod or DoD prime contractors:	\$0.00
Other Federal contract/grants:	\$108,924.00	Other Federal Agencies:	\$0.00
Angel Investors:	\$0.00	Private Sector:	\$39,013.00
Venture Capital:	\$0.00	Export Market:	\$1,635.00
Self-Funded:	\$0.00	3rd Party Revenue:	\$0.00
Private Sector:	\$12,091.00	Other Customers:	\$0.00
Other Sources:	\$7,000.00		

Other Sources Description:

Foreign Government

Investment Total:	\$128,015.00	Sales Total:	\$40,648.00
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STTR Specific Information

Who initiated the collaboration?:	Small Business Concern	Number of months taken to negotiate the Allocation of Rights agreement:	4
Who initiated the technology?:	Small Business	Percentage of proceeds going to the small business:	70%

Percentage of proceeds going to the research institution: 30%

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Automated Assessment of Leptomeningeal Collaterals on CT Angiograms

Agency/Branch:	Department of Health and Human Services/National Institutes of Health
Program/Phase/Year:	STTR/Phase II/2018
Topic #:	108
Contract/Grant #:	2R42NS086295-02A1
Achieved a cost saving or cost avoidance?:	No

Manufacturing related Subsidiaries	No N/A N/A
Other contributing SBIR/STTR awards	N/A
Used in Federal or acquisitions program?	No

Additional Investment From

DoD contract/subcontract:	\$1,027,620.00
Other Federal contract/grants:	\$388,373.00
Angel Investors:	\$0.00
Venture Capital:	\$0.00
Self-Funded:	\$0.00
Private Sector:	\$0.00
Other Sources:	\$0.00

Investment Total:

\$1,415,993.00

Phase III Sales To

Dod or DoD prime contractors:	\$227,621.00
Other Federal Agencies:	\$0.00
Private Sector:	\$0.00
Export Market:	\$0.00
3rd Party Revenue:	\$0.00
Other Customers:	\$0.00

Sales Total:

\$227,621.00

STTR Specific Information

Who initiated the collaboration?:	Research Institution
Who initiated the technology?:	Research Institution

Number of months taken to negotiate the Allocation of Rights agreement:

1

Percentage of proceeds going to the small business:

67%

Percentage of proceeds going to the research institution:

33%

Improving liver lesion biopsy in the CT suite through fusion with PET images

Agency/Branch:	Department of Health and Human Services/National Institutes of Health
Program/Phase/Year:	STTR/Phase II/2012
Topic #:	NCI
Contract/Grant #:	2R42CA153488-02A1
Achieved a cost saving or cost avoidance?:	No

Manufacturing related Subsidiaries	No N/A N/A
Other contributing SBIR/STTR awards	N/A
Used in Federal or acquisitions program?	No

Additional Investment From

DoD contract/subcontract:	\$0.00
Other Federal contract/grants:	\$433,694.00
Angel Investors:	\$0.00
Venture Capital:	\$0.00
Self-Funded:	\$0.00
Private Sector:	\$0.00
Other Sources:	\$0.00

Investment Total:

\$433,694.00

Phase III Sales To

Dod or DoD prime contractors:	\$0.00
Other Federal Agencies:	\$0.00
Private Sector:	\$22,200.00
Export Market:	\$0.00
3rd Party Revenue:	\$0.00
Other Customers:	\$0.00

Sales Total:

\$22,200.00

STTR Specific Information

Who initiated the collaboration?:	Research Institution
Who initiated the technology?:	Research Institution

Number of months taken to negotiate the Allocation of Rights agreement:

0

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SBIR Company Commercialization Report

Who initiated the technology?: Research Institution	Percentage of proceeds going to the small business:	0%
	Percentage of proceeds going to the research institution:	0%

Rapid, Hardware Accelerated, Large Data Visualization 35 of 67

Agency/Branch: Department of Defense/Army	Manufacturing related	No N/A
Program/Phase/Year: STTR/Phase II/2006	Subsidiaries	N/A
Topic #: N/A	Other contributing SBIR/STTR awards	N/A
Contract/Grant #: W911NF-06-C-0179	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:	\$37,453.00
Other Federal contract/grants:	\$208,216.00
Angel Investors:	\$0.00
Venture Capital:	\$0.00
Self-Funded:	\$0.00
Private Sector:	\$65,082.00
Other Sources:	\$0.00
Investment Total:	\$310,751.00
	Sales Total:
	\$478,860.00

STTR Specific Information

Who initiated the collaboration?: Research Institution	Number of months taken to negotiate the Allocation of Rights agreement:	1
Who initiated the technology?: Research Institution	Percentage of proceeds going to the small business:	100%
	Percentage of proceeds going to the research institution:	0%

Cloud/Web-based Advanced Modeling and Simulation Turnkey High-Performance Computing Environment for Surface and Subsurface Science 36 of 67

Agency/Branch: Department of Energy	Manufacturing related	No N/A
Program/Phase/Year: SBIR/Phase II/2020	Subsidiaries	N/A
Topic #: 03a	Other contributing SBIR/STTR awards	N/A
Contract/Grant #: DE-SC0019609	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
Other Federal contract/grants:	\$139,808.00
Angel Investors:	\$0.00
Venture Capital:	\$0.00
Self-Funded:	\$0.00
Private Sector:	\$132,065.00
Other Sources:	\$0.00
Investment Total:	\$271,873.00
	Sales Total:
	\$424,177.00

Privileged and confidential and not subject to disclosure pursuant to 15 U.S.C. 638 (k)(4) and 5 U.S.C. 552.



Wide Area Video Image Storage Techniques

Agency/Branch:	Department of Defense/Defense Advanced Research Projects Agency
Program/Phase/Year:	SBIR/Phase II/2009
Topic #:	SB072-019
Contract/Grant #:	W31P4Q-09-C-0233
Achieved a cost saving or cost avoidance?:	No

Manufacturing related	No N/A
Subsidiaries	N/A
Other contributing SBIR/STTR awards	N/A
Used in Federal or acquisitions program?	No

Additional Investment From

DoD contract/subcontract:	\$735,961.00
Other Federal contract/grants:	\$0.00
Angel Investors:	\$0.00
Venture Capital:	\$0.00
Self-Funded:	\$0.00
Private Sector:	\$0.00
Other Sources:	\$0.00
Investment Total:	\$735,961.00

Phase III Sales To

Dod or DoD prime contractors:	\$49,407.00
Other Federal Agencies:	\$188,781.00
Private Sector:	\$0.00
Export Market:	\$0.00
3rd Party Revenue:	\$0.00
Other Customers:	\$0.00

Sales Total:**\$238,188.00**

Open-Source, Distributed Computational Environment for Virtual Materials Exploration

Agency/Branch:	Department of Defense/Air Force
Program/Phase/Year:	SBIR/Phase II/2015
Topic #:	AF141-174
Contract/Grant #:	FA8650-15-C-5080
Achieved a cost saving or cost avoidance?:	No

Manufacturing related	No N/A
Subsidiaries	N/A
Other contributing SBIR/STTR awards	N/A
Used in Federal or acquisitions program?	No

Additional Investment From

DoD contract/subcontract:	\$40,000.00
Other Federal contract/grants:	\$0.00
Angel Investors:	\$0.00
Venture Capital:	\$0.00
Self-Funded:	\$0.00
Private Sector:	\$0.00
Other Sources:	\$0.00
Investment Total:	\$40,000.00

Phase III Sales To

Dod or DoD prime contractors:	\$40,000.00
Other Federal Agencies:	\$0.00
Private Sector:	\$70,000.00
Export Market:	\$0.00
3rd Party Revenue:	\$0.00
Other Customers:	\$0.00

Sales Total:**\$110,000.00**

An Open Source Digital Pathology System Supporting Multi-Touch Interaction

Agency/Branch:	Department of Health and Human Services/National Institutes of Health
Program/Phase/Year:	SBIR/Phase II/2013
Topic #:	NIBIB
Contract/Grant #:	2R44EB013518-02A1
Achieved a cost saving or cost avoidance?:	No

Manufacturing related	No N/A
Subsidiaries	N/A
Other contributing SBIR/STTR awards	N/A
Used in Federal or acquisitions program?	No

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SBIR Company Commercialization Report

Additional Investment From		Phase III Sales To	
DoD contract/subcontract:	\$0.00	Dod or DoD prime contractors:	\$8,250.00
Other Federal contract/grants:	\$569,782.00	Other Federal Agencies:	\$0.00
Angel Investors:	\$0.00	Private Sector:	\$158,843.00
Venture Capital:	\$0.00	Export Market:	\$0.00
Self-Funded:	\$0.00	3rd Party Revenue:	\$0.00
Private Sector:	\$688.00	Other Customers:	\$0.00
Other Sources:	\$0.00		
Investment Total:	\$570,470.00	Sales Total:	\$167,093.00

mIQa: A Highly Scalable and Customizable Platform for Medical Image Quality Assessment - Phase II

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Agency/Branch:	Department of Health and Human Services/National Institutes of Health	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase II/2020	Subsidiaries	N/A
Topic #:	101	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	2R44MH119022-02	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:	\$20,750.00
Venture Capital:	\$0.00	Export Market:	\$0.00
Self-Funded:	\$0.00	3rd Party Revenue:	\$0.00
Private Sector:	\$5,250.00	Other Customers:	\$0.00
Other Sources:	\$0.00		
Investment Total:	\$5,250.00	Sales Total:	\$20,750.00

Enabling Shared Analysis and Processing of Large Neurophysiology Data

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Agency/Branch:	Department of Health and Human Services/National Institutes of Health	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase II/2017	Subsidiaries	N/A
Topic #:	101	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	1R44MH115731-01	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:	\$527,884.00	Other Federal Agencies:	\$449,818.00
Angel Investors:	\$0.00	Private Sector:	\$16,875.00
Venture Capital:	\$0.00	Export Market:	\$0.00
Self-Funded:	\$0.00	3rd Party Revenue:	\$0.00
Private Sector:	\$5,625.00	Other Customers:	\$0.00
Other Sources:	\$0.00		

Privileged and confidential and not subject to disclosure pursuant to 15 U.S.C. 638 (k)(4) and 5 U.S.C. 552.



SBIR Company Commercialization Report

Investment Total:	\$533,509.00	Sales Total:	\$466,693.00
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Scalable Grid Technologies for Visualization Services

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Agency/Branch:	Department of Energy	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase II/2004	Subsidiaries	N/A
Topic #:	41	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	DE-FG02-03ER83692	Used in Federal or acquisitions program?	No
Achieved a cost saving or cost avoidance?:	No		

Additional Investment From

DoD contract/subcontract:	\$0.00
Other Federal contract/grants:	\$158,217.00
Angel Investors:	\$0.00
Venture Capital:	\$0.00
Self-Funded:	\$0.00
Private Sector:	\$50,000.00
Other Sources:	\$0.00

Investment Total:

\$208,217.00

Sales Total:

\$36,334.00

Phase III Sales To

Dod or DoD prime contractors:	\$0.00
Other Federal Agencies:	\$10,000.00
Private Sector:	\$26,334.00
Export Market:	\$0.00
3rd Party Revenue:	\$0.00
Other Customers:	\$0.00

Collaborative Visualization for Large-Scale Accelerator Electromagnetic Modeling

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Agency/Branch:	Department of Energy	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase I/2008	Subsidiaries	N/A
Topic #:	40 a	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	DE-FG02-08ER85143	Used in Federal or acquisitions program?	No
Achieved a cost saving or cost avoidance?:	Yes		
a. Agency/End user:	DOE, DOD		
b. System/Program:	NNSA ASC, ASCR, DOD PETTT		
c. Cost Savings:	\$2,000,000.00		
d. Cost Savings Type:	Annual savings		
e. Explanation:	This SBIR developed and enhanced collaborative and remote data analysis and visualization on the desktop and the web. This capability enabled DOE and DOD laboratories to avoid purchasing high end graphical workstations for their scientists and engineers.		

Additional Investment From

DoD contract/subcontract:	\$1,162,223.00
Other Federal contract/grants:	\$1,309,931.00
Angel Investors:	\$0.00
Venture Capital:	\$0.00
Self-Funded:	\$0.00
Private Sector:	\$89,650.00
Other Sources:	\$0.00

Phase III Sales To

Dod or DoD prime contractors:	\$542,532.00
Other Federal Agencies:	\$109,000.00
Private Sector:	\$302,617.00
Export Market:	\$0.00
3rd Party Revenue:	\$0.00
Other Customers:	\$175,354.00
Other Customers Description:	N/A

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SBIR Company Commercialization Report

Investment Total: \$2,561,804.00 **Sales Total:** \$1,129,503.00

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Advanced virtual simulator for real-time ultrasound-guided renal biopsy training

Agency/Branch:	Department of Health and Human Services/National Institutes of Health	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase II/2019	Subsidiaries	N/A
Topic #:	400	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	2R44DK115332-02	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
Other Federal contract/grants:	\$110,174.00
Angel Investors:	\$0.00
Venture Capital:	\$0.00
Self-Funded:	\$0.00
Private Sector:	\$70,380.00
Other Sources:	\$7,000.00
Other Sources Description: Foreign Government	
Investment Total:	Sales Total:
	\$187,554.00
	\$205,741.00

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Building Recognition by Function

Agency/Branch:	Department of Defense/Defense Advanced Research Projects Agency	Manufacturing related	No N/A
Program/Phase/Year:	STTR/Phase II/2010	Subsidiaries	N/A
Topic #:	ST081-009	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	W91CRB-10-C-0098	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:	\$1,534,722.00
Other Federal contract/grants:	\$0.00
Angel Investors:	\$0.00
Venture Capital:	\$0.00
Self-Funded:	\$0.00
Private Sector:	\$0.00
Other Sources:	\$0.00
Investment Total:	Sales Total:
	\$1,534,722.00
	\$4,083,641.00

STTR Specific Information

Who initiated the collaboration?:	Research Institution	Number of months taken to negotiate the Allocation of Rights agreement:	1
Who initiated the technology?:	Research Institution	Percentage of proceeds going to the small business:	100%

Percentage of proceeds going to the research institution: 0%

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SBIR Phase II: Visualizing Arbitrary Basis Functions for Advanced Engineering Analysis and Simulation

Agency/Branch:	National Science Foundation	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase II/2003	Subsidiaries	N/A
Topic #:	N/A	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	0238964	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:	\$1,670,218.00
Other Federal contract/grants:	\$238,000.00
Angel Investors:	\$0.00
Venture Capital:	\$0.00
Self-Funded:	\$0.00
Private Sector:	\$28,190.00
Other Sources:	\$0.00
Investment Total:	\$1,936,408.00
	Sales Total:
	\$553,055.00

SBIR Phase II: Visualization of Massive Multivariate Adaptive Mesh Refinement (AMR) Data

Agency/Branch:	National Science Foundation	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase II/2006	Subsidiaries	N/A
Topic #:	IT	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	0548729	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:	\$5,000.00
Other Federal contract/grants:	\$322,558.00
Angel Investors:	\$0.00
Venture Capital:	\$0.00
Self-Funded:	\$0.00
Private Sector:	\$1,625.00
Other Sources:	\$0.00
Investment Total:	\$329,183.00
	Sales Total:
	\$643,761.00

Imaging biomarkers of severe respiratory infections in premature infants Phase II

Agency/Branch:	Department of Health and Human Services/National Institutes of Health	Manufacturing related	No N/A
Program/Phase/Year:	STTR/Phase II/2021	Subsidiaries	N/A
Topic #:	NHLBI	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	2R42HL145669-02A1	Used in Federal or acquisitions program?	No
Achieved a cost	No		

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SBIR Company Commercialization Report

saving or cost avoidance?:

Additional Investment From

DoD contract/subcontract:	\$0.00
Other Federal contract/grants:	\$39,641.00
Angel Investors:	\$0.00
Venture Capital:	\$0.00
Self-Funded:	\$0.00
Private Sector:	\$6,029.00
Other Sources:	\$7,000.00

Other Sources Description:

Foreign Government

Investment Total:

\$52,670.00

Phase III Sales To

Dod or DoD prime contractors:	\$0.00
Other Federal Agencies:	\$0.00
Private Sector:	\$18,649.00
Export Market:	\$1,635.00
3rd Party Revenue:	\$0.00
Other Customers:	\$0.00

\$20,284.00

STTR Specific Information

Who initiated the collaboration?: Small Business Concern

Number of months taken to negotiate the Allocation of Rights agreement:

1

Who initiated the technology?: Small Business

Percentage of proceeds going to the small business:

67%

Percentage of proceeds going to the research institution:

33%

Kitware Image and Video Retrieval (KWIVER) Large Volume Motion Imagery (LVMI) Analytics

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Agency/Branch: Department of Defense/Air Force

Manufacturing related

No | N/A

Program/Phase/Year: SBIR/Phase II/2018

Subsidiaries

N/A

Topic #: AF131-151

Other contributing SBIR/STTR awards

N/A

Contract/Grant #: FA8650-18-C-1647

Used in Federal or acquisitions program?

No

Achieved a cost saving or cost avoidance?: No

Additional Investment From

DoD contract/subcontract:	\$0.00
Other Federal contract/grants:	\$0.00
Angel Investors:	\$0.00
Venture Capital:	\$0.00
Self-Funded:	\$0.00
Private Sector:	\$0.00
Other Sources:	\$0.00

Phase III Sales To

Dod or DoD prime contractors:	\$81,450.00
Other Federal Agencies:	\$0.00
Private Sector:	\$0.00
Export Market:	\$0.00
3rd Party Revenue:	\$0.00
Other Customers:	\$0.00

\$81,450.00

Open, Cross Platform Chemistry Application

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Agency/Branch: Department of Defense/Army

Manufacturing related

No | N/A

Program/Phase/Year: SBIR/Phase II/2012

Subsidiaries

N/A

Topic #: A10-110

Other contributing SBIR/STTR awards

N/A

Contract/Grant #: W912HZ-12-C-0005

Used in Federal or acquisitions program?

No

Achieved a cost saving or cost avoidance?: No

Additional Investment From

Phase III Sales To

Privileged and confidential and not subject to disclosure pursuant to 15 U.S.C. 638 (k)(4) and 5 U.S.C. 552.



SBIR Company Commercialization Report

DoD contract/subcontract:	\$21,338.00	Dod or DoD prime contractors:	\$28,518.00
Other Federal contract/grants:	\$397,972.00	Other Federal Agencies:	\$0.00
Angel Investors:	\$0.00	Private Sector:	\$24,208.00
Venture Capital:	\$0.00	Export Market:	\$0.00
Self-Funded:	\$0.00	3rd Party Revenue:	\$0.00
Private Sector:	\$24,208.00	Other Customers:	\$0.00
Other Sources:	\$0.00		
Investment Total:	\$443,518.00	Sales Total:	\$52,726.00

FAST TRACK: Open-Source Integrated Design-Analysis Environment for Nuclear Energy Advanced Modeling and Simulation

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Agency/Branch:	Department of Energy	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase I/2013	Subsidiaries	N/A
Topic #:	19d	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	DE-FG02-13ER90641	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:	\$7,682.00	Dod or DoD prime contractors:	\$7,682.00
Other Federal contract/grants:	\$132,789.00	Other Federal Agencies:	\$0.00
Angel Investors:	\$0.00	Private Sector:	\$32,242.00
Venture Capital:	\$0.00	Export Market:	\$21,876.00
Self-Funded:	\$0.00	3rd Party Revenue:	\$0.00
Private Sector:	\$0.00	Other Customers:	\$0.00
Other Sources:	\$0.00		
Investment Total:	\$140,471.00	Sales Total:	\$61,800.00

An Interactive, Patient-Specific Virtual Surgical Planning System for Upper Airway Obstruction Treatments

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Agency/Branch:	Department of Health and Human Services/National Institutes of Health	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase II/2019	Subsidiaries	N/A
Topic #:	NIBIB	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	2R44EB023121-02	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:	\$614,900.00	Other Federal Agencies:	\$0.00
Angel Investors:	\$0.00	Private Sector:	\$48,735.00
Venture Capital:	\$0.00	Export Market:	\$1,635.00
Self-Funded:	\$0.00	3rd Party Revenue:	\$0.00
Private Sector:	\$16,819.00	Other Customers:	\$0.00
Other Sources:	\$7,000.00		
Other Sources Description:			

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SBIR Company Commercialization Report

Foreign Government

Investment Total:

\$638,719.00 Sales Total:

\$50,370.00

Super Resolution of Satellite Imagery using Multi-Sensor Fusion

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Agency/Branch:	Department of Defense/National Geospatial-Intelligence Agency	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase II/2019	Subsidiaries	N/A
Topic #:	NGA172-005	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	HM047619C0026	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:	Dod or DoD prime contractors:	\$0.00
Other Federal contract/grants:	Other Federal Agencies:	\$747,419.00
Angel Investors:	Private Sector:	\$0.00
Venture Capital:	Export Market:	\$0.00
Self-Funded:	3rd Party Revenue:	\$0.00
Private Sector:	Other Customers:	\$0.00
Other Sources:		
Investment Total:	Sales Total:	\$747,419.00

Web-Based Computational Model Builder for Nuclear Energy

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Advanced Modeling and Simulation

Agency/Branch:	Department of Energy	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase I/2014	Subsidiaries	N/A
Topic #:	19d	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	DE-SC0012037	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:	Dod or DoD prime contractors:	\$0.00
Other Federal contract/grants:	Other Federal Agencies:	\$0.00
Angel Investors:	Private Sector:	\$0.00
Venture Capital:	Export Market:	\$0.00
Self-Funded:	3rd Party Revenue:	\$0.00
Private Sector:	Other Customers:	\$0.00
Other Sources:		
Investment Total:	Sales Total:	\$0.00

Supporting MultiPhysics Workflows for Particle Accelerator Simulations

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Agency/Branch:	Department of Energy	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase II/2016	Subsidiaries	N/A

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SBIR Company Commercialization Report

Topic #:	26b	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	DE-SC0013884	Used in Federal or acquisitions program?	No
Achieved a cost saving or cost avoidance?:	No		
Additional Investment From			
DoD contract/subcontract:	\$163,615.00	Phase III Sales To	
Other Federal contract/grants:	\$0.00	Dod or DoD prime contractors:	\$163,615.00
Angel Investors:	\$0.00	Other Federal Agencies:	\$0.00
Venture Capital:	\$0.00	Private Sector:	\$317,211.00
Self-Funded:	\$0.00	Export Market:	\$0.00
Private Sector:	\$0.00	3rd Party Revenue:	\$0.00
Other Sources:	\$0.00	Other Customers:	\$0.00
Investment Total:	\$163,615.00	Sales Total:	\$480,826.00

Integrated, Interoperable Software Environment for Fusion Simulation and Data Analysis Tools

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Agency/Branch:	Department of Energy	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase II/2018	Subsidiaries	N/A
Topic #:	20c	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	DE-SC0018054	Used in Federal or acquisitions program?	No
Achieved a cost saving or cost avoidance?:	No		
Additional Investment From			
DoD contract/subcontract:	\$0.00	Phase III Sales To	
Other Federal contract/grants:	\$1,186,526.00	Dod or DoD prime contractors:	\$0.00
Angel Investors:	\$0.00	Other Federal Agencies:	\$0.00
Venture Capital:	\$0.00	Private Sector:	\$22,500.00
Self-Funded:	\$0.00	Export Market:	\$0.00
Private Sector:	\$0.00	3rd Party Revenue:	\$0.00
Other Sources:	\$0.00	Other Customers:	\$0.00
Investment Total:	\$1,186,526.00	Sales Total:	\$22,500.00

Human-Robot Instruction for Perceptual Teamwork

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Agency/Branch:	Department of Defense/Defense Advanced Research Projects Agency	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase II/2010	Subsidiaries	N/A
Topic #:	SB082-031	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	W31P4Q-10-C-0214	Used in Federal or acquisitions program?	No
Achieved a cost saving or cost avoidance?:	No		
Additional Investment From			
DoD contract/subcontract:	\$1,361,112.00	Phase III Sales To	
Other Federal contract/grants:	\$926,439.00	Dod or DoD prime contractors:	\$1,492,990.00
Angel Investors:	\$0.00	Other Federal Agencies:	\$1,887,804.00
Venture Capital:	\$0.00	Private Sector:	\$19,853.00
		Export Market:	\$0.00

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SBIR Company Commercialization Report

Self-Funded:	\$0.00	3rd Party Revenue:	\$0.00
Private Sector:	\$0.00	Other Customers:	\$0.00
Other Sources:	\$0.00		
Investment Total:	\$2,287,551.00	Sales Total:	\$3,400,647.00

Software Toolkit for Image Guided Surgery

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Agency/Branch:	Department of Health and Human Services/National Institutes of Health	Manufacturing related	No N/A
Program/Phase/Year:	STTR/Phase II/2004	Subsidiaries	N/A
Topic #:	N/A	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	2R42EB000374-02	Used in Federal or acquisitions program?	No
Achieved a cost saving or cost avoidance?:	No		

Additional Investment From

Additional Investment From		Phase III Sales To	
DoD contract/subcontract:	\$0.00	Dod or DoD prime contractors:	\$0.00
Other Federal contract/grants:	\$490,489.00	Other Federal Agencies:	\$0.00
Angel Investors:	\$0.00	Private Sector:	\$44,948.00
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:	\$490,489.00	Sales Total:	\$44,948.00

STTR Specific Information

Who initiated the collaboration?:	Research Institution	Number of months taken to negotiate the Allocation of Rights agreement:	1
Who initiated the technology?:	Research Institution	Percentage of proceeds going to the small business:	100%

Percentage of proceeds going to the research institution: 0%

Computational Fluid Dynamics Co-processing for Unsteady Visualization

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Agency/Branch:	Department of Defense/Army	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase II/2008	Subsidiaries	N/A
Topic #:	A07-010	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	W911W6-08-C-0062	Used in Federal or acquisitions program?	No
Achieved a cost saving or cost avoidance?:	Yes		
a. Agency/End user:	DOE NNSA		
b. System/Program:	ASC		
c. Cost Savings:	\$1,000,000.00		
d. Cost Savings Type:	Annual savings		
e. Explanation:	The DOE NNSA program requires a new supercomputer at the Sandia, LLNL, and LANL sites roughly once per 1.5 years. In the technology used for these supercomputers, the discrepancy between computational power and storage capability has been widening.		

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SBIR Company Commercialization Report

Without

Additional Investment From		Phase III Sales To	
DoD contract/subcontract:	\$154,737.00	Dod or DoD prime contractors:	\$51,851.00
Other Federal contract/grants:	\$4,693,734.00	Other Federal Agencies:	\$596,140.00
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:	\$142,203.00	Other Customers:	\$0.00
Other Sources:	\$0.00		
Investment Total:	\$4,990,674.00	Sales Total:	\$647,991.00

Web-Based Computational Model Builder for Nuclear Energy Advanced Modeling and Simulation

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Agency/Branch:	Department of Energy	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase II/2017	Subsidiaries	N/A
Topic #:	19d	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	DE-SC0012037	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:	\$940.00	Dod or DoD prime contractors:	\$940.00
Other Federal contract/grants:	\$293,115.00	Other Federal Agencies:	\$32,500.00
Angel Investors:	\$0.00	Private Sector:	\$93,358.00
Venture Capital:	\$0.00	Export Market:	\$6,900.00
Self-Funded:	\$0.00	3rd Party Revenue:	\$0.00
Private Sector:	\$0.00	Other Customers:	\$0.00
Other Sources:	\$0.00		
Investment Total:	\$294,055.00	Sales Total:	\$133,698.00

Advanced virtual simulator for fundamentals of laparoscopic surgery training and credentialing

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Agency/Branch:	Department of Health and Human Services/National Institutes of Health	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase II/2015	Subsidiaries	N/A
Topic #:	NIBIB	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	1R44EB019802-01A1	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:	\$586,212.00	Other Federal Agencies:	\$0.00
Angel Investors:	\$0.00	Private Sector:	\$25,000.00
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		

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SBIR Company Commercialization Report

Investment Total:	\$586,212.00	Sales Total:	\$25,000.00
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Scalable Software for Reverse Engineering Neural Circuits from Histology**62 of 67**

Agency/Branch:	Department of Health and Human Services/National Institutes of Health	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase II/2012	Subsidiaries	N/A
Topic #:	NIMH	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	2R44MH088088-03	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:	\$642,164.00	Other Federal Agencies:	\$0.00
Angel Investors:	\$0.00	Private Sector:	\$54,068.00
Venture Capital:	\$0.00	Export Market:	\$0.00
Self-Funded:	\$0.00	3rd Party Revenue:	\$0.00
Private Sector:	\$313.00	Other Customers:	\$0.00
Other Sources:	\$0.00		
Investment Total:	\$642,477.00	Sales Total:	\$54,068.00

A Framework for In Situ Analysis and Visualization of Large-Scale Cosmology Simulations**63 of 67**

Agency/Branch:	Department of Energy	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase II/2013	Subsidiaries	N/A
Topic #:	26a	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	DE-FG02-12ER90330	Used in Federal or acquisitions program?	Yes
Achieved a cost saving or cost avoidance?:	Yes		
a. Agency/End user:	DOE NNSA	a. Primary Agency:	Department of Energy
b. System/Program:	ASC	b. System/Program:	NNSA ASC
c. Cost Savings:	\$10,000,000.00	c. Phase III Contract #:	N/A
d. Cost Savings Type:	Annual savings		
e. Explanation:	The DOE NNSA program requires a new supercomputer at the Sandia, LLNL, and LANL sites roughly once per 1.5 years. In the technology used for these supercomputers, the discrepancy between computational power and storage capability has been widening. Without co-processing technology, scientists would need access to large storage systems that are cost prohibitive. With the co-processing technology, the need to acquire larger and larger IO systems is reduced, leading to significant annual cost savings. These supercomputers cost between \$5-20 million each, and the IO component is a significant part of this cost. We estimate that this technology saves \$1,000,000 -		

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SBIR Company Commercialization Report

\$2,000,000 for each of these supercomputers.
 Note: The work performed in this SBIR is an enhancement to the Fluid Dynamics Co-Processing for Unsteady Visualization SBIR, done for the DOD, and has further refined the technology, making it feasible for upcoming supercomputers.

Additional Investment From

DoD contract/subcontract:	\$463,758.00
Other Federal contract/grants:	\$4,377,566.00
Angel Investors:	\$0.00
Venture Capital:	\$0.00
Self-Funded:	\$0.00
Private Sector:	\$28,495.00
Other Sources:	\$0.00
Investment Total:	\$4,869,819.00

Phase III Sales To

Dod or DoD prime contractors:	\$54,253.00
Other Federal Agencies:	\$1,800,879.00
Private Sector:	\$144,431.00
Export Market:	\$3,900.00
3rd Party Revenue:	\$0.00
Other Customers:	\$0.00
Sales Total:	\$2,003,463.00

Web-Based Computational Model Builder for Nuclear Energy Advanced Modeling and Simulation

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Agency/Branch:

Department of Energy

Program/Phase/Year:

SBIR/Phase II/2015

Topic #:

19d

Contract/Grant #:

DE-SC0012037

Achieved a cost saving or cost avoidance?:

No

Manufacturing related

No | N/A

Subsidiaries

N/A

Other contributing SBIR/STTR awards

N/A

Used in Federal or acquisitions program?

No

Additional Investment From

DoD contract/subcontract:	\$7,682.00
Other Federal contract/grants:	\$196,615.00
Angel Investors:	\$0.00
Venture Capital:	\$0.00
Self-Funded:	\$0.00
Private Sector:	\$6,710.00
Other Sources:	\$0.00
Investment Total:	\$211,007.00

Phase III Sales To

Dod or DoD prime contractors:	\$8,457.00
Other Federal Agencies:	\$16,250.00
Private Sector:	\$240,296.00
Export Market:	\$121,589.00
3rd Party Revenue:	\$0.00
Other Customers:	\$0.00
Sales Total:	\$386,592.00

Super 3D from Video

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Agency/Branch:

Department of Defense/Defense Advanced Research Projects Agency

Program/Phase/Year:

SBIR/Phase II/2010

Topic #:

SB082-028

Contract/Grant #:

W31P4Q-11-C-0086

Achieved a cost saving or cost avoidance?:

No

Manufacturing related

No | N/A

Subsidiaries

N/A

Other contributing SBIR/STTR awards

N/A

Used in Federal or acquisitions program?

No

Additional Investment From

DoD contract/subcontract:	\$1,011,515.00
Other Federal contract/grants:	\$0.00
Angel Investors:	\$0.00

Phase III Sales To

Dod or DoD prime contractors:	\$90,332.00
Other Federal Agencies:	\$482,206.00
Private Sector:	\$20,416.00

Privileged and confidential and not subject to disclosure pursuant to 15 U.S.C. 638 (k)(4) and 5 U.S.C. 552.



SBIR Company Commercialization Report

Venture Capital:	\$0.00	Export Market:	\$0.00
Self-Funded:	\$0.00	3rd Party Revenue:	\$0.00
Private Sector:	\$41,210.00	Other Customers:	\$0.00
Other Sources:	\$0.00		
Investment Total:	\$1,052,725.00	Sales Total:	\$592,954.00

Open-Source Visualization and Analysis Platform for 3D Reconstructions of Materials by Transmission Electron Microscopy

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Agency/Branch:	Department of Energy	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase I/2014	Subsidiaries	N/A
Topic #:	05a	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	DE-SC0011385	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:	\$7,800.00
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:	\$7,800.00

Visual Global Intelligence and Analytics Toolkit (VIGILANT) 2.0

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Agency/Branch:	Department of Defense/Air Force	Manufacturing related	No N/A
Program/Phase/Year:	SBIR/Phase II/2017	Subsidiaries	N/A
Topic #:	AF153-001	Other contributing SBIR/STTR awards	N/A
Contract/Grant #:	FA8650-17-C-9217	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:	\$1,731,249.00	Dod or DoD prime contractors:	\$4,276,915.00
Other Federal contract/grants:	\$57,810.00	Other Federal Agencies:	\$236,305.00
Angel Investors:	\$0.00	Private Sector:	\$22,260.00
Venture Capital:	\$0.00	Export Market:	\$0.00
Self-Funded:	\$0.00	3rd Party Revenue:	\$0.00
Private Sector:	\$7,420.00	Other Customers:	\$0.00
Other Sources:	\$0.00		
Investment Total:	\$1,796,479.00	Sales Total:	\$4,535,480.00

Privileged and confidential and not subject to disclosure pursuant to 15 U.S.C. 638 (k)(4) and 5 U.S.C. 552.

CERTIFICATE OF COMPLETION

THIS CERTIFICATE IS PRESENTED TO

Mary Key, Kitware

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



Nov 04, 2024

COMPLETION DATE

Nov 04, 2025

EXPIRATION DATE