CALL FOR WHITE PAPERS FOR 2022 LAS ACTIVITIES
June 1, 2021

1.0 Executive Summary

The Laboratory for Analytic Sciences (LAS, https://ncsu-las.org) is an academic-industry-government partnership that works at the intersection of technology and tradecraft. LAS participants collaborate on projects that entail research, development, and validation of broadly applicable analytic approaches that have an operational impact in the U.S. Intelligence Community (IC).

LAS is now calling for white papers from potential academic and industry partners interested in working with LAS in 2022. Your white paper should reflect your individual interests and propose potential research, design, or prototype development efforts that could be funded by LAS in 2022. Decisions about funding will be based, in part, on how well your interests and proposed efforts can be integrated with those of LAS staff and IC stakeholders. See Section 2: Projects and Project Teams at LAS for more details about how projects and project teams work at LAS.

The main purpose of this document is to provide you with descriptions and examples to help you determine how your interests align with those of LAS. This list is not exhaustive, and you are encouraged to submit white papers with project ideas not explicitly called for in this document. In order to provide you with more opportunities to discover areas of mutual interest, we will describe LAS interests in both general and specific areas. Section 3: General Areas of Research Interest describes broad technical areas of interest where LAS would be potentially interested in new project ideas and approaches. Section 4: Specific Areas of Research Interest describes more specific technical areas of interest where LAS has ongoing work and is looking for complementary expertise and ideas to advance these initiatives.

We will provide multiple opportunities to engage with LAS staff prior to the deadline for white paper submission to discuss your interests in greater detail. The primary venues for engagement with LAS staff will be the LAS Virtual Collaborators' Day (June 15, 2021) and Office Hours (June 16-July 2, 2021). During these events, which will be held entirely online, you will have the opportunity to learn more about the interests described in this document and engage with LAS staff to discuss how your interests might align (Section 5: LAS Virtual Collaborators' Day and Office Hours).

This document provides detailed guidance and important dates for submitting your white papers. **White papers describing your interests and potential work will be accepted through July 16, 2021.** Please see Section 6: Submitting a White Paper for details on how to submit a white paper.

2.0 Projects and Project Teams at LAS

LAS interprets its role as a mission-oriented research lab as supporting the maturation of IC mission-relevant technology and tradecraft. We execute this role through projects that produce tangible deliverables that enable progress towards operational solutions. Funded efforts at LAS have a 12-month period-of-performance that runs from January 1 to December 31, with the potential for follow-on funded efforts in subsequent years. Each effort is expected to produce at least one or more tangible deliverables during the period of performance. A deliverable can take various forms, and may include items such as research papers, documented workflows, storyboards, training aids, implemented technological components, and experimental prototype systems. For examples of efforts and outcomes that LAS has supported in the past, visit: https://symposium.ncsu-las.net/researchoverview2020.html.

Collaboration at LAS among academia, industry, and government personnel primarily occurs within projects. At LAS, we pride ourselves on our model of "immersive collaboration," where project teams, including funded performers and LAS staff members, work toward common mission-relevant outcomes. Project teams are formed after your white paper has been selected but before the start of the period of performance. While you will be ultimately responsible only for your own individual deliverables, you should be prepared to work closely with your project team to refine, execute, and integrate each other's efforts.

All LAS projects are required to be mission-relevant, which means they consider questions and address outcomes of interest to the IC. This requirement is motivated by the LAS objective of leveraging deliverables to influence improvements in analytic tradecraft and mission capabilities. However, mission relevance can take on different forms depending on the maturity level of an effort's intended deliverables. For example, all of the following efforts would be considered mission-relevant:

- A research effort designed to answer fundamental questions raised by a particular use case of interest to the IC.

- A design effort to conceptualize a novel analytic approach for achieving an outcome of interest to the IC.

- A proof-of-concept effort aimed at implementing an analytic approach on proxy datasets that serve as stand-ins for IC analogs.

- An evaluation effort focused on investigating the expected costs and benefits of a novel analytic approach in an IC-proximate environment.

Though many of the missions of LAS stakeholders are classified, projects and teams are organized so that most of the work done by funded performers is unclassified. Cleared LAS staff members involved in the project teams bring with them a reservoir of knowledge and understanding of the IC mission context, which is useful for guiding projects to mission-relevant outcomes. For specific projects, funded performers with appropriate clearances (minimum TS/SCI) can be helpful, and active or eligible clearances should be noted in the submitted white papers.

3.0 General Areas of Research Interest

LAS research interests can be organized by broad themes that are applicable across a multitude of IC mission contexts. We describe these interests below to provide guidance as you consider novel project ideas that may align with and advance these interests.

3.1 Analyst Performance

Analytic performance entails a complex interaction between human analysts, tools and workflows for analysis, and team collaboration to achieve rigorous outcomes. As the IC increasingly turns to artificial intelligence and machine learning strategies for augmenting analytic performance, successfully advancing the science of analysis will necessitate understanding the human costs and tradeoffs of these techniques (Konaev and Chahal, 2021). By understanding the human dimensions of analysis, insight can be gained on when and why effective analysis takes place, which can inform the development of tools for augmenting performance.

In 2022, LAS is interested in exploring the nuances of analyst performance, with a focus on understanding, measuring, and enhancing performance across analytic contexts. We are interested in investigations relevant to the following areas:

- **Human Performance:** Previous work in this area has identified the complexity of performance in human analysts, specifically around the importance of customer engagement. We are interested in understanding indicators of top performance in analysis, as well as empirically-based frameworks for testing performance. We are further interested in understanding the contexts in which performance interventions may have the greatest potential impact. As much of analytic work involves teams and collaboration, we are also interested in approaches to measuring team performance, such as when multiple analysts with varying skill sets work together to achieve an outcome. Interest in this area also covers measuring and intervening on performance with minimal disruption to analytic workflows.

- **Enhancing Performance in Workflows and Tools:** Over the course of analysis, a human analyst may leverage machine tools to accomplish the analytic task; the variety of human-machine teams poses unique considerations for evaluating performance. We are interested in human analyst performance while executing workflows and using tools, which may include characterizing and representing analytic workflows. Enhancing performance in these human-machine teams may leverage insights from human factors, cognitive science, and system design. We are further interested in approaches to ensure robust workflows that can withstand outside pressures, such as deception.

- **Communication and Reporting:** The final stage of analysis may often entail the publication of an analytic product that conveys key findings and underlying methods. We are interested in greater understanding of the end products of analysis, including insight on the customer-space and design of products to meet customer needs. Investigations on modernization of intelligence products may leverage insights from relevant interdisciplinary domains (e.g., journalism, design, communications, etc.) to improve how analytic products are created and presented to IC customers. Investigations in this area may also address inter- or intra-team

communication with respect to the communication of methods and findings applicable to multiple customer needs or intelligence questions.

3.2 Applications of Machine Learning

The IC is increasingly using artificial intelligence (AI) as a means of coping with the vast, disparate, and dynamic data that it collects and processes (ODNI, 2019). Successful adoption of AI technologies has been identified as critical for national security (NSCAI, 2021). In particular, the subset of AI technologies based on machine learning (ML) show great promise in helping the IC understand and adjust to the changing nature of threats and adversaries. ML-based analytics constitute a potentially dramatic shift in how the IC performs analysis — from a reliance on static rules and logic supplied by humans, to models that automatically generate and refine their own rules through continuous training (Heckman, 2020).

A continuing area of interest for LAS in 2022 is in the application of Machine Learning to intelligence analysis, particularly the interrelated set of challenges that must be tackled in order for the IC to realize the promise and potential of ML technology. LAS would be interested in ideas for projects that investigate questions relevant to the following areas:

- **ML Applications in Analyst Workflows:** Leveraging the complementary strengths of ML-driven automation and human analysts in collaborative teams to effectively address IC mission challenges. A particular interest is in novel interface components or concepts that could be tightly integrated with existing analytic workflows.

- **Efficient ML Development:** Decreasing the cost of the ML development cycle, with a particular goal of better supporting small teams or individual analysts and their correspondingly specialized use cases and datasets. Efforts that reduce or eliminate the burden of generating labeled training data are of interest, including applications of transfer learning, semi-supervised learning, and augmentation with synthetic data.

- **ML Fairness and Explainability:** Ensuring that ML applications in the IC are transparent and ethically sound (ODNI, 2020). Of particular interest are metrics related to non-functional requirements like fairness, privacy protection, transparency, and security that could be applied to a variety of ML models.

- **ML Operations:** Testing, maintaining, monitoring, and ensuring the integrity of deployed ML models —for example, by enabling users to provide feedback on model predictions, identifying opportunities for improved performance, and detecting and mitigating common issues (e.g., errors made during model development, data drift, and changes in data availability).

3.3. Information Retrieval and Knowledge Management

In assessing the contemporary strategic environment, the ODNI notes that "advances in communications and the democratization of other technologies" have fueled an explosion of information and data that the IC must "collect, process, evaluate, and analyze" with sufficient speed to "provide relevant and useful insight to its customers" (ODNI, 2019b). Lying at the heart of this challenge is the core function of data triage, which entails identifying the "right" data for a particular analysis. Strategies, methods, and tools are needed to explore data, to search, filter, sort, and prioritize massive datasets, and to find all

information that is responsive to customers' information needs. Building upon its previous work in this domain, LAS is interested in projects in the following areas:

- **Non-Text Based Information Retrieval:** Audio, image, video, and geospatial data make up much of the data available to intelligence analysts. While search-based retrieval methods remain a vital tool for analysts to find relevant content, the value of these methods depends greatly on the ability of an analyst to understand and use the indexed data features and metadata to find what they are looking for. We are interested in exploring different data structures and query mechanisms for these non-text-based databases that can enable efficient retrieval of relevant information.

- **Data Exploration:** Search-based tools for datasets are of limited use to analysts when they do not know what information is contained within the dataset—for example, a newly acquired dataset. LAS seeks to develop and demonstrate methods for surveying a given data corpus and helping analysts determine its potential information value.

- **Inferring Information Goals:** The goals of an analysis affect the relevance and priority of the information available to an analyst. Complex queries manually entered by analysts are a cumbersome mechanism for analysts to use to express these goals. We are interested in research that explores alternative and more natural ways of inferring the information goals of an analyst in order to better retrieve and / or prioritize relevant information.

- **Data Prioritization:** In an organizational analysis environment, data is collected and organized to address customers' current and anticipated future information needs. LAS is generally interested in methods of prioritizing data that the analyst might find most relevant within a large corpus. In particular, LAS is interested in scalable methods to understand the information needs of a given user base to rigorously prioritize data for both individuals and groups of analysts.

4.0 Specific Areas of Research Interest

In addition to the general areas of interest listed in Section 3, LAS has multiple existing efforts that could benefit from new collaborators with particular skills and expertise. In this section, we will describe some of these efforts along with associated specific aims for potential collaborators.

4.1 Understanding and Supporting Information Retrieval with Voice Data

IC analysts often work with intercepted adversary voice communications. Discovering valuable information within large volumes of speech audio data can be challenging, particularly as these communications are often in languages other than English; and yet analysts accomplish this task successfully every day. Ongoing research at LAS aims to understand in practice how analysts satisfy their information needs when working with voice data, and to leverage this knowledge in developing prototype tools to assist analysts in the content discovery process.

LAS partner researchers working in this area can expect to collaborate closely with government staff, so as to better understand the particular information needs of analysts working with voice and similar audio media content. Previous LAS research on this topic has used the Nixon White House tapes, as released by the National Archives, as a publicly available example of a large corpus of unscripted conversational

speech. LAS would welcome white papers describing research efforts and capabilities to achieve any of the following or similar specific aims:

- Characterizing analyst information-seeking behavior when searching through audio content, including behaviors associated with effective performance

- Developing and evaluating tools to support sensemaking and discovery in voice corpora

4.2 Knowledge Graph Applications

Like many large organizations, the IC faces challenges in ensuring that its collective body of knowledge remains accurate, up to date, and discoverable across the enterprise. Knowledge graphs are a promising architecture to support such use cases, and have received much attention from the research community. But the nature of intelligence work poses difficulties for widespread adoption of knowledge graphs. Compared to other successful knowledge management use cases, the information that analysts might seek to capture in a graph is arguably:

- *more implicit.* Important facts are rarely stated in text in a form that lends itself readily to automated extraction.

- *more provisional.* Intelligence generally deals with degrees of evidence, rather than clear truths or falsehoods.

- *more closely tied to context.* Valuable knowledge is often linked to particular time periods or locations, which may themselves be known only incompletely. Retaining links to the original provenance of a fact is of critical importance.

While challenging, LAS sees opportunities for knowledge graphs and similar systems to directly support IC analysts. In particular, we are interested in novel human-in-the-loop methods to populate knowledge graphs, and in intuitive ways to leverage information in graphs in the context of existing analyst workflows. Partner researchers working on this topic can expect close engagement with LAS analysts and developers, to help ensure that research outcomes are well aligned with mission needs.

Ongoing LAS work in this area has used publicly available television show scripts as a proxy for intelligence community data, with analysts using prototypes developed in the lab to populate entity-centric knowledge graphs that describe relationships between characters in the show. When an analyst is working with new content (e.g. a new episode of the show), this existing knowledge could be leveraged to help resolve known entities and relevant relationships mentioned in the text. LAS is interested in white papers that describe research to support this or similar efforts, including work to address the following specific aims:

- Developing novel interfaces for human-machine collaboration in extracting knowledge from text and/or suggesting knowledge potentially relevant to interpreting a text

- Improving resolution of coreferent entities and extraction of relationships from realistic, communicative text

- Representing potentially complex and uncertain contexts of knowledge (time, location, provenance) in a manner that is accessible to both machines and human analysts

4.3 Content Search and Triage for Video and Images

Video and images make up an ever-increasing proportion of communications traffic, challenging those analysts charged with making sense of it all. The last decade has brought justifiably celebrated advances in the ability of computers to "understand" visual information, and yet in many respects the "big data" problem of multimedia content is just as relevant in 2021 as it was in 2011: analysts often still struggle to quickly extract actionable intelligence from large volumes of rapidly changing image and video data.

LAS would welcome contributions from experienced researchers interested in collaborating with us to build multimedia content search prototypes. This research area benefits from a wide variety of relevant, publicly available datasets that could be leveraged in addressing the following or related specific challenges:

- How might an end user rapidly and flexibly search for a unique or unusual item of interest in image or video corpora?

- How can lengthy videos or large collections of images be summarized, so as to enable an analyst to effectively prioritize content for review?

- How could unknown images and video be localized in space or time, with or without manual intervention? How might text in an image be used to aid localization? How can image and video geolocation information be most effectively presented to aid an analyst in search and triage?

5.0 LAS Virtual Collaborators Week

To learn more about the 2022 LAS interest areas and how to work with LAS, you are encouraged to participate in both the LAS Collaborators' Day on June 15, 2021 and the LAS Collaborators' Office Hours from June 16 - July 2, 2021. These events will be 100% virtual. All information about the 2021 LAS Collaborators' Day and Office Hours, including detailed agendas for the days and registration forms for the webinars and office hours, will be accessible on the 2021 LAS Collaborators' Day and Office Hours website at: https://ncsu-las.org/2021-las-collaborators-day/.

At 2:30pm EDT on *Tuesday, June 15,* the LAS Principal Investigator, Director of Programs, and Technical Program Managers will host a Zoom webinar for all interested potential performers. This webinar will provide an overview of LAS, further details on the research and application interest areas in this call, and logistics for submitting white papers for 2022 activities. The presentation will be given as a Zoom Webinar and recorded for later viewing. Questions will be possible via chat and all answers will be recorded as well. *Attendance is open to all, but you will need to register through the 2021 LAS Collaborators' Day and Office Hours website to receive the Zoom webinar information.*

Starting *Wednesday, June 16,* and continuing through *Friday, July 2,* LAS staff members and selected stakeholders will host "office hour" sessions via Google Meet. These office hour sessions will provide you the opportunity to speak with LAS staff who have related interests about your project ideas and potential collaborations. These sessions will be organized along the general and specific areas of the interests described in Sections 3 and 4, and potential collaborators are highly encouraged to attend those

areas they are interested in. *Each area of interest will host multiple office hour sessions over the two and a half weeks. The sessions will be divided into time slots of 15 minutes each, and you will need to reserve a time slot through the [2021 LAS Collaborators' Day and Office Hours website](#).*

Additionally, during this same time period, members of the LAS Leadership team will also host office hour sessions via Google Meet to answer questions about the logistics of the white paper process, how to work with LAS, and provide general suggestions about how your research interests might align with the different LAS interest areas. Potential collaborators do not need to attend these office hours unless they have specific questions they would like answered. *There will be multiple of these "logistics" office hour sessions over the two and a half weeks. The sessions will be divided into time slots of 10 minutes each, and you will need to reserve a time slot through the [2021 LAS Collaborators' Day and Office Hours website](#).*

Should you be unable to attend the LAS Collaborators' Day on June 15, we will record the presentation and make it and the Q&A session available on the 2021 LAS Collaborators' Day and Office Hours website shortly after the event. If you are unable to schedule an appropriate office hour time slot, please send an e-mail to lasoutreach@ncsu.edu, and NC State staff will work with you to try and arrange a separate discussion.

6.0 Submitting a White Paper

If you would like to be considered for a funded project, you will need to submit a white paper to LAS for review no later than 11:59 pm EDT, Friday, July 16, 2021.

Your submission should NOT contain classified, proprietary, or sensitive information of any kind.

6.1 Scope, Schedule, And Budget
The period of performance for which we will make awards is January 1 – December 31, 2022. While we understand that some projects may naturally lead to follow-on efforts, we ask that you focus your white paper on potential 2022 work and only discuss potential outyear(s) work if contextually necessary. In your white paper, we would like you to submit a detailed description of the work that you would propose to undertake in 2022. You should describe your work as a project by defining a specific question or goal, an approach, and deliverables or outcomes that you would expect to be achievable by the end of 2022.

If you are submitting a white paper as a potential individual academic collaborator, please scope your base effort at the level of a month of summer salary support or academic release and a 12-month graduate student. This is our most common award. You may also choose to fund different personnel (research staff, post-docs, etc.); however, you should plan on receiving only the amount of funding that would cover a graduate student. In rare cases, we may fund additional students; you may submit up to three additional scope options at the level of one additional graduate student each. If you are submitting a white paper as part of an integrated team, each individual faculty performer can propose salary support and a student.

If you are submitting a white paper as a potential industry collaborator, please scope your base effort at $250K or less. This should include all personnel costs, fees, other direct costs, overhead, etc. You may submit up to three additional scope options at $100K each. This figure is meant to be a ROM estimate to

allow you to scope effort. For the white paper, we do not require a discussion of specific personnel at specific rates, nor do we require a cost proposal.

If these levels of effort do not seem appropriate to the work you would like to propose, please contact Dr. Matthew Schmidt (mcschmid@ncsu.edu), LAS's Director of Programs, to discuss other options.

6.2 Outline and Content of White Paper

White papers should include *both* a description of potential 2022 work and a description of relevant capabilities. The description of potential 2022 work should be no more than *two* (2) pages long and address one or more of the areas discussed in Sections 3 and 4. The description of relevant capabilities can be up to *one* (1) additional page in length.

Your description of potential 2022 work should define a specific question or goal, how it aligns with LAS interests, an approach to achieving it, and the specific deliverables that you expect (See Section 2 for example deliverables). This description may include brief scope options for additional students (academics) or funds (industry), as described in Section 6.1. *Do NOT include classified, proprietary, or sensitive information in the project description*.

You may submit team white papers that include more than one participant from academia or industry organizations. If you have discussed your ideas with LAS government staff, you may indicate this in your white paper, but government staff should not be included as performers.

Your description of relevant capabilities should include a brief, paragraph-long description of the relevant capabilities of the submitting faculty member(s), lab, or organization. The intent of this section is to allow submitters to reference prior work or existing resources (e.g., access to datasets) that may be relevant in our assessment of your capacity to perform the proposed work. It can also be helpful to understand the broader scope of the submitter's interests, apart from the specific proposed project. As part of this description, you may reference publicly available websites with more detailed information about you or your organization.

Please do not include any requested budget information in the white paper. There will be a separate text box in the online submission tool where information about the total budget requested should be submitted (Section 6.3)

6.3 White Paper Submission Process

White paper submissions will be made electronically via LAS's web-based submission tool at https://whitepapers.ncsu-las.net. There is no limit to the number of white papers you may submit, and we request that you submit multiple white papers if you are proposing multiple projects. For each submission, please include the following information:

- **Name, affiliation, and e-mail for the Principal Investigator (PI) or co-PIs of the proposed work.** If you have more than one team member, please list information for only funded PIs.

- **Primary point of contact for the work proposed, i**f different from the principal investigator.

- **Title and abstract of proposed project.** Please include a 200 word or less description of the proposed project. *The title and abstract will be widely distributed to potential government collaborators during the 2022 program development process. Do NOT include classified, proprietary, or sensitive information in either the title or abstract.*

- **White Paper.** Please include an Adobe PDF of your white paper. As described in Section 6.2, the white paper should include both:
  - A description of the potential 2022 work
  - A description of the submitter's relevant capabilities and resources

- **Budget Request:** Please specify the budget you are requesting for the potential work. See Section 6.1 for additional details on budgets. For academics, it is sufficient to describe the level of support, e.g., "a month of faculty support and a graduate student." For industry submissions, a rough order of magnitude (ROM) bottom line will suffice; please do not submit a detailed budget at this time.

Please submit white papers to LAS for consideration by July 16, 2021 at 11:59 pm EDT. You should submit your white paper(s) via the web-based tool at https://whitepapers.ncsu-las.net, where you also can find detailed instructions on the submission process. The tool will begin accepting submissions no later than June 15, 2021 at 12:00a EDT.

6.4 Review and Notification

Your abstracts and white paper will be reviewed by North Carolina State University and government domain experts, as well as by selected partners from industry and academia hired to make recommendations to LAS on which approaches will best help us achieve our goals. Decisions about funding will be based on a variety of criteria, to include the technical quality of the proposed work, the relevance of your white paper to the LAS stakeholder interests, the capabilities of the proposed performers or organizations, how well the proposed work can be integrated into project teams, and the availability of funding. While information and reviews will be gathered from a variety of stakeholders and domain experts, the decision on who receives funding rests with the LAS Principal Investigator, Dr. Alyson Wilson, and the LAS Director of Programs, Dr. Matthew Schmidt.

We will make preliminary notification of decisions on white papers by September 15, 2021. Due to the volume of white papers, we will not be able to provide feedback on white papers that are not selected. If your white paper is selected, we will work with you to integrate your work into NC State's overall portfolio for 2022. Based on the capabilities of the proposed performers and organizations, we may also suggest ways your project might be revised to align more closely with LAS interests. Final confirmation of project funding is dependent on government budget decisions, but our goal is to make final notifications of funding by November 1, 2021.

7.0 Contacts

If you have additional questions, please contact us at lasoutreach@ncsu.edu.[1]

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[1] If you received a forwarded copy of this document, but would like to ensure you are notified about future calls and events at LAS please contact Maggie Epps (mebeasle@ncsu.edu) to be added to the distribution list.

8.0 References

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