TGI INDUSTRY ENGAGEMENT PROGRAM

## REQUEST FOR PARTICIPATION

Questions or inquiries regarding this RFP can be directed to: TGI@slu.edu

The Taylor Geospatial Institute (TGI) has made a significant investment in building a nationally recognized academic center for geospatial science research, education and innovation. TGI is a cornerstone element of the "GeoFutures Strategic Roadmap," (released June 2020) which is a vision and plan for strengthening St. Louis's competitive advantage in geospatial research and technology.

TGI aims to address grand societal challenges in food systems, health systems, and national security using cutting-edge geospatial technologies, data, and analytics to build upon the broad existing research strengths in the St. Louis region. Advancements in core geospatial science and adjacent fields of Artificial Intelligence/Machine Learning and Analytics are critical to measurably impact these societal risks with outcomes that improve food security, increase health and social equity, as well as to build smart cities and resilient communities. Solutions and new products emerging from the TGI research community will be a key contributor to economic development through translation to commercial application and by training the next generation of the workforce (Figure 1).   An expanded overview of the research focus areas can be found at the end of this document in Appendix A.
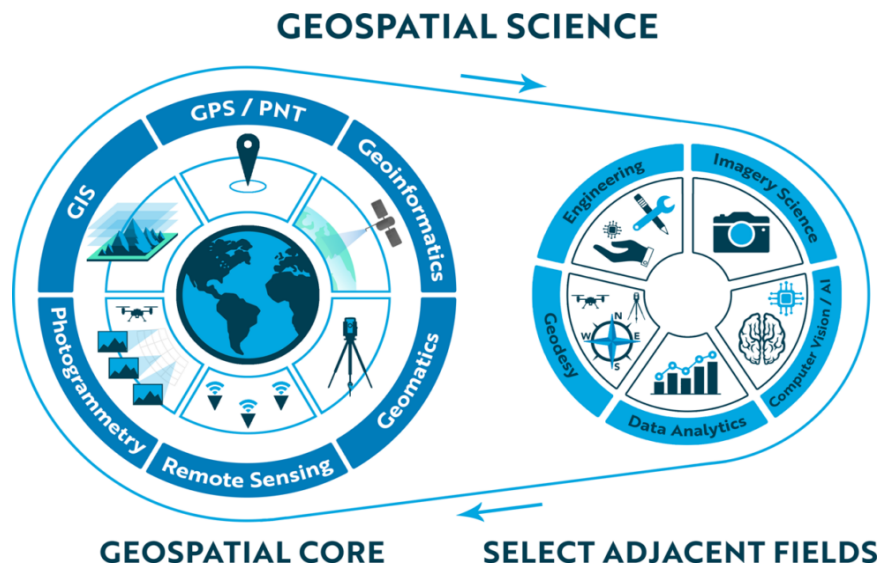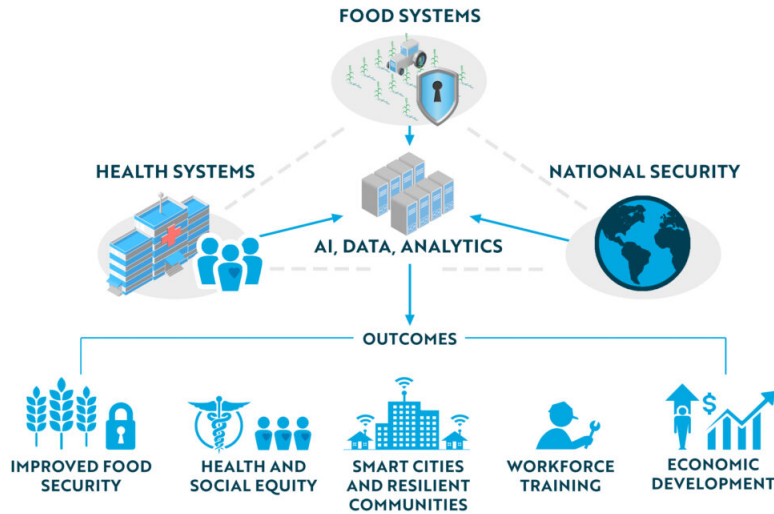
INDUSTRY ENGAGEMENT PRIORITIES AND SCOPE

The world-class, interdisciplinary, geospatial science research community being built within the TGI requires engagement with innovative companies that are leading the geospatial technology industry with new models, analytic approaches, data sources, processing power, pipelines-to-market and the next generation of business leaders.

We are establishing the TGI Industry Engagement Program in order to ensure that we, as a community, reach outcomes that are not only scientifically innovative, but that will go-to-market as products that will make an impact on the core societal issues TGI is setting out to address. The Industry Engagement Program envisions three core types of engagement:

1. Talent Partners will join TGI in reducing the talent gap in Geospatial industry
2. Research Partners will join TGI in increasing innovation in Geospatial Technology
3. Technology Partners (Data, Software, Cloud) will join TGI in expanding use cases ready for commercialization in the Geospatial Industry

Interested organizations can outline partnerships around the three engagement categories.

PARTNERSHIP	TGI VALUE TO INDUSTRY	INDUSTRY VALUE TO TGI
Talent Reducing Talent Gap in Geospatial Jobs	TGI will prepare its students with the highest priority geospatial skills that are in demand by our partners. Partners within the Institute offer coursework, training and graduate study opportunities to ensure graduates have	Industry commits to building a recruiting pipeline with TGI. Industry sponsors internship programs, individual student stipends or tuition coverage, or other innovative approaches to bridging long-term hiring gaps.

	the education, skills and experience necessary to be contributors to our partners on day 1 of employment.	Industry contributes experts to TGI to be professors of practice. Industry provides input to TGI related to the skills and expertise needed to fill talent gaps in geospatial jobs.
Research Increasing innovation in Geospatial Technology	TGI conducts research in response to industry priorities. This research can be done by TGI or in collaboration with industry.	Industry Partner commercializes and brings new products to market faster based on innovations within TGI . Industry funds specific research projects. Funds can be in-kind contributions.
Technology Expanding Scientific Validation of New Use Cases for commercialization in Geospatial Industry	TGI validates new use research outcomes to enable industry to productize and take to market. TGI utilizes tools to train the next generation of users, increase speed of reaching outcomes, build new innovation on top of the foundation of existing products to move industry forward, and publishes papers in peer reviewed journals lending scientific credibility to products used in research programs.	Industry provides geospatial software, data, and/or compute to the TGI community for use in research and education programs. Industry establishes mentoring program that shares their experience with commercialization.

1. Talent Partners

Progress towards digitalization in our daily lives and global economies makes geospatial technology and expertise increasingly vital to enhancing our understanding of the world and our impact on it so that we can be stewards of a sustainable global community. Geospatial jobs openings are outpacing the volume of candidates with expertise in core geospatial science and related technologies. The application of a geospatial lens on global challenges makes it a highly valuable and sought after set of professional skills. TGI is positioned to help close this talent gap.

TGI encompasses 8 institutions including over 100 faculty researchers working directly on core geospatial science and over 500 on adjacent fields including machine learning and artificial intelligence. There are over 500 students across the TGI institutions studying geospatial science and over 1000 in adjacent fields. Interested industry partners may consider ways in which this highly sought after talent pipeline would support their business goals through internships, undergraduate and graduate students' supporting contract positions, or as a strong pool of candidate hires.

In addition to engaging with industry in traditional intern and recruiting programs, TGI is also interested in establishing Talent Pipeline Partnerships for individual graduate students and research scientists.

- **TGI Industry Fellows**: Distinguished professionals in an area of practice or discipline valuable to meeting TGI's mission join as fixed-term faculty members. Expertise, achievements, and reputation that have developed over a sustained period qualify these distinguished professionals in an area of practice or discipline, although they may not have academic credentials or experience. Engagement activities include co-mentoring student projects, offering seminars, supervising university-industry joint projects. TGI will work with academic departments and provide opportunities for Industry Fellows to teach undergraduate and graduate courses in their areas of expertise.

- **Ambassadors / Science Fellows / Scientist in Residence**: TGI researchers hold a fixed-term role within a company or government organization to enhance their novel work in collaboration with a company or government organizations' particular product, dataset, compute capabilities etc.

TGI is open to other innovative engagements with industry around building a strong talent pipeline and deepening knowledge across enterprises.

2. Research Partners

TGI is seeking industry partnerships for collaborative research addressing regional, national and global challenges in food systems, health systems and national security. TGI welcomes industry to sponsor research relevant to an organization's business needs.

TGI welcomes long term investments from industry in the form of Endowed Professorships, undergraduate and graduate student fellowship or Lab Naming when the partner is interested in sponsoring a broad and long term research program.

TGI also welcomes other innovative engagements for collaborative research with industry.

The TGI research community has ongoing research practices across many use cases. The following highlights a broad swath of our expertise:

Food Systems
Health Systems
National Security & GEOINT
Core Geospatial Science including Data Science & Artificial Intelligence/Machine Learning

3. Technology Partners (Geospatial Data, Software and/or Cloud Processing/Storage Capabilities)

TGI intends to create a Geospatial Data Analytics Library, which is a repository of geospatial datasets and geospatial software tools for use by the academic community within the Institute. This library will be accessible by API, in the cloud, with access to storage and compute and ability to upload/run models and analytics within the infrastructure. The intention is to minimize the overhead for researchers by reducing the time they spend in discovering and acquiring data and tools. TGI's vision is to develop a world class repository of data, tools and compute to act as **both** a catalyst to innovation **and** a repository of world class analysis towards solutions to grand societal challenges.

The benefits of building a world class geospatial data, software and processing environment are as follows:

- Benefit to industry
  - Training: Exposure and education on products across the TGI community (researchers and students)
  - Discovery: innovative uses of products lead to additional use cases and findings
  - Scientific Validation: Research citing products published in peer reviewed articles

- Benefit to TGI
  - Training: TGI community can access and utilize industry leading products in courses
  - Discovery: TGI researchers can discover data and tools without moving through a timely procurement process; more focus on research and innovation than on gathering data and tools
  - Scientific Validation: TGI will have access to industry's best capabilities to conduct leading R&D

TGI intends to continue to build this repository as an asset for researchers by including research results back into the system.

Geospatial Data, Software and Cloud Storage / Processing

TGI is seeking partnerships with data companies in order to build a common repository of location data to support discovery and access by our research community, to include global and regional datasets that will be foundational inputs to answering global societal challenges. A key goal is to minimize time spent searching for and acquiring these products so that researchers optimize time spent on core science and impactful outcomes. We hope to include a broad range of both global, regional, and market specific datasets including but not limited to vector, raster, 3D, open source, proprietary and government sponsored datasets.

The TGI research community is most interested the following datatypes, provided for example; not an exhaustive list:
- LIDAR

- SAR
- Radar
- Hyperspectral
- High resolution imagery
- Emergency events
- Survey data
- Elevation data

Geospatial Software

TGI is seeking partnerships with geospatial software and tools companies in order to build a repository of tools available to the TGI research community.

Cloud Storage / Processing

TGI is seeking cloud storage and processing capabilities in order to provide an environment for the research community to conduct analysis.

TGI welcomes feedback on this engagement area and is also open to other innovative engagements for enabling more efficient and effective education and research.

PARTNERSHIP INTEREST

The Taylor Geospatial Institute is pleased to explore innovative engagements with industry partners. TGI intends to engage broadly and equitably across all interested parties. Partnership discussions may explore all types of mutually beneficial engagement.

We request that prospective TGI Industry Partners indicate the nature of their interest using the simple online form at https://taylorgeospatial.org/partnerships/ .

APPENDIX A – RESEARCH FOCUS AREAS

Building upon the St. Louis region's competitive strengths, the Geospatial Institute will address grand societal challenges in food systems, health , and national security with cutting-edge GeoAI and data analytics techniques. The Institute will generate research to improve food security, health and social equity, and build smart cities and resilient communities, and promote economic development through translation to commercial application and by training the next generation of the workforce (Figure 1).
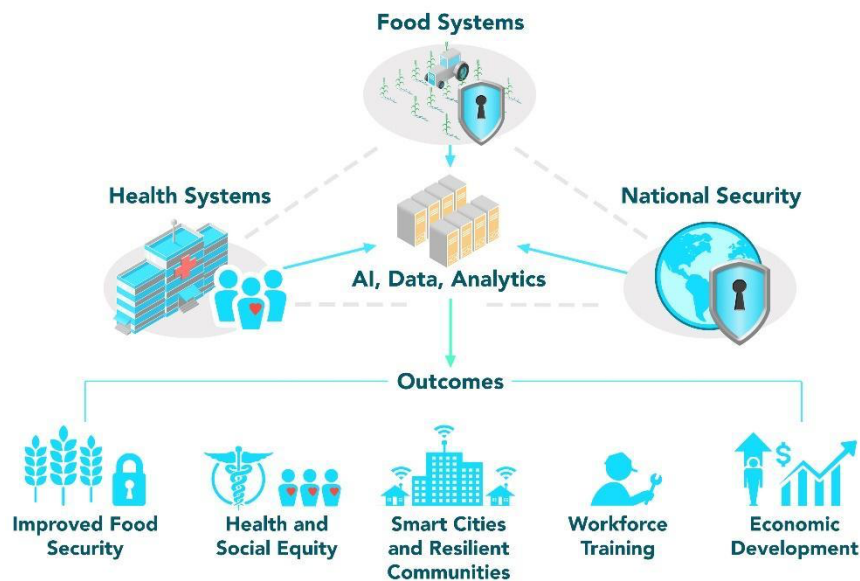

FIGURE 1. ADDRESSING GRAND SOCIETAL CHALLENGES AND OUTCOMES.

FOOD SYSTEMS

Everything comes from plants, not just the food on our dinner table, but everything from medicine, meat, to the strongest rubber used in spaceships.

One of the most challenging global problems today is feeding the growing global population, which will require increasing agricultural output by 70% in the next several decades. Food security is also an important national security issue and a major cause of social instability in many parts of the world. To address this challenge, we need to revolutionize the way we grow crops. We need to: create better crops that can thrive in the future climate with less water; utilize big data, advanced algorithms, and cloud computing at scale so we can monitor crops to improve yield and optimize resource use; and develop geospatial artificial intelligence to teach crops how to adapt to changing environments. To accomplish these goals, we must develop the capability to effectively harness big data and turn that into actionable crop intelligence with precision and speed. This important technology should help address our societal needs and improve our quality of life.

Geospatial science is fueling innovation and adaptation in food security and agriculture ecosystems by enhancing efforts to develop new crops and improve existing ones that meet both economic demands and ecological requirements. Data-driven AI, multi-scale imaging from satellites, drones, and ground robots have pushed the

envelope of technological developments. These advances can automate crop monitoring and compute precision farm directives for every farm in the world every week, covering about 1.76 billion hectares, and show farmers when to plant, fertilize, and harvest, as well as what their crop needs to improve yields and reduce input costs. With this technology, farmers can increase yields as much as 35% while lowering costs up to 25% using precision fertilization.

The St. Louis region boasts more than 1,000 plant science Ph.D. researchers, extensive research infrastructure, and a booming agtech sector, and thus is widely recognized as an international epicenter of agriculture research. The Geospatial Institute will build on this strong foundation, expanding on existing partnerships with regional institutions including the Donald Danforth Plant Science Center and regional universities, to address key challenges in food and ecosystem security including crop adaptation to changing climates and enhanced ecosystem functioning of our agricultural systems. Geospatial science is a powerful tool that is required to leverage agriculture as a means to combat climate change, regenerate soils and water systems, and reduce human impacts on biodiversity, while simultaneously producing food.

HEALTH SYSTEMS

Human health is largely determined by where we were born and live. From the air we breathe to the water that we drink, these resources are the building blocks of our health. Geospatial health builds on these very complex, and now easy to measure, air quality and water access and cleanliness concepts, to enhance what we know about where we work, live, and play. Geospatial technology and science have grown our opportunities in measuring location and its influence each day as we travel through our communities. Data from smartphones and watches, activity trackers, social media, and

"St. Louis region has substantial and highly specialized healthcare industry sector with significant activities and opportunities for innovation. Geospatial visualization and analysis is critical for improving healthcare delivery and health outcomes as demonstrated by use of spatial analysis in helping to guide health responses to COVID-19 pandemic, including identifying hotspots down to specific streets." – Geofuture Roadmap

satellite imagery can better inform the drivers of community health throughout the world. Some examples of how we continue to grow the knowledge and application of geospatial tools in health include developing and implementing multi-sensor infectious disease prediction modeling, perception health, and extended e-health tools such as telehealth and app and sensor-based tools.

Through advancements in technology, nontraditional public health and healthcare data from disparate sources can be combined to inform an early sensing system that would provide real-time COVID-19 risk assessments. The data sources include measures of community mobility such as app-based symptom tracking and contact tracing, anonymized smartphone data, geolocated social media mentions, satellite imagery analyses to identify vehicle traffic patterns of health care locations, and geolocated search terms. Synchronizing these data sources and fusing them to develop real-time models provide insights into community-level COVID-19 risks. There is great value in having this type of real-time risk assessment that can be used to identify health-related risks including risks related to the global COVID-19 pandemic, and other, more local examples like food poisoning from a restaurant. This type of early sensing system can enhance health equity by providing continued real-time data and analytics to devise needed real-time interventions.

Geospatial health research informs opportunities for workforce training in disaster preparedness and linking a trained workforce to locations where there is a need for healthcare workers. The tools we are devising will assist in growing, training, and preparing a workforce prior to arrival in locations that are experiencing disasters and other needs. The COVID-19 pandemic highlighted the lack of infection control preparedness. These tools and skills are necessary to have comprehensive response plans for a diverse workforce. For example, advanced supply chain management techniques for diverse health-related needs can also being explored. In addition to training and linking the workforce to locations in need, we are conducting a vaccine optimization study that leverages community mobility as a predictive and prioritized variable in the way vaccination allocation decisions are made. These types of analyses can be applied to many other challenges as well.

Geospatial technologies are the new macroscope to execute on NGA's vission of "Know the Earth...Show the Way...Understand the World".

NATIONAL SECURITY AND GEOINT

In 2017, the U.S. Department of Defense (DoD) decided to locate the new $1.75 billion National Geospatial-Intelligence Agency West (NGA-W) facility in North Saint Louis. When NGA-W opens in 2026, it will directly employ thousands of highly skilled employees. More importantly, a "geospatial ecosystem" of new knowledge-intensive businesses is expected to grow and generate thousands of new high-skill jobs in the surrounding area.

As the home for NGA-W, St. Louis has a strong legacy in mapping, geospatial analysis, and research and development primarily related to national security and defense. With over 350 companies in St. Louis supporting the NGA's mission with technologies involving advanced computing and geospatial analytics, national security is an anchor for regional geospatial research, training, and innovation.

National security and GEOINT encompasses all aspects of a geospatial science core, adjacent fields, and application domains from food security, political unrest, public health, environmental hazards (droughts, earthquakes, wildfires), and climate change. It includes but is not limited to the analysis of literal imagery, geospatial data, and information derived from the processing, exploitation, literal, and non-literal analysis of spectral, spatial, and temporal fused products utilizing computer vision, AI/ML, cloud computing, cyber-physical systems/IoT, and autonomy, among other critical technologies. These types of data can be collected on stationary and moving targets by electro-optical, synthetic aperture radar (SAR), related sensor programs, social media, mobile devices, and non-technical means (including geospatial information acquired by personnel in the field).

U.S. National Security research aims to maintain a leading edge over adversaries in digital revolution and cutting-edge technologies such as GPS, GPS alternatives, GeoAI, etc. The lack of talent with deep expertise trained through years of research in geospatial core has been recognized as a major national security threat as revealed in a recent article from NGA Director Vice Admiral Sharp[1]. Through the nexus of industry-university-government-community engagement around geospatial science and technology and research in food systems, health systems and application areas such as climate, water, and environment, the Geospatial Institute will make a significant impact on the national security complex through innovation and by creating tomorrow's highly skilled workforce required to keep America safe.

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[1] https://www.c4isrnet.com/opinion/2021/08/01/geomatics-is-vital-to-us-national-security-our-advantage-is-at-risk/