



**BTI** Institute

Borders • Trade • Immigration

A Department of Homeland Security Center of Excellence

# Annual Report

Program Year 3

1 July 2017 - 30 June 2018

Led by the University of Houston

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# **BTI** Institute

## Borders • Trade • Immigration

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A Department of Homeland Security Center of Excellence

Lead Institution: University of Houston (UH)

**Annual Performance Report – Program Year 3**

**Submitted to DHS S&T OUP by BTI Management 18 December 2018**

Anthony Ambler, Ph.D., Director, Principal Investigator, Dean, College of Technology, UH  
George Zouridakis, Ph.D., Research Committee Member, Associate Dean, College of Technology, UH  
Kurt L. Berens, Executive Director, UH  
Philip Boedeker, JD, Maj US Army Reserve, Manager, Communications/Operations, UH  
Yessenia Hernandez, Administrative Assistant, UH

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## **A. INTRODUCTION**

**Executive Summary.** The Borders, Trade and Immigration (BTI) Institute Performance Year 3 (PY3) Annual Report, released in 2018, conveys the BTI Institute's activities and contributions to the Homeland Security Enterprise over the third performance year of the Cooperative Agreement 2015-ST-061-BSH001-03 between the Department of Homeland Security and the University of Houston. The BTI Institute's mission is to conduct research, develop innovative solutions, and provide educational materials to enhance the nation's ability to secure our borders, facilitate legitimate trade and travel, and ensure the integrity of our immigration system. Through a multi-disciplinary team of national and international experts, the BTI Institute delivers transformational technology-driven solutions, data-informed policies, and professional development opportunities for today's Homeland Security Enterprise, and trans-disciplinary education for the next generation of homeland security experts. The BTI Institute's vision is to strengthen homeland security, social, and economic development as a world leader in research and education for transnational flows. Building on successes from previous performance periods, the BTI Institute continued to emphasize transparent processes to streamline reporting and reduce administrative burden on researchers participating in the project portfolio. The Institute continued efforts to define clear metrics for assessing performance of current programs, and for monitoring the success of highly focused new projects. Results from the Biennial Review have provided a clear roadmap for improving efforts to meet the needs of DHS components. Since its inception, the BTI Institute has maintained a core competency in Biometrics, and the UH Innovation Ecosystem provides fertile ground for the development of effective transition strategies to move DHS-funded R&D innovation into practice. The BTI Institute looks forward to exciting new projects and continued achievement in ongoing projects in the coming year.

### **Research Themes, Topics & Questions Addressed in BTI's PY3 Research Portfolio.**

- Theme Area 1: Border Security
  - Topic 1a: Policies
  - Topic 1b: Technologies
    - What new or emerging technology advances in change detection and anomaly recognition can provide authorities the ability to anticipate or recognize threats in real time?
  - Topic 1c: Concept of Operations
    - What innovative methodologies may be used to identify travel patterns and behavioral characteristics of individual terrorists, illegitimate actors and transnational criminal organizations?
  - Topic 1d: Other impacts
    - What are new sources of information and innovative methods and metrics to estimate the number and characteristics of human trafficking victims? Of criminal traffickers?
    - What useful historical information and trends can be derived from immigration, terrorism and illegal activities to enhance border security activities? For example, what can be learned from previous attempts to combat smuggling, drug trafficking and illegal immigration? How can the effectiveness of these efforts be measured?
- Theme Area 2: Legitimate Trade and Travel
  - Topic 2a: Policies
    - What policy or process opportunities could help streamline the flow of legitimate trade?
  - Topic 2b: Technologies
    - Do biometrics and mobile technologies offer opportunities to streamline processing of legitimate trade and travel?

- How can we measure, assess, and predict the impact of technology on the facilitation of legitimate trade and travel?
  - Topic 2c: Concept of Operations
  - Topic 2d: Export Control
- Theme Area 3: Immigration
  - Topic 3a: Policies
  - Topic 3b: Concept of Operations
    - How can we accurately predict the future magnitude of immigration flows to the U.S.?
    - What resource demands do immigrants place on public services?
    - What technologies can improve data collection on migrants that will allow officials to identify, track, and individuals while placing minimal data collection burdens on migrants themselves?
  - Topic 3c: Other impacts

**Activity Summary.** PY3 was associated with several key events that had significant impacts on the course and direction of the BTI Institute. Most significant of these events was the Biennial Review conducted by DHS Office of University Programs (OUP) over a five-month period with participation from external subject matter experts (SMEs), the Board of Directors (BOD), the BTI Institute’s Management, and the OUP Director and OUP Program Manager.

**Biennial Review.** The OUP Biennial Review involved three phases: Letter Review, BOD Review and OUP Management Review. The intent of the review was to evaluate performance and progress of Center activities over the preceding two-year period to provide guidance on the future direction of the Center of Excellence (COE). The Letter Review was comprised of SMEs from disciplines relevant to the technical aspects of Center projects. The BOD Review was conducted by Senior Executive Service personnel from: Customs and Border Protection (CBP), DHS Office of Policy, Immigration and Customs Enforcement (ICE) and a member from the DHS Science & Technology Directorate.

**Biennial Review Results.** The most significant recommendation from the Biennial Review instructed the University of Houston to replace the BTI Institute’s director and management team within 30 days and implement changes within 90 days due to the following deficiencies:

- The Institute’s Director was not responsive or sensitive to needs of DHS mission-oriented customers by developing or executing potential solutions
- BTI Strategic Director had not produced a Strategic Plan to guide activities
- BTI Management did not demonstrate leadership qualities when it interfaced with sub-recipients and DHS customers

On March 9, 2018 the following personnel were terminated: BTI Institute Director Ioannis Kakadiaris; Associate Director Ioannis Konstantinidis; and Executive Director, Strategic Partnerships Kevin Clement. In addition, the following individuals were removed from BTI Institute activities: Ioannis Pavlidis, Mary Ann Ottinger, Shishir Shah and Luis Torres. Five of the six ongoing research projects evaluated during the review were discontinued (one due to lack of relevance; three due to low scientific quality; and one received high scores, but the BOD determined that future work to examine another port of entry would not advance the research) effective June 30, 2018.

In March 2018, the Vice President for Research at the University of Houston appointed Anthony Ambler, Ph.D., Dean of the College of Technology as the Director and Principal Investigator (PI) of the BTI Institute. On April 1, 2018, Kurt Berens was hired as the Interim Executive Director.

Director Ambler and Executive Director Berens began the task of rebuilding the relationship between the Institute and OUP which had been severely strained. In addition to rebuilding trust with stakeholders within DHS, specifically OUP, the BTI Institute was tasked with providing responses to the below action items within 90 days.

- **Action:** Develop a follow-on plan to project entitled, *Image and Video Person Identification in an Operational Environment: Phase I* based on discussions with DHS S&T Borders and Maritime Security Division (BMD) and CBP Office of Field Operations (OFO) to increase project relevance to both CBP OFO and CBP U.S. Border Patrol missions.

**Response:** BTI worked with the PI and Project Champion to facilitate teleconferences during which details of the follow-on project were discussed. The Executive Director followed up on the suggestion by the Project Champion to contact Chase Garwood regarding vehicle telematics leading to contact with Stephen Popkin, Deputy Director of Research and Technology at the Volpe Center in Department of Transportation. The Executive Director also provided the PI with an opportunity via Texas Parks and Wildlife to place cameras in State parks to provide a relevant backdrop for optimizing the EDGE project. The Executive Director also suggested that the PI initiate contact with Joel Aud to draw from Mr. Aud's prior camera experience with Operation Drawbridge. Selection of the camera platforms used for the project were ultimately based on recommendations from Mr. Aud and the BTI Executive Director. BTI worked with the PI, Project Champion and OUP PM to draft multiple versions of a project work plan with an associated budget and budget justification.

- **Action:** Adjust the future direction of its portfolio to focus on increasing research to respond to legitimate trade and travel challenges, as the BOD expressed that this thematic area is in high demand. BTI Institute Requests for Proposals, currently under review, will be used to initiate new projects in this area.

**Response:** The Executive Director reviewed the forty-nine proposals submitted in response to the BTI requests for proposals from 2017 (RFP17-01 &-02) and assigned the projects to categories based on thematic alignment in the following categories: 1) border security; 2) legitimate trade & travel; 3) immigration. This information was provided to the Research Committee to compare with the results of the Research Committee's independent effort to conduct scientific merit and thematic alignment. The results were sent to OUP and five projects were selected for work plan development. The Executive Director worked the five PI's whose projects were selected to develop work plans through the end of the program year.

- **Action:** Adjust the future direction of its portfolio to focus on increasing research to respond to biometric challenges within the border security and legitimate trade and travel thematic areas.

**Response:** The Executive Director reviewed the forty-nine proposals as described above for projects that incorporated biometric challenge mitigation strategies. Two projects were identified and were suggested for further consideration. One of the two projects (EDGE Project submitted by PI Kakadiaris) was previously selected for work plan development. A list of eight additional projects was submitted by BTI for consideration by the Executive Director Planning, Program Analysis, Entry/Exit Transformation CBP/OFO. One project was initially requested for work plan development while the remainder were held for further consideration.



- **Action:** Develop a proposal addressing the community impact of physical infrastructure initiatives.

**Response:** The Executive Director worked with several US Border Patrol personnel in an attempt to clarify the details pertaining to the development of a proposal for this action item. Several potential performers were solicited for their interest in submitting a proposal, including: Arthur Laffer (Laffer Associates, Nashville, TN); Michael Lauderdale (UT Austin); Robert “Bill” Gilmer (UH); Roberto Coronado (El Paso Branch of Federal Reserve Bank of Dallas); Tom Fullerton (UT El Paso). Several potential investigators declined to submit a proposal due to the lack of clarity/definition being provided by DHS and the limitations in obtaining the necessary supporting information, e.g., construction schedule, locations, cost estimates. Patrick Schaefer (Hunt Institute, UT El Paso) and his colleagues agreed to draft a proposal and BTI facilitated the submission of a white paper in collaboration with the Hunt Institute. The project was selected for work plan development and the development of the work plan continued to the end of the performance period.

- **Action:** Adjust the future direction of its portfolio to focus on increasing immigration research, but only if the research can be conducted, completed and presented to DHS HQ/Components within an agreed upon short turnaround time to have relevance to DHS.

**Response:** The review of the 49 RFP proposals did not identify any projects that met the criteria of being able to be rapidly conducted, analyzed and reported. The Executive Director reached out to the Assistant Secretary for Border, Immigration and Trade Policy to assess project themes or topics of interest or operational need of investigation. Several topics were provided by the Assistant Secretary’s Office including: Sanctuary Cities; Venezuela-Nicaragua; Zero Tolerance and Family Separation. The Executive director identified PI’s interested in preparing and submitting proposals, including: Randy Capps and Andrew Selee, Migration Policy Institute (Sanctuary Cities and Venezuela Nicaragua); Stephanie Leutert, UT Austin (Zero Tolerance & Family Separation). Three white papers were prepared and submitted by BTI in collaboration with the PI’s and two (MPI submissions) were selected for work plan development.

- **Action:** Restructure the management team to be responsive and/or sensitive to the needs of DHS’ mission-oriented customers by developing or executing potential solutions.

**Response:** The University of Houston appointed Anthony Ambler, Ph.D. Director of the BTI Institute late March 2018. Dr. Ambler recruited Kurt Berens as the Executive Director in April 2018. Both the Director and Executive Director were provided the Biennial Review Report and thus were aware of the limitations and errors in execution and customer management of the prior BTI management team. The new management team embarked on a new customer-centric approach in management to assure that DHS stakeholders were engaged in a timely and meaningful way.

- **Action:** Produce a strategic plan to guide BTI Institute engagement and partnership activities.

**Response:** The Executive Director reviewed internal effort to develop a plan for Strategic Engagement and Outreach. Similarly, the results from a Strategic Planning exercise generated by through a preliminary assessment by an independent, external consultant were reviewed. The material was deemed by BTI management to be of sufficient quality

and in alignment with both the BTI Mission and the DHS and Homeland Security Enterprise mandates and was therefore utilized as the core of a revitalized Strategic Plan for the BTI Institute. The plan was submitted to OUP in June 2018.

- **Action:** Revitalized management team to demonstrate strong leadership qualities when interfacing with sub-recipients and DHS customers to educate and prepare its partners to work with DHS.

**Response:** The new management team has worked with DHS customers and subrecipients in a manner consistent with maintaining positive relationships while demonstrating strong leadership. Examples include the termination of several subrecipient agreements at the recommendation of the DHS Project Champion and the Office of University Programs. Despite projects being terminated, the PI's affiliated with the terminated projects continue to correspond with BTI in a cordial manner and have provided timely responses and material following requests from DHS for additional information. Similarly, BTI management has been proactive in its approach to prospective subrecipients to minimize the possibility of PI's responding in a manner that would be counterproductive in managing the DHS customer needs.

An additional action item was provided as follows:

- **Action:** U.S. Border Patrol is in the process of developing a catalogue of border metrics. USBP will apply these new metrics to many of its current and future business practices to measure effectiveness, efficiency and return on investment. Before DHS deploys these metrics, they require an objective third party Validation and Verification. BTI will develop a proposal to evaluate USBP metrics.

**Response:** BTI performed a search of external subject matter experts to generate a list of potential performers to conduct the verification and validation study of the US Border Patrol metrics database. The Executive Director contacted several investigators including: M. Whalen, (University of Minnesota); M. Wolf (Georgia Tech); R. Cooper (SAS Federal, LLC); V. Kumar (University of Minnesota); T. Gildea (NU Borders).

In parallel, BTI worked with several DHS POC's and potential stakeholders including: Branch Chief, Risk Analysis & Decision Support; Associate Chief, US Border Patrol Headquarters; Assistant Chief, USBP, Strategic Planning & Analysis Directorate; Operations Officer, University Programs Liaison, USBP SPAD.

There was significant difficulty in obtaining the structure of the database to be verified and validated. Despite the lack of additional information, BTI prepared and submitted a draft proposal to USBP SPAD on 5 June 2018. USBP SPAD provided some edits to the proposal and a performer was identified to conduct the analysis. BTI was informed by OUP PM that the project would not go forward and effort was to be suspended.

Through the remainder of the program year, the BTI Institute worked with the OUP PM to respond to each action item to the satisfaction of DHS. The Institute continues to address other areas of concern noted in the Biennial Review Report, for example:

- Articulating milestone/performance metrics for each member of the BTI management team
- Restructuring the Research Committee to provide a more diverse set of expertise capable of addressing a broad spectrum of interdisciplinary research thematic areas/topics

- Developing a Strategic Engagement strategy
- Improving turnaround time regarding white paper submissions
- Taking a more proactive role in managing the relationship between Project Champions and the Principal Investigators conducting BTI Institute projects
- Engaging customers (DHS) more effectively and providing timely and complete responses/actions following in-person meetings at HQ or in the field

Additionally, the new BTI Institute leadership restructured the management team, the research committee, physically relocated the team to the College of Technology, and initiated a financial audit of the Institute's activities.

**Partners.** The BTI Institute partners with academic, industry, or government partners in supporting the Homeland Security Enterprise through the Institute's research endeavors and educational initiatives. The following is a list of institutions that have collaborated with the Institute as researchers:

- Migration Policy Institute (Washington, D.C.)
- Voir Dire International, LLC (Texas)
- University of Houston (Texas)
- University of Texas at El Paso (Texas)
- University of North Carolina at Charlotte (North Carolina)
- Rutgers University (New Jersey)
- Texas A&M Engineering Experiment Station (Texas)
- American University (Washington, D.C.)
- Command, Control and Interoperability Center for Advanced Data Analysis, Rutgers University (New Jersey)
- University of Virginia (Virginia)
- Middlebury Institute of International Studies (Vermont)
- Texas A&M International University (Texas)
- Texas A&M Transportation Institute (Texas)
- Arizona State University (Arizona)
- University of Arizona (Arizona)
- University of Minnesota (Minnesota)
- West Virginia University (West Virginia)

The following are institutions the Institute engaged with during PY3 in an attempt to build transition partners, collaborative research partners, or expand the Institute's subject-matter expertise:

- MITRE, Inc. – intended to form a relationship as a transition partner
- Oak Ridge National Laboratories – identified ORNL as a potential research partner to meet identified needs
- SAS Federal, Inc. – intended to form a relationship as a transition partner
- South East Texas Regional Planning Commission – additional grant collaboration
- Southwest Border Sheriffs' Coalition – a partner in identifying needs along the Southwest Border
- Cross-Border Institute – an academic partner in identifying and developing research solutions to needs along the Northern Border
- Universidad Nacional Autónoma de Mexico – foreign academic partner in developing research solutions across the Southern Border

- Center for Homeland Defense and Security, Naval Postgraduate School – an academic partner in developing homeland security education programs

## **B. INSTITUTE MANAGEMENT ACTIVITIES**

### **B.1. Tasks**

Below is the status of the Institute Management tasks for PY3 (July 1, 2017 to June 30, 2018).

- **Request for Proposals.** All tasks associated with the RFP process (work plan refinement, contracting, and preparations) are consolidated under this bullet. RFP 17-01 commenced on April 7, 2017 (during PY2) and contained 27 questions. BTI received seven responses by the closeout date of May 5, 2017 (PY2). The scientific review was conducted from May 8 – 28, 2017 with submission of seven projects to DHS S&T OUP on December 14, 2017. The merit and relevancy review ran concurrently until decision on June 14, 2018.

RFP 17-02 launched on June 1, 2017 (during PY2) and contained 133 questions. By the closeout date of July 7, 2017 (PY3), BTI received 44 responses, 19 with institutional conflict of interest (COI). The scientific review began on August 1, 2017 and concluded on November 28, 2017 with submission of 25 project recommendations to DHS S&T OUP PM on December 14, 2017. The Arctic Domain Awareness Center (ADAC) submitted reviews of proposals with COI to the DHS S&T OUP PM on March 6, 2018.

For the scientific review process, the Institute employed the services of an independent researcher database that uses automated search algorithms to identify Subject Matter Experts (SMEs). These experts performed scientific quality reviews for all RFP-17 submissions not presenting a conflict of interest. At least two SME reviewers were assigned to each proposal to conduct the scientific merit review. The research committee viewed all proposals for a portfolio review as it relates to scientific merit. The independent scientific reviews and the portfolio review were forwarded to DHS to conduct the relevancy review. The BTI Institute did not receive any information about the reviewers employed by OUP.

To safeguard the integrity of the RFP selection process, the BTI Institute collaborated with the Arctic Domain Awareness Center (ADAC), a partner Center of Excellence, to handle the review of proposals that presented institutional conflicts of interest with the University of Houston. Procedures and documents implemented by the BTI Institute were shared with ADAC and utilized for completion of all scientific quality reviews to ensure consistency of the review process.

The SME review for BTI-RFP-17-01 began on May 8, 2017 and concluded on May 28, 2017. The SME review for BTI-RFP-17-02 began on August 1, 2017 and concluded on November 28, 2017. Twenty-five project proposals were submitted to the DHS S&T OUP PM on December 14, 2017.

As noted earlier, in April, once the new management team and research committee were in place, an additional scientific review was conducted to evaluate the merits and portfolio impact of the proposed projects on the Institute. This evaluation and its results were forwarded to the DHS S&T OUP PM in May 2018. The merit and relevancy reviews ran concurrently by DHS S&T OUP until decision on June 14, 2018.

In April 2018, the Institute was instructed to conduct a second review by the new leadership team of the 49 proposals submitted to RFP-17 to facilitate awarding of projects

along the revised thematic areas of emphasis, i.e., legitimate trade and travel; and immigration. The newly appointed Executive Director reviewed all 49 project proposals for operational feasibility and thematic alignment and assigned each to one of three categories, namely: a) border security, b) legitimate trade and travel, or c) immigration. Independently, the new Research Committee conducted another round of reviews focusing on scientific merit and alignment with thematic area. The results of these additional rounds of review were submitted to DHS in May 2018. A final relevancy review was conducted by DHS in June of 2018, and ultimately, five projects were selected for work plan development.

Five new projects were selected to begin work plan refinement on 14 June, 2018. Two projects were from RFP-17-01, and three were from RFP 17-02. No work plans were completed during PY3, and the effort was carried over into PY4.

- **Annual Report.** The PY2 Annual Report was prepared and scheduled for submission on August 29, 2017. Due to damages to the city of Houston during Hurricane Harvey, the University of Houston was closed between 25 August 2017 and 5 September 2017. An extension for submission of the PY2 annual report was granted by OUP. The document was submitted in draft to the OUP PM on 8 September 2017. The PY2 annual report narrative was approved by OUP on January 23, 2018. Minor clarifications to the expense report accompanying the narrative were requested by OUP. BTI submitted a response to this request on 2 February 2018.
- **Biennial Review Preparation and Follow-up.** In PY3, the BTI Institute underwent the OUP Biennial Review. Initial guidance to complete the biennial review was issued to the BTI Institute from OUP on 31 May 2017. The list of projects to be included in the review and the timeline were issued to the BTI Institute on 15 June 2017. On 9 July 2017, the BTI Institute requested some clarifications to the DHS S&T OUP COE Biennial Review process portion of the SOP that OUP answered on 17 July 2017. In order to fully prepare the researchers, the BTI Institute hosted a webinar on 14 August 2017 and collected all materials for submission on 18 August 2017. An extension was requested due to Hurricane Harvey, and a new deadline was extended through 8 September 2017.

The Institute prepared appropriate review materials by phase (Letter Review, BOD Review, and OUP Management Review). The Letter Review for projects listed below included a Project Report based on the template provided in the SOP. These materials were provided to OUP on 8 September 2017.

The BOD Review included an evaluation criteria crosswalk, project summary, transition plan, slide presentation, and customer commitment letter for each project listed:

- Homeland Security Symposium Series
- Security Technologies Kitchen
- Image and Video Person Identification in an Operational Environment: Phase I
- A Systematic Process for Vulnerability Assessment of Biometric Systems at Borders
- Modeling Methodology and Simulation of Ports-of-Entry Systems
- Participatory Operational Assessment (POA): Evaluating and Predicting the Operational Effectiveness of Cargo Security Processes at Ports of Entry

Additionally, for the Director briefing to the BOD on 6 February 2018, the Institute prepared management review documents including the BTI Institute Transition Strategy based on the Mission Model Canvas, the Process to Identify and Compete New Projects, and the Process to Reallocate Project Funding. The management review portion also addressed topics such as leveraging partner institutions, COE collaboration, leadership of the Research Committee, and the use of advisory committees.

- **Annual PI meeting.** The annual PI Meeting, in conjunction with the annual Showcase, was held on 4 December 2017 at American University in Washington, D.C. Attendees included the PY3 PIs, champions, members of DHS S&T OUP, representatives from UH, and two guest speakers. Maximum headcount throughout the meeting was 54.

The guest speaker from UH, Tom Campbell, Executive Director of UH Intellectual Property, discussed the Mission Model Canvas approach to identifying customer needs and pain points. Once identified, the research should then be tailored to meet those needs, either through the development of a new tool or through a knowledge product. Campbell also emphasized the support that the University of Houston is providing for the transition process. This support was extended to other non-UH researchers in a willingness for collaboration with other universities' IP departments.

The guest speakers from DHS focused on transition, specifically working with DHS and CBP. Discussions focused on how the deliverable must decrease operating cost or increase security. The researcher needs to be able to speak in terms of operational deliverables to help the customer understand what the research aims to accomplish.

Each researcher gave a short presentation on their research, including the pain points of their customers, the process by which their research was being conducted, and how they were going to transition that research into an actionable product for their customers. Each presentation was 20 minutes long with an opportunity for the Champion and others to have a brief question and answer session afterwards.

- **Annual OUP data call.** The annual OUP Data Call was issued in January 2018 to span Calendar Year 2017. The number of publications produced by BTI Institute associated researchers, the number of students enrolled in BTI Institute related education activities, the number of requests for assistance from DHS and other government agencies, and the amount of follow on funding awarded throughout the 2017 calendar year were submitted prior to the suspense of 31 January 2018.
- **Annual Work Plan.** Prior to the implementation of the managerial recommendations from the biennial review, a draft work plan for PY4 was developed with a suspense date of 30 March 2018. Upon removal of the previous executive leadership team and appointment of a new leadership team beginning 1 April 2018, a new PY4 work plan with a focus on correcting the deficiencies identified by the BOD review was drafted. With efforts guided by the Executive Director, a new work plan was drafted with attention to focus areas directed by OUP PM. To focus the Institute's efforts back on customer-oriented needs, the PY4 work plan includes travel for the research committee, Director and Executive Director to Washington, D.C, for face-to-face customer engagement of CBP and CBP's subcomponent agencies. PY4 work plan development has carried over into PY4.

## B.2. Milestones

Below is the status of the Institute Management milestones for PY3 (1 July 2017 to 30 June 2018)

- **Submitted Annual Report.** PY2 Annual Report was submitted to OUP on 8 September 2017. The narrative was approved on 23 January 2018.
- **Submitted material for BoD biennial review of BTI.** All materials for the OUP Biennial review were submitted on 8 September 2017.
- **Annual PI meeting held.** The BTI Institute Annual PI meeting was held on 4 December 2017.
- **Submitted work plans for projects selected by DHS from RFP-17-01 & RFP-17-02 submissions.** Projects for work plan development were selected on 14 June 2018. Work plan refinement began under the new research committee and the effort was carried over to PY4.
- **Responded to Annual OUP data call.** The Institute submitted the completed workbook with requested metrics to OUP by 31 January 2017.
- **Modified Annual Work Plan submitted (based on BoD recommendations).** The PY4 Work Plan included action items and efforts that directly addressed the recommendations to the BoD to include travel for the research committee to Washington, D.C. for face-to-face customer engagement with CBP. The Annual Work Plan was not submitted prior to the end of PY3, thus the effort to create the Annual Work Plan has carried over into PY4.
- **Feedback on BoD recommendations.** The University of Houston appointed a new director, and the BTI Institute leadership team restructured and relocated the Institute management team based on BoD recommendations.
- **RFP-18-01 issued.** The Institute did not issue RFP-18-01 due to the results of RFP 17-01 and 17-02 being so late in the performance year.

## B.3. Outputs

Below is the status of the Institute Management Outputs for PY3 (1 July 2017 to 30 June 2018).

- **BTI Annual Report.** Submitted on 8 September 2017. The BTI Institute PY3 Annual Report was approved by DHS S&T OUP in January 2018.
- **Annual Work Plan.** Development carried over to PY4.
- **RFP-18-01 (announced by).** Not announced at the request of DHS S&T OUP.
- **Revised Annual Work Plan (based on Biennial Review outcomes).** Integrated outcomes and action items to PY4 Work Plan.
- **Develop three project proposals in biometrics to address challenges that complement existing efforts.** Two proposals were submitted during RFP 17-01 and RFP 17-02 that addressed challenges complementing efforts in biometrics. They were *EDGE: The "Eye in the Woods" Image-based Human Trafficker Detection System* and *MANTIS: Image-based Vehicle Detection and Tracking System*.

## B.4. Performance Metrics

Below is the status of the Institute Management performance metrics for PY3 (1 July 2017 to 20 June 2018).

- **BTI Institute engages with Federal, State, Territorial, Tribal, Local and private stakeholders.** Throughout PY3, the Institute engaged with various DHS representatives, Texas State representatives, and private industry through conferences or direct face-to-face orientation meetings.
- **BTI Institute establishes strong, effective dialogue with PM, OUP and BoD.** The

former director and current Executive Director had weekly calls with the Program Manager from DHS S&T OUP.

- **BTI Institute ensures the appropriate mix of disciplinary skill sets and partners needed to achieve research objectives.** The Institute expanded its knowledge base through contracting relationships with subject-matter experts across the United States, having a multi-disciplinary research committee, and engaging other academic and industry organizations in an attempt to partner.
- **BTI Institute has established meaningful partnerships with Minority Serving Institutions (MSI) to provide collaborative research opportunities for MSI faculty and students.** The BTI Institute has partnerships with the University of Houston (lead), University of North Carolina at Charlotte, Rutgers Business School at Newark and New Brunswick, and the University of Texas at El Paso (all MSI). The BTI Institute did not host an MSI Research Team in PY3.
- **BTI Institute has established a transition strategy to ensure successful use of its research projects.** The BTI Institute completed a Transition Strategy, held a webinar to discuss the strategy with research partners, and assisted researchers in developing individual transition plans within each project.
- **BTI Institute regularly and actively collaborates on initiatives and research with other DHS Centers of Excellence and Federal Research Laboratories.** The Institute collaborated with CCICADA COE and began discussions to collaborate with Oak Ridge National Laboratory in PY3.
- **BTI Institute has established a process for reallocation of funds from unproductive or less relevant projects.** The process is established but no funds were reallocated during PY3.
- **The BTI Institute, in coordination with the DHS S&T OUP Program Manager and Board of Directors has established a prioritized list of unfunded research projects in the event funding becomes available.** The Institute has not created a list of prioritized unfunded research projects.
- **BTI Institute has an established methodology to identify and compete new projects of interest.** The Institute has developed a methodology to identify new projects through direct strategic engagement and white paper submissions.
- **BTI Institute has expanded its funding revenues through non-DHS grants.** The Institute was not awarded any non-DHS grants in PY3.
- **BTI Institute has expanded its funding revenues through non-OUP funding requests.** The former Executive Director is the lead for the Regional Response to a Complex Coordinated Terrorist Attack grant through the South East Texas Regional Planning Commission.

### C. PERSONNEL

Below is the summarized activities and status of the BTI Institute staff throughout PY3 (1 July 2017 to 30 June 2018).

**Director/PI:** Ioannis A. Kakadiaris (1 July 2017 to 6 March 2018)/Tony Ambler (1 April 2018 to 30 June 2018)

The Director and PI of the BTI Institute served as the primary liaison to the DHS Enterprise, the *de facto* chair of the Research Committee, and was responsible for the overall research portfolio and strategic direction of the Institute.

Until 6 March 2018, Ioannis Kakadiaris served as the Director and PI. He participated in weekly telephone calls with the DHS S&T OUP PM, monthly conference calls with other DHS COE



directors, and participated in the regular meetings of the Research Committee, where they reviewed work plans, transition activities, monthly reports and the progress of the projects

The BTI Director held weekly conference calls with the DHS S&T OUP Program Manager (the agenda items for each weekly meeting – emailed to DHS S&T OUP the Program Manager ahead of the meeting- are available upon request).

In addition, the BTI Director performed additional duties pertaining to BTI Institute operations, including preparation, review and approval of implementation process for the following:

- reporting BTI Institute research project PY2 activities; PY2 Annual Reports for BTI Institute research projects; PY2 Annual Report for BTI Institute Core.
- biennial review materials (quad charts, Letter Review, BoD review) for BTI Institute research projects and the BTI Institute Core.
- PY4 Annual Work Plan.
- annual PI meeting (December 2017); review and approval of the reports for BTI Institute research projects.
- engaging the UH Office of Intellectual Property Management to co-develop a comprehensive Transition Strategy document and guidelines as part of the PY3 work plan (19 July 2017), which was subsequently refined based on feedback from OUP, the partner PIs, and the External Advisory Board.
- Centers of Excellence Summit and Showcase Event, as part of the Organizing Committee; participation in all BTI Institute conference calls in preparation for the Centers of Excellence Summit and Showcase Event.
- management of hourly personnel time reporting and absence request approval.

Solicitation, review, formatting and submission of four White Papers was managed by the BTI Director including:

- A Bayesian Network Approach to Quantify and Predict Migration Trends, 24 June 2017 (the result of an unsolicited submission by a University of Houston faculty member)
- Opportunities for increased resilience for transnational trade and supply chain management disrupted by Hurricane Harvey, 16 October 2017
- 2018 DHS COE Summit, 17 October 2017
- Central American Immigrant and Refugee Flows: Alternatives to Reaching the U.S., 8 January 2018 (initiated by the Office of the CBP Commissioner on 20 December 2017)

The BTI Director solicited interest from multiple academic sources to develop a proposal for a project to conduct an economic assessment of the and to assess the delivery of benefits offered by the Customs-Trade Partnership Against Terrorism Program (C-TPAT). Professor Bruce Kellison at UT Austin expressed interest and BTI Institute provided his team with a proposal template on 6 March 2018.

The BTI Director initiated discussions with CBP which resulted in the first contract (Mobile Exit Hackathon; PI: Kakadiaris; \$221,891; 06/15/18-12/15/18) awarded to the BTI Institute using the Basic Ordering Agreement.

The BTI Director led the BTI Institute's Advisory Board Meeting at University of Houston in November 2017.

The BTI Director engaged in discussions regarding educational programming including

discussions with Mark DuPont National Maritime Law Enforcement Academy.

The following is a summary of the BTI Director's travel during PY3 (1 July 2017 to 6 March 2018).

17 July 2017: Director Kakadiaris accompanied an OFO delegation visiting ports of entry in the area of McAllen TX offering his ideas about Biometric Exit for pedestrians and vehicles.

27 July 2017: Director Kakadiaris met with Keith A. McManus (Assistant Chief Headquarters, U.S. Border Patrol) regarding the Institute's Transition Strategy; Marc Rosenblum (Office of Policy) regarding a data matching project; and John Boyd regarding the proposal of BTI Institute on blockchain research.

3 September 2017: Director Kakadiaris traveled to Washington, D.C. to meet with representatives from CBP.

31 October 2017: Director Kakadiaris traveled to Washington, D.C. to brief DHS S&T OUP on mission model canvas and to meet project champions and External Advisory Board (EAB) members.

3 December 2017: Director Kakadiaris attended the Annual BTI Institute Performers Meeting.

4 December 2017: Director Kakadiaris met with CBP Commissioner Kevin McAleenan accompanied by the DHS S&T OUP Director and the DHS S&T OUP Program Manager.

30 January 2018: Director Kakadiaris traveled to Austin, TX to present at the Texas Association of Regional Conferences meeting in Austin, TX and then the Border Security Expo San Antonio, TX in order to gain industry insights and trends within the HSE Enterprise.

3 February 2018: Director Kakadiaris traveled to Washington, D.C. to present an overview and detailed description of the BTI Institute, the Institute efforts, and individual research projects to the Board of Directors as part of the Biennial Review process.

Director Kakadiaris also submitted six research proposals during RFP 17-01 and RFP 17-02, including:

- *Observation/Reconnaissance Craft Architecture (ORCA)*
- *MANTIS: Image-based Vehicle Detection and Tracking System*
- *BTI Internship and Leadership Program*
- *BTI Training Program: Planning and Management*
- *EDGE: The "Eye in the Woods" Image-based Human Trafficker Detection System*
- *Semantics for Business and Visual Immigration Analysis (SYMBIOSIS)*

On 1 April 2018, Anthony Ambler was appointed by the university as the Director and PI of the BTI Institute. Director Ambler continues to oversee the overall portfolio and direction of the Institute.

Director Ambler continued the practice of conducting weekly conference calls with the DHS S&T

OUP Program Manager.

The BTI Director participated in the drafting, review and approval of the PY4 BTI Institute Work Plan.

The following is a summary of the BTI Director's travel during PY3 (1 July 2017 to 6 March 2018).

30 April 2018: Director Ambler traveled to El Paso, TX to speak and attend the symposium, "Drug Trafficking Organizations and Violence in Mexico" at the University of Texas El Paso Center for Law.

3 April 2018: Director Ambler traveled to Washington, D.C. to conduct customer discovery and outreach with stakeholders from DHS S&T OUP, DHS HQ and components to hear challenges and needs directly from key customers. Director Ambler met with representatives from CBP Trade Policy, Office of Field Operations, Office of Acquisition, Office of Strategy, Policy & Plans, and Border Patrol.

**Associate Director, Project Management:** Ioannis Konstantinidis (1 July 2017 to 9 March 2018)

The Associate Director, Project Management was responsible for overseeing the development and execution of standard operating procedures. He was responsible for implementing these procedures across the reporting processes of the Institute management team and the researchers.

Until 9 March 2018, Associate Director Konstantinidis created the researcher's monthly and quarterly report templates, created the Annual PI Meeting template and process, participated in the Research Committee monthly meeting and reviews, and handled the majority of project review correspondence with the researchers.

3 December 2017: Associate Director Konstantinidis traveled to Washington, D.C. for the BTI Institute Annual PI meeting and Showcase to provide oversight to the meeting.

**Executive Director:** Kurt L. Berens (1 April 2018 to 30 June 2018)

As of 1 April 2018, Kurt Berens assumed the responsibilities of the Associate Director along with those of the Executive Director of the BTI Institute. Mr. Berens was tasked upon arrival with responding to the list of action items identified in the Biennial Review Report.

The Executive Director worked with the PI, DHS stakeholders and the Project Champion to facilitate discussion and development of a work plan for a follow-on project to the project entitled "Image and Video Person Identification in an Operational Environment: Phase I". The new project entitled "EDGE: The "Eye in the Woods" Image-based Human Detection and Recognition System" was to be initiated in PY4.

In response to the request to adjust the future direction of the BTI portfolio to focus on research to respond to legitimate trade and travel challenges, the Executive Director completed a comprehensive thematic review of the 49 projects submitted in response to RFP-17 (-01 & -02) and assigned thematic alignment to each project. In addition, Executive Director Berens engaged the Research Committee to conduct a secondary, parallel scientific and thematic review. The results of these reviews were submitted to OUP for comparison to preview scientific

merit and relevancy reviews. DHS completed an additional round of relevancy reviews of the proposals for thematic alignment with legitimate trade and travel. As a result of these activities, DHS was able to select five projects for work plan development.

The Executive Director applied a similar approach to determine those projects suitable for adjusting the future direction of the BTI portfolio to increase research in the areas of Biometric challenges associated with border security and legitimate trade and travel. In addition, Biometric projects under consideration by faculty in Computational Biomedicine Laboratory at UH were assessed. The result of this effort was the submission on 15 May 2018 of summaries for nine potential projects to the Executive Director of Planning, Program Analysis and Evaluation in the Office of Field Operations within Customs and Border Protection for consideration of work plan development. These submissions were titled:

- EDGE: The “Eye in the Woods” Image-based Human Trafficker Detection System
- Evaluation of the Usefulness of Images obtained from LEO Wearable Cameras in Various Scenarios
- Evaluation of Face Recognition Performance in Understudied Populations: Minors
- Identity Verification of passengers in Self Driving Vehicles Traveling at Speed through Border Exits
- Capturing the Identity of Passengers in Vehicles Traveling at Speed through Border Exits
- Face Recognition using Multiple Images (RS2S)
- Robust Video to Image Face Identification System for Fast Authentication (RV2I)
- Human Detection in Images Obtained from Trail Camera Images (TRACE)

A project to assess the impact of physical infrastructure initiatives on small, medium and large southern U.S. border communities before, during and after construction was sourced through several potential investigators. On 24 May 2018 the Executive Director initiated contact with the Hunt Institute for Global Competitiveness and on 15 June 2018 BTI received a proposal which was forwarded to DHS on the same day.

In response to the action to increase emphasis in the BTI research portfolio in the area of immigration research, the Executive Director engaged the Assistant Secretary of Border, Immigration and Trade Policy via a telephonic discussion on 11 May 2018. Due to the dynamic nature of the issues related to immigration, DHS was interested in fast moving projects with short turnaround times from initiation to reporting in order to be responsive to the constantly shifting priorities in this thematic area. On 14 June 2018, BTI received a response from DHS with several topics of interest in the area of immigration research. The Executive Director began to solicit project proposals for these topics and the effort continued into PY4.

Several key changes in operations were implemented by the Executive Director to correct performance deficiencies of the BTI Institute under the former Director’s management. Project timelines were created for tracking progress on tasks, milestones and deliverables for portfolio projects and Institute deliverables. In addition, performance metrics for BTI staff were defined to align project effort reporting with deliverables to give the DHS S&T OUP Program Manager clarity regarding accountability for future return-on-investment analyses. In response to the action to produce a strategic plan to guide BTI engagement and partnership activities, the Executive Director compiled elements from legacy documents and submitted the BTI Strategic Plan on 8 June 2018.

In an effort to address additional concerns highlighted in the Biennial Review, the Executive Director, in conjunction with Director Ambler, focused the new management team to be facile and rapidly responsive to needs of its DHS mission-oriented customers and stakeholders in its approach to developing or executing potential solutions. Furthermore, Executive Director Berens and Director Ambler made concerted efforts to demonstrate strong leadership qualities when interfacing with award sub-recipients and DHS customers to align partners with DHS goals in support of the Homeland Security Enterprise.

Attention to strengthening the educational activities of the BTI Institute was initiated by the Executive Director through contact with the Deputy Assistant Commissioner, Office of Training and Development (CBP) on 3 May 2018 and again on 27 June 2018 to clarify the needs from DHS perspective. On 27 June 2018 a proposal for a Border Studies educational program was submitted for review and feedback.

The final action item from the Biennial Review was the development of a project to provide a third-party validation and verification of a catalog of border metrics being developed by US Border Patrol. The objective was to apply these metrics to current and future business practices to measure effectiveness, efficiency and return on investment. BTI submitted a proposal on 4 June 2018 to DHS S&T OUP. As of the end of PY3, DHS had not reached internal consensus regarding access to data necessary to complete the task.

Solicitation, review, formatting and submission of four White Papers was managed by the Executive Director including:

- Understanding and Addressing Employee Turnover Using Big Data, 31 May 2018
- Proposal to Evaluate US Border Metrics: A Verification and Validation Assessment, 15 June 2018
- Leveraging Transactional Data Systems to Maximize Value of the Repository for Analytics in a Virtualized Environment (RAVEN), 28 June 2018
- Proposal to Test the Use of Unmanned Autonomous Systems Carrying Radiation Detectors to Enhance Radiation Detection at Maritime Ports, 28 June 2018.

In response to a request from the DHS S&T OUP Program Manager, the Executive Director solicited interest from multiple academic and industry sources regarding proposal development for a project to determine the effectiveness of the Customs-Trade Partnership Against Terrorism Program (C-TPAT). Teleconferences with the Director of C-TPAT on 20 April 2018 and 7 June 2018 were conducted to clarify the project objective to verify whether the C-TPAT Program was providing the benefits to participants due to concerns highlighted in a report from the Government Accounting Office (GAO-17-84; February 2017). White papers produced by University of Texas at Austin and Center for Risk and Economic Analysis of Terrorism Events (CREATE) were forwarded to DHS (20 April 2018 and 27 June 2018, respectively) for review.

Additional duties that the Executive Director performed pertaining to daily operations of BTI included: management of hourly personnel time reporting and absence request approval; review and approval of invoices submitted to BTI from sub-award recipient institutions; preparation, review and approval of the PY4 Annual Work Plan for BTI Core; managing/repairing the strained relationships with PI's from ongoing sub-award projects; participation in all BTI conference calls in preparation for the Centers of Excellence Summit and Showcase Event; participation in the transfer of financial reporting infrastructure and property control from the Texas Institute for Measurement, Evaluation and Statistics to the College of Technology.

**Member, Research Committee:** Shishir Shah, Ph.D. (1 July 2017 to 9 March 2018)

As a member of the Research Committee, Shishir Shah participated in the verification of scientific reviews of proposed projects, the review of white paper submissions, and the ongoing feedback and review of the BTI Institute's current research and education portfolio. The committee reviewed individual project progress, provided guidance, and reviewed deliverables.

**Manager, Communications-Operations:** Philip J Boedeker (October 2017 to June 2018)

The Manager, Communications and Operations oversaw and implemented the communications strategy for the BTI Institute. Aspects of the strategy included creating written publications, updating the Institute website, engaging with stakeholders through emailers and social media, designing print materials, and photography. Most of these activities supplemented the other. For instance, at an event, the manager would write a release and take a photograph. The Manager would send the release and photograph out to public media, placed on social media, hyperlinked on the website and placed in the quarterly newsletter.

Additionally, the Manager, Communications and Operations, would assist the Executive Director, Strategic Partnerships or the Project Coordinator, Special Projects in coordinating and conducting Institute events such as scheduled visits, the meeting of the Executive Advisory Board, the PI Showcase, the COE Summit, and various presentations of the overview of the BTI Institute to potential partners.

The Manager developed nineteen news releases, three newsletters, eight monthly reports, the OUP BTI Fact Sheet, the BTI Institute Fact Sheet, contact cards, trade show displays, and a podium display. The Manager posted content and updates on the HSUP website, project reporting system, BTI Institute website, Twitter (190 posts), and LinkedIn (30 posts). The Manager assisted in planning and participated in an Unmanned Aerial Systems Working Group (teleconference); a meeting of the External Advisory Board (Houston, TX); a project kickoff meeting (teleconference); the Annual PI Meeting and Showcase (Washington, D.C.); the BTI Institute Distinguished Speakers Series (Houston, TX); the COE Summit (Washington, D.C.); the Congressional Staff Delegation visit (Washington, D.C.); and strategic engagement meetings with MITRE, SAS, Port of Houston, Southwest Gang Information Center, and Pacific North West Economic Region (PNWER).

**Media and Communications Advisor:** Lan Ni, Ph.D.

The Media and Communications Advisor helped transition the new Manager, Communications and Operations into the BTI Institute in PY3. She was primarily responsible for compiling the Fall Edition of the PY3 newsletter until the Manager took over the task. Additionally, she assisted in providing an orientation to the systems utilized by the Institute (Emma, Eventbrite, Twitter, LinkedIn, and Cascade CMS). For events on the University of Houston's campus, the Advisor assisted in marketing events, social media engagement during the event, and encouraging her students to attend. As of March 6, 2018, Dr. Ni was no longer acting as the Advisor.

**Website Support Specialist:** Nitisha Rawat

The Website Support Specialist assisted the Manager, Communications and Operations, by editing the BTI Institute's website until the Manager Communications and Operations assumed this duty. She was primarily responsible for the more complex aspects of the website, including the HTML coding of the front page.

**Program Director of Business Operations and Administration:** Rachel Brownlie (1 July 2017 to 3 October 2017).

The Program Director of Business Operations and Administration managed and booked all travel arrangements for the members of the BTI Institute. She also oversaw the personnel budget reallocations. She ordered and tracked all purchases and reimbursements for the Institute. She assisted the Associate Director in verifying stipend requests from sub-contracts.

Upon leaving in October 2017, some of the financial and budget tracking responsibilities were added to the Associate Director until 9 March 2018. The travel planning and booking, event venue and catering scheduling, purchase tracking and reimbursement, and stipend requests were added to the Program Coordinator, Special Projects until 19 February 2018, when the responsibilities transferred to the BTI Institute Administrative Assistant.

#### **D. RESEARCH COMMITTEE**

The BTI Institute's Research Committee was responsible for providing input on the quality and promise of incoming projects, monitoring progress throughout the performance year, and intervening when necessary. The committee, in part or in whole, was ultimately responsible for conducting and reporting each of the research projects. The research committee developed a monthly reporting template and a quarterly review template to monitor research progress. A deliverable sharing platform was under development under the direction of the former Administrative Director but was not completed. Peer-reviewed publications were reported to the Research Committee through the developed monthly reporting template.

The monthly report captured the researchers' progress based on tasks, milestones and deliverables. This report allowed committee members to track progress of each project in relation to the work plan and provide feedback and recommendations.

The quarterly review was conducted by webinar and allowed each researcher, through a template presentation, to present the current progress of the research including any current challenges. The researcher, the project champion, the Research Committee and the Associate Director were present for these webinars.

Upon the completion and approval of the BTI Institute Transition Strategy, the Research Committee assisted each researcher in adequately integrating transition activities into their work plans. Additionally, the Research Committee approved the template for the PI Annual Meeting that focused on transition efforts and activities.

Prior to March 2018, the Committee was comprised as follows: Director Kakadiaris, Ioannis Pavlidis (Computer Science), Shishir Shah (Computer Science), and Luis Torres (Social Work).

From March 2018, the Committee was comprised as follows: Director Anthony Ambler, George Zouridakis (Computer Engineering Technology), Luca Pollonini (Engineering Technology), Richard Willson (Biology and Biochemistry), and Dan O'Connor (Health and Human Performance).

#### **E. EXTERNAL ADVISORY BOARD**

The External Advisory Board (EAB) serves to assist BTI Institute leaders in planning, research, technology and market development. As such, members work to: provide strategic advice to the Director, actively assist in achieving Institute goals, provide links between the Institute and the operational environment, and enhance the reach and visibility of the Institute nationwide. Mr. Alan Bersin, former Commissioner for Customs and Border Protection, served as the chair.

The EAB met with the BTI Institute team at the University of Houston on 13-14 November 2017. The theme of the meeting was *Making Better Connections between Operations and Research*. The meeting focused on the members' experience with aligning research to operator needs and ensuring transition of research projects from the creation of the work plan to the deliverable stage. The members discussed partnerships that are necessary to ensure the Institute pulls in top talent to work on DHS' needs; partnerships aimed at accomplishing goals. The EAB members also helped refine the education and work force development mission of the Institute. Finally, there was an update on developments by Canada and Mexico on the changes in border management and the issues faced by those countries. The members voted on and adopted the EAB Charter.

*In lieu* of a January teleconference, the BTI Institute management team met with Mr. Alan Bersin while he was participating in the BTI Institute's Distinguished Speakers Series. The discussion revolved around the direction of the Institute's research portfolio and the potential of developing curriculum at the University of Houston that saw the border as an academic study area.

The other meeting and teleconferences originally drafted in the PY3 Work Plan were not planned or did not occur due to scheduling conflicts amongst the EAB members.

## F. PROJECT MANAGEMENT ACTIVITIES

### F.1. Tasks

Below is the status of the project management tasks for PY3 (1 July 2017 to 30 June 2018).

- **A member of the Research Committee will be assigned oversight of each BTI Institute project.** Each project was assigned a research committee member to provide additional oversight and guidance when required. The entire Research Committee reviewed all monthly and quarterly project updates.
- **The committee will meet with the PPI by teleconference three times a year, and provide written feedback.** The committee met with each PPI by teleconference, either through kick-off meetings or quarterly updates. No formalized written feedback system was utilized, however, the Research Committee utilized informal verbal and electronic communication to provide feedback and refinements as needed.
- **Conduct teleconference with each PPI for Committee Review of project progress.** In PY3, the BTI Institute instituted quarterly reviews of projects by the Research Committee, in addition to the monthly phone reviews that each Partner PI had with the Research Committee liaison assigned to their project. The first quarterly review was conducted in conjunction with the reporting requirements of the Biennial Review. A webinar was held on 7 August 2017 with a follow-up webinar on 14 August 2017. For new projects, the kickoff meeting was considered the first review. The second quarterly review was based on the materials submitted and presentations for the annual PI meeting in 4-5 December 2017. The third quarterly review was held on 28-29 January 2018 based on templates developed and implemented in fall 2017 (finalized as of Nov 15). The fourth round of quarterly reviews were held on 30 April 2018 and 1 May 2018 by the newly appointed research committee chaired by Dr. Zouridakis.
- **Conduct Committee Review of written project progress reports and provide feedback.** In November 2017, the Research Committee collaborated with partner PIs to develop a monthly report template that was approved in November 2017 and implemented



for use in December 2017. This allowed the research committee to provide informal feedback in the form of telephonic or electronic communication on the progress of each project in relation to milestones and customer need. The Committee reviewed monthly reports during the monthly research committee meeting.

- **Provide recommendation on Concept Papers received by the BTI Institute.** The Research Committee reviewed nine concept papers in PY3 for scientific merit and value to the BTI Institute's portfolio.

## F.2. Milestones

Below is the status of the project management milestones for PY3 (1 July 2017 to 30 June 2018).

- **Completion of Kick-Off Meetings for RFP 16-01 Projects approved by DHS.** Four projects kicked-off during PY3.
  - Central America's Immigrant and Refugee Crisis: Limiting Unauthorized Migration through the Alliance for Prosperity and Reintegration Efforts; PI: Randy Capps, Migration Policy Institute
  - Modeling International Migrant Flows: Theory, Evidence and Forecasts; PI: David Leblang, University of Virginia
  - Missed Detections: From Data to Actionable Estimates; PI: Dennis Egan, CICCADA COE, Rutgers University
  - The Impact of Central American Child and Family Migration on U.S. Communities; PI: Eric Hershberg, American University
- **Revision of Project Management activities based on Biennial Review recommendations.** Based on BoD Biennial Review recommendations, in addition to a change in the Associate Director and the Research Committee, the project management activities were focused on close out of discontinued projects. The discontinued projects were:
  - *Modeling Methodology and Simulation of Port of Entry Systems*, PI Benjamin Melamed, Rutgers University;
  - *Modeling International Migrant Flows*, PI David Leblang, University of Virginia; *Homeland Security Symposium Series*, PI Victor Manjarrez, University of Texas at El Paso;
  - *Participatory Operational Assessment (POA): Evaluating and Predicting the Operational Effectiveness of Cargo Security at Ports of Entry*, PI Maria Burns, University of Houston;
  - *Security Technologies Kitchen*, PI Shishir Shah, University of Houston; and
  - *Missed Detections: From Data to Actionable Estimates*, PI Dennis Egan, Rutgers University

## F.3. Outputs

Below is the status of the project management outputs for PY3 (1 July 2017 to 30 June 2018).

- **Progress reports from project PIs.** Eight progress reports from each project covering from the month the Monthly Report template was approved and disseminated to June 2018 were submitted to the BTI Institute. The progress reports, termed Monthly Reports, included an executive summary of the previous month's issues, concerns, progress and processes and the opportunity to update tasks, performance metrics, milestones, and deliverables.

- **Written review reports to PIs.** Formalized written reports in a template were not created, however, the research committee provided informal feedback in the form of telephonic or electronic communication on the progress of each project in relation to milestones and customer need.

#### F.4. Performance Metrics

Below is the status of the project management milestones for PY3 (1 July 2017 to 30 June 2018).

- **Project description clearly addresses a knowledge gap identified as a Homeland Security Enterprise problem or need.** All projects aligned against a research question from a DHS component organization and refined by the project Champion.
- **Project Champion is identified and engaged.** All projects had an assigned project champion and were invited to attend the quarterly review webinars and the PI Annual meeting. Champion engagement was included in each project work plan.
- **Project Champion signs off/approves the notional transition plan.** Each project had a notional transition plan as part of its work plan. The transition plan was discussed with the project champion, researcher, and Research Committee. The plan was also detailed during the PI Annual meeting.
- **Concluded Project has an identified, committed customer.** The Research Committee worked with the project champion and researcher to ensure the project could be adequately transitioned at the time of project termination.
- **Project has established meaningful performance metrics.** The Research Committee reviewed all work plans to ensure they contained performance metrics that would accurately assess the development of the project from beginning to completion and transition.
- **The Research Committee and designated research committee members are fully and continuously engaged with the PIs.** Each research committee member was assigned individual projects to assist in any feedback or development issues. Additionally, the Research Committee met monthly to review the project monthly reports and met quarterly to participate in the quarterly reviews.
- **Research Committee assists PIs in establishing project teams with optimal mix of interdisciplinary skill sets and partners.** The Research Committee reviewed each project to ensure that, if the project were multidisciplinary in nature, the research team would be sufficient.

### G. TRAINING AND WORKFORCE DEVELOPMENT

#### G.1. Tasks

Below is the status of the education and workforce tasks for PY3 (1 July 2017 to 30 June 2018).

- **Develop Education and Workforce Goals.** The BTI Institute retains a legacy goal to “Educate and train current and future workforce to meet evolving challenges in Transnational Flows”. Two objectives included in this goal were to train the current workforce and educate and train the future workforce. These objectives would be accomplished through initiatives developed by the Director of Education and Workforce initiatives. These initiatives included involving current students in Homeland Security Enterprise related research projects, develop course work for current students that could lead to a career in Homeland Security, provide training to the current Homeland Security work force on appropriate topics, and provide training to corporate executives on critical Homeland Security topics.

- **Attend monthly education working group calls.** The monthly COE Education working group call is hosted by OUP. This call allows education representatives across the DHS Centers of Excellence to share status of current educational offerings. The focus of the calls during PY3 included highlighting monthly educational and workforce development milestones, progress toward selection of summer research teams from minority serving institutions and planning for the 2018 COE Summit.

Summit planning became a separate bimonthly call in February 2018. The COE Summit Education Committee was comprised of representatives from nine Centers of Excellence. This committee was tasked with organizing the student poster session including student recognition and prizes; student engagement at the COE Summit to include a student breakfast and field visits to the Port of Baltimore, the National Targeting Center, and TSA screening at Baltimore-Washington International airport with the COE research PIs; establishing poster requirements and template; selecting judges for the poster contest and determining criteria for evaluation; collaborating with the Summit Communications Committee for content on the Summit student web page; reporting to the organizing committee; and communicating with the COE Directors.

- **Summer Research Team Program.** The BTI Institute was one of eight Centers of Excellence scheduled to participate in the Department of Homeland Security Science and Technology Directorate Office of University Programs 2018 Summer Research Team Program for Minority Serving Institutions (MSIs) administered through the Oak Ridge Institute for Science and Education (ORISE). The purpose of this program is to increase and enhance the scientific leadership at MSIs in research areas that support the mission and goals of DHS.

Ten applications were received by OUP from teams interested in collaborating with the BTI Institute for summer 2018. These applications were reviewed by BTI's research committee for relevance to the BTI mission and to identify a research collaborator to serve as the primary point of contact for each team to guide research activities. Seven of the ten applicants were invited to submit a full proposal to the BTI Institute. During proposal development, questions from faculty were directed to BTI's former Executive Director and members of the Research Committee for guidance.

Five research teams submitted full proposals to BTI. The research committee members evaluated these proposals for relevance and intrinsic merit of the research; faculty applicant qualifications; student applicant qualifications; and academic benefit. An overall rating of excellent, very good, good, fair or poor was provided for each proposal, and the teams were ranked based on their evaluation scores. A team rating sheet was completed and shared with ORISE. This document included BTI's overall team ratings, rankings, comments, and an assigned research collaborator for each proposal. BTI was eager to host a team with a rating of "excellent" and awaited award status from DHS, which was expected at the end of March 2018.

In mid-April 2018 Dr. Luis Torres, former member of the BTI Research Committee, was contacted by ORISE to determine his continued interest in serving as a mentor for the summer research program. Dr. Torres copied BTI staff in his reply stating that although he was available and willing to serve as a mentor, this decision should be made by BTI's new leadership team. On April 19, 2018 BTI staff was copied on an email from ORISE to

Dr. Torres informing him that DHS would not be supporting a team at BTI for summer 2018.

- **Student Summer Research Fellow.** Two courses were planned for development in July and August 2017 under the lead of Dr. Paula S. deWitte. Bobby Hsu, BTI student fellow participated in the development of courses titled *Risk Assessment and Management for Small Businesses* and *Critical Infrastructure*. The first course was completed, but completion of the *Critical Infrastructure* course experienced complications due to the devastation Houston experienced from Hurricane Harvey.
- **Submit proposals in response to relevant RFP.** Three Education and Workforce Development proposals were submitted to RFPs during PY3. Dr. Ioannis Kakadiaris submitted two proposals to BTI-RFP-17-02 in July 2017. The titles of the two proposals are *BTI Internship and Leadership Program* and *BTI Training Program: Planning and Management*. A third proposal titled *Preparedness Training for Cross-Border Biological Threat Detection and Response* was submitted to a Kansas State University RFP in July 2017.
- **C-Level Training: Global Maritime Supply Chain Leadership.** A timeline, plan, and budget for the first module of training on economic and maritime supply chains was developed, with training originally planned for fall 2017. Funding for the program would come from tuition charged to participants. A tour of the Port of Houston was included in the itinerary. Leadership personnel affiliated with this program included:
  - Eleftherios Iakovou, Director, Marketing and Logistics Innovation Initiatives, Texas A&M Engineering Experiment Station;
  - James Wall, Executive Director, Texas Center for Applied Technology, Texas A&M Engineering Experiment Station;
  - Ioannis Kakadiaris, former Director, BTI Institute, and
  - Hercules Haralambides, Professor of Maritime Economics and Logistics, Erasmus University Rotterdam.

The training was unexpectedly delayed due to health issues of the primary instructor. By the time all planning aspects were in place (venue, travel logistics, cost of course offering, instructors, curriculum), it was determined that the training would have to take place in PY4. Further coordination stopped upon the dissolution of the previous BTI Institute leadership team.

- **Develop and offer small Business training in Cyber Security and related topics.** Dr. Paula S. deWitte, with student support provided in conjunction with the Student Summer Research Fellowship program, scheduled three courses for development. The titles of the courses to be developed are *Everything You Wanted to Know about Cybersecurity but Were Afraid to Ask!*, *Risk Assessment & Management for Small Businesses*, and *Critical Infrastructure*. The Cybersecurity course was developed in PY2. The other two courses were scheduled for development early in PY3. The Risk course was completed, but there were complications with completion of the *Critical Infrastructure* course due to damages to the city of Houston from Hurricane Harvey.
- **Bachelor of Science Course: Transnational Flows course development.** Research on the creation of a BS course in Transnational Flows was conducted. The research

focused on course viability at the University of Houston assessing college/department alignment with content areas. Course development had not reached the stage of faculty adoption or course content development at the time of the Director of Education and Workforce Initiatives resignation. The course was integrated into the overall Border Studies concept that will be executed as part of PY4.

- **Stackable certificates: concept paper.** A stackable certification program is a current workforce focused education concept that allows for a series of certifications in an area of study that, if the student completes the entire program, the student is eligible for a degree. If the student is unable to complete the entire program, they have still obtained a number of career developing certifications. A concept paper titled *Thinking and Doing Across Borders: A Scalable Strategic Vision for Education and Workforce Development in Joint Border Management (JBM)* was produced to give a workforce strategic vision with the purpose for holistic development of all actors comprising the Joint Border Management workforce.
- **Certificate in Trade (concept draft).** The Certificate in Trade concept paper was not completed nor submitted to DHS.
- **Evaluation of training.** We prepared exit surveys for each participant and was prepared to conduct a 'hot wash' after the event with the purpose of identifying areas in which we could improve for the next iteration.
- **BTI Institute Facilitated Summer Internship Program (contingent on funding).** The Homeland Security Internships for service academy cadets took over a year in planning, coordination, and preparation.

The original intent of the Borders, Trade, and Immigration Institute's Homeland Security Internship Program with the U.S. Coast Guard Academy was to focus on suitable, short-term research projects relevant to the U.S. Coast Guard. The former Executive Director, Strategic Partnerships had solicited the involvement of the Director of the U.S. Coast Guard Research and Development Center, to recommend research projects, appropriate to the relatively short-term period (six weeks) of the internship. Cadets would be presented with an assortment of research projects to choose from, rather than "assigning" projects in which they might not have an interest. These research assignments would be selected by the cadet interns and confirmed by the U.S. Coast Guard Academy and the BTI Institute prior to arrival at the BTI Institute. At the conclusion of the internship, each cadet would be required to present their research to the BTI Institute's faculty and staff and to provide written documentation in support of their research (deliverables to be identified based on the research topic).

It was anticipated that each cadet would also provide a presentation of their research to the Director of the U.S. Coast Guard Research and Development Center and his staff upon return to New London, CT. This would provide additional opportunities to present the student research at professional conferences during their senior year (e.g., IEEE, The Infrastructure and Security Partnership, the Maritime Threat Conference, et al). Presentations at these conferences would only serve to enhance and publicize both the BTI Institute and its Homeland Security Internship opportunities within the U.S. Coast Guard community.

The meeting between the BTI Institute and the Director of the U.S. Coast Guard Research and Development Center, initially scheduled for early 2018, was cancelled by the Office

of University Programs. As a substitute, the BTI Institute allowed the cadet interns from the U.S. Coast Guard and U.S. Military Academy to choose focus areas for research from the project to develop a Unified Regional Response to a Complex Coordinated Terrorist Attack (CCTA).

The BTI Institute's inaugural Homeland Security Internship Program launched in June 2018 and spanned six weeks. This internship was intended to familiarize future leaders in the Homeland Security and National Security space with the breadth of operational needs and research opportunities available. Three cadets from the U.S. Coast Guard Academy and one cadet from the U.S. Military Academy, all rising seniors, participated in this program. The cadets were each supervised by Institute staff members. Internship assignments supported several BTI initiatives. Researching and creating executive read files on Department of Homeland Security leadership enhanced the Institute's customer discovery and outreach efforts. Cadet research on institutions that provide certification, undergraduate or graduate level degrees in border studies was crucial in enhancing the Institutes border studies and workforce development efforts. Conducting literature review research and developing applicable planning products in support of a regional response to a Complex Coordinated Terrorist Attack workshop series provided research experience.

## **G.2. Milestones**

Below is a status of the education and workforce development milestones for PY3 (1 July 2017 to 30 June 2018).

- **Conduct of C-Level training course.** C-Level training was not conducted during PY3.

## **G.3. Outputs**

Below is a status of the education and workforce development milestones for PY3 (1 July 2017 to 30 June 2018).

- **C-Level course offering.** A C-Level course was not offered during PY3.

## **G.4. Performance Metrics**

Below is a status of the education and workforce development performance metrics for PY3 (1 July 2017 to 30 June 2018).

- **C-Level training.** A C-Level training course was developed but not delivered in PY3.
- **SME course offerings.** No coursework of SME offerings was developed, but the single event of the Speakers Program brought an Illicit Flows subject matter expert to speak to students in the University of Houston law center.
- **Proposal submission.** Three proposals were submitted in response to relevant RFPs in PY3. Two were in response to the BTI Institutes RFP 17-02, and one was to Kansas State. No proposals were accepted to begin developing work plans.
- **Develop course offering plans.** The Education Director developed a concept for a course offering that was later further developed by the Program Coordinator and Manager of Communications and Operations into the Border Studies proposal. This effort will carry over into PY4.

## **H. STAKEHOLDER ENGAGEMENT**

- **New Mexico Homeland Security and Emergency Preparedness Conference in August 2017 (Albuquerque, NM).** The former Executive Director was invited to serve as keynote speaker at the conference in which he gave both an orientation to the Institute

and a presentation on the *Unified Regional Response to a Complex Coordinated Terrorist Attack* initiative. This increased the Institute's reach into New Mexico but did not result in any collaborative opportunities in PY3.

- **Port of Houston on 19 October 2017 (Houston, TX).** The former Executive Director and Manager of Communications and Operations visited the Port of Houston to give a detailed brief on the BTI Institute and its projects. Discussion included research collaboration opportunities including a discussion of the project *Participatory Operational Assessment: Evaluating and Predicting the Operational Effectiveness of Cargo Security Process at Port of Entries*. The leadership at the Port agreed to host a tour for the Institute's Homeland Security Interns from the Coast Guard Academy to familiarize them with the problem set that the Port faces every day.
- **Eighth Maritime Risk Symposium on 17 November 2017 (Tiffin, OH).** The former Executive Director attended the eighth Maritime Risk Symposium, a DHS S&T sponsored event designed to solicit research questions related to U.S. Coast Guard issues. The need for a focus on cyber security and the possibility of USCGA summer interns at the BTI Institute were discussed.
- **MITRE, Inc. on 2 November 2017 and 6 December 2017 (Houston, TX; McLean, VA).** Mr. Joe O'Neill visited the BTI Institute at the University of Houston to receive an overview of the Institute and discuss possible collaboration opportunities. O'Neill presented an overview of The MITRE Corporation and discussed how the BTI Institute could facilitate an independent test and evaluation to give an external, unbiased assessment. There was also a discussion of MITRE's core research program and the BTI Institute potentially hosting a team of researchers focused on CBP related issues. Specifically, there was a discussion of quick-response DNA kits, TSA identification issues, and research collaboration at the ports to modernize our port system.

In December, the former Director and Program Coordinator, Special Projects visited MITRE's corporate headquarters to meet with representatives, discuss future research opportunities, and to confirm potential use of MITRE facilities for the 2018 BTI Institute Research and Education Showcase. No research projects developed as a result of this engagement.

- **SAS Federal, LLC on 6 November 2017 and 5 December 2017 (Houston, TX, Washington, D.C.).** SAS Federal representatives Jeremy Hogg, Steve Bennet, and Catherine Land Baldwin visited BTI to discuss an overview of SAS Federal and collaboration opportunities with the Institute. The main points of discussion were opportunities for economic studies of the impact of current border related policies and the void in current UAS data. The UAS data is collected by various border agencies but is not compiled into a single database allowing for shared information.

In December, the former Director and the Program Coordinator, Special Projects met with SAS representatives to formalize the partnership between the organizations. While a willingness to work together is in place if an opportunity arises, no formal relationship was developed.

- **Kevin McAleenan, Commissioner of CBP on 4 December 2017 (Washington, D.C.).** The former Director met with Commissioner McAleenan during the 2017 PI Meeting and

Showcase in a scheduled office call at CBP Headquarters. The Director provided an overview of the Institute, proffered support of CBP mission and priority tasks, and requested input as to ways in which the BTI Institute could best render support to CBP in the future. The Commissioner discussed CBP's priorities and challenges with the BTI Director.

Upon follow up, the Commissioner asked BTI Institute to undertake an iterative, economic study about a "Safe Third Country Agreement" between US and Mexico. The BTI Institute submitted a proposal to OUP which underwent several rounds of revision. A final proposal was submitted on 10 January 2018. The project was not selected for work plan development.

There was no further activity directly related to CBP priorities or challenges as conveyed by the Commissioner.

- **Southwest Gang Information Center on 12 December 2017 (Houston, TX).** The former Executive Director met with Joe Kolb to discuss potential collaboration between the Southwest Gang Information Center and the BTI Institute in the area of MS-13 mapping. Follow up was conducted and no collaboration opportunities within the BTI Institute's mission space could be found.
- **Consul General of Costa Rica on 13 December 2017 (Houston, TX).** The former Executive Director met with Carlos Humberto Pacheco-Murillo, Consul General of Costa Rica to establish a partnership with the Universidad Nacional Costa Rica. Mr. Pacheco-Murillo also showed interest in participating in a panel discussion on transnational flows of financial capital as he has dealt with money laundering issues. The new management team determined that this activity was outside of the scope of BTI Institute's core mission and no further effort was applied.
- **Pacific Northwest Economic Region (PNWER) on 9 January 2018 (telephonic).** The former Executive Director and Manager of Communications and Operations participated in a phone call with Matt Morrison, Chief Executive Officer of PNWER, to discuss how the BTI Institute can be responsive and engaged in Northern border and trade issues. Discussed the concept of 'preclearance' and the value of testing along the Northern border. Also discussed partnership opportunities related to NAFTA and the potential changes under the current administration and the development of a Northern Boarder Working Group. The working group was not developed in PY3.
- **Border Security Expo from 31 January – 1 February 2018 (San Antonio, TX).** The former Director and the former Executive Director attended the Border Security Expo in San Antonio, TX. While attending, the Director met with EAB member Luc Portelance, also in attendance. The former Executive Director met with CBP Air and Marine Operations Acting Executive Director Dennis Michelini and sector chiefs Manuel Padilla and Jason Owens to discuss the way ahead with a command and control initiative for airspace in specific reference to UASs. Additionally, Chief Padilla wanted the UAS Working Group to meet in the Rio Grande Valley sector to discuss the new drones and develop strategies for their uses.



The former Executive Director also met with the CBP Commissioner Chief of Staff Timothy Quinn to follow up on the meeting with the CBP Commissioner, the “Safe Third Country” project, and the CBP Commissioner’s scheduled appearance at the University of Houston.

Additionally, the Executive Director was approached by the Assistant Director Field Operations, Laredo Field Office, Frank S. Longoria, who requested assistance in training on fingerprinting and latent prints. The BTI Institute coordinated a call from Houston Forensic Science Laboratory in order to begin addressing the operational concern.

- **Biometrics for Government and Law Enforcement Summit on 26-28 February 2018.** The former Director met with DHS S&T Program Managers and discussed a number of potential research projects and initiatives that the Institute could engage in quickly, such as the identification of human traffickers or the identification of passengers in vehicles traveling at speed.
- **Homeland Security Council Meeting on 2 May 2018 (Austin, TX).** The Executive Director attended the meeting hosted by the Texas Department of Public Safety at the Criminal Law Enforcement conference room on the Texas DPS campus. A presentation by Dr. Mike Lauderdale, Law Enforcement Director for Texas Homeland Security, provided details on the deteriorating conditions in Mexico and drew parallels to the collapse of Venezuela. Dr. Lauderdale agreed to prepare a proposal for the impact of physical infrastructure on border cities.
- **Oak Ridge National Laboratories in January 2018**  
In January 2018, Oak Ridge National Laboratories (ORNL) submitted a two-page white paper to BTI describing work completed on a prototype device using quantum cascade lasers to detect trace amounts of materials (explosives, illicit drugs) via a portable platform for “standoff” detection. The ORNL platform had been validated for detecting trace explosives and other substances and ORNL’s white paper proposed developing and validating the platform to detect opioids and in particular acryloylfentanyl (fentanyl). Following consultation with the former Executive Director, arrangements were made for ORNL personnel to visit the CBP Laredo Field Office on February 22, 2018. During this visit, ORNL personnel observed CBP field operations relevant to: 1) entry/exit of travelers; 2) interdiction of illegal goods.

In March 2018, the BTI management team was removed and in April a new BTI team was engaged. This project was identified as being in development and the Executive Director contacted ORNL to gauge interest in moving forward. A teleconference was arranged and participants included; DHS HQ, CBP HQ & OFO, BTI and ORNL. CBP personnel expressed enthusiasm for the project, particularly regarding the application of this platform technology in mail sorting facilities at speed, including:

- United Parcel Service facility in Louisville, KY (largest automated package handling facility in the world).
- Federal Express facility in Memphis, TN (second highest volume package sorting facility in the world).
- United States Postal Service facility at John F. Kennedy Airport in NY (largest office of exchange for international mail in the world; processes nearly half of the international mail volume of the US).

The potential project subsequently languished due to the inability of this DOE Laboratory to accept the flow down conditions within the Cooperative Agreement between DHS and UH.

- **Houston Forensic Science Center in February and April 2018**

In February 2018, BTI personnel met with personnel from the Houston Forensic Science Center (HFSC) to discuss opportunities for collaboration. The following list of potential projects was introduced:

- **National Database for Controlled Substances.** Create a government-controlled National Controlled Substance Data Base, dynamically managed throughout the system, and accessible through a formalized process by government laboratories and law enforcement agents within the United States. This data would integrate data currently found in various databases used by Customs and Border Protection (CBP), Drug Enforcement Administration (DEA), Federal Bureau of Investigation (FBI), U.S. Navy, U.S. Coast Guard, Immigration and Customs Enforcement (ICE), Alcohol, Tobacco and Firearms (ATF), and Secret Service. It would provide spectra that has been verified and updated in real time, which can be used to compare unknown samples. The database would be used to share data with hospitals, federal, state, and local law enforcement agencies.

Prospective Champion: Not identified

- **CBP Laboratory Information System.** Update/transition the CBP's South West Regional Science Center's Laboratory Information System to a secure, paperless system. This information system would: enable secure access to data from all diagnostic equipment, machinery, and lab notebooks present in the laboratory; allow for information exchange ("talk" to) with the laboratory's database; and generate laboratory reports. This system would provide access to lawyers building their cases. A handbook would be provided to explain system processes.

Prospective Champion: Ira Reese, Administrative Program Manager, CBP Regional Laboratories.

- **ACE Upgrade.** Upgrade the Automated Commercial Environment Data Base to collect, track, and store evidence covering the nine CBP Sectors on the southern border. Change from the current DHS Form 6051, "Custody Receipt for Seized Property and Evidence," to an electronic barcoding system, connected to the network that allows 54,000 agents and Assistant U.S. Attorneys (AUSAs) to have access to the location, status, and testing results of evidence. Provide a data mining capability for this system.

Prospective Champion: Not identified

- **Subscriber Identity Module chips.** Conduct research to assist in deciphering binary code to determine what information is on the SIM chip and to recover deleted data.

Prospective Champion: Ira Reese, Administrative Program Manager, CBP Regional Laboratories

- o **Latent Fingerprint Detection and Crime Scene Analysis Training.** Chief Frank Longoria, OFO (Laredo Sector) expressed a need for his personnel to receive training in latent fingerprint detection and crime scene analysis. The ideal situation would be that training could be conducted locally since they are chronically understaffed and traveling to receive training is both costly and reduces available personnel. A solution was offered by Houston Forensic Science Center that would involve a training module to be brought to the personnel in the field.

Prospective Champion: Not identified

In April 2018, the new Director and Executive Director of the BTI Institute met with senior management of HFSC to discuss the latent fingerprint detection mobile training program. Due to the presence of the Federal Law Enforcement Training Center (FLETC) in Glynco, GA, it became apparent that there was little interest from DHS for BTI to mature this potential project. In June 2018 correspondence from DHS effectively ended progress on this potential project. The remaining potential HFSC projects above likewise never evolved to provide any meaningful benefit for the parties involved.

## I. TRANSITION

The BTI Institute's Transition Strategy was published for PY3 and applied across current and developing research projects. The BTI Institute partnered with the UH Office of Intellectual Property Management to develop a comprehensive strategy as part of the work plan, which was subsequently refined based on feedback from OUP, the partner PIs, and the EAB. The document details the overall guidance to PIs for developing transition plans tailored to their end-user. To ensure that transition and a transitional approach to research was a priority, the management team conducted a webinar on October 26, 2017 focused on the Mission Model Canvas and the University of Houston's developed approach to transition led by Tom Campbell, Executive Director of IP Management at the University of Houston. Further, during the annual PI Meeting on 4 December 2017, each PI briefed on their current transition approach and the plan they had developed in collaboration with their project Champion.

The Research Committee selected three projects to serve as demonstration projects for this process, led by Maria Burns, Ioannis Kakadiaris, and Ben Melamed. The three projects implemented phase 1 - 2 of the Transition Strategy and presented their notional transition plans during the PI Meeting.

For projects that started in PY3, the Research Committee ensured that the PI and project champion had detailed the required steps and processes for transition.

The following is a list of projects that generated meaningful transition activities during PY3.

- *Uncovering Human Smuggling Patterns from Guatemala to the US*  
PI: Gary J. Hale, Voir Dire International, LLC

This project resulted in the uploading of all migrant interviews (approximately 300) and related project data for the DHS Champions and USBP Stakeholders to access via HSUP.

- *Homeland Security Symposium Series*  
PI: Victor Manjarrez, University of Texas at El Paso

This project resulted in the uploading (<http://clhb.utep.edu/series/overview>) of a series of Research in Briefs for access and use by DHS Champions and USBP and CBP Stakeholders, as follows:

- Symposium 1: Disrupting and Dismantling Transnational Criminal Networks
  - Banking, Finance and National Security: In the Paso Del Norte Region
  - Counterterrorism and Intelligence
  - Drug Trafficking Organizations and Violence in Mexico
  - The Human Smuggling Industry: Nuances and Complexities
- *Modeling Methodology and Simulation of Port-of-Entry Systems*  
PI: Benjamin Melamed, Rutgers University

This project resulted in the transition of multiple deliverables to the Project Champion and the HSUP website.

- Delivery of the Bridge of the Americas Port-of-Entry simulation program and user manual to HSUP and the Project Champion.

Of note, The Port of Entry Simulation System (POESS) was issued a copyright assignment.

- *Participatory Operational Assessment (POA): evaluating and predicting the operational effectiveness of Cargo Security Processes at Ports of Entry*  
PI: Maria Burns, University of Houston

Peer-reviewed publications:

Burns Maria. "Participatory Operational & Security Assessment on homeland security risks: an empirical research method for improving security beyond the borders through public/private partnerships." *J Transp Secur*, online July 2018.

- *Secure and Transparent Cargo Supply Chain: Enabling Chain-of-Custody and Economical and Privacy Respecting Biometrics, and Blockchain Technology*  
PI: Weidong Shi, University of Houston

Peer-reviewed publications:

- Lei Xu, Lin Chen, Zhimin Gao, Yanling Chang, Eleftherios Iakovou, Weidong Shi. "A Blockchain Approach for Cargo Supply Chain Security Enhancement". The 18th Annual IEEE Symposium on Technologies for Homeland Security (HST '18, October 2018).
- Zhimin Gao, Lei Xu, Glenn Turner, Brijesh Patel, Nour Diallo, Lin Chen, Weidong Shi. "Blockchain-based Identity Management with Mobile Device". Workshop on Cryptocurrencies and Blockchains for Distributed Systems (co-located with MobiSys 2018) June 15th, 2018.
- Lei Xu, Lin Chen, Zhimin Gao, Yang Lu, and Weidong Shi. "CoC: Secure Supply Chain Management System Based on Public Ledger." In Computer Communication and Networks (ICCCN), 2017 26th International Conference on, pp. 1-6. IEEE, 2017.
- Lei Xu, Lin Chen, Zhimin Gao, Shouhuai Xu, and Weidong Shi. "EPBC: Efficient Public Blockchain Client for Lightweight Users." In Proceedings of the 1st Workshop on Scalable and Resilient Infrastructures for Distributed Ledgers, p. 1. ACM, 2017.

- Zhimin Gao, Lin Chen, Lei Xu, Nolan Shah, Yang Lu, Weidong Shi. "Scalable Blockchain-based Smart Contract Execution." In 2017 IEEE International Conference on Parallel and Distributed Systems.
- *Migrants Returning to Mexico and the Northern Triangle: Reintegration Services and Development Initiatives to Reduce Regional Migration Pressures*  
PI: Randy Capps, Migration Policy Institute
  - Results from the project were presented in June 2018 to a roundtable audience of 25 members including participation by representatives from U.S. Government, regional governments, academia, civil society and reintegration service providers.
  - Two high quality research briefs were produced and will be published on MPI's website (<https://migrationpolicy.org/research/policy-briefs>) during early PY4.
- *The Impact of Central American Child and Family Migration on US Communities*  
PI: Eric Hershberg, American University

Two public sessions were held, one in Houston and one in Washington, D.C. The Washington, D.C. session was recorded and available here: <https://www.wcl.american.edu/impact/initiatives-programs/lawandgov/news/central-american-migration-and-u-s-communities/>

## J. MEDIA AND COMMUNICATIONS

**Summary.** The BTI Institute's efforts in communication for Performance Year 3 focused on the implementation of the communication strategy developed for the Performance Year 3 work plan. Engagement focused on creating partnerships within the Homeland Security Enterprise that would allow the BTI Institute to bring a wider berth of subject matter expertise to address the identified Homeland Security problem set. In addition to engagements, the Institute improved its efforts of describing center activities, research achievements and transition activities. The Institute hired the Manager of Communications and Operations, Philip Boedeker, in October 2017 to refine and lead this communication effort.

### J.1. Tasks

Below is the status of the communication tasks for PY3 (1 July 2017 to 30 June 2018).

- **Communication Plans.** Communication plans were developed for the 2017 PI Meeting and Showcase and the 2018 COE Summit. The plans focused on save-the-date creation and distribution, targeting audiences and stakeholders, and developing informative websites with all pertinent information. Details on each of the events can be found in their associated sections of the Annual Report.
- **Weekly Updates.** The weekly updates were designed to help the Director and Executive Director have an informed conversation with the OUP PM each week. These updates were captured in a simple document with highlights that were then rolled up each month into the monthly updates.
- **Monthly Updates.** Throughout the course of Performance Year 3, a monthly update captured the activities and performance of the Institute over the course of the previous month. Research and education included deliverables (published papers, presentations,

round tables, etc.) that occurred during the month. Additionally, other highlights, personnel changes, and updates on initiatives and activities were captured with a more detailed discussion. Nine issues of the monthly updates were created and distributed throughout the performance period. The updates were distributed through Outlook Email until October 2017, when it was distributed through EMMA Marketing Email. There were no monthly updates distributed through the final quarter of the performance year as the weekly interaction between the OUP PM and the leadership team had limited to no activity due to the onboarding of the new leadership team.

- **Immediate Releases.** A release was created for each major event or milestone of the Institute that included a summary of the significant event and photos if applicable. These releases were published to the Institute website and distributed to the BTI Institute team. Nineteen such releases and news updates were published through the website since 19 October 2017 until the conclusion of the Year 3 Performance period. Many of these newsworthy items were distributed through the Institute’s newsletter. All releases can be found here: <http://www.uh.edu/bti/news/>. The releases included:
  - [BTI Institute begins 5 new research projects](#)
  - [New Research – Dr. David Leblang – Modeling International Flows: Theory, Evidence and Forecast](#)
  - [Summer research at Institute](#)
  - [Student – Pengfei Dou wins award](#)
  - [New Research – Dennis Egan – Missed Detections: From Data to Actionable Estimates](#)
  - [UAS Working Group](#)
  - [Research - Participatory Operational Assessment](#)
  - [10th Homeland Security Symposium](#)
  - [Advisory Board helps shape way ahead](#)
  - [BTI Institute showcases research](#)
  - [BTI Institute, SE Texas group team up for terrorist response](#)
  - [BTI kicks off speakers series](#)
  - [BTI welcomes newest adviser: Atkin](#)
  - [BTI on Think, KERA](#)
  - [Harvey brought more human trafficking](#)
  - [Ambler named new Director/PI](#)
  - [Hershberg to speak in Houston](#)
  - [Summit of innovation, research](#)
  - [Homeland Security Summer Internship Program](#)
- **COE Communications Working Group.** The monthly COE Communications working group is hosted by OUP and gives an opportunity for all participants to discuss best practices. This Performance Year, the COE Communications working group focused very heavily on the steps and preparations leading to the COE Summit, before it became a separate meeting. Additionally, OUP redesigned the fact sheets leading to a new layout template and additional information needed to complete the fact sheets.
- **Newsletter.** Three issues of the newsletter were created and distributed across the Year 3 performance period. The distribution list, as a reflection of those interested in the Institute, grew by 1,443 people. This is a significant increase while also increasing the percentage and total number of views. The “spring” edition (covering January, February,

and March) was delayed and rolled into the “summer” edition due to the change in leadership.

- **Distribute and promote RFP.** RFP 17-01 was distributed during PY2 and RFP 17-02 was distributed during PY2 and closed during PY3. The Institute did not release an RFP 18-01. The Institute distributed the RFPs through the BTI Institute’s website, social media platforms, newsletter, and email distribution lists. The announcement was picked up by news sources such as Newswise (<https://www.newswise.com/articles/dhs-s-t-announces-funding-opportunity-for-border-trade-and-immigration-homeland-security-research>) and Homeland Security Today (<https://www.hstoday.us/industry/grants-funding/dhs-center-excellence-announces-funding-opportunity-border-trade-immigration-homeland-security-research/>), and by partner institutions distributions (such as Texas A&M Engineering Research Digest, <https://tees.tamu.edu/media/515988/eng-research-digest-apr-12-2017.pdf>).
- **Conduct analysis of BTI communications strategy, plan, and activities.** The communication strategy for PY3 was designed around three objectives: engage with stakeholders; market research and education activities and outputs to stakeholders and other key audiences; and recruit students into the professional and workforce development program. During PY3, the manager reviewed the distribution lists, targeted audiences and current stakeholders to determine if Institute communications was reaching the intended audiences. The manager determined the Institute was not adequately communicating with key members of the HS Enterprise or researchers interested in the HS Enterprise problem set and increased the distribution of the Institute’s products by 400%. Additionally, through the COE Communications Working Group and independent discussions with other COE communicators, the manager revamped the marketing materials and increased activity on social media platforms, particularly LinkedIn.

**Create and update publicity materials (media releases, talking points, point papers, information papers, photos, etc.) for projects.** The Institute designed and printed BTI Institute Fact Sheet that includes details of the Institute’s mission and research achievements. Press releases and news stories were created and distributed digitally through the BTI Institute website and social media.

- **Maintain stakeholder database/mailling lists.** The Stakeholder database and mailing list for PY3 grew from 468 to 1,911. An analysis of stakeholders determined how to categorize each contact allowing for more succinctness pinpointed communications.
- **Maintain the website: update with new events, research activities.** The Institute maintains a public facing website divided into separate pages with pertinent information for public audiences. The click depth of the website was redesigned bringing information up to one or two clicks deep, ensuring that items of interest to audiences were more readily available. A *Resource* page was created allowing members of the Institute to share information and key documents with stakeholders who do not have access to the UH information system. A front-page redesign was initiated to modernize the website’s feel and optimize the look on hand held devices. This effort will carry over into the Performance Period 4.
- **Update BTI Institute fact sheet.** Two Institute fact sheets were developed, redesigned and distributed throughout Performance Year 3. The first template, owned by OUP, was redesigned by the COE Communications committee to include graphics that are more

modern, impact statements, and customer quotes. This item was drafted and forwarded to OUP for layout. The second is an Institute's internal fact sheet with similar copy but designed more in line with the University of Houston's graphic standards. Both items were printed and made available during stakeholder engagements.

- <http://www.uh.edu/bti/about/about-bti/bti-factsheet.pdf>
- <https://web-oup.s3-us-gov-west-1.amazonaws.com/showc/assets/File/BTI-COE-Factsheet.pdf>

- **Update HSUP website (BTI Institute section).** The Homeland Security University Programs website is a public facing page with information on the Institute, researchers, and news. Through access to the content management system, content was updated monthly to reflect new projects, new deliverables and new newsworthy events.  
<https://www.hsuniversityprograms.org/centers/bti-border-security/>
- **Update the Project Reporting System.** The Homeland Security University Programs Project Reporting system is an online tool that allows for updates to status, outputs and metrics on each project funded through the BTI Institute. This system was updated monthly based on information obtained from Researchers' Monthly Reports.
- **Maintain current social media accounts (Facebook, LinkedIn) and expand social media outreach.** The Institute has a presence across two social media platforms: Twitter and LinkedIn. These two platforms provide the greatest reach within the Institute's customer and stakeholder space.  
Twitter: @bti\_uh; [https://twitter.com/BTI\\_UH](https://twitter.com/BTI_UH)  
LinkedIn: <https://www.linkedin.com/company/borders-trade-and-immigration-institute/>
- **Produce and pitch news media as newsworthy events occur and update repository.** Working closely with the University of Houston Media Relations representative, Jeannie Keever, the Institute produced two opinion editorials that were published in the Houston Chronicle and picked up by other publications. The OpEds focused on the lingering effects of Hurricane Harvey from both a supply chain management perspective and a human trafficking perspective. The supply chain article was posted on 26 October 2017. The human trafficking article was posted on 23 March 2018. Additionally, Dr. Luis Torres, research committee member and Associate Dean of Research and Strategic Partnerships with the Graduate College of Social Work conducted a radio interview through KERA Think. The interview focused on the use of technology along the border for both security and facilitation. The interview took place on 7 February 2018.
- **Create Resource database with publications, conference proceedings, white papers, photo gallery, videos, etc.** For internal use, the Institute utilizes SharePoint hosted by the University of Houston. Prior to January 2018, the primary means of internal archiving and storage was Dropbox. With the transition to SharePoint, we developed a new storage architecture and file naming convention. For external use, the Institute maintains web pages called *Archives* and *Useful Links* to share information papers, files and forms with researchers or stakeholders who cannot access the UH network
- **Promote Homeland Security Symposium series via newsletter, website, and social media.** The Homeland Security symposium series was an education initiative led by Victor Manjarrez, Jr. with the Center for Law and Human Behavior at the University of Texas at El Paso. For communications surrounding the symposium series, the Institute advertised



on social media, through news releases, and the newsletter and live-streamed each event through Twitter to increase viewership. At the conclusion of each seminar, a research-in-brief was produced, posted on the Institute's website, and disseminated through the network. Five symposia were conducted throughout PY3.

- **Evaluation of events: conduct Hotwash for smaller events (demonstrations by project PIs, visits, conferences, etc.) and formal After Action Reviews for major events (discussion-based and operations-based exercises, conferences hosted by BTI Institute, etc.).** The Institute's management team developed after action review comments for utilization with future planned events. Communication aspects of the events included advertisement, branding and wayfinding within the event space, and registration. An after action review was conducted for the Annual PI meeting and Showcase. The communication aspects discussed was the overwhelming branding of American University (host university) and the need for the Institute to develop more collateral to assist in the Institute's name recognition. BTI Institute created and ordered contact cards, pens, podium signs, and trade show banners to meet these identified shortcomings.

## J.2. Milestones

Below is the status of the communication milestones for PY3 (1 July 2017 to 30 June 2018).

- **Twelve Issues of Monthly Report disseminated.** Nine issues of the monthly report were disseminated from 1 July 2017 to 28 February 2018. No monthly updates were distributed through the final quarter due to the change in leadership and the onboarding of the new leadership team.
- **Four issues of Institute newsletter published.** The Institute published three issues of the Newsletter in PY3. The third and fourth newsletters were consolidated into one due to the timing and announcement of the new leadership team at the BTI Institute.
- **Call for Proposals issued.** The Institute issued RFP 17-01 and 17-02 in PY3.
- **Twelve articles posted on LinkedIn.** The Institute posted 30 articles on LinkedIn in PY3. Topics included:
  - initiation of five new research projects;
  - focus on two Homeland Symposium Series events;
  - spotlight on Dr. David Leblang's project kickoff;
  - an Opinion Editorial on Hurricane Harvey's impact to the supply chain;
  - student Pengfei Dou spotlight;
  - feature piece on Participatory Operational Assessment of Ports of Entry;
  - the meeting of the Executive Advisory Board;
  - a feature on the BTI Institute Principal Investigators' Meeting and Showcase;
  - promotion for the BTI Institute speakers' series;
  - comments on Border Security by BTI Fellow Jaeson Jones;
  - comments by EAB Chair Alan Bersin on transnational criminal organizations;
  - comments by BTI research Victor Manjarrez, Jr. on the tunnels near El Paso;
  - an introduction of the Institutes' newest External Advisory Board member, Tom Atkins;
  - Dr. Luis Torres' radio interview on technology on the border;
  - a repost of CBP's 15th Anniversary;

- spotlights on BTI Fellows Anthony Motola, David Danelo, and Dorothy Miller;
  - announcement of new director;
  - repost of CBP Commissioner's trip to Mexico; Dr. Ben Melamed's video on his Port of Entry Simulation System;
  - and the BTI Institute's participation in the 2018 COE Summit.
- **Eight Media Advisories of Speakers Program events.** The Institute published two media advisories for the Speakers Program in PY3, one for January (Alan Bersin) and one for March (Trade Panel). The other six intended Speakers Program events were never planned and thus warranted no media advisory.
  - **Conduct analysis of BTI communications strategy, plan, and activities.** The Manager of Communications and Operations conducted an analysis of the strategy, plan, and communication activities of the BTI Institute. This analysis was conducted in the 3rd Quarter of PY3 (January – March), after the completion of the PY3 PI Meeting and Showcase and a quarter of reviewing the Institute's existing processes and procedures.
  - **Update of Project Reporting System.** The manager routinely update the OUP Project Reporting System based on the monthly reports of the researchers.

### J.3. Outputs

Below is the status of the Communication Outputs for PY3 (1 July 2017 – 30 June 2018).

- **50 issues of BTI Institute Weekly Report.** The Institute leadership team discontinued the weekly report and instead utilized weekly telephonic communication with the OUP PM.
- **12 issue of BTI Institute Monthly Updates.** Eight of twelve were completed.
- **24 articles posted in social media (LinkedIn).** 220 posts across social media (30 in LinkedIn).
- **Four issues of BTI Institute newsletter.** Three of four were completed. The third and fourth edition were consolidated.
- **Publication and solicitation of projects to RFP-18-01.** No publication required. RFP 18-01 was not developed.
- **Analysis of BTI communications strategy, plan, and activities.** The Institute increased the frequency of social media interaction, designed additional marketing materials (connect cards, pens, fact sheet, podium sign, trade show pop-ups), and revamped the engagement strategy for PY4.

### J.4. Performance Metrics

Below is status of the communication performance metrics for PY3 (1 July 2017 to 30 June 2018).

- **Four issues of Institute newsletter.** Three of four issues were disseminated. The third issue was consolidated forward into the fourth.
- **Ongoing task: Website.** The website is located at [www.uh.edu/bti](http://www.uh.edu/bti). The website has been

updated frequently throughout the year with news releases, the Institute leadership, and structure.

- **Ongoing task: Social media.** The Institute maintains a social media presence on Twitter ([https://twitter.com/BTI\\_UH](https://twitter.com/BTI_UH)) and LinkedIn (<https://www.linkedin.com/company/borders-trade-and-immigration-institute/>).
- **Respond to Requests for Information.** The manager utilized the public facing email ([bti@uh.edu](mailto:bti@uh.edu)), phone number, and event registration (Eventbrite) to follow up on requests for information. Such requests included event times and locations, white paper submissions, and RFP submission follow up.

## **K. BTI INSTITUTE SPEAKERS PROGRAM**

The BTI Institute's Distinguished Speakers Program was designed to promote a balanced discussion of significant issues in homeland security, border security, international trade, and immigration policy. Primarily due to scheduling issues, most of the identified dates and subjects from the Year 3 Work Plan were not met. During preparation of the work plan for Performance Year 4, it was determined that the Speakers Program would be integrated into the Education and Work Force Development effort identified as Border Studies instead of standing alone. Below is a brief synopsis of the events that were scheduled in PY3.

**Schedule.** Below was the intended schedule developed in PY3 and the disposition of each event.

- **September 2017: *The Art of Cyber Conflict*, Henry Sienkiewicz**  
Henry Sienkiewicz, a BTI Fellow and nationally acknowledged cyber security expert, was scheduled to speak on Cybersecurity in September 2017. During the planning phase, it was determined that this event would be hosted by the UH Division of Research as part of the UH DOR Seminar Series since Cybersecurity is a UH initiative. UH DOR did not initiate the seminar series.
- **October 2017: The Scourge of Human Trafficking, Panel Discussion**  
Initial planning included having Representative Sheila Jackson Lee and a member of the DHS Blue Campaign on a panel discussion related to human trafficking. Scheduling prohibited coordination and a panel and date was never set.
- **November 2017: *Changing NAFTA?*, Panel Discussion**  
This panel materialized into a *Flows of Trade* panel scheduled for March 2018. The panel was going to be moderated by Eleftherios Iakovou, Ph.D., Director of Manufacturing and Logistics Innovation Initiatives at Texas A&M Engineering Experiment Station. The panel members would have included Gene Tyndall and Chris Gopal, both private sector authors and experts in supply chain. The event was postponed indefinitely due to scheduling conflicts.
- **January 2018: *Illicit Flows*, Alan Bersin**  
This event was not originally anticipated as part of the PY3 proposed Speakers Series program schedule. Alan Bersin, former Commissioner, U.S. Customs and Border Protection, on 24 January 2018. While at the University of Houston, Mr. Bersin spoke to a class of students with the University of Houston Law center organized by the Center for U.S. and Mexican Law. Mr. Bersin spoke on two subjects: the first being that criminal justice reform is needed in the area of compounding fees, and the second, on the Deferred Action for Childhood Arrival program. Mr. Bersin's evening presentation proposed a new

framework for combating transnational criminal activity in his presentation titled *Lines, Flows, and Transnational Crime: Toward a Revised Approach to Counter the Underworld of Globalization*. He spoke on the need to look at transnational criminal organizations from a narrower perspective of single points on a border to a broader perspective of North America in collaboration with Mexico and Canada.

- February 2018: *Sanctuary Cities: Yes or No?*, Panel Discussion  
No effort was spent in organizing this panel.
- March 2018: *The State of the Border*, TBN  
This event by CBP Commissioner Kevin McAleenan was originally scheduled for April before being postponed due to an unexpected scheduling conflict.
- April 2018: *Ports of the Future*, Panel Discussion  
No effort was spent in organizing this panel.

## **L. Other Activities within the Scope of the PY3 Work Plan**

### **L.1. Transnational Trade and Supply Chain Management Council**

The concept for the Transnational Trade & Supply Chain Management Council was initially developed to address the BTI Institute's perceived gap in trade knowledge and research. Its purpose was to collectively identify issues and concerns in the areas of international trade-related policy, technology, and education and develop research strategies to address them.

The intent was to solicit the participation of both public and private entities with a vested interest in international trade along both Northern and Southern borders. The BTI Institute would also seek to involve those federal agencies (example: CBP trade), therefore simultaneously identifying those organizations with research needs and those organizations that can address those needs. The initial plan was to hold a quarterly roundtable and attend select conferences to include CBP Trade Days. An annual meeting would be planned, hosted by the BTI Institute, to identify and discuss issues regarding international trade and to identify associated research needs.

The concept of the council morphed conceptually into the International Trade Advisory Network after discussions with the Alan Bersin, chair of the BTI Institute's External Advisory Board. The effort was then established as the International Trade Advisory Group.

The BTI Institute was working with The Cross Border Institute (University of Windsor, Ontario) and the Universidad Nacional Autónoma de México (University City, Mexico) to develop the trade advisory members. Efforts to expand international partnerships to Central America through Consuls General (Houston) and institutions of higher education in Central America had begun in support of this initiative.

The intent was for the following organizations based on region to participate:

#### **Northern Border**

- Pacific North West Economic Region (PNWER)
- Great Lakes Cross-Border Trade Organization
- Eastern Border Transport Coalition
- Canada-U.S. Transportation Border Working Group
- Business Council of Canada
- Canadian/American Border Trade Alliance

#### **Southern Border**

- Latin American Consuls General

- The Border Trade Alliance
- The Borderplex Alliance
- U.S. Mexico Border Mayors Association
- Foreign Trade Association
- Duty Free Americas, Inc.
- Rio Grande Valley Partnership
- San Diego Tijuana Smart Border Coalition

**Federal Agencies.** Invited federal agency representatives include:

- CBP Office of Trade
- DHS Director, Canadian Affairs and Senior Advisor
- Department of Commerce’s International Trade Administration
- U.S. Census Bureau (International Trade Management Division, Trade Outreach Branch)

**International Research Partners.** The BTI Institute’s domestic and international research partners will also be invited to participate. These include:

- The Cross Border Institute (University of Windsor, Ontario)
- UNAM (Mexico)
- Arizona State University’s North American Center for Transborder Studies (NACTS)
- The Hunt Institute, University of Texas at El Paso

The initial meeting was not convened prior to the change in Institute leadership and no further effort was spent during the remainder of PY3.

## **L.2. Council of Territories**

The Council of Territories was intended to discern any border security, trade facilitation, or immigration policy needs from the populated territories of the United States (American Samoa, Guam, Northern Marianas, Puerto Rico and the U.S. Virgin Islands). The Executive Director of Strategic Partnerships to contacted representatives with the U.S. Virgin Islands, American Samoa, Guam and Puerto Rico. Effort was also made to connect with the territorial government of Northern Marian Islands. The initial concept of conducting quarterly teleconferences was discarded due to the significant differences in time zones, reverting instead to periodic direct coordination between the BTI Institute and territorial representatives by either telephone or email.

No formal meeting was convened with all territories was convened prior to the leadership change and no further effort was spent during the remainder of PY3.

## **L.3. Border Security Unmanned Aerial Systems Working Group**

The Border Security Unmanned Aerial Systems Working Group was formed during PY2 with the purpose of collectively addressing policies and technology-related concerns for operations in border regions, developing strategies based on education of consumers and the law enforcement community, compliance with federal and state guidelines through improved information capabilities, and evaluating counter-drone technology to help minimize use in illegal activities and determine the impact on security and safety of communities and facilities in the border regions.

The UAS WG served to directly address then-Secretary Kelly’s stated first priority technical challenge to border security, “Unmanned Aerial Systems,” and aligned with NOFO 1.b.6., “*What innovative technologies can be modified or developed to detect and deter clandestine means of crossing borders, such as tunnels, ultra-light aircraft, etc.*”?, and also NOFO question 1.b.2.,

*“What new technologies and/or sensor systems can be developed and applied to improve the detection and tracking of vehicles, vessels, and persons along borders?”*

The working group met on a bi-monthly basis via webinar/telecom.

On 26 October 2017, members of the working group met at Lone Star Unmanned Aerial System Center of Excellence to discuss an overview of the capabilities, current efforts, and mission of the LSUAS and how law enforcement, border efforts, the Federal Aviation Administration, and BTI might engage in that effort. There was also a demonstration of a portable UAS radar detection system and discussion of tethered drones being classified as “kites” by the FAA. Attendees included representatives from the Texas State Guard, the FAA and BTI Fellows.

At the 2018 Border Expo, Chief Manuel Padilla had invited the working group to meet on-site in the Rio Grande Valley Sector.

CBP Air and Marine Operations Acting Executive Director Dennis Michelini had requested the BTI Institute arrange a meeting with Chief Padilla to further discuss the concept paper to address airspace management command and control issues (as identified in a concept paper developed by the working group) resulting from the cartels’ increasing use of UAS. The request was submitted to CBP Operations (Office of University Programs Liaison) but was delayed due to a VIP visit to the border region.

At the beginning of 2018, the working group was closed down at the request of the OUP Program Manager.

#### **L.4. Tunnel Detection Working Group**

The Tunnel Detection WG was formed at the end of PY2 with the purpose of promoting, through research, the development of technology to detect tunnels currently in existence and the construction of new tunnels to prevent their use by terrorist elements and criminal organizations seeking to gain illegal access to the nation.

This effort addressed then-Secretary Kelly’s stated second priority technical challenge to border security, “Tunnel Detection,” and aligned with NOFO question 1.b.6, *“What innovative technologies can be modified or developed to detect and deter clandestine means of crossing borders, such as tunnels, ultra-light aircraft, etc.?”*, and also NOFO question 1.b.2, *“What new technologies and/or sensor systems can be developed and applied to improve the detection and tracking of vehicles, vessels, and persons along borders?”*

The Tunnel Detection Working Group toured the CBP San Diego Sector on 7-10 August 2017. Attendees included representatives from CBP Headquarters, CBP San Diego sector, Border Patrol and BTI Institute.

The meeting included a series of briefings and visits to the tunnels detected under the U.S. Mexico border. The objectives were to review current and existing tunnel detection capabilities and efforts, identify potential areas for additional research, and identify current technology that could be further developed to support tunnel detection efforts. The following topics were discussed as part of the working group:

- CBP seeks to detect the tunnel, detect the void, and detect the use of the tunnel.
- The types of tunnels (rudimentary, interconnecting, sophisticated)
- General information about tunnels (use, creation, formation)
- San Diego Sector Tunnel Task Force briefing

- Key needs inside the tunnel (Mapping, Blue Force Tracking, Communications)

The working group was closed down in late August 2017, at the request of the OUP Program Manager.

### **L.5. DHS Grant to Prepare Communities for a Complex Coordinated Terrorist Attack**

At the request of the South East Texas Regional Planning Committee (SETRPC), a Texas Council of Government encompassing the Beaumont-Port Arthur-Orange region, the BTI Institute partnered with the SETRPC to develop a Unified Regional Response to a Complex Coordinated Terrorist Attack (CCTA). The grant was awarded to the SETRPC in July 2017, with work to begin in September 2017.

BTI Institute researchers conducted a detailed review of After Action Reports from CCTA and Active Shooter Incidents in the United States and in Mumbai, India and France. This review was published in two documents in January 2018.

The BTI Institute initiated a doctrinal review of Department of Justice and Department of Homeland Security publications addressing response to Active Shooter and CCTA incidents. The BTI Institute scheduled, coordinated and conducted CCTA workshops focused in the functional areas of Public Information (27-28 March 2018), Tactical Response (8-9 May 2018), and Medical Response (26-27 June 2018). Follow-on workshops were scheduled in Intelligence (July 17-18, 2018), Victims and Family Services (7-8 August 2018), and in Operational Communications (12-13 September 2018).

### **M. Other Activities Outside the Scope of PY3 Work Plan but Related to BTI Activities**

#### **M.1. BTI Institute Showcase**

The BTI Institute Showcase was held in conjunction with the PI Meeting at American University in Washington, D.C. 5 December 2017. The Showcase was hosted in Constitution Hall at American University's School of Public Affairs. The Showcase focused on poster displays and technology demonstrations. All PIs who presented at the PI Meeting the day prior were present or had students presenting posters or technology demonstrations. The Showcase was an opportunity to get "foot traffic" beyond the current Institute Stakeholders.

#### **M.2. COE Summit**

Based on the results of the 2017 COE Directors' Retreat, organized by the BTI Institute, the concept of reviving a summit showcasing all DHS COEs was presented for funding to DHS S&T OUP. Dr. Ioannis Kakadiaris developed a White Paper on the summit proposing to plan, coordinate, and conduct a four-day symposium. The organizing committee was formed in January 2018, co-led by the BTI Institute and CINA COE, who offered the facilities to host the event.

30-31 May 2018. The COE Summit was a two day event involving a series of plenary panels and guest speakers, an Innovation Showcase technology demonstration and booth room, and a student poster presentation. The BTI Staff who participated were Kurt Berens, Barbara Dwyer, and Phil Boedeker. Additionally, the BTI Institute was represented at the event in detail below.

- Dr. Ben Melamed, Innovation Showcase, Tech Demonstration
- Dr. Ioannis Kakadiaris, Innovation Showcase, Poster Demonstration
- Victor Manjarrez, Jr., Plenary Panel, Guest Speaker

- Victor Reyes, Jr., Student Poster
- Katie McKeon, Student Poster

In preparation for the event, the BTI Institute's management team participated in subcommittees as part of planning process.

- Dr. Ioannis Kakadiaris/Kurt Berens: Director's Committee: the committee was responsible for oversight and decisions for the event to include approval of subcommittee proposals and overall guidance
- Dr. Ioannis Konstantinidis/Phil Boedeker: Program and Innovation Showcase Subcommittee: the committee was responsible for the Innovation Showcase to include booth layout, order of events, and engagement opportunities.
- Barbara Dwyer: Education Subcommittee: the committee was responsible for organizing the student poster session, student engagement, establishing poster requirements, determining criteria for evaluation, selecting judges, and communicating with other subcommittees.
- Philip Boedeker: Communication Subcommittee: the committee was responsible for branding, website design, marketing the event, collateral, and event social media.

### **M.3. COE Congressional Staffer engagement**

On 24 June 2018, the Manager of Communication and Operations traveled to Washington, DC with eight representatives from other DHS COEs to present overviews of the Centers of Excellence to Congressional Staffers representing members of the Homeland Security Committee. Fifteen attendees were present representing six representatives, the Homeland Security committee and the Appropriations committee. Other COEs represented were National Consortium for the Study of Terrorism and Responses to Terrorism (START), Center for Awareness and Localization of Explosives-Related Threats (ALERT), Coastal Resilience Center (CRC), Critical Infrastructure Resilience Institute (CIRI), Maritime Security Center (MSC), Center for Accelerating Operational Efficiency (CAOE), and Criminal Investigations and Network Analysis (CINA).

## **N. Research and Education Projects**

### **N.1. Central America's Immigrant and Refugee Crisis: Limiting Unauthorized Migration through the Alliance for Prosperity and Reintegration Efforts**

Principal Investigator: Randy Capps, Director of Research for U.S. Programs, Migration Policy Institute (MPI)

#### **PROJECT RELEVANCE TO DHS**

This project addresses the overall goal of enhancing the U.S border management operations by promoting International partnerships for prevention, deterrence and facilitation. Key questions this project sought to address include:

- How can the U.S. help improve conditions, and which conditions, in the countries of origin to deter the unauthorized movement of large masses of people to the U.S.?
- How are reintegration efforts for people sent back working or not working?
- What data sources are available on reintegration programs, and what can be learned about them?
- What approaches can be developed to discourage individuals from attempting to return to the U.S. multiple times?



## EXECUTIVE SUMMARY

Migration of unaccompanied children (UACs) and families, primarily from the “Northern Triangle” Central American countries of El Salvador, Guatemala and Honduras, is an enduring phenomenon that continues to challenge DHS and other federal agencies. Understanding emigration pressures in the Northern Triangle, adopting long-term strategies to reduce unauthorized migration, and developing reintegration strategies to ensure safe repatriation and deter return migration are thus of critical policy significance to DHS.

This study pulls together analysis of reintegration programs, at the micro level of the individual repatriated migrants, with a regional analysis of the broad factors promoting emigration to the United States and strategies such as the Alliance for Prosperity (AFP) and USAID-funded development initiatives that might address these factors in the long run. The specific objectives of the study included:

- Examine early implementation of the AFP and other development initiatives in El Salvador, Guatemala, and Honduras
- Investigate reception and reintegration services and identify challenges and promising practices in Central America and Mexico.
- Describe reception and reintegration planning services provided prior to repatriation by Mexican and U.S. immigration authorities.
- Analyze the potential of reintegration services to stem repeat migration.
- Develop recommendations for the U.S. government to shape strategies that reduce Central American migration to the U.S. and ensure safe and orderly repatriation.
- Promote communication and collaboration between DHS and other stakeholders, including governments in the region, civil society organizations, reintegration programs, researchers, and other migration experts.

This project was originally designed for a 12-month performance period (July 2017 through June 2018), but a no-cost extension was requested and approved through September 2018, expanding the period of performance to 15 months. Despite challenges in identifying a DHS project champion that resulted in a delay of the project start by about three months, the remaining project activities occurred on schedule.

During the original 12-month performance period, MPI researchers and project consultants:

- Met with DHS Office of Policy champions and other stakeholders in CBP, ICE, USDOS, and USAID to discuss study objectives, methods, and data sources and contacts in the region.
- Conducted a policy scan of existing government, academic, and civil society research studies, policy documents, program descriptions, funding plans, and other sources.

- Met with over 130 key informants in government, academia, civil society, and international organizations in Mexico and Central America.
- Conducted focused group discussions or individual interviews with almost 100 repatriated migrants in the four countries.
- Explored government-sponsored and civil-society reception and reintegration programs in urban and rural settings.
- Analyzed the policy scan and field research notes and summaries to develop policy recommendations.
- Convened a private roundtable with 25 representatives from the U.S. government, regional governments, academics, civil society representatives, and researchers to discuss findings, analyze results and develop recommendations.
- Submitted to DHS an interim report summarizing the findings from the policy scan, fieldwork, and roundtable discussion.
- Began drafting two policy briefs describing the findings, analysis and recommendations—one about the AFP/development programs and the other about reception and reintegration strategies.

With the performance period extended to 15 months, three months of activity were carried over to PY4. Deliverables that were not completed but are expected to be completed in PY4 include; two policy briefs, accompanying commentaries, dissemination of the written products at release event(s), media outreach, and briefing of DHS and other stakeholders. The remaining work is anticipated to be completed during September 2018.

## PROJECT TEAM

### Personnel

**Table 1.** Project Personnel\*

First Name	Last Name	Institution	Role on Project
Randolph	Capps	MPI	Principal Investigator
Ariel	Ruiz Soto	MPI	Project manager
Doris	Meissner	MPI	Senior advisor
Luis	Argueta	Independent	Consultant/field researcher
Rodrigo	Dominguez Villegas	University of Massachusetts	Consultant/field researcher

\*No students worked on this project

## TASKS

**Table 2.** Task List

ID	Task Title	Status	Associated Deliverables
T.1	Teleconferences with project champion(s), DHS/ICE stakeholders	Complete	N/A
T.2	Refine study methodology	Complete	N/A
T.3	Conduct policy scan and field research	Complete	N/A
T.4	Write interim report on findings from policy scan and international field research	Complete	D1
T.5	Draft two policy briefs	Incomplete	D3, D4
T.6	Convene stakeholders to discuss project findings, recommendations	Complete	D2
T.7	Produce final project policy briefs and commentaries	Incomplete	D3, D4, D5, D6, D7

### Project Task Summary

#### Task T.1: Teleconferences with project champion(s), DHS/ICE stakeholders

During Fall 2017 MPI met in person with Latin America experts from the DHS Office of Policy; staff from the Office of Immigration Statistics; staff interested in reintegration planning at the ICE Office of Custody; the Chief and senior staff at the Border Patrol Office of Strategic Planning; USDOS Bureau of Western Hemisphere Affairs officers including the Bureau Chief and desk officers for Mexico and the Northern Triangle Countries; staff responsible for Central America from the USDOS Bureaus of International Narcotics (INL) and Law Enforcement Affairs and Intelligence and Research (INR) ; and USAID staff responsible for Central America early in the project, as the policy scan was being developed and fieldwork being planned. During these meetings federal agency staff contextualized country conditions and regional migration trends, shared summaries of the U.S. Strategy for Engagement in Central America, reviewed results of surveys about migration issues in the Northern Triangle countries, described prior US government reintegration planning strategies, noted their migration-related priorities and potential use of research products, provided helpful feedback on the project's study design, and facilitated communication with agency staff on the ground in each of the four study countries.

Project consultants met with USAID, USDOS, and DHS staff, as appropriate, in U.S. Embassies in the region during fieldwork. Consultants' discussions with U.S. agencies in Guatemala City, San Salvador, and Tegucigalpa focused on comparing country conditions across the Northern Triangle countries and understanding how existing U.S. development initiatives complemented those of the Plan of the Alliance for Prosperity (AFP). Additionally, in San Salvador and

Tegucigalpa consultants also learned about existing U.S. efforts to improve institutional capacity to reduce crime and drug trafficking. At the U.S. Embassy in Mexico City, the consultant met with state personnel to discuss migrant push and pull factors driving Mexican emigration, partnerships with Mexican government institutions on reception and reintegration issues, and U.S. consular practices and plans to provide services for U.S. citizen children who may relocate to Mexico when their parents return from the United States.

DHS Office of Policy, USDOS, and USAID staff also attended the project roundtable in June 2018. Each representative responded to fieldwork findings, reviewed existing agency programs, and noted key achievements of ongoing government efforts, as well as potential challenges for regional development. U.S. agency representatives applauded increasing collaboration among Northern Triangle governments and their efforts to foster a more inclusive dialogue on challenges to development and migration. The DHS project champion did not request regular phone calls over the course of the project.

#### **Task T.2:** Refine study methodology

The study methodology was refined during Fall 2017 in consultation with U.S. government stakeholders as described in Task 1 and the results of the refinements are included in Task 3. Refinements included applying lessons learned and best practices from DHS, CBP, ICE, USDOS and USAID in order to interact with the right key informants from government, academia and civil society.

#### **Task T.3:** Conduct policy scan and field research

During Fall 2017 and Winter 2018, MPI completed a policy scan that included prior MPI research, research by academics, studies by international organizations such as IOM and IDB, data on repatriation to the four study countries, and updates on priorities, spending, and implementation for the AFP and other development initiatives. The policy scan outlined study governments' existing reception and reintegration infrastructure and tracked implementation of recent policies, including Guatemala's National Strategy for Labor Reintegration for Returned Guatemalan Migrants and El Salvador's National Policy for the Protection and Development of Migrants and their Families. MPI researchers met with academic, U.S. government, and international organization authors of these studies, and attended a research conference about migration patterns in the region. Stakeholder accounts in the meetings added new insights to the country conditions, existing reception and reintegration services, and the AFP and U.S. Strategy for Engagement in Central America. The research conference focused on issues of security, governance, and impunity in the region, and helped establish fieldwork contacts for further investigation.

During their fieldwork Spring 2018 in each of the four countries, MPI's project consultants met with key informants from governments, academia and civil society. In each country they also arranged focus groups or individual conversations with repatriated migrants, recruited via governments, academia, and civil society. They visited at least two locations in each country, including a mix of country capitals, other major cities, and rural areas. They met with a total of 50 key informants and 30 migrants in Guatemala; 35 key informants and 20 migrants in El Salvador; 30 key informants and 25 migrants in Mexico; and 21 key informants and 19 migrants in Honduras. MPI researchers conducted follow-up interviews with contacts identified by key informants.

#### **Task T.4:** Write interim report on findings from policy scan and international field research

MPI findings from the policy scan and fieldwork were presented at the project roundtable in June 2018. The following is a summary of key findings originally submitted to DHS at the end of June.

### Reception and Reintegration Services for Returning Migrants

While the capacity and implementation of reception and reintegration services vary, Mexico, El Salvador, Guatemala, and Honduras follow similar frameworks and face similar challenges. All four countries' reception services and facilities have generally improved since 2015, becoming more secure and attentive to the needs of specific groups of vulnerable migrants who are returning (e.g., families, women, and unaccompanied children). Reintegration services include employment, support for entrepreneurship (generally small grants or micro-loans), skill accreditation, and reintegration into formal education systems. The four countries have started to channel reintegration services through one-stop offices at the municipal level, thereby increasing their geographic reach and visibility.

Key to Mexico's reintegration services, the National Institute of Migration's "We are Mexicans" (*Somos Mexicanos*) strategy coordinates reception services at reception centers and refers them to services available at their destination states or municipalities. These services include the Migrant Support Fund (*Fondo de Apoyo al Migrante*, FAM) which provides migrants one-time grants of up to USD 1,500 to start a new business. Through the National Institute for Adult Education (*Instituto Nacional de Educación de los Adultos*, INEA), the federal government provides exams for English certification required in call centers and many other skilled jobs available for returning migrants, while state vocational institutes run nationally recognized job placement, skills trainings, and certification programs. For migrants seeking to learn competitive skills, *Hola Code* provides immersive software engineering courses with flexible payment options, allowing migrants to pay for instruction after they become employed.

In El Salvador, returning migrants receive information about existing reintegration services and are referred to six Municipal Workstations for Returned Migrant Care (*Ventanillas de Atención a Personas Retornadas*, VAPR) located across the country in areas of high emigration. Government employees at VAPRs provide migrants information about El Salvador is Your Home (*El Salvador es Tu Casa*), an inter-institutional coordination system of public reintegration services available for returning migrants, including: professional and business development, vocational training and skill accreditation, assistance for college enrollment and completion, and psychosocial assistance. Promising reintegration services by civil society organizations include a mental health clinic by the Salvadoran Institute for Migrants (*Instituto Salvadoreño del Migrante*, INSAMI) which provides psychosocial support for migrants and their families to address mental health issues like depression and anxiety resulting from migration-related trauma.

Migrants in Honduras may attend a growing network of Municipal Units for Returnee Care (*Unidades Municipales de Atención al Migrante Retornado*, UMAR) where officers evaluate migrants' needs and match them to a broader list of services provided by government and civil society organizations. Notably, UMAR staff organize counseling sessions during migrants' visits and are required to follow up with individuals to ensure they obtained services as planned. While smaller in reach and capacity than government services, civil society organizations' reintegration services in Honduras are fundamental to migrants with unique needs, including the needs of those who returned voluntarily and are not recorded in government reception records. Promising examples of services by civil society organizations include vocational training, seed grants to create or overhaul small businesses, mental health support, group recreation for children in single parent households, and rehabilitation guidance for migrants with physical disabilities.

In Guatemala, the Ministry of Labor and Social Welfare expanded existing services to returning migrants at a Municipal Employment Workstation (*Ventanilla Única Municipal para el Empleo*, VUME) in Guatemala City to provide technical training and refer migrants to skill certification services and entrepreneurial opportunities—with government services to returning migrants outside the capital city more limited. Yet, reintegration services provided by civil society organizations have a wider reach among migrants. With established community ties, organizations like the Association of Returned Guatemalans (*Asociación de Retornados de Guatemala*, ARG) advertise their services outside of reception centers and follow up with interested migrants. *Te Conecta*, a nonprofit organization, builds and maintains close working relationships with potential employers, most commonly calls centers, and provides migrants practical employment-oriented services, including work orientation, computer training, and English workshops.

The challenges governments and civil society organizations face in their delivery of reintegration services are difficult to overcome. Public services tend to be highly concentrated in large cities, in part as a reflection of where returning migrants resettle, limiting access in rural and less developed areas in each country. Uneven policy implementation across states and localities compound these differences in access. Furthermore, government and civil society organizations collaborate to provide some reception services, but public reintegration services are generally not well-coordinated or visible, while, civil society initiatives often lack scalability and sustainability. But perhaps the most difficult challenges to reintegration services are the push factors that motivated migration in the first place: lack of economic opportunities, high levels of insecurity and violence, and distrust in government institutions.

#### *The Plan of the Alliance for Prosperity and U.S. Development Initiatives*

Adopted in September 2014 as a response to peak migration flows of Central American unaccompanied children seeking to enter the United States, the Plan of the Alliance for Prosperity (AFP) is a joint development initiative by the governments of El Salvador, Guatemala, and Honduras. To reduce regional emigration pressures over the long term, the AFP seeks to improve migration push factors and country conditions by investing in four priorities: (1) fostering the productive sector, (2) developing human capital, (3) improving citizen security and access to justice, and (4) strengthening state institutions and improving transparency. Significant development achievements are expected to bolster livelihoods in each country, incentivizing their populations to pursue economic opportunities in the region instead of migrating. The three countries budgeted a total of USD 2.3 billion in 2017 to conduct the AFP's actions across the four development priorities.

With the objectives of promoting economic prosperity, improving security, and strengthening governance in the region, U.S. development initiatives under the Strategy for Engagement in Central America complement goals of the AFP. By addressing these country conditions, the Strategy aims over the long term to reduce unauthorized migration from the region. Congress has appropriated nearly \$2.1 billion for the Strategy since fiscal year 2016, with nearly 41 percent of these funds appropriated for El Salvador, Guatemala, and Honduras, and 3 percent for Belize, Costa Rica, Nicaragua and Panama. The remaining 56 percent has been appropriated to the Central American Region Security Initiative (CARSI).

Funding specifically directed to reducing emigration under the AFP falls under the countries' priority of developing human capital. In Guatemala, funding for migration services is concentrated on strengthening reception capacity and renovating facilities for reception of family units. For El

Salvador AFP funds directly linked to migration emphasize economic and social reintegration, developing migration data tracking capacities, and producing media campaigns to dissuade children and adolescents from migrating illegally. Honduras also dedicated AFP funds allocated to migration-related projects to reception and reintegration services, and to poverty reduction initiatives.

More broadly the AFP has produced important accomplishments across its four priorities. The three countries have established a Central American Customs Union seeking to facilitate regional trade; trained thousands of young people and linked them to jobs; invested in small- and medium-sized enterprises seeking to create jobs; and begun to incorporate the private sector in economic plans to increase investment and employment. They have also improved access to healthcare and secondary education, and strengthened technical and vocational training. Anticorruption efforts and ongoing judicial reforms have led to increased criminal prosecutions and convictions. The three countries have made reforms to their procurement and contracting systems.

USAID and USDOS/INL are primarily responsible for implementing the US Strategy for Engagement in Central America. INL programs focus on strengthening citizen security and promoting rule of law by providing technical assistance, training, and support to professionalize local law enforcement agencies, investigators, and prosecutors. INL also supports school-based youth gang prevention programs in El Salvador and Honduras. By implementing place-based strategies, INL and USAID identify key high-crime locations and people at-risk for criminal involvement to strategically implement a balanced and integrated set of youth development, public health, and law enforcement interventions. Place-based strategies along with local government efforts have decreased homicide rates in some targeted communities by up to 50 percent. USAID also conducts agricultural programming in localities with high emigration rates, which have increased farmers' incomes, created thousands of agriculture jobs, and reduced poverty in some areas.

Despite these accomplishments, economic growth has varied across the three countries, and it has not resulted in better living conditions. Unemployment rates in El Salvador and Honduras are at nearly 7 percent, and most jobs in the three countries are in the informal labor market. Poverty rates across the Northern Triangle countries remain strikingly high: 33 percent in El Salvador, 66 percent in Honduras, and 59 percent in Guatemala.

At the same time the security environment in the Northern Triangle is improving. Homicides rates have decreased in each of the countries over the past three years, partially because of country-led initiatives to enhance security. The region remains among the most dangerous in the world, however, and public perceptions of violence, criminal activity, and insecurity have increased over the same period.

**Task T.5:** Draft two policy briefs

Due to the delay in finding a Project Champion identified previously, the two policy briefs were not completed during PY3 and are instead part of the no cost extension that is planned to conclude in September 2018.

**Task T.6:** Convene stakeholders to discuss project findings, recommendations

In June 2018, MPI held a roundtable with about 30 participants including the research team, U.S. government project champions and advocates, officials from governments in the region,

academics, and civil society representatives. The results of the fieldwork, as described in task four, were presented at the roundtable, and participants commented on the findings. The roundtable included discussions of the challenges faced by returning migrants, recommendations for services to assist them, and the long-term prospects of the AFP and U.S.-funded development assistance to reduce migration pressures in the region. Below are key challenges and recommendations discussed at the roundtable.

### *Reception and Reintegration Services for Returning Migrants*

- Pre-repatriation planning should include development of proper identification documents and orientation to reintegration services. Consulates in the United States could play an important role in this, especially if planning services could be coordinated with ICE during the removal process. Consular notification is voluntary, however, and many migrants do not know about consular services, do not feel comfortable accessing them, or do not believe they are effective.
- Tracking and case management for returning migrants allows governments to develop inventories of migrants' service needs and better tailor services to different populations, while also helping migrants access reintegration services. It is also important not to overburden migrants with data collection during reception (i.e., by asking the same questions multiple times), and to link collected information across other government databases used by service providers—while ensuring data confidentiality—so that the data collection is useful to individual migrants and the agencies serving them.
- To assist with social and psychological reintegration, it is important to prepare local communities for returning migrants so that they do not stigmatize them as strangers, criminals, or gang members. The governments of Guatemala and Honduras could implement public awareness campaigns that highlight the social and economic contributions of migrants abroad and returnees, as well as positive messages about people who have made it in society without migrating. Mexico and El Salvador have already launched public campaigns about the contributions of returning migrants but could expand the reach of these campaigns beyond urban centers.
- All four countries have large non-migrant populations that have service and support needs similar to those of returning migrants. Governments and civil society organizations should design reintegration services tailored to migrants' unique needs and challenges upon return, while ensuring that similar services are available to the public. Making services available to the broader population could reduce potential friction with returnees.

### *The Plan of the Alliance for Prosperity and U.S. Development Initiatives*

- Because of the long-term nature of expected development results, it is difficult to quantify or evaluate the short-term success of these policies in reducing migration pressures. But roundtable participants agreed that violence, insecurity, lack of economic opportunities, and social exclusion must be addressed to reduce long-term migration pressures.
- Existing research literature suggests that aid may result in economic growth, but growth can raise emigration rates in the short term as more and more people can afford to move and become better connected to the global economy. Also in the short-term, aid-supported



programs to increase employment of young workers may reduce migration in countries with little or no economic growth.

Given the limitations of economic growth and development to deter migration, aid agencies should work with migrant-origin countries to shape migration flows, i.e., to develop safe, lawful, and mutually beneficial channels for labor migration. For example, aid agencies can improve the skill levels of migrants from the Northern Triangle to the United States and Mexico by investing in training institutions in the origin countries. Additional aid could help develop systems in the region to monitor and enforce labor laws and agencies to monitor returns and prevent overstays.

- More research is required to analyze the short- and long-term effects of development on unauthorized migration from Central America. Such research should consider the effect of pull factors (e.g. family reunification) separate from push factors (i.e. country conditions).

**Task T.7:** Produce final project policy briefs and commentaries

Due to the delays in project start described under Task 5 above, MPI plans to publish the two policy briefs and commentaries based on them in Fall 2018.

**Explanation of any changes from the initially approved work plan (if applicable)**

The policy scan, fieldwork, analysis of results, and roundtable were completed within the initially-approved 12-month study period. A 3-month extension was requested and approved by DHS to complete the written products (deliverables) and disseminate results, based on a delayed project start date as described under Task 4 above.

As described in successive monthly reports, the delay in the project was mostly due to a delay in obtaining a project champion, which resulted in starting most project activities in September 2017 instead of July.

**MILESTONES**

**Table 4.** Milestone List

ID	Milestone Description	Status
M.1	Study plan/methodology completed (see February 2018 monthly report)	Complete
M.2	Policy scan and fieldwork completed (see May 2018 monthly report)	Complete
M.3	Interim report on policy scan and international fieldwork submitted (submitted to DHS with June 2018 monthly report in July 2018)	Complete
M.4	AFP research brief drafted (in progress)	Incomplete
M.5	Reintegration research brief drafted (in progress)	Incomplete

M.6	Stakeholders convened (June 11, 2018—see agenda, participants, and notes in interim report submitted July 2018)	Complete
M.7	Final briefs, fact sheets posted (to be completed after M4, M5)	Incomplete

**Explanation of why milestones were not reached (if applicable).**

As described in successive monthly reports, the delay in the project was due to a delay in obtaining a project champion, which resulted in starting most project activities in September 2017 instead of July 2017.

**PERFORMANCE METRICS**

**Table 5.** Performance Metrics List

ID	Description	Quantitative Performance Target
P.1	High-quality research briefs produced, published on MPI’s website	2
P.2	Commentaries/op-eds produced and published	2
P.3	Meetings with DHS/ICE officials: <ul style="list-style-type: none"> <li>• DHS Office of Policy</li> <li>• DHS Office of Immigration Statistics</li> <li>• ICE Office of Custody</li> <li>• Border Patrol Office of Strategic Planning</li> </ul>	4
P.4	U.S. and international governmental and nongovernmental stakeholders contacted/visited: <p><b>Mexico</b> <b>Government entities</b></p> <ol style="list-style-type: none"> <li>1. National Institute for Adult Education (<i>Instituto Nacional para la Educacion de los Adultos</i>)</li> <li>2. Ministry of Labor of Mexico City (<i>Secretaria del Trabajo de la CDMX</i>)</li> <li>3. Secretary of Migration (<i>Secretaria del Migrante de Michoacan</i>)</li> <li>4. José Luis Gutiérrez Pérez, State of Michoacán.</li> <li>5. Financing System for the Development of Michoacán (<i>Sistema Integral de Financiamiento para el Desarrollo de Michoacán, SIFINANCI</i>A)</li> <li>6. Workforce Training Institute of the State of Michoacán (<i>Instituto de Capacitación para el Trabajo del Estado de Michoacán, ICATMI</i>)</li> </ol>	50

	<p>7. Institute of Michoacán Youth (<i>Instituto de la Juventud Michoacana</i>, IJUMICH)</p> <p>8. National Migration Institute, Michoacán representatives</p> <p>9. Foreign Ministry, Michoacán representatives</p> <p><b>U.S. government and international organizations</b></p> <p>1. International Organization for Migration (IOM)</p> <p>2. Political Section of U.S. Embassy</p> <p><b>Civil society organizations</b></p> <p>1. <i>New Comienzos</i></p> <p>2. <i>Otros Dreams en Acción</i></p> <p>3. <i>Instituto para las Mujeres en la Migración</i> (IMUMI)</p> <p>4. <i>Deportados Unidos en la Lucha</i></p> <p>5. <i>Migrante Purépecha</i></p> <p>6. <i>Asociación de Migrantes Organizados en Retorno</i> (AMOR)</p> <p>7. <i>Pastoral de Movilidad Humana-Michoacán</i></p> <p>8. <i>Colectivo Transnacional del Tzitzio</i></p> <p>9. <i>Club Combutzio</i></p> <p>10. <i>Club Espejo de Chicago en Morelia</i></p> <p>11. <i>Fuerza Migrante</i></p> <p><b>Academics</b></p> <p>1. Lorena Guzman Elizalde, University of Sussex</p> <p>2. Rafael Alarcón, <i>Colegio de la Frontera Norte</i></p> <p>3. Oscar Ariel Mojica, <i>Colegio de Michoacán</i></p> <p>4. José Betancourt, <i>Universidad Autónoma de Guerrero</i></p> <p>5. María Elena Rivera, <i>Universidad Michoacana de San Nicolás de Hidalgo</i></p> <p><b>El Salvador</b></p> <p><b>Government entities</b></p> <p>1. Foreign Ministry, Office of Relations to Salvadorans Abroad</p> <p>2. <i>Consejo Nacional para la Protección de la Persona Migrante y su Familia</i> (Conmigrantes)</p> <p><b>U.S. government and international organizations</b></p> <p>1. IOM</p> <p>2. Political Section of U.S. Embassy</p> <p><b>Civil society organizations</b></p> <p>1. <i>Instituto Salvadoreño del Migrante</i> (INSAMI)</p> <p>2. <i>Red Nacional de Emprendedores Retornados de El Salvador</i> (RENACERES)</p> <p>3. <i>Cristosal</i></p> <p>4. <i>Seres</i></p> <p>5. <i>Casa del Migrante - Misioneros San Carlos Scalabrinianos</i></p> <p><b>Academics</b></p> <p>1. <i>Fundación Dr. Guillermo Manuel Ungo</i> (FUNDAUNGO)</p> <p>2. University of Central America, El Salvador</p>	
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3. *Universidad de El Salvador*
4. *Universidad de Oriente*
5. *Universidad Tecnológica de El Salvador*
6. *La Fundación Salvadoreña para el Desarrollo Económico y Social (FUSADES)*

**Guatemala**

**Government entities**

1. Ministry of Labor and Social Welfare, Labor Mobility
2. Ministry of Foreign Affairs, Immigration Affairs
3. Ministry of Foreign Affairs, Consular and Migratory Affairs
4. General Directorate of Migration (*Dirección General de Migración, Centro de Recepción de Retornados*)
5. National Program of Competitiveness (*Programa Nacional de Competitividad, PRONACOM*)
6. Ombudsman of Human Rights Office
7. Two former foreign ministers

**U.S. government and international organizations**

1. International Organization for Migration (IOM)
2. Political Section of U.S. Embassy
3. ICE, Office for Repatriation
4. U.S. Citizenship and Immigration Services
5. USAID

**Civil society organizations**

1. *Te Conecta (Conexión Laboral)*
2. SOCIAL LAB
3. *Fundación Fé y Alegría Guatemala*
4. *Fundación Avina*
5. *Asociación Pop No'j*
6. *Casa del Migrante, Tecún Uman*
7. *Desarrollo Sostenible Para Guatemala (DESGUA) / RED KAT*
8. *Grupo Cajolá*
9. *Casa del Migrante, Guatemala City*
10. *Asociación De Retornados Guatemaltecos (ARG)*
11. *Asociación Pro Mejoramiento de Deportados Guatemaltecos (APRODE)*

**Academics**

1. *Universidad del Valle de Guatemala*
2. *Instituto de Investigación y Proyección Social sobre Dinámicas Globales y Territoriales (IDGT)*
3. *Instituto Centroamericano de Estudios Sociales y Desarrollo (INCEDES)*
4. *Instituto Centroamericano de Estudios Fiscales (ICEFI)*
5. *Facultad Latinoamericana de Ciencias Sociales (FLACSO), Sede Guatemala*

	<p><b>Honduras</b></p> <p><b>Government entities</b></p> <ol style="list-style-type: none"> <li>1. General Directorate for the Protection of Honduran Migrants (<i>Dirección General de Protección al Migrante Hondureño</i>)</li> <li>2. Secretary for Government Coordination (<i>Secretaría de Coordinación General de Gobierno</i>)</li> <li>3. Ministry of Finance (<i>Secretaría de Finanzas</i>)</li> <li>4. Municipal Units for Returnees' Care (<i>Unidad Municipal de Atención al Retornado</i>)</li> <li>5. National Institute for Vocational Training (<i>Instituto Nacional de Formación Profesional, INFOP</i>)</li> <li>6. National Directorate for Children, Adolescents, and Family (<i>Dirección de Niñez, Adolescencia y Familia, DINAF</i>).</li> </ol> <p><b>U.S. government and international organizations</b></p> <ol style="list-style-type: none"> <li>1. United Nations Development Program (UNDP)</li> <li>2. IOM</li> <li>3. USAID</li> <li>4. U.S. Embassy Political section</li> </ol> <p><b>Civil society organizations</b></p> <ol style="list-style-type: none"> <li>1. <i>Casa Alianza</i></li> <li>2. <i>Pastoral de Movilidad Humana-Honduras</i></li> <li>3. Honduran Red Cross (<i>Cruz Roja de Honduras</i>)</li> <li>4. <i>Comisión de Acción Social Menonita</i></li> <li>5. <i>Red Jesuita con Migrantes</i></li> <li>6. National Commission for the Support of Returned Migrants with Disabilities, <i>Comison Nacional de Apoyo a Migrantes Retornados con Discapacidad (CONAMIREDIS)</i></li> <li>7. Norwegian Refugee Commission</li> </ol> <p><b>Academics</b></p> <ol style="list-style-type: none"> <li>1. Amelia Frank-Vitale, University of Michigan</li> <li>2. Martha Lorena Suazo, <i>Decana de la Facultad de Ciencias Sociales, Universidad Nacional Autónoma de Honduras</i></li> </ol>	
P.5	DHS and external stakeholders participating in policy roundtable	25
P.6	Dissemination of results to broad audiences, including webinar(s) or in-person event(s) when the briefs are published, and briefings to DHS Office of Policy and ICE Office of Custody.	4 briefings/ presentations

**Performance metrics overview**

**Table 6.** Performance Assessment

ID	Status	Far from meeting expectations	Close to meeting expectations	Met expectations	Exceeded expectations
P.1	Partially Complete		X (in progress, due to delay in project start)		
P.2	Partially Complete		X (due to delay in project start)		
P.3	Complete			X	
P.4	Complete				X
P.5	Complete			X	
P.6	Partially Complete		X (due to delay in project start)		

**P.1:** As described above, under tasks the research briefs are still in progress, with an anticipated completion date of September 2018, due to initial delays in project startup (finding a project champion).

**P.2:** Similarly, the commentaries are in progress and will be completed alongside or shortly after the briefs.

**P.3:** MPI researchers met with staff from DHS Office of Policy, ICE Office of Custody, Border Patrol Strategic Planning, and DHS officers in the field in the region over the course of the study. Meetings were also held with stakeholders from USDOS, USAID and U.S. Embassies in the region.

**P.4:** Project consultants met with over 130 key informants and almost 100 migrants in the four countries, greatly exceeding our original goal of 50 key informants in three countries. (DHS requested that we add Mexico to the study during the final work plan development phase.) The focus groups and individual meetings with repatriated migrants were added during the methodology design phase and were an additional component not anticipated in the work plan or original proposal.

**P.5:** MPI's June 2018 roundtable was attended by 25 representatives from the U.S. government, governments in the region, academic, civil society, and reintegration service providers.

**P.6:** Results have been disseminated and transitioned informally to DHS and other stakeholders during the roundtable and via the interim project report. The policy briefs and commentaries will be posted on MPI's website, with a release event likely held at MPI and our communications team engaged in media outreach, upon completion in about September 2018.

## PROJECT DELIVERABLES (OUTPUTS)

**Table 7.** Deliverables List

ID	Deliverable Name	Type	Status
D.1	Interim report on policy scan and international fieldwork	Report	Complete
D.2	Stakeholder convening		Complete
D.3	Final research brief on AFP	Brief	To be Completed in PY4
D.4	Final research brief on reintegration	Brief	To be Completed in PY4
D.5	Commentary/op-ed on AFP	Publication	To be Completed in PY4
D.6	Commentary/op-ed on reintegration	Publication	To be Completed in PY4
D.7	Project briefings/presentations		To be Completed in PY4

As described above, due to a delay in project start, MPI sought and received a no-cost extension through September 2018 to complete the research briefs and commentaries. A public release event and formal briefing for DHS are planned for that time.

**PUBLICATIONS, CONFERENCE PAPERS & PRESENTATIONS**

None. The two policy briefs will be published in September 2018, and a project briefing presentation and/or public release event presentation may be available at that time.

The interim report was submitted to DHS in June 2018, but is not a public product.

**WEBSITES OR OTHER INTERNET SITES**

No specific websites planned or anticipated in work plan, but final project deliverables will be posted on MPI’s website, and HSUP.

**INVENTIONS, PATENT APPLICATIONS and/or LICENSES**

No inventions, patent applications, or licenses are planned or anticipated in work plan.

**STAKEHOLDER ENGAGEMENT**

MPI is in contact with DHS on an ongoing basis about issues surrounding reintegration of returning migrants. For example, MPI is currently assisting the ICE Office of Custody in arranging meetings with reintegration service providers and experts in Guatemala for a trip planned in early October 2018. MPI will continue to be in contact with DHS, ICE, and other agencies to provide similar information and assistance on an ongoing basis.

**TRANSITION**

The transition plan, per the work plan, has involved working with DHS, USDOS, and USAID at every step of the project. As described above, MPI met with DHS, USDOS, and USAID staff early in the project to get their input into the policy scan and to plan the fieldwork. Staff from the three agencies were included in the fieldwork to differing degrees across the four countries, during

meetings at US Embassies. DHS Office of Policy, USDOS, and USAID staff attended the project roundtable where they provided input into the study’s findings and recommendations.

## **N.2. Uncovering Human Smuggling Patterns from Guatemala to the U.S.**

Principal Investigator, Gary J. Hale, Voir Dire International, LLC

### **PROJECT RELEVANCE TO DHS**

This project addresses the overall goal of enhancing the ability to secure and facilitate transnational flows of people by promoting prevention and deterrence of unauthorized flows of people. Key questions this project sought to address include:

- What innovative methodologies may be used to identify travel patterns and behavioral characteristics of individual terrorists, illegitimate actors and transnational criminal organizations?

### **EXECUTIVE SUMMARY**

This outcome of this research supports the DHS international strategy of combating terrorism and Transnational Criminal Organizations (TCO’s), strengthening the security and resilience of the Global Supply Chain and Travel System, expediting lawful flows of people and goods and promoting lawful immigration.

This project addressed the gap of knowledge in the Total Interdiction Rate (TIR) which is a risk-based strategy used by the U.S. Border Patrol to deploy resources and address emerging threats. The specific gap in the TIR formula relates to the number of “the unknowns get-ways” of human migrants moving north from Central America through Mexico. Project findings compared DHS detention data (the apprehensions) plus the “turn-backs” (number of detainees deported or repatriated), plus the “known get-aways” (the successful immigrants) and added an estimated number of migrants in the flow (Net capacity) or “unknown get-aways.”

The primary research objective was to develop the “Unknown Got-Aways” element of the Total Interdiction Rate (TIR) Formula. The TIR is comprised of the following formula:

$$TIR = \frac{\textit{Apprehensions} + \textit{Turn backs}}{\textit{Apprehensions} + \textit{Turn backs} + \textit{Estimated illegal entries}}$$

The results from this research will assist DHS in “validating or refining a methodology for estimating total illegal inflows” (Efforts by DHS to Estimate Southwest Border Security between Ports of Entry OIS, September 2017, page 5).

The project utilized Geographic Information Systems (GIS) to plot, map and analyze critical nodes in the transportation or Human Smuggling “supply chain” and to develop estimated numbers of migrants in the stream or network capacity. The GIS database established a framework that



allowed for visualization of the data and more efficient decision making. The project also conducted 273 interviews of apprehended immigrants to collect data that responds to the questions listed in the Goals and Objectives listed as well as other related questions.

The project accomplished the following during the second year of operation:

- Completed survey questionnaire with input from DHS and USBP regarding essential elements of information that will support the formulation of the Total Interdiction Rate.
- Obtained regulatory authority needed from IRB and DHS\_CAPO and U of H Compliance to conduct Human Subjects Research.
- Conducted approximately 270 surveys of OTM migrants primarily from Central America (at Laredo, Rio Grande Valley and Tucson Sectors)
- Conducted Open Source Research to identify facilities that support migrants in Mexico (charities, for profit, non-profit, government)
- Identified and mapped routes taken and the determined the capacity of facilities supporting migrants along those routes
- Data collected on current routes taken by Central American migrants through Mexico
- Data collected and measured on existence and estimated capacity of migrants at support structures.
- Data collected and measured on the number of migrants in the stream and arriving at the Mexico-U.S. border on any given day.
- Developed a Prototype Model for OTM (Northern Triangle) Migrant Stock traversing Mexico

The impact of this research to the Homeland Security Enterprise is to provide a specific response to the Department of Homeland Security Border Security Metrics Act of 2015 which call for specified metrics to measure the effectiveness of:

- Security between ports of entry, including in detecting and apprehending subjects and in seizing illicit drugs. Such metrics shall be informed by situational awareness, which is defined as knowledge and unified understanding of current unlawful cross-border activity.
- Collection of data related to apprehensions, inadmissible aliens, drug seizures, and other enforcement actions available to the public, academic research, and law enforcement communities in accordance with applicable privacy laws; provide DHS's Office of Immigration Statistics access to the data and evaluate and update such metrics to ensure that they meet DHS's performance management needs and are suitable to measure the effectiveness of border security.

## **PROJECT TEAM**

Gary J. Hale served as the PI on this project and was responsible for oversight of conduct and reporting of the study results. Alfonso Moreno served as the survey lead for the project. Adam Hale was the GIS analyst and cartographer for the project. Bif Browning served as the coordinator of activities in Washington, DC during the project. Lastly, Nathan Jones served as a consultant on the project and his primary responsibility pertained to his subject matter expertise in the area of human subject research. No students were involved in this project.

## **PROJECT GOALS AND OBJECTIVES**

The goal of this project was to develop a framework of assets related to Human Smuggling migration patterns and generate an associated geospatial model to provide an environment for analysis and visualization of those patterns, ultimately enhancing border security decision-making strategies. This framework evolved as new data was received so that changes in migration patterns could be discerned.

The specific project objectives for the period 1 July 2017 to 30 June 2018 were to acquire open-source information to assist in the visual identification of support-infrastructure related to Human Smuggling movement, allow for detection of the routes used by migrants and to develop a census of the number of migrants in the stream at any given time.

## TASKS

**Table 1.** Task List

ID	Task Title	Status	Associated Deliverables
T.1	Complete Data Collection	Complete	D.1, D.2
T.2	Develop/Conduct Migrant (“Smugglers Contract”) Surveys	Complete	D.1, D.2
T.3	Travel to D.C./DHS HQs for Update Meeting with Stakeholders/Champions	Complete	D.1, D.2
T.4	Perform Analysis/Validate Proof of Concept	Complete	D.1, D.2
T.5	Period III Review and Publish Findings	Complete	D.1, D.2
T.6	Travel to D.C./DHS to Delivery of Project Findings & Final Report	Complete	D.1, D.2

## TASK OVERVIEW

Task T.1: All data collection was completed as scheduled.

Collection Methodology: Conducted approximately 270 surveys of OTM migrants primarily from The Northern Triangle (at Laredo, Rio Grande Valley and Tucson Border Patrol Sectors). Conducted Open Source Research to identify facilities that support migrants in Mexico (charities, for profit, non-profit, government)

Validation: Interviews were conducted within hours (usually 1-4) of detention and at the first processing facility the migrants encountered. This reduced the chances for bias generated from prolonged contact with other detainees and increased the validity of the responses. Interviewers were identified as academics versus law enforcers. This improved the chances for obtaining truthful responses and increased the validity of the responses. The interviews were conducted on varying shifts (days, evening and nights) at three separate locations, increasing the validity of the responses.

Randomization: 270 Central American migrants primarily from the Northern Triangle were interviewed at 3 locations generating randomization of response data. The interviews were made part of the USBP Processing Center flow and individual migrant selection was made by USBP

Agents based on a next-available basis, increasing randomization. The interviews were conducted on varying shifts (days, evening and nights) at three separate locations, increasing randomization.

Data Validation (Shelters): Locations of shelters were determined by self-reporting on the internet and independently verified by Google street views and media reporting. Capacity of the shelters was determined by self-reporting and independent media reports on the internet about shelter capacity (the number of beds available). Migrants provided anecdotal estimates regarding shelter utility at locations where they overnighted. These occupancy or utility rates were not used in the following calculus due to limited validity, but they tend to provide corroboration.

Task T.2: Migrant interviews began at U.S. Border Patrol detention facilities in Laredo, Texas and McAllen, Texas on 24 October 2017 and finished in Tucson, Arizona on March 6, 2018. A total of 273 interviews were conducted at the three locations, combined.

Tasks 3, 4 and 6 were completed on 30-31 May 2018 in Washington, D.C. The project developed a Conceptual Calculus that defined OTM Stock, or the number of migrants from the Northern Triangle countries that are traversing Mexico at any given time. OTM Stock is also equal to our definition of Network Capacity.

Task 5 Final Report (in publication format) is in preparation. The final report delivery was not complete by the end of the performance period. Delivery of the final report via oral and power point briefings to our Champions and Stakeholders was scheduled in Washington, D.C. on 31 July 2018.

### **Explanation of any changes from the initially-approved work plan (if applicable)**

A request for a no cost extension was submitted to BTI on 17 May 2018 with the following narrative as to the reason why the project report was not submitted in accordance with the original project timeline. The project operational plan did not include add-ons that were informally requested by our DHS Champion (DHS/OIS) and USBP stakeholders (USBP/SPAD). These additional requested items were accepted and added to the project.

An informal request was accepted to conduct interviews of immigrants at Border Patrol Detention Centers. Immigrant interviews and data collection were requested at one, then two, then three detention centers to obtain information and data randomization regarding:

- 1) Smuggling contracts
- 2) Immigrant attitudes to Trump Administration Immigration Policies
- 3) Immigrant decision points along routes of travel within Mexico

Addition of these informally requested work packages necessitated unanticipated further review and approval by the Independent Review Board (Western IRB) resulting in a delay. The resulting plan was submitted and approved, however, the expanded scope relative to the original work plan (to 350 interviews) and the additional time necessary to conduct the analysis of items 1-3 above ultimately delayed the delivery of the final report.

### **MILESTONES**

Milestones that were listed in our approved work plan for the period 1 July 2017 to 30 June 2018 include the following:

**Table 2.** Milestone List

ID	Milestone Description	Status
M.1	Populate the Mapping Tool	Complete
M.2	Perform the Analyses	Complete
M.3	Proof of Concept/Make decisions based on analyses	Complete

**Explanation of why milestones were not reached (if applicable).**

Not Applicable.

**PERFORMANCE METRICS****Table 3.** Performance Metrics List

ID	Description	Quantitative Performance Target
P.1	Score on the Mapping Tool Rubric.	Above 80%
P.2	Score on the Rubric for Project Findings & Final Report	Above 80%

**Performance metrics overview****Table 4.** Performance Assessment

ID	Status	Far from meeting expectations	Close to meeting expectations	Met expectations	Exceeded expectations
P.1	Complete			X	
P.2	Complete			X	

**PROJECT DELIVERABLES (OUTPUTS)****Table 5.** Deliverables List

ID	Description	Type	Status
D.1	Project Findings & Final Report	Report	Partially Complete
D.2	Delivery of Map Service/Database	Database	Complete

**PUBLICATIONS, CONFERENCE PAPERS AND PRESENTATIONS**

The project Final Report (in publication format) was in preparation at the end of the performance period (30 June 2018) and was scheduled for delivery on 31 July 2018.

The Map Service/Database was delivered to USBP GIS and other stakeholders with a shared database.

#### **WEBSITES OR OTHER INTERNET SITES**

<https://www.hsuniversityprograms.org/member/login/exit.cfm> was created as a Work Group and sharing space to host Voir Dire International research data. The project has up-loaded all migrant interviews (approximately 300) and related project data for the DHS Champions and USBP Stakeholders to access.

#### **INVENTIONS, PATENT APPLICATIONS, AND/OR LICENSES**

None.

#### **STAKEHOLDER ENGAGEMENT & TRANSITION**

The project members had continuous contact with DHS Champions and Stakeholders throughout the project and engaged their input and feedback during the development of the survey questions as well as the selection of the survey locations. The project was adjusted several times after inception to include features (surveys, questions and locations) that were requested by DHS and USBP. We met frequently and traveled to USBP field offices on several occasions to coordinate and validate the survey process. The project met with USBP GIS Analysts and others on two occasions to provide guidance regarding the utility of the mapping service. We provided a final oral presentation to DHS and USBP officials at the end of the project, on 31 May 2018, and 12 June 2018, respectively.

### **N.3. Security Technologies Kitchen (STK)**

Principal Investigator, Shishir K. Shah, University of Houston

#### **PROJECT RELEVANCE TO DHS**

This project addresses the overall goal of enhancing the U.S border management operations by promoting education in the Homeland Security Enterprise (HSE). The Security Technologies Kitchen (STK) is an educational initiative that directly aligns with the DHS's mission of producing a new generation of HS experts by informing current STEM students of the critical mission of the DHS and engaging them in real-world problems that have a direct and obvious impact on our nation's security.

#### **EXECUTIVE SUMMARY**

CBP requires STEM educated professionals who are aware of, and knowledgeable in, the challenges and technologies relevant to air, marine and land border/port-of-entry (POE) security and first responder technologies. Training and exposure to technologies that can be used to facilitate solutions relevant to security and situational awareness problems will help encourage STEM students to consider career options that can serve the mission of CBP and the HSE.

The curriculum focused on fundamentals of engineering design, human centered approach to problem solving, and design and development of security solutions leveraging visual sensing. The project accomplished the following:

- developed instructional material to inform students about the critical mission of DHS and the HSE, and to increase an understanding on how their STEM knowledge and skills can be used in the context of security and situational awareness problems;
- developed and taught a course to support education of students in fundamentals of engineering design, problem solving, and design and testing of security solutions;
- facilitated problem identification, solution design formulation and validation, and solution prototyping that resulted in hands-on training to address real-world problems based on use of visual sensing; and
- provided space and support for students in the course to develop and test ideas related to technologies and solutions relevant to projects.

It is anticipated that students graduating with this knowledge will be more inclined to further their career (workforce or higher education) to help develop applicable technologies and solution to further the mission of DHS and HSE.

## PROJECT TEAM

### Personnel (Other than Students)

**Table 1.** Project Personnel (other than students)

First Name	Last Name	Institution	Role on Project
Shishir	Shah	University of Houston	Principal Investigator
Ioannis	Kakadiaris	University of Houston	Co-PI

**Table 2.** Students involved in the project

First Name	Last Name	Institution	Degree Pursued
Poonam	Beniwal	University of Houston	PhD
Fatima	Daha	University of Houston	PhD

**Student Name:** Poonam Beniwal and Fatima Daha engaged in both development of teaching material and supporting guides for resources to be used in the course. Both students worked on gathering and reviewing material related to human-centered engineering design principles, different sensors that could be easily used in coursework to prototype computer-based sensor data collection and analysis, as well as software libraries that could be easily leveraged to facilitate problem solving. They also gathered material available within the public domain that would be used in the course to provide understanding of mission of DHS. This gave them an opportunity to learn about DHS and exposed them to challenges and technologies relevant to land border security, maritime border security, POE security, and first responder technologies. This knowledge gave them a better appreciation of how their education can have an impact in

addressing interesting challenges that face our nation. This improved understanding has also given them a better appreciation of their own research and its applications.

## TASKS

**Table 3.** Task List

ID	Task Title	Status	Associated Deliverables
T.1	Discussion with project champion	Complete	
T.2	Develop and update material to educate students about the mission of DHS and HSE	Complete	D.1
T.3	Outline possible project topics and define their objectives	Complete	
T.4	Discussion with project champion	Complete	
T.5	Identify faculty mentors, develop educational material and resources necessary for finalized STK projects, and recruit students	Complete	
T.6	Perform surveys and evaluations	Complete	D.3
T.7	Discussion with project champion	Complete	
T.8	Conduct training, assess project progress, and facilitate project execution	Complete	
T.9	Perform surveys and evaluations	Complete	D.3
T.10	Perform analysis and write annual report	Complete	D.3
T.11	Develop presentation material that showcases the project and developed solution	Complete	D.2, D.4
T.12	Discussion with project champion	Complete	

### Task overview

**Task T.1, T.2:** The outcomes of prior course offering were discussed with our project champion from Office of Training and Development, CBP, and accordingly the course content was updated to include training related to problem understanding and solution design development and validation. This allowed for the course objectives to be expanded so that students could develop better understanding of gathering real-world requirements for design and development of a technological solution. The course focused on use of visual sensing to solve problems, hence included teaching content in visual processing to help solution implementation. The overall course website is available at <https://cosc4397.github.io/spring2018/>. [Below is the course description and overview of the learning objectives that was shared and made available to students prior to start of the course.](#)

#### Course Description as offered:

Physical computing refers to the design and construction of physical systems that use a mix of software and hardware to sense and respond to the surrounding world. Among various sensors, we will focus on cameras to sense spatial and temporal information in the visual spectrum. The course is organized around a semester long project that will build on the fundamentals of sensor signal processing, image analytics, and machine learning.

The exercises provide building blocks for collaborative projects that will utilize the essential skills and challenge students to not only consider how to make things, but also for whom we design, and why the making is worthwhile.

**Course Pre-requisites, Co-requisites, and/or Other Restrictions:**

COSC 4351 or equivalent; Approval of Instructor.

**Student Learning Objectives/Outcomes:**

Work in a mixed physical-digital environment; make effective use of standard hardware and software tools for physical computing; approach complex physical computing problems with a systematic overview that integrates iterative research and design steps; generate systems specifications from a perceived need; produce interface specifications for a system composed of numerous subsystems; use development tools for design, fabrication and testing and debugging evaluate the system in the context of an end user application or experience.

**Logistics:**

Projects will be based on teams and will be implemented using cloud computing resources and relevant sensors. Introduction to relevant security applications will be covered in class along with introductory concepts related to imaging and image processing. Each team will leverage Google cloud resources to realize their solution and to meet compute requirements for analysis.

**Group Work:**

This course relies on group work and group learning. Throughout the course, students will work in groups that are either random, assigned, and self-selecting. Randomly selected groups are intended to give students practice with teamwork among unfamiliar collaborators, a common setting in the real world. Members of each teams may have either fixed or fluid roles as long as each project responsibility is clearly assigned to a team member. The purpose of naming a role is defining a set of responsibilities for an individual to assume. When assuming a role, we expect each individual to fully assume the responsibilities of their selected role(s) for the project. Students are expected to reflect on their own successes and failures within each role and to develop a better understanding of how their own behavior can affect group dynamics and how group dynamics affect the development of a project.

Experimentation is encouraged with individual roles within each group. Each student is expected to occupy diverse roles over the course of the semester both within and outside their expertise. Some suggested roles include the following:

- Integrator: lead the overall development of the project. Responsibilities include leading the negotiation of a common objective, negotiating assigned roles and expectations for other group members, facilitating communication among group members, setting and maintaining and overall timeline for the project's execution, and researching existing relevant work.



- Developer: lead the design and fabrication of an aspect of the project. Responsibilities include researching relevant existing solutions, developing concepts which meet the objectives, producing sketches and diagrams to refine the implementation plan, and determining and executing fabrication strategies.
- Iterator: lead the testing and redesign of an aspect of the project. Responsibilities include evaluating prototypes against the agreed objectives, finding solutions to problems, and modifying or refabricating as appropriate.
- Scribe: document the project with photos, videos, and writing. Responsibilities include documenting the development process as well as the final outcome, and creating a well formatted document with text, images, and video describing the project's goals, methodologies and results.
- Tutor: teach specific techniques or knowledge to teammates. This role is natural for students with advanced knowledge or experience with the activity who will gain the most by teaching and helping others instead of breezing through familiar territory. Responsibilities include assuring that all group members gain the necessary essential skills required for the project.

A person may flow naturally from one role to the next as projects are subdivided into sub-goals, as long as an individual clearly takes responsibility for each element. Note that the role of scribe is often best universally shared so that each person is continually documenting their own process, and then collaborating on final documentation at the end.

### Grading

Activity	Percentage
Project Progress and Presentations	50%
Reports	30%
Final Project Deliverable	20%

### Required Reading and Materials

*The Field Guide to Human Centered Design*, produced by IDEO (ISBN: 978-0-9914063\_1\_9); additional reading material and resources provided in class.

*Computer Vision: Algorithms and Applications*, by Rick Szeliski.

### Recommended Reading

*Design Thinking: Understand – Improve – Apply*, by Hasso Plattner, Christoph Meinel (ISBN-13: 978-3642266386).

**Task T.3:** Projects were identified by students based on relevant review of multiple problems and challenges. The final topics were:

1. To reduce stakeholder response time when reacting to active shooter incidents in public schools.
2. Empty space finder and scheduler
3. Assisting suspect tracking
4. Face matching based authentication as a service

**Task T.4, T.7:** Project champion (Deputy Assistant Commissioner, Office of Training and Development, CBP) was updated on the progress in the course. Students were provided instructions in range of fundamental technologies for applications in security and their progress towards their project topics was tracked. Specifically, students focused their learning on visual sensing using cameras and technologies to facilitate data collection and analysis. This included learning of data streaming using IoT devices such as Raspberry Pi, cloud-based data collection and analysis using data processing in Python and OpenCV. The student teams were required to adhere to 4 major milestones that were made part of the overall graded components of the course. Specific requirements and deliverables for each of the assignments is available at: <https://sites.google.com/site/cosc4397spring2018/assignments>. These assignments allowed to continuous assessment of the projects.

**Task T.5:** Student recruitment efforts were started. We continued the effort to develop resources to help guide problem solving for student teams. We also began the process of advertising the course to students across the College of Engineering, College of Technology, and the Department of Computer Science. Faculty advisors in each of the colleges were contacted and they helped advertise the course to students. The course offering for Spring term was finalized and 25 students are enrolled in the course.

**Task T.6, T.9:** Students were given a survey at the start of the course as well as towards the end of the course. Questions 1-4 were part of the pre-course completion survey. The purpose of the pre-survey was to get a baseline of their understanding of their interest in learning about security related problems and technologies along with their inclination of pursuing employment or further education in the field. The survey questions presented are shown below. All questions were included in the post-course completion survey.

### Survey and Feedback Questionnaire

Please fill out the survey below. This survey will provide useful insights on learning achieved in this class and mechanisms for improving the content and learning objectives for future offerings of the course.

\* Required

1. Please rate your level of interest in learning about visual computing for security applications. \*

Mark only one oval.

1 2 3 4 5  
Low      High

2. Please rate your level of knowledge about Department of Homeland Security and its mission related to border security. \*

Mark only one oval.

1 2 3 4 5  
Low      High

3. Please rate your interest in finding a job (with Homeland Security Enterprises or private sector) related to computing for security applications and in addressing solutions relevant to the mission of DHS. \*

Mark only one oval.

1 2 3 4 5  
Low      High

4. Please rate your interest in pursuing further studies in a discipline related to security applications and broadly in areas relevant to DHS mission and needs. \*

Mark only one oval.

1 2 3 4 5  
Low      High

5. Please rate the appropriateness of topics selected for class projects. \*

Mark only one oval.

1 2 3 4 5  
Not interesting      Very interesting

6. Please rate the topics and teaching content covered in this class. \*

Mark only one oval.

1 2 3 4 5  
Not useful      Very useful

7. Please rate the support resources made available in this class (Raspberry Pi, Github, Google Cloud). \*

Mark only one oval.

1 2 3 4 5  
Not useful      Very useful

8. Please provide feedback about what additional topics should be taught in this class.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

9. Please provide feedback about what additional resources should be made available in this class.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

10. Please provide feedback about how this class can be improved.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Powered by  
Google Forms

**Task T.8:** Students were given instructions and training in topics related to visual processing, human centered design, and solution design and validation. Students were also educated about the mission of DHS and were assigned specific reading assignments to broaden their understanding of challenges relevant to CBP, specifically focusing on security technologies. Training was imparted through lectures as well as a series of assignments to facilitate hands-on experience and project execution. Assignments included identification of problems and sub-problems stemming from their understanding of CBP challenges, which eventually was used to identify and define student team projects. The learning modules and assignments are available through the course website: <https://cosc4397.github.io/spring2018/>. The material taught in the course, through lectures, readings, and discussions, met the education expectations of the course. The assignments and the project execution facilitated and hands-on training and support for testing solutions to selected problems.

**Task T.10:** Class survey was completed and the findings evaluated to assess measures of success and identify areas of improvement. 18 out of the 25 students completed the survey conducted both at the beginning and the end of the course. The survey was conducted on a 5-point scale with higher score indicating a greater interest. The scoring of the questionnaire was assessed using t-test and the results are presented below as part of the Performance Assessment.

**Task T.11:** Students completed work on their projects and presented their work. A final report and presentation of each project was prepared by student teams. Material for each of the teams can be viewed at: <https://cosc4397.github.io/spring2018/news/>.

**Explanation of any changes from the initially approved work plan (if applicable)**

N/A

## MILESTONES

**Table 4.** Milestone List

ID	Milestone Description	Status
M.1	Students recruited and assigned a project	Complete
M.2	Projects completed and student training assessed	Complete
M.3	Presentation material developed to showcase the project and developed solution	Complete

**Explanation of why milestones were not reached (if applicable).**

N/A

## PERFORMANCE METRICS

**Table 5.** Performance Metrics List

ID	Description	Quantitative Performance Target
P.1	# of students that intend to obtain employment in an HS-related area	>20% of students who will complete STK projects
P.2	# of students that intend to pursue graduate research in an HS-related area	>20% of students who will complete STK projects

### G.1. Performance metrics overview

**Table 6.** Performance Assessment

ID	Status	Far from meeting expectations	Close to meeting expectations	Met expectations	Exceeded expectations
P.1	Complete				X
P.2	Complete				X

**P.1:** Students in the course participated in completing a survey indicating their interest in pursuing employment in a HS-related area. 18 students completed the survey conducted at the beginning and end of the course. The survey was conducted on a 5-point scale with higher score indicating a greater interest. 80.0% of the students reported an increase in interest in the post-completion survey. We performed a t-test to validate the findings and found that there was a significant difference in the scores for post-completion survey ( $M=1.46$ ,  $Var=0.4$ ) compared to pre-completion ( $M=2.86$ ,  $Var=0.83$ );  $p=0.0003$ . These results suggest that there is an increase in the number of students interested in pursuing employment in a HS related field after having completed this course.

**P.2:** Students in the course participated in completing a survey indicating their interest in pursuing graduate studies or research in a HS-related area. 18 students completed the survey conducted at the beginning and end of the course. The survey was conducted on a 5-point scale with higher score indicating a great interest. 77.8% of the students reported an increase in interest in the post-completion survey. We performed a t-test to validate the findings and found that there was a significant difference in the scores for post-completion survey ( $M=2.06$ ,  $Var=1.63$ ) compared to pre-completion ( $M=3.36$ ,  $Var=1.07$ );  $p=0.0002$ . These results suggest that there is an increase in the number of students interested in pursuing graduate studies or research in a HS related field after having completed this course.

## PROJECT DELIVERABLES (OUTPUTS)

**Table 7.** Deliverables List

ID	Deliverable Name	Type	Status
D.1	Course description, developed project topics, and education material to support hands-on training and mentoring for project topics relevant to HS	Report	Complete
D.2	Project reports describing team projects and implemented solutions	Report	Complete
D.3	Annual report	Report	Complete
D.4	Presentation developed to showcase project and developed solution	Report	Complete

## PUBLICATIONS, CONFERENCE PAPERS & PRESENTATIONS

None.

## WEBSITES OR OTHER INTERNET SITES

<https://cosc4397.github.io/spring2018/>. This website was developed as part of the course offering and hosts the course curriculum along with lecture materials, reading assignments, and specifications of student assignments. Student presentations and reports are also hosted on this website.

## **INVENTIONS, PATENT APPLICATIONS and/or LICENSES**

None. No patentable inventions were created during the budget period.

## **STAKEHOLDER ENGAGEMENT**

Minimal. See above.

## **TRANSITION**

N/A

### **N.4. Homeland Security Symposium Series**

Principal Investigator, Victor M. Manjarrez, Jr., The University of Texas at El Paso

#### **PROJECT RELEVANCE TO DHS**

This project addresses the overall BTI goal of enhancing the U.S border management operations by promoting Homeland Security Enterprise (HSE) Training and Professional Development. Key questions this project sought to address include:

- What useful historical information and trends can be derived from immigration, terrorism and illegal activities to enhance border security activities?
- What can be learned from previous attempts to combat smuggling, drug trafficking and illegal immigration? How can the effectiveness of these efforts be measured?

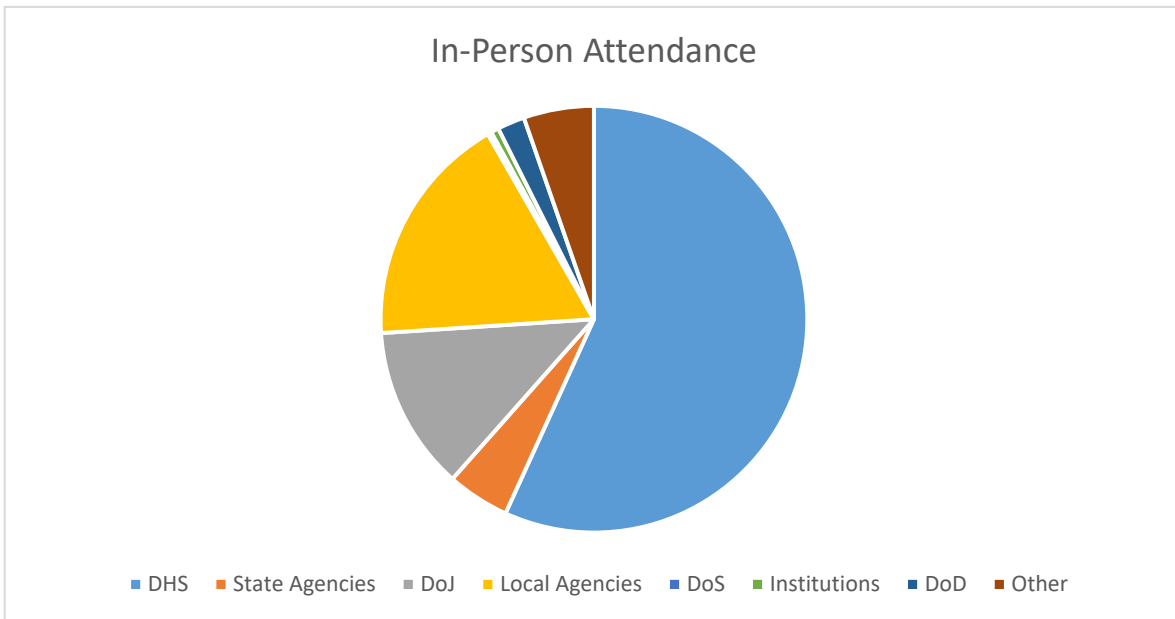
#### **EXECUTIVE SUMMARY**

The Homeland Security Symposium Series addressed educational and supplemental training needs identified by DHS and other homeland security enterprise stakeholders. The University of Texas at El Paso (UTEP) developed a symposium series on topical issues related to border security and legitimate trade and travel. The nature of the project allowed other topical themes to emerge during the performance period, as stakeholder dictated. The symposium series utilized subject matter experts contracted by UTEP.

Five (5) symposium events were conducted between 1 July 2017 and 30 June 2018. Participation in the five (5) symposiums was sum of; number of in-person attendees, individual webcast viewers, and video downloads through the Center for Law & Human Behavior (CLHB) website and the CLHB YouTube site. The five (5) symposiums were viewed for at least a total of 1,926 times. Unfortunately, website and YouTube views do not account for multiple people watching the same video in class room settings or homeland security practitioners in a training session environment. The CLHB Homeland Security Symposium Series webpage and video downloads were visited by 81 institutions of higher education and 64 federal, state, and local government entities.

The number of "In-Person Attendees" came from over 33 different federal, state, and local agencies from Arizona, New Mexico, and Texas. The table below delineates the number of "In-Person Attendees", Webcast Individual Views, and YouTube/Website views. In addition, Figure 1 (In-Person Attendance) graphically demonstrates the agency attendance.

	In-Person Attendees	Webcast Individual Views	YouTube & CLHB Website Views	Total
Symposiums1-5	337	384	1,542	2,269



Each symposium event had five (5) deliverables which are outlined below:

- Results of the Pre/Post Symposia Tests
- Results of the Exit Satisfaction Surveys
- Research in Brief
- Symposia After Action Report
- Symposia Recordings

The exit surveys contained seven (7) questions that were developed to gauge various facets of the participant's experience for each symposium. Below is a table with each question identified and the average rating for each question for the five (5) symposiums.

Question	Percentage
1   The seminar met my expectations	90.0%

2	The overall topics covered in this seminar were relevant and useful to my current assignment	86.2%
3	The seminar description accurately described the seminar content	92.9%
4	The seminar increased my <b>knowledge</b> of the subject matter	89.7%
5	The seminar increased my <b>interest</b> of the subject matter	91.3%
6	The overall quality of this seminar was excellent	91.8%
7	The instructors' presentation style was effective	93.7%

## PROJECT TEAM

### Personnel (Other than Students)

**Table 1.** Project Personnel (other than students)

First Name	Last Name	Institution	Role on Project
Victor	Manjarrez	University of Texas at El Paso	Principal Investigator

**Table 2.** Students involved in the project

First Name	Last Name	Institution	Degree Pursued
Victor	Reyes	University of Texas at El Paso	BA
Anjelica	Manjarrez	University of Texas at El Paso	BS

**Student Name:** Victor Reyes

Mr. Reyes assisted in the development, scheduling, advertising, and coordinating of the Homeland Security Symposium Series. In addition, he played a significant role in collecting exit survey data that was utilized in the After Action Reports and other required reports. Mr. Reyes extensively interacted with the homeland security practitioners who attended each symposium event. In addition, he interacted with the Homeland Security Symposium Series Advisory Board gaining insight into the Department of Homeland Security. The interaction with professionals of the Department of Homeland Security enriched the Mr. Reyes' understanding of the mission of the department and world view. Mr. Reyes was selected to present a poster at the Department of Homeland Security Center for Excellence Summit 2018 at George Mason University.

**Student Name:** Anjelica Manjarrez



Ms. Manjarrez assisted in the development, scheduling, advertising, and coordinating of the Homeland Security Symposium Series. In addition, she played a significant role in collecting exit survey data that was utilized in the After Action Reports and other required reports. As part of the deliverables for the Homeland Security Symposium Series, the PI was responsible for providing a *Research in Brief* that described the symposium. The idea behind the brief is to provide future homeland security practitioners the knowledge of the event content in order to improve work place knowledge. The student was a key contributor in developing the *Research in Brief*. Ms. Manjarrez extensively interacted with the homeland security practitioners who attended each symposium event. In addition, she interacted with the Homeland Security Symposium Series Advisory Board gaining insight into the Department of Homeland Security. Ms. Manjarrez was also responsible for managing the CLHB Twitter account that promoted the symposium series. The interaction with professionals of the Department of Homeland Security enriched the Ms. Manjarrez' understanding of the mission of the department and world view.

## TASKS

**Table 3.** Task List

ID	Task Title	Status	Associated Deliverables
T.1	Meeting with project champion	Complete	D.1 – D.5
T.2	Select first two topics of the symposia series	Complete	D.1 – D.5
T.3	Seek course providers/materials to meet interests identified	Complete	D.1 – D.5
T.4	Announce and schedule first two symposium events	Complete	D.1 – D.5
T.5	Symposium 1	Complete	D.1 – D.5
T.6	Meeting with project champion (telephonic)	Complete	D.1 – D.5
T.7	Announce and schedule third and fourth symposium event	Complete	D.1 – D.5
T.8	Symposium 2	Complete	D.1 – D.5
T.9	Symposium 3	Complete	D.1 – D.5
T.10	Meeting with project champion (telephonic)	Complete	D.1 – D.5
T.11	Announce and schedule fifth symposium event	Complete	D.1 – D.5
T.12	Symposium 4	Complete	D.1 – D.5
T.13	Symposium 5	Complete	D.1 – D.5
T.14	Meeting with project champion	Complete	D.1 – D.5

## **Task overview**

**Task T.1:** Met with project champion CBP Office of Training and Development (OTD) Deputy Assistant Commissioner (DAC) on 14 September 2017 to discuss the symposium series and topical areas of interest.

**Task T.2:** In coordination with the CBP OTD DAC and the Homeland Security Symposium Series Advisory Board selected symposium topics for the first half of period two (2) of the performance period.

**Task T.3:** Sought course providers for the first two (2) symposiums.

**Task T.4:** Announced and scheduled first two (2) symposium events.

**Task T.5:** Symposium 1 occurred on 25 October 2017 and was presented by Dr. Brandon Behlendorf.

**Task T.6:** Teleconference call with project champion CBP Office of Training and Development Deputy Assistant Commissioner on 7 November 2017. The call centered on the idea that the project was resourced for another year. I informed the CBP OTD DAC that I was meeting with the project's Advisory Board for potential symposium topics. The CBP OTD DAC was happy to hear that the project was resourced for another year.

**Task T.7:** Announced and scheduled third and fourth symposium events.

**Task T.8:** Symposium 2 occurred on 7 December 2017 and was presented by Mr. Patrick Schaefer.

**Task T.9:** Symposium 3 occurred on 15 February 2018 and was presented by Dr. Erik Dahl.

**Task T.10:** Teleconference call with project champion CBP Office of Training and Development Deputy Assistant Commissioner on 16 February 2018. The call centered on after action reports for the previous symposiums with particular interest in the symposium that occurred the day before. The CBP OTD DAC was also interested in the symposium scheduled for May 2, 2018 and the ability to have multiple CBP OTD representatives in attendance.

**Task T.11:** Announced and scheduled fifth symposium event.

**Task T.12:** Symposium 4 occurred on 2 May 2018 and was presented by Ms. June Beittel and Dr. David Shirk.

**Task T.13:** Symposium 5 occurred on 13 June 2018 and was presented by Dr. Luigi Achilli.

**Task T.14:** Teleconference call with project champion CBP Office of Training and Development Deputy Assistant Commissioner on 14 June 2018. The call centered on after action reports for the project. In addition, I informed the CBP OTD DAC that I believed the project would not be refunded due to the confusion at the DHS OT OUP and BTI.

No.	Date	Symposia Title	Presenters	Attendees	Overall Satisfaction
1	10/25/17	Disrupting and Dismantling Transnational Criminal Networks	Brandon Behlendorf	64	91.0%
2	12/07/17	Banking, Finance, and National Security: In the Paso Del Norte Region	Patrick Schaefer	86	86.4%
3	02/15/18	Counterterrorism and Intelligence	Erik Dahl	65	87.3%
4	05/02/18	Drug Trafficking Organizations and Violence in Mexico	June Beittel and David Shirk	77	100%
5	06/13/18	The Human Smuggling Industry: Nuances and Complexities	Luig Achilli	45	94.2%

**Explanation of any changes from the initially approved work plan (if applicable)**

Not Applicable

**MILESTONES**

**Table 4.** Milestone List

ID	Milestone Description	Status
M.1	Deliver five (5) symposium events	Complete
M.2	Conduct and distribute to the BTI Institute Director a symposium After Action Report for symposium 1.	Complete
M.3	Conduct and distribute to the BTI Institute Director a symposium After Action Report for symposium 2.	Complete
M.4	Conduct and distribute to the BTI Institute Director a symposium After Action Report for symposium 3.	Complete
M.5	Conduct and distribute to the BTI Institute Director a symposium After Action Report for symposium 4.	Complete
M.6	Conduct and distribute to the BTI Institute Director a symposium After Action Report for symposium 5.	Complete

**Explanation of why milestones were not reached (if applicable).**

Not applicable. All milestones achieved.

## PROJECT DELIVERABLES

**Table 5.** Deliverables List

ID	Deliverable Name	Type	Status
D.1	Symposia #1: Results of the Pre/Post Symposia Tests, Exit Satisfaction Surveys, Research in Brief, After Action Report, and symposia recordings.	Report/Survey/Video	Complete
D.2	Symposia #2: Results of the Pre/Post Symposia Tests, Exit Satisfaction Surveys, Research in Brief, After Action Report, and symposia recordings.	Report/Survey/Video	Complete
D.3	Symposia #3: Results of the Pre/Post Symposia Tests, Exit Satisfaction Surveys, Research in Brief, After Action Report, and symposia recordings.	Report/Survey/Video	Complete
D.4	Symposia #4: Results of the Pre/Post Symposia Tests, Exit Satisfaction Surveys, Research in Brief, After Action Report, and symposia recordings.	Report/Survey/Video	Complete
D.5	Symposia #5: Results of the Pre/Post Symposia Tests, Exit Satisfaction Surveys, Research in Brief, After Action Report, and symposia recordings.	Report/Survey/Video	Complete

## PERFORMANCE METRICS

**Table 6.** Performance Metrics List

ID	Description	Quantitative Performance Target
P.1	Satisfaction with symposia content, quality, and relevance as reported by participant exit surveys.	Above 70%
P.2	Conduct a single pre-test and post-test for each symposium to measure learning as a result of the event experience.	The average Post-Test score will be 10 points higher than the average Pre-Test Score

P.3	The single pre-test and post-test for each symposium will measure the level of understanding of the content as a result of the event experience.	Average participant post-score of 70% or better
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**Performance metrics overview**

**Table 7.** Performance Assessment

ID	Status	Far from meeting expectations	Close to meeting expectations	Met expectations	Exceeded expectations
P.1	Complete				<b>X</b>
P.2	Complete			<b>X</b>	
P.3	Complete				<b>X</b>

The performance metrics outlined in Table 6 revolve around learning. Evaluation of learning that occurred during the Homeland Security Symposium Series was conducted by using the methodology utilized in Donald L. Kirkpatrick’s (1996) four level model of evaluating training programs. The U.S. Office of Personnel and Management (OPM) views the Kirkpatrick (2006) model as the accepted methodology for evaluating training programs in the United States Government. The Kirkpatrick Model is comprised of the following four levels, but the Homeland Security Symposium Series only focused on the first two levels of the Kirkpatrick Model as per the approved work plan.

**Table 8.** Kirkpatrick Model

Level	Identifier	Description	Measurement
1	Reaction	A measure of customer satisfaction	Exit Surveys
2	Learning	Measuring changing attitudes, knowledge, increase in skill as a result in attending the program	Pre-tests and Post-tests
3	Behavior	A change in behavior because the participant attended the symposium series	Not measured
4	Results	The final results that occurred because the participants attended the program.	Not measured

Every symposium attendee was asked to take a six (6) question Pretest Questionnaire in order to gauge the level of understanding of the topic. In addition, the participants were asked to take the same six (6) question Posttest Questionnaire at the conclusion of the symposium.

## **Analysis:**

**Project Performance Metric Number 1:** The quantitative performance target of 70% or better for gauging satisfaction with the symposia content, quality, and relevance as reported by participant exit surveys (questions 1, 2, & 6) was exceeded with an 89.3% rate for the five (5) symposiums conducted.

**Project Performance Metric Number 2:** The quantitative performance target of increasing learning by the average test score being 10 points (or 20%) higher was exceeded with a five (5) symposium average of 20.2% higher test scores.

**Project Performance Metric Number 3:** The quantitative performance target of having the average participant Posttest score of 70% or better was exceeded with a five (5) symposium average of 83.8%.

## **PUBLICATIONS, CONFERENCE PAPERS & PRESENTATIONS**

The following Research in Briefs were developed and made available to BTI and all can be found on the University of Texas at El Paso Center for Law & Human Behavior website:

Symposium 1: Disrupting and Dismantling Transnational Criminal Networks

<http://clhb.utep.edu/series/overview/29-symposium/77-symposium-ten>

Symposium 2: Banking, Finance, and National Security: In the Paso Del Norte Region

<http://clhb.utep.edu/series/overview/29-symposium/78-symposium-11>

Symposium 3: Counterterrorism and Intelligence

<http://clhb.utep.edu/series/overview/29-symposium/79-symposium-12>

Symposium 4: Drug Trafficking Organizations and Violence in Mexico

<http://clhb.utep.edu/series/overview/29-symposium/80-symposium-13>

Symposium 5: The Human Smuggling Industry: Nuances and Complexities

<http://clhb.utep.edu/series/overview/29-symposium/81-symposium-14>

## **WEBSITES OR OTHER INTERNET SITES**

<http://clhb.utep.edu/series/overview>

## **INVENTIONS, PATENT APPLICATIONS, and/or LICENSES**

Not Applicable

## **STAKEHOLDER ENGAGEMENT**

Detailed in Task Overview above.

## TRANSITION

A series of Research in Briefs for access and use by DHS Champions, and stakeholders from USBP and CBP were transitioned to the customer including:

- Disrupting and Dismantling Transnational Criminal Networks
- Banking, Finance and National Security: In the Paso Del Norte Region
- Counterterrorism and Intelligence
- Drug Trafficking Organizations and Violence in Mexico
- The Human Smuggling Industry: Nuances and Complexities

## N.5. Image and Video Person Identification in an Operational Environment: Phase I

Principal Investigator, Ioannis A. Kakadiaris, University of Houston

### PROJECT RELEVANCE TO DHS

This project addresses the overall goal of enhancing the ability to secure and facilitate transnational flows of people. Key questions this project sought to address include:

- What are new sources of information and innovative methods and metrics to estimate the number and characteristics of human trafficking victims?
- What are new sources of information and innovative methods and metrics to estimate the number and characteristics of criminal traffickers?

### EXECUTIVE SUMMARY

The goal of the project was to develop accurate, robust, and efficient 3D-aided face recognition algorithms from image and/or video for verification or identification in adverse outdoor conditions. The project accomplishments in PY3 were:

1. Benchmarked system for matching non-frontal images of varying resolutions to a frontal image
2. Tested the prototype software

### PROJECT TEAM

The project team consisted of faculty, staff, and graduate students. Table 1 lists the faculty and staff members involved. Student participants are listed in Table 2.

#### Personnel (Other than Students)

Table 1. Project Personnel (other than students)

First Name	Last Name	Institution	Role on Project
Ioannis	Kakadiaris	University of Houston	Principal Investigator
Shishir	Shah	University of Houston	Co-Principal Investigator

Table 2. Students involved in the project

First Name	Last Name	Institution	Degree Pursued
Pengfei	Dou	University of Houston	PhD
Ha	Le	University of Houston	PhD
Mengjun	Leng	University of Houston	PhD
Lei	Shi	University of Houston	PhD
Yuhang	Wu	University of Houston	PhD
Xiang	Xu	University of Houston	PhD
Lingfeng	Zhang	University of Houston	PhD

**Student Name:** Pengfei Dou

P. Dou worked on 3D face reconstruction and biometric template matching. He developed a system that combines a coupled-dictionary model for parametric facial shape representation and a two-stage framework for 3D face reconstruction from a single image using facial landmarks, and a method that directly estimates a 3D model without using 2D landmarks. He also worked on a patch-based face recognition algorithm with improved performance under large head pose variations, and an algorithm for multi-view 3D face reconstruction.

**Student Name:** Ha A. Le

H.A. Le worked-on publishing UHDB31, a dataset for better understanding face recognition across pose and illumination variation. After that, H.A. Le jointly worked with Y. Wu and X. Xu on the 3D face reconstruction module of the UR2D pipeline. They improved the 3D face reconstruction module by introducing a re-projection consistency aware framework. Additionally, he evaluated 3D face reconstruction methods on the validation set provided by the FG 2018 challenge on the dense 3D reconstruction of 2D face images in the wild.

**Student Name:** Mengjun Leng

M. Leng worked on the problem face recognition with multiple images in the probe and single image in the gallery. She evaluated the recently developed algorithm (confidence-driven network) on IJBA and UHDB31 dataset and proposed a related system extension from matching single face images to multiple face images.

**Student Name:** Yuhang Wu

Y. Wu proposed a new approach for face pose estimation. The method disentangles the effectiveness of different pose parameters and is demonstrated perform well under strong external occlusions and large head pose variations. Besides that, he demonstrated that his proposed approach for facial landmark detection can significantly improve the face recognition performance in-the-wild.

**Student Name:** Lei Shi assisted Xiang Xu in engineering tasks listed in the publication “Local Classifier Chains for Deep Face Recognition” and the publication “When 3D-Aided 2D Face Recognition Meets Deep Learning: An extended UR2D for Pose-Invariant Race Recognition.”



**Student Name:** Xiang Xu

X. Xu worked on four algorithms. First, he worked with H.A. Le and Y. Wu to develop a new algorithm named ReCAL for reconstructing face model and estimating the pose parameters. In this work, he implemented E2FAR in pytorch for multiple GPUs training and kept adding more components to E2FAR to explore how to reconstruct face model more precisely. In addition, he wrote a program to evaluate the face reconstruction results on UHDB31, BU3D-FE, and AFLW2000. Second, he participated in the face reconstruction challenge in FG 2018. He evaluated E2FAR algorithm using the evaluation dataset provided in the challenge. Third, he trained the 2D face recognition signature generator using the UR2D face recognition preprocessing techniques and DenseNet on original WebFace and achieved 98.42% verification accuracy on the LFW dataset.

**Student Name:** Lingfeng Zhang

L. Zhang worked on creating a hierarchical framework that builds chains of local binary CNN classifiers after the global CNN classifier over all the class labels (LCC-CNN) for improved face recognition.

**TASKS**

Table 3.

ID	Task Title	Status	Associated Deliverables
T.1	Meet with project champion	Complete	D.2
T.2	Benchmark method for matching non-frontal face images in varying resolutions	Complete	D.1; D.2
T.3	Test our prototype software in collaboration with our Champion	Complete	D.1; D.2
T.4	Refine method based on the results of testing	Complete	D.2
T.5	Meet with project champion and write annual report	Complete	D.2

**Task overview**

All above tasks were completed during PY3. The proposed methods were developed on time and evaluated against the set of performance metrics.

**Task T.1**

The Project PI (Dr. Kakadiaris) met with the project champion and members of his staff on several occasions:

- In person, when the PI was in the DC area visiting DHS headquarters, or during professional meetings (e.g., Border Security Expo),
- By videoconferencing, when in person meeting was not feasible.

The meetings were held to (a) present this project's work progress, methodology, and results; (b) explain the concepts of the mission-based model canvas and its role in planning for the project's transition, and (c) obtain guidance on how to perform testing using government-owned data.

Regarding (b), the PI shared with the project champion several documents about the transition strategy for this BTI project:

- Glossary.doc: definitions of the stakeholders and their role in shaping the project and the transition to the Government
- Project-Transition-Meeting-Guidance.doc: Guidance for the project's kickoff meeting with the Champion and BTI Institute team
- Transition-v09.docx: BTI Institute's Transition Strategy
- MOR.doc: a memorandum of record for the project team's interactions with the project champion

Following up on this material, the PI sought the project champion's feedback to develop the mission-based model canvas (customer discovery). The following questionnaire was used to facilitate this process:

1. Who is/are the end user(s) of proposed deliverables? (An end user is not necessarily the project champion or a customer at DHS HQ – it could be an agent on the field)
2. For each user, clearly describe the use case(s) that outline the use of developed deliverable
3. For each use case:
  - a. What are the functional requirements for the proposed deliverable (will it be used as a stand-alone? Does it have to be integrated with other systems? If so, please specify integration requirements.)
  - b. What are the requirements for the development of proposed deliverable as defined by each end-user?
  - c. What improvement in use of the proposed technologies will be necessary for end-user adoption?
  - d. Specify any dependencies that would be required for the end-user to use the developed solution.
  - e. Are any dependencies that would require licensing or purchases for user by end-user?
  - f. Are there alternate technologies/knowledge products that could address the requirements for solving the problem? What are their limitations?

The champion's feedback was helpful in creating the transition strategy. In particular, the champion and his staff highlighted challenges in the current process and potential solutions, focusing on the need for a method that will identify individuals in reasonable time to enable the dispatchers to alert the agents in the field. The methods currently available do not perform well for images where a person's face is only partially visible or have certain limitations in pose or illumination.

## **Task T.2**

**Experiments on the UHDB31 dataset:** The project team chose a configuration to demonstrate that the system was robust to different poses and used this configuration to exclude other variations (e.g., illumination and expressions) and only keep the pose variations.

The project team treated the frontal face images as gallery images, and the remaining images from the other 20 poses as probes, independently. Both the gallery and the probe contained 77 images, each of which belongs to a subject. The face identification experiment was performed using 20 pairs of sigsets.

### **Task T.3**

The project team sought guidance with the project champion as to how the customer could test the developed algorithms using real government-owned data. The problem to overcome was that the government could neither release data to the research team, nor accept the research team's code to perform their own testing. The research team also set up a live software demo during the annual BTI Showcase in Washington, DC, but the Champion was not able to attend. The software developed was also offered to the Champion for testing and evaluation (loaded on a purpose-built laptop), but the sponsor was not able to accept it. As a result, Champion feedback was limited to high-level discussion. While a solution could not be found within the six month period of performance, these discussions informed the PI's proposals for the project's Phase II, which include cloud-based deployment of software.

### **Task T.4**

As a result of testing, the research team made several refinements to its method, with results detailed in their publications.

A novel landmark detector was developed to compensate for the pose and illumination variation. The new landmark detector detected 13 facial key-points more accurately than the other algorithms. Performance testing demonstrated a 44% improvement using the newly developed landmark detector outperforming the state-of-the-art at the time of testing.

The performance of landmark detection algorithms suffers when the facial image is partially occluded or heavily blurred. The project team developed an algorithm for estimating the head pose using few or no landmark annotations to estimate a 3D-to-2D projection matrix simply by observing the input image. The team created the first reinforcement learning-based landmark detector that is able to use facial contours as well as visible landmarks to jointly estimate the 3D-to-2D projection matrix

To improve face recognition performance under challenging pose conditions, the project team developed a 3D model reconstruction method from a single image. To complement this new method, the team developed a new dataset including both 2D and 3D data that would aid the analysis of performance of face recognition algorithms under different conditions. A pose-invariant 3D-aided 2D face recognition system that is robust to pose variations as large as 90 degrees by leveraging deep learning technology was also developed. In addition, a template matching algorithm to improve face recognition performance under large head pose variations was developed.

### **Task T.5**

The project PI met with the project champion and members of his staff on several occasions, as detailed in Task 1.

### **Explanation of any changes from the initially approved work plan**

N/A

### **MILESTONES**

ID	Milestone Description	Status
M.1	Benchmarking of our method in varying resolutions	Complete
M.2	Feedback received during the testing of the prototype software integrated to our face matching software system	Incomplete

**Explanation of why milestones were not reached (if applicable).**

The PI sought guidance from the project Champion as to how the customer could test the developed algorithms using government-owned data. The government could neither release data to the research team, nor accept the research team’s code to perform testing. The software developed was also offered to the Champion for testing and evaluation (loaded on a purpose-built laptop), but the sponsor was not able to accept it.

**PERFORMANCE METRICS**

Table 7. Performance Metrics List

ID	Description	Quantitative Performance Target
P.1	Rank-1 Identification rate for multiple probes with pose variations within $\pm 90^\circ$ and resolution equivalent to inter-pupillary distance of 250-300 pixels	At least 5% improvement over baseline

The system achieved 100% Rank-1 accuracy for all pose variations with a yaw angle of  $30^\circ$  or less, and improved over the baselines by 1-17 percentage points for all  $\pm 60^\circ$  yaw angles (average 6%), and 5-43 percentage points for all  $\pm 90^\circ$  yaw angles (average 21%).

**Performance metrics overview**

Table 8. Performance Assessment

ID	Far from meeting expectations	Close to meeting expectations	Met expectations	Exceeded expectations
P.1		<b>X</b>		

**P.1:**

A comparison with current state-of-the-art face recognition systems indicated that the system achieved 100% Rank-1 accuracy for all pose variations with a yaw angle of  $30^\circ$  or less, and improved over the baselines by 1-17 percentage points for all  $\pm 60^\circ$  yaw angles (average 6%), and 5-43 percentage points for all  $\pm 90^\circ$  yaw angles (average 21%).

## PROJECT DELIVERABLES (OUTPUTS)

Table 9. Deliverables List

ID	Deliverable Name	Type	Status
D.1	Prototype code for facial matching (identification) for multiple probe images with pose $\pm 30^\circ$ and IPD of 250-300 pixels	Software	Complete
D.2	Annual Report detailing the developed methods and results of performance evaluation and testing	Report	Complete

## PUBLICATIONS, CONFERENCE PAPERS & PRESENTATIONS

1. P. Dou and I.A. Kakadiaris, "Multi-view 3D face reconstruction with deep recurrent neural networks", in Proc. IEEE International Joint Conference on Biometrics (IJCB), Denver, CO, 2017, pp. 483-492
2. P. Dou, Y. Wu, S.K. Shah, I.A. Kakadiaris, "[Monocular 3D facial shape reconstruction from a single 2D image with coupled-dictionary learning and sparse coding](#)", Pattern Recognition, 81()515-527
3. P. Dou, S.K. Shah, I.A. Kakadiaris, "[End-to-end 3D face reconstruction with deep neural networks](#)," in Proc. IEEE Conference on Computer Vision and Pattern Recognition (CVPR), Honolulu, HI, 2017, pp. 1503-1512
4. H.A. Le and I.A. Kakadiaris, "UHDB31: A Dataset for Better Understanding Face Recognition across Pose and Illumination Variation", in Proc. IEEE International Conference on Computer Vision Workshops (ICCVW), Venice, Italy, 2017, pp. 2555-2563.
5. M. Leng and I.A. Kakadiaris, "Confidence driven network for point-to-set matching," in Proc. IAPR International Conference on Pattern Recognition, Beijing, China, 2018 (accepted)
6. Y. Wu, S.K. Shah, I.A. Kakadiaris, "Tackling the Optimization and Precision Weakness of Deep Cascaded Regression for Facial Key-Point Localization", Deep Learning in Biometrics, CRC Press, 2018, pp. 85-108
7. Y. Wu, S.K. Shah, I.A. Kakadiaris, "Annotated face model-based alignment: a robust landmark-free pose approach for 3D model registration", Machine Vision and Applications, 29(3)375-391.
8. Y. Wu, S.K. Shah, I.A. Kakadiaris, "[GoDP: Globally Optimized Dual Pathway deep network architecture for facial landmark localization in-the-wild](#)", Image and Vision Computing 73()1-16
9. Y. Wu and I.A. Kakadiaris, "Facial 3D model registration under occlusions with sensiblepoints-based reinforced hypothesis refinement," in Proc. 2017 IEEE International Joint Conference on Biometrics (IJCB), Denver, CO, 2017, pp. 493-502.
10. X. Xu, H.A. Le, P. Dou, Y. Wu, I.A. Kakadiaris, "Evaluation of a 3D-aided pose invariant 2D face recognition system", in Proc. 2017 IEEE International Joint Conference on Biometrics (IJCB), Denver, CO, 2017, pp. 446-455.
11. L. Zhang, P. Dou, I.A. Kakadiaris, "[Patch-based face recognition using a hierarchical multi-label matcher](#)", Image and Vision Computing, 73()28-39
12. L. Zhang and I.A. Kakadiaris, "Local Classifier Chains for Deep Face Recognition," in Proc. International Joint Conference on Biometrics (IJCB), Denver, Colorado, 2017, pp. 158-167

## WEBSITES OR OTHER INTERNET SITES

1. X. Xu, P. Dou, H.A. Le, I. A. Kakadiaris, "When 3D-Aided 2D Face Recognition Meets Deep Learning: An extended UR2D for Pose-Invariant Face Recognition", arXiv preprint arXiv:1709.06532, submitted on Sep 19, 2017
2. L. Zhang, P. Dou, I.A. Kakadiaris, "[A Face Recognition Signature Combining Patch-based Features with Soft Facial Attributes](#)", arXiv preprint arXiv:1803.09359, submitted on March 25, 2018
3. L. Zhang, I.A. Kakadiaris, "[Fully associative patch-based 1-to-n matcher for face recognition](#)", arXiv preprint arXiv:1805.06306, submitted on May 15, 2018
4. L. Zhang, I.A. Kakadiaris, "[A Hierarchical Matcher using Local Classifier Chains](#)", arXiv preprint arXiv:1805.02339, submitted on May 7, 2018

## YouTube

Video of live software demo: [https://www.youtube.com/watch?v=Cjnl0o\\_gy8o](https://www.youtube.com/watch?v=Cjnl0o_gy8o)

## INVENTIONS, PATENT APPLICATIONS and/or LICENSES

None

## STAKEHOLDER ENGAGEMENT

See above

## TRANSITION

The PI worked with DHS S&T BMD and CBP OFO to increase project relevance to CBP OFO and CBP USBP missions resulting in the decision to move the project into Phase II and the effort on Phase II, including work plan development, is scheduled to continue into PY4.

## N.6. A Systematic Process for Vulnerability Assessment of Biometric Systems at Borders

Principal Investigator, Bojan Cukic, University of North Carolina at Charlotte

## PROJECT RELEVANCE TO DHS

This project addresses the overall goal of enhancing the ability to secure and facilitate transnational flows of people. Key questions this project sought to address include:

- What technologies can improve data collection on migrants that will allow officials to identify, track, and individuals while placing minimal data collection burdens on migrants themselves?
- What new or emerging technology advances in change detection and anomaly recognition can provide authorities the ability to anticipate or recognize threats in real time?

## EXECUTIVE SUMMARY

Biometric systems are now prime targets for identity theft, spoofing and vulnerability exploitation in homeland security enterprise. A practical methodology for the risk assessment related to identity breaches in high-consequence biometrics infrastructures does not exist and studies of

concerted efforts to subvert biometric recognition, such as those using artificial materials (gummy fingers, intense face make-up or patterned lenses in eyes) are becoming known once the reports of successful attacks surface in public. This project built upon the existing efforts in biometric liveness detection and security flaw analysis, taking into account DHS biometric collection workflows, and expanded it by hypothesizing attacker’s motivation, required means / costs and required technical competence. The project was designed to create a practical methodology for vulnerability assessment and a definition of countermeasures, social and technical. The project goal was to identify possible gaps and develop a methodology for the deployment of critical new countermeasures. The long-term goal was to introduce change / anomaly detection in biometric identification usage and develop capabilities to identify coordinated identity attacks in real time.

The specific project objectives included investigation of open and dark websites and a comparison the availability of tools, hardware and software required for faking identity and biometric presentation attacks as they may relate to immigration services. In addition, this project involved investigation of the availability, costs, ease of acquisition, effectiveness of application and other metrics related to biometric acquisition manipulation (presentation attacks) and process tampering as related to travelers, immigrants and refugees.

This project highlighted vulnerable processes, devices, operations and activities in the visa processing, border control and vetting processes while analyzing the effectiveness of known countermeasures and their availability in homeland security operations.

The project identified resources and techniques for identity concealment that could be acquired from open and black markets, and open and dark websites. This information allowed updating the risk model with collected metrics, costs and possible experiences related to attack vectors. Taken together, these accomplishments allow risk analysts in Homeland Security Enterprise to identify repeating patterns in human identity attacks and pursue a systematic approach to develop and deploy the most effective countermeasures.

**PROJECT TEAM**

**Personnel (Other than Students)**

**Table 1.** Project Personnel (other than students)

First Name	Last Name	Institution	Role on Project
Bojan	Cukic	University of North Carolina at Charlotte	Principal Investigator
Mohamed	Shehab	University of North Carolina at Charlotte	Co-Principal Investigator
Siddharth	Krishnan	University of North Carolina at Charlotte	Co-Principal Investigator

**Table 2.** Students involved in the project

First Name	Last Name	Institution	Degree Pursued
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Weitong	Yin	University of North Carolina at Charlotte	PhD
Sai Eshwar Prasad	Muppalla	University of North Carolina at Charlotte	MS
Rauf	Usman	University of North Carolina at Charlotte	PhD

**Student Name: Weitong Yin**

Mr. Yin is a PhD student in the Department of Mathematics at the University of North Carolina at Charlotte. He is developing a dissertation proposal related to privacy preservation in predictive analytics. We involved him in the project to study what privacy threats may emerge from the use of biometric identification at US points-of-entry. More specifically, since the project developed real-time capabilities for biometric usage pattern trend analysis (anomaly detection), Mr. Yin’s role was to determine if the use of anonymous features (e.g. match scores) represented a threat for exposing sensitive personal information (medical, travel patterns, etc.). Mr. Yin was funded by this project for approximately three months.

**Student Name: Sai Eshwar Prasad Muppalla**

Mr. Muppalla is a student in the Master of Science program in Computer Science. His research is related to Open and Dark Web search techniques, including crawlers, automated optimization of search terms, and the visualization of search results. He developed automated information search techniques to find information about biometric spoofing and presented that information to an analyst in a succinct form allowing her to select better search terms and improve the precision of search results. Mr. Muppalla was funded by this project for a one semester and significantly contributed to the technical report submitted in June 2018.

**Student Name: Usman Rauf**

Mr. Rauf is a PhD student in the Department of Software and Information Systems at the University of North Carolina at Charlotte. His dissertation work is related to mobile systems and cybersecurity. Part of his expertise includes threat analysis and attack trees. In the context of this project, Mr. Rauf developed a software tool that ingests biometric attack trees, interacts with users to estimate probabilities of events, report the availability of tools to enable the attacks and describe social motivating factors that may incite the attack. Mr. Usman was funded by this project for 1.5 summer months.

**Table 3.** Task List

ID	Task Title	Status	Associated Deliverables
T.1	Meeting with project champion (phone).	Incomplete	<b>N/A</b>
T.2	Create new data management plan to include dark web data, receive approval from UNC Charlotte and BTI.	Complete	<b>D.1</b>
T.3	Selection of dark web browser, search engine and crawler.	Complete	<b>D.1</b>
T.4	Analysis of availability, costs, ease of acquisition of biometric impersonation tools	Complete	<b>D.1, D.3</b>



T.5	Analysis of countermeasures and definition of Attack Countermeasure Trees	Incomplete	<b>D.2</b>
T.6	Update of the Risk model	Incomplete	<b>D.4</b>

**Task overview**

**Task T.1:** Meeting with project champion (via telephone).

The tasks rendered occasional contacts with project champion. Schedule conflicts inhibited maximally productive engagement.

**Task T.2:** Created new data management plan to include dark web data, receive approval from UNC Charlotte and BTI.

The data management plan developed in 2016 was analyzed and deemed to be sufficient for the purposes of the project. The data from Dark Web were obtained through a for-fee service, isolating the project and students from potential liability and adverse content. No additional approvals from BTI and UNCC were necessary.

**Task T.3:** Selection of dark web browser, search engine and crawler.

Crawling Dark Web space has the potential to return results that are not appropriate for viewing by students in an educational setting. The project team resolved the problem by using a service provider, Webhose.io, The provider offers dark web searches as a service. Results are filtered (process called granular filtering) so that inappropriate content is not passed unless explicitly required. This decision simplified task T.2, since we did not need to modify existing Data Management Plan.

Webhose.io returns very large volume of results. Searching for the identity manipulation content in the information returned by the crawler was more complex than we originally anticipated. Technical solutions have been under investigation in Task T4.

**Task T.4:** Analysis of availability, costs, ease of acquisition of biometric impersonation tools

The technical report provided an overview of the search techniques developed and the results acquired related to the presence of “know-how” information that may assist in identity spoofing at US ports of entry. The methods that to perform interactive query expansion focused on illicit activities, such as falsifying biometrics, obtaining or forging identity documents to enter the country. Figure 1 gives an overview of the methodology to expand the list of query words. This process consists of the following steps:

1. Build a vocabulary of queries from human knowledge.
2. Query open and dark web from the given input queries to collect a set of webpages.
3. Preprocess the webpage text and extract features of cleaned words.
4. Create k clusters from the results.
5. Visualize the data with k word clouds.
6. Let the user pick more relevant key words from word clouds and k clusters.
7. Repeat until the results are satisfactory.

These steps and the results are described in detail in the deliverable D.1.

### Task T.5: Analysis of countermeasures and definition of Attack Countermeasure Trees

Not completed.

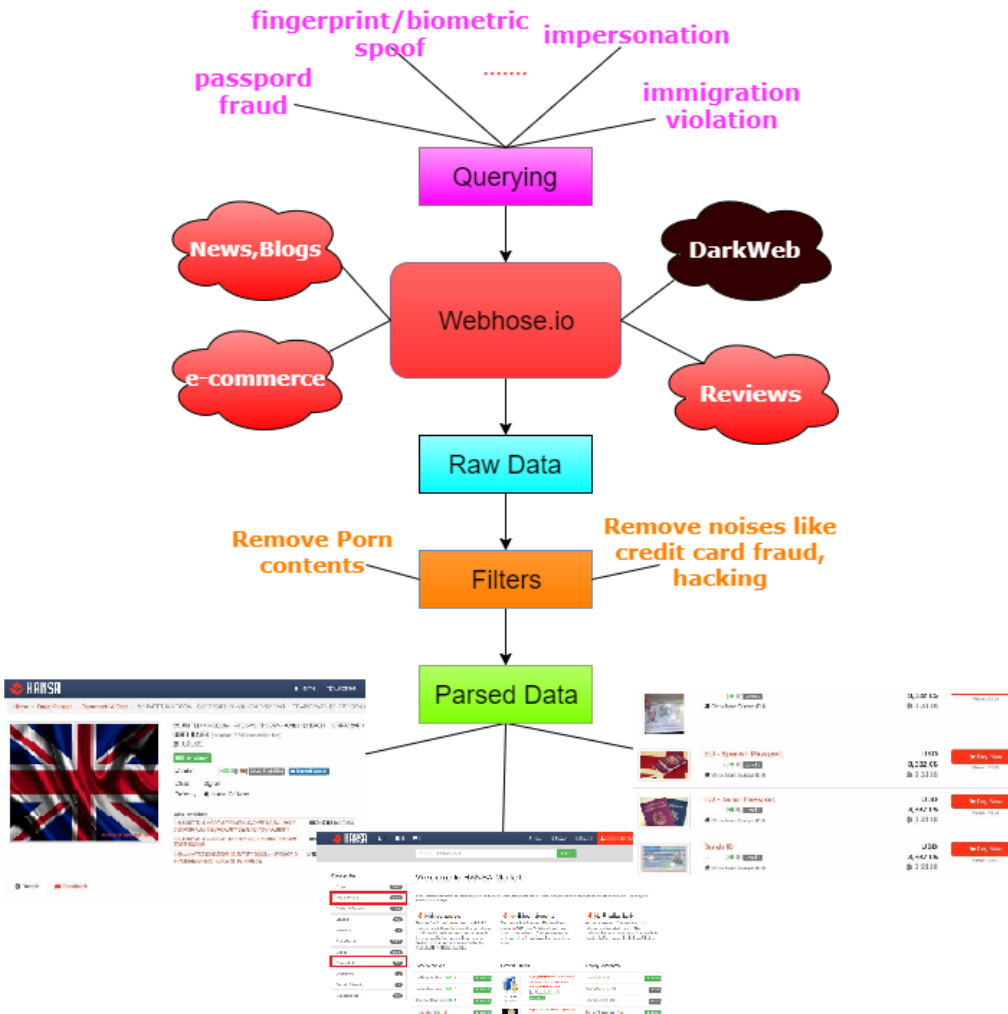


Figure 1: Data Crawling Overview

### Task T.6: Update of the Risk model

Not completed.

#### Explanation of any changes from the initially approved work plan (if applicable)

Delays in the set-up of Dark-Web search tools and techniques occurred. Task T.3 was completed with 2 months of delay. Subsequently, Task T.4 was completed in May 2017. Task T.5 was initiated in May, while software tools from Task T.6 were under development. In July 2018, the project did not receive approval for the no-cost extension.

#### MILESTONES

**Table 4.** Milestone List

ID	Milestone Description	Status
M.1	Updated data management plan approved	Incomplete
M.2	Completed analysis of dark web	Complete
M.3	Definition of Attack Countermeasure Trees for travelers, immigration and refugee management.	Incomplete
M.4	Completed risk modeling for attack vectors in day-to-day operations of traveler, immigration and refugee identity management systems.	Incomplete

**Explanation of why milestones were not reached (if applicable).**

The delays in set-up of Dark-Web search tools and techniques propagated into other tasks. The volume of data returned by Dark Web crawlers impeded the ability to search for specific identify manipulation information. Therefore, milestone M.2 was completed in May 2017 instead of January. The work on milestone M3 initiated in May 2018, but was interrupted at the end of the fiscal year (30 June 2018). The attack tree was not developed in the performance year due to a delay caused by a technical challenge created from the immense amount of data returned by dark web searches.

**PERFORMANCE METRICS****Table 5.** Performance Metrics List

ID	Description	Quantitative Performance Target
P.1	Identify biometric identity fraud tools for presumed perpetrator's for each of the following three DHS operational domains: a. traveler operations b. immigration services c. refugee management	At least one biometric identity fraud scenario (attack vector) for each of the three DHS operational domains.
P.2	Identify countermeasures (if any) for each attack vector identified in the previous task.	Identify at least one countermeasure in each of the three DHS operational domains: a. traveler operations b. immigration services c. refugee management
P.3	Establish risk mitigation for each attack vector identified in the previous task.	Identify at least one attack vector with High or Medium probability of occurrence in each of the three DHS operational domains.

**Performance metrics overview****Table 6.** Performance Assessment

ID	Status	Far from meeting expectations	Close to meeting expectations	Met expectations	Exceeded expectations
P.1	Complete			X	
P.2	Incomplete		X		
P.3	Incomplete	X			

The delays in set-up of Dark-Web search tools and techniques propagated into other tasks. Therefore, milestone Performance metric P.1 was completed in May 2017 instead of January. The work on milestone P.2 was initiated in May 2018, but was interrupted at the end of the fiscal year (30 June 2018). The work on P.3 was not initiated.

### PROJECT DELIVERABLES (OUTPUTS)

**Table 7.** Deliverables List

ID	Deliverable Name	Type	Status
D.1	Technical report: A inventory of dark web marketplace for identity misrepresentation	Report	Complete
D.2	Technical Report: Attack Countermeasure Trees for travelers, immigration and refugee management.	Report	Incomplete
D.3	Conference Paper submission: Cost and ease of acquisition of biometric impersonation tools.	Publication	Incomplete
D.4	Final Report: Attack risk management in traveler, immigration and refugee identity management.	Report	Incomplete

Deliverables 2 through 4 were not completed on the original timeline due to the delay discussed entailing the massive amount of information returned by the Dark Web crawlers. As a result of this delay, and in conjunction with the termination of the project, deliverables 2-4 were not completed.

### PUBLICATIONS, CONFERENCE PAPERS & PRESENTATIONS

E. Marasco, P Wild, B Cukic, Robust and interoperable fingerprint spoof detection via convolutional neural networks, 2016 IEEE International Symposium on Technologies for Homeland Security (HST), pp. 1-6.

E. Marasco, M. Shehab, B Cukic, A methodology for prevention of biometric presentation attacks, 2016 IEEE Latin American Dependable Computing Conference, pp. 9-14.

E. Marasco, B. Cukic, M. Shehab, U. Rauf, Attack trees for preventing biometric systems against evolving presentation attacks, 2017 IEEE International Symposium on Technologies for Homeland Security (HST), pp. 1-6.

#### **WEBSITES OR OTHER INTERNET SITES**

None

#### **INVENTIONS, PATENT APPLICATIONS and/or LICENSES**

None

#### **STAKEHOLDER ENGAGEMENT**

See above

#### **TRANSITION**

None

### **N.7. Modeling Methodology and Simulation of Port-of-Entry Systems**

Principal Investigator, Benjamin Melamed, Rutgers University

#### **PROJECT RELEVANCE TO DHS**

This project addresses the overall goal of enhancing the ability to secure and facilitate transnational flows of people and goods. A key question this project sought to address is:

- How can we measure, assess, and predict the impact of technology on the facilitation of legitimate trade and travel?

#### **EXECUTIVE SUMMARY**

Rapid, sustained and secure flows of people and freight through a Port-of-Entry (POE) are essential to the U.S. economy. Excessive POE delays translate into a variety of burdens and costs, including personal inconvenience to travelers in terms of time and missed connections, increased supply chain lead times and their attendant disruptive effects and high costs, and an elevated transportation carbon footprint resulting in environmental and public health consequences. The U.S. Customs and Border Protection (CBP) agency is the nation's largest law enforcement agency, responsible for securing U.S. borders while facilitating lawful travel and trade across its POEs. As such, CBP plays a key role in supporting the nation's physical and economic security. CBP needs to find efficient and cost effective solutions to the problem of managing traffic across POEs and overseeing their evolution commensurate with fluctuating traffic levels. To this end, this project provides decision support tools in the form of a suite of detailed, accurate and easy-to-use simulations of POEs.

Currently, operating decisions concerning POE management are made in an *ad hoc* manner, based primarily on simplified models and observed traffic conditions. However, CBP needs detailed simulation models of POEs that permit flexible experimentation and provide decision support, primarily for planning of POE evolution. Typical applications include longer-term planning

of POE facilities, e.g., adding lanes, stacking booths by adding an additional officer in a booth, and experimenting with new trusted traveler programs that speed up inspection. Furthermore, stakeholders need to study “what-if” questions concerning POE performance in the wake of adverse hypothetical events that disrupt traffic flows, such as a major accident, natural disaster, terrorist incident, etc., which require managing temporary congestion resulting from reduced inspection capacity and/or surges of flows across POEs. Such emergency management issues should also be of interest to FEMA.

This project’s goal was to enhance CBP’s POE operations so as to facilitate transactional flows of people and goods in a cost-effective manner. Accordingly, its objective was to provide modeling-based decision support for managing POE resources and POE evolution, dubbed *POE Simulation System (POESS)*. For each POE modeled, this project’s deliverables included the following (1) an AnyLogic simulation program as well as the corresponding java apps; (2) a default input file; (3) a comprehensive user guide; (4) a design and requirement document; (5) a model validation document; and (6) a usability and user satisfaction, based on a user survey. Software and modeling support (bug fixes and guidance) were provided by the project throughout its duration, and tutorial sessions were held upon request.

The project’s key accomplishments for PY3 were as follows:

- Two design documents have been written to guide the POESS implementation process: (1) a technical report on modeling methodology and requirements; and (2) a technical report on model parametrization.
- A detailed simulation model of the Bridge of the Americas (BOTA) POE at El Paso, Texas, has been completed, tested, verified and delivered to our primary champion and her end-user group.
- A detailed simulation model of the Peace Arch (PA) POE at Blaine, Washington, has been completed, tested, verified and delivered to our primary champion and her end-user group.

Each simulation model implementation includes the following: (1) the POE layout, superimposed on a geographic map of the POE and its incoming and outgoing roads from Mexico to the U.S.; (2) the POE Privately-Owned Vehicles (POV) and Commercially-Owned Vehicles (COV) POE facilities and operations; (3) traffic animation (motion of vehicles on the geographic map); (4) a suite of key simulation output statistics (including various vehicle waiting times, inspection utilization, driver cost of waiting in the POE); (5) a default input file (which users can modify), an output file of simulation statistics; (6) a disruption feature allowing the user to place obstructions in a POE and its nearest approach road segment so the resultant traffic congestion can be studied by simulation; (7) a graphical user interface for initializing the simulation model, changing its parameters dynamically, and launching simulation runs in both animation mode and batch mode (running multiple simulation replications with animation turned off for faster execution, and collecting summary statistics of the replications); (8) statistics animation (showing their dynamic evolution over time); (9) and dumping trace files of vehicle histories in the POE for later data mining.

A detailed user guide has been written for each simulation model and a video describing the project has been produced to inform stakeholders and others.

## **PROJECT TEAM**

### **Personnel (Other than Students)**

**Table 1.** Project Personnel (other than students)

First Name	Last Name	Institution	Role on Project
Benjamin	Melamed	Rutgers University	PI
Weiwei	Chen	Rutgers University	co-PI

**Table 2.** Students involved in the project

First Name	Last Name	Institution	Degree Pursued
Mingfei	Teng	Rutgers University	PhD

**Student Name** Mingfei Teng

The project has employed one fully funded (tuition plus stipend) graduate student, Mr. Mingfei Teng, from the Department of Management Science and Information Systems at the Rutgers Business School—Newark and New Brunswick. Mr. Teng has two roles in the project: first, to assist in designing the simulation software; and second, to code the simulation model implementation in the Java-based platform of AnyLogic. Mr. Teng is a proficient Java programmer and has done a good job in the ongoing development of the simulation models. The experience gained in Mr. Teng’s hands-on activities of design and implementation of Monte Carlo simulation models is an excellent educational preparation for working in the simulation area, which extends beyond the specific POE domain of this project. Specifically, his project work is a major enterprise involving both modeling complex systems and implementing such models in a simulation platform. In addition, the PI’s and co-PI’s extensive interactions with Mr. Teng is a valuable learning and training experience for him, received from simulation experts. Mr. Teng is also learning to write technical papers (see Section H.1). Mr. Teng is currently in the preliminary stage of identifying a research area for his thesis, and the experience gained in the project would benefit him greatly, should he choose a simulation-related research topic.

**TASKS****Table 3.** Task List

ID	Task Title	Status	Associated Deliverables
T.1	Validate the simulation model of the Bridge of the Americas (BOTA) POE	Complete	D.1
T.2	Meet project champion (by phone/skype or in person)	Complete	
T.3	Write user manual for BOTA and deliver the BOTA simulation to CBP	Complete	D.2

T.4	Perform usability assessment of POESS for BOTA	Complete	D.3
T.5	Develop a detailed prototype simulation model design, including structure, user interface and other features of the Peace Arch POE	Complete	D.4, D.5
T.6	Meet project champion (by phone/skype or in person)	Complete	
T.7	Code the design and produce the prototype simulation model program of the Peace Arch POE	Complete	The PA POE delivery was planned for next period, but achieved in this period.
T.8	Meet project champion (by phone/skype or in person)	Complete	
T.9	Verify the simulation model of the Peace Arch POE	Complete	D.6 (this document)
T.10	Meet project champion (by phone/skype or in person)	Complete	

**Task overview**

**Task T.1:**

The BOTA model was validated with respect to selected waiting time averages. More specifically, model predictions were compared to historical data and found to be within the requisite maximal deviation of 10%, and their monotonicity properties were verified as well. A detailed description of this task appears in a model validation document, which was uploaded to a HSUP site as the Technical Report document Melamed et al. (2017a).

**Task T.2, T.6, T8 and T.10:**

Our primary champion and his analyst group at CBP-OFO constitute the bulk of users of POESS. In order to ensure that POESS covers all their needs, we conducted numerous meetings with them, including in-person meetings in Washington DC to demo the POESS prototype and obtain feedback, and numerous teleconference to obtain information from this group. In addition, we conducted a site visit with our primary champion at the Bridge of the Americas (BOTA) POE and the Peace Arch (PA) POE. Due to the complexity of the simulation models created by this project, it was necessary to communicate extensively with our stakeholders.

**Task T.3:**

A comprehensive user guide was written for the BOTA POE and uploaded to a HSUP site as the document Melamed and Chen (2017).

**Task T.4:**

This task consisted of distributing the BOTA POE simulation model and its user guide to our primary champion and his analyst group at CBP-OFO. Following a tutorial to train the users, an online survey was distributed to the user group to gauge the simulation model’s usability and user



satisfaction. The results showed a higher satisfaction level than the requisite level. A detailed description of this task appears in a model usability document, which was uploaded to a HSUP site as the Technical Report document Melamed et al. (2017b).

#### **Task T.5:**

This task produced a design of the PA POE simulation model, which reused and modified the BOTA model's design elements. It involved close collaboration with our primary champion and his analyst group at CBP-OFO via multiple meetings as described in the tasks above. The design included the simulation layout, facilities, traffic, statistics, input and output files, and an extensive easy-to-use graphical user interface; see Task T.7 for more details. The key elements of this task are reviewed below.

The broad problem tackled in this proposal is how to create POESS as a suite of high fidelity POE simulation models so as to generate good estimates of performance metrics (in terms of traffic throughput, various wait time, inspection personnel utilization, and the monetary value of waiting times in a POE). The models will then be validated against empirical measurements, to be carried out in the respective POE under study. To this end, the POESS design uses Monte Carlo simulation modeling [Bratley et al. (1987), Law and Kelton (1991), Altioik and Melamed (2007)] to capture all salient features of a POE's structure and operations, as well as the attendant traffic patterns. Each simulation model will produce statistical estimates related to the aforementioned performance aspects in terms of distributions, means, variances, etc. Furthermore, each simulation model will also depict an animation of simulation runs, showing both the movement of vehicles on roads set in geographic maps of the POE area and approach/exit roads.

The simulation methodology has three key paradigms:

- (1) System dynamics studies the dynamic behavior of systems whose state evolution is governed differential equations combined with flow diagrams, feedback loops and time delays;
- (2) Discrete-event simulation models a system from a process/activity perspective, where the system evolves via a sequence of discrete states and their transitions over time; and
- (3) Agent-based simulation is a more recent modeling approach, capable of capturing interactions of entity populations (so-called agents) whose behavior is determined by their internal dynamics, captured by system dynamics or discrete-event modeling.

POESS models calls for a combination of two modeling paradigms. More specifically, simulated POE traffic streams will be modeled using the agent-based paradigm (capturing traffic flows of interacting vehicles and/or pedestrians), with traffic generation carried out by time-dependent stochastic processes and lane changing modeled by agent logic, while POE operations will be modeled by the discrete-event paradigm (capturing inspection operations).

POESS interacts with three sets of external files, for reading inputs, writing output statistics, and dumping vehicle trace data. An Excel input file specifies all simulation parameters (e.g., simulation start and end time, incoming traffic rates, service rates at inspection booth, etc.) which are used to construct the simulation model and initialize its state. An Excel output file records the statistics collected by the simulation. In addition, CSV trace files record a trace for each vehicle passing through the system as a sequence timestamps of visits to specific locations (e.g., arrival point to the system, inspection booth, secondary inspection if applicable, and departure point from

the system). The vehicle trace data allows analysts to perform data analysis on simulation histories.

POESS is designed as an in-vitro simulation lab that supports flexible modeling and experimentation. Accordingly, while the input and output files are static model files, POESS models will further have a graphic user interface (GUI), which serves as a dynamic editor to change POE model parameters and display evolving statistics in the course of a POESS animated simulation run. This capability enhances the user's ability to experiment with POE configurations, offered traffic loads and inspection capacities in order to answer "what-if" questions.

An important feature of POESS models is the ability of users to create, turn on, and turn off physical obstructions in a POE model. These capture traffic disruptions due to various adverse events, such as accidents, car fires, etc. The analyst can then gauge the resultant congestion and the dynamics of deteriorating performance measures (mainly waiting times). These capabilities would be useful for Port Directors, and should further render the simulation models of interest to preparedness and response organizations in HSE (e.g., FEMA), in addition to CBP.

POESS is constructed over a modern simulation platform with advanced modeling and programming features, called AnyLogic. It affords an organic integration of three modeling paradigms: system dynamics, discrete-event simulation, and agent-based simulation. Another key advantage of AnyLogic is that model programming combines visual facilities for creating model objects, and Java programming for specifying object behavior. A key advantage of simulation modeling as compared to analytical modeling is the ability to model complex system and illustrate its evolution visually via a set of simulated scenarios. AnyLogic offers a rich set of graphical tools, a debugger, visual and textual model construction, animated simulation runs and dynamic statistics in 2D and 3D views of the system. It also allows the analyst to create a rich GUI using various controls (e.g., drop-down lists, sliders, buttons), data visualization tools (e.g., statistical charts and plots), and 3D visual elements (e.g., cameras and lights). A model developed in AnyLogic is mapped into Java code. AnyLogic facilities and services mitigate the complexity of creating large and intricate models. In addition, as AnyLogic is itself implemented in Java, its models can be readily published as Java applications. The use of AnyLogic has been approved by CBP.

A detailed description of this task appears in a model design and parameterization document, which was uploaded to a HSUP site as the Technical Report document Melamed et al. (2018b).

#### **Task T.7:**

This task is the core task of the project. It coded the design of Task T.5, including the following components: (1) the PA POE's layout superimposed on a geographic map of the POE and its incoming and outgoing roads from Mexico to the U.S.; (2) PA's Privately-Owned Vehicles (POV) facilities and operations; (3) traffic animation (motion of vehicles on a space-constrained geographic map); (4) a suite of key simulation output statistics (including various vehicle waiting times, inspection utilization, driver cost of waiting in the POE); (5) PA model's default input file (which users can modify) and output file of simulation statistics; (6) a disruption feature allowing the user to place obstructions in a POE and its nearest approach road segment so the resultant traffic congestion can be studied by simulation; (7) a user interface for initializing a PA POE simulation, launching simulation runs in both animation mode and batch mode (running multiple simulation replications with animation turned off for faster execution, and collecting summary

statistics of the replications), and changing its parameters dynamically (while the simulation is running in animation mode); (8) statistics animation (showing their dynamic evolution over time); (9) and dumping trace files of vehicle histories in the PA POE for later data mining.

A comprehensive user guide was written for the PA POE and uploaded to a HSUP site as the document Melamed and Chen (2018).

**Task T.9:**

This task verified that the code written captures the intended design. It involves a code review by the project team, which also ensures that the code has adequate comments.

Although not included in this task, the following activities were also carried out to complete the PA simulation model:

- The PA model was validated similarly to the validation of the BOTA model (see Task T.1). A detailed description of this validation activity appears in a model validation document, which was uploaded to a HSUP site as the Technical Report document Melamed et al. (2018b).
- The user satisfaction and usability of the PA simulation model were gauged similarly to that of the BOTA model (see Task T.4). A detailed description of this activity appears in a model usability document, which was uploaded to a HSUP site as the Technical Report document Melamed et al. (2018c).

**Explanation of any changes from the initially approved work plan (if applicable)**

None. The project was actually a few weeks ahead of schedule, which allowed us to complete the PA simulation model originally scheduled for early in the next period.

**MILESTONES**

**Table 4.** Milestone List

ID	Milestone Description	Status
M.1	Completion of simulation model validation and tests of the Bridge of the Americas (BOTA) POE	Complete Verified by deliverables D.1 and D.2
M.2	Completion of usability assessment of POESS for BOTA, thereby completing the BOTA project	Complete Verified by deliverable D.3
M.3	Completion of model information gathering and data collected of the Peace Arch POE	Complete Verified by deliverables D.4
M.4	Completion of data models identification and preliminary parameterization of the Peace Arch POE	Complete Verified by deliverable D.5
M.5	Completion of prototype model design and coding of the Peace Arch POE	Complete Verified by uploading the POESS model of PA POE and associated documents to the secure HSUP server

**Explanation of why milestones were not reached (if applicable).**

All milestones were reached.

**PERFORMANCE METRICS**

**Table 5.** Performance Metrics List

ID	Description	Quantitative Performance Target
P.1	Usability metric of the simulation program’s user interface. We will recruit up to 15 but not less than 10 potential users who will run the software in one session. They will then fill out the usability questionnaire (on a Likert scale of 1-7) in (Lund, 2001).	Average satisfaction rate > 75% through a test-retest process.
P.2	POE crossing time response curve to a range of increasing traffic congestion for sets of fixed service resources	Monotonically increasing response curve
P.3	POE crossing time response curve to a range of increasing service resources for sets of fixed traffic congestions	Monotonically decreasing response curve

**Performance metrics overview**

**Table 6.** Performance Assessment

ID	Status	Far from meeting expectations	Close to meeting expectations	Met expectations	Exceeded expectations
P.1	Complete				X
P.2	Complete			X	
P.3	Complete			X	

**P.1:**

This performance metric was used to gauge the usability and user satisfaction of both the BOTA and PA POEs. To this end, each simulation model and its user guide were distributed to our primary champion and his/her analyst group at CBP-OFO. Following a tutorial to train the users, an online survey was distributed to the user group. The results for both POEs showed a higher satisfaction level than the requisite level of 75%. A detailed description of the BOTA model survey appears in Melamed et al. (2017b), and for the PA model survey in Melamed et al. (2018c).

**P.2, P.3:**

These metrics were used as part of the verification testing both the BOTA and PA POEs. Both simulation models exhibited the requisite monotonicity of average waiting times. A detailed description of the BOTA model verification appears in Melamed et al. (2017a), and for the PA model verification in Melamed et al. (2018b).

## PROJECT DELIVERABLES (OUTPUTS)

**Table 7.** Deliverables List

ID	Deliverable Name	Type	Status
D.1	Delivery of the simulation program of the BOTA POE in the public archive FIGSHARE (changed to the HSUP secure server)	Software	Complete
D.2	User manual of the simulation model of the BOTA POE	Report	Complete
D.3	Report on the usability assessment of the POESS BOTA model	Report	Complete
D.4	Technical report of model description of the Peace Arch POE	Report	Complete
D.5	Technical report describing the parameterized models of traffic and service processes for the Peace Arch POE	Report	Complete
D.6	Annual report, to be delivered to BTI, primary project champion, and archived on the HSUP server. Elements of this project will be targeted for publication in peer-reviewed journals and presentation in peer-reviewed conferences.	Report	Complete

## PUBLICATIONS, CONFERENCE PAPERS & PRESENTATIONS

- Chen, W., Melamed B., Teng M. and Canaday C. (2017) “Modeling and Simulation of Port-Of-Entry Systems”, *Proceedings of the 2017 Winter Simulation Conference* (W. K. V. Chan, A. D'Ambrogio, G. Zacharewicz, N. Mustafee, G. Wainer, and E. Page, eds.), December 3-6, 2017, Las Vegas, NV.

**WEBSITES OR OTHER INTERNET SITES:** Project video clip: This video clip (about 7 minutes) describes the problem of keeping waiting times at a port-of-entry (POE) as short as possible, faced by CBP. It then proceeds to describe key features of the POE Simulation System (POESS) that is being developed at Rutgers University under the project “Modeling

Methodology and Simulation of Port-of-Entry Systems”, as a decision support system for POE planning. Available at <https://youtu.be/GzX1n3XND54>

## **INVENTIONS, PATENT APPLICATIONS and/or LICENSES**

A Notice of Software Development (NOS) for the POESS software has been filed with the Rutgers University Office of Research and Economic Development as disclosure of POESS.

Subsequently, the Rutgers Office of Research and Economic Development, which issued a copyright assignment agreement on 1-17-2018 for a work entitled “*Port-of-Entry Simulation System (POESS)*” (RU Ref. No. 2018-046).

## **STAKEHOLDER ENGAGEMENT**

Due to the complexity of the simulation models created by this project, it was necessary to communicate extensively with our stakeholders to conduct and successfully complete this project. Our primary champion and his analyst group at CBP-OFO represented the primary users of POESS. In order to ensure that POESS covered all their needs, we conducted numerous meetings with them, including in-person meetings in Washington DC to demo the POESS prototype and obtain feedback, and numerous teleconference to obtain information from this group. In addition, we conducted a site visit with our primary champion at the Bridge of the Americas (BOTA) POE and the Peace Arch (PA) POE.

## **TRANSITION**

This project resulted in the transition of a simulation program and user manual to the Project Champion and HSUP. The information was submitted to the Project Champion through a Work Group on the HSUP website. The process used to develop the POESS simulation program can be replicated at any POE to produce an equivalent deliverable specifically tailored to each unique operating environment.

## **N.8. Modeling International Migrant Flows: Theory, Evidence and Forecasts**

Principal Investigator, David Leblang, University of Virginia

### **PROJECT RELEVANCE TO DHS**

This project addresses the overall goal of enhancing the ability to secure and facilitate transnational flows of people by promoting prevention and deterrence in addition to developing an understanding of the push and pull factors affecting transnational flows. A key question this project sought to address is:

- How can we accurately predict the future magnitude of immigration flows to the U.S.?

### **EXECUTIVE SUMMARY**

The project was planned as a two-year effort to “operationalize” existing knowledge for illegal migration and enable CBP to routinely assess the risk of future (illegal) flows from Latin American countries into the United States while also making the knowledge available to the general public. The project sought to identify qualitative illegal immigration drivers (i.e. push and pull factors) for Latin American countries with high-levels of illegal immigration flows into the United States and

compare/contrast them with conditions in Latin American countries with lower-levels of illegal immigration flows into the United States. In addition, the project facilitated the identification of data sources that provided quantitative metrics for the qualitative illegal immigration drivers (for Latin American countries to the United States), provided a means to gather the data and create a database. Using this database, an analysis model was developed for translating data from quantitative metrics into a risk analysis for illegal migration for Latin American countries to the United States to include leading indicators and confidence intervals. A graphical user interface (GUI) to the database was planned to provide CBP users the ability to investigate the risk analysis for illegal migration from Latin American countries to the United States (which are based by the analysis model developed) to include “what if” scenarios. The culmination of project activities was publication of a peer-reviewed manuscript detailing the drivers, data sources, and analysis model used to quantify illegal migration from Latin American countries to the United States.

The project goal was to build a publicly available database housed at the University of Virginia (with copies at the ICPSR) and conforming to the Open Science Framework to be accessible through both a dedicated web address and via the University’s Library and UVA’s Frank Batten for Leadership and Public Affairs website. It was anticipated that a major benefit from the web-based user interface would be to provide CBP and other authorized users the ability to investigate risk assessments of illegal migration flow from Latin American countries to the United States along with ability to conduct “what-if” scenarios.

There were differences of expectations for the project between the Project Champion who had created the topic (based on CBP customer priority requirements) and the Principal Investigator. These differences persisted throughout the project and resulted in its early termination on 7 May 2018. Early termination of the project prevented the PI from completing the proposed set of deliverables.

## PROJECT TEAM

### Personnel (Other than Students)

**Table 1.** Project Personnel (other than students)

First Name	Last Name	Institution	Role on Project
David	Leblang	UVA	Principal Investigator
Melissa	Henriksen	UVA	Project Manager
Abhiraj	Deshpande	UVA	Full Stack Developer
Mahesh	Rao	UVA	Software Developer

**Table 2.** Students involved in the project

First Name	Last Name	Institution	Degree Pursued
Ben	Helms	UVA	PhD
Kelsey	Hunt	UVA	MPP

Rebecca	Brough	UVA	Undergrad
Alexa	Iadarola	UVA	Undergrad
Sam	Morales	UVA	Undergrad
Ankita	Satpathy	UVA	Undergrad
Eric	Xu	UVA	Undergrad

**Student Name:** Ben Helms

Student was involved in data collection, data cleaning, statistical analysis, writing up of empirical results, development of background research, formulating hypotheses, and development of the academic papers.

**Student Name:** Kelsey Hunt

Student was involved in data collection, data cleaning, statistical analysis, writing up of empirical results, development of background research, formulating hypotheses, and development of the academic papers.

**Student Name:** Rebecca Brough

Student was involved in data collection, data cleaning, statistical analysis, writing up of empirical results, development of background research, formulating hypotheses, and development of the academic papers.

**Student Name:** Alexa Iadarola

Student was involved in data collection, data cleaning, statistical analysis, writing up of empirical results, development of background research, formulating hypotheses, and development of the academic papers.

**Student Name:** Sam Morales

Student was involved in data collection, data cleaning, statistical analysis, writing up of empirical results, development of background research, formulating hypotheses, and development of the academic papers.

**Student Name:** Ankita Satpathy

Student was involved in data collection, data cleaning, statistical analysis, writing up of empirical results, development of background research, formulating hypotheses, and development of the academic papers.

**Student Name:** Eric Xu

Student was involved in data collection, data cleaning, statistical analysis, writing up of empirical results, development of background research, formulating hypotheses, and development of the academic papers.

**TASKS**



Tasks that were included in the approved revised work plan for the period 1 January 2018 to 30 June 2018, and their status.

**Table 3. Task List**

ID	Task Title	Status	Associated Deliverables
T.1	Kick off Meeting with Project Champion (PC)	Complete	
T.2	Present at BTI Institute Performers Meeting in Washington Dec	Complete	
T.3	Engage DHS end user to collect GUI requirements.	Complete	D.2 Graphical User Interface for Database made available to authorized users via the internet
T.4	Monthly meeting with PC	Complete	
T.5	Monthly meeting with PC	Canceled by Project Champion Month 8 (Apr18)	
T.6	ID Variables for Illegal Immigration	Incomplete  (Never produced list of variables validated by the Project Champion)	D.1 Database: push/pull factors for Illegal Immigration
	ID Primary Sources for Illegal Immigration		
T.7	Monthly meeting with PC	Requested of Project Champion Month 9 (May18)	
T.8	Monthly meeting with PC	Project terminated May 7 Month 10 (June 18)	

T.9	ID Novel Open Source Data Sets for Illegal Immigration	Incomplete (Never produced list of novel open source data sets validated by the Project Champion)	D.1 Database: push/pull factors for Illegal Immigration
T.10	<del>Unauthorized Population Estimation by country of origin</del>	Task eliminated by Project Champion	
	Monthly meeting with PC		
T.11	Prep Pilot Version of GUI	Incomplete (Never produced Pilot Version GUI validated by the Project Champion)	D.2 Graphical User Interface for Database made available to authorized users via the internet
	Monthly meeting with PC		
T.12	Database Build First Round	Incomplete (Never produced database validated by the Project Champion)	D.1 Database: push/pull factors for Illegal Immigration

### E.1. Task overview

T.1 Kick off Meeting with Project Champion (PC). Initial meeting was scheduled and conducted in Sept 2017 however a common understanding for executing the work plan was not established between the Principal Investigator and Project Champion. Project placed on hold in December 2017. Project was updated and restarted in Jan 2018 with an updated work plan.

T.2 Present at BTI Institute Performers Meeting in Washington. PI, PM and Graduate Student attended. PI presented research in a talk. Graduate Student presented poster.

T.3 Engage DHS end user to collect GUI requirements. PC created and provided a mock-up of the desired GUI. GUI developers began design of a dashboard GUI appropriate for this database.

T.4 Monthly meeting with PC (March 2018). This meeting was meant as a status check for progress being made by UVA and opportunity for feedback to ensure project was focused to produce deliverables which met CBP priority requirements.

T.5 Monthly meeting with PC: (April 2018). Meeting materials were providing in lieu of holding a meeting at a given time during the month of April 2018

T.6 ID Novel Open Source Data Sets for Illegal Immigration. Identification of novel open source data sets for illegal immigration were not reported out in the April 2018 status report or any prior report.

T.7 ID Variables for Illegal Immigration. Identification of some variables for illegal immigration were reported out in the April 2018 status report but the variables were not validated by the PC as being the complete set needed to model illegal immigration behavior prior to termination of the project on May 7, 2018.

T.8 Monthly meeting with PC: PC (May 2018). No meeting due to termination of the project on May 7, 2018.

T.9 Monthly meeting with PC: PC (May 2018). No meeting due to termination of the project on May 7, 2018.

T.10 ID Novel Open Source Data Sets for Illegal Immigration Identification of novel open source data sets for illegal immigration were not reported out in the April 2018 status report or any prior report.

T.11 Unauthorized Population Estimation by country of origin. An estimation of unauthorized population by country of origin was not produced prior to termination of the project on May 7, 2018.

T.12 Prep Pilot Version of GUI. A slide for the proposed GUI implementation was provided by UVA in the April 2018 Monthly Meeting slides. The proposed GUI implementation diverged drastically from the mock-up provided by the PC for needed interface to provide decision support for the CBP customer.

T.13 Database Build First Round. The database was still being working on as of the April 2018 monthly meeting status report and was not provided to the PC prior to project termination on 7 May 2018.

#### **Explanation of any changes from the initially approved work plan (if applicable)**

As noted in previous sections, an approved work plan was not generated until January 2018 which included modifications to the work plan submitted during the proposal process. The modifications clarified wording in the initial proposed work plan to ensure the project addressed CBP customer priority requirements and delivered a solution which enabled decision support. The project was discontinued on 7 May 2018 prior to the completion of the remaining tasks.

In addition, the PI formally requested on 4 December 2017 a change in Project Champion (PC) from DHS S&T to DHS Policy. The PC was selected because S&T wrote the research questions in which the PI's proposal was reviewed and selected, which were based on primary user needs. The PI's request was denied because the PI's work plan directly supported the overall research program of S&T on behalf of multiple DHS component's knowledge gaps, including DHS Policy.

## **MILESTONES**

Since the first milestone (final version of the database completed) was scheduled for completion by month 14 of the project no milestones were completed prior to project termination.

**F.1. Explanation of why milestones were not reached (if applicable).** See explanation under Tasks above.

## **PERFORMANCE METRICS**

Performance metrics were to be achieved by project months 14 (P.1) and 22 (P.2).

## **PROJECT DELIVERABLES (OUTPUTS)**

Deliverables were to be complete by project months 14 (D.1) and 22 (D.2-D.5).

## **PUBLICATIONS, CONFERENCE PAPERS & PRESENTATIONS**

“Temporary Protected Status and Immigration to the United States,” Under review. Working paper available at [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3206009](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3206009)

## **WEBSITES OR OTHER INTERNET SITES**

N/A

## **INVENTIONS, PATENT APPLICATIONS and/or LICENSES**

N/A

## **STAKEHOLDER ENGAGEMENT**

See above

## **TRANSITION**

N/A

## **N.9. Missed Detections: From Data to Actionable Estimates**

Principal Investigator, Dennis Egan, Rutgers University

## **PROJECT RELEVANCE TO DHS**

This project addresses the overall goal of enhancing the ability to secure and facilitate transnational flows of people Key questions this project sought to address include:

- What methods can determine missed detections (of undocumented migrants, drugs, other contraband, etc.)?
- What methods inform decisions about countering illegal flows?
- What methods enable accurate measures of illegal flow volumes?

## EXECUTIVE SUMMARY

Borders cannot be 100% secure. Some persons, drugs, and fake or stolen goods will cross the border. Knowing how much is caught (or turned back) (which is observable and measurable) leaves open two crucial questions: how much crossed the border in spite of our efforts? How much was deterred and did not try to cross? Such unobserved events occur elsewhere; tax cheating is an example. Methods used to estimate unobserved events include: administrative records review; surveys; inspections, investigations and audits; experimental methods; and technical measurement. DHS has developed several performance metrics for this problem, seeking to inform Congress and the executive branch about border risks and effective methods to reduce those risks and inform its own policy. This project utilized two methods for analyzing data to estimate the missed detections: Extended Capture-Recapture and Data Envelopment Analysis.

The simple capture-recapture model has been used to try and model missed detections of illegal border crossers but the assumptions made regarding animal behavior which make it accurate for that context do not apply to human behavior. People have a complex set of logic and may exit the population of those trying to cross the border illegally either by successfully crossing or by being deterred. Data Envelopment Analysis is a mathematical, management science approach used to compute a kind of “relative efficiency” of organizational units. Data Envelopment Analysis modeling provides a complementary viewpoint of capture-recapture modeling and uses many of the same variables (e.g., deterrence, got-aways, turn-backs, apprehensions) as capture/recapture and allows for evaluation for how resource deployments impact what events are observed and what are missed (due to lack of resource deployments).

There were differences of opinion between the Project Champion and the PI regarding the interpretation of the activities contained the work plan and project implementation. These differences persisted thru the duration of the project and the inability of the BTI Institute to broker a resolution of the differences led to the termination of the project prior to completion.

## PROJECT TEAM

### Personnel (Other than Students)

**Table 1.** Project Personnel (other than students)

First Name	Last Name	Institution	Role on Project
Dennis	Egan	Rutgers University	Principal Investigator
Paul	Kantor	Rutgers University	Co-PI
Fred	Roberts	Rutgers University	Co-PI
Vladimir	Menkov	Rutgers University	Senior Personnel

**Table 2.** Students involved in the project

First Name	Last Name	Institution	Degree Pursued
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Katie	McKeon	Rutgers University	Ph.D.
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**Student Name:** Katie McKeon

Katie McKeon’s training activities included working closely with Dr. Paul Kantor on creating and coding mathematical models for weighting and aggregating the estimates of subject matter experts participating in a Modified Online Delphi (MOD) session. The estimates concerned recidivism and recapture probabilities. Her training also included working with Dr. Egan and Dr. Kantor to develop a google sheets based system for administering the MOD sessions and collecting the estimates. McKeon’s professional development activities included attending and presenting a poster describing her work on the project at the COE Summit held at George Mason University.

## TASKS

**Table 3.** Task List

ID	Task Title	Status	Associated Deliverables
T.M.1	Identify people to interview and data sources	Incomplete	D.1
T.M.2	Manage research and preparation of reports	Complete	D.2
T.M.3	Meet with project stakeholders	Complete	D.1
T.E.1	Define Models	Incomplete	D.1
T.E.2	Synthesize data and conduct initial interviews	Incomplete	D.1
T.E.3	Fit models to synthesized data; evaluate, validate	Incomplete	D.1
T.E.4	Initiate and support transition	Incomplete	D.1
T.E.6	Prepare scientific publications	Complete	D.2
T.D.1	Define mathematical (DEA) models	Incomplete	D.1

### E.1. Task overview

#### Task T.M.1: Identify people to interview and data sources

This list of people to interview was provided. Due to the sensitive nature of CBP enforcement data the work plan was revised prior to approval to remove the sensitive CBP enforcement data from list of data sources and guidance provided to identify open source data which correlated to missed detections. A list of open source data was not provided prior to termination of the project.

#### Task T.M.2: Manage research and preparation of reports

This was an ongoing task throughout the project, and resulted in the four technical reports listed below prior to termination of the project.

### **Task T.M.3: Meet with project stakeholders**

Multiple meetings were held throughout the duration of the project prior to discontinuing the project.

### **Task T.E.1: Define Models**

High level descriptions of the Extended Capture-Recapture and Data Envelopment Analysis models were provided in the work plan and slides but details of the model, their inputs, outputs, and algorithms for analysis was not provided prior to termination of the project.

### **Task T.E.2: Synthesize data and conduct initial interviews**

The data sources needed as inputs to the Extended Capture-Recapture were not identified (see T.M.1) and the model itself was also not provided (see T.E.1). Conducting initial interviews to gather some of the required data from subject matter expert thru elicitation was dependent on identifying the data needed and how it was going to be used. Given neither condition was met the initial interviews were not conducted prior to termination of the project.

### **Task T.E.3: Fit models to synthesized data; evaluate, validate**

The previous tasks which this task was dependent on were not completed prior to termination of the project and resulted in this task not being performed prior to termination of the project.

### **Task T.E.4: Initiate and support transition**

The previous tasks which this task was dependent on were not completed prior to termination of the project and resulted in this task not being performed prior to termination of the project

### **Task T.E.6: Prepare scientific publications**

The PI generated four technical reports that can be the basis of scientific publications, or at the very least archived in the Defense Technical Information Center (DTIC) repository. The reports were submitted to BTI for review and recommendation regarding preferred disposition.

### **Task T.D.1: Define mathematical DEA models**

Work on this was deferred until after progress had been made on the Extended Capture-Recapture model. Lack of progress on the Extended Capture-Recapture model prior to termination of the project resulted in this task not being performed prior to project termination.

### **Explanation of any changes from the initially approved work plan (if applicable)**

It is BTI's assessment that from the Project Champion's perspective, the activities in the work plan needed to align with CBP customer requirements and entail extending the Capture-Recapture model by integrating modeling of human behavior which would address the elimination of assumptions about animal behavior when using the Capture-Recapture model for estimating animal populations. The modeling would use multi-type population (passive) and discrete

intervention (active) approaches and weight estimations made by different models. The modeling would include behavior (and data sources) which the research showed a correlation to illegal migration attempts.

It is also BTI’s assessment that from the Principal Investigator’s perspective, the work plan needed to solely focus on subject matter expertise estimates using a proposed elicitation method called Delphi and modify it to remotely conduct the elicitation sessions and not rely on any other data sources. The weighting of estimates would be done across the various estimates done by subject matter experts rather than various models used to estimate missed detections.

These perceived differences of opinion regarding the interpretation of the activities necessary for the optimal implementation the work plan persisted thru the duration of the project and the inability of the BTI Institute to resolve the impasse ultimately led to the termination of the project.

## MILESTONES

**Table 4.** Milestone List

ID	Milestone Description	Status
M.1	Working code for ECR models	Incomplete
M.2	Initial Stakeholder interviews completed	Incomplete
M.3	Simulated Data for ECR Models	Incomplete
M.4	Stakeholder Progress Review	Complete

### Explanation of why milestones were not reached (if applicable).

As noted earlier, many of the tasks defined in the work plan were not completed during the project prior to termination and therefore the milestones which were dependent on task completion were not met.

## PERFORMANCE METRICS

**Table 5.** Performance Metrics List

ID	Description	Quantitative Performance Target
P.1	Use ECR model to refine estimates of missed detections.	Improvement over baseline estimates
P.2	DEA model of station or sector relative efficiencies	Evaluation of model using data from one set of stations or sectors. Evaluation of model performance when applied to



		data from a new set of stations or sectors.
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### Performance metrics overview

**Table 6.** Performance Assessment

ID	Status	Far from meeting expectations	Close to meeting expectations	Met expectations	Exceeded expectations
P.1	Incomplete	X			
P.2	Incomplete	X			

### PROJECT DELIVERABLES (OUTPUTS)

**Table 7.** Deliverables List

ID	Deliverable Name	Type	Status
D.1	Report and usable Java code for ECR methods.	Source Code	<p>The Principal Investigator is making the unfinished/unvalidated code available as source, binaries and documentation which can be downloaded from the above site, but are password protected.</p> <p>See:  <a href="http://kantor.comminfo.rutgers.edu/MissedDetections/">http://kantor.comminfo.rutgers.edu/MissedDetections/</a></p> <p>Source, binaries and documentation can be downloaded from the above site, but are password protected.</p>
D.2	ECR conference and journal publications	Publication	<p>The Principal Investigator feels that these (unvalidated) reports may be publishable in some form, after suitable review by BTI and editing. At the very least, the report authors wish to post these reports to the Defense Technical Information Center (DTIC) repository.</p> <p>See:  <a href="http://kantor.comminfo.rutgers.edu/MissedDetections/">http://kantor.comminfo.rutgers.edu/MissedDetections/</a>  <a href="#">Report on Aggregating Imperfect Estimates of several key variables</a>. Lead Author, Paul B. Kantor, March 29, 2018.</p>

			<p><a href="#">Estimating Missed Detections by Combining Diverse Sources: Algorithms. Missed Detections Working Report-002</a>. Authors: Vladimir Menkov &amp; Paul B. Kantor, July 1, 2018.</p> <p><a href="#">Estimating Missed Detections: A "Two Types" Model. Missed Detections Working Report ECR-003</a> Authors: Paul B. Kantor and Vladimir Menkov, June 30, 2018.</p> <p><a href="#">White paper on the potential of Data Envelopment Analysis as a tool for assessing the impact of specific resources, on border security</a>. Author, Paul B. Kantor, June 27, 2018.</p>
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## PUBLICATIONS, CONFERENCE PAPERS & PRESENTATIONS

Paul Kantor, "Estimating Missed Detections at the Southern Border" presentation given at the U.S. Department of Homeland Security Centers of Excellence Summit 2018, May 31, 2018, George Mason University.

Katie McKeon, "The Modified Online Delphi Process Software" poster presented at the U.S. Department of Homeland Security Centers of Excellence Summit 2018, May 30-31, 2018, George Mason University.

On June 14<sup>th</sup>, Kantor and Egan gave a presentation to Marc Rosenblum, Deputy Assistant Secretary, DHS Office of Immigration Statistics, and his staff via a conference call.

Paul Kantor gave a presentation of the Missed Detections project to members of CBP in Washington, D.C. on June 22, 2018. The presentation was organized at the request of Mr. Ryan Riccucci, Assistant Chief, Operational Requirements Management Division, Strategic Planning & Analysis Directorate.

The four reports listed below are awaiting review by BTI. Once reviewed and edited, they will be made available through the Defense Technical Information Center (DTIC) repository. Subsequent versions of the reports may be submitted for publication.

[Report on Aggregating Imperfect Estimates of several key variables](#). Lead Author, Paul B. Kantor, March 29, 2018.

[Estimating Missed Detections by Combining Diverse Sources: Algorithms. Missed Detections Working Report-002](#). Authors: Vladimir Menkov & Paul B. Kantor, July 1, 2018.

[Estimating Missed Detections: A "Two Types" Model. Missed Detections Working Report ECR-003](#) Authors: Paul B. Kantor and Vladimir Menkov, June 30, 2018.

[White paper on the potential of Data Envelopment Analysis as a tool for assessing the impact of specific resources, on border security.](#) Author, Paul B. Kantor, June 27, 2018.

## **WEBSITES OR OTHER INTERNET SITES**

The site: <http://kantor.comminfo.rutgers.edu/MissedDetections/> makes available the four reports from the project listed above (see H.1).

The site: <http://kantor.comminfo.rutgers.edu/MissedDetections/> contains the source code, binaries, and software documentation from the project. This site is password protected, but anyone authorized to access it will be given the password by Dr. Egan or Dr. Kantor.

## **INVENTIONS, PATENT APPLICATIONS and/or LICENSES**

Dr. Paul Kantor and graduate student Katie McKeon filed an invention disclosure with the Rutgers University research commercialization group on April 6<sup>th</sup>. The invention is a Modified Online Delphi Process, entitled “A method and system for aggregating diverse judgments and opinions virtually and/or asynchronously.” Rutgers considered the invention for possible patenting, but decided not to file for a patent.

## **STAKEHOLDER ENGAGEMENT**

**Project Kickoff Meeting (28 September 2017):** A presentation of the plan for the project was given to an audience of stakeholders including representatives from CBP US Border Patrol Strategic Planning and Analysis Directorate and Operational Requirements Directorate, CBP Office of Information Technology, and DHS Borders & Maritime Division. Feedback on project objectives, methods, and milestones was discussed.

**Demonstration of TrendFlagger smart spreadsheet tool (5 December 2017):** This tool was presented as a live interactive demonstration at the BTI Institute Showcase. Two representatives from the CBP Office of Field Operations (OFO) Planning, Program Analysis, and Evaluation group were quickly able to identify a number of datasets for which the tool might be very useful.

**Meeting with Marc R. Rosenblum, Deputy Assistant Secretary, DHS Office of Immigration Statistics (5 December 2017):** Dr. Rosenblum had attended the presentation at the BTI Institute Performers Meeting, and invited the project team to meet with him and some of his staff members. The project team shared with OIS research plans and preliminary concepts concerning Extended Capture-Recapture models. The team also learned the research priorities of OIS, how their priorities are established, and how our project intersected OIS priorities. OIS also described their efforts to make data publicly available through proposed anonymization techniques.

**Conference call with Ryan Riccucci, Operational Requirements Management Division, Strategic Planning and Analysis Directorate, U.S. Border Patrol (13 February 2018):** Project team members Egan and Roberts briefed Mr. Riccucci via conference call after being introduced to him by a third party from the U.S. Coast Guard. Mr. Riccucci expressed interest in making introductions to SMEs, setting up meetings with operations staff along the border, and facilitating transition activities upon project completion.

**Presentations at DHS Centers of Excellence Summit (30 May 2018):** The project was described in a talk and a poster presented to numerous potential stakeholders at the DHS COE Summit:

- Paul Kantor, “Estimating Missed Detections at the Southern Border” presentation given at the U.S. Department of Homeland Security Centers of Excellence Summit 2018, May 31, 2018, George Mason University.
- Katie McKeon, “The Modified Online Delphi Process Software” poster presented at the U.S. Department of Homeland Security Centers of Excellence Summit 2018, May 30-31, 2018, George Mason University.

**Presentation to OIS (14 June 2018):** Kantor and Egan gave a presentation to Marc Rosenblum, Deputy Assistant Secretary, DHS Office of Immigration Statistics, and his staff via a conference call. Rosenblum and his staff expressed interest in Kantor’s model of “persistent” versus “detractable” immigrants crossing the border illegally, as well as statistical techniques to assess the stability of the probability of apprehension over time. Possibilities for further collaboration were discussed.

**Presentation to CBP (22 June 2018):** At the request of Ryan Riccucci, Paul Kantor gave a presentation about the project to a group of eight CBP staff and technical personnel. He presented two models of Missed Detections: the “Persister” model and the “Weighted Expert Sources” model. It appeared that all attending the presentation understood the basic concepts of both models. Riccucci seemed especially interested in using the Rutgers online Delphi tool to gather input from field personnel on the front lines. Possibilities for follow-on work will be discussed with Riccucci and Melissa Herrera, Assistant Chief, University Programs Liaison USBP.

## **TRANSITION**

No transition activities occurred during performance period.

## **N.10. Participatory Operational Assessment (POA): Evaluating and Predicting the Operational Effectiveness of Cargo Security Processes at Ports of Entry**

Principal Investigator, Maria Burns, University of Houston

### **PROJECT RELEVANCE TO DHS**

This project addresses the overall goal of balancing national security and export competitiveness to facilitate legitimate trade. A key question this project sought to address is:

- What policy or process opportunities could help streamline the flow of legitimate trade?

Through examination of the commercial operations, reasons for delays, and common risks that may occur associated with the inbound flow of containers entering US territorial waters, the results of this project may provide strategies and operating methods to improve the performance of various U.S. Ports of Entry (PoEs).

### **EXECUTIVE SUMMARY**

This project sought to identify solutions that improved the processing times of inbound containers in selected POEs at the southern border. The primary focus was the development of a Risk

Assessment and Participatory Operational Assessment (POA) framework to be applied by DHS in diverse Ports of Entry, while encompassing multimodal transportation.

Measuring processing times at U.S. Ports of Entry (POEs) is a significant goal for DHS and the CBP. Diverse methods and technologies are used for estimating delays, including RFID-based sensors, CCTV Cameras, visual surveillance, driver surveys etc. Our goal was not only to measure time delays in selected POEs, but also to identify their root causes beyond the border (throughout the entire supply chain), and offer recommendations on eliminating time delays.

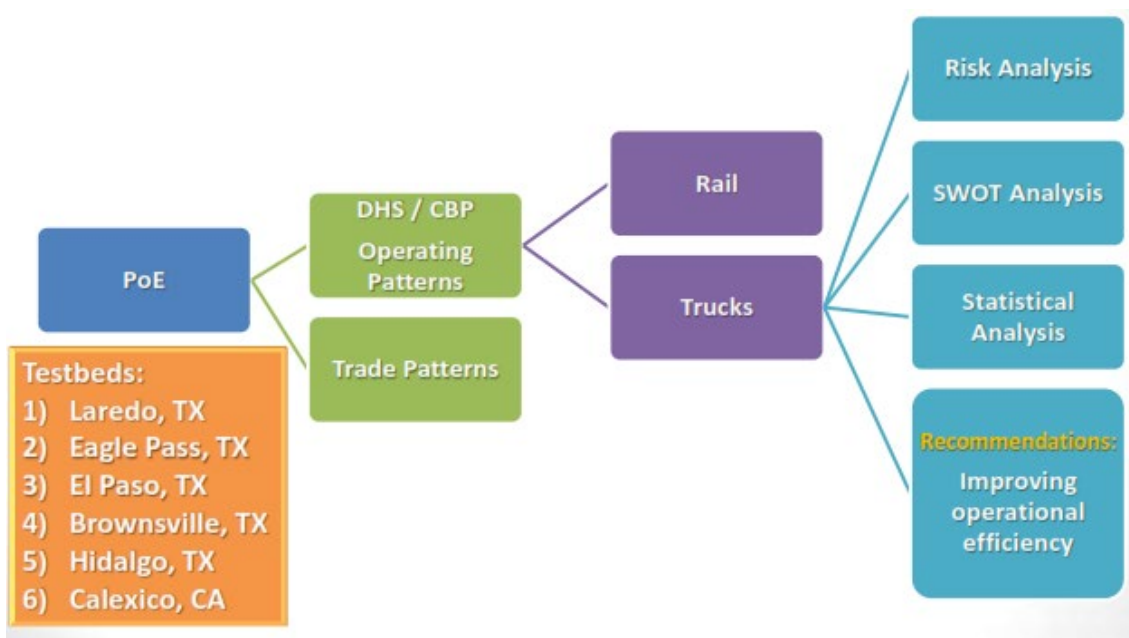
The project was conducted in three periods, as follows (Figure 1):

**Period I:** During the initial period of performance (15 January 2016 to 30 June 2016) the project focused on maritime transportation and the Port of Houston was used as testbed to evaluate processing times for inbound containerized cargoes.

**Period II:** During the second period of performance (1 July 2016 to 30 June 2017) the project focused on land transportation (trucking, rail) and the Port of Laredo was used as testbed to evaluate processing times for inbound containerized cargoes at southern Ports of Entry (PoEs). Upon completion of Period II, the project champion expressed interest in the findings for Laredo, and requested expanding the analysis with a comparison to five additional land PoEs along the southern border.

**Period III:** A No-Cost Extension was granted (from 1 July 2017 to 31 December 2017) to evaluate selected Ports of Entry on the southern border with high trade volume and value, e.g.: 1) Laredo, TX; 2) Eagle Pass, TX; 3) El Paso, TX; 4) Brownsville, TX; 5) Hidalgo, TX; 6) Calexico, CA. The findings of this study combined with the recommendations and conclusions on best practices verified that despite each POE’s unique profile, the findings and deliverables of this work allow for generalization of the study results to land Ports of Entry nationwide.

**Figure 1. Project Schematic**



Research findings therefore offered interesting recommendations and solutions which can be of interest to DHS/CBP, industry and academia. Of note, project results indicated that POE delays are deeply rooted beyond the border. In the case of inbound cargoes from Mexico into the U.S., ample risks and the root causes of delays are found in all stages of the supply chain. Thus, mapping of the key supply chains demonstrated trade route patterns commencing in Mexico's agricultural and industrial cities, and constructed virtual lines passing through Mexico's key highways and leading to U.S. POEs.

Recommendations were provided on how to improve processing times. This project's initial goal was to save at least 3% of time. The project results indicate a higher percentage of time can be saved when the process of monitoring and elimination of risks commences beyond the borders. The higher the collaboration levels between U.S. and Mexican authorities, and between private and public sectors, the more time and money can be saved.

This project demonstrated how improvements in the efficiency of inbound, containerized cargo operations at Ports of Entry (PoEs) reduce the costs of implementation and execution of operational configurations. The deliverables for period II of the research applied to land border containers transported via trucks and rail.

## PROJECT TEAM

### Personnel (Other than Students)

**Table 1.** Project Personnel (other than students)

First Name	Last Name	Institution	Role on Project
Maria	Burns	University of Houston	PI
Glen	Harrison		Consultant

**Table 2a.** Students involved in the project (Period III)

First Name	Last Name	Institution	Degree Pursued
Kishan	Savant	University of Houston	MSc

**Table 2b.** Five Students involved in the project (Periods I, II, III)

First Name	Last Name	Institution	Degree Pursued
Parth	Shah	University of Houston	MSc
Kishan	Savant	University of Houston	MSc
Freddie	Trammell	University of Houston	BSc
Jose Roel	Vasquez	University of Houston	BSc
Brian	Todaro	University of Houston	BSc

As part of their professional development, students became familiar with the project, in a training session where border security was presented in a context of global supply chains, trade and transport.

**Cumulative list of Students' Accomplishments:**

- Both Graduate and Undergraduate students learned how to work both as leaders, and as team-players.
- All students learned how to collect data from various secondary sources, and synthesize it to generate a unique research outcome.
- The research environment has enabled them to expand their academic knowledge and test it in a homeland security environment.
- All students were nominated as Ambassadors for the Logistics and Transportation Policy Program, College of Technology.
- All students obtained the prestigious 40 hour "Advanced International Logistics Certificate", consisting of 12 transport related topics, and gained with 4.0 Continuing Professional Education (CPE) credits.
- All students would consider pursuing a homeland security or transport security career.

**Student Name:** Parth Shah

Parth worked for the project from 1 July 2016 to February 2017. He helped gather information from Government websites, related to border crossing times, delays, etc. As a student in Engineering, Parth learned how to apply theoretical STEM methods into solutions for the processes and the structure of things. His participation as Graduate Researcher in the program has helped him better apply the engineering and econometric principles on a Homeland Security & Border Security perspective.

**Student Name:** Kishan Savant

Kishan worked for the project for the Spring & Summer 2017, and continued to work in Period III of this project. He helped gather secondary data from Government websites, related to the POE bridges in Mexico and the U.S. As a student in Engineering, Kishan became familiar with STEM applications and how these can methods into solutions for the processes and the structure of things. His participation as Graduate Researcher in the program broadened his experience in statistical tools, like Analysis of Variance, multivariate regression analysis and other tools, to test Homeland Security hypotheses.

The following three undergraduate students were selected from the College of Technology's Supply Chain and Logistics Technologies Undergraduate Program, based on their academic performance, and unique skillset in supply chain, and scholarly activities. The program offered them the theoretical knowledge of global supply chains, yet their work as student researchers with the BTI DHS project offered them a new understanding on the border security notion.

**Student Name:** Freddie Trammell

Freddie is a US Marine Corps Veteran, and serving our nation has offered him extensive experience in the realm of homeland security. His role as student researcher entails the gathering and analysis of secondary data related to border crossing times, and the supply chain network between Mexico and the U.S.

**Student Name:** Jose Vasquez

Jose is a former Hewlett Packard employee, with IT experience; His fluency in Spanish helped the team in obtaining data from Mexican Government websites pertaining to the infrastructure and border crossing delays.

**Student Name:** Brian Todaro

Brian is a transportation specialist, building his experience in containerized transport and the food industry. His meticulous nature enabled him to find and interpret secondary data on trade patterns.

## TASKS

**Table 3.** Task List\*

\*The task list below does not match the approved Year 3 Work Plan as reported in the BTI Institute Year 3 Work Plan due to PI never receiving approval from the Project Champion. Instead, a no-cost extension was requested from 31 August 2017 to 31 December 2017 with the below Task originally reported for Year 2. The PI operated under the No-Cost and previous work plan's task list.

ID	Task Title	Status	Associated Deliverables
T.1	Meeting with project champion(s) DHS, CBP, POE Champion (A list of the participating offices is found below).	Complete	D.1 D.2 D.3
	Development of a DHS Advisory Board that meets at least quarterly (*in person or conference call) to discuss the research findings and to facilitate the use of the Risk Assessment and POA tool at various POEs.		
T.2	Background research Data collection. Visiting the US-Mexico border crossing PoE (Laredo) and conducting time measurements.	Complete	D.1 D.2 D.3
T.3	Meeting with project champion(s) (DHS, CBP, Port champion)	Complete	D.1 D.2 D.3
T.4	Data analysis and evaluation of processes and time. Comparison with Baseline. Recommendations on process improvement.	Complete	D.1 D.2 D.3
T.5	Organizing meeting or workshop with champion and industry stakeholders to present preliminary project findings and seek for solutions.	Complete	D.1 D.2 D.3
T.6	Meeting with DHS/CBP project champion(s) (*in person or conference call) Presenting research findings and recommendations.	Complete	D.1 D.2 D.3



### **Task #1: Meeting with project champion(s)**

Conducted monthly conference calls with project champion and DHS Advisory Board.  
Twice a year met face-to-face with Project Champion and other Advisory Board Members in DC.

Monthly conference calls included several CBP stakeholders, including:

1. Supervisory CBP Officer, Manifest and Conveyance Security, Cargo and Conveyance Security, Office of Field Operations
2. Branch Chief, CCS, Manifest & Conveyance Security Division, CBP
3. Director, Manifest and Conveyance Security, OFO, CBP

Separate conference calls were conducted with each of the six selected Ports of Entry:

- 1-2. Laredo Field Office (World Trade Bridge & Columbia Bridge; TX) – CBP Deputy Director
3. Eagle Pass Field Office (TX) – CBP Director
4. Calexico Field Office (CA) - Assistant Port Director, Trade CBP
5. San Diego Field Office (CA) – CBP Supervisory Program Manager
6. Ysleta Import Lot, Port of El Paso (TX) – CBP Assistant Port Director

During the Transition stage of the research project, the following CBP stakeholders were also included:

- A. Program Manager; Customs - Trade Partnership Against Terrorism (C-TPAT), Cargo and Conveyance Security, Office of Field Operations, CBP
- B. Branch Chief, Outbound Enforcement and Policy, Cargo and Conveyance Security, CBP

### **Task overview**

Description of project activities related to each task listed in Table 3:

**Task T.1:** Preliminary meeting with champions, in order to set the goals and verify the methodology for the year to come.

**Task T.2:** PI visited the Border/POE at Laredo / Eagle Pass area (TX), and gathered primary baseline data (duly analyzed in Appendix 4a of the Annual Report and video footage of the regional traffic (non-CBP data, presented in the Annual Video). Subsequently, met with CBP at the POE, in order to share findings on data gathered.

The primary data collection stage methodology includes the following tools:

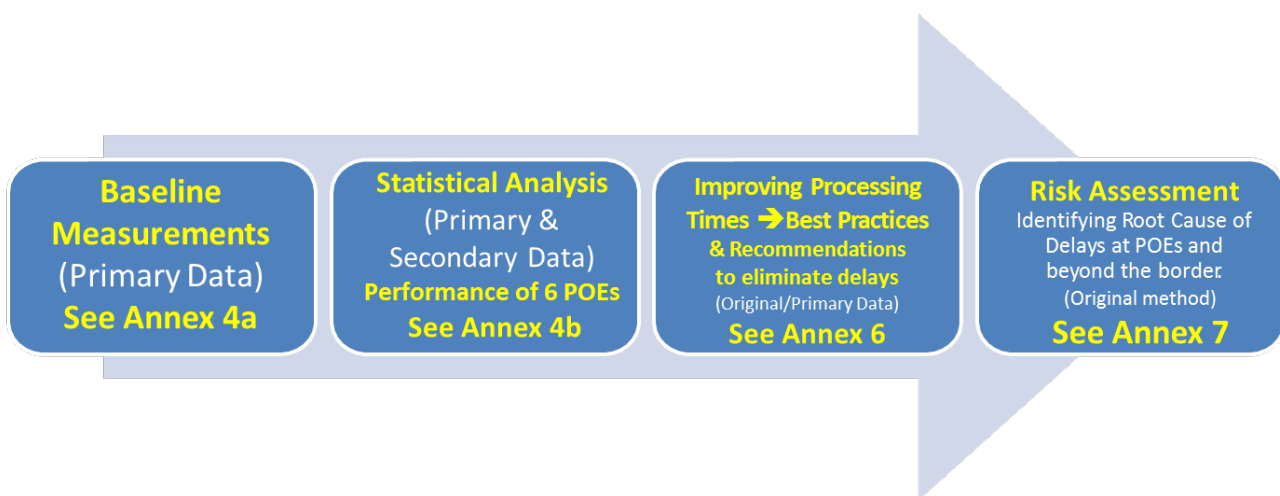
- 1) Meeting with Laredo's CBP Deputy Port Director, and conducting monthly conference calls.

- 2) Through members of the Texas Trucking Association 5 truck drivers in the Laredo area were interviewed; 10 trucking companies involved in US-Mexico transportation, as well as two rail companies involved in the US – Mexico transportation (UP Rail and KC Southern Rail).
- 3) Conducted phone interviews to World Trade and Columbia Bridge (POE) personnel in Laredo, to verify the findings we had already obtained by interviews and monthly / annual traffic data (public domain) obtained through CBP and DOT websites.
- 4) Conducted phone interviews to the city of Laredo, to better understand the traffic patterns, causes of delay, infrastructure challenges and opportunities for improvements.

**Task T.3:** Findings were shared with CBP Champions.

The findings were discussed with CBP champion and stakeholders, and the POA Advisory Board. Figure 2 demonstrates the structure of research deliverables, and the report sections where these findings are located.

**Figure 2. Structure of research deliverables**



### **Baseline Measurements**

The baseline process of time measurement at the border includes the following stages:

1. The researchers visited the Laredo area to evaluate baseline.
2. Time measurement #1: Qualitative Surveys were taken at the Port of Entry, to evaluate time delays in each stage of the transiting process, i.e. from arrival on the Mexico side of the border, to clearance on the U.S. side of the border.
3. Time measurement #2: Qualitative Surveys were taken by rail and trucking professionals as part of the POA methodology. Namely, processing times and delay points were verified by industry members of the Advisory Board for the Participatory Operational Assessment.

4. Time measurement #3: Official traffic and delays' data was received from CBP website (<https://bwt.cbp.gov/>) for a broader, large scale analysis.

Tables 4a.1 and 4a.2 below, duly demonstrate the findings of our baseline measurements for trucks and rail at the Laredo port of entry.

<b>Table 4a.1.: Baseline Measurements at the Port of Laredo (TX)</b>							
<b>TRUCKS → Port of Entry: World Trade Bridge * Laredo, Texas</b>							
	<b>Stage 1</b> Arrival in Mexico Customs (specify time waiting in line)	<b>Stage 2</b> Clearance from Mexico	<b>Stage 3a</b> Moving/ waiting in line for US Customs  <b>Stage 3b</b> Change of drivers at the border	<b>Stage 4</b> Routine/Primary CBP inspection	<b>Stage 5</b> Truck Weigh -in-motion systems	<b>Stage 6</b> Extended/ Secondary CBP inspection	<b>Stage 7</b> Clearance. End of process. Laredo city traffic e.g. conjunction rail/highway
<b>#1</b> Sept 12, 2016 Monday	30 minutes 11:00 am to 11:30 am	11:31 am	3a) 15 minutes 11:31 am to 11:46 am  3b) 60 minutes	20 mins	Wait in motion is a roll through	Not applicable in this trip.  15 mins to several hours In other trips, when subject to extended examination	
<b>#2</b> Sept 16, 2016 Friday	15-30 mins when pre-filing is in place and shipper is C- TPAT cert or known	30 - 45 mins	3a) ≤15 mins *depending on time of day and number of lanes opened  3b) 60 minutes	~15 mins	5-10 mins	Not applicable in this trip.  30 mins to several hours In other trips, when subject to extended examination	
<b>#3</b> March 29, 2017 Wednesday	20-30 mins	20- 30 mins	3a) 15- 30 mins  3b) 60 minutes	15-20 mins	15-20 mins	Not applicable in this trip.  30 mins to several hours In other trips, when subject to extended examination.	

**Explanatory Notes to Table 4a.1:**  
**Baseline Measurements at the Port of Laredo (TX)**  
**TRUCKS → Port of Entry: World Trade Bridge \* Laredo, Texas**

**Stage 3 Note: Waiting in line for US Customs**

The statistical analysis section of this report demonstrates waiting times per times of the day, days of the week, and months of the year. **The findings of our primary and secondary data analysis were confirmed by testimonies of the industry Advisory Board Members, as part of the Participatory Operational Assessment created for this research project:**

- The average waiting time for ready and standard lanes is 30 minutes, depending to the time of day / day of the week, and numbers of lanes opened.
- When a single lane is open, we should expect 30 - 45 minutes of delay.
- When two or more lanes are open, waiting times are reduced.

**Stage 5 Note: Truck Weigh -in-motion systems**

No wait unless overweight in which case a violation and shut down until another truck from same company helps take some of the load off. Once that is done and all paperwork is verified (load manifest matches load) the truck is on its way.

**Stage 7 Note: Clearance. End of process. Laredo city traffic e.g. conjunction rail/highway**

Highway 59 is the primary way truck drivers take going from Laredo, TX towards Freer Texas. Trucks are usually stopped at the checkpoint there and asked for their credentials. The busiest times are 8 to 11 am and 1 to 5 pm.

**Comparison between Laredo Bridges**

- Laredo Bridge 1: with Ready lane & Standard lane [2|2 =4 lanes], waiting times are less than 30mins
- Laredo Bridge 2: less than 3 standard lanes, <15 minutes of delay should be expected;
- When 5 or more lanes are open for Ready lanes and Senti lanes, minimum delays should be expected.

**Table 4a.2.: Baseline Measurements at the Port of Laredo (TX)**  
**RAIL → Port of Entry: World Trade Bridge \* Laredo, Texas**

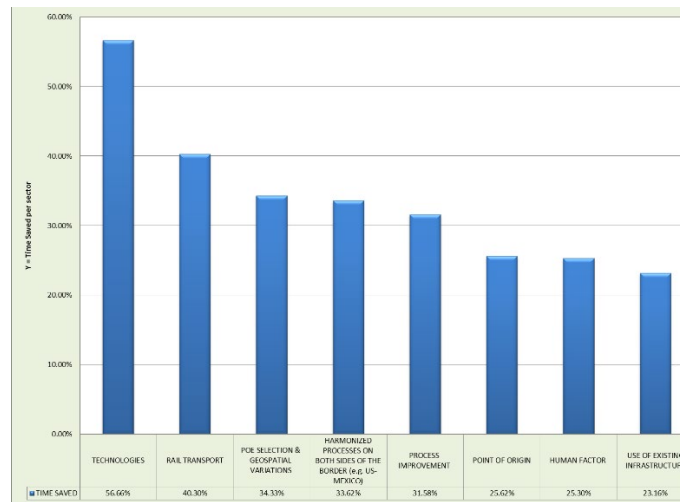
	<b>Stage 1</b> Arrival in Mexico Customs (specify time waiting in line)	<b>Stage 2</b> Clearance from Mexico	<b>Stage 3a</b> Moving/ waiting in line for US Customs  <b>Stage 3b</b> Change of drivers at the border	<b>Stage 4</b> Routine/Primary CBP inspection	<b>Stage 5</b> Truck Weigh -in-motion systems	<b>Stage 6</b> Extended/ Secondary CBP inspection	<b>Stage 7</b> Clearance. End of process. Laredo city traffic e.g. conjunction rail/highway
<b>#1</b> Sept 12, 2016 Monday	30 minutes 11:00 am to 11:30 am	11:31 am	3a) 15 minutes 11:31 am to 11:46 am  3b) 60 minutes		Wait in motion is a roll through	N/A >15 mins if subject to extended examination	
<b>Notes:</b>	<b>Stage 3 : Waiting in line for US Customs</b>  <b>Primary Data collection:</b> <ul style="list-style-type: none"> <li>• Professionals from Union Pacific and Kansas City Southern Railway Company were interviewed.</li> <li>• Rail processing times is typically more standardized or predictable, due to the long-term partnerships between manufacturers and carriers, as well as the large scale haulage that offers economies of scale.</li> </ul>						

**Task T.4:** The baseline performance was established, and evaluated in comparison with POA members and secondary data previously gathered. Recommendations on process improvement were made.

**Task T.5:** Findings on process improvement were shared with the Project Champion and CBP Stakeholders. More than thirty (30) delay factors were identified throughout the supply chain stages commencing from inbound transportation and completed after the border crossing and customs clearance process.

## Findings' analysis and method used:

**Figure 3: Delay Factors and Time Saving Best Practices**



Both the Delay Factors and the Time Saving Best Practices/Recommendations (Figure 3) entail original findings derived by baseline measurements, original interviews with industry stakeholders, public domain data and articles. The findings were presented to the Project Champion and CBP stakeholders, and positive comments were obtained as to the originality and feasibility of these implementations. It is worth noting that each port of entry or bottleneck incident should be treated as a separate case, hence it is up to the CBP leadership to implement the case-specific best practices, as and where applicable.

In Mexico/southern border, the most likely points of origin may include regions demonstrated in Figure 4:

- Region 1: Heavy and high-tech industry centers
- Region 2: Major industrial center (Monterrey-Nuevo Laredo corridor)
- Region 3: Major industrial center (Guadalajara-Mazatlán corridor)
- Region 4: Border city assembly centers
- Region 5: Industrial region (Coahuila-Veracruz-Campeche)

**Figure 4:**



Table 5 demonstrates a more detailed explanation of the delay factors and time saving recommendations. Note: The point of origin stage pertains to any and all locations beyond the port of entry. Due to the infinite number of combinations of origin location and selected port of entry location, values were omitted for items 1-3 in Table 5. Nevertheless, the full report contains in detail best practices for transportation planners to facilitate optimum selection based on safety, time and cost priorities.

**Table 5: Delay Factors, Time Saving Best Practices & Median Time Saved**

	DELAY FACTOR	TIME SAVING BEST PRACTICES & RECOMMENDATIONS	MEDIAN TIME SAVED %
<b>A</b>	<b>POINT OF ORIGIN → ~25.62% OF TIME SAVED (MEDIAN)</b>		
<b>1</b>	<b>Transportation Planning: Selection of the transportation mode and POE.</b>	<b>Selection is made based on safety, time and cost priorities. Distance will determine route options and time</b>	<b>N/A</b>
<b>2</b>	<b>Early congestion stages occur from cargo origin point as cargo is released simultaneously as part of a larger order.</b>	<b>This factor may lead to traffic at a later stage of transportation near the border.</b>	<b>N/A</b>
<b>3</b>	<b>Trucks driving together in convoys, causing traffic from origin point all the way to the borders.</b>	<b>This factor may lead to traffic at a later stage of transportation near the border.</b>	<b>N/A</b>
<b>4</b>	<b>Road Conditions,</b>	<b>Time saved: &gt; 5-15 %</b>	<b>10 %</b>

	<b>Route Selection.</b>	of overall travelling time beyond the border. >60 mins depending on the route distance and condition <b>Recommendations:</b> Optimum time management and transportation planning	
5	Selecting the transport mode and the route to avoid risk. (Illegitimate activities, e.g. Cartel operations, Cargo Theft etc.)	Time saved: >12.5% 60 minutes beyond the border  25% - 50% 15-60 minutes at the border	>12.5% beyond the border  ~12.5% at the border
6	a) Selecting the Port of Entry b) Deviation from originally declared POE to another to avoid traffic.	Time saved: ~50% >60 mins Depending on optimum POE selection <b>Recommendations:</b> Deviation time must be shorter than waiting time at the original POE. Alternative POE must be equally close to highways, warehouses and logistics centers.	~50%
7	Joint Customs Inspections at POEs. E.g. between U.S. & Mexico customs; U.S. & Canada customs.	Time saved: ~ 50% ~60 mins Half time saved from the overall inspection process.	~ 50%
8	Limited advance notice for Land Borders.	Proposed CBP Program For Trucks: We recommend an extended Advance notice (24 hours) for trucks on a voluntary basis.  Time saved 12.5%-50% 15-60 mins In case of heavy traffic, proactive notice and deviation will avoid delays of several hours	~18.75%
<b>B</b>	<b>FACTORS OF PRODUCTION: TECHNOLOGIES</b> ➔ ~56.662% OF TIME SAVED (MEDIAN)		
9	Use of obsolete Paper Log methods may cause delays at the border and beyond the border.	Recommendation: VTS Logs must replace Paper Logs Time saved 50%-70% cumulative time saved throughout the voyage and the Border (POE).  >60 mins depending on the route distance.	~60%

10	Use of obsolete mapping and route selection methods may cause delays at the border and beyond the border.	<p><b>Recommendation: GPS systems must replace obsolete mapping and route selection methods.</b></p> <p><b>Time saved 50%-70% cumulative time saved throughout the voyage and the Border (POE).</b></p> <p><b>&gt;60 mins depending on the route distance.</b></p>	~60%
11	Use of obsolete cargo scanning technologies.	<p><b>Use of modern post- VACIS technologies at POEs will save at least 50% of inspection time, and increase security / scanning accuracy.</b></p> <p><b>Time saved:</b> <b>&gt;50 %</b> <b>Of scanning time</b> <b>&gt;60 mins</b></p>	>50% of inspection time
<b>C FACTORS OF PRODUCTION: THE HUMAN FACTOR</b> <b>➔ ~25.3% OF TIME SAVED (MEDIAN)</b>			
12	Private and Public Officers' level of experience and familiarization with the POE will determine processing times and operational efficiency.	<p><b>Time saved Via Enhanced Familiarization Training (POE-specific material found in this report)</b></p> <p><b>Private Sector</b> <b>3%-40% Of POE processing times</b></p> <p><b>Public Sector &gt;3%</b> <b>Of POE processing times</b></p>	<b>Private Sector</b> <b>~18.5%</b>  <b>Public Sector</b> <b>&gt;3%</b>
13	<p><b>Need for CBP to Hire extra staff.</b>  <b>CBP should increase staffing in busy POEs:</b>  <b>a) to reduce waiting times; and</b>  <b>b) to increase security &amp; efficiency</b></p>	<p><b>Time saved: ~25%-50% of cumulative inspection time at POEs. (Cumulative time for primary, secondary and tertiary inspection if needed.</b></p> <p><b>&gt;30%</b>  <b>&gt; 20 minutes saved per extra staff per hour for all standard lanes.</b></p> <p><b>12%-30%</b>  <b>~15-20 minutes saved per hour per standard lane</b></p>	<p><b>~37.5%</b></p> <p><b>&gt;30%</b></p> <p><b>~21%</b></p>



14	Need for selected U.S. POEs to increase Operating Hours. (See POE Data Analysis section of this Report).	Time saved: ~4.1% per hour added daily  Recommendations: Extending operating time & hiring extra staff will smoothen out peak traffic times & heavy workload.	~4.1%
<b>D</b>	<b>HARMONIZATION OF PROCESSES ON BOTH SIDES OF THE BORDER</b> ➔ ~33.62% OF TIME SAVED (MEDIAN)		
15	Inconsistent Operating Hours on both sides of the border cause delays & traffic fluctuations.	Recommendations: 1.Harmonization Time saved: ~4.1% per hour added daily (>60 mins) Need for Harmonization on both sides of the border.  2. Joint Inspections Time saved: ~ 50% Half time saved from a process of ~60 minutes	~4.1%     ~ 50%
16	Inconsistent processes and paperwork between both sides of the border cause delays & duplication of effort.	Recommendations: 1.Harmonization Time saved ~3%- 50% of document preparation and checking between authorities.  2.Joint Inspections Time saved: ~ 50% Half time saved from the overall inspection process ~60 minutes	~26.5%     ~ 50%
17	Improving Coordination of driver change and drayage on both sides of the border. Selecting short haul or long haul drivers for both sides of the border.	Time saved: 25-50% 15-60 mins  Recommendations: Both short and long haul drivers' arrangement can be done faster, if both sides of the border coordinated better.	~37.5%
<b>E</b>	<b>FACTORS OF PRODUCTION: INFRASTRUCTURE</b> ➔ ~23.16% OF TIME SAVED (MEDIAN)		
18	Delay Factor: Inconsistent Infrastructure between the two sides of the Border. a) Number of Lanes; b) Aging Bridges. c) POE Configuration	Time saved: 12%-30% ~ 15-20 minutes saved per hour per standard lane.	~21%

		<b>Recommendations:</b> <b>1. Infrastructural Harmonization is needed.</b>  <b>2. We recommend an industry outreach campaign as the next stage of this project.</b>	
19	<p>Need to shift traffic from Over-Utilized vs. Under-Utilized POEs.</p> <p>Need to optimize infrastructure capacity &amp; utilization of existing POEs.</p>	<p>Time saved: 12%-30% ~ 15-20 minutes saved per hour per standard lane.</p>	~21%
20	<p>Improving the working space (motion management &amp; time management tools, inside and outside booths) to improve processing times at POEs.</p>	<p>Time saved: 5%-50% per processing/ inspection hour</p> <p>8.3 – 30 minutes per processing/inspection hour</p>	~27.5%
<b>F</b>	<b>PROCESS OPTIMIZATION</b> <b>➔ 31.58% OF TIME SAVED (MEDIAN)</b>		
21	<p>Optimizing the use of ACE and automated (single window) systems. This excellent system will not accept shortcuts to the submission process.</p>	<p>Time saved: 25%-60% of submission and amendment from overall preparation and submission time</p> <p>Recommendations: Users who tried to take operational shortcuts encountered some delays. The Federal government/DHS/CBP offers useful familiarization training videos that will convert users into Pros!</p>	42.5%
22	<p>Available vs open lanes; Standard vs fast lanes.</p>	<p>Time saved: 12%-30% ~ 15-20 minutes saved per hour per standard lane.</p>	~21%
23	<p>Need for increased participation in C- TPAT's FAST and other trusted programs.</p>	<p>Recommendations: Both short and long haul drivers' arrangement can be done faster, if both sides of the border coordinated better.</p> <p>Time saved: 12.5%-50% 15-60+ minutes</p>	~31.25%
<b>G</b>	<b>POE AND GEOSPATIAL VARIATIONS</b> <b>➔ 34.33% OF TIME SAVED (MEDIAN FIGURE)</b>		
24	<p>POE accessibility to highways and warehouses determines POE traffic.</p>	<p>Time saved: ~50% 60-120 mins</p>	~50%

	<b>Also see #18 Over- utilized and Under- utilized POEs.</b>		
25	<b>Geographical Traffic fluctuations: Traffic is spread unevenly across the border's POEs.</b>	<b>Time saved: ~3%- 50% of inbound traffic OR ~3%- 50% of delay time spread at low traffic times and POEs.</b>	<b>~26.5%</b>
26	<b>Spatial, Seasonal Traffic fluctuations: Traffic fluctuates widely, i.e. it is spread unevenly throughout the years, days or times.</b>	<b>Time saved: ~3%- 50% of inbound traffic OR ~3%- 50% of delay time spread at low traffic times and POEs.</b>	<b>~26.5%</b>
<b>H</b>	<b>RAIL AND INTERMODAL TRANSPORTATION ➔ 40.3% OF TIME SAVED (MEDIAN FIGURE)</b>		
27	<b>Consolidating rail container shipments beyond the southern border.</b>	<b>Time saved: 4%-50% per consolidation 60 minutes to several days, depending on storage and consolidation needs.</b>	<b>~27%</b>
28	<b>One rail wagon can delay the entire shipment</b>	<b>Time saved: 4%-50% per day 60 minutes to several days, depending on the reason for delay, and corrective action time.</b>	<b>~27%</b>
29	<b>Low frequency of rail service</b>	<b>~20-100% per day, when the rail service frequency increases.  If a container is delayed/misses the rail service, up 24 hours can be lost.</b>	<b>~60%</b>
30	<b>Delays in multimodal rail-truck crossing conjunctions</b>	<b>Time saved 25%-50% 15-60 minutes per crossing. Several crossings occur daily.</b>	<b>~37.5%</b>
31	<b>Expanding the use of double-stack container trains to eliminate tardiness, and optimize operational efficiency</b>	<b>Time saved Shortening crossing times by 50% per rail.</b>	<b>50% per rail</b>

**Task T.6:** Research scope was expanded to encompass a total of six (6) ports of entry. This extension was initiated by a request from Project Champion at the end of Period II, i.e. in June 2017.

**Explanation of any changes from the initially approved work plan (if applicable)**

The project deliverables were expanded to encompass a total of six (6) ports of entry, and not just one (Laredo, TX) as per the initially approved work plan. This project investigated the following POEs: 1) Laredo, TX; 2) Eagle Pass, TX; 3) El Paso, TX; 4) Brownsville, TX; 5) Hidalgo, TX; 6) Calexico, CA.

A non-cost extension was granted in order for the researchers to complete their study on the newly added Ports of Entry (econometric analysis, metrics comparison, identification of similarities and disparities, identification of region-related risks).

These findings were presented to the DHS/CBP Champion in Washington DC on 4 December 2017. The presentation was also provided to the DHS S&T leaders and numerous DHS/CBP stakeholders at the BTI Institute's Research Meeting & Showcase held on 4-5 December 2017 in the American University, Washington D.C.

**Task T.7:** Material was developed for two journal publications.

**Task T.8:** Annual Report, video and final presentation was produced.

**Task T.9:** Meeting with champions/stakeholders in Washington DC, to present project.

**The final presentation of this project to the project Champion occurred in December 2017.**

The following CBP stakeholders were also included:

- C-TPAT Program Director, CBP
- C-TPAT Program Manager; Cargo and Conveyance Security, Office of Field Operations, CBP

A conference call including the above CBP/C-TPAT stakeholders also took place shortly before the face-to-face presentation, and included:

- Branch Chief, Outbound Enforcement and Policy, Cargo and Conveyance Security, CBP

## MILESTONES

**Table 6.** Milestone List

ID	Milestone Description	Status
M.1	Land Border Crossing, inbound containers: Baseline performance: Visiting the US-Mexico border crossing PoE (Laredo) and conducting time measurements.  Means of verification: Report, scheduled meeting and images have been presented to CBP Stakeholders. These are part of the Final Report.	Complete
M.2	Risk Assessment and POA Methodology completed.  Means of verification: Report & data have been presented to CBP Stakeholders. These are part of the Final Report.	Complete
M.3	Y2 Report completed. Comparison between baseline and improved methodology.	Complete

	Means of verification: Report & data have been presented to CBP Stakeholders. These are part of the Final Report.	
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**Explanation of why milestones were not reached (if applicable).**

N/A

**PERFORMANCE METRICS**

**Table 7.** Performance Metrics List

ID	Description	Quantitative Performance Target
P.1	<p>Improve time at land border crossing for inbound containerized cargoes on trucks.</p> <p>Time is broken down in</p> <p>a) cycle time (including all inbound logistics processes); and</p> <p>b) process time (estimating value-added activities, and eliminating non-value-added activities).</p>	<i>&gt;3% less time at land border crossing for inbound containerized cargoes on trucks.</i>

**Performance metrics overview**

**Table 8.** Performance Assessment

ID	Status	Far from meeting expectations	Close to meeting expectations	Met expectations	Exceeded expectations
P.1	Exceeded expectations				<b>X</b>

**P.1:** Exceeded expectations. The research deliverables proposed a list of risk factors that cause time delays at the border, and the pertinent recommendations on improving processing times were made.

This research project has also exceeded its geographical scope, i.e. 5 additional Ports of Entry, and has investigated delay factors that are presented in the U.S. Border, but are caused in Mexico, i.e. beyond the borders. These deliverables were presented to the DHS/CBP champions.

## PROJECT DELIVERABLES (OUTPUTS)

**Table 9.** Deliverables List

ID	Deliverable Name	Type	Status
D.1	Risk Assessment & POA methodology report for Land Border Crossing * Inbound containers on Trucks at PoE, US-Mexican Border (Testbed: Laredo, TX).	Protocol, Report	Complete
D.2	Project reports and video footage of visits at selected points-of-entry. * Baseline timing vs. improved timing including new processes, and implemented solutions.	Report Video	Complete
D.3	Annual report	Report	Complete

## PUBLICATIONS, CONFERENCE PAPERS & PRESENTATIONS

### #1. Published Paper:

Burns, M. (2018a) Participatory Operational & Security Assessment on homeland security risks: an empirical research method for improving security beyond the borders through public/private partnerships. Journal of Transportation Security, <https://doi.org/10.1007/s12198-018-0193-1>. Publisher: Springer US; Print ISSN 1938-7741, Online ISSN 1938-775X. Available at: <https://link.springer.com/article/10.1007/s12198-018-0193-1>

### #2. Paper in Print:

Burns, M. (2018b) Securing the Southern Border: A Risk Assessment methodology reflecting the correlation between Mexican Cartel activities and Port of Entry processing times. Journal of Transportation Security, Publisher: Springer US

### #3. Conference/Presentation:

Burns, M. (2018c) Cargo Theft and logistics security. The Texas Trucking Association, Houston. Available at: <https://www.texasrucking.com/txta/pdf/Speaker%20bios%2031818.pdf>

## WEBSITES OR OTHER INTERNET SITES

N/A

## INVENTIONS, PATENT APPLICATIONS and/or LICENSES

N/A

## STAKEHOLDER ENGAGEMENT

Described throughout above.

## **TRANSITION**

See publications.

### **N.11. Secure and Transparent Cargo Supply Chain: Enabling Chain-of-Custody with Economical and Privacy Respecting Biometrics, and Blockchain Technology**

Principal Investigator, Weidong Shi, University of Houston

#### **PROJECT RELEVANCE TO DHS**

This project addresses the overall goal of enhancing legitimate trade and travel by connecting cargo to people and transnational criminal organizations. Key questions this project sought to address include:

- Bound within the maritime supply chain, how might a study be conducted to understand information flows between all players involved (including owners, buyers, sellers, governments and logistic parties) who aim to increase the visibility of goods by providing information into the supply chain?
- Is there a way to incorporate biometrics into the supply chain management process in order to ensure a secure chain-of-custody? If so, how would it be accomplished?
- If biometrics can be incorporated into the supply chain, how can the return-on-investment be determined and what would improve the economic viability of biometrics?
- Do biometrics and mobile technologies offer opportunities to streamline processing of legitimate trade and travel?

This project was intended to address the need of maritime supply chain transparency and to improve supply chain security, prevent cargo fraud/theft, and strengthen resilience against cyber exploits/insider threats through secure chain-of-custody. The project leveraged the recent advances in mobile biometrics and blockchain as tools to achieve its goal and implement supply chain best practices recommended by the stakeholder community.

#### **EXECUTIVE SUMMARY**

Each year, more than 11 million maritime containers arrive at U.S. seaports. Working with global supply chain industry stakeholders, CBP is responsible for facilitation of legitimate flow of cargo through U.S. ports of entry while enforcing U.S. trade laws to assure import security. Critical to global trade, the maritime supply chain is a complex system involving multiple parties (e.g., shippers, carriers, importers, exporters, 3PL, brokers, port authorities, logistics providers, finance institutions, insurance companies). Due to the large number and often wide distribution of stakeholders, the industry suffers a lack of transparency and visibility exposing the maritime supply chain and cargo transportation to fraud, thefts and smuggling of illegal goods.

In late 2017 and early 2018, led by global supply chain stakeholders, and technology solution providers, a number of proof of concept and pilot studies were conducted to test and demonstrate the power of blockchain to achieve transparency, visibility, and efficiency. Despite validation of blockchain as a viable solution for supply chain transparency and efficiency, there are both

knowledge and capability gaps how CBP and government stakeholders can benefit from this new trend and emerging supply chain digitalization ecosystem in order to enhance its missions and strike appropriate balance among the goals of trade facilitation, import security, and trade law enforcement.

This project demonstrated that blockchain, leveraged with mobile biometric authentication, is a viable strategy to secure chain-of-custody and create new capability that can connect cargo to people and provide auditable supply chain intelligence, reduce cost, strengthen compliance, deter cargo fraud/theft, and improve efficiency.

The project was modified at the end of the first year in collaboration with OUP, the DHS Project Champion, and the project PI. Efforts for the newly modified project and the work plan development associated with the modification is planned to occur in PY4.

Highlights from the project include:

- Defined the tools (e.g., different blockchain platforms, APIs of mobile biometrics, TWIC development process) and exploration of technical components (e.g., mobile biometrics, standard of TWIC, cargo release document process).
- Specified requirement and design documents
  - framework using blockchain for achieving chain-of-custody in global supply chain and cargo control
  - digital identity mechanism for global supply chain security that leverages biometric authentication to bind government issued ID/credential with maritime cargo handlers
- Acquired subject matter expertise and knowledge regarding CBP security filing requirements, mandatory EDIFACT process, cargo security best practice (e.g., C-TPAT cargo security program, COAC supply chain security practice), operational environment (terminal operation, cargo release process).
- Conducted survey of recent efforts and initiatives applying blockchain technology to global shipping, cross-border trade and supply chain including PoC tests.
- Engaged relevant CBP stakeholders, including Office of Trade, C-TPAT, Office of Trade Transformation, CBP Houston Field Office, and CBP PoE for Galveston.
- Initiated broader engagement with global supply chain stakeholders, in particular companies and industry players who are involved in recent pilots and technology development leveraging blockchain to enhance global supply chain security and efficiency, include:
  - Accenture Labs (end-to-end supply chain, and trade digitalization using blockchain).
  - TBSX3 (supply chain security and counterfeit detection using blockchain).
  - T-mining & Port of Antwerp (secure cargo process using blockchain, cargo document flow between international ports).
  - CSA (cargo security alliance – non-profit organization focusing on cargo security and C-TPAT compliance).
  - Port of Houston (IBM, Maersk, Port of Houston, blockchain for global supply chain and maritime cargo trade).
  - COAC subject matter experts focusing on trade compliance and global supply chain security including people who are involved in CBP pilots of blockchain.



- Established collaboration and partnership with other universities on research relevant to the project. For instance, Georgetown University focusing on academia/industry partnership on blockchain research and education.
- Organized a blockchain summit (21-22 May 2018 in Houston: Blockchain for Supply Chain and Logistics Forum) to promote collaboration, innovation, and research among technologists, industry stakeholders, solution providers, public sectors, and business leaders. The event featured more than 40 speakers (supply chain, logistics, transportation, international trade). It attracted over 180 attendees and many of them were HSE stakeholders and potential partners such as Accenture Labs, Hapag-Lloyd, Hitachi, ZIM Integrated Shipping, Dunavant Logistics Group, Phillips 66, Expeditors Inc, Caterpillar Inc, PortAmerica, Crane World Logistics, Houston Terminal LLC, COSCO Shipping Line (North America), International Trade Systems, BDP International, Sherwood Global Logistics, Port of Antwerp, CBP Office of Trade Transformation, CBP Field Office (Galveston).

## PROJECT TEAM

### Personnel (Other than Students)

**Table 1.** Project Personnel (other than students)

First Name	Last Name	Institution	Role on Project
Weidong (Larry)	Shi	University of Houston	Principal Investigator
Jeffrey	O. Baldwin, Sr.	Retired CBP director, field operations	Consultant
Lei	Xu	University of Houston	Senior Personnel
Eleftherios	Iakovou	Texas A & M University	co-Principal Investigator
Yanling	Chang	Texas A & M University	Research
Chen	Lin	University of Houston	Research Staff

**Table 2.** Students involved in the project

First Name	Last Name	Institution	Degree Pursued
Zhiming (Kelvin)	Gao	University of Houston	Ph.D.
Nour	Diallo	University of Houston	B.S.
Larry	Carranco	University of Houston	Post Baccalaureate
Nolan	Shah	University of Houston	B.S.
Glenn	Turner	University of Houston	M.S.

Brijesh	Patel	University of Houston	M.S.
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**Student Name:** Zhiming (Kelvin) Gao (Ph.D.):

As research associate, Mr. Gao made contributions in the following aspects: research of different blockchain platforms (Hyperledger, Ethereum) for supply chain data sharing (tools, test network, limitations, existing projects related to supply chains); how to support and integrate mobile biometrics and identity control (touchID, faceID, digital credential) using iOS platform; study of TWIC standard; publication of peer reviewed articles [1-5] (listed as author or co-author); preparation of presentation slide and poster (PI meeting); and prototype design (test code implementation, and design document deliverable). The research was incorporated in Mr. Gao's Ph.D. dissertation.

**Student Name:** Nour Diallo (B.S.):

As a research assistant, Mr. Diallo made contributions to the following: communication and interaction with stakeholders; outreach activities related to the project including meetings, participation of events, teleconference with consultants, partners, and supply chain stakeholders; solicitation of feedback and comment to the project efforts from stakeholders; preparation of presentation slides and poster (PI meeting); publication of peer reviewed article (listed as co-author); and suggestions/comments to the deliverables.

**Student Name:** Larry Carranco (Post Baccalaureate):

As research assistant, Mr. Carranco made contributions to the following: communication and interaction with stakeholders; setup and experiments with blockchain platforms.

**Student Name:** Nolan Shah (B.S.):

As a research assistant, Mr. Shah made contributions to the following: research of blockchain technologies and application related to the project; participation of discussions, and meetings; publication of peer reviewed article [5] (listed as co-author). He received CRA (Computing Research Association) Outstanding Undergraduate Researcher Award (Honorable Mentions), a prestigious award for undergraduate researchers.

**Student Name:** Glenn Turner (M.S.):

Mr. Turner took research course with the PI as mentor. He made contributions in the following: study and research of Hyperledger platform (one of the target platform for implementing deliverables of this project). Mr. Turner is working on his M.S. thesis (planned dissertation defense date, Summer 2019). He hasn't finalized his thesis title. The dissertation topic is on how Hyperledger uses trusted execution environment and its applications to IoT use cases related to supply chain and trade such as tracking of logistics and chain-of-custody. Mr. Turner has a plan to pursue Ph.D. program after graduation.

**Student Name:** Brijesh Patel (M.S.):

Mr. Patel has the PI as M.S. dissertation committee chair. He made contributions in the following aspects: survey and research of identity management using blockchain (related to project goal and deliverable); and publication of peer reviewed article [2] (listed as co-author). He is completing his M.S. thesis “Blockchain Application for Self-sovereign Identity” with blockchain based identity control as research topic (planned graduation date, December, 2018).

## TASKS

**Table 3.** Task List

ID	Task Title	Status	Associated Deliverables
T.1	Project kick-off and communications with project champion.	Complete	D.1
T.2	Meeting with BTI.	Complete	
T.3	Identifying partners.	Complete	D.1
T.4	Plan development for field study and financial impact study.	Complete	D.1
T.5	Design of blockchain based chain-of-custody.	Complete	D.2
T.6	Design of integration with mobile biometrics.	Complete	D.2
T.7	Development, test and evaluation of the prototype for block chain-based cargo supply-chain system software.	Incomplete	D.3, D.4, D.5
T.8	Review full/expedited/exempt IRB submission.	Incomplete	
T.9	Conduct field study and financial impact study with selected partner, and collect feedbacks.	Incomplete	D.6, D.7
T.10	Final report preparation.	Incomplete	D.8

### Task overview

#### Task T.1: Project kick-off and communications with project champion

Conducted kick-off meeting and follow up activities. Had iterative discussions with project champion regarding project related issues.

#### Task T.2: Meeting with BTI

Communication between BTI and Project Team members occurred on a regular basis and is documented in in quarterly meeting updates and general correspondence via email.

#### Task T.3: Identifying partners

The research team reached out to many global supply chain stakeholders to identify potential partners to assist evaluation of the developed technology in the second year of the project. Those included carriers, logistic brokers, port authorities, technology solution providers focusing on trade compliance & cargo security, COAC, government stakeholders (e.g., C-TPAT, Office of Trade Transformation), cargo security specialist, and companies that develop blockchain based solutions for maritime trade and global supply chain digitalization. In particular, the team established collaboration with early adopters (Port of Antwerp and T-mining) using blockchain to secure cargo release (prevent tampering of PIN code used in cargo release). The team also shared project information with government stakeholders and established communication channels with C-TPAT specialists and CBP field office stakeholders (port of entry, maritime and air).

#### **Task T.4: Plan development for field study and financial impact study**

Consulting with partners and subject matter experts, the research team studied best practice of C-TPAT regarding physical and IT security of cargo handling process, and usage of biometrics; requirements of Maritime Transportation Security Act for trusted maritime transportation workers (access to terminals, container yard, port facilities), analysis of TWIC protocols, technologies, and cost models; best practice of compliance regarding global supply chain security recommended by COAC and C-TPAT; operational environment of cargo handling/release process using Port of Houston authority, Port of Long Beach, and terminals as case study targets; CBP security filing requirements related to container status; and details of container information flow - EDIFACT messaging standards (EDIFACT is the messaging system that deals with who/what/where/when in relation to a container). In addition, the team mapped maritime cargo handling process and evaluated how technology components can be integrated in operational environment to, improve physical and IT security of cargo handling process, ensure compliance, and achieve chain-of-custody. We also investigated and experimented with 3<sup>rd</sup> party biometric solutions (TouchID, FaceID) as component that can be integrated with blockchain based chain-of-custody. The team also developed a scenario to demonstrate the developed technology in realistic operation environment, where chain-of-custody information can be digitalized using mobile gadgets that records container status, and connects cargo handler to cargo event.

#### **Task T.5: Design of blockchain based chain-of-custody**

The team designed a digital framework to record chain-of-custody in maritime container handling that connects cargo handler (trusted maritime transportation worker) with container status. The team studied and compared different technology platforms regarding implementation of the designed approach. The plan was to leverage experiences from early adopters such as Port of Antwerp, and develop an approach that can be applied to U.S. terminal operations.

#### **Task T.6: Design of integration with mobile biometrics**

The team developed a design that integrates biometrics to authenticate cargo handlers based on commercially available off-the-shelf technologies (FaceID, TouchID). The benefit of integrating biometrics is that it enhances physical security of container handling from one factor authentication to two factor authentication (biometrics).

**NOTE:** Tasks 7 through 10 below were planned for the future years of the project. The project has since been modified. At the request of OUP and in conjunction with the DHS Project

Champion, Dr. Shi's effort in the area of blockchain research was continued into the next program year under a new work plan to be developed in PY4.

**Task T.7: Development, test and evaluation of the prototype for block chain-based cargo supply-chain system software**

The evaluation is divided into two categories: (i) Technical test and evaluation, which include testing software functionalities (correctness of responses to inputs) and performance such as latency/throughput evaluation, and resource consumption evaluation; (ii) Operational utility evaluation, which includes evaluation of usefulness of the system in practice or operational environment. This study will be done by subject matter experts with operational knowledge.

This task verifies designs developed in T.5 and T.6 and evaluates them to check whether the challenges are addressed.

**Task T.8: Review full/expedited/exempt IRB submission**

The research team is not developing nor collecting any biometric information from individuals. To conduct field study or field demonstration, individuals may interact with our system and they will be asked for feedback/comments. Then the University's IRB committee will determine if an expedited or exempt IRB is required prior to the project kickoff and/or evaluation. The team has discussed with University of Houston Division of Research and an IRB request is under review.

**Task T.9: Conduct field study and financial impact study with selected partner, and collect feedbacks**

This task was to be completed in future years of the project, however, the project was modified after its first year.

**Task T.10: Final report preparation**

This task was to be completed in future years of the project, however, the project was modified after its first year.

**Explanation of any changes from the initially approved work plan (if applicable)**

The project was terminated prior to completion and a follow-on project was developed to be implemented in PY4.

**MILESTONES**

**Table 4.** Milestone List

ID	Milestone Description	Status
M.1	Completed partner selection, system requirements analysis, and filed study/cost analysis plan.	Complete

M.2	Completed system design.	Complete
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**Explanation of why milestones were not reached (if applicable).**

N/A

**PERFORMANCE METRICS**

**Table 5.** Performance Metrics List

ID	Description	Quantitative Performance Target
P.1	System performance, which is further divided into: (i) Latency of adding records to the system. Latency will be measured when the information is uploaded to the blockchain. The timestamp of a request is compared with the timestamp of the ending of the transaction. (ii) Throughput. Throughput will be measured by the number of records that the system can handle in a given time period.	System performance targets include: (i) Latency: maximal 1 second delay; (ii) Throughput: at least 1,000 records per minute.
P.2	Financial impact of end-to-end chain-of-custody using biometrics and blockchain.	Because there is no comparable or equivalent system available in the market yet, the analysis will be determined by consulting with selected project partner.
P.3	Reduction of cargo fraud/thefts that are related to cargo management IT system. Specifically, the developed system will provide following features: (i) an adversary cannot delete a transaction record stored in the system; (ii) an adversary cannot alter or modify an existing transaction record.	The system includes decentralized immutable ledger that comprises multiple nodes. If majority of the nodes are honest or trusted (permission based blockchain) and an adversary only has bounded computation and storage capability, it is guaranteed that these features be satisfied.

**Performance metrics overview**

**Table 6.** Performance Assessment

ID	Status	Far from meeting expectations	Close to meeting expectations	Met expectations	Exceeded expectations
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P.1	Incomplete				
P.2	Incomplete				
P.3	Incomplete				

**P.1:** It is anticipated to meet system performance targets in table 5 at the end of second phase, when a PoC prototype will be implemented. According to current study and evaluation, there will be no issue to meet both latency and throughput targets using permissioned blockchain (e.g., Hyperledger fabric) in test environment. However, when deployed in geo-distributed data centers, latency may be affected by physical distance between nodes separated in different continents, which is bounded by speed of light.

**P.2:** Availability of P.2 result depends on completion of PoC prototype in the second phase.

**P.3:** P.3 is guaranteed by immutability and security assurance of blockchain. Actual demonstration depends on completion of PoC prototype at the end of second phase.

## PROJECT DELIVERABLES (OUTPUTS)

**Table 7.** Deliverables List

D.1	Requirement and performance definition.	Report	Complete
D.2	System design document including biometrics integration and privacy protection mechanism for blockchain.	Report	Complete
D.3	Prototype demonstration of the use case scenario: secure cargo pickup by trusted transportation worker, which can handle each verification step involved in the procedure. This prototype will leverage D.4 for trucker identity information. The prototype will be delivered as implementation and design document.  Outputs of T.7.	Software	Incomplete
D.4	Prototype of integration of trusted transportation worker identity, mobile biometrics, which will interact with the prototype D.3. The prototype will be	Software	Incomplete

	delivered as implementation and design document.  Outputs of T.7.		
D.5	Prototype of integrating D.3 and D.4. This prototype is a set of protocols/middleware that allows D.4 to be integrated to D.3 to facilitate the verification process of cargo release. The prototype will be delivered as implementation and design document.  Output of T.7.	Software	Incomplete
D.6	6 publications in relevant conferences, magazines and journals.	Publication	Incomplete
D.7	Report on field study and cost analysis.	Report	Incomplete
D.8	Final evaluation report covers system performance, findings, evaluation, and lessons learned.	Report	Incomplete

## **PUBLICATIONS, CONFERENCE PAPERS & PRESENTATIONS**

[1] Lei Xu, Lin Chen, Zhimin Gao, Yanling Chang, Eleftherios Iakovou, Weidong Shi. "A Blockchain Approach for Cargo Supply Chain Security Enhancement". The 18th Annual IEEE Symposium on Technologies for Homeland Security (HST '18, October 2018).

[2] Zhimin Gao, Lei Xu, Glenn Turner, Brijesh Patel, Nour Diallo, Lin Chen, Weidong Shi. "Blockchain-based Identity Management with Mobile Device". Workshop on Cryptocurrencies and Blockchains for Distributed Systems (co-located with MobiSys 2018) June 15th, 2018.

[3] Lei Xu, Lin Chen, Zhimin Gao, Yang Lu, and Weidong Shi. "CoC: Secure Supply Chain Management System Based on Public Ledger." In Computer Communication and Networks (ICCCN), 2017 26th International Conference on, pp. 1-6. IEEE, 2017.

[4] Lei Xu, Lin Chen, Zhimin Gao, Shouhuai Xu, and Weidong Shi. "EPBC: Efficient Public Blockchain Client for Lightweight Users." In Proceedings of the 1st Workshop on Scalable and Resilient Infrastructures for Distributed Ledgers, p. 1. ACM, 2017.

[5] Zhimin Gao, Lin Chen, Lei Xu, Nolan Shah, Yang Lu, Weidong Shi. "Scalable Blockchain-based Smart Contract Execution." In 2017 IEEE International Conference on Parallel and Distributed Systems.

## **WEBSITES OR OTHER INTERNET SITES**

None.



## **INVENTIONS, PATENT APPLICATIONS and/or LICENSES**

None

## **STAKEHOLDER ENGAGEMENT**

The project team reached out and engaged with relevant CBP stakeholders, including C-TPAT specialists, Office of Trade Transformation, CBP Houston Field Office, CBP POE (Port of Entry) for Galveston, and members of COAC committees who are involved in global supply chain security and emerging technologies. The team shared project materials with the CBP stakeholders and established communication channels. The interactions with the stakeholders helped the team to align efforts in future phase of the project with CBP cargo security priorities, in particular, updated framework of C-TPAT best practice related to providing *“evidence of the implementation of security measures; examples of documented processes; indication of having a system of checks, balances, and accountability; as well as some innovative business processes/technology appropriate for the business model/size/industry”*.

The project team also initiated broader engagement with global supply chain stakeholders and technology providers, in particular companies who are involved in recent pilots and technology development leveraging blockchain to enable end-to-end supply chain digitalization and enhance global supply chain security. The team established collaborative relationships and/or partnerships with stakeholders regarding developing solutions for cross-border trade, summarized as follows:

- COAC subject matter experts focusing on trade compliance and global supply chain security including people who are involved in CBP blockchain pilots.
- Early adopters applying blockchain to secure process of cargo release including T-mining & Port of Antwerp. The collaboration helped the team to collect lessons learned and evaluate if similar PoC can be applied to ports in the U.S.
- Technology solution providers including IBM (Tradelens – blockchain based end-to-end supply chain digitalization platform), Accenture Labs (end-to-end supply chain, and trade digitalization using blockchain).
- Cargo security stakeholders and specialist including CSA (cargo security alliance – non-profit organization focusing on cargo security and C-TPAT compliance).
- Port Authority, terminal operator, and freight forwarders. The team engaged with port authority, operators, and freight forwarders for purpose of mapping the process of cargo release/handling, EDI interface, and used the knowledge to develop scenarios to evaluate the developed technology.

## **TRANSITION**

See publications above.

## **N.12. The Impact of Central American Child and Family Migration on U.S. Communities**

Principal Investigator, Eric Hershberg, American University

## **PROJECT RELEVANCE TO DHS**

This project addresses the overall goals of: 1) enhancing the ability to promote the integrity of the immigration system within the US border; 2) improving the understanding of the economic and societal impact of the immigrant population in the US, by promoting immigrant integration and utilizing performance metrics. Key questions this project sought to address include:

- What is the impact of Central American immigration on local governments and communities, including with respect to healthcare, education, and safety and security?
- What are the short- and long-term costs and benefits to U.S. communities of Central American immigration?
- How strong is the infrastructure for providing services to the population in the U.S.?
- Which agencies are providing services, and what are the gaps in the services?
- Are immigrants or refugees being released into U.S. communities adapting and becoming integrated into their local communities, or are they struggling?
- What are the health, mental health, educational, behavioral, employment, etc., outcomes of immigrants or refugees being released into communities in the U.S.?
- How is DHS handling the increase in arrivals, especially women and children?
- How is the Immigration and Customs Enforcement's (ICE) new Family Case Management Program performing?
- What are the outcomes of families with histories of trauma enrolled in the program?

## **EXECUTIVE SUMMARY**

Increased Central American child and family migration is impacting communities across the U.S. These local communities are assume a significant burden in attempting to ensure the welfare of this growing immigrant population. Communities assist and support immigrants as they navigate the immigration process and begin the process of integration for those deemed eligible to receive immigration benefits. The capacity of the receiving communities to respond to this ongoing humanitarian situation is uneven and, in many cases, likely insufficient. This project is part of a targeted research effort to;

- analyze varying levels of capacity and response across diverse community contexts
- map the landscape of local government and community services available to this population
- determine how those factors are shaping newcomers' ability to adapt and integrate

Such work is critical to enhancing local communities' capacity to respond, by offering evidence-based recommendations for how best to leverage existing resources to strengthen and sustain community preparedness. This project contributed the following accomplishments from the project period between 1 July 2017 to 30 June 2018:

- completed a comprehensive review of existing information regarding project research questions
- conducted 124 key informant interviews in the Washington, DC metropolitan area, the Houston metropolitan area, and North and South Carolina
- performed data analysis activities, including the transcription of all project interviews, development of codebooks, and coding of project data
- launched a dedicated project webpage housing project information and deliverables

- hosted two stakeholder briefings to present and discuss project findings.

As a supplement to the project report, the project team produced a report that summarized the research questions the project aimed to answer, the data gathered, and associated deliverables. (i.e., project website, stakeholder meetings, and service area briefs and case studies). The service area briefs and community case studies are being edited for precision and nuance and will be posted to the project webpage in PY4. This report offers a synthesis of the key findings from each of the case studies and service area briefs.

## PROJECT TEAM

### Personnel (Other than Students)

**Table 1.** Project Personnel (other than students)

First Name	Last Name	Institution	Role on Project
Eric	Hershberg	American University	PI
Jodi	Berger Cardoso	University of Houston	Co-PI
Aaron	Bell	American University	Investigator
Dennis	Stinchcomb	American University	Investigator

**Table 2.** Students involved in the project

First Name	Last Name	Institution	Degree Pursued
Alex	Steffler	University of Houston	MSW
Elsa	Mendoza	University of Houston	MSW
Stephanie	Gomez	University of Houston	MSW/MPP
Stephanie	Perinne	University of Houston	MSW
Patricia	Miguel	American University	MA
Antonio	Alvarez	American University	BA

#### **Student Name:** Alex Steffler

Under the direction and supervision of the Co-PI, Alex Steffler was involved in carrying out the review of existing data, identifying and recruiting key informants, conducting and transcribing interviews, developing codebooks, coding transcribed interviews, analyzing coded data, and presenting project findings in Houston and Washington, DC.

#### **Student Name:** Elsa Mendoza

Under the direction and supervision of the Co-PI, Elsa Mendoza was involved in carrying out the review of existing data, identifying and recruiting key informants, and conducting and transcribing project interviews.

**Student Names:** Stephanie Gomez and Stephanie Perinne

Under the direction and supervision of the Co-PI, Stephanie Gomez and Stephanie Perinne were involved in transcribing and coding project interviews.

**Student Name:** Patricia Miguel

Under the direction and supervision of the PI, Patricia Miguel was involved in carrying out the review of existing data, identifying and recruiting key informants, conducting and transcribing interviews, developing codebooks, and coding transcribed interviews.

**Student Name:** Antonio Alvarez

Under the direction and supervision of the PI, Antonio Alvarez was involved in transcribing project interviews, developing codebooks, and coding transcribed interviews.

## TASKS

**Table 3.** Task List

ID	Task Title	Status	Associated Deliverables
T.1	Start-Up Meeting with Project Champion	Complete	
T.2	Comprehensive Review of Existing Information	Complete	
T.3	Meeting with Project Champion	Complete	
T.4	Key Informant Interviews	Complete	
T.5	Meeting with Project Champion	Complete	
T.6	Interview Transcription and Data Analysis	Complete	
T.7	Meeting with Project Champion	Complete	
T.8	Community Case Studies and Service Area Briefs	Incomplete	D.1, D.2
T.9	Stakeholder Briefings	Complete	D.3, D.4
T.10	Final Report	Complete	D.5

### Task overview

**Task T.1 Start-Up Meeting with Project Champion:** Accomplished as planned.

**Task T.2 Comprehensive Review of Existing Information:** The project team completed a “literature review” synthesizing the existing knowledge base on community responses and available resources for Central American newcomers, drawing on academic, local government, and nonprofit community-based organization (CBO) reports.

**Task T.3 Meeting with Project Champion:** Accomplished as planned.

**Task T.4 Key Informant Interviews:** As outlined in our approved work plan, we conducted 124 key informant interviews with government officials; community-based nonprofit service providers; and nonprofit advocacy groups across the three identified service areas. A similar approach was used to assess overall DHS response and ICE’s FCMP. The table below shows the distribution of interviews across sites and service areas.

	Washington, DC Metropolitan Area	Houston Metropolitan Area	North and South Carolina
Education	11	12	11
Health and Human Services	12	14	12
Legal Services	17	12	11
FCMP	12		
Total (N = 124)	52	38	34

**Task T.5 Meeting with Project Champion:** Accomplished as planned.

**Task T.6 Interview Transcription and Data Analysis:** Key informant interviews were transcribed and coded in Dedoose for analysis according to a standardized protocol across the research sites. The project team included three coders based at American University and four at the University of Houston. Codebooks were developed for each of the three service areas through a reiterative process of issue and theme identification, team discussion, codebook drafting, application, and codebook revision until no new themes emerged. An initial set of coded interviews for each service area were shared and reviewed by the research team to evaluate inter-coder reliability. Qualitative analyses of interview data were also supplemented by published reports and publicly available data on community impact and response gathered during T.2.

**Task T.7 Meeting with Project Champion:** Accomplished as planned.

**Task T.8 Community Case Studies and Service Area Briefs:** Drafts of the community case studies and service area briefs are being edited for precision and nuance and will be posted to the project webpage in PY4 and published in our SSRN Working Paper series. The accompanying report offers a synthesis of the key findings of each of those documents.

**Task T.9 Stakeholder Briefings:** In June 2018 the project team hosted two stakeholder briefings. The first took place in Houston on 7 June 2018 at Catholic Charities’ Cabrini Center, and was co-hosted by the Houston Immigration Legal Services Collaborative. The second was held in Washington, DC on 27 June 2018 at the American University Washington College of Law. At these briefings, members of the project team presented preliminary findings with a broad range of community stakeholders, many of whom participated as key informants. Re-engaging with community stakeholders gave the team an opportunity to validate findings, solicit feedback, and consolidate a network through which we will widely disseminate project deliverables.

**Task T.10 Final Report:** Accompanying this annual report is a substantive report that summarizes the research questions the project aimed to answer, the data gathered, and associated deliverables. (i.e., project website, stakeholder meetings, and case studies and service area briefs). The community case studies and service area briefs are being edited for precision and nuance and will be posted to the project webpage in PY4. The accompanying report offers a synthesis of the key findings of each of those documents.

**Explanation of any changes from the initially approved work plan (if applicable)**

Not applicable.

## MILESTONES

**Table 4.** Milestone List

ID	Milestone Description	Status
M.1	Completion of Comprehensive Review of Existing Data	Complete
M.2	Completion of Key Informant Interviews	Complete
M.3	Publication of Three Community Case Studies	Incomplete
M.4	Publication of Three Service Area Briefs	Incomplete
M.5	Submission of Draft Final Report	Complete
M.6	Submission of Final Report	Complete

### Explanation of why milestones were not reached (if applicable).

The service area briefs and community case studies are being edited for precision and nuance and will be posted to the project webpage PY4. The accompanying report offers a synthesis of the key findings of each of those documents. The area briefs and community case studies were delayed due to in impact of Hurricane Harvey on the Houston area and a significant number of interviewees across all three research sites declined to participate in a DHS-funded project. To overcome this challenge, extra effort was spent identifying and recruiting additional informants resulting in a delay in interviews.

## PERFORMANCE METRICS

**Table 5.** Performance Metrics List

ID	Description	Quantitative Performance Target	Status
P.1	Number of Key Informant Interviews	120	124
P.2	Number of Interview Transcriptions	120	124
P.3	Number of Attendees at Dissemination Briefings	150	90
P.4	Number of Case Study Downloads	1000	Performance measures could not be measured until the completion of the associated deliverable. Once the deliverable is complete, the

			document will be made available for download and the number of downloads can be tracked.
P.5	Number of Service Area Brief Downloads	1500	pending
P.6	Number of Project Webpage Visits	1000	720
P.7	Social Media Engagement: Number of likes, shares, retweets, reposts, etc.	250	588

**Performance metrics overview**

**Table 6.** Performance Assessment

ID	Status	Far from meeting expectations	Close to meeting expectations	Met expectations	Exceeded expectations
P.1	Complete			X	
P.2	Complete			X	
P.3	Complete		X		
P.4	Incomplete		X		
P.5	Incomplete		X		
P.6	Complete			X	
P.7	Complete				X

**P.1 Number of Key Informant Interviews:** With 124 key informant interviews, we surpassed our target of 120 interviews (38 in Houston; 52 in DC; and 34 in the Carolinas).

**P.2 Number of Interview Transcriptions:** With 124 key informant interviews transcribed, we surpassed our target of 120 transcriptions.

**P.3 Number of Attendees at Dissemination Briefings:** Slightly lower than anticipated attendance at the stakeholder briefings in Houston and Washington, DC was more than compensated for by views of the video recording of panelist presentations, which total 500.

**P.4 Number of Case Study Downloads:** As anticipated, we would not be able to adequately track downloads of project deliverables during the project period. When published, the deliverables will be widely disseminated via the project webpage, social media platforms, and

extensive distribution lists. These performance measures cannot be measured until the completion of the associated deliverable. Once the deliverable is complete, the document will be made available for download and the number of downloads can be tracked.

**P.5 Number of Service Area Brief Downloads:** As anticipated, we would not be able to adequately track downloads of project deliverables during the project period. When published, the deliverables will be widely disseminated via the project webpage, social media platforms, and extensive distribution lists. These performance measures cannot be measured until the completion of the associated deliverable. Once the deliverable is complete, the document will be made available for download and the number of downloads can be tracked.

**P.6 Number of Project Webpage Visits:** We expect webpage visits to continue to increase beyond the project period.

**P.7 Social Media Engagement:** In conjunction with the stakeholder meetings, we launched an aggressive dissemination campaign, including the creation of a project-dedicated webpage and the strategic use of social media to project the reach of those public presentations and preliminary project findings. We expect webpage visits to continue to increase beyond the project period.

## PROJECT DELIVERABLES (OUTPUTS)

Table 7. Deliverables List

ID	Deliverable Name	Type	Status
D.1	Three Community Case Studies: Washington, DC; Houston; North and South Carolina	Reports	Incomplete
D.2	Three Service Area Briefs: Education; Health and Human Services; Legal Services	Briefs	Incomplete
D.3	Project Results Disseminate through CLALS website		Complete
D.4	Stakeholder Briefings (Recordings)		Complete
D.5	Final Report	Reports	Complete

## PUBLICATIONS, CONFERENCE PAPERS & PRESENTATIONS

The Impact of Central American Migration on U.S. Communities: Washington, DC, Houston, and the Carolinas (in production).

Service Area Brief #1: Newcomer Central American Immigrants' Access to Education (in production).

Service Area Brief #2: Newcomer Central American Immigrants' Access to Health and Human Services (in production).

Service Area Brief #3: Newcomer Central American Immigrants' Access to Legal Services (in production).

## WEBSITES OR OTHER INTERNET SITES



“Central American Migration and U.S. Communities”

<https://www.american.edu/centers/latin-american-latino-studies/central-american-migration-and-us-communities.cfm>.

This project-dedicated webpage includes a summary of the project, information regarding recent stakeholder meetings, and a video recording of the researcher presentations in DC. This page will also host the published versions of the community case studies and the service area briefs.

#### **INVENTIONS, PATENT APPLICATIONS and/or LICENSES**

None.

#### **N.13 Unconstrained Face Recognition using Cell Phone Devices: Faces in the Wild**

Principal Investigator, Thirimachos Bourlai, West Virginia University

#### **PROJECT RELEVANCE TO DHS**

This project addresses the overall goal of enhancing the ability to secure and facilitate transnational flows of people by developing an alternative passenger screening capability that can efficiently perform face-based screening at ports of entry using commercially available cell phones. A key question this project sought to address is:

- Do biometrics and mobile technologies offer opportunities to streamline processing of legitimate trade and travel?

#### **EXECUTIVE SUMMARY**

Facial recognition (FR) systems compare a facial images against a gallery of images to establish/confirm identity. FR systems are remarkably reliable under laboratory conditions and with certain variables controlled FR systems also perform well in the field. Challenges occur for FR systems in law enforcement scenarios where source images are acquired using cell phones, tablets under less than ideal conditions (variations in distance, light, camera resolution). The current project focus was the development of a mobile biometric tool to efficiently deal with unconstrained, multi-scenario face datasets.

The project was one of the initial proposals funded through the BTI Institute. The project received a no-cost extension until August 31, 2017 in order to conclude Phase 1. Performance Year 3 for the project was Phase 2 of the project. The WVU and Rutgers team completed and submitted the Phase 2 work plan, however, the PI and Office of Sponsored Programs at West Virginia University requested the project withdrawn as of August 30, 2017. A database consisting of photographs and video of 100 subjects was delivered to the BTI Institute at the conclusion of the project.

Additionally, two papers were published in the 2017 12th IEEE International Conference on Automatic Face & Gesture Recognition. Those papers were:

- Lezi Wang, Xiang Yu, Dimitris N. Metaxas, “A Coupled Encoder and Decoder Network for Face Detection and Landmark Localization”, accepted by IEEE International

Conference on Automatic Face Gesture Recognition (FG) 2017.

<https://ieeexplore.ieee.org/document/7961749/>

- Neeru Narang, Michael Martin, Dimitris Metaxas, Thirimachos Bourlai, “Learning Deep Features for Hierarchical Classification of Mobile Phone Face Datasets in Heterogeneous Environments”, accepted by IEEE International Conference on Automatic Face Gesture Recognition (FG) 2017.

<https://ieeexplore.ieee.org/document/7961740/>

## Appendix A: Acronyms

2D	Two dimensional
3D	Three dimensional
3PL	Third-party logistics
ACE	Automated Commercial Environment
ADAC	Arctic Domain Awareness Center
AFP	Alliance for Prosperity
ALERT	Awareness and Localization of Explosives-Related Threats
API	Application Programming Interface
ARG	Asociación de Retornados de Guatemala
ATF	Bureau of Alcohol, Tobacco and Firearms
AUSA	Assistant United States Attorney
BA	Bachelor of Arts
BMD	Borders and Maritime Security Division
BoD	Board of Directors
BOTA	Bridge Of The Americas
BS	Bachelor of Science
BTI	Borders, Trade, and Immigration
CAOE	Center for Accelerated Operational Efficiency
CAPO	Compliance Assurance Program Office
CARSI	Central America Regional Security Initiative
CBO	Community-based organization
CCICADA	Command, Control, and Interoperability Center for Advance Data Analysis
CCTA	Complex Coordinated Terrorist Attack
CCTV	Closed-circuit television
CINA	Criminal Investigation Network Analysis Center
CIRI	Critical Infrastructure Resilience Institute
CLALS	Center for Latin American & Latino Studies
CLHB	Center for Law & Human Behavior
CNN	Convolutional Neural Networks
COAC	Commercial Operations Advisory Committee
COE	Center of Excellence
COI	Conflict of Interest
CPE	Continuing professional education
CRC	Coastal Resilience Center
CSA	Cargo Security Alliance
CSV	Comma-separated values
C-TPAT	Customs-Trade Partnership Against Terrorism

DAC	Deputy Assistant Commissioner
DEA	Data Envelopment Analysis
DEA	Drug Enforcement Administration
DHS	Department of Homeland Security
DNA	Deoxyribonucleic acid
DOD	Department of Defense
DOE	Department of Energy
DOJ	Department of Justice
DOS	Department of State
DTIC	Defense Technical Information Center
EAB	External Advisory Board
ECR	Extended capture-recapture
EDI	Electronic Data Interchange
EDIFACT	Electronic Data Interchange For Administration, Commerce and Transport
FAA	Federal Aviation Administration
FAM	Fondo de Apoyo al Migrante
FAST	Free and Secure Trade
FBI	Federal Bureau of Investigation
FCMP	Forms Content Management Program
FEMA	Federal Emergency Management Agency
FG	Face Gesture
FLETC	Federal Law Enforcement Training Center
FR	Facial Recognition
GAO	Government Accountability Office
GIS	Geographic Information System
GoDP	Globally optimized Dual Pathway
GPS	Global Positioning System
GUI	Graphical User Interface
HFSC	Houston Forensic Science Center
HQ	Headquarters
HS	Homeland Security
HSE	Homeland Security Enterprise
HSUP	Homeland Security University Programs
ICCVW	International Conference on Computer Vision Workshop
ICE	Immigration and Customs Enforcement
ICPSR	Inter-university Consortium for Political and Social Research
IEEE	Institute of Electrical and Electronics Engineers
IJCB	International Joint Conference on Biometrics

INEA	Instituto Nacional de Educación de los Adultos
INL	Bureau of International Narcotics and Law Enforcement Affairs
INR	Bureau of Intelligence and Research
INSAMI	Instituto Salvadoreño del Migrante
IOM	International Organization for Migration
iOS	iPhone Operating System
IP	Intellectual property
IRB	Institutional Review Board
ISBN	International Standard Book Number
ISSN	International Standard Serial Number
ITA	International Trade Administration
LCC	Local Classifier Chains
LSUAS	Lone Star Unmanned Aerial System
M	Mean
MOD	Modified Online Delphi
MOR	Memorandum of Record
MPI	Migration Policy Institute
MPP	Master of Public Policy
MS	Microsoft
MS or MSc	Master of Science
MSC	Maritime Security Center
MSI	Minority Serving Institution
MSW	Master of Social Work
NACTS	North American Center for Transborder Studies
NAFTA	North American Free Trade Agreement
NOFO	Notice of funding opportunity
OFO	Office of Field Operations
OIS	Office of International Services
OpEds	Opinion editorial
OPM	Office of Personnel Management
ORISE	Oak Ridge Institute for Science and Education
ORNL	Oak Ridge National Laboratory
OTM	Other than Mexico
OUP	Office of University Programs
PA	Peace Arch
PC	Project champion
PhD	Doctor of Philosophy
PI	Principal Investigator

PIN	Personal Identification Number
PM	Program Manager
PNWER	Pacific North West Economic Region
POA	Participatory Operational Assessment
POC	Point of Contact
PoC	Proof of concept
POE	Port of entry
POESS	Port-Of-Entry Simulation System
PY2	Program Year 2
PY3	Program Year 3
PY4	Program Year 4
RAVEN	Repository for Analytics in a Virtualized Environment
RFID	Radio-frequency identification
RFP	Request for Proposals
S&T	Science and Technology Directorate
SETRPC	South East Texas Regional Planning Commission
SME	Subject matter expert
SOP	Standard Operating Procedure
SPAD	Strategic Planning and Analysis Directorate
SSRN	Social Science Research Network
START	National Consortium for the Study of Terrorism and Responses to Terrorism
STEM	Science, Technology, Engineering, and Mathematics
STK	Security Technologies Kitchen
TBSX3	Supply chain security and counterfeit detection
TCO	Trans Criminal Organizations
TIR	Total Interdiction Rate
TWIC	Transportation Worker Identification Credential
TSA	Transportation Security Administration
U.S.	United States
UAC	Unaccompanied minors
UAS	Unmanned Aerial System
UH	University of Houston
UH DOR	University of Houston Department of Research
UMAR	Unidades Municipales de Atención al Migrante Retornado
UNAM	Universidad Nacional Autónoma de México
UNCC	University of North Carolina at Charlotte
USAID	United States Agency of International Development

USBP	United States Border Patrol
USCGA	United States Coast Guard Academy
USD	United States Dollar
UTEP	University of Texas – El Paso
UVA	University of Virginia
VACIS	Vehicle and Cargo Inspection System
VAPR	Ventanillas de Atención a Personas Retornadas
Var	Variance
VIP	Very important person
VUME	Ventanilla Única Municipal para el Empleo
WVU	West Virginia University



## A Special Thanks to DHS First Responders

Though it has been over a year at the time of this document's publication that Hurricane Harvey devastated the Houston region, many are still feeling those effects. The staff, all affected in one way or another by this storm, wanted to take a moment to share our sincerest appreciation to the men and women of the Department of Homeland Security for the tireless effort in supporting our community. We want to thank the agents of the U.S. Border Patrol, Customs and Border Protection, Immigration and Customs Enforcement, FEMA, and Coast Guard, who, at great risk to themselves, braved rising waters to help rescue Texans trapped in their homes. While we may never be able to express the full extent of the gratitude we have, we offer this note as a small thanks.

Graciously,

The Staff of the BTI Institute

*Photos credit to Customs and Border Protection*



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[bti@uh.edu](mailto:bti@uh.edu)



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