BTI Institute

Borders, Trade, and Immigration (BTI) Institute

A Department of Homeland Security Center of Excellence

Led by the University of Houston

Annual Report for Program Year 4

01 July 2018 – 30 June 2019

Submitted 30 October 2019

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The BTI Institute team were Exhibitors at the 2019 Border Security Expo in San Antonio, TX, on March 26 - 28, 2019. Front row: Administrative Assistant Virginia Hernandez, Education Manager Maura Pereira de Leon; Back row: Executive Director Kurt Berens, Research Committee Chair George Zouridakis, Communications Manager Philip Boedeker, and Research Manager Abria Magee.

A.   Executive Summary

This Annual Report of the Borders, Trade, and Immigration Institute covers the effort of the Management Team, Research Committee, and individual Principal Investigators over Program Year 4 (PY4; 01 July 2018 to 30 June 2019).

Border security, trade and immigration remain key priorities for the United States and its citizens. U.S. Customs and Border Protection (CBP) remains on the frontline of each of these issues. It is the BTI Institute's mission to conduct research and develop educational curricula to assist CBP pursuant to the Institute's mission to secure our borders, facilitate legitimate trade and travel, and ensure the integrity of our immigration system.

PY4 included a renewed emphasis of the BTI Institute on specific customer needs discovery. The leadership team and the members of the Research Committee traveled to Washington, D.C. on several occasions throughout this reporting period to meet with stakeholders from multiple offices within CBP. These customer discovery meetings served as a catalyst for the submission of 22 White Papers to address the identified issues. Six of those White Papers were developed into Work Plans that will carry over into Program Year 5.
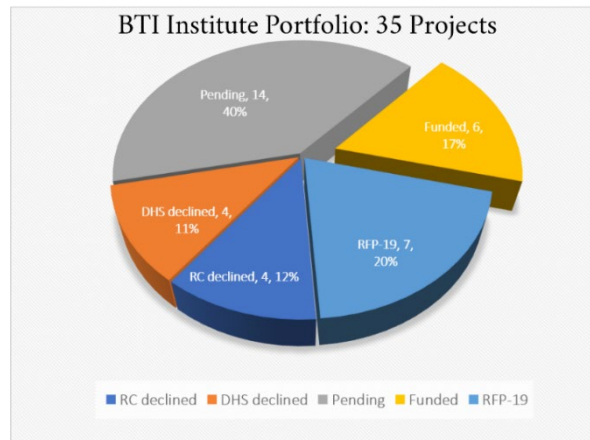
In conjunction with senior leadership from the CBP Office of Training and Development, curricula designed to address the educational needs of the current DHS workforce is being created by BTI and several offerings of this online program will be available to University of Houston students in the Fall semester of 2019.

BTI Institute Request for Proposals 19-01 invited submission of proposals to address research questions related to the Conference on Prosperity and Security in Central America. The questions focused on economic and social development in the Northern Triangle countries as a means to manage migration push factors. As of the end of PY4, six proposals through the Institute were currently under review by DHS.

The Institute concluded PY4 with the 2019 Annual Meeting located in Washington, D.C. in the Office of Training and Development on 26 June 2019. The meeting, titled *From Challenge to Solution,* gathered participants from the private sector, academia and government to hear about current BTI projects, current challenges faced by DHS, and potential solutions to some of those challenges.

B.   Administration and Execution

B.1. Effort Summary

Administrative Team. The following personnel are the members of the BTI Institute Administrative team as of the end of this reporting period (from left to right).

Anthony Ambler, PhD, Director and Principal Investigator, University of Houston (UH)
Kurt L. Berens, Executive Director, UH
Abria Magee, PhD, Manager of Research and Development, UH
Philip J. Boedeker, JD, Manager of Communications and Operations, UH
Maura Pereira De Leon, PhD, Manager of Education and Training, UH
Virginia Y. Hernandez, Administrative Assistant, UH

The summary highlights the Institute's efforts to accomplish the action items as a result of the OUP S&T Biennial Review and the overall objectives of Program Year 4 related to customer outreach and project development/execution.

A timeline of Administration and Execution efforts can be seen in Appendix I to BTI Institute PY4 Annual Report.

B.2. Milestones, Deliverables, Performance Metrics

B.2.1. Milestones

ID	Description	Effort Period	Status
M1	Submit work plans for projects selected by DHS	Sep 2018	Complete & ongoing
M2	Negotiate work plan, budget and contract implementation for each project	Ongoing	Complete & ongoing
M3	Submit Quarterly Action Plan	Quarterly	Complete
M4	Submit Annual Report	1 July 2018 + 60 days	Complete
M5	Hold Annual PI Meeting	Apr 2019	Complete
M6	Respond to Annual OUP Data Call	Mar 2019	Complete
M7	Submit draft Annual Work Plan & Incremental Funding Request	Mar 2019	Complete
M8	Modify/Submit Final Annual Work Plan & Budget	Apr 2019	Complete

B.2.2. Milestones Report

M1. Submit work plans for projects selected by DHS

Principal Investigators whose projects were selected by DHS from RFP-17 were notified 18 June 2018 of their selection and the Principal Investigators were invited to begin work plan development. BTI worked with each Principal Investigator (Eleftherious Iakovou, Texas A&M University; Benjamin Bagozzi, University of

Delaware; George Thompson, ANSER, Inc; Benjamin Rohrbaugh, Lantern UAS) to develop work plans, budgets and budget justifications for their respective projects. First drafts of work plans were submitted to DHS as follows:

- 19 July 2018: "Homeland Security Applications for Unmanned Autonomous Systems at Maritime Ports", Ben Rohrbaugh
- 20 July 2018: "Validating Deterrence Models", George Thompson
- 23 July 2018: "Game Theory-based Strategic Framework for Border Security Control and Risk Management for Protecting Globalized Supply Chains Against Illicit Use", Eleftherios Iakovou, Ph.D.
- 23 July 2018: "A Multi-resolution, Multi-perspective Port Capacity Estimation Model for Global Supply Chain Decision Support and Analysis", Eleftherios Iakovou, Ph.D.
- 09 October 2019: "Dynamic Network Models of Transnational Migration Flows: Modeling the Influences of Social, Spatial, Demographic, Political, Disaster, and Economic Processes", Benjamin Bagozzi, Ph.D.

All of the Principal Investigators responded swiftly (4/5 submitted draft documents within 10 business days or less) to the request for preparation of the draft work plan and associated budget. The reason for delay in receipt of the proposal from Bagozzi and colleagues was the original PI (Zack Almquist, University of Minnesota) resigned from the University of Minnesota shortly after being notified of the selection of his project. Several weeks of discussion occurred before Dr. Bagozzi agreed to assume the role as PI. Upon, identifying a co-PI, the new team updated the original plan and submitted their work plan on 09 October 2018.

M2. Negotiate work plan, budget and contract implementation for each project

BTI worked with each PI and the Office of University Programs through several iterations of each work plan until the DHS S&T OUP PM was satisfied with a version that could be sent to prospective project champions within DHS for further development and optimization to align with the HSE mission and component needs. Similarly, budgets and budget justifications were iteratively developed for each work plan. As of 17 December 2018, lack of interest from prospective DHS Project Champions resulted in none of the RFP-17 projects being approved and consequently no contract negotiations were initiated in the first half of PY4. In the second half of PY4, two of the projects were approved (Rohrbaugh and Thompson) and contracts for sub-awards for these projects were negotiated and executed.

M3 Submit Quarterly Action Plan

Quarterly action status updates were submitted to the DHS S&T OUP PM, as follows:

- 07 September 2018, <ACTION_BTI_Q42018_07Sep2018.mpp>
- 07 December 2018, <ACTION_BTI_Q42018_07Dec2018.mpp>
- 07 March 2019, <ACTION_BTI_Q22019_07Mar2018.mpp>

Each quarterly action status update file contained the following sections to align with the budget categories recognized by the Sponsor:

1) Administration and Execution (A&E)
2) Research and Development (R&D)
3) Education and Training (E&T)
4) Customer Outreach and Communications (O&C)
5) Transition (T)

M4. Submit Year 3 Annual Report

The BTI Institute submitted the Program Year 3 Annual Report to the DHS S&T OUP PM on 29 August 2018. The OUP PM reviewed the draft and on 13 September 2018 provided comments to BTI Institute Executive Director during a meeting in Washington, DC. The OUP PM followed up with an email summary of the comments regarding the draft Annual Report. Additional comments and requests for clarification were submitted to BTI over several weeks and a revised Annual Report was submitted to DHS S&T OUP PM on 29 October 2018. After further review, OUP PM provided additional comments and a final version of the PY3 Annual Report was submitted to DHS S&T OUP PM on 18 December 2018. On 05 February OUP PM replied with a request for the report -with changes highlighted. A version with track changes feature invoked was submitted by BTI on 20 February 2019 conforming to the PM request. While the Year 3 Annual Report was accepted by DHS, it was not approved due to the lack of documentation from the previous BTI leadership team.

M5. Hold Annual PI Meeting

The 2019 Annual Meeting was convened on 26 June 2019 in Washington, D.C. at the CBP Office of Training and Development. Invited speakers included Michael Dougherty, Assistant Secretary, Border, Immigration and Trade Policy; Paul Baker Deputy Assistant Commissioner, DHS CBP Office of Training & Development; Melissa Herrera, Assistant Chief, U.S. Border Patrol; Matt Schneider, Director, Land Border Initiatives, Entry/Exit Transformation; and Vincent Annunziato, Director, CBP Business Transformation & Innovation. George Zouridakis, Ph.D., Research Committee Chair, gave a presentation on the BTI Institute's customer discovery efforts, current portfolio, and the curriculum development activities. Each PI, or a representative, presented the current status of their projects and a roadmap to deliverables. The Institute also had two invited potential researchers present: Ramanan Krishnamoorti, Ph.D., Chief Energy Officer for UH, presented "Operational

Means for Forensic Characterization of Imported Crudes," and Jeronimo Cortina, Ph.D., Faculty Senate President-elect for UH, presented "The Impact of Indirect Remittances on Development."

M6. Respond to Annual OUP Data Call

The BTI Institute submitted the 2018 Data Call to DHS S&T OUP on 28 February 2019. The Data Call consolidated the BTI Institute's output activities for the 2018 calendar year. The Institute reported: development of two new software algorithms; publication of 31 new articles; enrollment of 51 students; and 45 requests for assistance or advice from DHS.

M7. Submit draft Year 4 Annual Work Plan & Incremental Funding Request

The initial draft of the PY4 work plan was submitted to OUP in PY3 (28 June 2018). Comments on the initial draft were received from OUP on 3 July 2018. A revised version of the PY4 work plan and budget were submitted on 07 August 2018.

The first draft of the PY5 work plan was submitted to OUP on 28 February 2019. A revised draft was received from OUP on 22 March 2019.

M8. Modify/Submit Final Year 4 Annual Work Plan & Budget

The OUP PM and a support contractor traveled to Houston and met with BTI staff from 09 July 2018 to 12 July 2018 and provided guidance on the development of the PY4 work plan and the PY3 Annual Report. At the request of the OUP PM, a recently approved project work plan (EDGE Project) was added to the document and the revised (final) version re-submitted to OUP on 21 August 2018. The PY4 work plan and budget were approved by the OUP PM on 21 August 2018.

The PY5 work plan and budget were approved by the OUP PM on 28 June 2019. While not specified in the PY4 work plan, a new reporting requirement was implemented per the updated Terms and Conditions of the Cooperative Agreement. A Semi-Annual report was prepared and submitted to OUP on 21 December 2018. A follow-on request for budget information to supplement the Semi-Annual reports was received from OUP on 25 February 2019 and BTI submitted a response on 28 February 2019.

B.2.3. Deliverables Table

ID	Description	Effort Period	Status
D1	BTI Annual Report	1 July 2018 + 60 days	Complete
D2	Submit draft Annual Work Plan	By Mar 2019	Complete
D3	Revise Final Annual Work Plan	By May 2019	Complete

B.2.4. Deliverables Report

D1. BTI Year 3 Annual Report

BTI Final PY3 Annual Report submitted 18 December 2018 but was not approved.

D2. Submit draft Year 5 Annual Work Plan

The initial draft work plan for Program Year 5 was submitted to OUP on 28 February 2019. BTI received comments and edits to the initial draft PY5 work plan on 22 March 2019 from OUP.

At the request of OUP, the education program was restructured as follows: Milestones originally proposed by BTI, including; M.1(Three webinars on Trade and Immigration as training events for DHS personnel), M.3 (Brown bag for college students about professional careers in DHS), M.4 (Brown Bag on Tariff Classification and International Supply Chain for industry personnel), and M.5 (Half-day workshop on Border Management and emerging technologies for Operational Optimization in the context of the port-of-the-future conference) were removed by OUP. In addition, proposed Summer Research Team participation and scholarships were removed by OUP.

A new project was created to capture the effort associated with development of a new, distance learning curriculum for DHS employees. The work plan for this curriculum development project was submitted to OUP and CBP Office of Training and Development on 24 April 2019. Additional details are provided in Section E: Education and Training.

D3. Revise Final Year 5 Annual Work Plan

The revised PY5 work plan was submitted to OUP on 13 May 2019. Comments and edits on this version of the work plan were received from OUP on 30 May 2019.

BTI began development of the associated budget to accompany the PY5 work plan, and the final version of the work plan and budget justification were submitted to OUP on 4 June 2019. Budget modifications were requested by OUP and a revised core budget justification was submitted on 24 June 2019. The PY5 work plan and budget in the amount of $994,473 was approved by OUP on 28 June 2019.

B.2.5. Performance Metrics Description

ID	Description	Quantitative Performance Target	Effort Period	Status
P1	BTI Institute establishes strong, effective dialogue with PM, OUP	Conduct customer survey	Biannually	Incomplete
P2	Annual Report accurately and succinctly captures BTI activities for the program year 3.	Acceptance by OUP PM by due date and approved no later than +30 days	Aug 2018	Incomplete, PM approval pending
P3	Approved FY5 work plan and budget	Approved by OUP PM prior to next program year	Mar-Jun 2019	Complete
P4	BTI Institute regularly and actively collaborates on initiatives and research	Three projects and/or initiatives in which BTI Institute collaborates with	Ongoing	Complete

with other DHS Centers of Excellence and Federal Research Laboratories	other COE and Federal Research laboratories			

B.2.6. Performance Metrics Report

P1. BTI Institute establishes strong, effective dialogue with PM, OUP

BTI Director, Executive Director and Research Committee Chair have conducted weekly teleconferences with DHS S&T OUP PM to keep all team members informed and assure project momentum. In addition, the BTI Director, Executive Director and BTI Research Committee members have traveled to Washington, DC on multiple occasions and met with the OUP PM for additional dialogue.

P2. Annual Report accurately and succinctly captures BTI activities for the PY3

Despite a complete turnover in BTI management during PY3, BTI compiled a summary of BTI Institute activities for the program year as detailed in the PY3 BTI Annual Report .Detailed documentation of Program Year 3 management team activities from 01 April 2018 to 30 June 2018 was provided. Details of management team activities from 01 July 2017 to 09 March 2018 were provided as available but were significantly less detailed.

P3. Approved FY5 work plan and budget

The work plan and budget for PY5 was approved by OUP on 28 June 2019.

P4. BTI Institute regularly and actively collaborates on initiatives and research with other DHS Centers of Excellence and Federal Research Laboratories

During the first half of PY4, BTI has engaged Federal Research Laboratories and other DHS Centers of Excellence.

BTI worked on developing the concept proposed in a white paper from Ali Passian, Ph.D., from the Oak Ridge National Laboratory. Dr. Passian's project involved the use of quantum cascade laser methods for a stand-off detection system capable of identifying trace amounts of narcotics, *e.g.*, fentanyl, for use at border check points and for use in screening mail and packages at sorting facilities. Flowdown requirements in the Cooperative Agreement between DHS and UH precluded the ability of ORNL to work directly with BTI. BTI made introductions between ORNL and DHS CBP Non-intrusive Inspection Division to allow the possibility of the project to continue under an interagency agreement.

BTI also worked with several Centers of Excellence during the first half of PY4. BTI solicited a proposal from colleagues at Center for Risk and Economic Analysis of Terrorism Events (CREATE) for an economic analysis of the Customs Trade Partnership Against Terrorism (C-TPAT). BTI also worked with the Center for Accelerating Operational Efficiency (CAOE) to develop an alternate proposal for the Director of C-TPAT.

BTI is currently engaged with current and emeritus COE's to identify Grand Challenge topics/themes for a COE Summit Meeting to be held in summer or fall of 2019.

During the first half of PY4, BTI encountered several potential projects that appeared to be out of the BTI mission scope. BTI notified the other COE's and US government agencies as follows:

- A white paper titled "Strong, Compact and Light Foamed Precast Concrete Panels for Efficient US-Mexican Border Wall Construction" was forwarded to US Army Corps of Engineers at the suggestion of the OUP PM on 22 August 2018 for consideration in Corps projects.
- A white paper titled "A Compact Portable Hybrid Power House System to Provide Energy Resiliency for Remote Surveillance" was received and BTI submitted the proposal for consideration to OUP on 17 August 2018 and encouraged the PI to submit to Critical Infrastructure Resiliency Institute (CIRI).
- A white paper titled "Underwater Visibility in Turbid Aqueous Environments for Port and Waterway Protection" was submitted to OUP on 19 October 2018. BTI notified Arctic Domain Awareness (ADAC) COE of this technology due to the potential benefit for this technology in Arctic conditions. In addition, BTI notified FEMA and encouraged the PI to follow-up on these potentials leads. BTI was informed by the OUP PM that the project would not be considered for funding under the Cooperative Agreement due to the potential for perceived conflict of interest. The Investigator presented this concept to FEMA Regional Interagency Steering Committee meeting (5-7 February 2019) at the FEMA Region 6 Headquarters in Denton, TX.

C.   Research and Development

C.1. Effort Summary

Research Committee Personnel. The following personnel are part of the BTI Institute Research Committee as of the end of this reporting period.

George Zouridakis, PhD, Chair, Associate Dean for Research & Graduate Studies, College of Technology
Luca Pollonini, PhD, Assistant Professor, Engineering Technology
Elaine Liu, PhD, Associate Professor, Department of Economics
Richard Willson, PhD, Huffington-Woestemeyer Professor of Chemical and Biomolecular Engineering

A timeline of Research and Development efforts can be seen in Appendix II to BTI Institute PY4 Semi-Annual Report.

C.2. Milestones, Deliverables, Performance Metrics

C.2.1. Milestones Description

ID	Description	Effort Period	Status (%)
M1	Review and provide recommendation on Concept & White Papers submitted to BTI and make necessary edits prior to submission for DHS routing via OUP Program Manager.	Ongoing	Ongoing
M2	Distribute DHS feedback to White Paper author(s). If interest, work with PI to develop a work plan for submission to OUP.	Ongoing	Ongoing
M3	Review draft work plans for new projects	Jul-Aug 2018	Ongoing
M4	Work plan approval by OUP	Aug 2018	Ongoing
M5	Completion of Kick-Off Meetings projects approved by DHS	Sep 2018	5 out of 5
M6	Review updated work plans for Y5 for continuing projects	Mar 2019	100%
M7	Conduct teleconference with each PI and the project champion as appropriate for Committee Review of project progress	Sep 2018; Mar 2019; Jun 2019	100%
M8	Conduct Committee Review of written project progress reports and provide feedback. Quarterly assessment reports will be provided to the DHS OUP PM.	Sep 2018; Mar 2019; Jun 2019	100%
M9	Implement appropriate corrective actions in response to list of Biennial Review action items	Ongoing	Ongoing
M10	Complete preliminary research of CBP programs prior to meetings	Sep 2018	100%
M11	Conduct meetings with CBP Office of Trade (ACE; IPR;CEE; Forced Labor)	Sep 2018	100%
M12	Conduct meetings with CBP Office of Field Operations (OBIM; APTL; APP; CSS; C-TPAT)	Oct 2018	100%
M13	Conduct meetings with USBP Strategic Planning & Analysis Directorate	Nov 2018	100%
M14	Present findings from meetings with customers in Washington, DC	Nov-Dec 2018	Incomplete

C.2.2. Milestones Report

M1. Review and provide recommendation on Concept & White Papers submitted to BTI and make necessary edits prior to submission for DHS routing via OUP Program Manager

The Research Committee Chair approved 22 white papers this reporting period. The BTI Executive Director routed all approved white papers to the DHS S&T OUP Program Manager. During PY4, BTI has submitted a total of 22 White Papers to the OUP Program Manager.

The Research Committee and Research Manager have been reviewing all White Papers submitted to BTI. White Papers are submitted to BTI through the institutional email address. The Research Manager generated an evaluation rubric to review White Papers. The Research Manager reviewed and commented on each white paper pertaining to content and format. The Research Committee has used the evaluation rubric to review white papers. The Research Manager provided written feedback as well as an annotated version of the original white paper document to all investigators who submitted a White Paper during the reporting period. The written feedback addressed the alignment with the BTI mission and where relevant, noted the corresponding "Research and Education Themes, Topics and Questions" addressed in the submission. Proposed projects that were in line with the BTI

mission, were edited by the investigator according to the feedback provided by BTI. The Research Manager reviewed the revised White Paper to ensure all comments and concerns were addressed and sent the document and additional comments to the Chair of the Research Committee for final approval. Upon approval by the Research Committee Chair, the document was submitted to the DHS S&T OUP PM and, if identified, the component Project Champion.

M2. Distribute DHS feedback to White Paper author(s). If interest, work with PI to develop a work plan for submission to OUP

BTI Institute worked with the following Principal Investigators and the corresponding DHS Project Champions during PY4:

- Ioannis Kakadiaris, University of Houston
    - Office of Field Operations: Entry Exit Transformation
- Weidong Shi, University of Houston
    - Office of Trade: Director, Business Transformation and Innovation
- Randy Capps & Andrew Selee, Migration Policy Institute
    - Office of Policy: Deputy Assistant Secretary, Immigration Statistics; Director, Latin America; Director, The Americas; Director, Mexico
- Stephanie Leutert, University of Texas at Austin
    - Office of Policy: Deputy Assistant Secretary, Immigration Statistics; Director, The Americas
- Ahmed Senouci, University of Houston
    - Office of University Programs; Program Manager
- Bruce Kellison, University of Texas at Austin
    - Office of Field Operations: Director, Customs Trade Partnership Against Terrorism
- Adam Rose, Center for Risk and Economic Analysis of Terrorism Events (CREATE)
    - Office of Field Operations: Director, Customs Trade Partnership Against Terrorism
- Eva Lee, Georgia Tech University
    - Office of Field Operations: Director, Customs Trade Partnership Against Terrorism
- Anima Bose, University of Houston
    - Office of Acquisition: Assistant Commissioner
- Chris Ford, University of Houston
    - Office of Technology Transition: Director
- Manos Papadakis, University of Houston
    - Office of University Programs: Program Manager
- Patrick Schaefer, Hunt Institute, University of Texas at El Paso
    - US Border Patrol, Strategic Planning and Analysis Directorate: Assistant Chief, University Liaison Office
- Jose Martinez, University of Houston
    - Homeland Security Investigations (Immigration and Customs Enforcement): Special Agent
- Eleftherious Iakovou, Texas A&M University
    - Office of Field Operations: Director, Non-intrusive Inspection
- George Thompson, ANSER, Inc.

- o Program Manager, Countering Weapons of Mass Destruction (CWMD)
- Benjamin Rohrbaugh, Lantern UAS, Inc.
    - o Program Manager, CWMD
- Ben Bagozzi, University of Delaware
    - o Office of Policy: Deputy Assistant Secretary, Immigration Statistics; Director, Latin America; Director, The Americas; Director, Mexico
- Regina Jeffries, University of New South Wales
    - o Office of Strategy, Policy and Plans: Assistant Secretary, Border, Immigration and Trade Policy; Assistant Secretary, Immigration Statistics; Director, Mexico
- Ferenc Bunta, University of Houston
    - o US Citizenship and Immigration Services, External Affairs Directorate: Director
- Lisa Sullivan, Infuse, Corp.
    - o CBP, Office of Human Capital
- Andy Hines, University of Houston
    - o Office of Trade: Deputy Executive Assistant Commissioner
- Michelle Belco, University of Houston
    - o US Citizenship and Immigration Services, External Affairs Directorate
- Thomas Moencke
    - o CBP, Laboratory and Scientific Services Directorate
- Kristina Acri, Colorado College
    - o Office of Trade: Trade Policy Programs
- Christine McDaniel, Mercatus Center, George Mason University
    - o Office of Trade: Deputy Executive Assistant Commissioner
- Richard Willson, University of Houston
    - o CBP, Laboratory and Scientific Services Directorate
- Ramanan Krishnamoorti, University of Houston
    - o CBP, Petroleum and Natural Gas Center for Excellence and Expertise: Director
- Timothy Mackey, UC San Diego
    - o US Border Patrol, Strategic Planning and Analysis Directorate: Assistant Chief
    - o Immigration and Customs Enforcement, Homeland Security Investigations: Special Agent
- Gary Hale, Baker Institute, Rice University
    - o US Border Patrol, Strategic Planning and Analysis Directorate: Assistant Chief

M3. Review draft work plans for new projects

Eight Principal Investigators submitted nine draft work plans to BTI in PY4, utilizing the BTI work plan template, to the Executive Director of BTI. The Executive Director circulated the draft work plans to the Research Manager and Research Committee for review. The Research Manager provided technical and grammatical edits and generated a work plan key elements evaluation template for the Research Committee to use to evaluate the draft work plan. The Research Committee verified that the proposed work was in line with the proposed budget. The Research Manager collated the reviews. BTI provided a summary document and edited draft work plan to the investigator for revisions. The Research Manager verified all comments and

concerns were addressed and sent the documents and any additional comments to the Chair of the Research Committee for final approval. In PY4, BTI submitted nine work plans to the OUP Program Manager.

M4. Work plan approval by OUP

Upon approval by the Research Committee, work plans, budget and budget justification documents were forwarded to the BTI Executive Director for routing to OUP. In PY4, OUP has approved six work plans, as follows:

- EDGE: The "Eye in the Woods" Image-based Human Detection and Recognition System (Principal Investigator, Ioannis Kakadiaris)
- Transforming Trade & Ensuring Global Supply Chain Security with Blockchain and Smart Contracts (Principal Investigator, Weidong Shi)
- Venezuela and Nicaragua: Regional Migration Crises in the Making (Principal Investigator, Andrew Selee)
- Validating Deterrence Models for Scanning Technologies (Principal Investigator, George Thompson)
- Workplan to Explore Homeland Security Applications for Unmanned Autonomous Systems (UAS) at Maritime Ports (Principal Investigator, Benjamin Rohrbaugh)
- Curriculum Development for Border Management Degree and Certificate Programs (Principal Investigator, Maria Burns)

M5. Completion of Kick-off meetings for projects approved by DHS

PROJECT	KICK-OFF MEETING DATE
EDGE: "Eye in the Woods" Image-Based Human Detection and Recognition System	31 July 2018
Transforming Trade & Ensuring Global Supply Chain Security with Blockchain and Smart Contracts	29 November 2018
Venezuela and Nicaragua: Regional Migration Crises in the Making	15 February 2019
Validating Deterrence Models for Scanning Technologies	02 April 2019
Homeland Security Applications for Unmanned Autonomous Systems (UAS) at Maritime Ports	08 April 2019

The Research Manager scheduled project Kickoff meetings through the Homeland Security University Programs (HSUP) website and Skype for Business, these meetings were recorded and archived. The project kickoff meeting agenda was as follows: Review Meeting Objectives, Personnel Introductions, Project PI Presentation, Discussion and Review of next steps and scheduling of future meetings.

M6. Review updated work plans for PY5 for continuing projects

Currently, all active projects will continue into PY5.

M7. Conduct teleconference with each PI and the project champion as appropriate

As scheduled in the respective work plan or unscheduled as necessary, the BTI Executive Director, Research Manager and Research Committee members have participated in operational teleconferences conducted by the PI and project Champion. In addition, quarterly teleconferences were conducted to track the progress of each project. The BTI Executive Director, Research Committee Chair and Research Manager have been involved in most of the operational teleconferences associated with the Transforming Trade & Ensuring Global Supply Chain Security with Blockchain and Smart Contracts (Principal Investigator, Weidong Shi) project.

M8. Conduct Committee review of written project progress reports and provide feedback

The BTI Research Manager created formal written reports based on Quarterly Meetings for each project in the BTI Research portfolio. These reports were reviewed by the Research Committee and sent to the PI via email. The UAS and EDGE projects conducted their 1st and 4th quarterly meeting, respectively, during the BTI Institute Annual Meeting.

M9. Implement appropriate corrective actions in response to list of Biennial Review action items

BTI has assembled a new multi-disciplinary Research Committee. We have committee members that represent the social sciences, technology and engineering. This interdisciplinary committee has strengthened our ability to evaluate projects and conduct research in multiple arenas. The Chair of the Research Committee is George Zouridakis, Ph.D. Dr. Zouridakis is the Associate Dean for Research & Graduate Studies for the College of Technology and the Director of the Biomedical Imaging Lab. Luca Pollonini, Ph.D. is a committee member and Assistant Professor of Engineering Technology and the Director of the Optical Bioimaging Lab. Elaine Liu, Ph.D. is a committee member and Associate Professor in the Department of Economics. Lastly, Richard Willson, Ph.D. is a committee member and Huffington-Woestemeyer Professor of Chemical and Biomolecular Engineering and Professor of Biochemical and Biophysical Sciences. BTI will utilize *ad hoc* committee members as needed to maintain adequate diversity in subject-matter expertise.

BTI hired a Research Manager with experience in the biological sciences. With the help of the BTI team, the Research Manager has established checklists and processes to help the COE manage multiple, multidiscipline projects. The Research Manager and other BTI staff have completed a Safety Awareness for Non-Lab Personnel course offered through the University of Houston's Environmental Health and Laboratory Safety department. The Research Manager has reviewed and updated the BTI Research Safety Plan, Information Protection Plan, confidentiality forms and flow down requirements. The Research Manager is actively involved with project operations. The Research Manager has scheduled and participated in operational meetings between PIs and Project Champions. BTI has implemented project management tools such as checklists, memoranda of record and notebooks to document operational activities.

BTI has established new and meaningful performance metrics. BTI has developed the following survey: https://www.surveymonkey.com/r/7Y7Y668. This has been sent to all PY4 investigators. Results for the survey will be reviewed and actioned in PY5.

M10. Complete preliminary research of CBP programs prior to meetings

Prior to CBP program meetings, the BTI Executive Director developed an agenda and pulled background information for read ahead preparation. The BTI Executive Director provided a summary presentation to familiarize the committee members with the mission of the offices and the backgrounds of the key stakeholders prior to the face to face meetings.

M11. Conduct meetings with CBP Office of Trade (ACE; IPR; CEE; Forced Labor)

On 23 October 2018, members of the BTI Research Committee and the BTI Executive Director met with individuals from the Office of Trade. Key stakeholders in this meeting included:

- James Byram, Deputy Director, Trade Transformation Office
- Vincent Annunziato, Director, Business Transformation and Innovation
- Jim Swanson, Director, Office of Field Operations
- Mark Ziner, Executive Director, Commercial Analysis Division
- Bill Delansky, Director, Trade Transformation Office
- Kevin McCann, Chief, Analytical Communications Branch
- Neil Chaudhry, Director, Systems and Innovation Division
- Kyle Griffen, Cyber Program Advisor, Trade Transformation Office
- Chris Mebelitini, Chief, Trade Transformation Office
- KC Milligan, Director, Trade Transformation Office
- Marie Williams, Project Manager, Office of Trade Relations
- Theophilos Gemelas, Program Manager, DHS S&T, Office of University Programs
- Georgia Harrigan, Program Manager, DHS S&T, Office of University Programs

Numerous topics were discussed during this meeting, and a synopsis is provided below.

1) Trade Facilitation and Trade Enforcement Act (TFTEA) now grants new authorities over importers, but there is opportunity around measuring the impact of this act, e.g.,: a) Impact of "Intelligent Enforcement" metrics; b) Effect of deterrence and disruption?; c) How to measure deterrence and disruption?; d) How to improve enforcement action?
2) There was also a discussion around the potential blind spots in the trade mission and a potential study involving an experienced SME to help the University understand CBP's mission, role and potential areas of interest.
3) There was also an interest in "Futurist studies": What does "the border of the future" look like and how does CBP prepare?; In general, what will the port of

the future look like? How will future technologies and processes impact CBP operations, including revenue streams?

4) There was a brief mention of the Single Window 2.0 and the Phase 2 of Blockchain: the potential to reduce data duplication/complexity (e.g., FDA); simplifying based on the data collected from phase 1 blockchain study.

5) Lastly, there was discussion regarding data and analytics. Big data solutions leverage cloud architecture. Government agencies including CBP are moving to the cloud but there will be a period where analytics will take place in the cloud but leverage data from on-site systems. How could a university study help with a data model for maintaining confidentiality and integrity during the interim state, enabling the development of more robust analytic capabilities?

On 25 October 2018, members of the BTI Research Committee and the BTI Executive Director met with individuals from the Office of Trade. Key stakeholders in this meeting included:

- Brenda Smith, Executive Assistant Commissioner, Office of Trade
- Cynthia Whittenburg, Deputy Executive Assistant Commissioner, Office of Trade
- Theophilos Gemelas, Program Manager, DHS S&T, Office of University Programs

The Executive Assistant Commissioner of the Office of Trade discussed her forward looking research needs. Numerous topics were discussed, and a synopsis is provided below.

1) **Future:** What challenges will the Office of Trade face in the next 5-10 years? There is a current project looking into what U.S. customs should be doing in the next 30 years to support a vibrant economy.

2) **Present:** What investments should the Office look into that will pay in the future? What technologies, processes, or policies does the Office need to address current challenges

3) **Past:** How well did an action work? What actions should the Office continue, and what actions should the Office discontinue? This will include assessing the value of the Office's enforcement efforts, such as anti-dumping measures and free trade agreement violations, to help convey impact to stakeholders, including Congress, and determine what to do in the future. A deterrence index would be helpful for this assessment.

A challenge for BTI and researchers will be structuring research questions in a way that adds value to the expertise of the SMEs within the Office of Trade. Research questions should not address issues that can be answered by an analyst within Trade Intelligence.

There was also a discussion involving Priority Trade Issues:

1) What issues or challenges is the Office unaware of that should become priority?

2) What is the Office not doing that could affect seizures in the future?; Currently, seizures are going up approximately 8 percent each year (80 percent China/80 percent Postal);

3) Excluding items created through forced labor is difficult because the evidence to determine exclusion is difficult to prove; Could DNA and a blockchain approach be effective? All of the above questions were topics that arose and that if answered could provide value to the Office of Trade.

On 14 November 2018, members of the BTI Research Committee and the BTI Executive Director met with John Leonard, Executive Director, Trade Policy Programs. Numerous topics were discussed, and a synopsis is provided below.

1) Anti-dumping
2) Free trade agreements
3) Import safety
4) Intellectual property rights
5) Tariffs (e.g. aluminum and steel).

Executive Director Leonard expressed interest in the development of a deterrence index. This would be helpful in determining the return of investment for deterrence measures currently being deployed. Areas that this would be relevant in include:

- Narcotics
- The *de minimis* value threshold
- E-commerce
- Bi-lateral free trade agreements
- Preference programs

Another topic discussed was the subject of origin analysis (e.g., country of origin), this is partly in response to Section 321. Changes in the behavior of shippers are occurring and posing challenges for CBP. A study to evaluate the impact of duty loss would also be useful.

On 14 November 2018, members of the BTI Research Committee and the BTI Executive Director also met with Deborah Augustin, Executive Director, Trade Remedy Law Enforcement Directorate. Numerous topics were discussed, and a synopsis is provided below.

1) Importation of products made using forced labor
2) Enforcement of anti-dumping/countervailing duty
3) Allegations of duty evasion
4) Suspension & disbarment
5) Cross functional workforce training in enforcement
6) Return on investment (Ops maintained model)
7) Cognitive analytics
8) National threat analysis
9) Enhanced consequence delivery
10) Deterrence

Executive Director Augustin emphasized deterrence and indication that TRLE would be very interested in research that would provide insight into factors that drive non-compliance in the current system of trade.

On 2 May 2019, the BTI Institute Research Manager and Research Committee Chairman met with Attorney Thomas Kendrick and the Forced Labor group.

The group noted two high risk industries for forced labor, i.e., mining and agriculture. Interest was expressed in tracing products through the supply chain, economic analysis and defining risks as they relate to forced child labor.

Economic analysis could examine potential importers who were already the subjects of Withhold Release Orders (WRO) to determine specific risks among companies. The Forced Labor team mentioned that they had data for investigators to access as well as Department of Labor data and statistics that are publicly available.

Another topic discussed was Corporate Social Responsibility (CSR) programs. CSR programs involve accountability between companies in response to forced child labor. A potential approach proposed included answering the following questions: What industry and/or companies are CSR programs active and effective? If we focus on those companies and/or countries that lack active and effective CSR programs, will we be targeting those that are at a higher risk for forced child labor?

The aforementioned questions could also be applied to laws and acts applied by different nations and at the state level such as the Transparency Act in California.

Director Estes specifically asked about projects including blockchain in factories in Malaysia, Indonesia and Thailand where all data (*e.g.* passports) on factory workers could be secured and managed.

Several potential University partners were mentioned based on their published research on modern slavery or human trafficking, e.g., Yale University and the University of California Berkeley. Ms. Jahnke advised the BTI Institute to only identify partners at the University level or non-profits, she advised against private companies and corporations to avoid tangible or perceived conflicts of interest.

On 20 February 2018 BTI submitted a white paper titled "Operational Means For Forensic Characterization of Imported Crudes" to the Director of the Petroleum, Natural Gas, and Minerals Center of Excellence and Expertise.

M12. Conduct meetings with CBP Office of Field Operations (OBIM; APTL; APP; CSS; C-TPAT)

On 15 November 2018, members of the BTI Research Committee and the BTI Executive Director were scheduled to meet with Mark Borkowski, Assistant Commissioner, Office of Acquisition. Due to an unresolvable schedule conflict, the meeting was cancelled.

On 15 November 2018, members of the BTI Research Committee and the BTI Executive Director were also scheduled to meet with Colleen Manaher, Executive Director, Entry Exit Transformation. Due to a schedule conflict, Ms. Manaher was also not able to meet. Several members of Ms. Manaher's staff were able to meet including:

- Kian Tomas, Branch Chief, CBP, OFO, Entry Exit Transformation
- Sikina Hasham, Policy Advisor, CBP, OFO, Entry Exit Transformation

Numerous topics were discussed, and a synopsis is provided below.

- 15 locations in the US equipped for facial recognition verification for Entry into the US and 19 locations for Exit. BTI was encouraged to review a report from the Office of the Inspector General from September 2018 which highlighted the challenges remaining to implement Biometrics to track air passenger departures nationwide.
- CBP is currently working with National Institute of Standards and Technology (NIST) and NEC Corporation of America on technology and algorithms for facial recognition standards and implementation strategies. The concept of spoof-testing the system was raised by BTI management and there may be interest in a project to test the integrity of the system using masks, etc.
- Also, of future interest is Artificial Intelligence and machine learning applications as applied to facial recognition systems.
- There is little interest in multi-level biometric systems (*e.g.* FR and iris matching at the present time).

On 15 November 2018, members of the BTI Research Committee and the BTI Executive Director met with Larry Fluty, Executive Director, Laboratories and Scientific Services and Patricia Coleman, Deputy Director, Laboratories and Scientific Services. Numerous topics were discussed, and a synopsis is provided below.

- BTI mentioned project in development for the Petroleum & Natural Gas CEE to determine country of origin for petroleum and track trade compared to production capacity. Mr. Fluty mentioned that a good contact for this activity is based in San Francisco and that he will provide contact information.
- BTI also inquired about the trace detection of pollen, etc in package dust as a forensic strategy. BTI offered to make an introduction to the Alkek Center for Metagenomics and Microbiome Research based in Houston and indicated that this renowned Center could serve as a key partner in this area.
- BTI inquired as to the use of high throughput methods of qualitative screening being used by CBP. One immunoassay (Rapid Response; BTNX, Inc., Markham, ON, Canada) is currently utilized for the detection of fentanyl. Development of a platform technology in this area would be highly useful to CBP.
- One area that CBP is struggling with is in the analysis of CBD oil and other cannabinoid products. Unlike fentanyl and derivatives (sufentanil, carfentanil)

cannabinoids lack a core structure therefore posing an analytical challenge. Projects in this area would also be of interest to CBP.

- On the subject of trace analysis as a means of tracking counterfeit products or as a tool for AD/CVD investigations, BTI mentioned possible projects in plastics or resin-based products, petroleum and pharmaceuticals. Mr. Fluty indicated that trace analysis was likely of marginal benefit for metals (aluminum, steel) as many foreign produced metals contain ore from multiple sources thus posing difficulty for profiling.
- An interest was expressed in projects that could produce novel training aids for narcotics detection using canines.

On 2 May 2019, the BTI Institute Research Manager and Research Committee Chairman met with C-TPAT Director Manuel Garza, Jr., Program Manager Phyllis Bennett and Supervisor Trudy Rutland.

Director Garza asked the BTI Institute to provide an update on previously submitted proposals and the outcomes. A proposal from the COE CREATE titled "Economic Assessment of the C-TPAT Program" was submitted to C-TPAT in July of 2018 with little feedback. This study was focused on monetizing the impact of C-TPAT status. CREATE carried out a project that quantified the impact of membership in a CEE on exam rates, Form 28 and 29 filing rates. The results of this study showed that trusted trader status led to reduced exam and form filing rates. CREATE proposed a similar study to quantify the impact of these rates on having C-TPAT status. Another study submitted to the office was developed with C-TPAT after multiple conference calls and finalized in December 2018. The study was from a Georgia Tech investigator and titled: "Economic and Systems Quantitative Analysis of CTPAT Membership Benefits." This study was designed to use economic and analytic models to quantify program benefits achieved by C-TPAT members. All data related to the project would be collected through surveys, interviews, etc. with CBP and client organizations.

Director Garza outlined 4 major points that should be addressed and/or provided by a potential study:

a. Interviews: surveys are okay, but they must be followed up with hands-on approaches, e.g., interviewing companies and understanding why they like or don't like C-TPAT. Director Garza commented that Boeing mentioned that they would not be able to function without C-TPAT. They process 11,000 shipments a year and C-TPAT has decreased their inspection rates and times.
b. A thorough evaluation of stated benefits vs actual benefits: What do companies believe they are receiving? Director Garza worked on a study that determined that C-TPAT is saving the trade industry $70 million a year but that the industry may be unaware of the savings. His study broke the savings out by sectors, rail savings vs ocean savings, etc.
c. FAST lanes: An estimation of actual wait times and whether or not working with Mexico and the Authorized Economy Operator (AEO) changes access to FAST lanes.
d. Overall Assessment of C-TPAT: What can be improved in the validation process? Director Garza has heard customers say, "My specialist isn't

returning my calls." How can C-TPAT investigate this and improve the overall validation process?

On 2 May 2019, the BTI Institute Research Manager and Research Committee Chairman met with the Laboratory and Scientific Services Director of Administration, Patricia Hawes-Coleman.

The BTI Institute met with Director Hawes-Coleman to discuss 3 White Papers:

- o Fingerprinting the Source of Steel and Aluminum Imports into the US by Thomas Monecke, PhD
- o DNA Assays for Determining Honey Origins: DNA Sequencing, PCR, and Filtered Honey Analysis by Richard Willson, PhD
- o Operational Means for Forensic Characterization of Imported Crudes by Drs. Bissada and Krishnamoorti

The honey White Paper was submitted to LSS in April of 2019. The investigator proposes to utilize DNA in pollen to identify the country of origin of the plant they also propose a method for the purification and amplification of filtered/pollen free honey. With the use of metagenomics to develop profiles/signatures, this technology could be transitioned and used in the field. Director Hawes-Coleman is very interested in this project. Currently, the LSS is creating knowns for China, collecting in-country samples and identifying insect parts using microscopy. This project could be very useful in their current efforts.

The steel White Paper was submitted to LSS in February 2019 and discusses fingerprinting aluminum and steel using the isotopic and elemental characteristics, creating a database using a reference sample collection and predicting country of origin using mass spectrometry and emission spectrometry. Director Hawes-Coleman was interested in using inductively coupled plasma mass spectrometry (ICPMS) to do trace metal analysis. Most of the LSS' efforts use light isotope analysis and statistical modeling. LSS currently has a steel, aluminum and fentanyl effort with Phylagen via Defense Advanced Research Projects Agency (DARPA).

The crudes White Paper was originally submitted to the Petroleum, Natural Gas & Minerals Center in January of 2019. This White paper discusses developing a utility for a global oil-characterization system and tying a diverse set of crudes to a geological source rock using the GeoMark Research database which houses 15,000 oil samples. This study was designed to utilize GC-MS and multivariate statistics to characterize oil families. Director Hawes-Coleman mentioned that she would forward this White Paper to the petroleum chemist in the LSS.

M13. Conduct meetings with USBP Strategic Planning & Analysis Directorate

While the following meeting was not conducted with USBP-SPAD, the topic is directly relevant and is included here as a result of the contextual impact. On 24 October 2018, the BTI Research Committee and Executive Director met with DHS

staff from Office of Resource Management including a Management Analyst from the Office of Human Capital and the Branch Chief of Human Capital Analytics.

The primary theme of the discussion centered around the attrition rate of CBP personnel with a primary emphasis on US Border Patrol agents. In a CBP workforce of approximately 45,000 employees there is historically a 5% attrition rate. Alarmingly, there were 30 CBP officers and 10 US Border Patrol agents that committed suicide in 2017 and the situation is complicated by the fact that more than a quarter of the workforce are retired veterans. A priority for DHS is understanding the factors contributing to resiliency of CBP front-line officers and determination of factors that may be associated with suicide among this subset of front-line CBP personnel. BTI has identified several potential PI's and white paper proposals to address this critical operational concern will be developed in the second half of PY4.

BTI submitted a White Paper to Mr. Wojtasik's office on 09 January 2019. This White Paper was developed in collaboration with Lisa Sullivan at INFUSE and titled: "Understanding, Assessing and Addressing Risk Factors and Protective Factors in Suicide Prevention Strategies in Complex Workplace Environments."

The goal of this proposed study is to identify, assess and measure current suicide prevention programming and resources as well as develop an overarching strategy to improve suicide prevention, intervention and post-intervention outcomes for CBP. The program was designed to be aligned with programs at NSSP, DoD and the VA.

Mr. Wojtasik expressed interest in this proposal. Specifically, the meta-analysis of what has been done and working with the resiliency taskforce to define the entire scope of the program.

On 14 November 2018, BTI management and the Research Committee met with individuals from the US Border Patrol Strategic Planning and Analysis Directorate.

The discussion involved numerous topics & themes, e.g.: a) future technology (Port of the Future); b) Field agents/officers at the port, hiring and recruitment (*i.e.*, attrition rates); c)Training agents and Professional staff (*e.g.*, analytic shops). USBP indicated the availability of a large amount of institutional data but cited a lack of means to analyze it. BTI was encouraged to review open audits (*e.g.,* GAO and other public documents) of USBP to identify potential areas for research projects. A recurrent theme from a border patrol perspective is return on investment. USBP would like an investigator to research metrics currently employed and provide a quantifiable ROI. One of the USBP Officers mentioned that a lot of their officers are interested in receiving formal training/credits.

M14. Present findings from meetings with customers in Washington, DC

This deliverable was incomplete (D6: Nov-Dec 2018). There are several reasons for this including unanticipated delays in scheduling meetings with key stakeholders, cancellation of several planned meetings due to unavailability of DHS personnel and Holiday/vacation schedules. Further delays imposed by a government shutdown prompted the decision to communicate with stakeholders via email and teleconference.

The following list of products were created in response to direct customer discovery and/or outreach efforts.

Project Description (PI, Institution)	DHS Entity	Champion or POC	Status
Laser-Based Fiber Optic Intrusion Detection Technology (Dave Iffergan, BEI Security)	CBP (Acquisition)	Borkowski	White Paper
Industrial Policy Strategies in Mexico for Slowing Migration, Adam Rose, CREATE)	Policy	Huston	White Paper
Paradigm Shift in US Border Patrol Staffing Models (Gary Hale, Rice University)	USBP	Herrera	White Paper
Digital Social Surveillance Net, Tim Mackey, UC San Diego)	ICE (HSI)	Etter	White Paper
DNA Assays for Determining Honey Origins (Richard Willson, University of Houston)	CBP (LSS)	Hawes	Work Plan
A Retrospective Study on the US Economic Effect of Raising De Minimus	CBP (Trade-EAC)	Whittenburg	Work Plan
Preparatory Education Opportunities for US Citizenship Exams (Michelle Belco, University of Houston)	USCIS	Melero	White Paper
The US Drug Harm Index (Kristina Acri, Colorado College)	CBP (Trade-TPP)	Leonard	White Paper
Investigation of Cryptocurrency Network for Combatting Illicit Trade (Aziz Mohaisen, U Central Florida)	ICE (HSI)	Giangregorio	White Paper
Promoting Integration of Immigrants Through Language Learning (Ferenc Bunta, University of Houston)	USCIS	McHale	Work Plan
Validating Deterrence Models for Trade Enforcement (George Thompson, ANSER, Inc.)	Trade (TRLE)	Whittenburg	White Paper
Forensic Characterization of Imported Crudes (Ramanan Krishnamoorti, University of Houston)	Pet Nat Gas CEE	McGurk	White Paper
Fingerprinting Source of Steel and Aluminum (Thomas Monecke, CO School of Mines)	LSS	Fluty	White Paper
Futures of the Border (Andy Hines, University of Houston)	Trade (DEAC)	Whittenburg	White Paper
Risk and Protective Factors in Suicide Prevention (Lisa Sullivan, Infuse, Corp)	CBP (Human Capital)	Hubbard	Work Plan
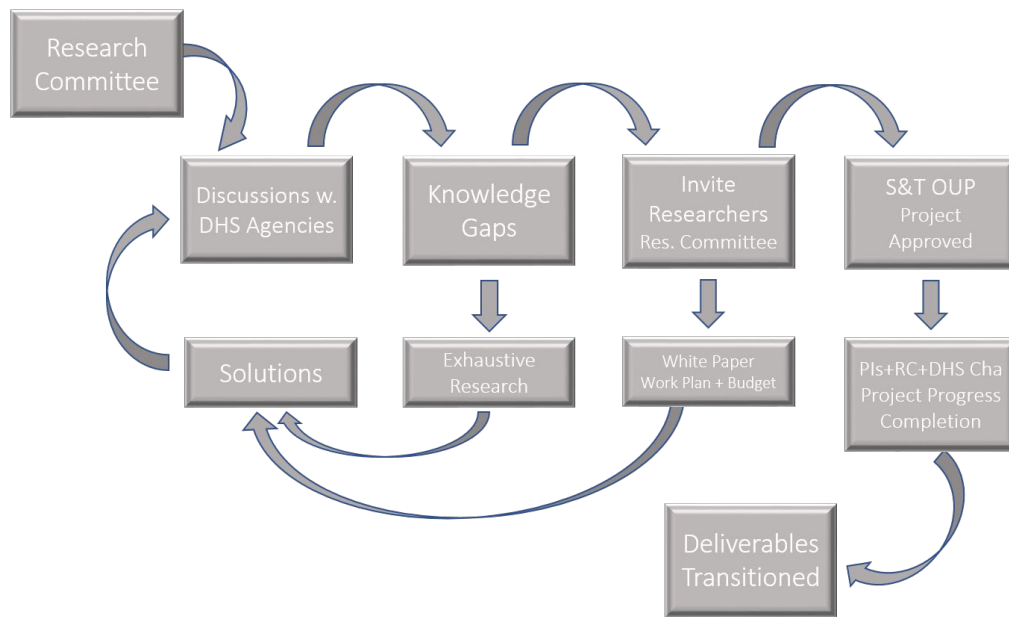
C.2.3. Deliverables Description

ID	Description	Effort Period	Status (%)
D1	Progress reports from project PIs. These quarterly assessment reports will be provided to the DHS OUP PM.	Nov 2018; Mar 2019; Jun 2019	100%
D2	Written review reports to PIs	Nov 2018; Mar 2019; Jun 2019	100%
D3	Produce Memorandum of Record (MOR) for each meeting at CBP Office of Trade (ACE; IPR; CEE; Forced Labor)	5 working days post meeting	100%
D4	Produce Memorandum of Record (MOR) for each meeting at CBP OFO (OBIM; APTL; APP; CSS; C-TPAT)	5 working days post meeting	100%
D5	Produce Memorandum of Record (MOR) for each meeting at USBP Strategic Planning & Analysis Directorate	5 working days post meeting	100%
D6	Provide briefing on findings from meetings with DHS program customers in Washington, DC	Nov-Dec 2018	Incomplete
D7	Produce proposals based on findings from meetings with DHS program customers and meeting in Washington, DC	Jan 2019	Ongoing

C.2.4. Deliverables Report

D1. Progress reports from project PIs. These quarterly assessment reports will be provided to the DHS OUP PM

BTI had five active projects in PY4 and two projects produced a progress report and the reports were uploaded to the BTI file sharing system.

- EDGE: The "Eye in the Woods" Image-based Human Detection and Recognition System (Principal Investigator, Ioannis Kakadiaris)
  - 1st Quarter Report submitted October 2018
  - 2nd Quarter Report submitted January 2019
  - 3rd Quarter Report submitted April 2019
  - 4th Quarter Report submitted June 2019
- Transforming Trade & Ensuring Global Supply Chain Security with Blockchain and Smart Contracts (Principal Investigator, Weidong Shi)
  - 1st Quarter Report March 2019
  - 2nd Quarter Report submitted May 2019
- Venezuela and Nicaragua: Regional Migration Crises in the Making (Principal Investigator, Andrew Selee)
  - 1st Quarter Report submitted June 2019
- Validating Deterrence Models for Scanning Technologies (Principal Investigator, George Thompson)
  - 1st Quarter Report submitted June 2019
- Work plan to Explore Homeland Security Applications for Unmanned
  - Autonomous Systems (UAS) at Maritime Ports (Principal Investigator, Benjamin Rohrbaugh)
  - 1st Quarter Report submitted June 2019

D2. Written review reports to PIs

There have been three written review reports distributed to the EDGE PI and two written review reports distributed to the Blockchain PI and one each to all other active projects (Migration, UAS and Deterrence).

D3. Produce Memorandum of Record (MOR) for each meeting at CBP Office of Trade (ACE; IPR; CEE; Forced Labor)

BTI has produced MORs for the meetings with the personnel from the Office of Trade.

D4. Produce Memorandum of Record (MOR) for each meeting at CBP OFO (OBIM; APTL; APP; CSS; C-TPAT)

BTI has produced MORs for the meetings with the personnel from the Office of Field Operations.

D5. Produce Memorandum of Record (MOR) for each meeting at USBP Strategic Planning & Analysis Directorate

BTI has produced an MOR for the meeting with the personnel from the US Border Patrol Strategic Planning and Analysis Directorate.

D6. Provide briefing on findings from meetings with DHS program customer in Washington, D.C.

Due to difficulties in scheduling follow-up briefings in Washington, DC (imposed by stakeholder annual leave, holidays and the 22 December 2018 to 25 January 2019 government shutdown), BTI decided to work individually with the stakeholders via telephone and email for briefing of concepts, white papers, etc. A summary of the follow-up with stakeholders is provided below.

CBP, Office of Trade

BTI met with stakeholders on 23 October 2018 from the following CBP components; Trade Transformation Office, Business Transformation & Innovation, Office of Field Operations, Analytical Communications and the Deputy Executive Commissioner's Office. A second meeting with senior leadership from the Office of Trade occurred on 25 October 2018.

BTI reviewed the portfolio of in-house project proposals but there were none deemed to be responsive to the topics discussed with the stakeholders. Of the topics discussed, the question regarding the border of the future was deemed to be a high priority as it garnered significant discussion time and was reiterated in a subsequent meeting with the Executive Assistant Commissioner and her Deputy.

BTI reached out to the Foresight Director at UH, Andy Hines on 17 December 2018 with a request to prepare a White Paper on the Future of the Border. On 27 January 2019 the PI submitted the first draft of the White Paper and a revised version was submitted to Deputy Executive Assistant Commissioner on 13 February. A teleconference was convened with the DEAC and her team and the PI and BTI on 19 March 2019 to discuss the project and the outcome of the call was the development of a work plan and budget. As of the end of PY4 the details of the work plan were still being revised.

CBP, Human Capital Analytics

After the initial meeting on 24 October 2018 with the stakeholders, it was clear that the stakeholders were seeking a project proposal to assist in efforts to understand why suicide was occurring in the CBP workforce and to reduce/eliminate suicide in CBP Field Officers and USBP personnel. BTI reviewed portfolio of project proposals from RFP-017 and found two that were relevant ("Psychological Effects of Processing a Never Ending Queue", PI Christiane Spitzmueller; "Psychosocial Factors Predicting Attrition Among USBP Agents", PI Amanda Venta). These proposals were forwarded to the Office of Human Capital on 07 November 2018. In addition, both PI's were contacted and were invited to submit a revised work plan or create a new White Paper but declined.

BTI identified an expert in the field of suicide prevention, Lisa Sullivan at Infuse, Corp, and a request to prepare a White Paper was extended to Ms. Sullivan who

agreed and submitted a document titled "Understanding, Assessing and Addressing Risk Factors and Protective Factors in Suicide Prevention Strategies in Complex Workplace Environments". BTI submitted this White Paper on 09 January 2019 to Office of Human Capital Analytics and on 19 March 2019 the stakeholder replied positively. Development of a work plan was requested on 07 May 2019. A work plan, budget and budget justification were prepared by Ms. Sullivan and were submitted to office of Human Capital. Project definition was ongoing at the end of PY4 and the project is expected to be initiated in PY5.

CBP, Office of Trade

On 14 November 2018 BTI met with Executive Directors of Trade Remedy Law Enforcement and Trade Policy Programs to continue discovery efforts begun on 23 October.

Several key topics resonated in these meetings, notably; deterrence, *de minimus* value threshold, country of origin verification. On 16 November 2018, BTI forwarded a copy of a work plan developed in response to RFP-017 by George Thompson and colleagues at ANSER, Inc. to the Executive Directors of TRLE and TPP. The work plan described validation of deterrence models for scanning technologies.

A revised white paper was developed titled "Validating Deterrence Models: An Application to Trade Enforcement" and submitted to stakeholders on 20 February 2019.

A white paper titled "The United States Drug Harm Index 2019" was submitted to the Executive Director of TPP on 28 March 2019 and BTI was instructed that this white paper would be more appropriate for the Office of Field Operations but no POC was provided. BTI submitted the White Paper to National Institute of Drug Abuse for review and consideration as a collaborative project but there was no interest and the effort to find a suitable customer was terminated.

US Border Patrol; Strategic Planning and Analysis Directorate

On 14 November 2018 BTI met with two Assistant Chiefs from USBP-HQ for ongoing discussions regarding USBP needs. Key topics discussed were the impact of lowering the de minimus value threshold on border operations, design & field testing of novel devices using biometrics for victims of human trafficking and USBP suicides.

On 21 November 2018 BTI forwarded a copy of a work plan developed in response to RFP-017 by Preethi Gunaratne at the University of Houston titled "Rapid Real-Time Identification of Human Trafficking Victims and Exploited Children using Novel Population-based DNA fingerprinting on a Portable Sequencer".

CBP, Office of Education and Training & Development (OTD)

On 14 November 2018 BTI met with Deputy Assistant Commissioner (DAC) to discuss the needs for CBP personnel. It was clearly evident that the Office was seeking a formal educational program that was distinct yet complementary to the

training and development programs currently employed by CBP. The program was to emphasize writing skills early and to provide a comprehensive overview of Border Operations management.

On 21 November 2018 BTI submitted to DAC of OTD a plan to create curricula and infrastructure for a distance learning education program to support continuing educational needs of CBP employees and to train the next generation of DHS field personnel in USBP and CBP. On 19 April 2019 BTI submitted a work plan and budget for the curriculum development project and on 25 April 2019 the project was approved by DHS S&T.

CBP, Laboratories and Scientific Services (LSS)

On 15 November 2018 BTI met with the Executive Director and Deputy Director to discuss areas of potential project development in support of the LSS mission. Key topics discussed included development of platform technologies for rapid detection (high-throughput, qualitative) of illicit narcotics and cannabidiol containing products. Other methods for using trace analysis methods for determining trade/tariff violations and country of origin were discussed. Lastly, improved methods and novel training aids for narcotics detecting canines were discussed.

On 15 February 2019 BTI submitted a White Paper titled "Fingerprinting the Source of Steel and Aluminum Imports into the US" in collaboration with Thomas Monecke of the Colorado School of Mines.

On 2 April 2019 BTI submitted a White Paper to LSS titled "DNA Assays for Determining Honey Origins: DNA Sequencing, PCR and Filtered Honey Analysis" in collaboration with Richard Willson at the University of Houston.

CBP, Office of Field Operations, Entry Exit Transformation

On 15 November 2018 BTI met with a Policy Advisor and Branch Chief from Entry Exit Transformation *in lieu* of cancellation of the scheduled meeting with the Executive Director.

Topics of discussion included aligning with NIST and NEC America to optimize BTI projects in facial recognition, possibility of conducting "spoof-tests" using masks to penetrate existing biometric systems, use of artificial intelligence and machine learning to evolve biometrics.

CBP, Office of Policy

On 15 November 2018 BTI participated in a teleconference with Deputy Assistant Secretary, Director of Latin America, Director of Mexico as an in-person meeting was not possible.

Updates were provided on proposals in development including Sanctuary Cities, Zero-Tolerance/Family Separation and Venezuela. Future proposals might involve Central American (e.g., Costa Rica, Panama) and South American (e.g., Ecuador, Colombia) assistance programs.

D7. Produce proposals based on finding from meetings with DHS program customers and meetings in Washington, D.C.

New White Papers: 22

RC declined 18%
DHS declined 18%
Pending 64%

■ RC declined ■ DHS declined ■ Pending
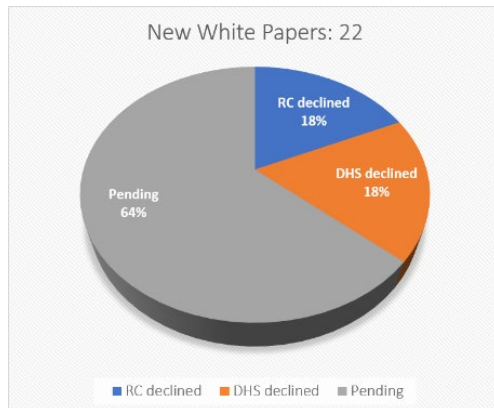
After the BTI management team attended meetings in Washington, D.C. with DHS program customers, BTI was able to pull relevant proposals from BTI RFP-17 for submission. Six of these legacy proposals, that were relevant to DHS program customers' needs, were submitted to customers for review. Three were submitted to US Border Patrol, one was submitted to both Trade Remedy Law Enforcement and Trade Policy & Programs and two were submitted to Human Capital Analytics. The Research Committee and the BTI Executive Director engaged potential researchers to consider the development of white papers and work plans.

The following proposals were presented to DHS program customers and work plans will be developed and if approved, the projects will be implemented in PY5:

- o **DNA Assays for Determining Honey Origins: DNA Sequencing, PCR, and Filtered Honey Analysis** (PI, Richard Willson, University of Houston). There is considerable mis-identification of sources of honey imported into the United States, and identifying the true origin of imported honey is of considerable interest to Customs and Border Protection. This project would develop means to identify honey country of origin (initially, India and China) using the DNA in pollen, and DNA dissolved in filtered honey.

- o **The Futures of the Border** (PI, Andy Hines, University of Houston). A challenge for DHS is that it must keep up with a "constantly evolving security landscape." The notion of what constitutes security continues to evolve as new developments in trade, new technologies, environmental issues, etc. expand the set of factors that need to be considered to provide security. Border-related trade issues are a sensitive topic, which makes it challenging to think about the long-term future. Yet understanding that long-term context – knowing which direction to go and which to avoid – is essential to decision-making in the present. This project was designed to use scenario planning to explore the future of the border-related trade landscape in order to identify potential disruptions and develop an integrated strategic approach for the short-, medium-, and long-term future. The resulting futures perspective can help identify disruptions, such as economic downturns, technology breakthroughs, environmental events, or political shifts that could make short-term policies and investments obsolete, and open up more flexible, future-friendly options.

- o **A Retrospective Study on the US Economic Effects of Raising the De Minimis Threshold** (PI, Christine McDaniel, MacroDyne) Imports of small value items have traditionally been exempt from import duties and lengthy customs assessments and procedures. The so-called *de minimis* threshold

(DMT) is a valuation ceiling for imports, below which no duty or tax is charged and the clearance procedures are miminal. The United States raised its DMT from $200 to $800 in March 2016. While importers are enthusiastic, the higher rate appears to be proving costly for customs authorities to administer. There is little or no evidence, however, on the costs of raising the DMT particularly in terms of the increased volume of parcels and corresponding enforcement costs and security risks. With three years since the increase, data required for a solid retrospective study (a "look back" study that uses data for what happened) should be available. This research project would examine the economic effects, including enforcement and security costs, of the increased de minimis threshold in the United States. Understanding these economic effects is important because the DMT is appearing in more policy discussions of trade facilitation and in recent trade agreements (*e.g.*, the United States-Mexico-Canada Agreement, or USMCA and the Trans-Pacific Partnership, or TPP). The U.S. Customs and Border Protection (CBP) is the agency charged with securing the border and this study would support the agency in evidence-based policy discussions in this increasingly important trade policy issue.

- o **Promoting the Integration of Immigrant into Mainstream US Society through Language Learning** (PI, Ferenc Bunta, University of Houston). A crucial element to becoming a successful and productive member of society is to be able to communicate effectively in the majority language. For the individual immigrant, effective command of English has numerous benefits from having better employment opportunities to successfully navigating everyday life, but the US also benefits from having productive members of society who are able to integrate into their greater communities and contribute to society. However, learning a foreign language as an adult often proves challenging and may become a barrier to successfully integrating immigrants into US society. Immigrants may experience fossilization between Stage 2 (=Stress) and Stage 3 (=Coping) of the assimilation process, which could lead to feeling isolated, depressed, and frustrated that, in turn, could result in immigrants exhibiting self-destructive behaviors potentially leading to disengagement from society and radicalization. Better integration is **significant to homeland security** because it reduces the risk of individuals becoming marginalized and disengaged from society, which decreases potential security risks by having immigrants more engaged with the majority language and culture. Thus, a critical aspect of integrating immigrants into mainstream US society is to help them learn the language of the majority, which also promotes engagement with the larger society and may reduce reliance on government services. Yet, relatively little attention and funding have been committed to such a critical aspect of immigrant integration as how adult second language learners acquire their non-native language. The **goal of the proposed project** is to investigate how different levels of speech and language ability predict successful integration into the mainstream community to provide mutual benefits for immigrants and the US.

- o **Understanding, Assessing and Addressing Risk Factors and Protective Factors in Suicide Prevention Strategies in Complex Workplace Environments** (PI, Lisa Sullivan, Infuse Corp.). Suicide risk in high stress occupations is a relatively new field of research and creates unique

challenges when addressing mental health and other risk factors for suicide. This project is designed to assess, align and execute suicide prevention plans based on a public health approach that is being deployed through efforts of the Centers of Disease Control, SAMHSA, the U.S. Department of Veterans Affairs, the National Action Alliance for Suicide Prevention, and the U.S. Department of Defense, among others. By aligning and integrating this approach into the Department of Homeland Security and the US. Border Patrol suicide prevention framework, a comprehensive approach to suicide prevention can be developed, implemented, monitored and evaluated.

The BTI Institute team completed a Request for Proposals (RFP) titled "Prosperity and Security in Central America". The Institute received ten completed applications by 10 May 2019. The RFP opened on 14 March 2019. The Research Committee and Institute management team have reviewed the proposals and submitted scores to the OUP PM.

C.2.5. Performance Metrics Table

ID	Description	Quantitative Performance Target	Effort Period	Status
P1	Project description clearly addresses a knowledge gap identified as a Homeland Security Enterprise problem or need	100% of BTI projects clearly identify and document the knowledge gap identified as an HSE problem or need	Jun 2019 & ongoing	Ongoing
P2	BTI Institute ensures scientific progress of research efforts and relevancy to customers.	Quarterly meetings with the project PIs and project champions to assess progress.	ongoing	Ongoing
P3	BTI Institute has established a transition strategy to ensure successful use of its research projects	Work Plan transition approach is coordinated and approved by customers/champions BTI Institute involves partners in implementation of its transition strategy 100% of Project Transition Plans that have transition agreements with end-users	ongoing	Ongoing
P4	Research Committee assists PIs in establishing project teams with optimal mix of interdisciplinary skill sets and partners	100% of projects assessed by the Research Committee for interdisciplinary skill sets and partners	June 2019 & ongoing	Ongoing
P5	Initiated Project has an identified, committed customer	Customer agrees to accept background papers, studies or analyses	Jun 2019 & ongoing	Ongoing
P6	Project has meaningful performance metrics	Customer agrees with performance metrics	Jun 2019 & ongoing	Ongoing
P7	The Research Committee continuously engaged with the PIs	9 Monthly Conference Calls Conduct of three (3) progress reviews and assessment BTI Institute policy of open communication # conference calls	ongoing	Ongoing
P8	Develop project proposals for each meeting at CBP Office of Trade	Two proposals have scientific and relevancy merit each for ACE, IPR, CEE, or Forced Labor	Dec 2018	100%

P8	Develop project proposals for each meeting at CBP Office of Field Operations	Two proposals have scientific and relevancy merit each for OBIM, APTL, APP, CSS, or C-TPAT	Jan 2019	100%
P8	Develop project proposals for each meeting at USBP Strategic Planning and Analysis Directorate	Two proposals have scientific and relevancy merit (Programs TBD)	Feb 2019	100%

C.2.6. Performance Metrics Report

P1. Project description clearly addresses a knowledge gap identified as a Homeland Security Enterprise problem or need

The Research Committee, BTI Executive Director and Research Manager use the "Research and Education Themes, Topics and Questions" to align projects to the BTI mission as well as the gaps identified as a Homeland Security Enterprise problem or need.

P2. BTI Institute ensures scientific progress of research efforts and relevancy to customers

The Research Manager and Research Committee assessed monthly project reports from investigators and engaged in Quarterly Meetings. The Institute reviewed timelines for tasks, deliverables and performance metrics. During the Quarterly Meeting, the investigator presented his/her project and the status of all outputs. The Project Champion was involved here and in operational meetings and provided valuable feedback on whether the efforts remained relevant to their mission.

P3. BTI Institute has established a transition strategy to ensure successful use of its research projects

The Research Committee considered potential BTI projects through white paper and work plan reviews. They assessed and evaluated the transition plan. The transition strategy was evaluated separately on all Research Committee evaluation documents.

P4. Research Committee assists PIs in establishing project teams with optimal mix of interdisciplinary skill sets and partners

The Research Committee has reviewed 22 white papers. The Research Committee considered the investigator and project team's background. The PI and the team were asked to submit a curriculum vitae along with their white paper draft. The committee reviewed these documents to ensure the project team was qualified to conduct the research project.

P5. Initiated project has an identified, committed customer

The five initiated projects have identified, committed customers.

Kakadiaris; EDGE: *The 'Eye in the Woods' Image-based Human Detection and Recognition System*: Arun Vemury, Director of DHS S&T's Biometrics and Identity Technology Center

Shi; *Transforming Trade and Ensuring Global Supply Chain Security with* Blockchain *and Smart Contracts*: Vincent Annunziato, Director, Business Transformation & Innovation Division (BTID)

Selee; *Venezuela and Nicaragua: Regional Migration Crises in the Making*: David Cloe, Director, Latin America and Caribbean Affairs

Thompson; *Validating Deterrence Models for Scanning Technologies:* Namdoo Moon, PhD, Program Manager, Countering Weapons of Mass Destruction

Rohrbaugh; *Workplan to Explore Homeland Security Applications for Unmanned Autonomous Systems (UAS) at Maritime Ports:* Namdoo Moon, PhD, Program Manager, Countering Weapons of Mass Destruction

P6. Project has meaningful performance measures

The Work Plan evaluation document included a section that addressed the performance metrics and the potential impact of the deliverables. The project Champion also reviewed the Work Plan to ensure that they were aligned with the proposed metrics.

P7. The Research Committee continuously engaged with the PIs

The Research Committee Chair, BTI Executive Director and Research Manager have participated in all of these operational meetings. The BTI personnel engaged with all other project PIs as needed.

P8. Develop project proposals for each meeting at CBP Office of Trade, Office of Field Operations, and USBP Strategic Planning and Analysis Directorate

The Research Committee and BTI Executive Director engaged multiple researchers regarding the topics and challenges discussed at each meeting with CBP Office of Trade, Office of Field Operations, and USBP Strategic Planning and Analysis Directorate as result, the team submitted 22 white papers to DHS this PY. The team distributed proposals from BTI RFP-17 deemed responsive to those challenges presented. The Research Committee solicited interest from investigators across the nation and from various Universities to evaluate their research potential.

D.   Transition

As the BTI management team and Research Committee reviewed potential project ideas, White Papers and during the process of Work Plan development, the Institute was ever mindful of opportunities to transition knowledge and technology.

Three projects that concluded during PY3 had deliverables transitioned during PY4. All deliverables are accessible through the respective project pages on the BTI Institute website.

Project PI: Dr. Randy Capps
Lead Institution: Migration Policy Institute
Project: Central America's Immigrant and Refugee Crisis: Limiting Unauthorized Migration through the Alliance for Prosperity and Reintegration Efforts
Deliverable: Final Report – *Migrants Returning to Mexico and the Northern Triangle: Reintegration Services and Development Initiatives to Reduce Regional Migration Pressures*

Project PI: Gary J. Hale
Lead Institution: Voir Dire International, LLC
Project: Uncovering Human Smuggling Patterns from Guatemala to the U.S.
Deliverable: Final Report – *Uncovering Human Smuggling Patterns from Guatemala to the U.S.*

Project PI: Dr. Eric Hershberg
Lead Institution: American University
Project: The Impact of Central American Child and Family Migration on U.S. Communities
Deliverable: Final Report – *Newcomer Central American Immigrant's Access to Legal Services*

The projects initiated in PY4 in the BTI Institute of portfolio have not reached stages that can be transitioned to a customer.

E.   Education and Training

E.1. Effort Summary

The Manager, Education and Training, led the overall effort in developing an education plan for the BTI Institute. The plan encompassed a continuum of two certificates, a minor, an undergraduate program and a master's degree program. This plan was presented to the Deputy Assistant Commissioner of the Office of Training and Development in Washington, D.C. on 18 December 2018.

The education plan involves two professional development certificates: 1) Border Operations Management Security; 2) Border, Trade and Transport Security. These certificates will be developed in PY5 and delivered in online or hybrid formats as they become available. Certification credits will be transferable and apply toward degree-granting programs at the University of Houston or any other higher education institution. The Minor, Bachelor, and Master's Degree programs would be in Border Management, Trade and Transport Security. The courses for the certificates and programs would include themes relevant to current and future DHS CBP issues and trends such as customs regulations and procedures, international trade treaties, and border management ethics and governance.

Further, the manager worked with faculty to schedule education and training brown bags and invited current CBP or ICE agents to the University of Houston to discuss with students the trends affecting DHS. The first brown bag of the series was scheduled in late November with students in a Transportation Security class but the speaker, a local CBP port agent, was unavailable and the event was cancelled. Between January and June 2019, BTI facilitated three brown bags, which were attended by 93 participants.

During this effort period, guidelines to invite graduate students to apply for a Cross-Border Fellowship Program were developed as well as guidelines to invite college students to apply for three scholarships. The BTI Research Committee agreed on announcing the fellowship and scholarships. By the time of this report, no candidate has been identified.

Beginning on 26 May 2019 and and continuing into PY5, a Summer Research Team for Minority Serving Institutions assigned by DHS/ORISE was hosted by BTI. Dr. Nursen Zanca (PI) and her graduate student Nicholas Randol worked on the study "The Global Terrorism Index (GTI): Methodology and Meaning."
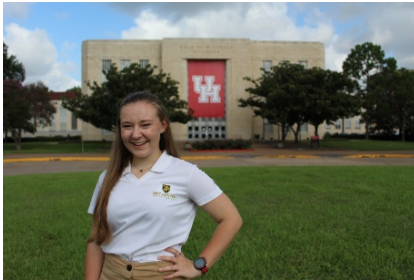
Cadet Sarah Donaldson from the US Military Academy at West Point Academy hosted by UH faculty Drs. Larry Shi and Christopher Bronk beginning on 24 June 2019 and continuing into PY5. During her internship Cadet Donaldson focused on the use of cryptocurrencies in illicit activities including areas such as Darknet marketplaces, terrorism financing, and illicit trade. She also worked on issues related to cybersecurity.

A timeline of Education and Training efforts can be seen in Appendix III to BTI Institute PY4 Semi-Annual Report.

E.2. Overall Milestones, Deliverables, Performance Metrics

E.2.1. Milestones Table

ID	Description	Effort Period	Status
M1	Develop ETIP events (training, seminars and workshops) critical to HSE	Ongoing	Ongoing
M2	Create a path for post-secondary students to pursue a career in HSE	Ongoing	Ongoing
M3	Facilitate career development for current DHS personnel	Ongoing	Ongoing

E.2.2. Milestones Report
M1. Develop ETIP events critical to HSE

The framework was developed for the Education and Training Initiatives Program(ETIP) events to bring DHS representatives to the University of Houston to discuss with current students, faculty and staff the mission, procedures and challenges these agents face in their respective organizations. The first event, a brown bag scheduled for 29 November 2018, was coordinated to focus on Trade Security involving 30 students from a transportation logistics course. The Institute was informed on 20 November 2018 that the speaker was not available and due to year end schedules, there would not be an available speaker for the remainder of 2018. This event was cancelled and not rescheduled.

Between January and June 2019, BTI facilitated three brown bags. On 31 January 2019, in conjunction with Human Trafficking month, a brown bag on *Human Trafficking-The Role of the Medical and Legal Professions* was offered. 30 participants including UH faculty, UH students (College of Technology, Law Center, and College of Pharmacy), UH Equal Opportunity Specialist, UH Sexual Misconduct Prevention, Psychologist, Social Workers, Physicians, ICE, and Texas Department of Public Safety attended the event. At the end of the session, 91% of the participants (30) filled out an eight-question evaluation form to gather feedback on the brown bag. Overall feedback from respondents was highly positive. The majority of participants (97%) agreed that, after this brown bag, they have a better understanding of the many forms of the human trafficking phenomenon, learned about the devastating effects of human trafficking for victims, and that their knowledge of human trafficking indicators had improved. Similarly, the great majority of participants agreed that the speakers were knowledgeable the content was informative and they would attend another event like this brown bag.

On 27 February 2019, a brown bag on *Blockchain, Transforming Global Supply Chain Security* was facilitated. The purpose of this Brown Bag was to discuss the use of the blockchain to secure and facilitate legitimate trade and travel. Fifty-three participants attended this event including UH faculty, students, staff (College of Technology, Computer Science, and Business) and local industry personnel. At the end of the session, 33 participants (62%) completed a nine-question evaluation form to gather feedback on the brown bag. A summary of the evaluation indicates that the majority of participants (86%) gained a better understanding of how blockchain technology can contribute to improving security operations. Similarly, most of the respondents (83%) agreed that they have learned about the use of blockchain in customs and regulatory processes improving fraud detection, while 68% agreed that they gained knowledge about moving blockchain from concept to reality.

On 17 April 2019, BTI facilitated a brown bag on *Policy in Cybersecurity and Critical Infrastructure.* Thirty-three participants attended this event including UH faculty, students, and staff (College of Technology, Computer Science, and Business). At the end of the session, 28 participants (85%) completed a nine-question evaluation form to gather feedback on the brown bag. Overall feedback from respondents was very positive. The majority of participants (89%) agreed that, after participating in this brown bag, their knowledge about Cybersecurity policy had improved. Similarly, most of the respondents (93%) agreed that they had learned about the sectors identified as part of the Nation's critical infrastructure and that they have a better understanding of the key challenges in cyber threat intelligence. The vast majority of the respondents agreed that this brown bag was informative and the speaker was very knowledgeable and they would attend another event similar to this brown bag.

M2. Create a path for post-secondary students to pursue a career in HSE

A comprehensive education plan that includes a minor option for students pursuing degrees in Science Technology Engineering and Mathematics and Social Behavioral Science disciplines, a Bachelor of Science degree, and a Master's Degree programs were designed to prepare the new generation of professionals in Homeland Security Enterprise. This plan was presented to the Deputy Assistant Commissioner of the Office of Training and Development on 18 December 2018. The Deputy Assistant Commissioner indicated that the plan aligned with his objectives for education and training the current and future workforce.

The Curriculum Development Plan for the academic programs was approved on 28 April 2019. A kickoff meeting was held on 3 May 2019. The development team gathered feedback from the project champion Paul Baker. Three courses of the Bachelor Degree in Borders Management, Trade and Transport Security are being offered to University of Houston catalog for the 2019 fall semester.

M3. Facilitate career development for current DHS personnel

The education plan was designed to provide current DHS CBP personnel with opportunities to enhance their technical knowledge and expertise through professional development certificates and/or degree programs. The two certificate programs are currently in the development phase and will be offered at the beginning of PY5.

E.2.3. Deliverables Table

ID	Description	Effort Period	Status

D1	Conduct six ETIP events	Nov 2018 Mar 2019 May 2019	3/6
D2	Develop Cross-Border Fellowship Program	ongoing	ongoing
D3	Award Scholarships for students pursuing advanced degrees in HSE	Mar 2019	Incomplete

E.2.4. Deliverables Report

D1. Conduct six ETIP events

Three of the planned six ETIP events were held in PY4 including the following three brown bags: in January *Human Trafficking-The Role of the Medical and Legal Professions;* in February *Blockchain, Transforming Global Supply Chain Security;* and in March *Policy in Cybersecurity and Critical Infrastructure.*

D2. Develop Cross-Border Fellowship Program

Initial communication with Cross-Border Institute at Windsor complete. Guidelines to invite graduate students to apply for a Cross-Border Fellowship Program were developed. The BTI Research Committee agreed on announcing the Fellowship. By the time of this report, no candidate has been identified.

D3. Award scholarships for students pursuing advanced degrees in HSE

As of June 30, 2019, no scholarships were awarded during PY4. Delays in hiring of the Manager, Education prevented the execution of this program in the alignment with the academic year. .

E.2.5. Performance Metrics Table

ID	Description	Effort Period	Status
P1	Distribute reports and evaluations from ETIP events to OUP	Dec2018 April 2019 June 2019	3 submitted
P2	Submit DHS approved Cross Border Fellowship Program to OUP	Mar 2019	Complete

E.2.6. Performance Metrics Report

P1. Distribute reports and evaluations from ETIP events to OUP

Evaluation reports of the three brown bags facilitated during this effort period were submitted to OUP.

P2. Submit DHS approved Cross Border Fellowship Program to OUP

Guidelines to invite graduate students to apply for a Cross-Border Fellowship Program were developed. The BTI Research Committee agreed on announcing the Fellowship. These guidelines were submitted to DHS.

E.3. Education Initiatives Milestones, Deliverables, Performance Metrics
E.3.1. Border Studies
E.3.1.a. Milestones Table

ID	Description	Effort Period	Status
M1	Complete two Border Studies workshops	Nov 2018; May 2019	Incomplete
M2	Complete three Brown Bag Sessions	Nov 2018; Mar 2019; May 2019	Complete

E.3.1.b. Milestones Report
M1. Complete two Border Studies workshops

Border studies workshops were not conducted in PY4. Delays in the hiring of the Manager, Education required a priority re-alignment to focus effort on completing the Brown Bag sessions and to prepare for the Curriculum Development activities.

M2. Complete three Brown Bag Sessions

Three brown bag sessions were conducted in PY4.

E.3.1.c. Deliverables Table

ID	Description	Effort Period	Status
D1	Border Studies Workshop Report with evaluations	Jun 2019	Incomplete
D2	Brown Bag sessions report with evaluations	Nov 2018; Mar 2019; May 2019	3

E.3.1.d. Deliverables Report
D1. Border Studies Workshop Report with evaluations

Reports and evaluations could not be delivered since the workshops did not occur.

D2. Brown Bag sessions report with evaluations

At the end of the three brown bags held during this effort period, evaluations were administered to gather feedback from participants. After the Human Trafficking session, 91% of the participants (30) filled out an eight-question evaluation form to gather feedback on the brown bag. Overall feedback from respondents was highly positive. The majority of participants (97%) agreed that, after this brown bag, they have a better understanding of the many forms of the human trafficking phenomenon, learned about the devastating effects of human trafficking for victims, and that their knowledge of human trafficking indicators has improved. Similarly, the great majority of participants agreed that the speakers were knowledgeable the content was informative and they would attend another event like this brown bag.

At the end of the brown bag on Blockchain, 33 participants (62%) completed a nine-question evaluation form to gather feedback on the brown bag. A summary of the evaluation indicates that the majority of participants (86%) have a better understanding of how blockchain technology can contribute to improving security operations. Similarly, most of the respondents (83%) agreed that they have learned about the use of blockchain in customs and regulatory processes improving fraud detection, while 68% agreed that they gained knowledge about moving blockchain from concept to reality.

At the end of the brown bag on *Policy in Cybersecurity and Critical Infrastructure.* Thirty-three participants attended this event including UH faculty, students, and staff (College of Technology, Computer Science, and Business). At the end of the session, 28 participants (85%) completed a nine-question evaluation form to gather feedback on the brown bag. Overall feedback from respondents was very positive. The majority of participants (89%) agreed that, after participating in this brown bag, their knowledge about Cybersecurity policy has improved. Similarly, most of the respondents (93%) agreed that they have learned about the sectors identified as part of the Nation's critical infrastructure and that they have a better understanding of the key challenges in cyber threat intelligence. All of the respondents agreed that this brown bag was informative and the speaker was very knowledgeable and they would attend another event similar to this brown bag.

E.3.1.e. Performance Metrics Table

ID	Description	Effort Period	Status
P1	Border Studies Workshops census 50 participants; >90% highly satisfied on logistic rating metrics	Jun 2019	0
P2	Brown Bag Sessions 15 enrolled per offering; three offerings from student population, three offerings from DHS workforce	Dec 2018 Mar 2019 Jun 2019	3 Brown Bags completed

E.3.1.f. Performance Metrics Report
P1. Border Studies Workshops census 50 participants

Incomplete-The workshops were not offered during PY4.

P2. Brown Bag Sessions 15 enrolled per offering

The brown bag on Human Trafficking offered in January was attended by 30 participants including UH faculty, UH students (College of Technology, Law Center, and College of Pharmacy), UH Equal Opportunity Specialist, UH Sexual Misconduct Prevention, Psychologist, Social Workers, Physicians, ICE, and Texas Department of Public Safety.

The brown bag on Blockchain was attended by 53 participants including UH faculty, students, staff (College of Technology, Computer Science, and Business) and local industry personnel.

33 participants attended the brown bag on *Policy in Cybersecurity and Critical Infrastructure* including UH faculty, students, and staff (College of Technology, Computer Science, and Business).

E.3.2. Summer Research Team for Minority Serving Institutions

E.3.2.a. Milestones Table

ID	Description	Effort Period	Status
M1	Confirm with ORISE BTI interest in hosting MSI SR Team	Sep 2018	Complete
M2	Submit list of potential collaborator applicants to ORISE	Jan 2019	Complete
M3	Identify UH Mentor	Feb 2019	Complete
M4	Select team	Mar 2019	Complete
M5	Host Summer Research Team	May-Jul 2019	Complete

E.3.2.b. Milestones Report

M1. Confirm with ORISE BTI interest in hosting MSI SR team

The BTI Institute has confirmed with Dr. Beth White, Oak Ridge Institute for Science and Education that the BTI Institute plans on hosting a Minority Serving Institute summer research team.

M2. Submit list of potential collaborator applicants to ORISE

BTI submitted a list of potential collaborator applicants to ORISE.

M3. Identify UH mentor

Dr. Luis Torres, UH Professor College of Social Work, was identified as a mentor.

M4. Select team

Dr. Nürşen Zanca (PI) and her graduate student Nicholas Randol were assigned to UH-BTI to work on the study "The Global Terrorism Index (GTI): Methodology and Meaning."

M5. Host Summer Research Team

By the time of this report the summer research team is being hosted at UH-BTI. A full report will be provided as part of the Program Year 5 Annual Report. For Program Year 3 to Program Year 4, the BTI Institute did not host a Research Team.

E.3.2.c. Deliverable Table

No deliverables schedule during this reporting period.

E.3.2.d. Deliverables Report
D1. Summer Research Team report with evaluations

This output will occur in the next reporting period.

D2. UH Mentor evaluation

This output will occur in the next reporting period.

E.3.2.e. Performance Metrics Table

No Performance metrics available for the current reporting period.

E.3.2.f. Performance Metrics Report
P1. UH mentor evaluation is above average to exemplary

This metric will occur in the next reporting period.

P2. Research team report/presentation evaluations by Research Committee

This metric will occur in the next reporting period.

E.3.3. Homeland Security Summer Internship Program

E.3.3.a. Milestones Table

ID	Description	Effort Period	Status
M1	Contact Institutions to express interest in hosting Summer Interns	Sep 2018	Complete
M2	Identify BTI project activities for suitable for summer interns	Jan 2019	Complete
M3	Institutions notify BTI of students selected to participate	Feb 2019	Complete
M4	Students arrive at BTI Institute	Jun 2019	Complete

E.3.3.b. Milestones Report
M1. Contact institutions to express interest in hosting Summer Interns

The BTI Institute contacted Commander Joseph Callaghan, U.S. Coast Guard Academy to express our interest in hosting up to six cadets from the Academy over the summer.

M2. Identify BTI project activities suitable for summer interns

UH faculty Dr. Weidong (Larry) Shi developed a research project on usage of cryptocurrencies in illicit activities including areas such as Darknet marketplaces, terrorism financing, and illicit trade. Dr. Christopher Bronk proposed an overview of issues related to cybersecurity.

M3. Institutions notify BTI of students selected to participate

Dr. Richard Yon from the West Point Academy informed BTI their interest in sending Cadet Sarah Donaldson to complete a summer internship at UH-BTI.

M4. Students arrive at BTI Institute

On 24 June 2019, Cadet Sarah Donaldson joined BTI for a three-week summer internship.

M5. Students give presentations

Beginning in PY3 and carrying over to PY4, the BTI Institute hosted three cadets from the United States Coast Guard Academy and one cadet from West Point. The cadets conducted literature review and developed applicable planning products in support of a Workshop Series on a Regional Response to a Complex Coordinated Terrorist Attack. Each cadet was assigned a different aspect of a regional response including emergency medical services, intelligence or victim support. The cadets presented the findings of their research and workshop support to the BTI Institute management team and Research Committee.

For PY4 to PY5, this milestone will occur during the next reporting period.

E.3.3.c. Deliverables Table

ID	Description	Effort Period	Status
D1	PY3 Student presentations and summary report and evaluations to OUP	July 2018	Complete

E.3.3.d. Deliverables Report

D1. Student presentations and summary report and evaluations to OUP

For the internships that concluded in PY4, presentations and evaluations were completed and submitted.

For the internships that began in PY4, this deliverable will occur in the PY5.

E.3.3.e. Performance Metrics Table

ID	Description	Effort Period	Status
P1	BTI receives feedback from students on overall experience Target: 100% response on evaluations; 100% evaluations rated as excellent	July 2018	Complete

E.3.3.f. Performance Metrics Report
P1. Feedback from students on overall experience

For the PY3 internships that concluded in PY4, the cadets were asked to provide feedback on their overall experience with the BTI Institute and include it as part of their final presentations. In general, the cadets were satisfied with the internship opportunity and felt that had learned something new as a result of the experience. Each cadet stated they enjoyed the culture experience of being in Houston, including opportunities to attend local sporting events and museums. Improvement feedback centered around the limited number of projects available for the cadets. The feedback was incorporated into the planning process for the internship that

began in PY4, to include aligning the cadet with two ongoing research projects.

For the PY4 internship that concluded in PY5, this performance metric will be reported in the PY5 Annual Report.

E.3.4. Scholarships

E.3.4.a. Milestones Table

ID	Description	Effort Period	Status
M1	Announce the Scholarship Opportunity	Oct 2018	Incomplete
M2	BTI Review of Applications	Dec 2018	Incomplete
M3	BTI Selection of Scholarships Recipients	Jan 2019	Incomplete

E.3.4.b. Milestones Report
M1. Announce the scholarship opportunity

Due to the delayed filling of the lead for Education and Training and the effort placed in developing the education plan that creates a path for post-secondary students to pursue a career in HSE and facilitating career development for current DHS personnel, the award scholarship timeline has been delayed until the second half of PY4.

In February 2019, guidelines to invite students to apply for scholarship were developed and announced. At the time of this report no candidate has been identified.

M2. BTI Review of applications

By the time of this report, no candidate has been identified.

M3. BTI selection of scholarships recipients

By the time of this report, no candidate has been identified.

E.3.4.c. Deliverable Table

ID	Description	Effort Period	Status
D1	Report on Scholarship Competition including recipient essays to OUP	Feb 2019	Incomplete

E.3.4.d. Deliverable Report
D1. Report on scholarship competition including recipient essays to OUP

By the time of this report, no candidate has been identified.

E.3.4.e. Performance Metrics Table

ID	Description	Effort Period	Status
P1	BTI Successfully Competes and Awards three Scholarships	Oct 2018-Feb 2019	Incomplete

E.3.4.f. Performance Metrics Report
P1. BTI successfully compete and awards three scholarships

By the time of this report, no candidate has been identified.

E.3.5. Cross-Border Fellowships

The Manager for Education and Training, along with the rest of the BTI Institute management team, held a telephonic meeting with Bill Anderson, Director of the Cross-Border Institute (CBI), and Marta Leardi-Anderson, Executive Director of CBI to discuss the possibility of developing a cross-border fellowship program. The fellowship would take advantage of the CBI's association with Windsor University and BTI's association with the University of Houston. The fellowship will focus around graduate studies with the STEM disciplines, preferably focusing in the theme of facilitating legitimate trade and travel.

Guidelines to invite graduate students to apply for a fellowship were developed and announced. By the time of this report, no candidate has been identified.

F. Customer Outreach and Communication

F.1. Effort Summary

The Manager, Communication and Operations, led the overall strategic customer outreach and communication effort. In this role during the period covered by this report, the manager developed the BTI Institute Communication Strategy, attended the US/Canada Border Conference in Detroit on 20, 21 September 2018, developed and distributed six monthly reports and two newsletters, organized a telephonic meeting with the Cross-Border Institute at the University of Windsor, maintained interaction across the Institute's social media platforms, and has represented the Institute at the Border Security Expo in San Antonio, TX, the AAEI conference in Washington, DC 27, 28 June 2019, and has begun the steps for the Institute to present at the COE Summit in Washington, D.C. in July 2019.

The Executive Director and Research Committee engaged in numerous customer outreach efforts as part of the PY4 work plan. The primary stakeholder engaged was CBP Office of Trade through multiple trips to the Washington, D.C. area for in-person conversations. Specifics on those visits are captured under the milestones in Research and Development.

The Border Security Expo 2019 was held in San Antonio, TX, 26 - 27 March 2019. The Institute hosted a booth in the exhibit hall and attended the conference sessions. Fifty three (53) individuals visited the booth representing government, industry and academic institutions. The story can be found here: http://www.uh.edu/bti/news/stories/2019/bse19/. As a result of the contacts made during this conference, two potential principal investigators from BEI Security, Inc., submitted a White Paper titled, "Refinement of a Laser-based Fiber Optic Outdoor Security Intrusion Detection Technology with Inherent Alarm Assessment Capability for Critical Infrastructure and Border Security Applications."

The BTI Institute 2019 Annual Meeting was held in Washington, D.C., 26 June 2019. Members of the BTI Institute staff, research committee, principal investigators, project

champions and other DHS stakeholders discussed updates on the current project portfolio. For the story, click http://www.uh.edu/bti/news/stories/2019/2019-annual-meeting-news/

Additionally, the Manager, Communications drafted shells for each of the following reports: the PY3 Annual Report; the PY4 Semi-annual report; ; the PY4 Annual Report. Each of the group leads (Manager of Education, Manager of Research and the Executive Director) Provided content which was integrated into the respective document shell. The Manager, Communications built numerous management documents, built the SM Apply website process for RFP 19-01, and drafted the standard operating procedure for requests for proposals.

The Customer Outreach and Communication effort was additionally supported in part by the Administrative Assistant, Manager of Research, Manager of Research, and the Executive Director.

BTI Institute website: www.uh.edu/bti/
BTI Institute newsletters: http://www.uh.edu/bti/news/newsletter/
Twitter: @BTI_UH
LinkedIn: https://www.linkedin.com/company/15220329/admin/

A timeline of efforts under Customer Outreach and Communication can be found in Appendix IV to BTI Institute PY4 Annual Report.

F.2. Milestones, Deliverables, Performance Metrics

F.2.1. Milestones Table

ID	Description	Effort Period	Status
M1	Development of the Institute Communication Strategy. Identify the best methodology to engage our target audiences, cultivate relationships, and produce our planned objectives/deliverables	Sep 2018	100%
M2	Create and distribute Monthly Updates on BTI Institute activities to BTI Institute Team, PIs, External Advisory Board members, and list serve. Scheduled, regular updates that report the activities of the Institute	Monthly	100%
M3	Create and distribute the BTI Institute Quarterly Newsletter. A publicly consumable, 'newsworthy' report of the activities, accomplishments, highlights and features	Quarterly	100%
M4	Create all publicity materials (e.g. media releases, talking points, information papers, photographs, backgrounders, fact sheets, videos) for projects and activities	Quarterly and ongoing	Ongoing
M5	Twelve articles posted on LinkedIn to promote the activities of the BTI	Jun 2019	100%
M6	Conduct analysis of BTI communications strategy, plan, and activities to be provided to OUP PM	Oct 2018	100%
M7	Update of Project Reporting System through HSUP	Quarterly	100%

F.2.2. Milestones Report
M1. Development of the Institute Communication Strategy

The BTI Institute Communication Strategy was submitted to DHS OUP on 27 September 2018. The purpose of the strategy is to engage Institute stakeholders systematically with the overall goal of identifying research and education

opportunities that result in near, mid and long-term solutions. The strategy outlines concepts and methods that the Institute will utilize under the three lines of effort of outreach, marketing, and communication in order to engage our stakeholders and customers. The strategy lists goals, objectives and execution plans under each line of effort.

M2. Create and distribute Monthly Updates on the BTI Institute activities

12 monthly reports have been created and distributed for PY4. The monthly report for June 2019 was distributed on 3 July 2019 (PY5). The monthly reports are submitted to DHS S&T OUP, the EAB, our past and present researchers and our past and present champions. The monthly reports include information on personnel additions, white paper submissions, project milestones, and customer engagement. Each monthly report was divided the lines of effort: Administration & Execution, Research & Development, Education & Training, and Outreach & Communication.

M3. Create and distribute the BTI Institute Quarterly Newsletter

The PY4Q1 July to September newsletter included a spotlight on the Institute's research committee, the article about our Homeland Security Summer Internship program, and a call for white papers with template and instructions. The newsletter was distributed on 16 October 2018 and can be found here: http://www.uh.edu/bti/news/News%20Letter/newsletter_py4_july-sep_2018.pdf.

The PY4Q2 October to December newsletter included notice of the Institute's participation in the 2019 Border Security Expo and a welcome to the two new members of the team, Drs. Magee and Pereira de Leon. The newsletter was distributed on 24 January 2019 and can be found here: http://www.uh.edu/bti/news/News%20Letter/newsletter_py4_q2_20190114_v2.pdf

The PY4Q3 January to March newsletter included a news story of the team's participation in the Border Security Expo 2019, an announcement of RFP 19-01, an update on the 2018 Summer Cadet Interns, the recent Brown Bags, and a save-the-date for the 2019 COE Summit. The newsletter was distributed on 8 April 2018 and can be found here:
http://www.uh.edu/bti/news/News%20Letter/newsletter_py4_q3_20190405.pdf

The PY4Q4 April to June newsletter included DHS COE Summit, a year in review, and the 2019 Annual Meeting. The newsletter will be distributed in the next reporting period and can be found on the Newsletter website, here http://www.uh.edu/bti/news/newsletter/.

M4. Create all publicity materials for projects and activities

The primary printed publicity material for the Institute remains the BTI Institute factsheet. The factsheet details the impact of the Institute, our partners, and our mission and methodology. The factsheet is available in both print and digital download to distribute during engagements. This factsheet is in line with the University of Houston branding standards.
http://www.uh.edu/bti/about/bti-institute_fact-sheet_print_20190522.pdf

Additionally, the DHS S&T OUP developed a factsheet in line with DHS branding standards. BTI provided images and content that OUP formatted. OUP then provided the completed product to BTI for printing and distribution.

The Institute created an Education & Training factsheet that focused on PY4 education initiatives to include the Brown Bags and curriculum development. http://www.uh.edu/bti/education/et-handout_20190306.pdf

There were three Brown Bags conducted under the Education & Training effort. Each Brown Bag had a dedicated website, flyer and Eventbrite page. http://www.uh.edu/bti/education/brown-bags/

The BTI Institute wrote and published an article on Institute activities in the online magazine Border Management. http://bordermanagement.net/?page_id=1474

M5. Twelve articles posted on LinkedIn to promote the activities of the BTI Institute

37 Updates/Articles have been posted on LinkedIn. Posts have included highlights of the Institute's education activities (Homeland Security Internship, Brown Bags, MSI Summer Research team), research activities (project deliverables, kick-off meetings, RFP 19-01), and administrative actions (new hires). The Institute has also reposted relevant articles related to legitimate trade and travel and DHS Hiring Actions in an effort keep our stakeholders informed of changes and updates in the areas in which the Institute does research.

M6. Conduct analysis of BTI communications strategy, plan, and activities to be provided to OUP PM

The analysis of the communication strategy and activities was integrated into the creation of the Communication Strategy. The strategy, including the key stakeholders, provided an overall framework in which to achieve the goals and objectives of the BTI Institute. Communication Plans have been created for the Institute's Brown Bags, RFP 19-01, 2019 Annual Meeting, and 2019 COE Summit.

M7. Update of Project Reporting System through HSUP

Five new projects were added to the project reporting system during this reporting period. This includes creating the project framework and adding all milestones, quarterly reviews, and deliverables. Additionally, deliverables such as conference papers and research briefs were added to each project that had produced them over the course of the previous program year. At the end of PY4, the Homeland Security University Programs (HSUP) Portal which includes the HSUP website, collaboration portal and Project Reporting System has closed.

F.2.3. Deliverables Table

ID	Description	Effort Period	Status
D1	Develop and post 12 issues of BTI Institute Monthly Updates	Published and disseminated within 3 days of	100%

		the end of the month	
D2	24 articles posted in social media (LinkedIn/Twitter)	Not less than two per month	100%
D3	Four issues of BTI Institute newsletter	Quarterly	100%
D4	Analysis and creation of BTI communications strategy, plan, and activities	Ongoing	Ongoing
D5	One OUP and one BTI Institute fact sheet with relevant quotes, data, and impact statements	Updated ongoing; quarterly review	Ongoing
D6	Provide a quarterly status report and assessment of progress/ accomplishments to BTI Executive Director and DHS OUP PM.	Quarterly	Ongoing

F.2.4. Deliverables Report

D1. Develop and post 12 issues of the BTI Institute Monthly Updates

12 (one per month during reporting period) monthly updates have been completed and distributed.

D2. 24 articles posted in social media (LinkedIn/Twitter)

In PY4, the Institute posted 46 Twitter posts and 37 LinkedIn posts.

D3. Four issues of the BTI Institute newsletter

Three editions of the Newsletter were distributed by the end of PY4. PY4Q4 distribution window falls out of PY4. It is planned to be distributed by 15 July 2019, in line with the distribution plan.

D4. Analysis and creation of BTI communications strategy, plan and activities

The analysis of the communication strategy and activities was integrated into the creation of the Communication Strategy. The strategy, including the key stakeholders, provided an overall framework in which to achieve the goals and objectives of the BTI Institute. Communication Plans have been created for the Institute's Brown Bags, RFP 19-01, 2019 Annual Meeting, and 2019 COE Summit.

D5. One OUP and one BTI Institute fact sheet with relevant quotes, data, and impact statements

Complete and available.

D6. Provide a quarterly status report and assessment of progress/accomplishments to BTI Executive Director and DHS OUP PM

Status reports were conducted through weekly calls between the Director, Executive Director, Research Committee Chair and the OUP PM. Quarterly Plans were

submitted from the Executive Director and updated throughout the quarter to reflect the progress of the Institute's lines of effort.

F.2.5. Performance Metrics Table

ID	Description	Quantitative Performance Target	Effort Period	Status (%)
P1	Four issues of Institute newsletter	Newsletter reach as reflected in click rate and open rate, both to be above industry average (6% and 20%, respectively)*	Quarterly	100%
P2	Ongoing task: Website	Assessing website traffic to the projects through number of unique visits and average number of page visits: 100 unique visitors, accessing more than two pages per visit	Ongoing	Ongoing
P3	Ongoing task: Social media	Number of social media members engaged with the Institute (such as number of followers, retweets, likes) to reach an equivalent to that of recently-established peer COEs (150 impressions on LinkedIn; Increase Twitter followership by 10%)	Ongoing	Ongoing
P4	Ongoing task: News story	All newsworthy events have story posted within 24 hours of event.	Ongoing	Ongoing

F.2.6. Performance Metrics Report
P1. Four Issues of Institute Newsletter

The PY4Q1 edition (July to September 2018) had an open rate of 26% and a click rate of 9.1%. The PY4Q2 edition (October to December 2018) had an open rate of 22.4% and a click rate of 6.2%. The PY4Q3 edition (January to March 2019) had an open rate of 23.6% and a click rate of 10%. The PY4Q4 edition (April to June 2019) will be distributed after the end of PY4. The open rate and click rate will be captured and reported at a later date outside of this reporting period.

*NOTE: The click rate and open rate percentages in the Quantitative Performance Target were inadvertently switched in the Work Plan. They are corrected in this report.

P2. Ongoing Task: Website

For PY4, the BTI Institute website had 4,700 unique users and 11,891 unique page views.

P3. Ongoing Task: Social Media

For PY4, the BTI Institute Twitter account has received 25 new followers (15% increase) and nearly 30,000 impressions. The BTI Institute LinkedIn account has over 2,100 impressions.

P4. Ongoing Task: News Stories

All newsworthy events have had an article posted to the BTI Institute website and distributed through social media, the monthly report, and the newsletter, as

appropriate. Those releases can be found here: http://www.uh.edu/bti/news/. They include the following subjects: 2018 Summer Internship, Project Deliverables, Brown Bags, publication of Institute article, Border Security Expo 2019, and the 2019 Annual Meeting.

G.   BTI Institute Project Portfolio

G.1. Ioannis A. Kakadiaris, University of Houston, *EDGE: The 'Eye in the Woods' Image-based Human Detection and Recognition System*

G.1.1. BTI Management Summary

EDGE: The 'Eye in the Woods' Image-based Human Detection and Recognition System

Ioannis Kakadiaris, Ph.D., University of Houston
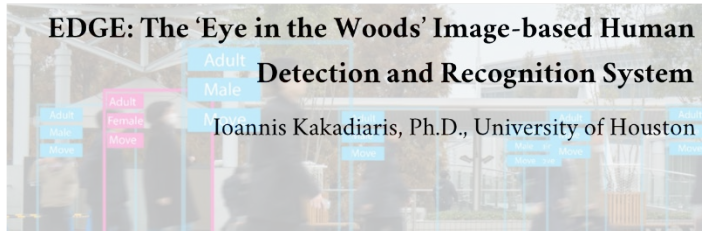
Successful detection and recognition of person-of-interest and data-driven accurate insight to the whereabouts and activity patterns of human crossers.

DHS Champion: Arun Vemury, Director, Biometric and Identity Technology Center

As of the end of the reporting period, the investigator had designed and developed algorithms for matching images in the visible domain; acquired, curated, and annotated images by trail cameras in non-urban environments; and deployed a private cloud-based software system for software evaluation, leading to the completion of one milestone (Image Annotation module ready), three deliverables (EDGE private cloud infrastructure, Image annotation algorithms and performance analysis, and Image collection and annotation report), and one performance metric (Achieve >70% inter-annotator agreement for image annotation).

The Research Committee has reviewed and provided quarterly reviews to the project team and have determined that, despite occasional delays, the project is progressing in a satisfactory manner.

G.1.2. Executive Summary
Project PI: Dr. Ioannis Kakadiaris
Lead Institution: University of Houston
Support Personnel: Dr. Ioannis Konstantinidis (Project Coordinator), Ha Le (Graduate Research Assistant), Lei Shi (Graduate Research Assistant), Charles Livermore (Graduate Research Assistant), Xiang Xu (Graduate Research Assistant), and Yuhang Wu (Graduate Research Assistant)
Project Champion: Arun Vemury
Reporting Period: Project Year 1 (Project months 1 through 12)
Technical Readiness Level: 4-5

EDGE aims to analyze trail camera images to detect the presence of people, detect and recognize faces that can be matched to known crossers, count the number of people, and detect carry-load (gun, bag) to characterize individuals. This year, we have: 1) completed the data collection process and delivered the data, 2) completed and delivered the image annotation module, 3) developed components of the EDGE integrated system that address issues related to occlusion, illumination and template

size, 4) created AWS demos, and 5) initiated the development of the pedestrian detection algorithm.

Publications (*abstracts & non-peer reviewed in italics*)

1. *Y. Wu, I.A. Kakadiaris, "Occlusion-guided compact template learning for ensemble deep network- based pose invariant face recognition," In Proc. IAPR international conference on biometrics, Crete, Greece, pp. 1-8, June 4-7, 2019.*
2. *H. Le and I. A. Kakadiaris. Illumination-invariant Face Recognition with Deep Relit Face Images. In Proc. Winter Conference on Applications of Computer Vision, Waikoloa Village, Hawaii, January 7-11, 2019.*
3. *X. Xu, H. Le, and I. A. Kakadiaris. On the Importance of Feature Aggregation for Face Reconstruction. In Proc. Winter Conference on Applications of Computer Vision, Waikoloa Village, Hawaii, January 7-11, 2019.*
4. *L. Shi, X. Xu, and I. A. Kakadiaris, Smoothed Attention Network for Single Stage Face Detector, In Proc. International Conference on Biometrics, Crete, Greece, June 4-7, 2019.*
5. *L. Shi, X. Xu, and I. A. Kakadiaris, A Simple and Effective Single Stage Face Detector, In Proc. International Conference on Biometrics, Crete, Greece, June 4-7, 2019.*
6. *X. Xu, H. Le, and I. A. Kakadiaris. On the Importance of Feature Aggregation for Face Reconstruction, In Proc. Winter Conference on Applications of Computer Vision, Waikoloa Village, Hawaii, January 7-11, 2019.*
7. *H. Le and I. A. Kakadiaris. Semi-supervised low light face enhancement for mobile face unlock. In Proc. International Conference on Biometrics, Crete, Greece, June 4-7, 2019.*
8. L. Shi, X. Xu, and I. A. Kakadiaris, SSFD: A Face Detector using a Single-scale Feature Map, In Proc. The IEEE International Conference on Biometrics: Theory, Applications, and Systems, Los Angeles, CA, Oct. 22-25, 2018.

9. L. Shi, X. Xu and I. A. Kakadiaris. "SSFD+: A Two-Stage Robust Face Detector." IEEE Transactions on Biometrics, Behavior, and Identity Science. (In Press)
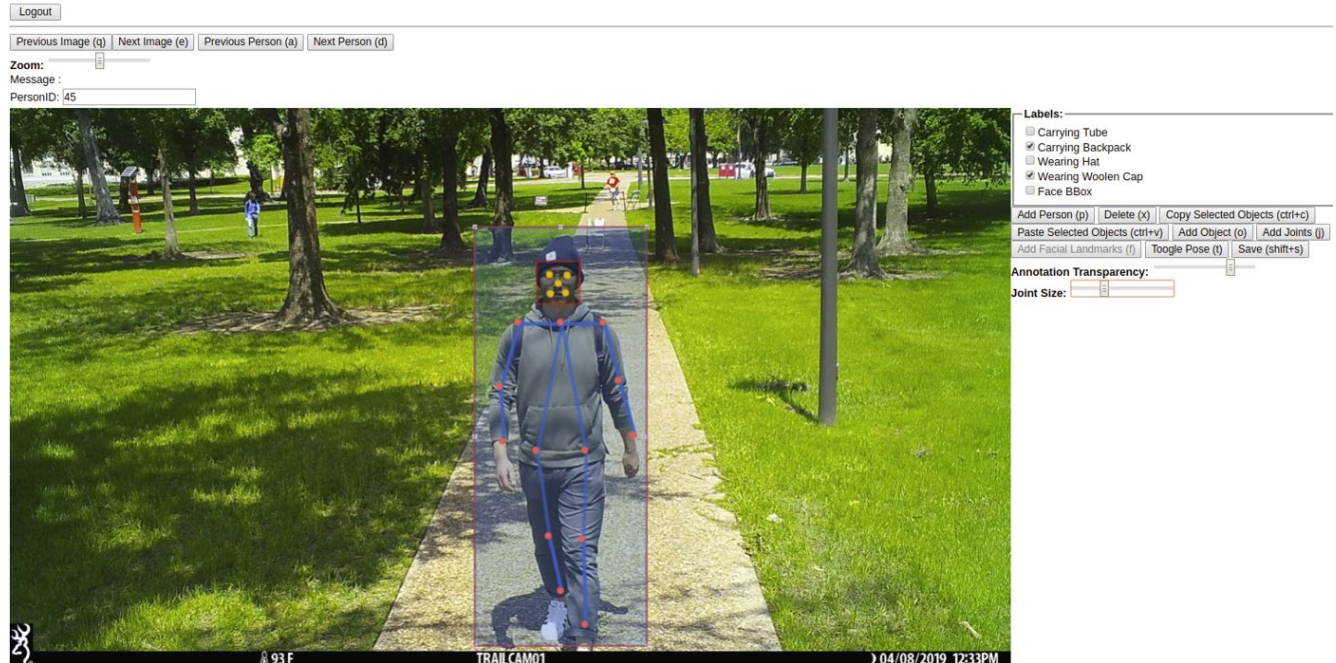
G.1.3. Milestones, Outputs, and Performance Metrics

G.1.3.a. Milestones Table

ID	Description	Effort Period	Status
M1	Image Annotation module ready	April 2019	*Complete*

G.1.3.b. Milestones Report

M1. Image Annotation module ready

To annotate images we developed the InstANT (Image ANnotation Tool) [1]. The tool allows users to incorporate the output of separate automated person pose estimation methods (such as AlphaPose (Fang *et. al.*)) to speed up the annotation process. Users can create new bounding box and pose annotations or refine proposals produced by an automated method while focusing on tasks such as providing labels related to persons, objects and scene attributes of an image. Version v.2.0 of the InstANT tool is a web application with support for multiple users that also attempts to simplify many of the functions of the previous desktop version. Since the InstANT was updated, the User's and Developer's manuals were revised to cover the newly added functionalities. The tool is accompanied by a short training video that is part of the deliverables for EDGE Tasks 5 and 6, demonstrating the adopted annotation protocol, and the functionalities of the tool. Finally, the

tool is deployed at an AWS EC2 instance for interactive demonstration and exploration and is available upon request.

G.1.3.c. Deliverables Table

ID	Description	Effort Period	Status
D1	EDGE Private cloud infrastructure	December 2018	Complete
D2	Image annotation algorithms and performance analysis	April 2019	Complete
D8	Quarterly Reports on communication with project champion	Quarterly	Complete

G.1.3.d. Deliverables Report

D1. EDGE Private cloud infrastructure

Implementation of the cloud-based infrastructure for the EDGE project utilizes Amazon Web Services (AWS). We have developed the needed AWS infra-structure on time and within schedule as per our Work Plan. The graphic below describes the interactions.
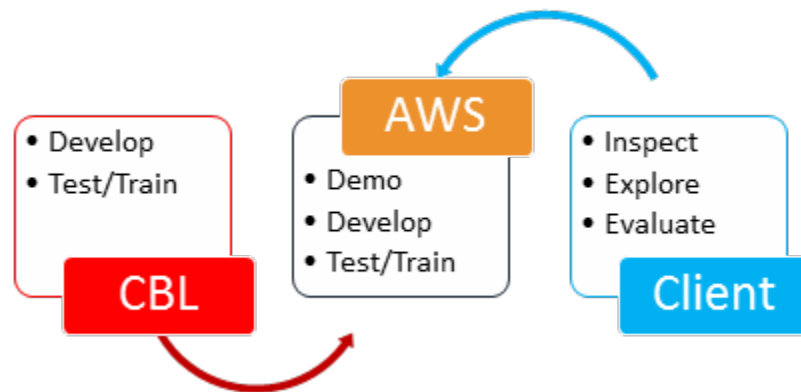
We have setup the AWS. Specifically, EC2 resources included a series of EC2 instances. The AMIs in use include: 1) Deep Learning AMI (Amazon Linux), and 2) Ubuntu 18.04 (x64)

In addition, to afford project security, to protect data and intellectual property, ensure regular backup policies and to provide adequate mechanisms for to manage these resources an Elastic Block Store (EBS) was employed. Use of S3 by the EDGE project thus far has been to demonstrate its use to provide networked access to datasets for use by programs, and to serve as an intermediate storage between project pipelines. S3 is also used by AWS to store copies of EBS volume snapshots for backup purposes. In addition, we have used the Identity and Access Management (IAM) to create and manage users and user-groups.

As of today we have provisioned resources included an EC2 instance, EBS volume, S3 bucket and the generation of demo account credentials. The latest was part of our June 31, 2019 deliverables.

D2. Image annotation algorithms and performance analysis

Two human annotators annotate images were involved in the task of image annotation. As mentioned in section M1, to annotate images we developed the InstANT (Image ANnotation Tool), which is meant to aid users in producing image annotations for a variety of computer vision tasks. The tool allowed users to incorporate the output of separate automated person pose estimation methods such as AlphaPose to speed up the annotation process.

G.1.3.c. Performance Metrics Table

Research and Innovation KPIs		Effort Period	Status
KPI-RI-1	Achieve >70% inter-annotator agreement for image annotation	April 2019	Complete

G.1.3.e. Performance Metrics Report

KPI-RI-1. Achieve >70% inter-annotator agreement for image annotation

As mentioned in section D2 two humans were tasked to annotated a subset of the collected images. To ease the burden of the two annotators, all images were handed to the AlphaPose algorithm in order to automatically generate person bounding boxes and pose keypoints. The two human annotators had to correct the errors produced by AlphaPose and add labels for actions performed by each person in the image using the constrained vocabulary introduced earlier. Additionally, they had to annotate a person's facial bounding box along with the five facial landmarks. Since AlphaPose is an automated method it significantly reduced the effort and time required from human annotators. To measure how relevant are the suggestions for bounding boxes and pose key points produced by AlphaPose, the Pearson's correlation coefficient between AlphaPose suggestions and the corrections made by two human annotators was measured. Additionally, the Pearson's correlation coefficient between the annotations for person and facial bounding boxes, pose key points and facial landmarks produced by the two human annotators, was computed, to note how related they are. Furthermore, since the Pearson correlation demonstrates the relation of two variables but not the agreement between them, we used the Bland-Altman plot method (*Bland et al.*). For inspecting annotator agreement, the Bland-Altman plot method, uses the differences between each pair of the two variables. The mean of these differences is termed bias and the reference interval (mean ± 1.96 × standard deviation) is termed limits of agreement. The limits of agreement provide insights about how much random variation may be influencing variable values. If the variables tend to agree, the differences between the variable values will be near zero. If one variable is usually higher or lower than the other by a consistent amount, the bias (mean of differences) will be different from zero. If the variables tend to disagree, but without a consistent pattern of one having larger variables than the other,

the mean will be near zero. To perform this type of analysis we split the dataset in sixteen parts.

After performing the statistical analysis, we concluded that there was a strong positive correlation between the annotations produced from Alpha Pose and the two human annotators (over 0.9). Moreover, the two human annotators achieve over 0.9 correlation between them, regardless of annotation type (person or facial bounding boxes, pose key points, facial landmarks). Additionally, from the Bland-Altman plots, we observed that annotators tended to agree with each other and with the suggestions proposed by AlphaPose, as the differences between the variable values in most of the plots are close to zero. For the detailed analysis and the Bland-Altman plots the reader is referred to our July deliverable.

G.2. Larry Shi, University of Houston; Eleftherios Iakovou, Texas A&M University; *Transforming Trade and Ensuring Global Supply Chain Security with Blockchain and Smart Contracts*

G.2.1. BTI Management Summary

Transforming Trade and Ensuring Global Supply Chain Security with Blockchain and Smart Contracts

Weidong "Larry" Shi, Ph.D., University of Houston
Eleftherios Iakovou, Ph.D., Texas A&M University

Leverage new technologies around blockchain to improve the mission of CBP in facilitating global trade and ensuring compliance with trade law and regulations.

DHS Champion: Vincent Annunziato, Director, Business Transformation & Innovation, CBP

As the end of this reporting period, the investigators have completed their kickoff meeting, numerous telephonic and in person meetings with their project champion, three milestones, drafted two deliverables. They also presented at the BTI Institute 2019 Annual Meeting.

During this reporting period, the U.S. government experienced a furlough in January 2019. As the project began in December 2018, the effort to schedule meetings with the Project Champion and survey government stakeholders was delayed. While the delay did not significantly impact the overall timeline of the project, it has resulted in slight delays in some activities and deliverables.

During the reporting period, the Project Champion had made numerous specific requests regarding the broader picture explanation of blockchain and how it could be applied to the current entry process. The Research Committee Chair and Manager of Research and Development conducted a teleconference with the investigator team to ensure they were addressing the Champion's specific request. Through an in person engagement with the Project Champion, the lead investigator and the Research Committee, the presentation for the 2019 Annual Meeting was developed that helped answer the Champion's specific questions.

The Research Committee has reviewed and provided quarterly feedback to the project team and determined that, despite a one month delay, the project was progressing in a satisfactory manner. The project was delayed as a result of the month long federal government shutdown. The delay inhibited access to project champion and input from the government stakeholders was critical during the early phase of the survey process. In addition the delay imposed a compressed timeline for industry meetings (Milestone 1) and imparted a one month delay for the Assessment Report and Phase 1 report (Milestone 4, Deliverable 1, and Deliverable 2).

G.2.2. Executive Summary

Project PI: Dr. Larry Shi
Lead Institution: University of Houston
Co-PI: Dr. Eleftherios Iakovou
Co-Institution: Texas A&M University
Support Personnel: Damon Spencer (Research Assistant); Abraham Baez Suarez (Research Associate); Lin Chen (Research Assistant Professor); Kelvin Gao (Research Associate)
Project Champion: Vincent Annunziato, Director, CBP Business Transformation & Innovation
Reporting Period: Project Year 1 (December 2018 through June 2019)
Technical Readiness Level: 4-5

The overarching goal of the investigation effort is to: (i) explore innovation opportunities provided by blockchains and other relevant technologies for transforming entry data process in order to facilitate timely analysis of supply chain risk, and to ensure trade compliance and import security; (ii) conduct feasibility evaluations of simplifying and moving forward entry data collection by leveraging commercial blockchain based end-to-end supply chain ecosystems; (iv) identify values and use case scenarios of alternative and new technologies for entry data collection; and (iii) provide recommendations and assessment (technical, business flow, and operation aspect) of the viability of blockchain and related innovations to HSE stakeholders and CBP components.

We organized project efforts by applying DSR methodology (Design Science Research), which is an established and proven practice for re-designing business process. According to DSR, efforts can be divided into phases below: understanding the problem (entry data collection and business process), brainstorm for suggestions and ideas, process redesign, evaluation through engagement with stakeholders, and report.

Working closely with project champion and subject matter experts, the project team:
- Carried out investigation to document and map AS-IS landscape of entry business process. This was achieved using publicly available entry related documents and business process guidelines published by CBP; insights and comments from project champion, consultant, and subject matter experts; as well as relevant literatures (e.g., academic research papers, WCO reports, WTO reports and documents, GAO reports).
- Conducted comprehensive literature survey on entry process modernization driven by new technologies such as digitalization, advanced data sharing

platforms, IoTs, and AI, in particular potential application of blockchains to global supply chain management and its impact/opportunities to customs entry process. The survey literatures include: reports of CBP blockchain related pilots, reports from WCO and WTO (focus on data sharing, and blockchain), reports/whitepapers focusing on application of blockchain to global supply chain management, trade finance, and logistics, blockchain use case studies focusing on cross border trade, workshops/presentations/keynotes focusing on blockchain application scenarios relevant to the missions of customs and entry process, reports on application use cases of blockchain for detecting fraud in entry process (e.g., VAT fraud, trade based money laundering).

- Based on results of the steps above, conducted brainstorms to create ideas and suggestions for entry process re-design.
- Analyzed AS-IS flow of data attributes and documents for entry process and conducted ontology map at entry data element level.
- Summarized the analysis and brainstorm outcome as entry re-design suggestions.
- Conducted Before/After analysis to the re-design suggestions in terms of benefits such as gains achieved and pains reduced.
- Planned activities and efforts for the remaining phases of the project, in particular focusing on: a survey of stakeholders on adoption of blockchain as data sharing solution for entry process; model of adoption and ownership cost of re-designed entry process to stakeholders; and analysis of consortium based approach for developing blockchain based supply chain data sharing platforms as private public partnership (e.g., issues such as ROI, governance model, standardization, cross chain interoperations).
- Engaged with stakeholders (e.g., customs brokers, importers, logistics providers, sellers, 21CCF) relevant to the project mission though project consultant, and project champion.
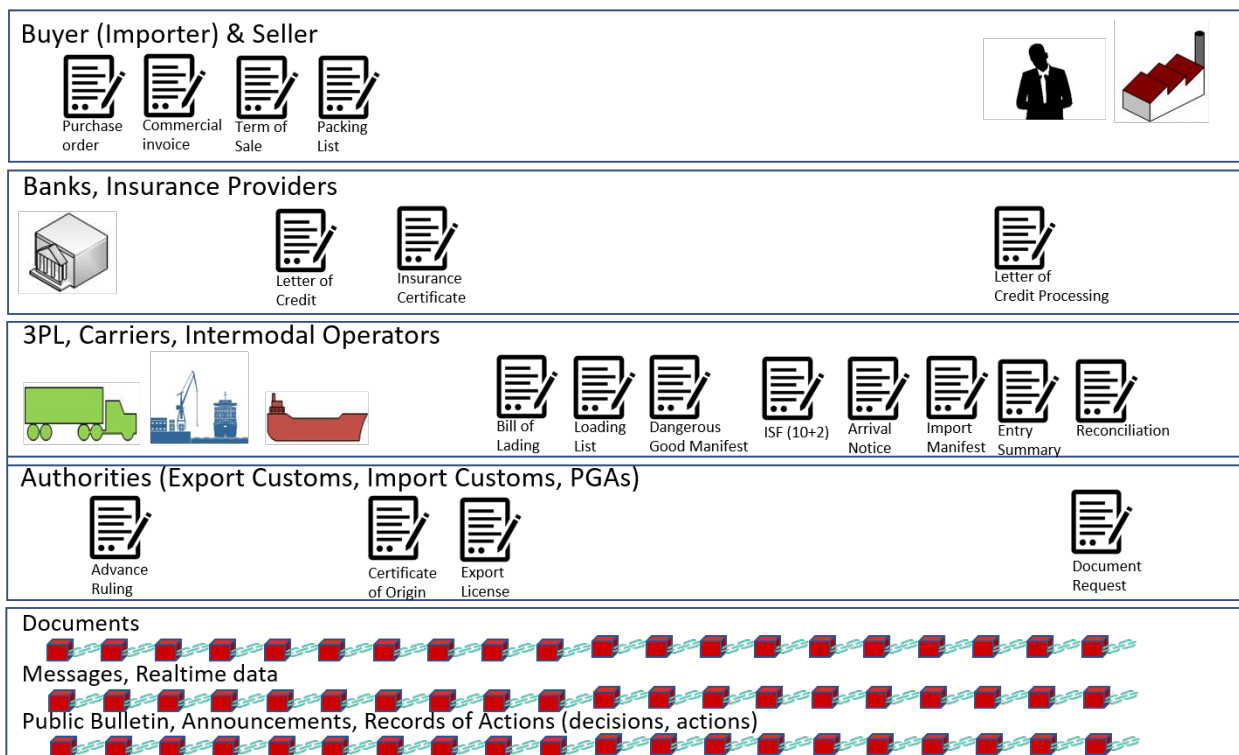
G.2.3. Milestones, Deliverables, and Performance Metrics

G.2.3.a. Milestone Table

ID	Description	Effort Period	Status
M1	Completion of survey study.	January 2019	*Survey study completed*
M2	Completion of mapping the flow (linking shipping data, entry data, purchase order, etc) to existing CBP business process.	April 2019	*Completed*
M3	Completion of benefit assessment and analysis (trade facilitation, import security, trade enforcement).	April 2019	*Completed*
M4	Completion of Phase I report.	May 2019	*Incomplete*

G.2.3.b. Milestone Report
M1. Completion of survey study

Though engagement with stakeholders and project consultant, the team conducted survey of blockchain related pilots. We collected insights and understood mechanism regarding the studied pilots. Comments from the stakeholders who were/are involved in the pilots provided valuable information for the project efforts.

M2. Completion of mapping the flow (linking shipping data, entry data, purchase order, etc) to existing CBP business process

The team conducted investigation to document and map AS-IS landscape of entry business process. In particular, we analyzed during import process, flow of data attributes and documents among stakeholders. The team performed ontology map at required entry data element level (breakdown trade related documents into data elements, map them to stakeholders and documents involved in cross border supply chain).

M3. Completion of benefit assessment and analysis (trade facilitation, import security, trade enforcement)

The team conducted several rounds of brainstorms and came up suggestions for entry process re-design. We performed Before/After analysis (A/B test) in terms of benefits such as gains achieved and pains reduced. The beneficiaries of the outcome of this project include the Office of Trade, 21st Century Customs framework, CBP field officers and the Trade. Gains to be realized include Facilitation (e.g., faster processing, fewer supply chain disruptions, labor reductions without productivity loss), Security (e.g., enhanced transparency and visibility for global supply chain, flexibility to automated revenue collection system, improved targeting of high risk shipments and importers),

M4. Completion of Phase I report

The team is working on a summary report of the artifacts created in Phase I. In addition, the report should include activities planned for the rest of the project including design of a stakeholder survey on adoption of blockchain for entry data sharing with customs, and adoption/ownership cost modeling. The Phase I Report was delayed as a result of the month long federal government shutdown. The delay inhibited access to project champion and input from the government stakeholders was critical during the early phase of the survey process. In addition, the delay imposed a compressed timeline for industry meetings (Milestone 1) and imparted a one month delay for the Assessment Report and Phase 1 report (Milestone 4, Deliverable 1, and Deliverable 2).

G.2.3.c. Deliverable Table

ID	Description	Effort Period	Status
D1	Assessment report	June 2019	Incomplete
D2	Phase 1 report	June 2019	Incomplete

The Assessment Report (D1) and Phase 1 Report (D2) were delayed as a result of the month long federal government shutdown. The delay inhibited access to project champion and input from the government stakeholders was critical during the early phase of the survey process. In

addition the delay imposed a compressed timeline for industry meetings (Milestone 1) and imparted a one month delay for the Assessment Report and Phase 1 report (Milestone 4, Deliverable 1, and Deliverable 2).

G.2.3.d. Deliverable Report
D1. Assessment Report

As of June 30, 2019, a report draft was created, which summarizes research finding so far.

D2. Phase 1 report

As of June 30, 2019, an initial report draft was created, which documents results of M1, M2, and M3.

G.2.3.e. Performance Metrics Table

All performance metrics are scheduled for delivery in PY5.

G.2.3.f. Performance Metrics Report
As of the end of this reporting period, no Performance Metrics have been reached. All will occur outside of this reporting period.

G.3. Andrew Selee and Randy Capps, Ph.D., Migration Policy Institute; *Venezuela and Nicaragua: Regional Migration Crises in the Making*
G.3.1. BTI Management Summary

Venezuela and Nicaragua: Regional Migration Crisis in the Making

Andrew Selee, Ph.D., Migration Policy Institute
Randy Capps, Ph.D., Migration Policy Institute

Examine the current and potential impact of migration, assess current regional responses, and suggest steps that the U.S. government can take to prevent a broader hemispheric crisis.

DHS Champion: David Cloe, Director, Latin America and Caribbean Affairs, Office of Strategy, Policy and Plans

As of the end of this reporting period, the investigator has completed his kickoff meeting, begun field research in host countries (Peru, Colombia, Brazil, Chile, Argentina, Uruguay, Mexico and Costa Rica), and presented at the BTI Institute 2019 Annual Meeting. The investigators and Project Champion proposed a change to the work plan in order to add Uruguay. The work plan was revised to become effective at the beginning of Program Year 5. The changes include the consolidation of Milestone 1 (Report on Dimensions of the Crisis) into Milestone 3 (Report on Policy Options). Additionally, Milestone 2 (Roundtable) will take place in the next reporting period. The Research Committee provided written feedback at the project's first quarterly review and determined that, based on the new work plan, the project is on time and progressing in a satisfactory manner.

G.3.2. Executive Summary
Project PI: Andrew Selee, President
PI Organization: Migration Policy Institute
Co-PI: Randy Capps, Ph.D.
Co-PI Organization: Migration Policy Institute
Project Champion: David Cloe, Director, Latin America and Caribbean Affairs,
Office of Strategy, Policy and Plans, DHS
Reporting Period: Project Year 1 (Project months 1 through 5)
Technical Readiness Level: 3

Overall, the project status aligns with what is laid out in the revised workplan, which consolidates two reports originally proposed into one final project report and slightly delays the roundtable of policy experts. The study team is in the process of drafting the report on policy options, which, under the revised workplan, also includes some elements of the report on dimensions of the crisis. The team has completed about 85 percent of the fieldwork, having visited nine countries, with only Ecuador remaining to visit, as well as some follow-up work in Costa Rica and phone interviews in Guyana. In the course of that fieldwork, interviews have been conducted with more than 70 key informants, including government officials, academics, leaders of local non-governmental organizations (NGOs), and officials from international organizations. The findings from desk research, review of the data, and the fieldwork are being consolidated into a draft report, with a roundtable to discuss findings and draw out policy recommendations planned for August or September. The report will then be finalized and published, with release events planned for October.

Additionally, the team has engaged with officials at DHS repeatedly over the course of the work, with the next meeting with officials from DHS' Office of Policy to update on fieldwork findings planned for July 12.

Timeline of Key Events
2/6/19-2/7/19: Preliminary field work in San Juan, Costa Rica
2/15/19: Kickoff presentation
3/5/19: February monthly report submitted
3/11/19: Research safety plan submitted
3/17/19-3/19/19: Field work in Lima, Peru
3/20/19-3/23/19: Field work in Bogotá, Colombia
4/4/19: March monthly report submitted
4/8/19-4/9/19: Field work in Mexico City, Mexico
5/3/19: April monthly report submitted
5/13/19-5/14/19: Field work in Santiago, Chile
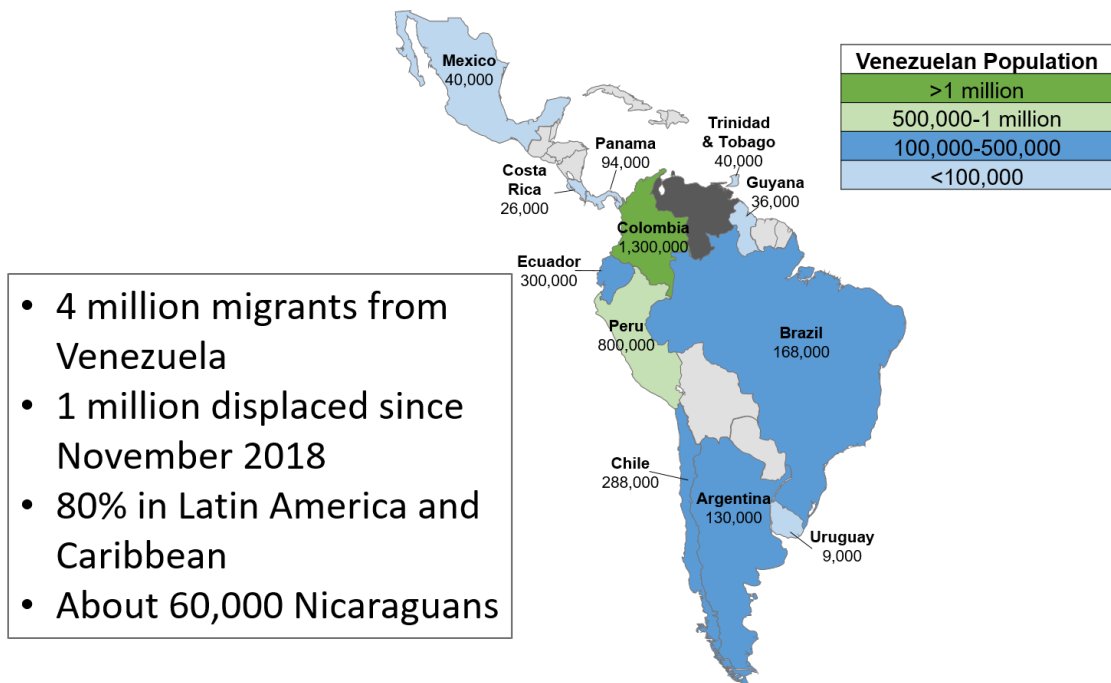5/15/19-5/16/19: Field work in Buenos Aires and La Plata, Argentina
5/17/19: Field work in Montevideo, Uruguay
6/4/19: May monthly report submitted
6/10/19: Quarterly review presentation
6/21/19: Field work in Port of Spain, Trinidad & Tobago
6/26/19: Presentation at BTI annual meeting

Venezuelan Population

| >1 million |
| 500,000-1 million |
| 100,000-500,000 |
| <100,000 |

Mexico 40,000

Trinidad & Tobago 40,000

Panama 94,000

Costa Rica 26,000

Guyana 36,000

Colombia 1,300,000

Ecuador 300,000

Peru 800,000

Brazil 168,000

Chile 288,000

Argentina 130,000

Uruguay 9,000

- 4 million migrants from Venezuela
- 1 million displaced since November 2018
- 80% in Latin America and Caribbean
- About 60,000 Nicaraguans

G.3.3. Milestones, Outputs, and Performance Metrics

G.3.3.a. Milestone Table

Please note that BTI revised the workplan in June 2019, effective July 1, 2019, with approval from the Project Champion at DHS, so the milestones and effort periods listed here have changed slightly. A separate Report on Dimensions of the Crisis will not be prepared, and instead the team will consolidate that work into the Policy Options report. Additionally, the Roundtable Discussion will now take place in late August/early September, the Report on Policy Options will be released in October, and the Launch Events will take place in October.

ID	Description	Effort Period	Status
M1	Report on Dimensions of the Crisis	Jun 2019	See G.3.3.a. for updated status
M2	Roundtable Discussion	Jun 2019 *rescheduled for Oct 2019*	Incomplete

G.3.3.b. Milestone Report

M1. Report on Dimensions of the Crisis

N/A, consolidated with M3, Report on Policy Options.

M2. Roundtable Discussion

Milestone scheduled to complete outside of this reporting period, in August or September 2019. The milestone is currently about 20 percent complete.

During the process of conducting interviews via field work, the team has identified key players in the region who are studying and/or making policy on Venezuelan migration. The team has compiled a preliminary list of invitees from the region:

- Felipe Muñoz, Presidential Advisor for the Colombia-Venezuela Border, Colombia
- Victor Barrantes, Deputy Minister of the Interior and Police, Costa Rica
- Roxana del Aguila, Superintendent and Manager of the National Migration Superintendence, Peru
- Feline Freier, Professor of Social and Political Sciences, Universidad del Pacífico, Peru
- Diego Beltrand, Regional Director for South America, International Organization for Migration, Argentina
- Jose Tomas Vicuña, National Director for the Jesuit Refugee Service, Chile
- Priya Kissoon, Head of Geography Department and Lecturer in Human Geography, University of the West Indies, Trinidad & Tobago

The team has compiled a preliminary list of U.S.-based stakeholder agencies from which representatives will be invited as follows: U.S. Department of Homeland Security (Office of Policy); U.S. Department of State (Western Hemisphere Affairs; Population, Refugees, and Migration); USAID; Organization of American States; Inter-American Development Bank; World Bank; International Organization for Migration; UN High Commissioner for Refugees; Embassies of Ecuador, Brazil, and Mexico; Chemonics; Brookings Institution; Inter-American Dialogue; Washington Office on Latin America; Center for Justice and International Law (CEJIL); American Enterprise Institute; National Defense University; Open Society Foundation.

The next steps are to finalize the list of invitees, decide on an agenda, send invitations, coordinate RSVPs and travel for those coming from the region, provide participants with our draft paper, and host the meeting.

G.3.3.c. Deliverables Table
Please note that BTI revised the workplan in June 2019, effective July 1, 2019, with approval from the Project Champion at DHS, so the deliverables and effort periods listed here have changed slightly. The team is no longer writing a separate Report on Dimensions of the Crisis, instead consolidating that work into the Policy Options report. Additionally, the Roundtable Discussion will now take place in late August/early September, we will work on the Report on Policy Options from July – October, and it will be released in October, and the Launch Events will take place in October.

ID	Description	Effort Period	Status
D1	Report on the Dimensions of the Crisis	May - Jun 2019	See G.3.3.c. for updated status

D2	Stakeholders Roundtable	Jun 2019 rescheduled for Oct 2019	Incomplete

G.3.3.d. Deliverables Report

D1. Report on the Dimensions of the Crisis
N/A, consolidated with D3, Report on Policy Options

D2. Stakeholders Roundtable
Deliverable scheduled to complete outside of this reporting period. The deliverable will be completed when we achieve the milestone. The team has completed about 20 percent of the milestone. The network of contacts obtained from the fieldwork will facilitate completion of the remaining 80 percent. [Please see B.2.M2. for more on the status of the Stakeholders Roundtable.]

G.3.3.e. Performance Metrics Table

Please note that BTI revised the workplan in June 2019, effective July 1, 2019, with approval from the Project Champion at DHS, so the performance metrics and effort periods listed here have changed slightly. A separate Report on Dimensions of the Crisis will no longer be produced, instead consolidating that work into the Policy Options report. Additionally, the Roundtable Discussion will now take place in late August/early September, we will release the Report on Policy Options in October, and the Launch Events will take place in October.

	Research and Innovation KPIs	Effort Period	Status
KPI-RI-1	First report useful to Project Champion and broader public	Jun 2019	See G.3.3.e. for updated status
KPI-RI-2	Stakeholders Roundtable Successful	Jun 2019, rescheduled for Oct 2019	Incomplete

G.3.3.f. Performance Metrics Report

KPI-RI-1. First report useful to Project Champion and broader public
N/A, consolidated with KPI-RI-3, Report on Policy Options

KPI-RI-2. Stakeholders Roundtable Successful
Performance measure scheduled to complete outside of this reporting period. The measure will be completed when we hold the roundtable in August/September. We are working towards a successful roundtable by identifying stakeholders who are both knowledgeable and influential in the spheres of Venezuelan and Nicaraguan migration in Latin America and by developing a thought-provoking draft report, thereby ensuring that we receive valuable feedback on our report and preliminary recommendations in order to eventually provide high-quality recommendations to the U.S. and Latin

American governments. [Please see B.2.M2. for more on the status of the Stakeholders Roundtable.]

G.4. George Thompson, Analytical Services (ANSER) Inc.; *Validating Deterrence Models for Scanning Technology*

G.4.1. BTI Management Summary

Validating Deterrence Models for Scanning Technologies

George Thompson, ANSER
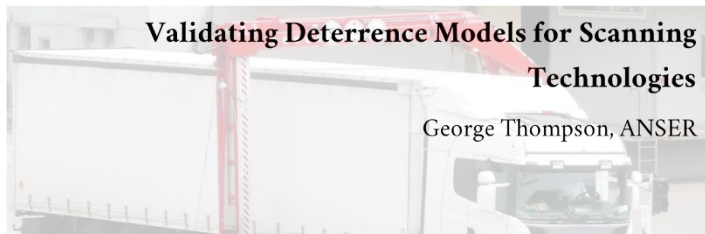
Enabling policymakers to make decisions about scanning technologies, screening rates, and other deployment issues with full understanding of the deterrence impacts.

DHS Champion: Namdoo Moon, Ph.D., Program Manager, CWMD

During this reporting period, the investigator has completed two milestones, two deliverables and two performance metrics. The milestones include a kickoff meeting and a list of extended models. The investigator has been engaged with their project champion and the BTI Institute management team. The Project Champion requested that the investigators mathematically differentiate nuclear smuggling and drug smuggling. While this was not originally articulated in the Work Plan, the investigators felt this would not cause any delay and created separate models that differentiate the two populations. The Research Committee provided written feedback at the project's first quarterly review and has determined that the project is currently on time and progressing in a satisfactory manner.

G.4.2. Executive Summary

Project PI: George Thompson
PI Organization: Analytic Services Inc. (ANSER)
Support Personnel: Dennis Wagner (Project Management); Lisa Pogue (Research Support); Damien Cobey (Technical Editing)
Project Champion: Namdoo Moon, Ph.D., Program Manager, CWMD
Reporting Period: Project Year 1 (months 1 through 3)
Technical Readiness Level: 3

The project kickoff meeting was held on 02 April, 2019. ANSER presented the kickoff briefing, participated in the ensuing discussion with the Research Committee and the DHS sponsor, and prepared and delivered an after-action summary later that day. The kickoff meeting established the initial focus on nuclear terrorism (including the criminal nexus) and drug smuggling populations.

In April, the project team created an internal (ANSER) SharePoint site to collect and organize information for the purposes of project management (e.g., draft versions of deliverables) and research (information resources). During months 1 through 3 (April – June 2019), the team researched, collected, and catalogued approximately 100 information resources. Each resource was tagged to indicate its relevance to one or more project topics (smuggling, nuclear terrorism, deterrence modeling, etc.) and whether it had yet been reviewed by a member of the team.

During May and June, ANSER began identifying and analyzing factors that determine smugglers' knowledge of screening rates/effectiveness and their longer-term tolerance for success or failure of individual smuggling attempts. The team began characterizing the "why" and "how" behind organizations' decisions to smuggle to describe their inclination and ability. This characterization allowed the team to develop a framework for the upcoming analysis: motives ("why") may include personal, profit (criminal), terrorism, and the crime- terror nexus; organizational capability ("how") is characterized using Greiner's five phases of growth to describe increasing levels of capability. Both "why" and "how" may be dependent on "what" – that is, the commodity being smuggled.

Also during this period, ANSER completed its literature search and review on applicable deterrence models. The team identified four types of mathematical representations for the term defined in the project plan as the "deterrence threshold," and recommended that two of these be analyzed further in the validation phase. In addition, ANSER identified definitions commonly used for determining critical threshold values in deterrence models, and expressed these definitions in generic terms (e.g., "reward," "punishment if caught") that are independent of the particular mathematical nomenclature used by different researchers. In particular, two of these generic definitions – one applicable to nuclear terrorism, the other to commodity smuggling and general criminal behavior – will be analyzed further in the validation phase of the project.

The principal investigator engaged with representatives of the Transportation Security Administration (TSA) to determine whether the set of smuggling activities / populations under study should be expanded to include cases relevant to that organization. Since no reply has been received to date, the plan is simply to provide TSA with research and analysis results at the close of the project.

ANSER submitted monthly project reviews on 08 May (for the month of April 2019) and 10 June (for the month of May 2019). The ANSER Project Manager presented a brief project overview at the BTI 2019 Annual Meeting, held 26 June in Washington, D.C. We also prepared and conducted an In-Progress Review of the first quarter's activities and accomplishments and briefed that to the Research Committee on July 1, 2019. Based on the outcomes of that briefing, the Committee authorized the PI to continue pursuing the research in accordance with the approved plan.

G.4.3. Milestones, Deliverables, and Performance Metrics
G.4.3.a. Milestone Table

ID	Description	Effort Period	Status
M1	Initial kickoff. Establishes a shared understanding of exactly what the project will accomplish and how it will be conducted.	Apr 19	*Complete*
M2	List of extended models. Bounds study scope and establishes a framework for the deterrence parameters whose values must be estimated.	Jun 19	*Completed and (presented and accepted at the 01 July, 2019 quarterly IPR)*

G.4.3.b. Milestone Report

M1. Initial Kickoff

Complete. The project kickoff meeting was held on 02 April, 2019. ANSER presented the kickoff briefing, participated in the ensuing discussion with the Research Committee and the DHS sponsor, and prepared and delivered an after-action summary later that day.

M2. List of Extended Models

ANSER presented the extended models proposed for validation to the Research Committee at the July 1, 2019 IPR. The Committee approved progress to date and authorized the project to continue pursuant to the approved research plan.

G.4.3.c. Deliverables Table

ID	Description	Effort Period	Status
D1	Kickoff meeting notes. Documents discussions and follow-up actions.	Apr 19	*Complete*
D2	Monthly status reports. Describes activity and accomplishments; intermediate results, including milestone status; assessment of overall progress toward accomplishing study objectives; issues and proposed mitigation; and activities planned for the upcoming reporting period.	Apr 19 - Jan 20	*Month (date submitted): April (08 May) May (10 June)*
D*	Project overview presentation to BTI 2019 Annual Meeting	Jun 2019	*Complete*

G.4.3.d. Deliverables Report

D1. Kickoff Meeting Notes

Complete: kickoff meeting notes were delivered on 02 April 2019.

D2. Monthly Status Reports

Monthly reports were delivered on 08 May (for the month of April 2019) and 10 June (for the month of May 2019).

D* Annual Meeting, Quarterly IPR, Annual Report and Revised Budget.

The ANSER PM provided an overview of the project and accomplishments to date at the BTI 2019 Annual Meeting. A quarterly IPR was held on 01 July, 2019; the DHS project champion participated in the review and ensuing discussion. An annual report, along with an updated budget for the upcoming BTI budget-year, was provided on 09 July, 2019.

G.4.3.e. Performance Metrics Table

Research and Innovation KPIs	Effort Period	Status

KPI-RI-1	Overall project success: the occurrence of at least one instance in which the indirect verification method sharpens the estimate for a deterrence model parameter, compared with previously published, unverified, direct estimates.	Jan 2020	*Scheduled January 2020*
KPI-RI-2	Milestone M.1 success: agreement on project goals, technical approach, and management.	Apr 2019	*Complete (agreement documented in kickoff meeting notes)*
KPI-RI-3	Milestone M.2 success: at least two different mathematical constructs for modeling deterrence.	Jun 2019	*Complete (accepted by Research Committee 1 July)*

G.4.3.f. Performance Metrics Report

KPI-RI-1. One instance in which the indirect verification method sharpens the estimate for deterrence model parameter

Performance measure scheduled to complete outside this reporting period (January 2020). All project activity is directed toward the accomplishment of this performance measure.

KPI-RI-2. Agreement on project goals, technical approach, and management

Complete. Project goals, technical approach, and management approach were discussed during the project kickoff. Agreement was documented in the kickoff meeting notes, which were delivered on 02 April 2019.

KPI-RI-3. Two different mathematical constructs for modeling deterrence

Complete. During May and June, ANSER identified the mathematical constructs to be analyzed and validated, based on the results of literature review. ANSER presented these constructs at the July 1, 2019 Quarterly IPR resulting in acceptance by the Research Committee.

G.5. Benjamin Rohrbaugh, David Hensell and Brian Henderson, Lantern Unmanned Autonomous Systems (UAS) LLC; *Exploring Homeland Security applications for unmanned autonomous systems at maritime ports*

G.5.1. BTI Management Summary

Exploring Homeland Security Applications for Unmanned Autonomous Systems at Maritime Ports
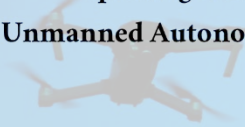
Benjamin Rohrbaugh, Lantern UAS LLC
David Hansell, Lantern UAS LLC
Brian Henderson, Lantern UAS LLC

Systems based on UAS technology have the potential to contribute to several aspects of port security with minimal impact on current port operations.

DHS Champion: Namdoo Moon, Ph.D., Program Manager, CWMD

During this reporting period, the investigator has completed their kickoff meeting, traveled to the University of Houston to meet the Institute team and secure a

controlled testing location, and completed Milestone 1, determine UAS/sensor configurations and necessary hardware. The investigator also presented their project at the BTI Institute 2019 Annual Meeting. The Research Committee provided written feedback at the quarterly review on 26 June 2019 and confirmed that the project is on track to complete all milestones, deliverables and performance metrics.

G.5.2. Executive Summary

Project PI: Benjamin Rohrbaugh
PI Organization: Lantern Unmanned Autonomous Systems LLC (Lantern UAS)
Project Co-PI: David Hansell
Project Champion: Namdoo Moon, Ph.D., Program Manager, Counter Weapons of Mass Destruction
Reporting Period: Project Year 1 (Project Months 1 through 3)
Technical Readiness Level: 3-4

Lantern UAS began the implementation of our project on maritime port applications for unmanned autonomous systems on 15 April 2019. The team immediately began working to establish a secure facility for controlled testing and to obtain the aerial drone platforms and initial sensor packages to allow us to begin experiments, with an initial focus on radiation detection, thermal imaging, and high resolution imaging of container exteriors, as documented in our monthly progress reports. The Lantern Team worked with BTI to identify an appropriate site for controlled testing. On May 29 and 30, Ben Rohrbaugh and David Hansell were able to travel to Houston to meet with the BTI team in person and to review a potential controlled testing site. Lantern UAS attended the BTI annual meeting in Washington, DC on June 26, and had the opportunity to brief on the progress of the project and to talk with the project champion and other key DHS leaders. Now, with our equipment in hand, a robust simulation framework for radiation detection ready to be validated and refined through live testing, and a lease nearly in place for a controlled testing site, the team is ready to start flying and eager to begin.
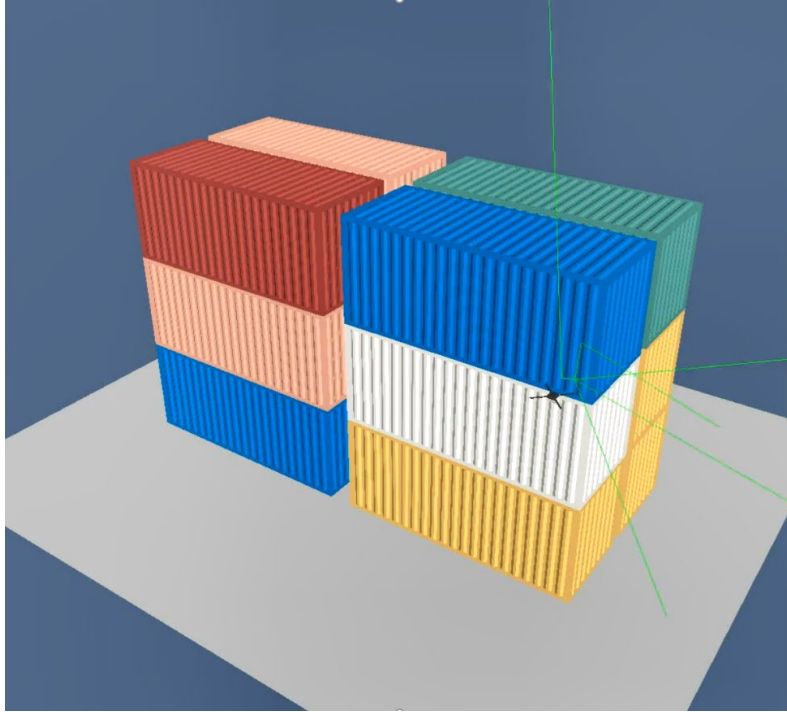
G.5.3. Milestones, Deliverables, and Performance Metrics

G.5.3.a. Milestone Table

ID	Description	Effort Period	Status
M1	Establish program of research for different UAS/sensor configuration and obtain necessary hardware. Determine the contraband types and cargo configurations to be prioritized.	Jun 2019	Complete, we have obtained the initial hardware necessary to begin this testing.

G.5.3.b. Milestone Report

M1. Establish program of research for different UAS/sensor configuration and obtain necessary hardware. Determine the contraband types and cargo configurations to be prioritized.

Complete. The team identified the equipment necessary to begin testing for several scenarios to offer particularly compelling applications of aerial drones and match identified DHS mission priorities: Using gamma radiation detection for detection and identification of a potential radiological dispersal device, using thermal imaging cameras to identify potential human or wildlife smuggling in a cargo container or other enclosed space, and using high resolution cameras to gather information about container surfaces and identify potential tampering. The team intends to continuously refine the plans and to potentially revise the additional equipment to be purchased to facilitate testing and enrich the analysis of initial test results. As an example of the ongoing refinement of the testing plans, the team has recently developed a promising concept for narcotics detection which can be incorporated into future testing.

G.5.3.c. Deliverables Table

Deliverables were not expressly developed for the approved Work Plan. They have been derived from the approved Work Plan task list and are all scheduled for delivery in PY5.

G.5.3.e. Performance Metrics Table

All performance metrics are scheduled for PY5.

H. DHS Related Activity Not Specified in PY4 Work Plan

H.1. RFP 19-01

The BTI Institute was directed to prepare to distribute a request for proposals that address research questions related to the Conference on Prosperity and Security in Central America. Eight (8) specific research questions were proposed. The RFP submission window opened on 14 March 2019 and closed on 10 May 2019. The BTI Institute review process was completed by 28 May 2019. Ten (10) applications were received. Seven (7) were reviewed for scientific merit, mission relevance and project management. At the end of this reporting period, those six are with DHS for review.

H.2. DHS COE Summit 2019

The BTI Institute participated in the planning of the 2019 DHS COE Summit. The Summit is 29 July to 2 August and will include an Innovation Showcase, Education Grand Challenge, and panel discussions. The Executive Director was involved, in conjunction with the Executive Director from the Arctic Domain Awareness Center, a DHS COE, in developing a thematic track for the Summit. The Manager for Research and Development was involved in the Innovation Showcase committee. The Manager for Education and Training was involved in the Education Committee, specifically with effort on creating the Education Roundtable. The Manager for Communication and Operations and the Administrative Assistant were involved in the Communication committee, which included updated COE vignettes, the DHS S&T OUP fact sheet, and review of the COE Summit website. Actual execution of the Summit will be reported outside of this reporting period through Monthly Reports and the PY5 semi-annual report.

Appendix I to BTI Institute PY4 Annual Report

Administration and Execution Timeline

1 July 2018: Program Year 4 begins.

2 July 2018: Research Committee received and reviewed the draft Work Plan from Texas A&M University, "Game Theory Framework for Global Supply Chain." This is an RFP 17 project.

2 July 2018: Research Committee received and reviewed the draft Work Plan from Texas A&M University, "Port Capacity Estimation Model." This is an RFP 17 project.

9-12 July 2018: S&T OUP PM conducted a site visit of the Institute and the new executive leadership team.

19 July 2018: Draft Work Plan submitted to OUP from Lantern, "UAS at Maritime Ports." This is an RFP 17 project.

20 July 2018: Draft revised Work Plan submitted to OUP from ANSER, "Validating Deterrence Models." This is an RFP 17 project.

23 July 2018: Draft Work Plan submitted to OUP from Texas A&M University, "Game Theory Framework for Global Supply Chain." This is an RFP 17 project.

23 July 2018: Draft Work Plan submitted to OUP from Texas A&M University, "Port Capacity Estimation Model." This is an RFP 17 project.

28 August 2018: Submitted Draft Annual Report v1 to S&T OUP.

31 August 2018: Mrs. Barbara Dwyer, Project Coordinator for Special Projects, retired.

August 2018: S&T OUP approved PY4 work plan.

September 2018: Barbara Dwyer, Project Coordinator for Special Projects, retired.

7 September 2018: Submitted Quarterly Action Plan to OUP PM for Q2.

13 September 2018: Executive Director traveled to DC to work through some time sensitive issues with the BTI Annual Report with DHS Office of University Programs Project Manager.

13 September 2018: Received OUP comments on Draft Annual Report v1 for revision.

13 September 2018: Research Committee received and reviewed draft Work Plan from University of Maryland, "Dynamic Network Models of Migration." This is an RFP 17 project.

9 October 2018: Draft White Paper submitted to OUP from University of Maryland, "Dynamic Network Models of Migration." This is an RFP 17 project.

11 October 2018: Executive director traveled to Washington, D.C. to meet with Dr. William Bryan, DHS Senior Official Performing the Duties of the Under Secretary for Science and Technology along with other COE Directors.

15 October 2018: Dr. Abria Magee, Manager of Research and Development, joined the BTI Institute team.

29 October 2018: Submitted the Draft Performance Year 3 Annual Report v2 to DHS S&T OUP.

1 November 2018: Dr. Maura Pereira De Leon, Manager of Education and Training, joined the BTI Institute team.

7 December 2018: Submitted Quarterly Action Plan to OUP PM for Q3.

17 December 2018: Director met with Matt Coats, Program Director of the Office of University Programs in Washington, D.C.

18 December 2018: Submitted PY3 Annual Report to OUP.

16 January 2019: The Executive Director attended a presentation given by Tony Payan, fellow at the Baker Institute for Public Policy and Director of the Mexico Center, hosted by the United States Mexico Chamber of Commerce.

28 February 2019: The Institute submitted the 2018 Data Call to DHS S&T OUP.

28 February 2019: The Institute submitted the Draft Program Year 5 Work Plan to DHS S&T OUP.

7 March 2019: Manager, R&D, and Manager, E&T attended a presentation at the Baker Institute, titled "The Future of Immigration."

14, 15 March 2019: The Executive Director traveled to El Paso to meet with members of the U.S. Border Patrol El Paso Sector and researchers from the Hunt Institute to review a potential project.

18 March 2019: The Executive Director attended a presentation by the President of the Migration Policy Institute, titled "Vanishing Frontiers: The Forces Driving Mexico and the United States Together."

18 April 2019: The RC Chair gave an overview presentation of the BTI Institute at the Texas Southern University Department of Homeland Security Scientific Leadership Award program.

22 April 2019: Draft PY5 Work Plan submitted to DHS S&T OUP.

3 May 2019: BTI Institute Director and RC Chair attended the COE Data Workshop in Washington, D.C.

30 May 2019: The BTI Institute received revisions to DRAFT PY5 Work Plan from DHS S&T OUP.

26 June 2019: The BTI Institute held the 2019 Annual Meeting in Washington, D.C.

28 June 2019: The BTI Institute submitted revised Draft PY5 Work Plan to DHS S&T OUP.

30 June 2019: Program Year 4 ends.

Appendix II to BTI Institute PY4 Annual Report

Research and Development Timeline

2 July 2018: Five projects were selected from RFPs 17-01 and 17-02 for work plan development.

2 July 2018: Revised Work Plan and Budget submitted to OUP from the University of Houston, "The 'Eye in the Woods' Image-based Human Detection and Recognition System."

2 July 2018: Received and reviewed White Paper from the USC Center for Risk and Economic Analysis of Terrorism Events Center of Excellence, "C-TPAT Benefit Analysis."

9 July 2018: BTI Institute received and reviewed a White Paper from the Migration Policy Institute, "The Impact of Sanctuary Policies on ICE Activities, Crime Rates and Internal Migration Patterns." The White Paper was submitted to DHS S&T OUP.

11 July 2018. BTI Institute received and reviewed a White Paper from the Migration Policy Institute, "Venezuela and Nicaragua: A Regional Migration Crisis in the Making."

13 July 2018. BTI Institute received and reviewed a White Paper submitted jointly from the University of Houston and Texas A&M University, "Blockchain and Smart contracts.

24 July 2018: White Paper submitted to OUP from the USC Center for Risk and Economic Analysis of Terrorism Events Center of Excellence, "C-TPAT Benefit Analysis."

30 July 2018: Work Plan and Budget approved by OUP from the University of Houston, "EDGE: The 'Eye in the Woods' Image-based Human Detection and Recognition System."

3 August 2018: The BTI Institute held the kickoff meeting for "EDGE: The 'Eye in the Woods' Image-based Human Detection and Recognition System."

7 August 2018: DHS review of White Paper from the USC Center for Risk and Economic Analysis of Terrorism Events Center of Excellence, "C-TPAT Benefit Analysis" concluded it was inadequate to address the concern. BTI Institute made contact with Arizona State University Center for Accelerating Operational Efficiency Center of Excellence.

8 August 2018: Work Plan development began for White Paper from the Migration Policy Institute, "The Impact of Sanctuary Policies on ICE Activities, Crime Rates and Internal Migration Patterns" submitted on July 9, 2018.

9 August 2018: Received and reviewed White Paper from the University of Texas, "Zero Tolerance Family Separation." White Paper was submitted to OUP.

15 August 2018: Research Committee received and reviewed draft work plan from the Migration Policy Institute, "Venezuela and Nicaragua: A Regional Migration Crisis in the Making."

15 August 2018: Received and reviewed White Paper from the University of Houston, "Foamed Pre-cast Concrete Panels."

16 August 2018: Submitted White Paper from the University of Houston, "Foamed Pre-cast Concrete Panels" to OUP.

17 August 2018: Received draft Work Plan from the University of Houston, "Facial Recognition in Minors."

20 August 2018: Received White Paper from the University of Houston, "30 Habits Secure & Efficient Cargo Flows."

20 August 2018: The BTI Institute received and reviewed a White Paper from the University of Houston, "The 30 Habits for Exceptionally Secure and Efficient Cargo Flows at US Borders."

22 August 2018: Informed there was no interest from DHS in White Paper from the University of Houston, "Foamed Pre-cast Concrete Panels." Instead passed the White Paper to the Army Corps of Engineers.

30 August 2018: Research Committee reviewed draft work plan from the Migration Policy Institute, "The Impact of Sanctuary Policies on ICE Activities, Crime Rates and Internal Migration Patterns."

August 2018: The BTI Institute received and reviewed a White Paper from the University of Houston, "Comparative Analysis of Best Practices in International Immigration Policy, Procedures, and Regulations."

4 September 2018: Draft work plan submitted to OUP from the Migration Policy Institute, "Venezuela and Nicaragua: A Regional Migration Crisis in the Making."

4 September 2018: Received and reviewed a White Paper from Georgia Tech, "C-TPAT Benefit Analysis." This was based on a recommendation from ASU CAOE COE as a follow up to DHS request.

9 September 2018: Submitted a White Paper to OUP from Georgia Tech, "C-TPAT Benefit Analysis."

11 September 2018: Received draft Work Plan from the Hunt Institute, "Border Wall Impact."

18 September 2018: Submitted draft Work Plan to OUP from Georgia Tech, "C-TPAT Benefit Analysis."

19 September 2018: Revised work plan received for review from the Migration Policy Institute, "Venezuela and Nicaragua: A Regional Migration Crisis in the Making."

21 September 2018: White Paper received and reviewed by the Research Committee from the University of Houston, "Technology Transition COETT." Submitted directly to DHS, Office of Technology Transition.

21 September 2018: Draft Work Plan submitted to OUP from the Hunt Institute, "Border Wall Impact."

26 September 2018: Research Committee reviewed and approved for recommendation the revised work plan and budget from the Migration Policy Institute, "The Impact of Sanctuary Policies on ICE Activities, Crime Rates and Internal Migration Patterns."

4 October 2018: The BTI Institute Research Committee held a quarterly review for "EDGE: The 'Eye in the Woods' Image-based Human Detection and Recognition System." The project was determined to be on track.

9 October 2018: Submitted the revised work plan and budget to OUP from the Migration Policy Institute, "The Impact of Sanctuary Policies on ICE Activities, Crime Rates and Internal Migration Patterns."

9 October 2018: Submitted the revised work plan and budget to OUP from the Migration Policy Institute, "Venezuela and Nicaragua: A Regional Migration Crisis in the Making."

29 October 2018: Received and reviewed revised Work Plan and Budget from the Hunt Institute, "Border Wall Impact."

November 2018: The Manager reviewed the current Research Safety Plan and created a checklist to integrate into the research tasks.

November 2018: The BTI Institute received a White Paper from the University of Houston, "Promoting the integration of immigrants into mainstream US society through language learning."

November 2018: The BTI Institute received and reviewed a White Paper from the University of Houston, "Theory and Model of DNA Encryption Based on Reverse Protein Decomposition Puzzle."

November 2018: The BTI Institute received and reviewed a White Paper from the University of Houston, "Intelligent Monitoring System."

2 November 2018: Research Committee reviewed and requested revision of White Paper from the University of Houston, "The 30 Habits for Exceptionally Secure and Efficient Cargo Flows at US Borders."

16 November 2018: Submitted revised Work Plan and Budget to USBP from the Hunt Institute, "Border Wall Impact."

28 November 2018: The BTI Institute held the kickoff meeting for Dr. Larry Shi and Dr. Eleftherios Iakovou, "Transforming Trade and Ensuring Global Supply Chain Security with Blockchain and Smart Contracts."

30 November 2018: DHS Office of Policy notified the BTI Institute that the White Paper from University of Texas, "Zero Tolerance Family Separation," was no longer under consideration.

3 December 2018: Research Committee received and reviewed revised White Paper from the University of Houston, formerly "The 30 Habits for Exceptionally Secure and Efficient Cargo Flows at US Borders" is now,

3 December 2018: Revision of Work Plan and Budget sent from USBP to the Hunt Institute for the project "Border Wall Impact."

10 December 2018: Research Committee meeting. This meeting addressed the research committee's role with BTI. BTI management reminded individuals of the commitment and responsibilities. We reviewed pending white papers and the research safety plan. We also discussed potential project management software.

11 December 2018: BTI Institute received notice from OUP that DHS is no longer interested in the White Paper from Georgia Tech, "C-TPAT Benefit Analysis."

19 December 2018: Submitted White Paper to OUP from University of Houston, "Promoting the Integration of Immigrants into Mainstream US Society through Language Learning."

17 January 2019: Research Committee meeting.

January 2019: Kakadiaris reached first milestone and submission of first deliverables.

January 2019: The Research Committee received and reviewed the White Paper, "The Futures of the Borders," by Dr. Andy Hines, University of Houston.

January 2019: The Research Committee received and reviewed the White Paper, "Fingerprinting the source of steel and aluminum imports into the U.S.," by Dr. Thomas Monecke, Colorado School of Mines.

January 2019: The Research Committee received and reviewed the White Paper, "Operational Means for Forensic Characterization of Imported Crudes," by Dr. Ramanan Krishnamoorti, University of Houston.

1 February 2019: The BTI Institute began a new project with the Migration Policy Institute, titled "Venezuela and Nicaragua: Regional Migration Crisis in the Making."

15 February 2019: The Research Committee held a meeting to review White Papers submitted specifically in response to customer discovery efforts.

28 February 2019: The Research Committee held a meeting to reviewed proposed scholarship and fellowship opportunities from the Manager, Education and Training, and make a selection on the Minority Serving Institution Summer Research Team.

February 2019: The Research Committee received and reviewed the White Paper, "DNA Assays for Determining Honey Origins: DNA Sequencing, PCR, and Filtered Honey Analysis," by Dr. Richard Willson, University of Houston.

February 2019: The Research Committee received and reviewed the White Paper, "A Retrospective Study on the U.S. Economic Effects of Raising the De Minimus Threshold," by Dr. C. McDaniel, Mercatus Center at George Mason University.

14 March 2019: The BTI Institute published RFP 19-01.

28 March 2019: The Research Committee met to review White Papers and confirm kickoff and quarterly meetings.

21 March 2019: The BTI Institute funded a new project, titled "Validating Deterrence Models for Scanning Technologies," by George Thompson, Analytic Services Inc (ANSER).

March 2019: The Research Committee received and reviewed the revised White Paper, "DNA Assays for Determining Honey Origins: DNA Sequencing, PCR, and Filtered Honey Analysis," by Dr. Richard Willson, University of Houston.

March 2019: The Research Committee received and reviewed the White Paper, "Digital and Social Surveillance (DaSS) Net: Detection and Disruption of Border Security Threats," by Dr. Tim Mackey, UC San Diego.

March 2019: The Research Committee received and reviewed the White Paper, "Preparatory Educational Opportunities for US Citizenship Examinations," by Michelle Belco, University of Houston.

March 2019: The BTI Institute submitted the White Paper, "The United States of America Drug Harm Index 2019," by Dr. Kristina M. L. Acri nee Lybecker, Colorado College; to the Office of Trade (Trade Policy & Programs).

2 April 2019: PI Thompson held their project's kickoff meeting.

8 April 2019: PI Rohrbaugh held their project's kickoff meeting.

11 April 2019: The RC met to evaluate white papers and produce written reviews on current projects.

25 April 2019: The RC met to evaluate white papers and discuss the BTI Institute Annual Meeting and DHS COE Summit.

April 2019: The RC received and reviewed the White Paper, "Border, Trade and Transport Management Training Workshops," by Maria Burns, University of Houston.

April 2019: The RC received and reviewed the White Paper, "Preparatory Educational Opportunities for US Citizenship Examinations," Michelle Belco, University of Houston.

April 2019: The RC received and reviewed the revised White Paper, "The United States of America Drug Harm Index 2019," by Dr. Kristina M.L. Acri nee Lybecker, Colorado College.

April 2019: The RC received and reviewed the revised White Paper, "Digital and Social Surveillance (DaSS) Net: Detection and Disruption of Border Security Threats," by Dr. Tim Mackey, UC San Diego.

April 2019: The BTI submitted the White Paper, "A Retrospective Study on the U.S. Economic Effects of Raising the De Minimus Threshold," by Dr. C. McDaniel, Mercatus Center at George Mason University, to DHS S&T OUP.

April 2019: The BTI Institute submitted the White Paper, "DNA Assays for Determining Honey Origins: DNA Sequencing, PCR, and Filtered Honey Analysis," by Dr. Richard Willson, University of Houston, to DHS S&T OUP.

9 May 2019: 2nd Quarterly Meeting and Report for PI Shi, et al.

10 May 2019: RFP 19-01 closed.

23 May 2019: The RC met to evaluate recent White Paper submissions and review Work Plan development.

May 2019: The RC received and reviewed the White Paper, "A Paradigm Shift in U.S. Border Patrol Staffing Models and Deployment Strategies," Gary Hale, Voir Dire International LLC.

May 2019: The RC received and reviewed the White Paper, "Designing A Regional/Transnational Institutional Structure for the Economic and Political Development of the Central American Northern Triangle," by Dr. Gaspare Genna and Dr. Victor Manjarrez, University of Texas at El Paso.

May 2019: The RC received and reviewed the White Paper, "Refinement of a Laser-based Fiber Optic Outdoor Security Intrusion Detection Technology with Inherent Alarm Assessment Capability for Critical Infrastructure and Border Security Applications," by Evenson and Iffergan, BEI Security Inc.

May 2019: The RC received and reviewed the White Paper, "Wirelessly Powered Border Patrol Vehicles with Dynamic Fast Charging Capability using Solar Power," by Dr. Wajiha Shireen, University of Houston.

May 2019: The BTI Institute was asked to refine five White Papers into Work Plans.

June 2019: The RC received and reviewed the White Paper, "Detection of Clandestine Tunnels in Southern Border Areas Using Mobile Sensing Techniques and Machine Learning" by Dr. Xuqin Wu, University of Houston.

June 2019: The RC received and reviewed the revised White Paper, "Wirelessly Powered Border Patrol Vehicles with Dynamic Fast Charging Capability using Solar Power," Dr. Wajiha Shireen, University of Houston

June 2019: The RC received and reviewed the revised White Paper, "Refinement of a Laser-based Fiber Optic Outdoor Security Intrusion Detection Technology with Inherent Alarm Assessment Capability for Critical Infrastructure and Border Security Applications," by Iffergan and Evenson, BEI Security Inc.

June 2019: The BTI Institute submitted the Work Plan, "A Retrospective Study on the U.S. Economic Effects of Raising the De Minimus Threshold," by Dr. C. McDaniel, Mercatus Center at George Mason University, to DHS S&T OUP.

June 2019: The BTI Institute submitted the Work Plan, "The Futures of the Border," by Dr. Andy Hines, University of Houston, to DHS S&T OUP.

26 June 2019: BTI Institute hosted 2019 Annual Meeting in Washington, D.C.

26 June 2019: 1st Quarter Meeting and Report for PI Rohrbaugh, et al.

Appendix III to BTI Institute PY4 Annual Report

Education and Training Timeline

July 2018: Homeland Security Internship, involving three cadets from the U.S. Coast Guard Academy and one cadet from the U.S. Military Academy at West Point, ends.

October 2018: Coordinated with Beth White from Oak Ridge Institute for Science and Education to develop research topics or projects to collaborate on with a Minority Service Institute during the summer.

October 2018: Coordinated with Commander Joseph Callaghan from the United States Coast Guard Academy to renew the academy summer internship opportunity for Summer 2019.

21 November 2018: BTI Institute submitted a comprehensive education program revolving around border operations management, trade, and transport security for review to the Deputy Assistant Commissioner of the Office of Training and Development.

18 December 2018: The Director and the Manager, E&T met with the Deputy Assistant Commissioner of the Office of Training and Development to discuss the BTI Education and Training Plan.

24 January 2019: The Manager, E&T submitted the Institute's preferred selection for the 2019 DHS Minority Serving Institutions Summer Research Team.

31 January 2019: The BTI Institute hosted the Human Trafficking Brown Bag and the University of Houston.

26 February 2019: The Manager, E&T met with met with faculty and staff form the Honor College at the University of Houston to discuss the "Citizenship Learning Project."

27 February 2019: The BTI Institute hosted the Blockchain Brown Bag at the University of Houston.

6 March 2019: The BTI Institute confirmed with the United States Military Academy at West Point that the Institute would host Cadet Sarah Donaldson.

29 March 2019: The BTI Institute was informed of the team selection for the 2019 DHS MSI SRT.

17 April 2019: The BTI Institute hosted the Cybersecurity Brown Bag at the University of Houston.

29 April 2019: The Manager, E&T, and University of Houston mentor Dr. Luis Torres held a telephonic orientation meeting with the DHS MSI SRT.

2 May 2019: The Manager, R&D, and RC Chair met with the Deputy Assistant Commissioner of the CBP Office of Training & Development to review the curriculum development program.

6 May 2019: The BTI Institute Curriculum Development project team held their kickoff meeting.

31 May 2019: Dr. Zanca Nursen and graduate student Nicholas Randol, the DHS MSI SRT hosted by the BTI Institute, met with UH mentor Dr. Luis Torres to receive guidance and begin their research study.

24 June 2019: Cadet Sarah Donaldson, United States Military Academy at West Point, arrived to the University of Houston.

June 2019: The course, "Introduction to Homeland Security," was submitted to CBP Office of Training & Development for review as part of the BTI Institute's Curriculum Development project.

June 2019: The DHS MSI SRT submitted a poster, titled "The Global Terrorism Index (GTI): Methodology and Meaning."

Appendix IV to BTI Institute PY4 Annual Report

Customer Outreach and Communication Timeline

13 July 2018: Posted summer intern profile for Cadet Emiliano Gonzalez on LinkedIn and News and Media. http://www.uh.edu/bti/news/stories/2018/intern-profile-emiliano/

August 2018: The Institute refreshed the website front page in order to provide more dynamic content. The URL remains the same: www.uh.edu/bti.

August 2018: Posted Summer Intern article on News and Media. http://www.uh.edu/bti/news/stories/2018/summer-internship/

August 2018: Posted Hershberg presentation on News and Media. http://www.uh.edu/bti/news/stories/2018/hershberg-presentation/

10 August 2018: July Monthly report distributed.

7 September 2018: August Monthly Report distributed.

20 September 2018: Manager of Communication and Operations attended the US/Canada Border Conference in Detroit.

27 September 2018: Finalized the BTI Institute Communication Strategy and submitted to S&T OUP.

October 2018: Executive Director met with the Director of the Petroleum, Natural Gas and Minerals COEE to discuss areas that BTI may assist the Center in successfully achieving its mandate in support of the Homeland Security Enterprise.

8 October 2018: September Monthly Report distributed.

15 October 2018: Reviewed BTI Institute Fact Sheet and submitted for reprinting.

16 October 2018: BTI Institute Newsletter (July – September Edition) was distributed through Emma email marketing.

16 October 2018: Executive Director presented an overview of the Institute and discussed potential research and transition partnership opportunities at the University of Houston College of Technology Industry Advisory Board Meeting.

23-24 October 2018: Executive Director and members of the Research Committee traveled to Washington, D.C. to meet with representatives from the Trade Transformation Office, Business Transformation & Innovation, Analytical Communications Branch, Office of Trade Relations, Office of Field Operations, Commercial Analysis Division and Systems and Innovation Division.

24 October 2018: Manager of Communications participated in OUP Communication Conference Call where the committee discussed the new S&T organizational construct, the need for stakeholder quotes, supporting weekly activity reports, and updating the HSUP center page.

6 November 2018: October Monthly report distributed.

8 November 2018: The BTI Institute met telephonically with the director and executive director of the Cross-Border Institute at the University of Windsor.

8 November 2018: Executive Director and Research Committee chair conducted a teleconference with the University of Houston Chief Energy Officer and personnel from the DHS Petroleum, Natural Gas and Minerals COEE.

8 November 2018: Built and populated an HSUP Work Group for Kakadiaris EDGE project.

11 November 2018: Built and populated an HSUP Work Group for the Shi Blockchain project.

13-15 November 2018: Executive Director and Research Committee traveled to Washington, D.C. to meet with senior leadership and staff from CBP Office of Education and Training; Office of Trade, Trade Policy and Remedy; Office of Trade, Trade Remedy Law Enforcement Directorate; and Office of Operations Support, Laboratories and Scientific Service Directorate.

29 November 2018: As a follow up to the 16 October 2018 presentation at the UH CoT Industry Advisory Board Meeting, the Executive Director met with Senior Vice President of Maritime Affairs at the West Gulf Maritime Association.

4 December 2018: The Homeland Security University Programs website is down, to include the main page and the project reporting system.

10 December 2018: November Monthly report distributed.

19 December 2018: The Homeland Security University Programs website was restored.

20 December 2018: Created webpage for Shi Blockchain project. Approved by project champion. http://www.uh.edu/bti/research/shi-iakovou-blockchain/

4 January 2019: December Monthly report distributed.

22 January 2019: Human Trafficking Brown Bag invitation was distributed in conjunction with website and Eventbrite page going live.

24 January 2019: Newsletter for October to December 2018 (PY4Q2) was distributed through EMMA Email Marketing, the BTI Institute website and Social Media.

2 February 2019: Updated Selee Venezuela and Nicaragua project on HSUP Project reporting website.

2 February 2019: Built and populated HSUP Work Group for Selee Venezuela Nicaragua project.

6 February 2019: January Monthly report distributed.

18 February 2019: Blockchain Brown Bag invitation was distributed in conjunction with website and Eventbrite pages going live.

20 February 2019: Participated in the monthly COE communications committee meeting. The committee discussed public access initiatives and the 2019 DHS COE Summit.

27 February 2019: The BTI Institute was published in www.bordermanagement.net.

1 March 2019: The Manager, R&D, and the Manager, E&T presented during the University of Houston's Women's Leadership Conference.

5 March 2019: February Monthly report distributed.

14 March 2019: RFP 19-01 information was distributed in conjunction with website and SM Apply going live.

20 March 2019: Funding opportunity email in support of CINA's RFP was distributed.

21 March 2019: Cybersecurity Brown Bag invitation was distributed in conjunction with website and Eventbrite pages going live.

22 March 2019: Built and populated HSUP Work Group for Thompson Deterrence project.

22 March 2019: Created webpage for Thompson Deterrence project.
http://www.uh.edu/bti/research/deterrence-models/index.php

26 - 28 March 2019: The Executive Director, Research Committee Chair, Communications Manager, Research Manager, Education Manager and Admin Lead attended the 2019 Border Security Expo in San Antonio, TX.

3 April 2019: March Monthly Report was distributed.

3 April 2019: PI Meeting save the date was distributed.

3 April 2019: Updated Thompson Deterrence project on HSUP Project Reporting website.

3 April 2019: Updated Lantern UAS project on HSUP Project Reporting website.

8 April 2019: Newsletter for January to March 2019 (PY4Q3) was distributed through EMMA Email Marketing, the BTI Institute website and Social Media.

17 April 2019: Created article for Cybersecurity Brown Bag.
http://www.uh.edu/bti/news/stories/2019/bb-cybersecurity/

17 April 2019: Created webpage for Lantern UAS project.
http://www.uh.edu/bti/research/lantern-uas/index.php

25 April 2019: Updated deadline for RFP 19-01 distributed through EMMA Email Marketing, the BTI Institute website and Social Media.

2 May 2019: The Manager, R&D, and RC Chair met with members from DHS Customs-Trade Partnership against Terrorism, DHS US Citizenship and Immigration Services, CBP Human Capital Analytics & Accountability, CBP Office of Operations Support, and DHS Trade Remedy Law Enforcement Directorate to determine customer needs and potential solutions.

8 May 2019: April Monthly Report distributed.

8 May 2019: Academic Programs added to the Education portion of the BTI Institute website. http://www.uh.edu/bti/education/academic-programs-development/

8 May 2019: Updated and submitted Vignette and BTI Institute Fact Sheet to OUP Communications committee in preparation for 2019 COE Summit.

10 May 2019: RFP 19-01 closed. Moved projects to completeness review and then to management, relevancy, and scientific review.

23 May 2019: Updated BTI Institute Factsheet (UH branding) to coincide with new projects.

5 June 2019: May Monthly report distributed.

26 June 2019: The BTI Institute hosted the 2019 Annual Meeting in Washington, D.C.

27, 28 June 2019: The Executive Director and Manager, Communications attended the American Association of Exporters and Importers Annual Meeting and Exposition.