U.S. Customs & Border Protection

Passenger Systems Program Directorate

Land Border Integration Division

Anzalduas Technology Demonstration

May 16, 2022

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1 Executive Summary

The analysis and review of biometric facial capture in the land vehicle environment began with the 2017, Vehicle-At-Speed (VAS) Project and continued with the 2018-2019, VAS Pilot at Anzalduas International Bridge Port of Entry (POE). The follow-on biometric capability investigative effort was initiated on September 14, 2021, with the U.S. Customs and Border Protection (CBP) Component Acquisition Executive (CAE) granting approval to conduct the Biometric Entry-Exit Program Land Vehicle Entry Technology Demonstration at the Anzalduas International Bridge, Texas POE.

As technologies have evolved, facial comparison has become the most efficient solution for CBP across all modes of entry (air, land, and sea). Simplified Arrival (SA) is the enhanced arrival inspection application that uses facial biometrics to automate manual document inspection required to determine admissibility into the United States. SA provides travelers with a secure and seamless travel experience while fulfilling the longstanding Congressional mandate to verify the entry and exit of non-U.S. citizens.

The Office of Field Operations (OFO) Program Management Office (PMO) in coordination and collaboration with the Office of Information and Technology (OIT) Passenger Systems Program Directorate (PSPD) conducted the Anzalduas International Bridge POE Technology Demonstration to evaluate, over the course of 152 days, the technical feasibility of capturing facial images for biometric comparison (b)(7)(E)

The technology demonstration objectives were:

- Capture photos of arriving vehicle occupants and comparing photo(s) to the source photo(s) on file for the travel document(s).
- Utilize (b)(7)(E) biometric matching capabilities to conduct a 1:1 facial comparison of the encounter photo to the travel document source photo enabling identity verification.
- Verification of automated notification of biometric match or no-match result to the U.S. Customs and Border Protection Officer (CBPO) for use in the admissibility decision.
- Collect data to ensure the crossing record of all in-scope arriving travelers is updated in the Arrival Departure Information System (ADIS), to include a biometrically confirmed arrival.
- Identify any additional cost requirements, such as infrastructure, software, or services.

At the conclusion of the technology demonstration, all stated objectives were successfully met.

The standard Land Border Integration (LBI) lane technology of license plate readers (LPRs), radio frequency identification (RFID) document readers, and sensors, were enhanced by the inclusion of the (b)(7)(E) to capture traveler images in the lane's pre-primary zone. This fully integrated biometric solution generated and transmitted the vehicle package to SA Vehicle (SAV). (b)(7)(E)

(b)(7)(E)

(b)(7)(E) Following (b)(7)(E) validation, the SAV application presented biometric (match/no match) and biographic query results to the CBPO for admissibility determination.

The (b)(7)(E) successfully captured vehicle occupant images (b)(7)(E) (b)(7)(E) during its approach to the primary booth under both daytime and nighttime conditions. The photo captured in the lane was then compared against an existing photo associated with RFID enabled travel documents presented in the lane for match/no match using (b)(7)(E)

A significant number of adjustments to the occupant camera were implemented during the period of performance,[1] which resulted in higher image capture rates. By the end of the reporting period,[2] the following observations were made:

- When there was an unobstructed view of occupants, 100 percent encounter photo rate of vehicle occupant photos was achieved.
- 63 percent of all single-occupant (driver only) vehicle images were captured, up from 38 percent at the beginning of the demonstration.
- 76 percent of all occupants (front and back seat) in the vehicle had a photo captured in the lane; of these photos captured, 81.5 percent met (b)(7)(E) validation requirements for biometric matching.

1.1 Approach

Two of the six vehicle inbound lanes at Anzalduas International Bridge (lanes 1 and 2) were selected for this demonstration. Lane selection comprised a mixture of both dedicated (b)(7)(E) (b)(7)(E) document holder commuter traffic and general traffic:

- Lane 1: SENTRI traffic in morning with general traffic processing the remainder of the day.
- Lane 2: processes general traffic all day.

The assessment focused on evaluating:

- The system's ability to capture a quality facial image for each occupant of a moving vehicle under environmental challenges not seen in the air, sea, or pedestrian environments.
- The accuracy of the matching algorithms to inform future biometric enhancements for vehicle entry processing.

1.2 Performance Findings

To achieve the objectives of the demonstration, the camera solution was fully integrated with the technology in the pre-primary zone (PPZ) and the CBP network to deliver real-time match results to primary officers in the booth, via SAV. Through repeated camera adjustments to

[1] Section 5.3 "Solution Configuration and Adjustments"

optimize performance, the image capture rate for occupants rose from 42 percent in the first reporting period, to 76 percent by the end of the demonstration. Of the photos captured, 81.5 percent were of sufficient quality to be sent to (b)(7)(E) for a match attempt.

Ultimately, the data shows that, by the end of the demonstration, when a traveler had a valid encounter photo and presented an (b)(7)(E) travel document, the biometrically confirmed technical match rate (TMR) was more than 99 percent.

Also of note: while the capture rate of quality photos plateaued at ~81%, the technical quality of those photos improved by approximately 6 percent over the course of the demonstration (TMR improved from 93.6 percent to 99.2 percent). The adjustments made to the technology made a difference, but more work is required to match the capture rates of other modes of travel ~ 95 percent).

1.3 Recommendations - Path Forward

Consistent and steady solution improvement was noted over the course of the technology demonstration however more solution analysis and testing are needed to reach the 100 percent occupant capture requirement and ensure that a viable, sustainable biometric capability is implemented in the land vehicle environment. To that end, OIT recommends the following:

- Implement the technology improvements to attain as close as possible to 100 percent traveler capture rate (Section 8.1).
- Examine the feasibility of a primary zone biometric capture capability to capture vehicle occupant images not acquired in the PPZ. (Section 8.2).
- (b)(7)(E)
-

2 Background – Vehicle Facial Biometric Capability Development

2.1 2017 Occupant Camera Analysis of Alternatives

In December 2017, seven camera vendors were invited to participate in the VAS project. The purpose of the effort was to identify biometric occupant camera technology (b)(7)(E) (b)(7)(E) The image capture was in support of OFO's request to test the feasibility of biometric facial identity verification in the land vehicle environment. Participating vendors supplied hardware and software, while LBI managed CBP network integration and back-end systems.

OIT conducted the formal evaluation exercise at the Outdoor Test Lane Facility (OTLF) in Stafford, VA. A total of five vendors responded with interest to participate. Two of the five vendors (b)(3) declined to participate shortly before testing commenced at the OTLF. Three vendors (b)(3) participated fully. Oak Ridge National Laboratories (ORNL) provided the baseline data from an earlier study that was not a production-ready solution and had no integrated components. In more than 570 unique test cases, OIT

incorporated and tracked such variables as time of day, weather conditions, and physical obstructions (i.e., hats, sunglasses, number of passengers, and facial positions). For a broader in-depth review, refer to the analysis of alternatives (AoA) report, *Integration Traveler Initiative (ITI) Vehicle-At-Speed (VAS) Camera Evaluation, February 5, 2018*. (Appendix A).

2.2 2018 Vehicle at Speed at Anzalduas, Texas

Following the assessment of the vendor technologies, and extensive AoA (b)(3) and (b)(3) were selected to participate in VAS or Vehicle Biometric at Speed (VBS) Technical Demonstration, which continued the evaluation for an ultimate down-select to one vendor. This second stage of the evaluation took place from August 2018 to February 2019, employing two lanes at Anzalduas, TX. Vendors were requested to capture facial images of occupants in vehicles that were on the move[3]. Both vendors placed their solutions in front of the inbound lanes (b)(7)(E) Ultimately (b)(3) (b)(7)(E) camera was selected for (b)(7)(E) (b)(7)(E). The June 2019 LBI Vehicle Biometric Solution Pilot at Anzalduas Recommendation Report (Appendix B) provides an in-depth review of this effort.

2.3 2019 The Data Breach Impact

On May 24, 2019, the CBP Security Operations Center discovered media reports regarding a cyberattack, which placed CBP data at risk. This cyber security incident happened because of a ransomware attack on the corporate servers of Perceptics, the long-time provider of CBP LPR technology. It was determined that, while supporting the VAS/VBS pilot, Perceptics removed unauthorized copies of traveler image personally identifiable information (PII) and copied this information to Perceptics' corporate servers.

Immediately following the incident, CBP took several remediation actions to include a forensic assessment of all existing camera and biometric technologies to ensure data was not retained on any end point device and performed an assessment of additional data protection and insider threat security controls that could be incorporated to prevent a future incident from occurring.

2.4 2019 – 2020 (b)(3) Production Deployments

(b)(3)

OFO, in consultation and coordination with OIT, made the decision to move forward with (b)(7)(E),(b)(3) (b)(7)(E),(b)(3). OIT developed new integration software to manage packaging of encounters for sending to CBP backend systems.

[3] Vendors decide on camera solutions based on OITs requirement to capture all occupants in a vehicle.

Soon after deploying the (b)(3) LPR lanes with (b)(7)(E) cameras, (b)(7)(E),(b)(3)

(b)(7)(E),(b)(3)

(b)(7)(E),(b)(3)

2.5 (b)(3)

(b)(7)(E),(b)(3)

3 (b)(7)(E) Architecture Development

(b)(3)

Informed by live testing results from the original AoA, and production experience at Anzalduas, OIT determined that the fastest course to meet program requirements would be to design and build an occupant camera solution (b)(7)(E) (b)(7)(E) The resulting occupant camera solution would be included in a second AoA.

3.1 (b)(7)(E)

Based on an open and non-proprietary architecture that had proven to be a high-performing, low-cost alternative to proprietary solutions, OIT began replacing the (b)(3) LPR systems with (b)(7)(E) LPR systems. One of the most promising features of the (b)(7)(E) Architecture was

the ability to use interchangeable cameras and configurations across multiple solution areas, including inbound, outbound, cargo, and U.S Border Patrol (USBP) checkpoints. This flexible framework simplified the solutions and reduced supply chain risks, while also boosting performance, reliability, and maintainability.

3.2 (b)(7)(E) Camera Design

As part of the design and testing, OIT leveraged the success of (b)(7)(E) (b)(7)(E) (b)(7)(E) (b)(7)(E) The team also worked with component vendors to apply suggestions in solving the through-the-windshield challenge of face image capture for a biometric matching capability. The result of this engineering effort is (b)(7)(E) that was tested with SAV and (b)(7)(E) at the commercial test lane facility (CTLF) and OTLF.

Inbound (IB) privately owned vehicle (POV) lane components include:

- (b)(7)(E), an advanced, outdoor, high-resolution network camera, for LPR capture and face image capture. For solutions where an occupant camera, or face capture for (b)(7)(E) integration is desired, other models of (b)(7)(E) may be used.
- (b)(7)(E) for overcoming lighting challenges. The use of a white light illuminator is not advisable as it distracts the driver.
- (b)(7)(E)

4 Anzalduas Technology Demonstration Execution

The 2021/2022 Anzalduas Technology Demonstration takes the next steps in advancing the OFO mission goal of biometric capture and identity verification beyond previous efforts by:

- Integrating facial comparison capability into CBP's network; and,
- Including real-time biometric match results in the SAV client, along with existing biographic capabilities provided to CBPOs in the primary booth.

Previous testing had never included full CBP system integration in the land vehicle environment.

4.1 Anzalduas Operational Requirement and Technical Objectives

The Anzalduas Technology Demonstration memo dated September 14, 2021 (see Appendix C), provided OIT the overarching operational requirement to determine if the installation of a facial biometric capability in the land vehicle environment will garner operational processing improvements which are of benefit to CBP mission execution. OFO's approach to testing the viability of this operational requirement included:

- Employing the use of facial recognition occupant cameras in two inbound lanes; (b)(7)(E) (b)(7)(E) per vehicle lane to capture vehicle occupant images.

- Installing static signage to satisfy privacy and regulatory requirements in the inbound lanes included in the technology demonstration.
- Conducting CBPO training on inbound biometric processing.
- Monitoring and reporting occupant camera performance.

The technical objectives for the demonstration were:

- Full CBP network integration of an (b)(7)(E) camera solution which provides real-time results to primary officers in the passenger vehicle environment.
- Full integration of the camera solution with (b)(7)(E) LPR lane technology.
- Occupant camera placement in the PPZ.
- Capture occupant images[4] of travelers in arriving vehicles and comparing those images to the source photo(s) on file for the travel document(s).
- Monitor and report vehicle occupant image capture rates.
- Monitor and report the quality of images captured by occupant cameras.
- Utilize (b)(7)(E) biometric matching capabilities to conduct a 1:1 facial comparison of the encounter photo to the travel document source photo enabling identity verification (see Exhibit 2).
- Verify the automated notification of biometric match or no-match result to the CBPO for use in the admissibility decision.
- Collect data to ensure the crossing record of all in-scope arriving travelers is updated in the ADIS, to include a biometrically confirmed arrival.

5 Land Vehicle Biometric CONOPS

The current land border vehicle CONOPS focuses on traveler identification based on vehicle license plate and traveler RFID document *biographic* data. Land border vehicle *biometrics* CONOPS transforms the current process by fusing biographic with biometric data captured in the PPZ. Leveraging the SA application, which was developed to streamline and modernize traveler primary inspection processes across all modes of passenger travel, SAV now presents biometric results to the CBPO in the primary booth.

Biometric facial capture and traveler vetting through (b)(7)(E) has proven successful in the air and pedestrian environments. Duplicating that success in the vehicle environment is a particular challenge, where cameras (b)(7)(E) (b)(7)(E) The occupant camera is an integral part of the land vehicle biometrics CONOPS.

The physical equipment in the lane (see Exhibit 1, *Land Vehicle Biometrics CONOPS*) works

[4] An occupant image is any image captured for the purpose of identification using facial recognition.

together as a system to capture the facial biometric images:

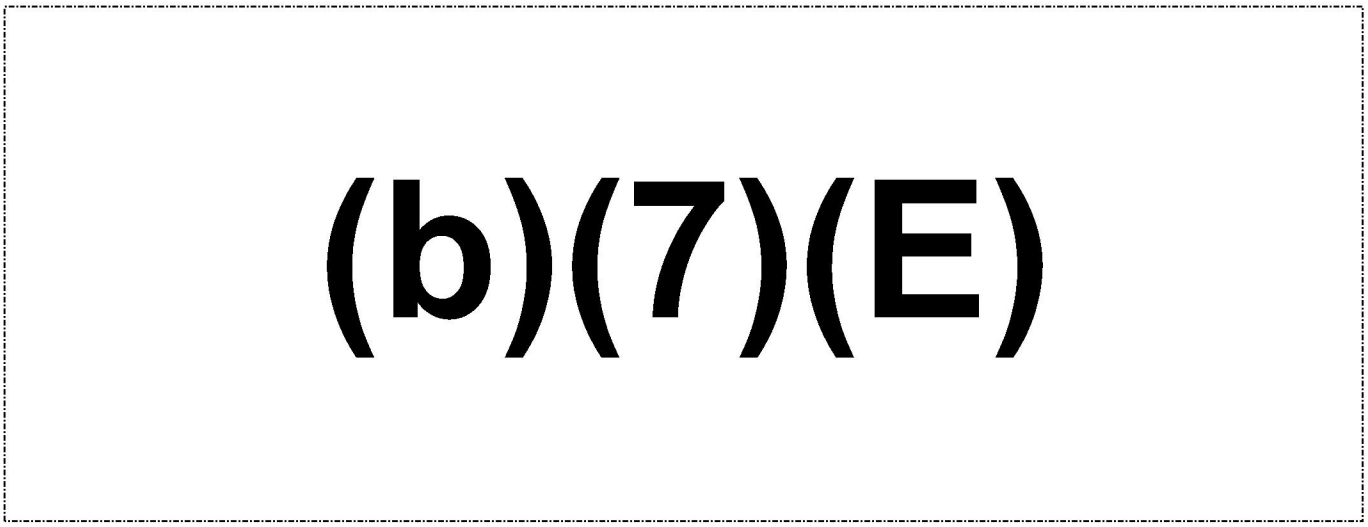


Exhibit 1 – Land Vehicle Biometrics CONOPS

1. As the vehicle travels through the lane the following is captured:
   - RFID Document
   - Front and Rear License Plate
   - Scene Image
   - Driver Image (b)(7)(E)
   - Occupant Images

2. Data collected is sent to SAV in real time.
   - RFID information is sent to SAV to perform two actions:
     - Data call to travel documents and encounter data (TDED) (b)(7)(E) (b)(7)(E)
     - Retrieve the photo associated with the RFID document (source photo).
   - License plate information collected is sent to SAV in real time (b)(7)(E) (b)(7)(E)
   - Occupant image is captured (b)(7)(E) (b)(7)(E) and sent to SAV. If both source and occupant images are captured, SAV sends these images to (b)(7)(E) for a match/no-match (b)(7)(E)
   - The occupant camera may take multiple images of the same person, but only one image is sent to SAV. (b)(7)(E) (b)(7)(E)

3. (b)(7)(E) compares the RFID document photo to the occupant photo and sends the *match/no match* result to SAV in the booth.

5.1 (b)(7)(E)

(b)(7)(E)

(b)(7)(E). See Exhibit 2 – (b)(7)(E)

(b)(7)(E)

(b)(7)(E)

Exhibit 2 – (b)(7)(E)

Exhibit 2 illustrates two scenarios based on (b)(7)(E)

(b)(7)(E)

(b)(7)(E) Exhibit 3 illustrates the Biometric Operations that are used in the Land Border Vehicle Primary Process.

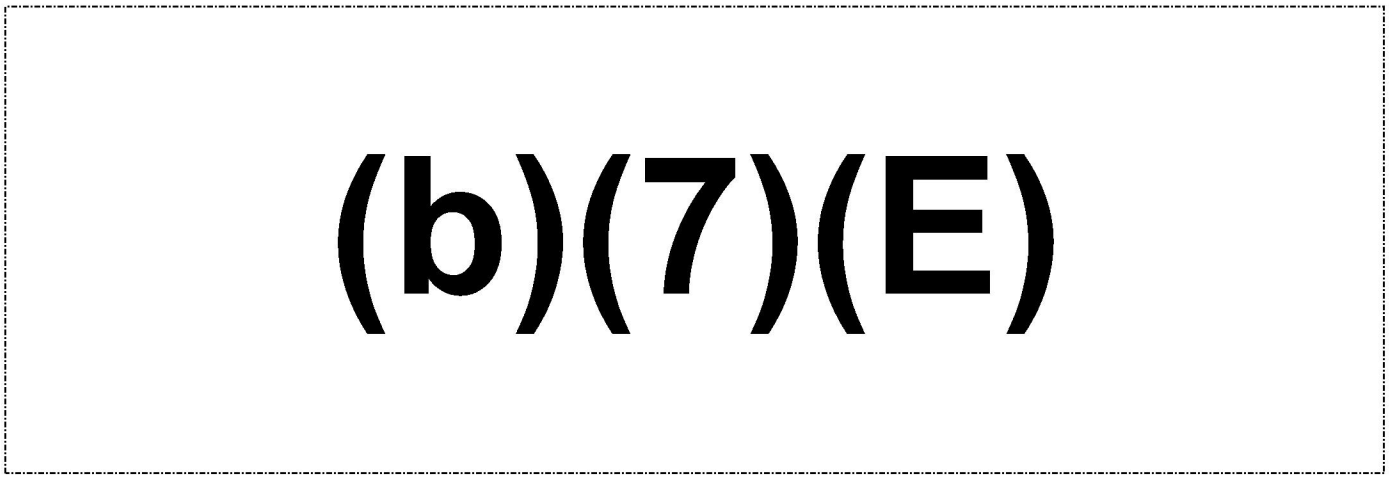


Exhibit 3 – Biometric Operations used in Land Border Vehicle Primary Process

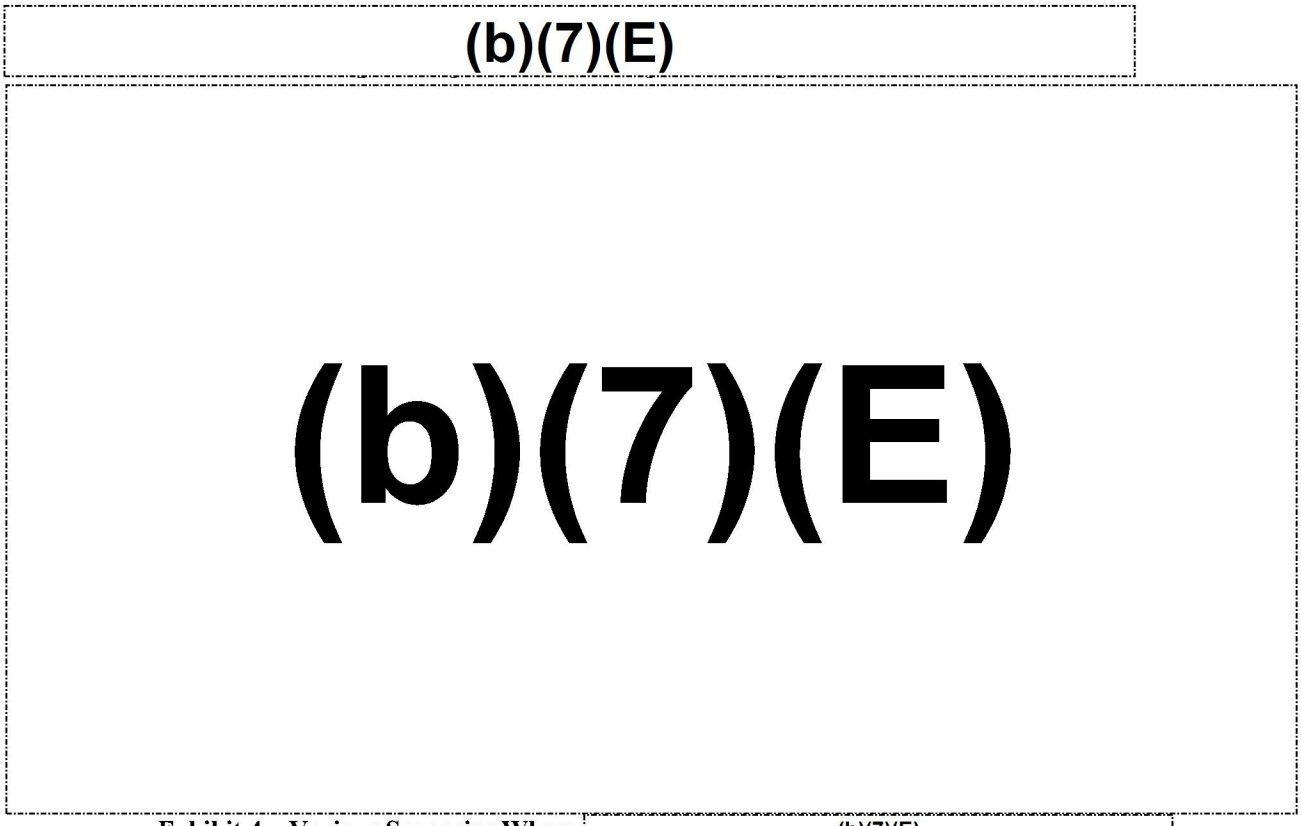


Exhibit 4 – Various Scenarios Where (b)(7)(E)

5.2 Land Vehicle Data Flow

As the vehicle traverses the lane, (b)(7)(E) (b)(7)(E) The occupant camera control unit utilizes the LBI face detection service and LBI (b)(7)(E) (b)(7)(E) software to process the facial image capture and send the encounter package through the SA

Connector to the SAV application in real time. The encounter package includes the LPR and (b)(7)(E) data as well as the facial capture(s). (b)(7)(E)

(b)(7)(E)

Exhibit 5: *Biometric Data Flow* illustrates the flow of data as the vehicle travels through the lane, multiple systems work simultaneously to build the traveler data package and process it through to the CBPO booth for admissibility review/processing.

(b)(7)(E)

Exhibit 5 – Biometric Data Flow

(b)(7)(E)

5.3 Land Border Vehicle Facial Biometric Capture Challenges

Capturing facial biometrics in the land vehicle environment presented many challenges not experienced in the air and pedestrian environment. In the air and pedestrian environment travelers present themselves for inspection one at a time and pause for biometric facial capture in

an enclosed environment. In the land vehicle environment, the challenges include:

(b)(7)(E)

5.4 Solution Configuration and Adjustments

This section describes the progression of the technology demonstration solution placement, monitoring, and adjustments over the scheduled 152-day evaluation period beginning September 20, 2021. To illustrate the impact had on image capture rates, the timeline is divided into four periods of 30 days each and one period of 32 days. These time intervals are referred to as reporting periods one through five Exhibit 6- *Solution Configuration Enhancements* summarizes the solution configuration enhancements and improvements made to the occupant image capture solution for both lanes.

Reporting Period	Adjustment
1 Day 0-30 9/20/2021 to 10/19/2021	(b)(7)(E)
2 Days 31-60 10/20/2021 to 11/18/2021	
3	

Reporting Period	Adjustment
Days 61 to 90 11/19/2021 to 12/18/2021	(b)(7)(E)
4 Days 91 to 120 12/19/2021 to 1/17/2022	
5 Days 121 to 150 1/18/2022 to 2/19/2022	

Exhibit 6 – Solution Configuration Enhancements

6 Performance Measurement

As stated in Section 5, land border vehicle biometrics transforms the current inbound inspection process by fusing biographic and biometric data captured in the PPZ. To determine the effectiveness of the biometric solution, key performance indicators (KPI), and metrics were established to evaluate performance and to identify areas of improvement.

6.1 Assessment Methodology

The technology demonstration performance assessment methodology consisted of four main steps:

1. Establish occupant camera KPIs. The primary KPIs for the occupant camera were image quantity and quality which is represented by:

- Encounter Photo Rate: the percentage of travelers who had at least one facial image captured in the lane.
- (b)(7)(E) Valid Rate: the percentage of facial images that met the (b)(7)(E) threshold to be sent to (b)(7)(E) for matching.

(See Exhibit 7 for a complete list of performance metrics)

2. Monitor solution performance based on the established KPIs. Performing encounter analysis and ground truthing enabled the assessment of image capture quality and quantity.
3. Apply corrective action to resolve performance issues. Analyzing the performance issue led to the development of solution configuration adjustments and enhancements which led to immediate performance issue resolution or required further technology research for resolution.
4. Monitor the (b)(7)(E) TMR – Based on the corrective actions to resolve camera performance issues, evaluate the impact to the percentage of match/no match results returned by (b)(7)(E) when there is a quality occupant photo and a quality source photo available.

6.2 Demonstration Objectives

As described in the Anzalduas Technology Demonstration memo of September 14, 2021 (Appendix C), the objectives of the technical demonstration are:

- Capture photos of arriving vehicle occupants and comparing the captured photo to the source photo on file associated with the (b)(7)(E) travel document(s).
- Utilize (b)(7)(E) biometric matching capabilities to conduct a 1:1 facial comparison of the encounter photo to the (b)(7)(E) travel document source photo for identity verification.
- Verify automated notification of biometric match or no-match result to the CBPO for use in the admissibility decision.
- Collect data to ensure the crossing record of all in-scope arriving travelers is updated in ADIS, to include a biometrically confirmed arrival; and,
- Identify any additional cost requirements such as infrastructure, software, or services.

The first two objectives were the primary focus of the demonstration's performance measurement activities.

6.3 Performance Metrics and Definitions

The following performance metrics in Exhibit 7, were evaluated to determine the overall feasibility of biometric verification capability in the land vehicle environment:

Metric	Definition
Vehicles	The count of vehicles that were processed through lanes 1 and 2
Travelers	The count of travelers that were processed by SAV through lanes 1 and 2
Image Quality	Poor quality, grainy, out of focus image
Encounter Photo	The count of encounter photo images captured through lanes 1 and 2

Metric	Definition
Encounter Photo Rate	The number of encounter photos divided by the sum of travelers
(b)(7)(E) Valid Count	The number of encounter photos captured that met the minimum (b)(7)(E) specification on the images, after they have been sent to SAV
(b)(7)(E) Valid Rate	The (b)(7)(E) valid count divided by the sum of the encounter photos
Biometrics Performed	The count of travelers with encounter photos and a facial comparison performed
Technical Match Rate	The number of matches of travelers aged 14 to 79 years old (in-scope), divided by the count of total travelers aged 14 to 79 years that had a quality encounter photo and a facial comparison performed

Exhibit 7 – Key Performance Metrics and Definitions

7 Technology Demonstration Findings

The results of the technical demonstration show that, when all conditions are met (i.e., the image captured is of good quality and the traveler has a Source photo associated with the RFID document), the technology works well in providing a biometric match result to the officer. The demonstration also revealed, however, that the traveler image capture rate, though improved over the course of the experiment, continues to be lower than that of other modes of travel.

7.1 Demonstration Objectives and Outcomes

The results of the demonstration are described by phrasing each technology demonstration objective as a question to be answered:

- Objective 1: Was the system able to capture photos of arriving vehicle occupants and compare them to the source photo on file?
- Objective 2: Was (b)(7)(E) able to conduct a 1:1 comparison of the encounter photo to the source photo?

The overall answer for objectives 1 and 2 is yes. Through repeated improvements in camera placement, filters, and internal settings, the encounter photo rate for occupants rose from 42 percent in the early weeks of the demonstration, to 76 percent by the end of the demonstration. Approximately 80 percent of the photos captured were of sufficient quality to be sent to (b)(7)(E) for a 1:1 (single occupant with (b)(7)(E) document) or 1:few match attempt (for occupants with more than one (b)(7)(E) document). Ultimately, the data shows that, when a traveler had a (b)(7)(E)-valid encounter photo *and* presented an (b)(7)(E) travel document with a source photo, more than 99 percent of the travelers were biometrically confirmed by CBP, i.e., (b)(7)(E) had a Technical Match Rate (TMR) of 99 percent.

The number of adjustments, per reporting period, are summarized in Exhibit 8, below:

Reporting Period	Camera Adjustments	Start Date	End Date
1	(b)(7)(E)	9/20/2021	10/19/2021
2		10/20/2021	11/18/2021
3		11/19/2021	12/18/2021
4		12/19/2021	1/17/2022
5		1/18/2022	2/19/2022

Exhibit 8 – Reporting Period and Number of Camera Adjustments

The gains achieved during the demonstration, illustrated in Exhibit 9, are shown delineated by the number of camera adjustments made to the occupant camera technology over the course of the demonstration:

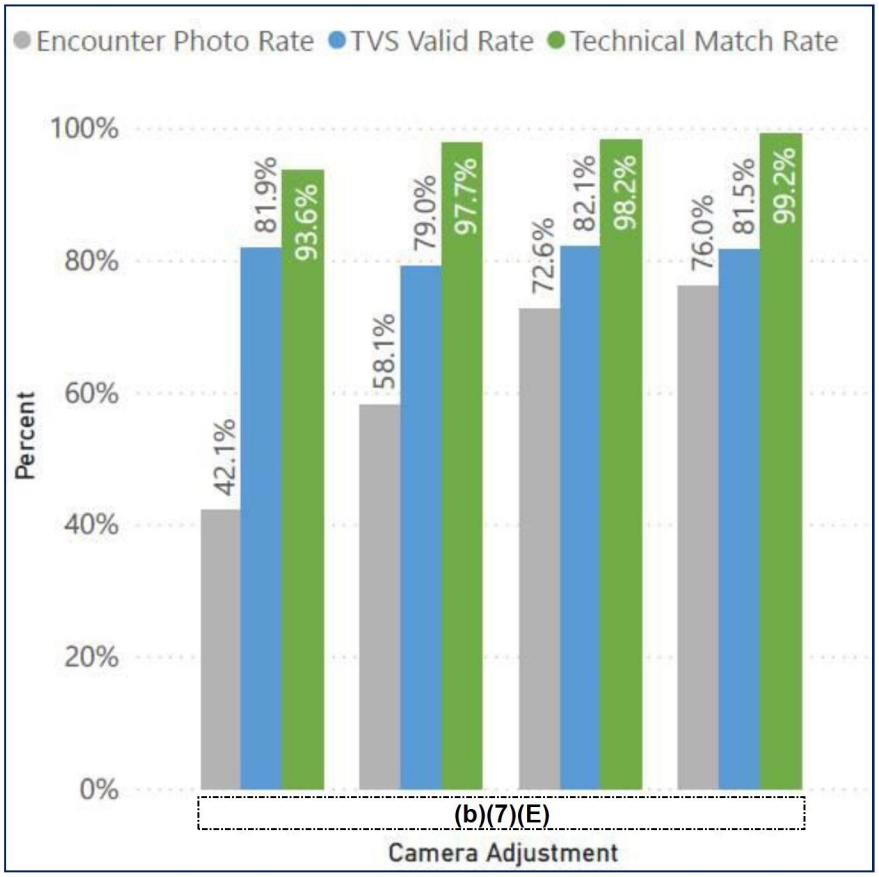


Exhibit 9 – Combined Image Capture Rate, (b)(7)(E) Quality Photo Rate, and Technical Match Rate for All Lanes by Number of Camera Adjustments

Exhibit 10 on the next page, shows that the number of travelers crossing the border greatly increased due to the lifting of COVID-19 travel restrictions after reporting period 2. The data also shows that, by reporting period 5, the number of encounter photos captured had increased significantly, while the percentage of (b)(7)(E) quality photos remained near 80 percent. However,

the quality of these photos had improved, as evidenced by the technical match rate climbing to 99 percent, which shows that, although the capture rate of quality photos had plateaued, the technical quality of those photos had improved by approximately 6 percent over the course of the demonstration. The adjustments made to the technology had made a difference, but more work is required to approximate the capture rates of the air and pedestrian environments.

Lane	Reporting Period	Vehicles	Travelers	Encounter Photo	Encounter Photo Rate	(b)(7)(E) Valid Count	(b)(7)(E) Valid Rate	Biometrics Performed	Technical Match Rate (TMR)
All	1	16,892	32,366	13,639	42.1%	11,170	81.9%	5,865	93.6%
All	2	18,320	40,847	23,740	58.1%	18,758	79.0%	9,154	97.7%
All	3	28,491	91,492	67,168	73.4%	54,418	81.0%	24,045	98.3%
All	4	26,526	90,112	64,588	71.7%	53,752	83.2%	32,382	98.1%
All	5	22,151	66,570	50,593	76.0%	41,242	81.5%	41,024	99.2%

Exhibit 10 – Detail of Lane Metrics for All Lanes by Reporting Period

- Objective 3: Was Simplified Arrival able to notify the CBPO of the match result?

Yes. For travelers with a good quality facial image and an associated source photo, SAV presented a (b)(7)(E) Match/Mismatch result just over 99 percent of the time (see Exhibits 9 and 10 TMR percentages).

- Objective 4: Is CBP able to view a biometrically confirmed arrival in ADIS once a traveler is admitted on primary?

Yes. Biometrically confirmed vehicle crossings at Anzalduas have been independently verified by ADIS.

- Objective 5: Have additional cost requirements been identified?

Yes, additional cost requirements were identified to ensure implementation of an operationally viable and sustainable biometric capability in the land vehicle environment. Implementation of the recommendations detailed in section 8 will require additional funding for execution.

7.2 Challenges to Encounter Photo Capture

Numerous reasons exist to explain why an occupant's photo may not have been captured. The reasons for non-photo capture, and definitions, are listed in Exhibit 11.

Reason	Example
Glare	(b)(7)(E)
Human Factor	
Image Quality	
Incorrect Prediction	
Mask	

Reason	Example
Other Obstructions	(b)(7)(E)
Sun Visor	
Vehicle Height/Type	

Exhibit 11 – Reasons for Occupant Image not Being Captured

The graphs shown in Exhibit 12, illustrate, over the five reporting periods, the obstructions that prevented the capture of a (b)(7)(E) Valid image of vehicle occupants in both lanes. As previously discussed, continuous solution enhancements and camera tuning occurred to remedy performance issues. This can be seen most clearly in the declining trend for the (b)(7)(E) category. (b)(7)(E) was the most significant inhibiter to capturing a quality image and, due to (b)(7)(E) (b)(7)(E). The dotted line is a trendline that forecasts the next 30 days (reporting period 6), based on the reporting periods 1 through 5.

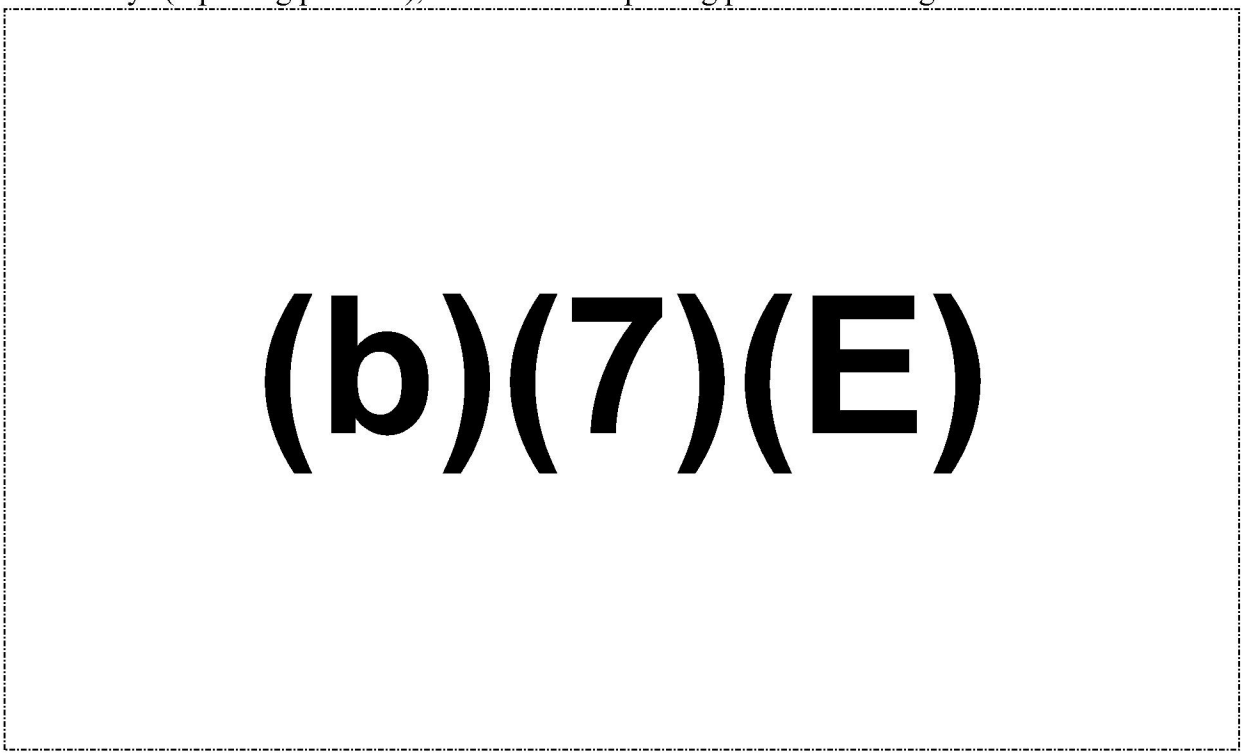


Exhibit 12 – Why the Driver Image was not Captured in Both Lanes, Categorized by the Five Reporting Periods

7.3 (b)(7)(E)

(b)(7)(E)

(b)(7)(E)

7.4 Non-Technology Challenges to Biometric Photo Matching

A significant challenge to biometric verification in the vehicle lane is not a camera issue. The data in Exhibit 13 illustrates that, despite capturing (b)(7)(E)-quality photos for 62 percent of the total travelers[5] in reporting period 5, less than half of those travelers had a source photo available with which to conduct a (b)(7)(E) match.

(b)(7)(E)

Exhibit 13 - Operational Attrition of Travelers Able to be Biometrically Matched with a Source Photo

(b)(7)(E)

(b)(7)(E)

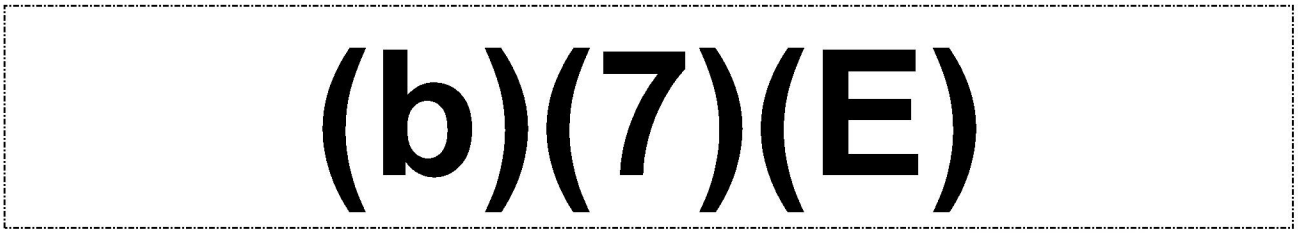
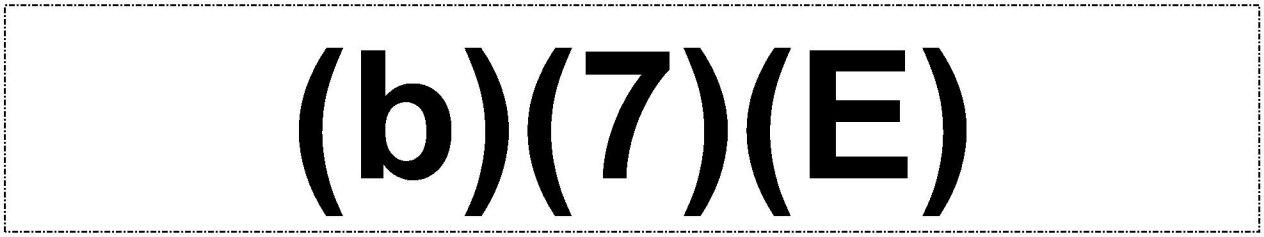


Exhibit 14 - Data Detail with Operational Match Rate for All Lanes, by Reporting Period

Exhibit 15 provides an at-a-glance representation of the traveler biometric attrition, caused in part by the image capture rate of encounters and (b)(7)(E)

(b)(7)(E)



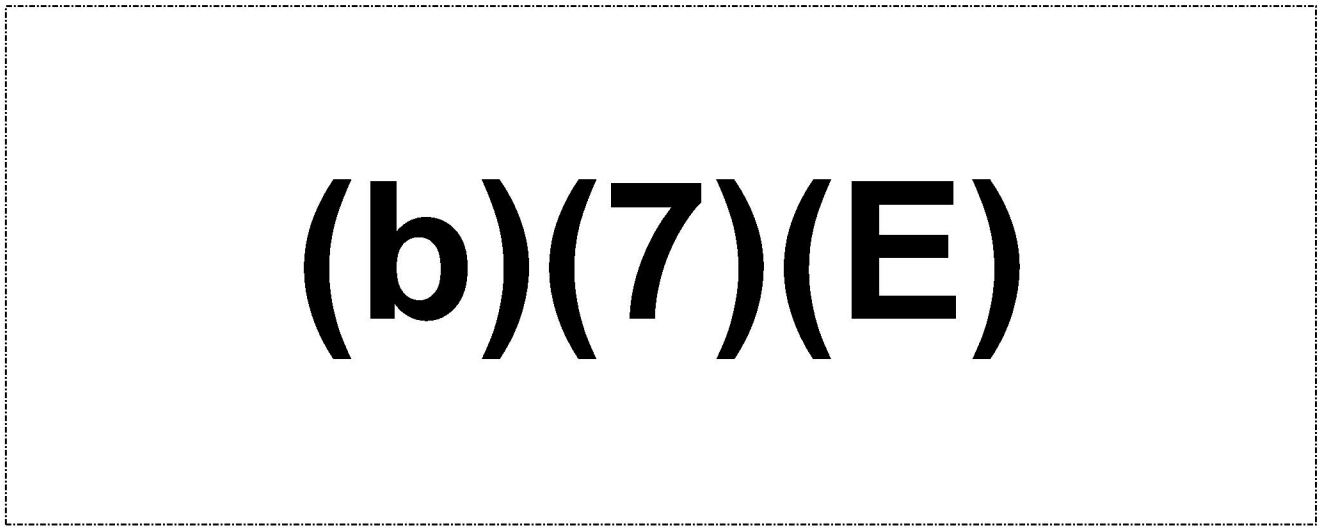


Exhibit 15 – Visual Representation of Operational Match Rate for Reporting Period 5

(b)(7)(E)

8 Recommendations

As stated in Section 7, over the course of the Anzalduas technology demonstration, CBP was able, through camera adjustments, to:

- Increase the number of occupant images capture.
- Significantly improve the quality of those images, which in turn,
- Improved the (b)(7)(E) match rate.

However, the analysis led to the conclusion that, to ensure that an operationally viable biometric capability is implemented in the land vehicle environment, a two-pronged approach is necessary.

- Approach 1: CBP must significantly increase the number of occupants whose image is captured.
- Approach 2: CBP must ensure that a greater number of inbound vehicle occupants use an (b)(7)(E) enabled travel document. (b)(7)(E) travel documents have an associated source photo for biometric comparison to the image captured in the lane.

As increasing occupant image capture has a technology-based solution and is within the purview of OIT, Approach 1 is the focus of the recommendations set forth in this document. To ensure that CBP has the required technical capability to increase border security, as well as reduce the administrative burden on the CBPO, OIT will continue to develop biometric solutions with these CBP operational requirements in mind:

- Site constraints, including port size and configuration.
- Network bandwidth and capacity concerns; and,
- Port operational staffing capabilities and constraints.

It is with this understanding of the land vehicle environment that OIT provides the following recommendations, summarized, below, and described in detail in the identified subsections:

- Examine the feasibility of primary zone biometric capture (Section 8.1).
- Implement additional image quality improvements in the PPZ (Section 8.2).
- Partner with S&T to identify other camera types/vendors to be assessed using current camera physical set up. (Section 8.3).
- Examine and leverage existing land border camera solutions and "Pre-Arrival" data capture capabilities for use in the vehicle lanes. (Section 8.4).

Additionally, it is understood that all camera solutions must undergo thorough testing at the CTLF and OTLF prior to implementation at a POE, as well as meet OFO-approved Service-Level Agreements (SLAs).

8.1 Add Primary Zone Biometric Capture Capability

Ideally all vehicle occupants would be captured in the PPZ; however, as shown by the technology demonstration, (b)(7)(E)

(b)(7)(E)

(b)(7)(E)

The enhanced capability can:

- More reliably validate traveler identity and citizenship without significantly slowing inspection processing times or wait time for admission into the U.S.
- Strengthen border security and facilitate entry into the U.S. for U.S. citizens and legitimate international travelers.

Additional research is required to further examine the feasibility of this solution. Partnering with DHS Science & Technology Directorate could expedite identifying solution options.

8.2 Perform Integration of Image Quality Evaluation into PPZ Lane Security Controller

To enhance the quality of the facial images, OIT continues to investigate improvements to the pre-verification of occupant image captures prior to transmission to SAV, to ensure that the data package only contains images meeting the (b)(7)(E) minimum specification.

(b)(7)(E)

8.3 Continue Current Lane Configuration with Different Camera Types/Vendors

As a vendor-agnostic solution, the (b)(7)(E) will function with any vendor's non-proprietary occupant camera. CBP's biometric solution can, and should, be able to be updated as superior technologies come on the market. Partnering with S&T for future technology demonstrations can include replacing the current occupant camera in one or more lanes, with another vendors. The same metrics will be used to evaluate performance to provide an accurate solution comparison.

8.4 Leverage Existing Capabilities

To overcome challenges in the field (such as the need to develop technical solutions that minimized or eliminated COVID-19 virus transmission), OIT has innovated solutions and tailored them to individualized environments. As each POE is unique in its layout, including booth types and placement, so unique solution designs have been necessary. As a result, throughout the land border environment, OIT developed and implemented various solutions that could be reused, modified, and leveraged to meet the primary zone facial biometric capture requirement.

Several biometric and biographic programs already exist that ease passenger processing in advance of a request for admission to enter the United States. Examples include, CBP ROAM, 1-94 and ESTA (b)(5)
(b)(5)
(b)(5) See Appendix F for more detail on existing capabilities.

9 Conclusion

The Anzalduas Technology Demonstration objectives were met, thus successfully proving the technical feasibility of capturing a facial image for biometric comparison (b)(7)(E)
(b)(7)(E)

As stated in Section 8, further analysis, solution improvement and testing are required to ensure that an operationally viable biometric capability is implemented in the land vehicle environment. While challenges remain, this demonstration has provided a clear path forward for future activity. Addressing both technical and operational aspects of the camera system and inbound processing, as outlined in this report, will continue to drive performance, increasing the number and quality of photos taken and biometrically matched.

It is concluded that to maintain the momentum generated by the Anzalduas Technology Demonstration success, an OFO/OIT strategy and schedule should be jointly developed for the execution of the recommendations detailed in Section 8.

10 Appendices

10.1 Appendix A - Analysis of Alternatives: ITI Vehicle at Speed Camera Evaluation February 2018

10.2 Appendix B - LBI Vehicle Biometric Solution Pilot at Anzalduas Recommendation Report June 2019

10.3 Appendix C - Anzalduas Technology Demonstration Memo, September 2021

10.4 Appendix D - Primary Zone Camera Market Research to Date

10.5 Appendix E - Information Technology Teams - Areas of Responsibility

10.6 Appendix F - Leveraging Existing Capabilities – Camera Solutions and Pre-Arrival Data

10.7 Appendix G - Assessment Tools and Analysis

10.8 Appendix H - Acronym List