

A network diagram with a blue background and white lines connecting nodes. Six circular icons are placed along the network lines: a biohazard symbol, a padlock, a map of the United States, a building, a globe, and a biohazard symbol.

Rapid DNA

DHS Science and Technology Directorate



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DHS Current Biometric Activities

DHS COMPONENT					
	FINGERPRINT	IRIS	FACIAL RECOGNITION	DNA OUTSOURCED	DNA IN-HOUSE
CBP	Operational Capability	Initiating Capability	No Capability	Operational Capability	No Capability
USCIS	Operational Capability	No Capability	No Capability	Operational Capability	No Capability
USCG	Operational Capability	No Capability	No Capability	Operational Capability	No Capability
ICE	Operational Capability	Initiating Capability	Initiating Capability	Operational Capability	No Capability
USSS	Operational Capability	Operational Capability	Operational Capability	Operational Capability	No Capability
TSA	Operational Capability	Operational Capability	Initiating Capability	No Capability	No Capability

Operational Capability 

Initiating Capability 

No Capability 



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Why DNA?

- Unique, Strong Biometric
 - The ONLY Biometric that Accurately Verifies Biological Relationships
 - 99.5% threshold for first-order biological relationships (e.g. Parent/Child)
 - Actual performance better than 99.99995% (10,000x better than threshold)
 - False claims by non-related persons are 100% excluded
 - 90% Threshold for Second-Order Relationships (e.g. Sibling/Sibling, Aunt/Niece, Grandparent/Grandchild)
 - More Distant Relationships are possible with extra family members
 - One of the most effective tools in modern law enforcement.
 - National Institute of Justice studies found DNA evidence identifies 2x the suspects, 2x arrestees, 2x prior felony arrests, and 2x prosecutions. Processing a case with DNA averaged \$1,397 vs. traditional processing cost \$14,169.¹

¹webarchive.urban.org/publications/411697.html



Why DNA? (cont'd)

- Based on Objective Scientific Principles
 - Statistics Driven Comparisons, Not Proprietary Algorithms
 - NIST Population Statistics Set Evidentiary Value of each DNA location
 - Mutation rates for each DNA location are known and calculated.
 - AABB Certified Relationship Testing Standards and FBI Rapid DNA Quality Assurance Standards
- Easy IT Implementation
 - Small Data Storage Footprint
 - ANSI/NIST ITL 2011-1 Type 18 Record Defines DNA profile and Biological Relationship Data Formats
 - Privacy is protected by choosing DNA locations that do not reveal physical traits, race, ethnicity, disease susceptibility, medical information or other sensitive information.



DHS Applications

Border and Enforcement:

- Countering human smuggling and trafficking by verifying relationships of suspicious persons and claimed families.
- Supporting investigations by linking objects to known persons.
- Screening arrested/detained persons against DNA watch lists.



Immigration:

- Enabling officers to rapidly screen applicant relationships:
- During refugee interviews and against remote family members.
- For those putting children up for overseas adoptions.
- Against federal watch lists/criminal databases.



Disaster Recovery and Resilience:

- Medical Examiner daily use for morgue identifications reduces body storage costs and ensures medicolegal staff is ready to deploy.
- Helps resilient communities rapidly recover by identifying victims – even before decontamination – and reuniting families.
- FEMA grants can fund system and consumables purchase.



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Border and Enforcement

Needs and Requirements Findings:

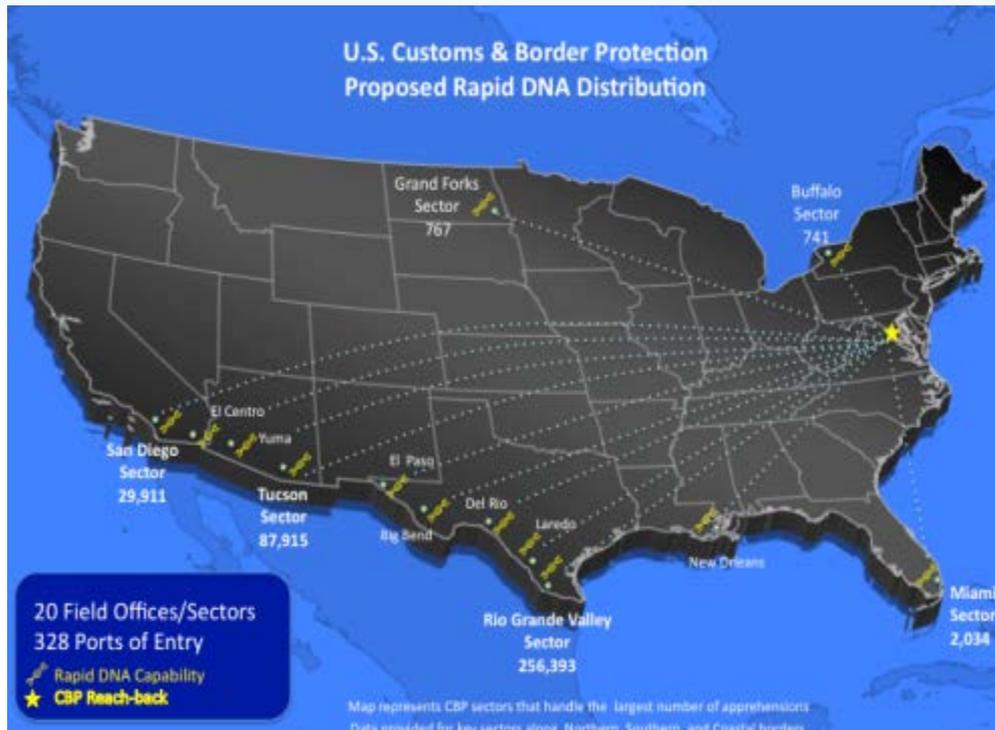
- On an average DAY in the life of CBP:
 - 1,069,266 passengers and pedestrians processed
 - 326,723 international air passengers
 - 53,786 ship/boat passengers and crew
 - 688,757 incoming land travelers
 - 328 Ports of Entry (POE)
 - 1140 apprehensions between POE
 - 118 Unaccompanied Alien Children
 - 223 Family Unit Individuals
 - 22 wanted criminals arrested at POE
 - 752 refused entries at POE
 - 877 suspected persons with National Security concerns identified



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Border and Enforcement



- Identify Potential Victims of Human Trafficking, per the Trafficking Victims Protection Act (TVPA)
- Identify & dismantle human trafficking/smuggling networks
- Real-time ID of potential threats crossing the US borders
- Link terrorists seeking entry to criminal activities outside the US
- Provide investigative leads to criminal enterprise activities
- Comply with 2009 legislative mandate to collect DNA from all individuals arrested/detained



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Rapid DNA: CBP Laboratory Evaluation

November 2014 - Chicago LSSD Performance Evaluation

- Two Rapid DNA systems tested over 6 weeks
 - 15 human DNA samples were processed and the results verified by a certified DNA laboratory
 - Kinship analysis 100% accurate on 16 families
 - Full DNA profiles generated 87 percent of the time
 - Family relationships verified to a better than 99.94% probability (almost ten times the goal of 99.5%)
- Additional conclusions:
 - Systems are accurate and ready for field use with LSSD backup
 - Either instrument could be used in its current state in the field to generate DNA profiles from buccal samples
 - Kinship evaluation software needs further integration, automation, and simplification for field use [companies have delivered new kinship software since that test]



Elliott Ness Building, Chicago



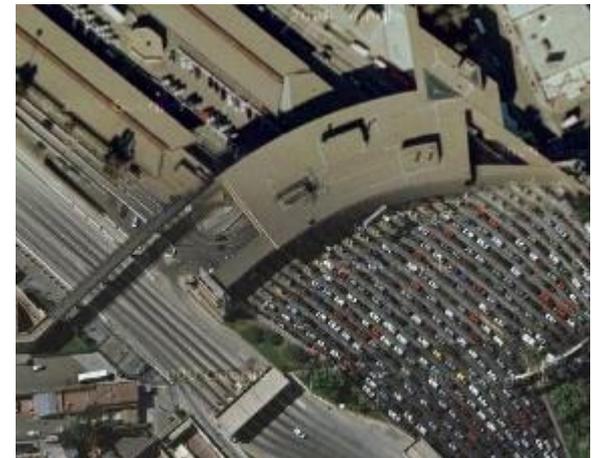
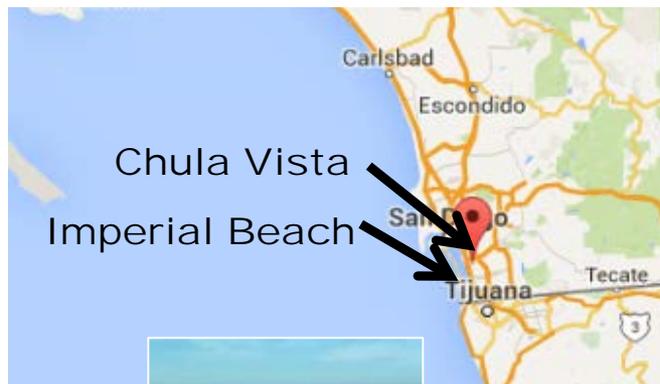
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Rapid DNA: CBP Interviews

30 CBP Interviews Conducted to Assess Field Impact/Support

- Nov 2015: Interviewed 15 Border Patrol agents, supervisors, and Union representative (1.5 days/site) and observed work flow.
 - Interviews conducted by Research Triangle Institute (RTI)
- Jan 2016: Conducted 12 OFO interviews and site visits at San Ysidro and Rapid DNA demos at San Diego HQ and San Ysidro and Imperial Beach.
 - 44 samples processed (16 lab, 28 volunteers). All sufficient for kinship
- Mar 2016: Conducted 3 HQ CBP Staff interviews.



San Ysidro Border Crossing



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Rapid DNA: CBP Interviews

Summary of Findings

- Large majority viewed Rapid DNA as a useful, efficient and effective decision support tool, especially for verifying family relationship claims
- Identification of persons with criminal records and verification of family claims seen as most beneficial use scenarios
- Few saw the need for DNA testing of all detainees
- Most felt Rapid DNA, with proper training and benefits explanation, would be well accepted and embraced by most agents and officers
- Majority indicated Rapid DNA would not have an adverse impact on overall operational flow
- All interviewed suggested Rapid DNA would be best placed where detainee processing occurs and many suggested it would deter trafficking/smuggling
- Many felt the greatest challenge would be addressing policy regarding DNA collection, privacy, and civil rights and liberties of visitors to the United States



Rapid DNA: CBP Demonstrations

Summary of Feedback:

- BP agents and OFO officers expressed a need for a DNA capability
- Rapid DNA technology would augment current CBP biometric capabilities
- Participants expressed that the technology appeared user friendly
- Policy issues were the primary issues raised including:
 - CBP authority to collect DNA samples, who to collect from, and who performs the collections
 - DHS authorities & policies to database DNA profiles
 - Current capabilities of IDENT to ingest, store and search DNA profiles
 - Authorities & policies to access/search against existing federal/state/ local DNA databases
 - DHS/CBP policies on biological relationships beyond parent/child
- Technical reach-back support needed



Rapid DNA: Lab and Field Evaluations

- Sep 2014 – CBP Chicago LSSD Evaluation
- Sep 2015 – NIST Rapid DNA maturity assessment
- Jan 2016 – CPB San Diego Sector demonstrations
- Mar 2016 – DHS S&T Kinship Assessment
- Jul 2016 – VT Vigilant Guard 16 FEMA Urban Search and Rescue earthquake/landslide exercise. LSSD Sprinter Van (see pictures below)
- May 2017 – Florida Emergency Mortuary Operations Response System (FEMORS) Miami, Florida exercise



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DHS Applications: Immigration

Needs and Requirements Findings:

- On an average **DAY** in the life of USCIS:
 - 200 refugee applications processed worldwide
 - 45 persons in the US are granted asylum
 - 3700 applications to sponsor relatives and fiancées entry to the United States
 - 25 foreign born orphans are adopted by American parents
 - Fingerprints and photographs are taken of 13,000 applicants at the 137 Application Support Centers (ASC)
 - 135,000 national security background checks are conducted
 - 2,000 persons are granted citizenship (36 are serving in the US military)
 - 2,100 lawful permanent residence and 7,000 Green Cards issued

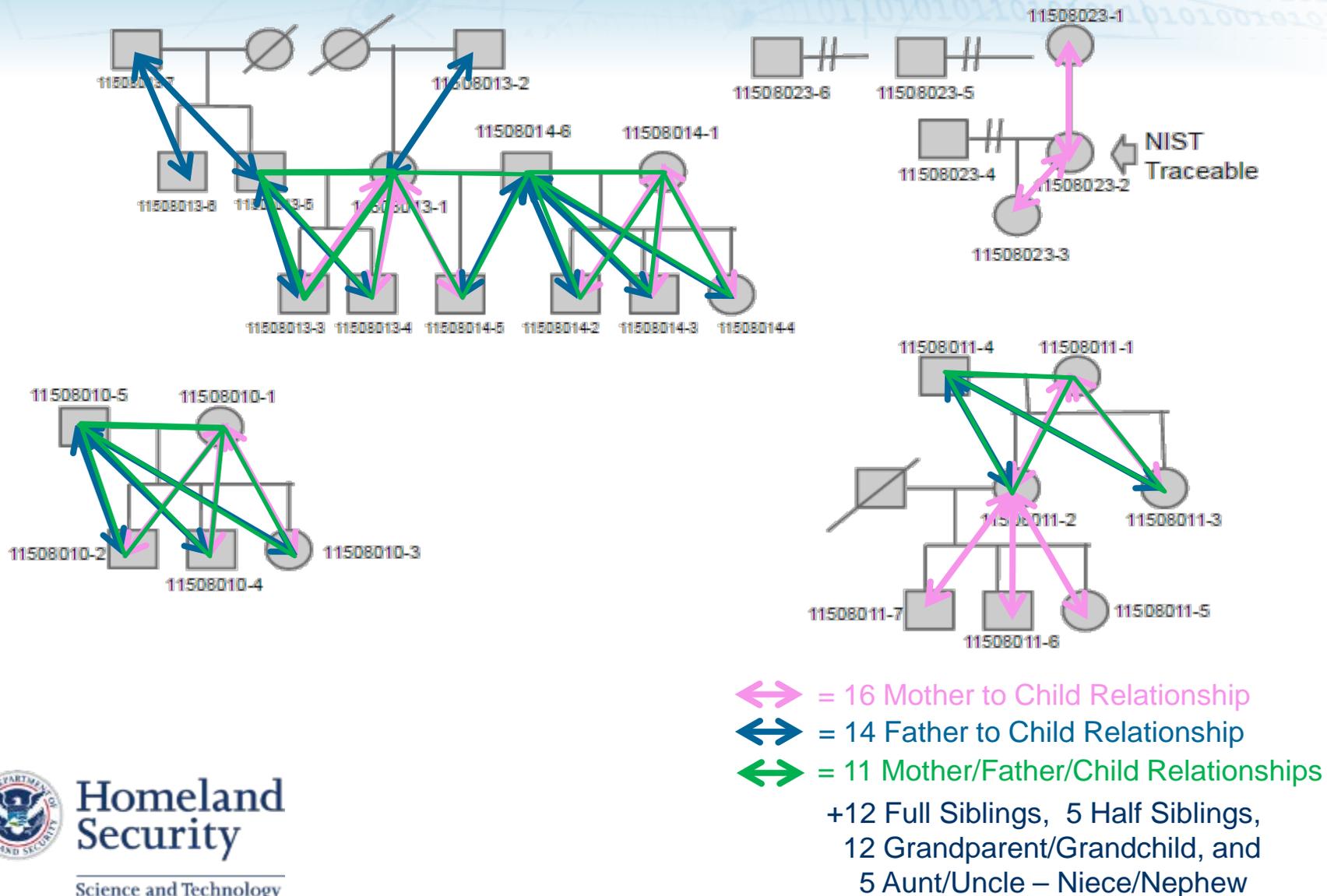


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S&T Kinship Validation Samples

Rapid DNA Performance Evaluation based on 31 Known Persons



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DHS Kinship - True Claims

PTC Kinship Samples	# of tests	Average Relationship Result	Minimum Result
Mother – Child	16	99.999999997%	99.99995%
Father – Child	14	99.99999998%	99.99998%
<i>Family Trio (Paternity)</i>	11	99.999999998%	99.99998%
<i>Full Siblings</i>	12	99.999999997%	94.84%
<i>Half Siblings</i>	5	99.78%	95.53%
Grandmother – Grandchild	4	99.93%*	91.66%
Grandfather – Grandchild	8	98.93%*	8.12%
<i>Aunt/Uncle – Niece/Nephew</i>	5	99.21%	30.02%

*When additional family is added for grandparent-grandchild relationships in 8 available tests, the average probability of relationship is 99.99997% with a low of 99.4%



DHS Kinship - False Claims

PTC Kinship Samples False Claims	# of tests	Average Relationship Result	Maximum Result
Aunt – Child (<i>Mother Claim</i>)	3	Exclusion	NA
Uncle – Child (<i>Father Claim</i>)	2	Exclusion	NA
Aunt – Uncle – Child (<i>Mother/Father/Child Claim</i>)	3	Exclusion	NA
Half Siblings (<i>Full Siblings Claim</i>)	5	98.60%*	99.65%
Aunt – Niece (<i>Grandmother – Grandchild Claim</i>)	3	98.34%**	98.48%
Uncle – Nephew (<i>Grandfather – Grandchild Claim</i>)	2	99.52%	98.98%

* False Half Siblings averaged 0.019% when additional siblings are added across 2 tests

** False Grandmother-Grandchild with the mother included averaged 36.44% across 3 tests



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New Technology is More Robust

Relationship	# of tests	Average Probability of Relationship		
		CODIS 13 Loci	CODIS 20 Loci	24/27 Loci
Parent-Child	10	99.98%	99.99996%	99.999997%
Full Siblings	5	99.97%	99.99996%	99.999996%
Half Siblings	3	73.64%	73.1%	96.88%
Grandparent-Grandchild	7	74.10%	88.72%	95.88%
Aunt/Uncle-Niece/Nephew	3	23.18%	36.53%	74.82%



Technology is Field Ready!



Two US small-businesses have commercial ready Rapid DNA instruments



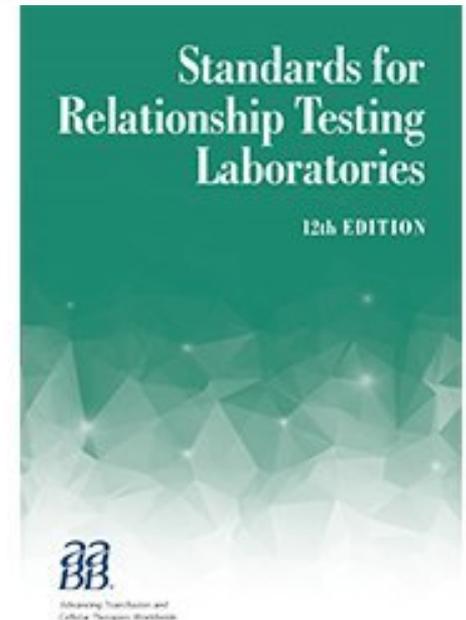
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Rapid-DNA Standards

AABB (formerly American Association of Blood Banks)

- Standards for Relationship Testing Laboratories, 12th edition
- Requirements that must be implemented by laboratories accredited by AABB for relationship testing
- Includes data collected with the sample, how long samples should be retained for, how many test samples should be run to validate device performance, records that should be maintained, requirements for test reports, etc.



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Mass Fatality Applications (Thursday AM)



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Rapid DNA: Built on Partnerships

Small Business Innovative Research (SBIR) Office:

- Program initiated under SBIR Phase I and II funding.
- Successfully transitioned to Phase III commercialization funding.

Departments of Defense and Justice:

- DoD funded touch capability (i.e., IED use) and field readiness.
- DOJ plans to implement in booking stations across the country.

In-Q-Tel and Intelligence Community:

- Venture Capital Series A, B, and C funding leveraged.

National Institute of Standards and Technology (NIST):

- Conducting tri-laboratory performance evaluations.
- Serving as SMEs in development & reporting technical progress.

Homeland Security Solutions and Analysis Institute (HSSAI):

- Needs assessment and business case development.

SNA International: Validation Tools, Use-case Priorities, Field Evals.

Systems Available from
Two U.S. Small Businesses



ANDE System



IntegenX RapidHIT



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