NEXT GENERATION IDENTIFICATION

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Large-Scale Biometric Testing at the FBI

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Background: Moving from IAFIS to NGI

- **FBI Mission Evolution**
  - Changed since IAFIS went live in 1999
  - Successful criminal, as well as, non criminal justice missions

- **Focus on Technology Advancements**
  - Improved biometric services
  - Expanded support for new counterterrorism mission
  - Continually added enhancements to the system
  - Continually seeks technological advancements to improve the system

- **Changing Business Needs**
  - New legislation requires increased background checks
  - Increased noncriminal justice fingerprint background checks
  - Department of Homeland Security support

IAFIS Integrated Automated Fingerprint Identification System

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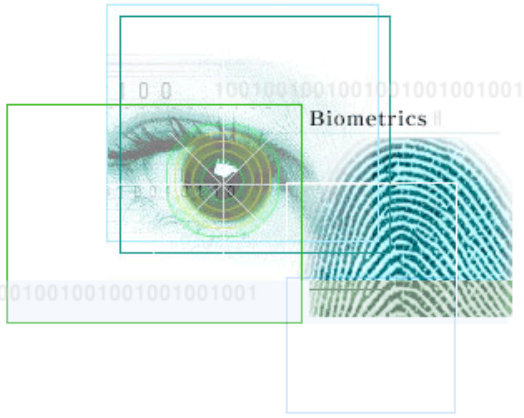


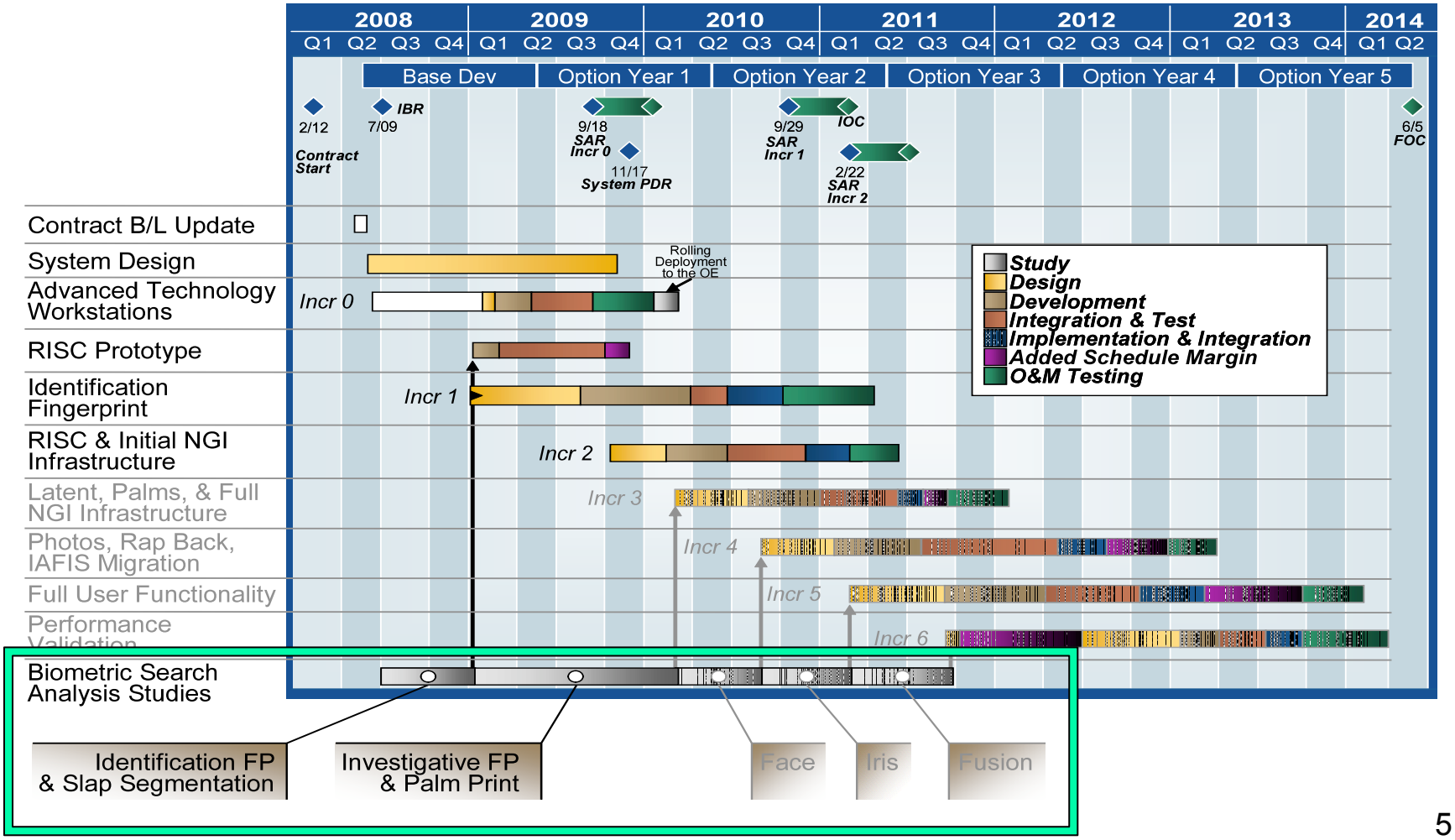
NGI Drivers for Large-Scale Testing

- **Advanced Fingerprint Identification Technology (AFIT)**
  - Fewer missed identifications
  - Faster response times
  - Greater throughput
  - Determine accuracy of latent fingerprint matching
  - Slap fingerprint segmentation
- **National Palm Print System (NPPS)**
  - Establish national palm print repository against which latent prints may be searched
  - Solidify the knowledge of the similarities and differences between fingerprint and palm print matching
- **Enhanced IAFIS Repository (EIR)**
  - Evaluate state-of-the-art as other modalities are integrated
  - Interstate Photo System (IPS)
    - Faces, Scars, Marks, and Tatoos
  - Iris
  - Multi-biometric fusion
- **All of the above necessitate large-scale testing efforts**

What is a Trade Study?

- Trade Studies were intended to provide clarity through an assessment of market capabilities resulting in high confidence investment decisions
- Focused on evaluating the ability of biometric algorithms provided by vendors to meet select NGI performance requirements
  - Accuracy, workload, capacity, response time, availability, and scalability
- The onus to conduct NGI Trade Studies is on the NGI integrator
- Trade Studies occur Just in Time (JIT) to support development activities for a given biometric technology

NGI Implementation Schedule



NIST Evaluation and Challenge Events

NIST

MBGC
Multiple Biometric Grand Challenge

FRVT
FACE
RECOGNITION
VENDOR TEST

FRGC
FACE RECOGNITION GRAND CHALLENGE

MINEX
Minutia Exchange

ICE
IRIS CHALLENGE EVALUATION

irex
IRIS EXCHANGE

Biometric Modality	Evaluation / Challenge	Year(s)
Multi-Biometric	Multiple Biometric Evaluation (MBE)	2009-201?
	Multiple Biometric Grand Challenge (MBGC)	2008-201?
Fingerprint	Evaluation of Latent Fingerprint Technology : Extended Feature Sets (ELFT-EFS)	2009-201?
	Evaluation of Latent Fingerprint Technology (ELFT)	2007-2008
	Slap Fingerprint Segmentation Evaluation II (SlapsegII)	2008-201?
	Minutiae Exchange II (MINEX II)	2007-201?
Face	Face Recognition Vendor Test (FRVT)	2006-2007
	Face Recognition Grand Challenge (FRGC)	2004-2006
Iris	Iris Exchange (IREX)	2008-201?
	Iris Challenge Evaluation (ICE)	2005-2006

Data Preparation

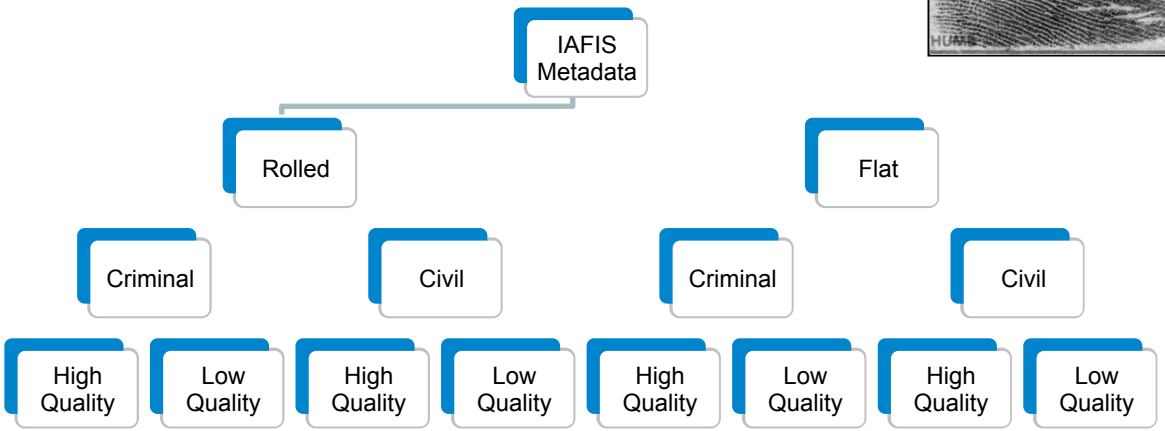
- The diversity of large-scale testing drivers requires the development of a variety of datasets which serve as the foundation of testing

- As part of datasets development the following considerations needed to be addressed
  - Ensure no vendor bias exists in data
  - Ensure sufficient quantities of data exist to support system performance and accuracy projections
  - Ensure adequate amount of data can be made publicly available
  - Ensure adequate amount of data remains sequestered
  - Ensure data is operationally representative

- Led to the recent preparation of multiple test beds
  - Rolled and Flat Fingerprint - Platinum Data Repository (PDR)
  - Latent Fingerprints and Palm Prints
  - Facial Images

Data Preparation for NGI Development

- **Rolled and Flat Fingerprints - Platinum Data Repository (PDR)**
  - FBI GFI to be provided to the NGI Integrator in support of the NGI Trade Studies.
- Selection of the PDR based on an analysis of IAFIS transaction metadata over a year long period
  - All days between Nov. 11, 2007 and Dec. 31, 2008
  - 45.9M samples, an average of 111K per Day
  - Idents 10.5M, Nonidents 28.9M
  - 21.8GB of ASCII data
  - Rolled
    - Idents 10.25M
    - Nonidents 15.63M
  - Flat
    - Idents 309K
    - Nonidents 13.37M

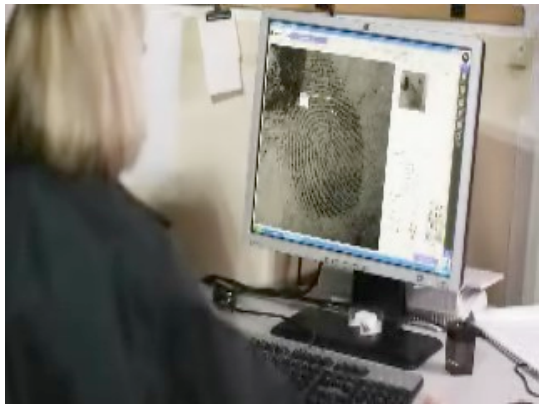


Data Preparation for NGI Development

- A subset of the PDR was used to support Identification Fingerprint Search and Slap Segmentation testing
  - IdFP search set (IdFP 600K) totaled 598,062 probes (299,810 rolled, 298,252 flat)
    - The number of search probes with mates in the repository was 269,323 (149,297 rolled, 120,026 flat)
    - Total of 289,880 true matches in the test set (150,843 rolled, 139,037 flat)
  - Final IdFP repository size was 3,199,683 subjects.
    - Including required mates from search set
    - The IdFP repository contained 51.3% Criminal submissions and 48.7% Civil
  - RISC search set (RISC 160K) totaled 159,446 probes (151,446 two finger, 4,560 rolled tenprint and 3,440 flat tenprint).
    - The number of search probes with mates in the repository was 83,210 (79,134 two finger, 2,284 rolled tenprint, 1,792 flat tenprint).
    - Total of 100,384 true matches in the test set (95,855 two finger, 2311 rolled tenprint, 2210 flat tenprint).
  - Final RISC repository size was 3,199,666 subjects
    - 69% rolled and 31% flat; 95% tenprint and 5% 2 print.
  - Slap Seg 15,558 (7779 subjects * 2 slaps per subject) 2 inch and total of 32,625 (10,875 subjects * 3 slaps per subject) 3 inch

Role of Human Capital in Data Preparation

- Human capital investments for data preparation and post-test analysis
  - Manual resources were applied to substantially improve utility of datasets
    - Ground truthing for slap segmentation tests
    - Assistance in miss analysis
    - Analysis of unexpected results
    - Latent examiner expertise
    - Ensure availability of support tools



Data Preparation for Latent Testing

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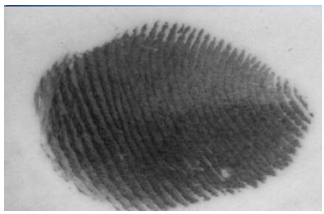
- Baseline dataset collected from multiple sources including both operational and laboratory environments
- Largest latent fingerprint dataset with verified by examiners (FBI and contractors) including extended markup data

Source Name	# Latent Images	# Distinct Fingers	# of Subjects	Description
Casework 1	372	372	272	Operational casework images
Casework 2	165	165	163	Operational casework images
WVU	446	446	383	Laboratory collected images
FLDS	93	93	15	Laboratory collected images
MLDS	38	38	4	Laboratory collected images
Totals	1,114	1,114	837	Laboratory collected images (small set of publicly releasable images for examples in reports)



Data Preparation for Face Testing

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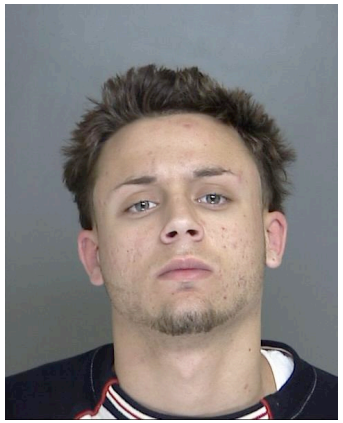
- Existing FBI data holdings
  - 7.1 million EBTS submissions
  - 10.8 million photos
  - Assessing JABS extract
  - Include scars, marks, and tattoos



- Building a Face Test Set
  - NIST Special database of deceased individuals
  - 2.4 million EBTS submissions
  - 3.5 million face images
  - Sorted by capture angle
    - ≈ 2.6M Frontal
    - ≈ 0.9M Profile

Summary

- **Identification Fingerprint and Slap Segmentation Solution**
  - Lockheed Martin completed the independent trade study
  - Lockheed Martin awarded a subcontract to the Alexandria, Virginia based MorphoTrak
- **Identification Fingerprint Search Capability**
  - Supports increased accuracy of fingerprint search results and provides better support for processing flat and less than ten fingerprint submissions

•Tenprint Performance Comparison

Performance Metric	Current IAFIS	NGI Objective (Increment 1)
Tenprint True Match Rate	92%	99%
Tenprint False Match Rate	1.15%	0.30%
Processing Capacity (Daily Throughput)	150K	299K
Storage Capacity (Repository Size)	100M	157M

•Electronic Tenprint Response Times

IAFIS	Criminal	Civil
Response Time	2 hours	24 hours
NGI	**Criminal**	**Civil**
High	10 minutes	15 minutes
Routine	30 minutes	2 hours
Low	24 hours	24 hours
Non-Urgent	15 days	15 days

•80% better accuracy at three times the overall matching capacity at IOC scalability to accommodate greater capacity at FOC

Summary

- NGI latent fingerprint and palm print technical evaluation is complete
- NIST ELFT-EFS preliminary report delivered on 01.26.10
- NIST MBE Still Face Track currently accepting SDKs
- NGI Face Trady Study approach and planning underway