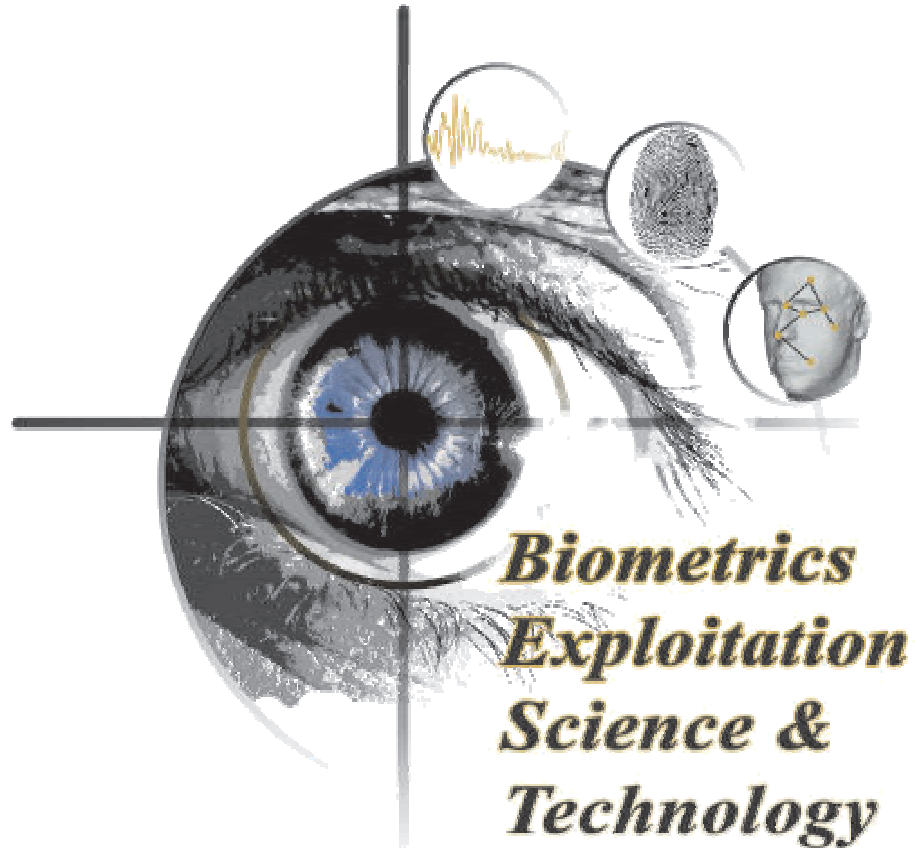




IARPA  
BE THE FUTURE



# Program Overview

## 15 January 2009

Unclassified



# Disclaimer on Today



- **Nothing said at Proposer's Day changes the requirements set forth in a BAA**
- **Any conflict between what is said at Proposer's Day and what is in a BAA will be resolved in favor of the BAA**



# Overview



- Goal of Proposer's Day
- State of the Practice
- Advancing the State of the Science
- Programmatic approach
- Technical thrusts

*Please reserve your questions until the Q&A session*

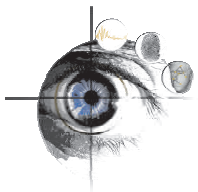


# Goals of Proposer's Day

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- Familiarize participants with IARPA's interest in biometrics technologies
- Foster discussion of synergistic capabilities among potential program participants.



# BEST Background/Scope

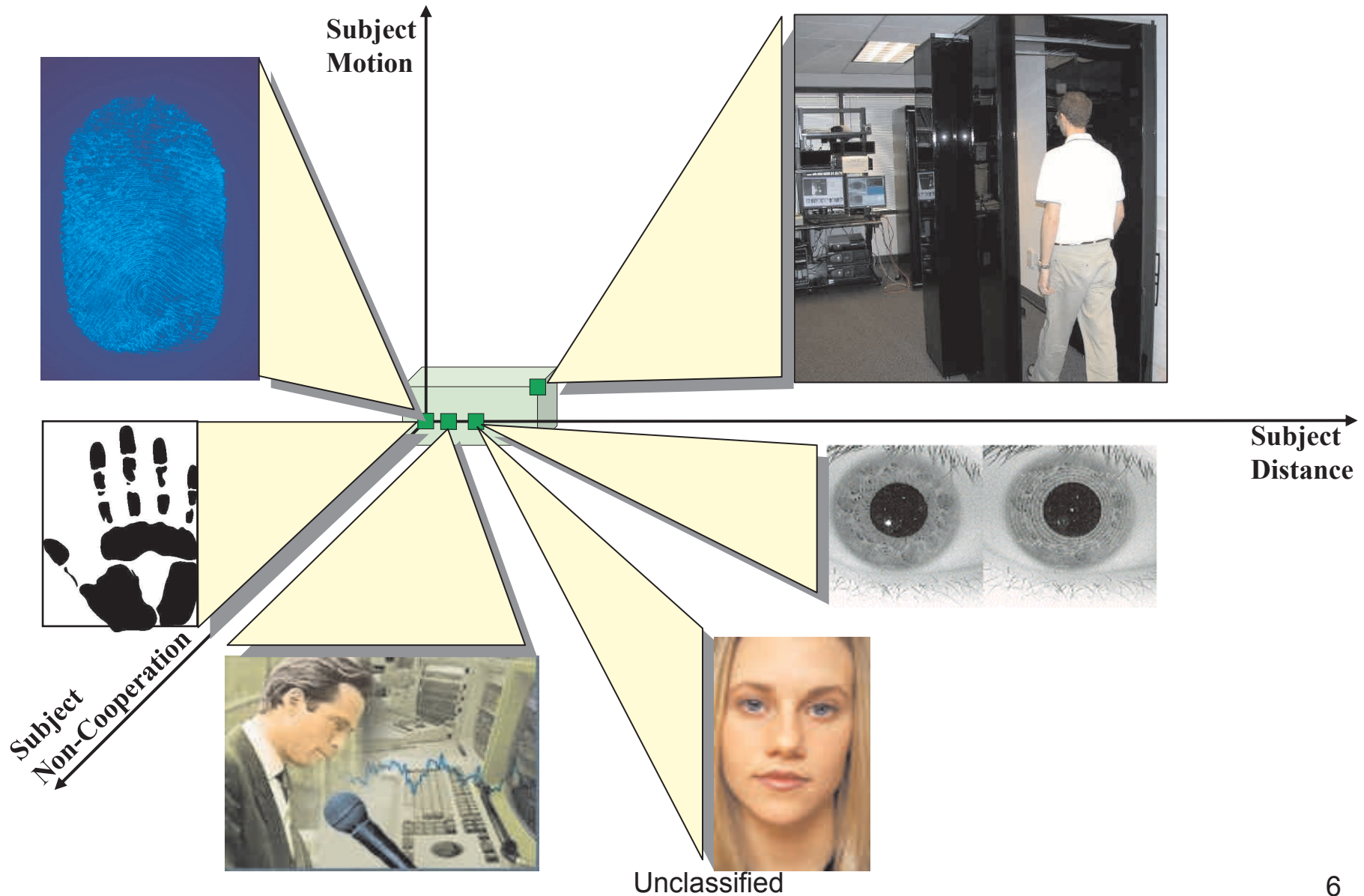
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- NSPD 59/HSPD 24 *“Biometrics for Identification and Screening to Enhance National Security”*
- Biometrics
  - Biographical information not always dependable
  - Answer a small part of the “who is this?”
- Focus on the science of “recognition”
  - Identity: ill-posed
- Exclusions
  - Not interested in contact-type biometrics
  - Not interested in authentication/verification
  - Not seeking to gauge intent (e.g. deception)
  - Not biometric product development effort
  - Not interested in medical assessment approaches



# Biometrics: State of the Practice

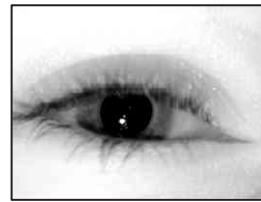
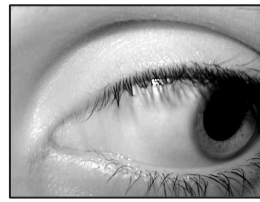




# Program Goals



- Significantly advance the ability to achieve high-confidence match performance on features derived from non-ideal data
- Significantly relax the constraints currently required to enable acquisition of biometric signatures





# Scope of R&D Interests



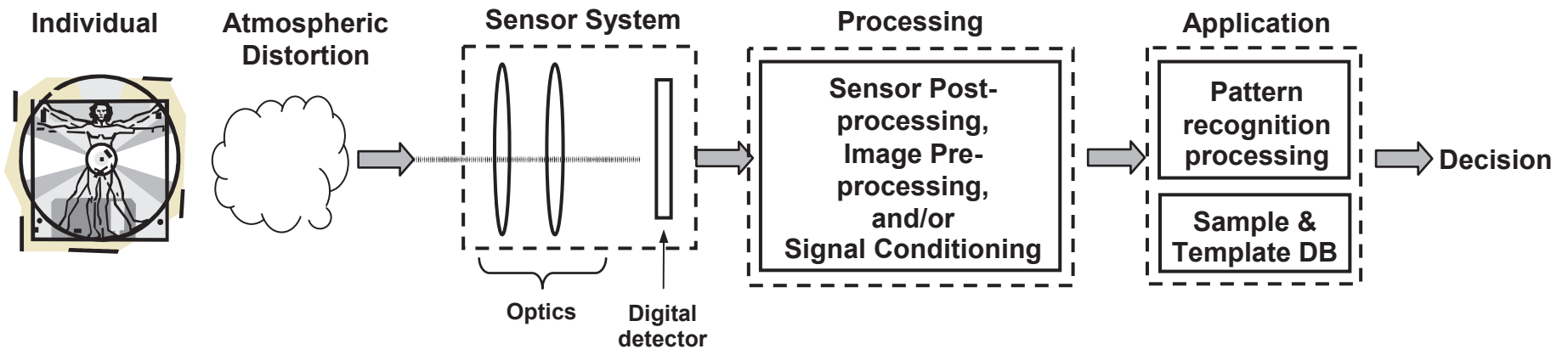
## Exploitation & Analysis

- *Face Recognition*
- *Ocular Recognition*
- *Speaker Recognition*



## Robust Acquisition

- *Coupled face and ocular*
- *Novel sensing techniques*
- *Short/long range sensing*
- *High fidelity 2D and 3D*



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# Exploitation: Notional Challenge

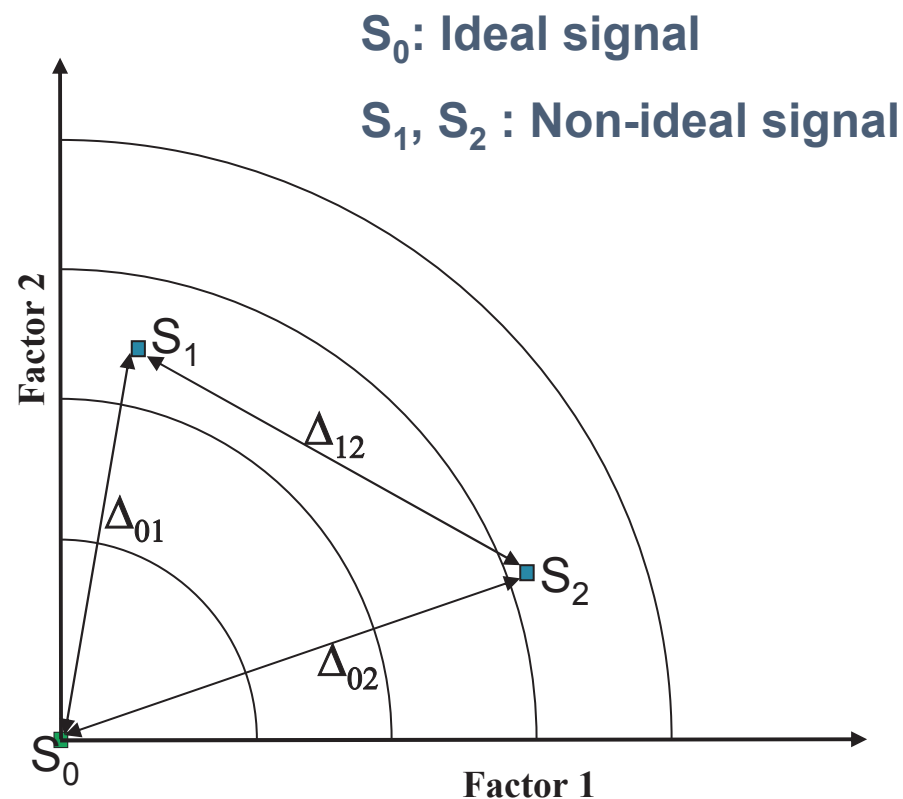


- **As a characteristic\***

- *A measurable biological (anatomical or physiological) and behavioral characteristic that can be used for automated recognition*

- **As a process\***

- *Automated methods of recognizing an individual based on measurable biological (anatomical and physiological) and behavioral characteristics*



\*Source: National Science and Technology Council, Subcommittee on Biometrics and Identity Management, "Biometrics Overview" (<http://www.biometrics.gov/Documents/BioOverview.pdf>)



# Exploitation: Paradigm Shift



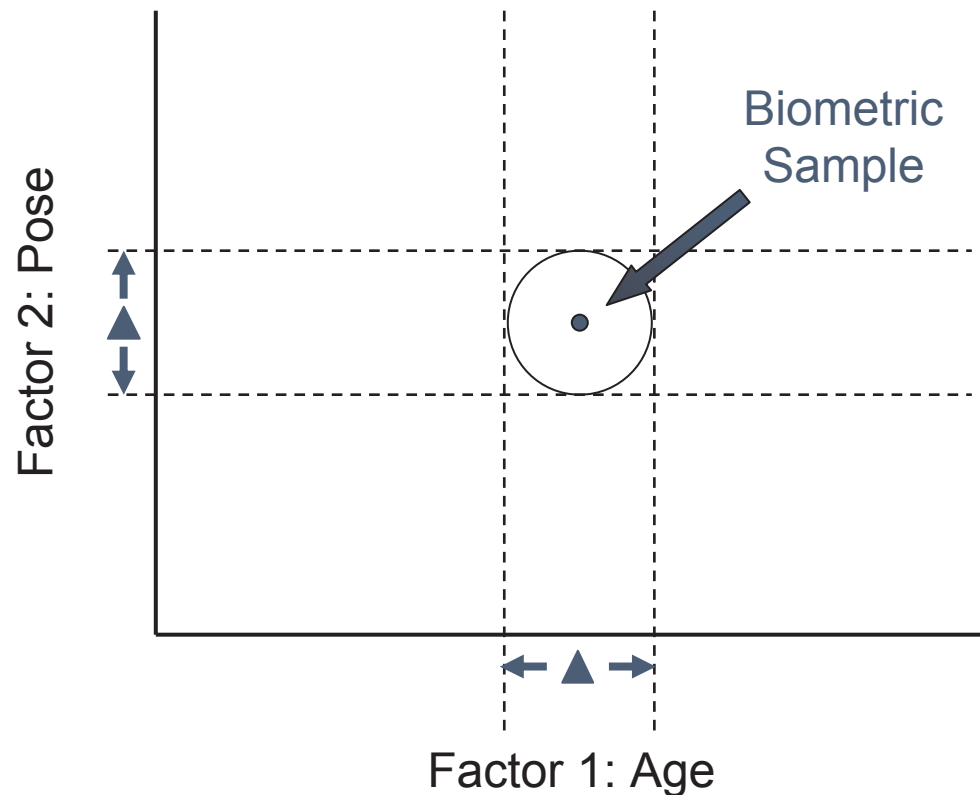
- **Current approach:**

- *Collect data*
- *Train algorithm*
- *Measure performance*

- **Planned approach:**

- *Identify key factors affecting performance*
- *Collect and model corpora to study factors in isolation*
- *Evaluate performance of factor compensation techniques in aggregate*

Modalities: Voice, Face, Ocular



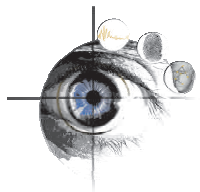


# Exploitation and Analysis



*Goal: Introduce techniques to derive and exploit biometric signatures from data collected under relaxed acquisition constraints while maintaining recognition performance*

- **Potential efforts of interest include:**
  - Investigating the fundamental limits and characteristics of one or more biometric modalities,
  - Exploitation techniques for improving the match performance of a biometric with non-ideal data
  - Scientific investigation of key factors that adversely affect the performance of biometric modalities
- **Challenges:**
  - Data may originate from a variety of sources (e.g., video, still images, etc.)
  - Relaxed constraints (e.g., distance, illumination, angle)
  - Ambient noise effects (e.g., indoors and outdoors)



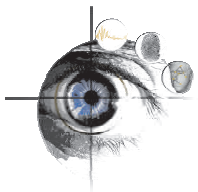
# Advanced Face Recognition Interests



**Goal:** *Enable all-aspect face recognition through the study and development of algorithms robust to key inter-session variables*

- **Potential efforts of interest include (not exhaustive):**
  - Signature normalization; e.g., 3D modeling
    - Not exclusively 2D => 3D morphing
    - Techniques for non-ideal data enhancement
  - Tightly coupled face and iris texture analysis
- **Challenges:**
  - Mitigation of pose, illumination, and expression (PIE) effects
  - Decoration and occlusions (i.e. hats, glasses, etc.)
  - Craniofacial morphology due to aging and weight gain/loss, with diverse demographic data

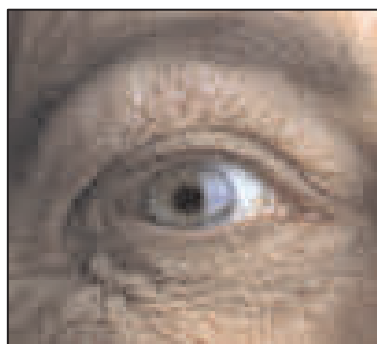
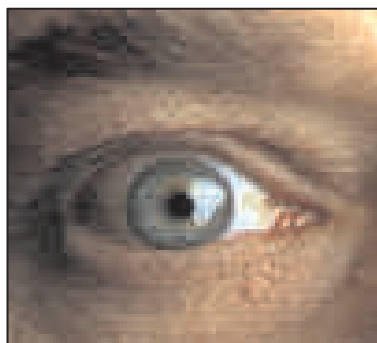




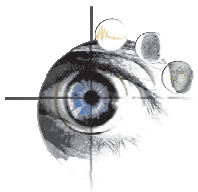
# Ocular Recognition



**Goal:** *Expand conventional iris recognition technology via the inclusion of periocular features to broaden usability*



- **Potential efforts of interest include (not exhaustive):**
  - Identify key features in the ocular region that will enhance iris recognition performance using non-ideal data
  - Techniques for non-ideal data enhancement
- **Challenges:**
  - Improved detection and segmentation performance
  - Variable angle recognition (i.e. off-axis)
  - Cross wavelength recognition (i.e. visible to near-infrared)

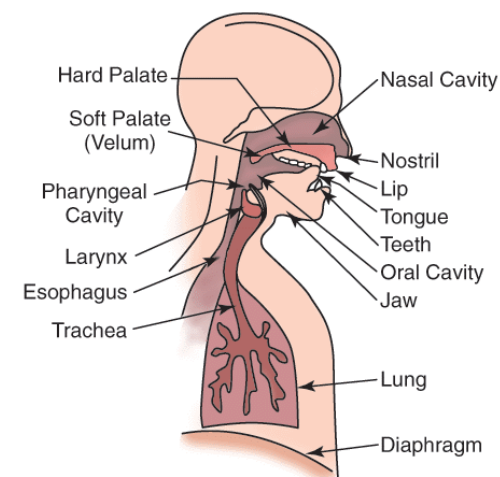


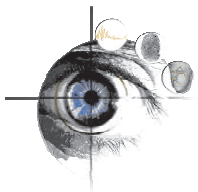
# Speaker Recognition



**Goal:** *Push the state-of-the-science in speaker recognition technology against challenging extrinsic and intrinsic effects*

- **Potential efforts of interest include (not exhaustive):**
  - Exploitation of language independent higher-order (i.e. phonetic cues, prosody, etc.) features
  - Fusion of higher-order features with spectral-based methods
- **Challenges:**
  - **Extrinsic**
    - Noise level & type (e.g. music vs. air handler)
    - Room acoustics/Channel
    - Different sensors & coding (u-law vs. GSM)
  - **Intrinsic**
    - Speech Rate & Style (read vs. extemporaneous)
    - Multi-lingual speech
    - Health variations (cold/fatigue)
    - Vocal tract aging





# Robust Acquisition



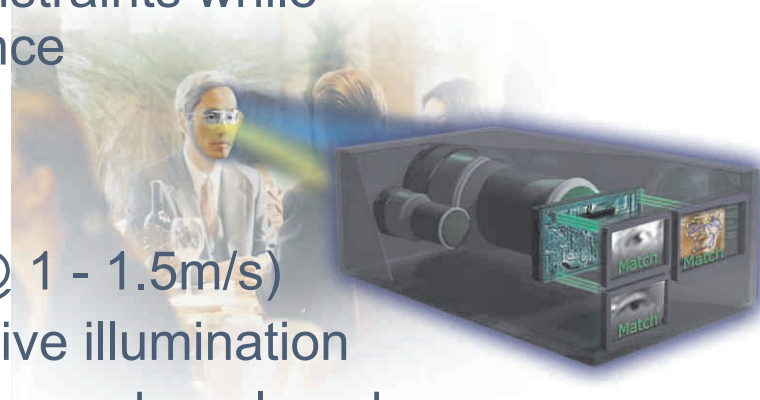
**Goal:** *Extend the acquisition range of face and iris as far as possible under a variety of environmental conditions while relaxing acquisition constraints*

- **Potential efforts of interest include (not exhaustive):**

- New sensor or sensor configuration for acquiring face or iris biometric signatures
- Techniques for relaxing acquisition constraints while maintaining biometric match performance

- **Challenges:**

- Mitigating subject motion (non-radial @ 1 - 1.5m/s)
- Indoors and outdoors, ambient and active illumination
- Collecting high fidelity biometric features under relaxed constraints
- Eye safe (systems that require active illumination)





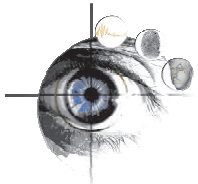
# Research Corpora

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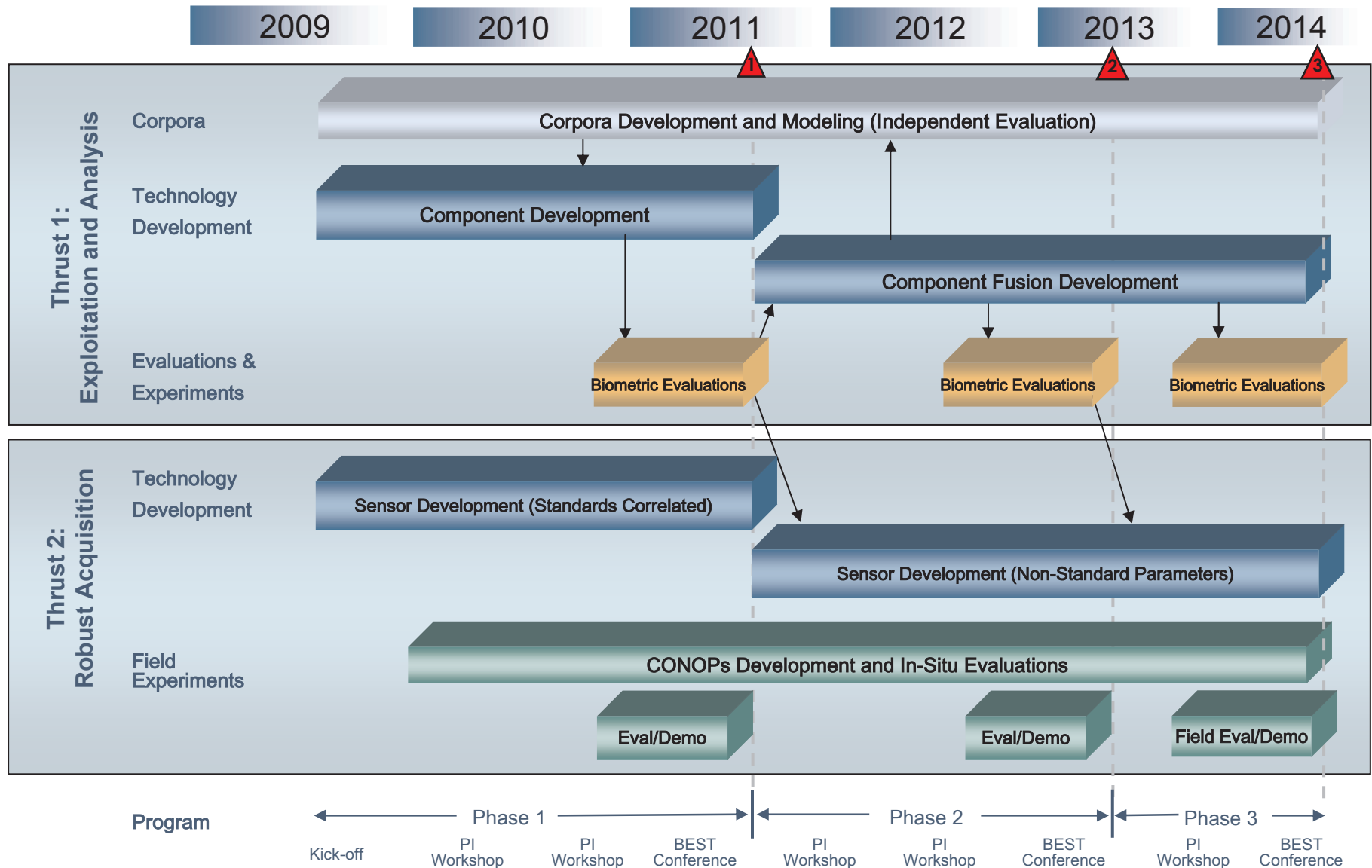


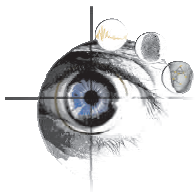
- Program anticipates corpora development to support research on many of the technical challenges of interest to the program
- Corpora will represent a diverse demographic with a broad range of variability
- Additional small-scale, lab level data collection efforts by performers may be necessary to support specialized/focused investigatory efforts





# BEST Program Plan (Tentative)





# Final Thoughts



- Phase I research has a strong scientific focus
- Intent of program is to improve the robustness of biometric exploitation technology
- Ultimately, the community must move beyond a collect and train methodology
- Need focused investigation of key factors that adversely affect the performance of biometric technologies
- Significant advancements will require a paradigm shift to augment corpora collection with data synthesis techniques (e.g. modeling)
- Explore acquisition systems concepts that adapt to the subject—not force the subject to adapt to the system.



# Additional Info

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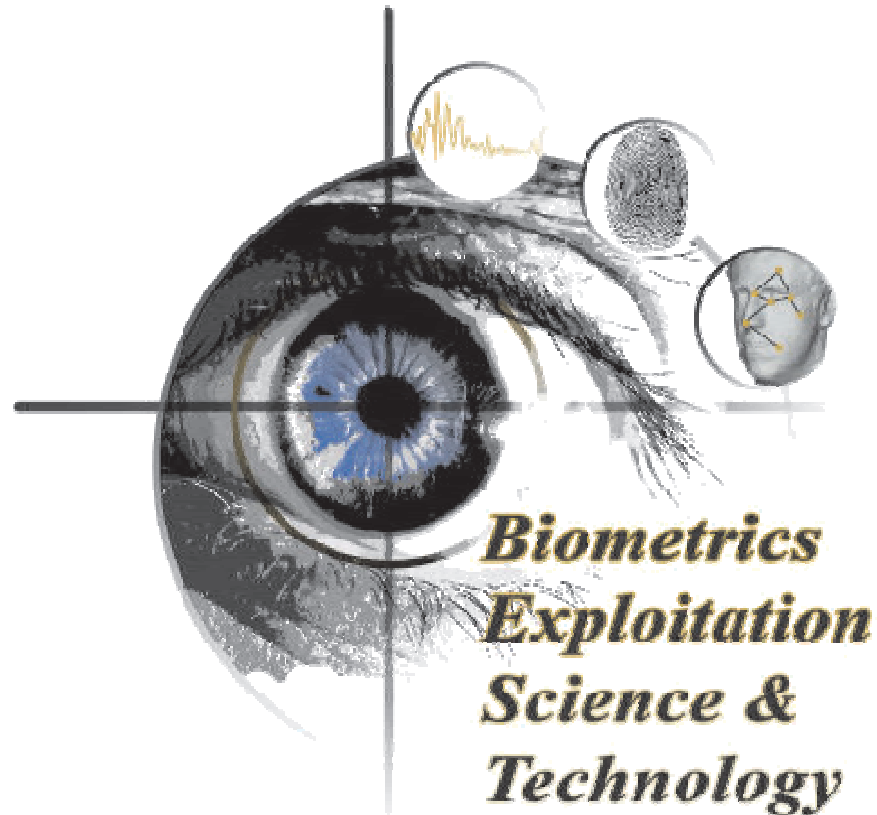


- Contact info: [dni-iarpa-baa-09-02@ugov.gov](mailto:dni-iarpa-baa-09-02@ugov.gov)
- Additional information planned on [www.iarpa.gov](http://www.iarpa.gov)



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# Thank You



Dr. Michael C. King, Program Manager  
**Intelligence Advanced Research Projects Activity (IARPA)**

<http://www.iarpa.gov>

15 January 2009

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