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14. ABSTRACT Integrated transformational identity Cyberscience will be essential for the Department of Defense to conduct their missions in the future. The plethora of new and emerging sensor systems will enable sampling of an ever-larger ecosystem which, when combined with advances in semantic language processing and complex narrative analysis will provide insights and relationships never before seen. Combined with agile, rapid data processing and analysis based upon the combined power of parallel and cloud computing, the future warrior will have real-time, actionable intelligence in hand within a matter of minutes. These systems will become the foundation for an entirely new					
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## Report Title

Final Report: STIR: Scientific Exploration of Cyber-Driven Dynamic, Distributed Big Data Forensics Systems

### ABSTRACT

Integrated transformational identity Cyberscience will be essential for the Department of Defense to conduct their missions in the future. The plethora of new and emerging sensor systems will enable sampling of an ever-larger ecosystem which, when combined with advances in semantic language processing and complex narrative analysis will provide insights and relationships never before seen. Combined with agile, rapid data processing and analysis based upon the combined power of parallel and cloud computing, the future warrior will have real-time, actionable intelligence in hand within a matter of minutes. These systems will become the foundation for an entirely new mission set. Fueled by the availability of low-cost electronics, sensors and wearables, high performance computing, and network connectivity, society is in the midst of a major revolution in cyber-driven, dynamic distributed big data systems. Our current understanding of the integration of cloud computing, mobile devices and the explosion of information is somewhat limited in the context of machine learning and artificial intelligence. Exploiting key elements of this modernization could result in previously unimaginable applications, surges in operational efficiency, and crisis management.

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**Enter List of papers submitted or published that acknowledge ARO support from the start of the project to the date of this printing. List the papers, including journal references, in the following categories:**

**(a) Papers published in peer-reviewed journals (N/A for none)**

<u>Received</u>	<u>Paper</u>
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**(b) Papers published in non-peer-reviewed journals (N/A for none)**

<u>Received</u>	<u>Paper</u>
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**TOTAL:**

**Number of Papers published in non peer-reviewed journals:**

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**(c) Presentations**

Number of Presentations: 0.00

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**Non Peer-Reviewed Conference Proceeding publications (other than abstracts):**

Received      Paper

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Number of Non Peer-Reviewed Conference Proceeding publications (other than abstracts):

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**Peer-Reviewed Conference Proceeding publications (other than abstracts):**

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**TOTAL:**

Number of Peer-Reviewed Conference Proceeding publications (other than abstracts):

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**(d) Manuscripts**

Received      Paper

**TOTAL:**

Number of Manuscripts:

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**Books**

Received      Book

**TOTAL:**

Received

Book Chapter

**TOTAL:**

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**Patents Submitted**

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**Patents Awarded**

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**Awards**

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**Graduate Students**

<u>NAME</u>	<u>PERCENT SUPPORTED</u>
<b>FTE Equivalent:</b>	
<b>Total Number:</b>	

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**Names of Post Doctorates**

<u>NAME</u>	<u>PERCENT SUPPORTED</u>
<b>FTE Equivalent:</b>	
<b>Total Number:</b>	

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**Names of Faculty Supported**

<u>NAME</u>	<u>PERCENT SUPPORTED</u>	National Academy Member
Iyengar	0.10	
Woodard, Damon	0.10	
Forte, Dominic	0.10	
<b>FTE Equivalent:</b>	<b>0.30</b>	
<b>Total Number:</b>	<b>3</b>	

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### Names of Under Graduate students supported

<u>NAME</u>	<u>PERCENT SUPPORTED</u>	<u>DISCIPLINE</u>
Aleman, Sheila	10	
Beltran, Jonathan	10	
Gil-Montiel, Miguel	10	
<b>FTE Equivalent:</b>	<b>0.30</b>	
<b>Total Number:</b>	<b>3</b>	

### Student Metrics

This section only applies to graduating undergraduates supported by this agreement in this reporting period

The number of undergraduates funded by this agreement who graduated during this period: ..... 1.00

The number of undergraduates funded by this agreement who graduated during this period with a degree in science, mathematics, engineering, or technology fields:..... 1.00

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### Names of Personnel receiving masters degrees

<u>NAME</u>
<b>Total Number:</b>

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### Names of personnel receiving PHDs

<u>NAME</u>
<b>Total Number:</b>

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### Names of other research staff

<u>NAME</u>	<u>PERCENT SUPPORTED</u>
<b>FTE Equivalent:</b>	
<b>Total Number:</b>	

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**Sub Contractors (DD882)**

**Inventions (DD882)**

## **Scientific Progress**

The Transformative Identity Cyberscience Computing relies on a broad spectrum of big data sciences to provide undeniable scientific associations between people, places, events and materials from evidence. It's most well-known application determines if/how/when a criminal/terrorist activity was committed, identifies victims, distinguishes between the innocent and the guilty, and links the guilty to unsolved crimes. Identity science, "the study of the use of physiological signals, cultural traits, behavioral interactions, digital artifacts, and emotion cues for establishing the identity of an individual or group as well as the policy/ethical issues related to the use of identity" is an important aspect of overall identity. When the two sciences are integrated, or fused, we have an opportunity for a truly new science of integrated transformative Identity Cyberscience.

## **Technology Transfer**

# Final Report W911NF-16-1-0238 Florida International University

Grant: STIR: Scientific Exploration of Cyber-Driven Dynamic, Di, Project ID 800007041

Submitted October 1, 2016

Proposal Submitted October 1, 2016

Title: Integrated Transformative Identity Cyberscience: A Foundational Research Proposal

**OBJECTIVE:** Integrated transformational identity Cyberscience will be essential for the Department of Defense to conduct their missions in the future. The plethora of new and emerging sensor systems will enable sampling of an ever-larger ecosystem which, when combined with advances in semantic language processing and complex narrative analysis will provide insights and relationships never before seen. Combined with agile, rapid data processing and analysis based upon the combined power of parallel and cloud computing, the future warrior will have real-time, actionable intelligence in hand within a matter of minutes. These systems will become the foundation for an entirely new mission set.

**DESCRIPTION:** Fueled by the availability of low-cost electronics, sensors and wearables, high performance computing, and network connectivity, society is in the midst of a major revolution in cyber-driven, dynamic distributed big data systems. Our current understanding of the integration of cloud computing, mobile devices and the explosion of information is somewhat limited in the context of machine learning and artificial intelligence. Exploiting key elements of this modernization could result in previously unimaginable applications, surges in operational efficiency, and crisis management.

***Potential Military Applications:*** The Transformative Identity Cyberscience Computing relies on a broad spectrum of big data sciences to provide undeniable scientific associations between people, places, events and materials from evidence. It's most well-known application determines if/how/when a criminal/terrorist activity was committed, identifies victims, distinguishes between the innocent and the guilty, and links the guilty to unsolved crimes. Identity science, "the study of the use of physiological signals, cultural traits, behavioral interactions, digital artifacts, and emotion cues for establishing the identity of an individual or group as well as the policy/ethical issues related to the use of identity" is an important aspect of overall identity. When the two sciences are integrated, or fused, we have an opportunity for a truly new science of integrated transformative ***Identity Cyberscience***.

***Scope:*** The objective of this proposal is to address the challenges through a large multidisciplinary research effort that consists of building a system of systems that will be developed in three phases.

Phase 1: Involves developing initial concepts/ design analysis, and modeling theoretical characterization of biometric and integrated transformative identity Cyberscience data.

Phase 2: Leveraging our parallel computing expertise to develop, real-time transformative data algorithms that store and process large amount of captured data or information.

Phase 3: Focuses on testing and evaluating through case studies with the data from military applications such as automated target recognition, battlefield surveillance, etc.

Anticipated breakthroughs to be accomplished by this research include;

- (a) developing innovative quantitative metrics for evaluating the quality of biometrics/signatures (including multimodal, mixed, and noisy samples),
- (b) exploring the properties of emerging biometrics (ECG, EEG, PUF, etc.) and how they can contribute to novel forensic applications,

(c) creating semantically enriched workflows/abstractions to automate biometric/forensic management and analytics processes,

(d) developing novel predictive and real-time big data analytics for accurate pattern recognition and signature identifications supported by new parallel cloud computing paradigms,

(e) evaluating the fundamental security and privacy issues, and exploiting what is learned to optimize the communication, storage, security, and performance of the forensic system from the front end (devices/sensors) through the back end (cloud).

**Topic Chief:** Dr. Cliff Wang, ARO, 919 549 4207, [cliff.x.wang.civ@mail.mil](mailto:cliff.x.wang.civ@mail.mil)

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