Increase Situational Awareness

Increase Survivability

Increase Surgical Lethality

TALOS PROJECT to JATF NEXT

Increase Human Performance

Data

Where Did We Start?

Individual Equipment Evolution...What has Changed?

WWI	MACVSOG VIETNAM	OEF / OIF	FUTURE

DISTRIBUTION A: APPROVED FOR PUBLIC RELEASE

Organizational Priorities

Original TALOS Functional Area

Combat Suit Development: Research, assessment, test and development of emerging / disruptive technologies; integrator of multiple sub-systems and tactical components.

Accelerate Tech Development / Transitions: Over-the-horizon technology focus; equipping SOF to win in a complex, uncertain future.

Pioneer Innovative Processes: Rapid prototyping, prize challenges, streamlined acquisition; leveraging novel acquisition and development methods.

Persistent Collaboration: Maintaining extended network, continuous end-user engagement; forging new relationships with Academia, Industry, and Government.

TALOS: Protecting the Operator at his most vulnerable moment

- Mobility & Agility
- Power & Energy
- Computing
- Command, Control, Communications & Intelligence
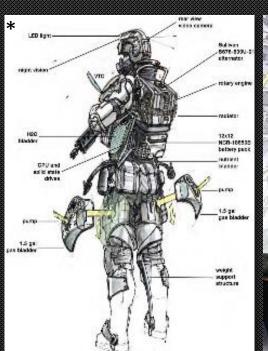- Human Factors
- Operator Interface
- Offensive Systems
- Survivability
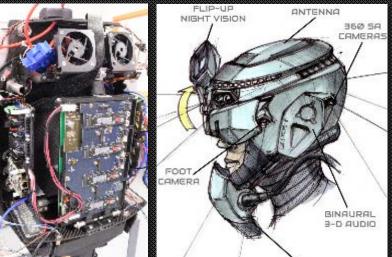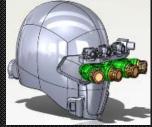
Pioneered SOCOM Prototyping

DISTRIBUTION A: APPROVED FOR PUBLIC RELEASE

Persistent Collaboration and Innovative Processes

Government, Academia, Industry

SOFWERX Emerges

SOCOM blanket Cooperative Research and Development Agreement (CRADA)

Prize Challenges

Fostered small business growth Small Business Innovation Research

Pioneered Commercial Solutions Opening enabling more rapid and tailored acquisition

DISTRIBUTION A: APPROVED FOR PUBLIC RELEASE

TALOS Combat Suit Tenents

Survivability: Comprehensive and improved ballistic protection. Develop an exoskeleton that supports near unconstrained movement and provides a load bearing structure.

Human Performance: Develop an independently powered actuated suit integrated with biomedical monitoring and thermoregulation to extend human performance thresholds.

Situation Awareness: Develop a visual augmentation, multidimensional display of fused sensors and an integrated array of intelligence and operational data.

Surgical Lethality: Shorten the time to target engagement and create options for novel weapons integration.

TALOS System Life-Cycle

2013   **2014**   **2015**   **2016**   **2017**   **2018**   **2019**

- **State-of-the-art Market Research**
- **Non-traditional Partnering**
- **Ideation**
- **Team Building**

- **Use Case derivation (CONOP)**
- **Explored the Design Spaces**
- **Modeling and Simulation**
- **Architectural Designing**
- **Iterative Prototyping**

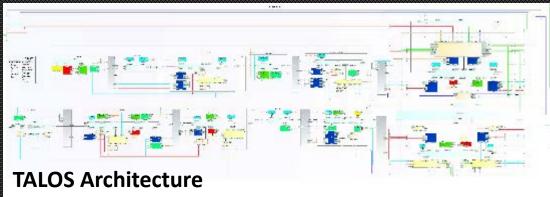- **Design and Build Sub-System Components**
- **Configuration Management**
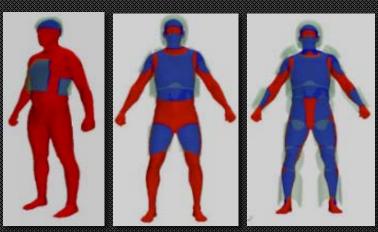- **Preliminary and Critical Design Reviews**
- **Test and Evaluation**

- **System Integration**
- **Demonstrated prototypes**

TALOS Architecture

ARMOR

Research Objectives:
- Increased Ballistic Threat Protection
- Reduced Size/Weight
- Novel Armor Design
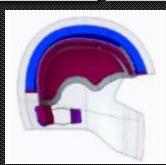
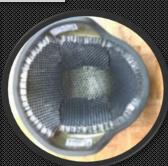SPEAR   MK5   Alt Material*

2013   2014   2015   2016   2017   2018

DISTRIBUTION A: APPROVED FOR PUBLIC RELEASE

POWER

Research Objectives:
- Improve Battery Technologies
- Lithium Polymer
- Solid Oxide Fuel Cell
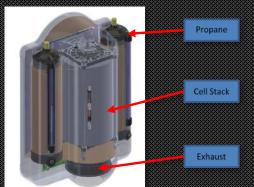- Hybrid Engines

Power Enclosure

Ballistic Power Plate
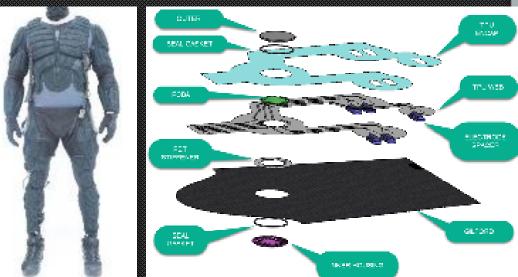

Hybrid Engines

Solid Oxide Fuel Cells

Propane
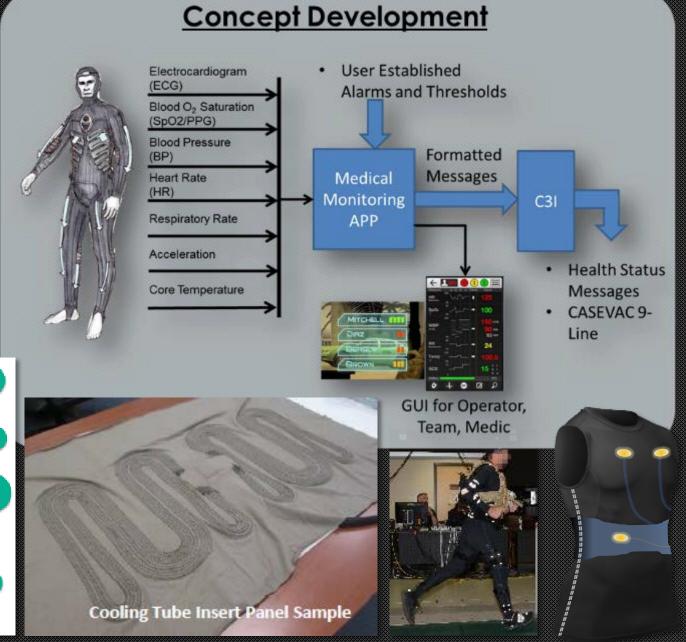
Cell Stack

Exhaust

DISTRIBUTION A: APPROVED FOR PUBLIC RELEASE

BASELAYER

Research Objectives:
- Physiological Status Monitoring
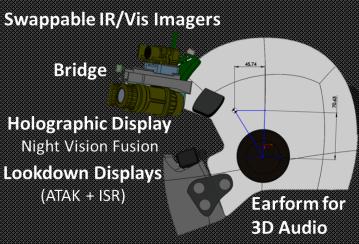- Active Thermal Management
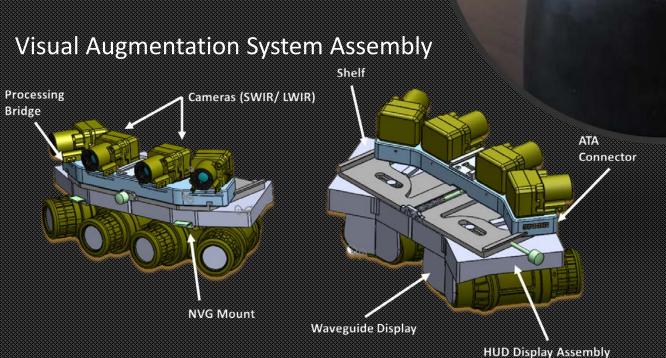- EMG Technology
- Novel Textiles

Cooling Tube Insert Panel Sample

HELMET

Research Objectives:
- Target Acquisition
- Digital Vision Displays
- Augmented Reality
- 3D Audio

Swappable IR/Vis Imagers

Bridge

Helmet Computing

Holographic Display
Night Vision Fusion

Lookdown Displays
(ATAK + ISR)

Earform for 3D Audio

Visual Augmentation System Assembly

Shelf

Processing Bridge

Cameras (SWIR/ LWIR)

ATA Connector

NVG Mount

Waveguide Display

HUD Display Assembly

3d Audio
(Ambient and RF)

DISTRIBUTION A: APPROVED FOR PUBLIC RELEASE

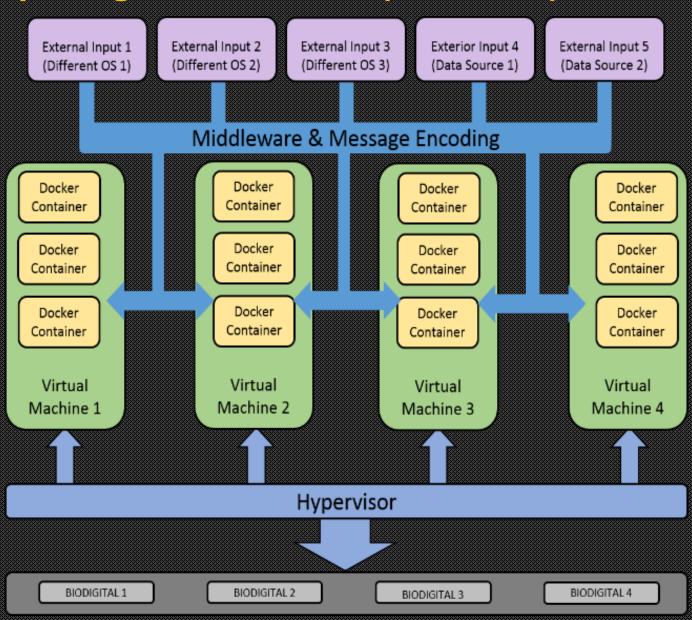# SOCOM Embedded Computing Environment (SEMONE)

C4I

Research Objectives:
- Software Integration
- Computing Hardware
- Networking hardware
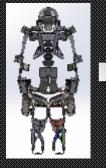
Design Principles
Survivable
Adaptable
Open

External Input 1 (Different OS 1)
External Input 2 (Different OS 2)
External Input 3 (Different OS 3)
Exterior Input 4 (Data Source 1)
External Input 5 (Data Source 2)

Middleware & Message Encoding

Docker Container
Docker Container
Docker Container
Virtual Machine 1

Docker Container
Docker Container
Docker Container
Virtual Machine 2

Docker Container
Docker Container
Docker Container
Virtual Machine 3

Docker Container
Docker Container
Docker Container
Virtual Machine 4

Hypervisor

BIODIGITAL 1
BIODIGITAL 2
BIODIGITAL 3
BIODIGITAL 4

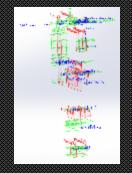# Modeling and Simulation

EXOSKELETON

Research Objectives:
- **Modeling and Simulations**
- Actuation
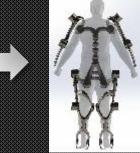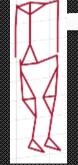- Structures
- Sensors & Control

Exoskeleton Kinematics

Analyze kinematic effects

Extract joint centers and axes rotations

Overlay model onto 3D scan

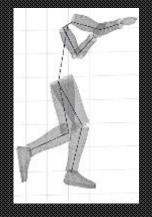**Create Kinematic model**

Human Motion Analysis

**Walking
Running
Step up/down**

Capture human motion data

Translate human motion data into model

Align human motion model with kinematic model

Requirements

Regression-Based Filtering

Detailed Filtering

EXOSKELETON

Research Objectives:
- Modeling and Simulations
- **Actuation**
- **Structures**
- **Sensors & Control**

Early Prototypes

Load Carriage Designs

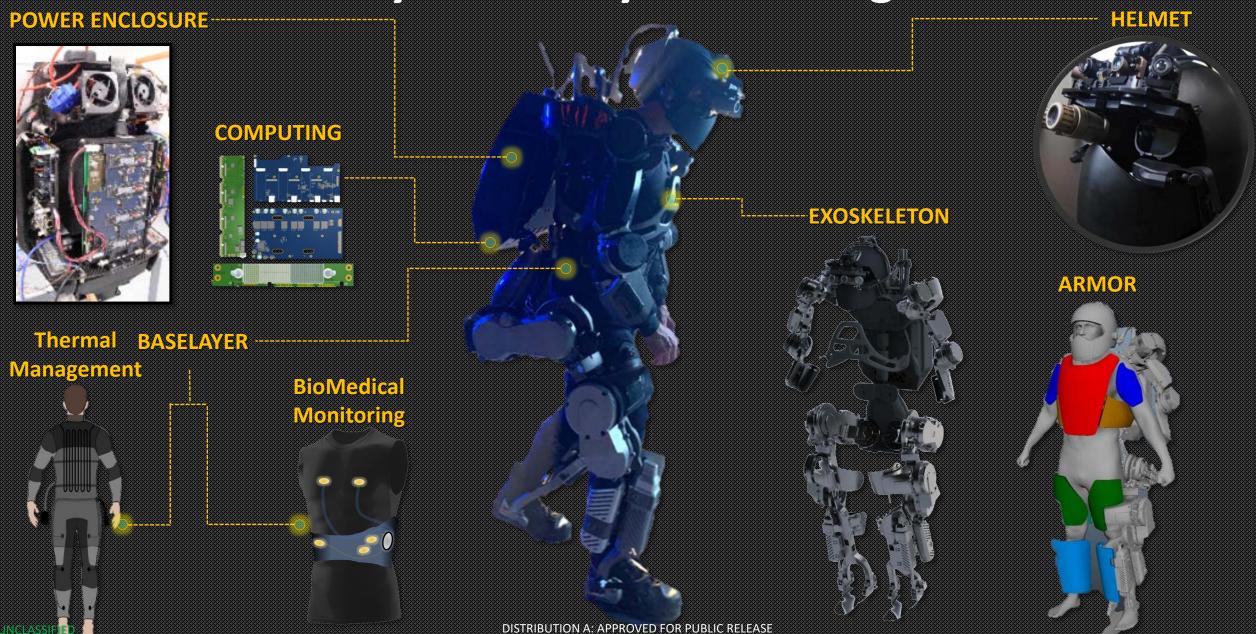### Government Led System of Systems Integration

Single Vendor (SBIR)

DISTRIBUTION A: APPROVED FOR PUBLIC RELEASE
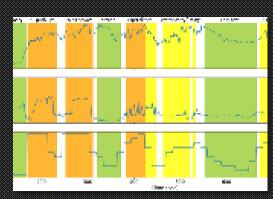
Lightweight Augmentation Design

Single Vendor (SBIR)
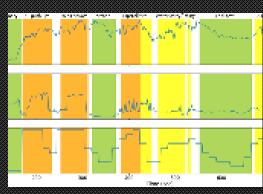
MK5 System of Systems Integration

POWER ENCLOSURE

HELMET

COMPUTING

EXOSKELETON

ARMOR

Thermal Management

BASELAYER

BioMedical Monitoring

Integrated TALOS Prototype

OPERATIONAL
STRESS INDEX

BIOMEDICAL
MONITORING
SHIRT

Integrated TALOS Prototype

OPERATIONAL STRESS INDEX

BIOMEDICAL MONITORING SHIRT

LIGHTWEIGHT POLYETHYLENE ARMOR

Integrated TALOS Prototype

3D AUDIO

LOOKDOWN DISPLAYS

OPERATIONAL STRESS INDEX

SHOT DETECTION GARMENT

BIOMEDICAL MONITORING SHIRT

BALLISTIC BATTERY PLATE

LIGHTWEIGHT POLYETHYLENE ARMOR

METABOLIC COST REDUCTION SYSTEM (PNEUMATIC KNEES AND ANKLES)
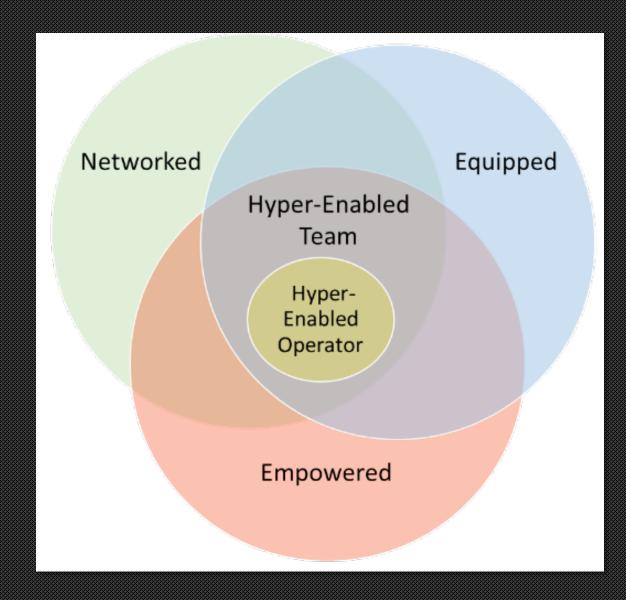
SMALL ARMS STABILIZATION

Future Operating Environment

Multi-Domain Environment
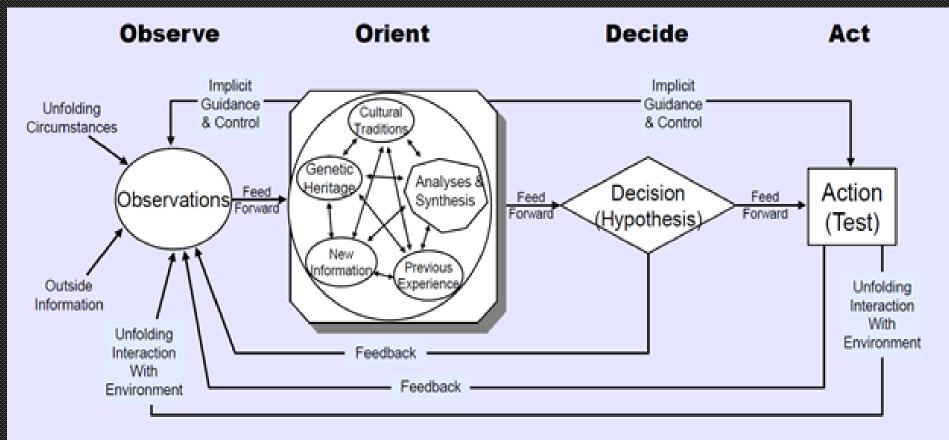
- **Physical (air, land, sea, space)**
- **Virtual (cyberspace)**
- **Cognitive (influence minds)**

The democratization of emerging technologies provide our competitors with the means to predict and act faster than we do.

The Hyper-Enabled Team must quickly and effectively use information to predict and act while leveraging the decentralized flexibility of the SOF professional.

Enhancing Cognition
(OODA Loop)

Observe   **Orient**   **Decide**   **Act**

Unfolding Circumstances

Implicit Guidance & Control

Cultural Traditions

Genetic Heritage

Analyses & Synthesis

New Information

Previous Experience

Observations

Feed Forward

Feed Forward

Decision (Hypothesis)

Feed Forward

Implicit Guidance & Control

Action (Test)

Outside Information

Unfolding Interaction With Environment

Feedback

Feedback

Unfolding Interaction With Environment

Cognitive Overmatch: The ability to dominate the situation by making informed decisions faster than the opponent.

Data   **Information**   **Knowledge**   **Judgment**

We must leverage technologies to asymptotically drive the OODA Loop to zero.

Hyper-Enabling the Operator

HEO Technology Enablers at the Edge

 DATA ASSETS / SENSORS

 COMMUNICATIONS

 COMPUTING

 HUMAN MACHINE INTERFACE

Accelerate Decision Making

Increase Situational Awareness

Reduce Cognitive Load

Enhance Cognition

Technical Infrastructure Foundation
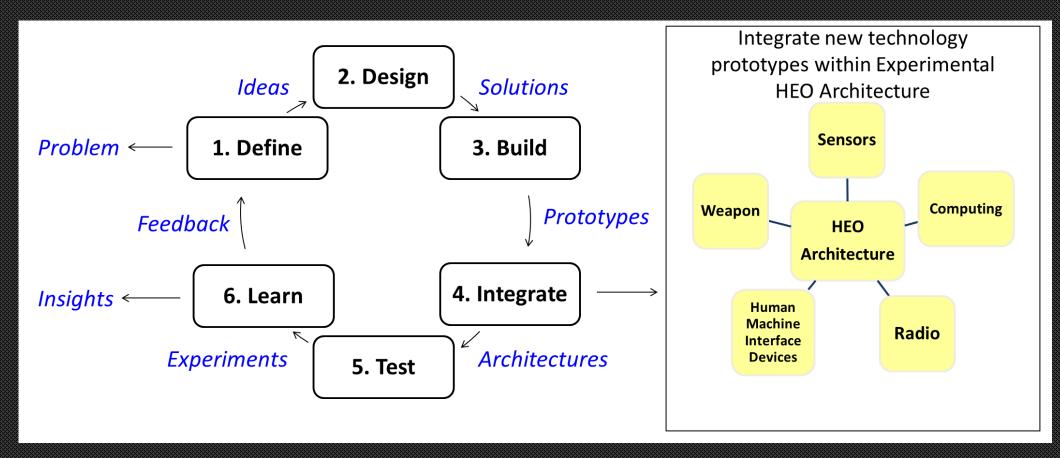
Data Management Analytics

Hybrid Cloud Strategy

Communications Network Architecture

Culture

Decision-Quality Data Drive Decisions

Warfighter Teamed with Technologists and Data Scientists

Learning Culture

Transformational innovations do not start with solutions; they begin with a clear understanding of a problem

Define Problems –> Rapidly Prototype –> Learn –> *Accelerate SOF Innovation*