U.S. AIR FORCE

USSF

AFRL

Human Engineered Resilience Optimization (HERO)

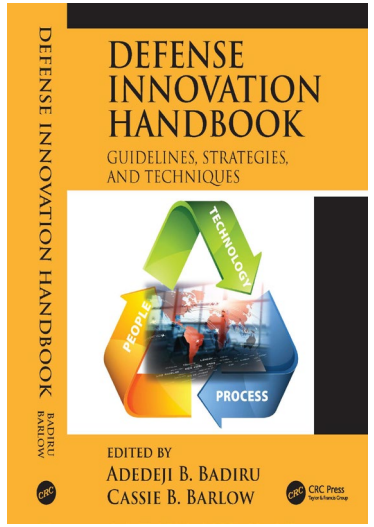
NDIA Human Systems Conference
Teaming at the Edge - Joint Cognitive Systems

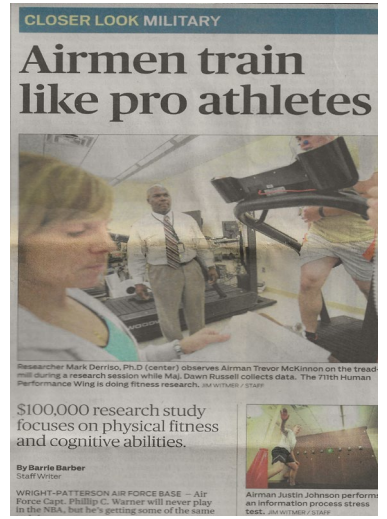
Dr. Mark M. Derriso, Chief Engineer

711 HPW, 15 June 22

Team & Expertise

Experts in Airman performance and recognized Department of Defense leaders in human performance





ENGINEERING SPORTS PERFORMANCE
6808 SW 81st Street, Miami, FL 33143

Experts in professional athlete performance training and injury prevention based on engineering principles and biomechanics

rippleworx

Experts in performance data analytics and business intelligence platforms to a deliver effective personalized interventions

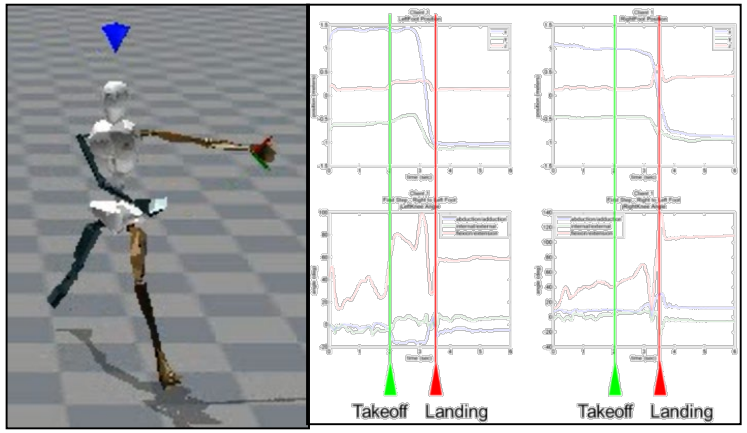
AFRL partnership seeks to "engineer" improved human performance

By Air Force Research Laboratory 711th Human Performance Wing / Published February 24, 2021

The Air Force Research Laboratory has teamed with small business partners Engineering Sports Performance LLC, and RippleWorx Inc. to develop, refine, and validate innovative training methodologies based on engineering principles. Here, Ed Downs, CEO of Engineering Sports Performance, assesses a client during a training session, modeled in the image on the right via a 3D motion capture suit. (U.S. Air Force graphic)

HERO Objectives:

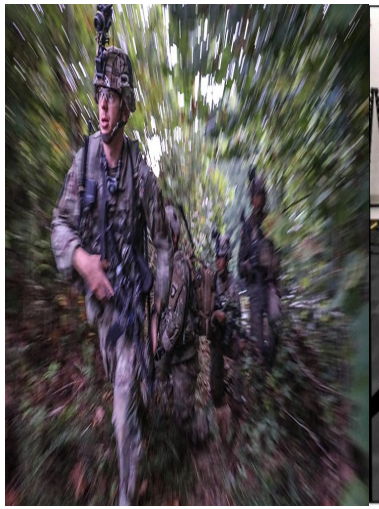
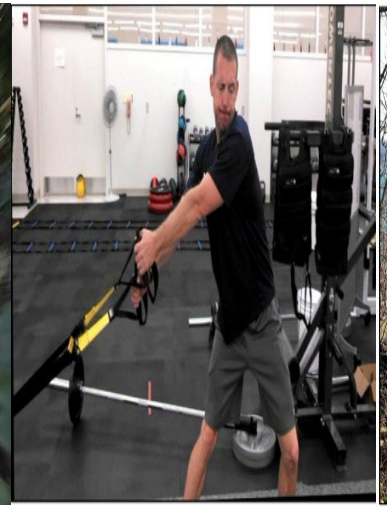
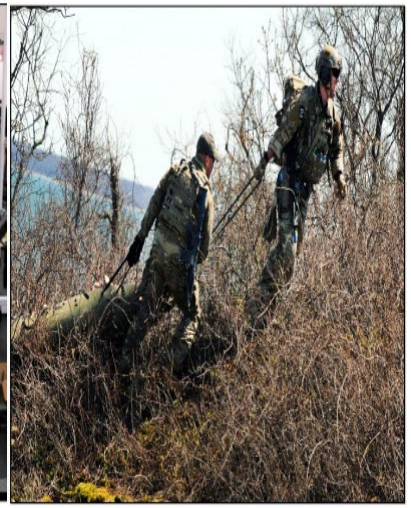
- ✓ Create an innovative training methodology that reliably transfers to operational performance while enhancing overall health, fitness, resilience and wellness
- ✓ Develop Digital Training Aides (DTA) coupled with wearable devices and questionnaires to enable quantifiable, evidence-based progression training and interventions to optimized overall performance and wellbeing
- ✓ Implement a novel career cycle management system that collects, stores and analyze performance data to deliver timely individualized training and intervention plans to personnel across the organization and beyond

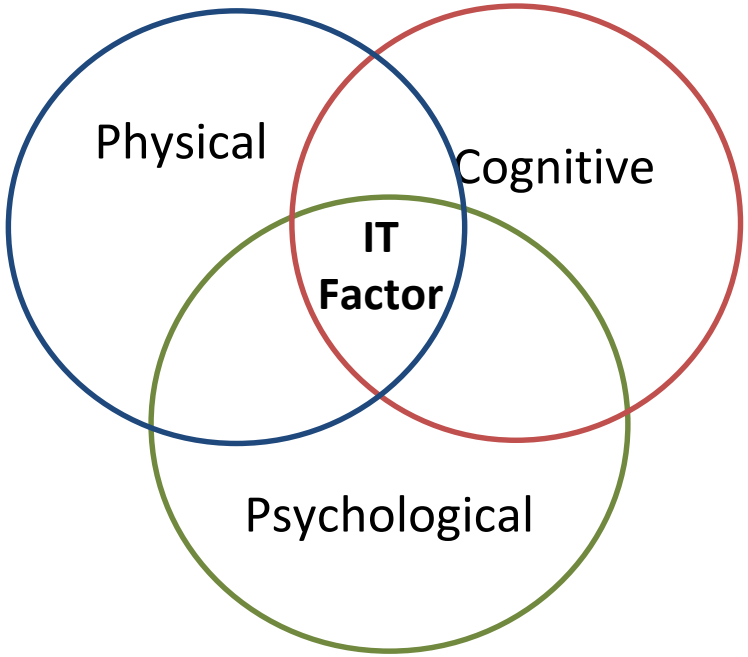


Performance Training Methodology

Theory of Operational Performance (TOP)

Performance (A,B,C,D) = A (accomplishing trained activities) + B (by using body mechanics and mental processes) + C (for executing strategies and tactics) + D (within an operational environment)



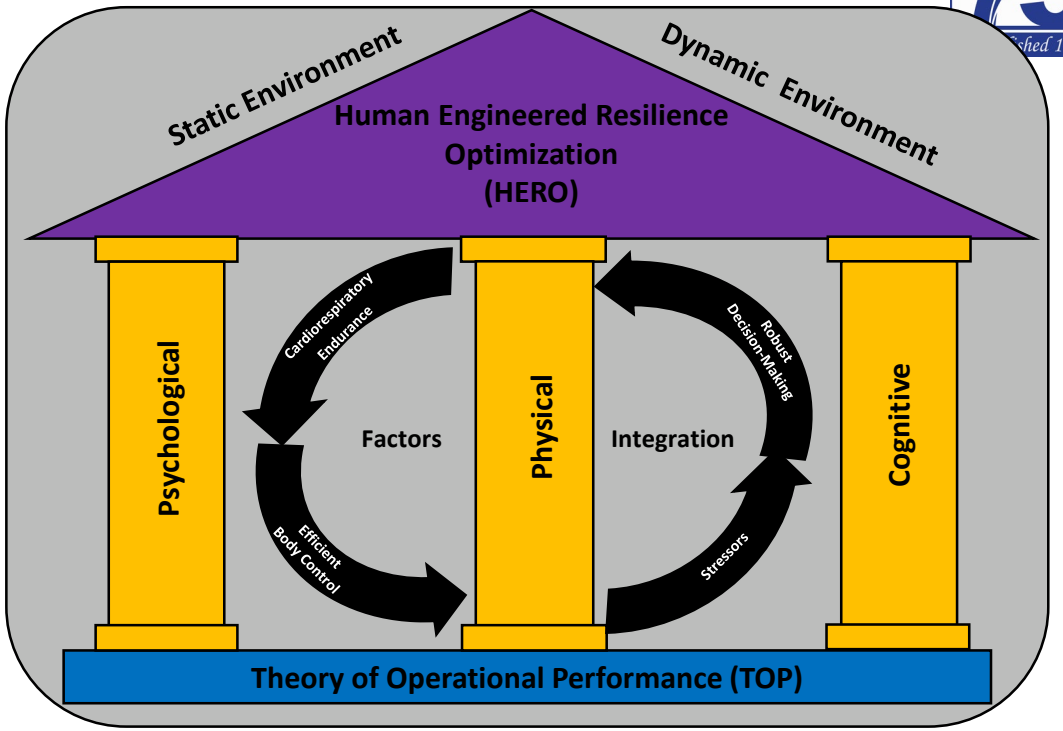
- Holistic, integrated control-based methodology
- Proven results both scientifically and practical applications
- Effective throughout the health, fitness and performance continuum

Health → **Fitness** → **Performance**

"This is groundbreaking and has the potential of creating a new field"
Dr. Cedric X. Bryant, President and Chief Science Officer, American Council On Exercise

HERO Model/Framework

- Baselines are established via assessments
- Progression-based, tailored training routines with personalized interventions
- No phase left behind (phases are integrated throughout the training process)
- Each performance parameter has an increasing level of difficulty
- Training routines includes internal and external stressor to improve resiliency

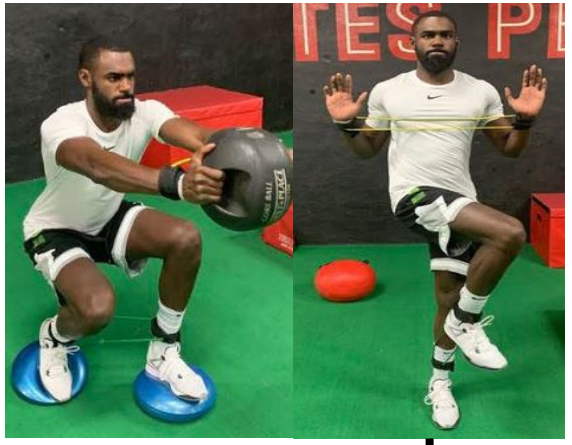


Perform Individualized Assessments

Establish Baseline (e.g., Phase 2, Level 4)

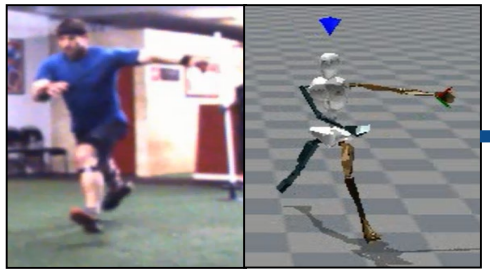
Create Individualized Progression Training Plan to Optimize Performance

Execute Training Plan



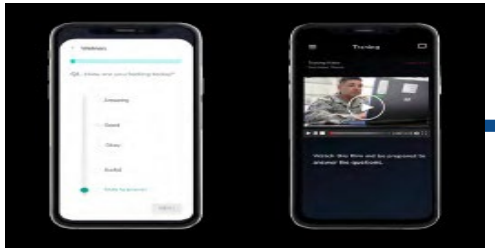
Digital Training Aide (DTA)

Digital Training Aide (DTA)



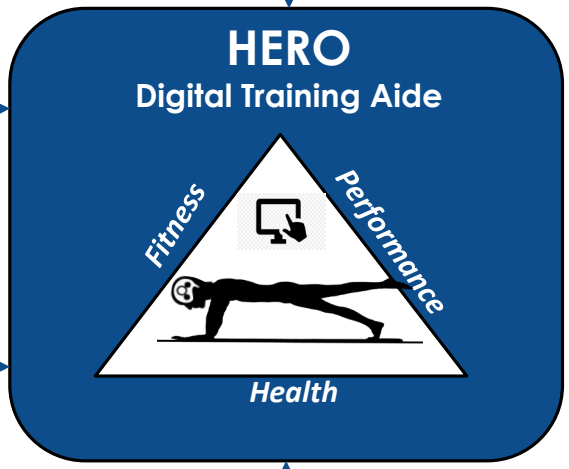
Physical Data

Cognitive Data



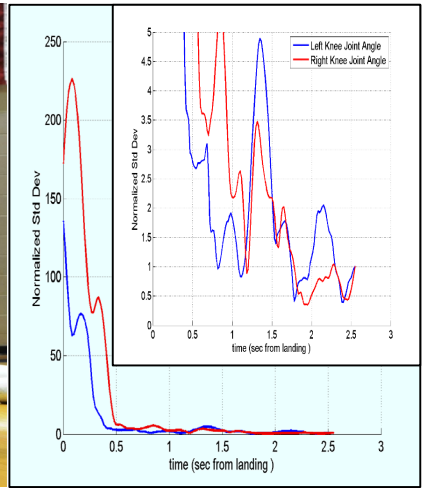
Psychological Data

Environmental Data



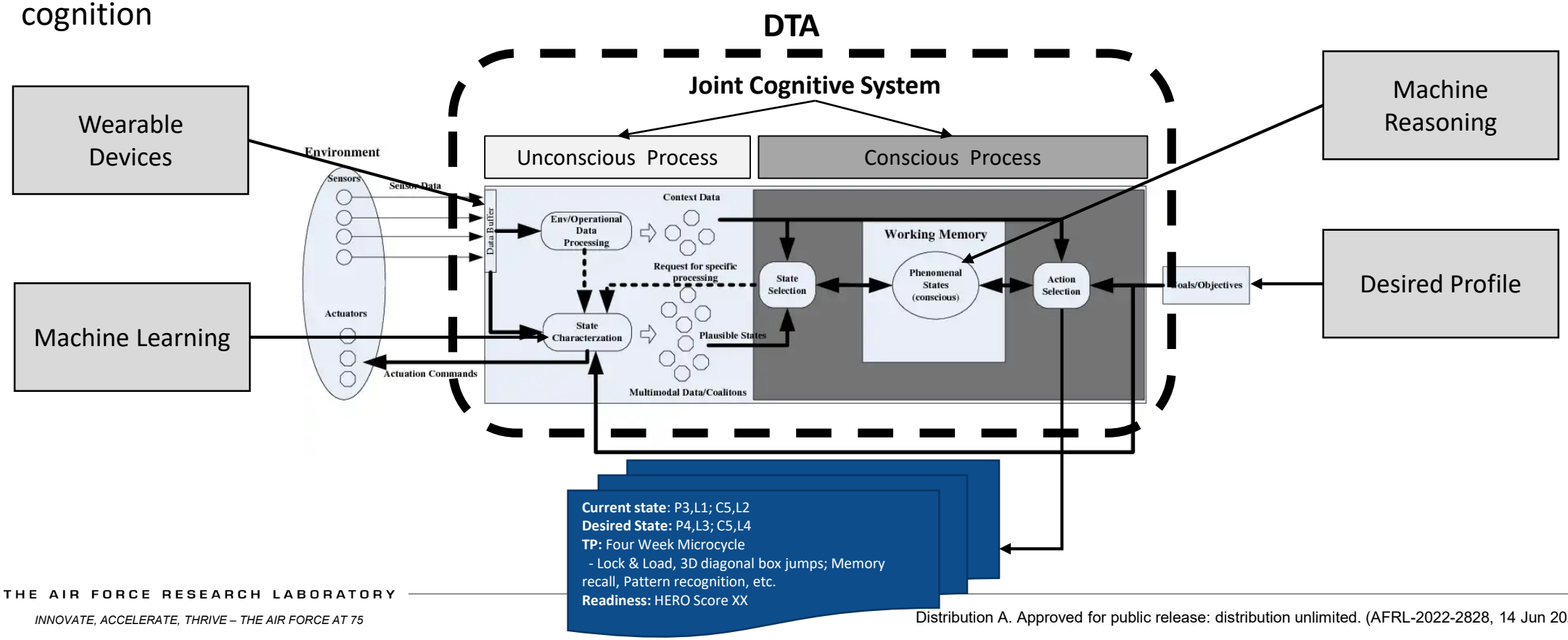
DTA Capabilities

- ✓ Establish baseline from initial assessment
- ✓ Calculate profile needed for successful task/job performance
- ✓ Compare baseline to task profile to determine the difference
- ✓ Create personalized, progression-based training plan to optimize performance
- ✓ Reassess Periodically



Conscious Architecture of State Exploitation (CASE)

- CASE is a general purpose architecture that autonomously generates state information to enhance decision making
- The CASE computational philosophy is inspired by the cognitive information processing of humans
- Specifically, CASE incorporates specific characteristics of the unconscious and conscious processes of human cognition

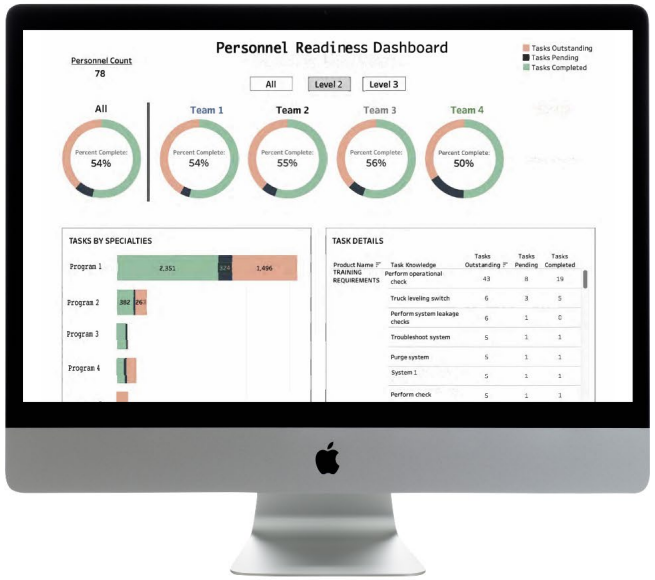


Performance Accelerator and Management Systems

Presented by Angie Sandritter, CEO of RippleWorx, Inc.

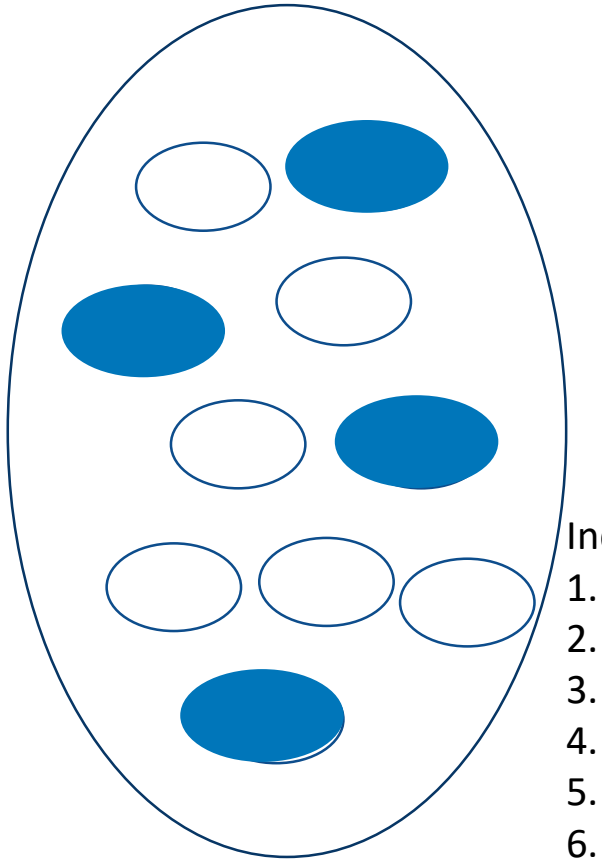
System Deployment - RippleWorx

A mobile and web-based solution, incorporating the framework and algorithms of HERO, using AI to automatically display the recommended, personalized interventions for individualized, optimum performance.



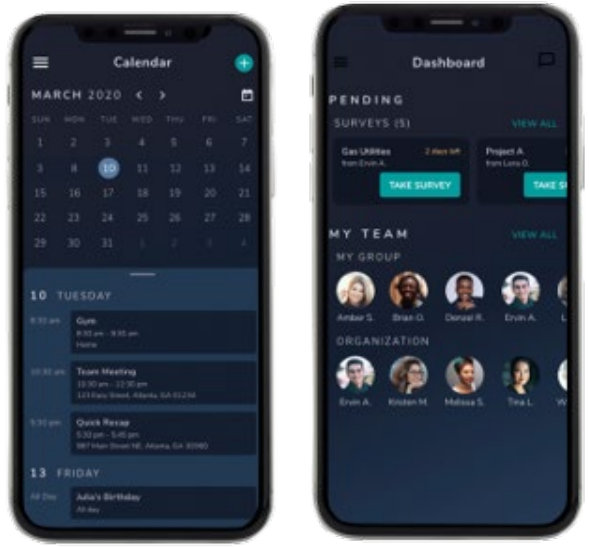
Dashboards display correlated data for loads, physical performance, cognitive performance (inclusive of motivational construct), and the "readiness" to perform. Targets can be set for each athlete and role – specifying where individuals need to upskill and how to motivate them. The machine can insert the right intervention and content to facilitate this individual performance improvement.

Individual Skills/Datasets Possibilities:



Dashboard view to manage success – individually, or for the team

Individuals receive a schedule and a training plan as well as see their progress towards a goal.



Individual Training and Conditioning is Determined, By:

1. Analyzing the collected data (biometric, surveys, performance, medical, environment, etc.)
2. Establishing a baseline for individual performance based on the Theory of Performance
3. Applying the “Target” set for that role and the level expectation based on the HERO framework & CASE
4. Determining which of the available skills (from the possibilities) will be the right set to upskill.
5. Applying that progressive training plan with individual specification.
6. Iterative measurement to determine success on target achievement.

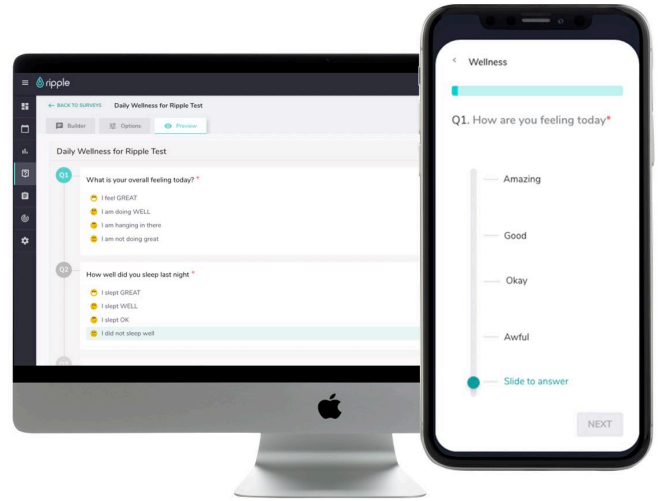
Individual Motivation

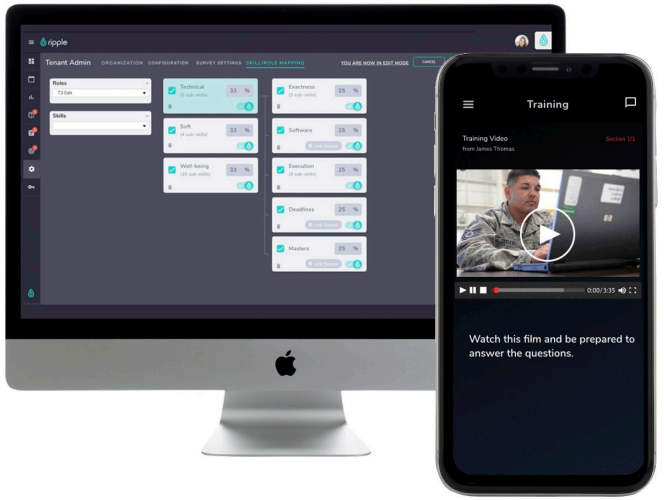
Motivated cognition refers to the influence of motives on various types of thought processes such as memory, information processing, reasoning, judgment, and decision making.

This can be based on both intrinsic and extrinsic motivational factors. This can drive their ability to physically perform.

People will be motivated by different goals and conditions. Even though people are motivated by different factors, in high performance sports, motivation is a key factor for achieving athletic performance.

Our platform uses domain-specific natural language processing (deep sentiment analysis) to understand contextual motivational-factors to individually drive performance.

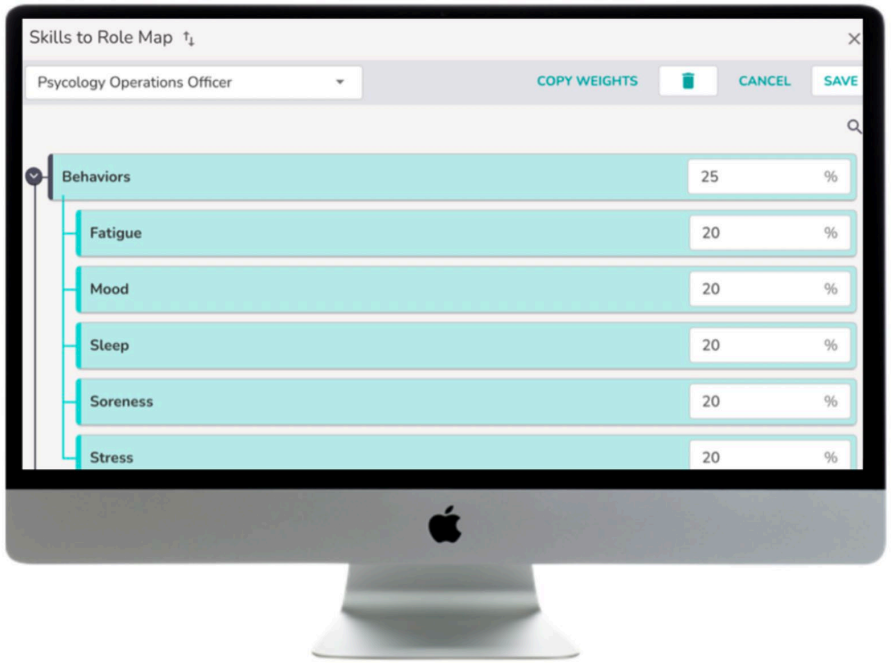




Individual Interventions: Cognitive, Physical and Psychological

Based on biometrics, sentiment analysis, athletes' qualitative responses, and performance on the field, this data is correlated and individual interventions can be recommended by a machine.

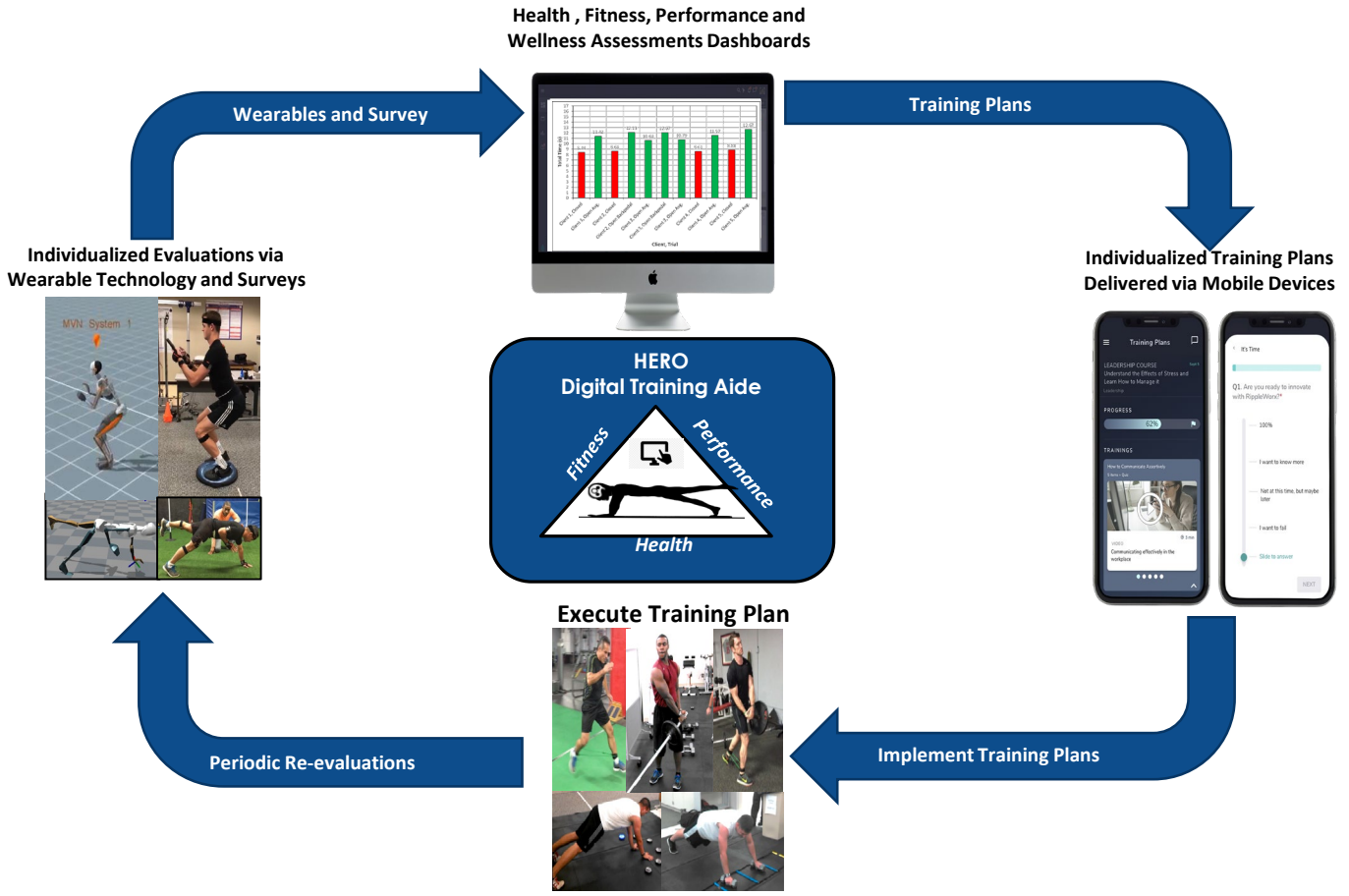
Resiliency, motivation, and conditioning do not happen quickly. It takes consistent behaviors and influences over time. This technology platform offers bite-size "nudges" training techniques to build resiliency, increase motivation levels and conditioning, ultimately impacting performance.



HERO Train the Trainer Pilot

Objectives:

- Demonstrate a secure, near real-time Wearable IoT capability
- Evaluate the efficacy of remote/virtual training versus in-person
- Demonstrate the ability to perform near real-time data analytics for human performance
- Demonstrate the ability to create intuitive dashboards for communication and decision making
- Demonstrate the ability to create appropriate workflows for a seamless human performance and life-cycle management system



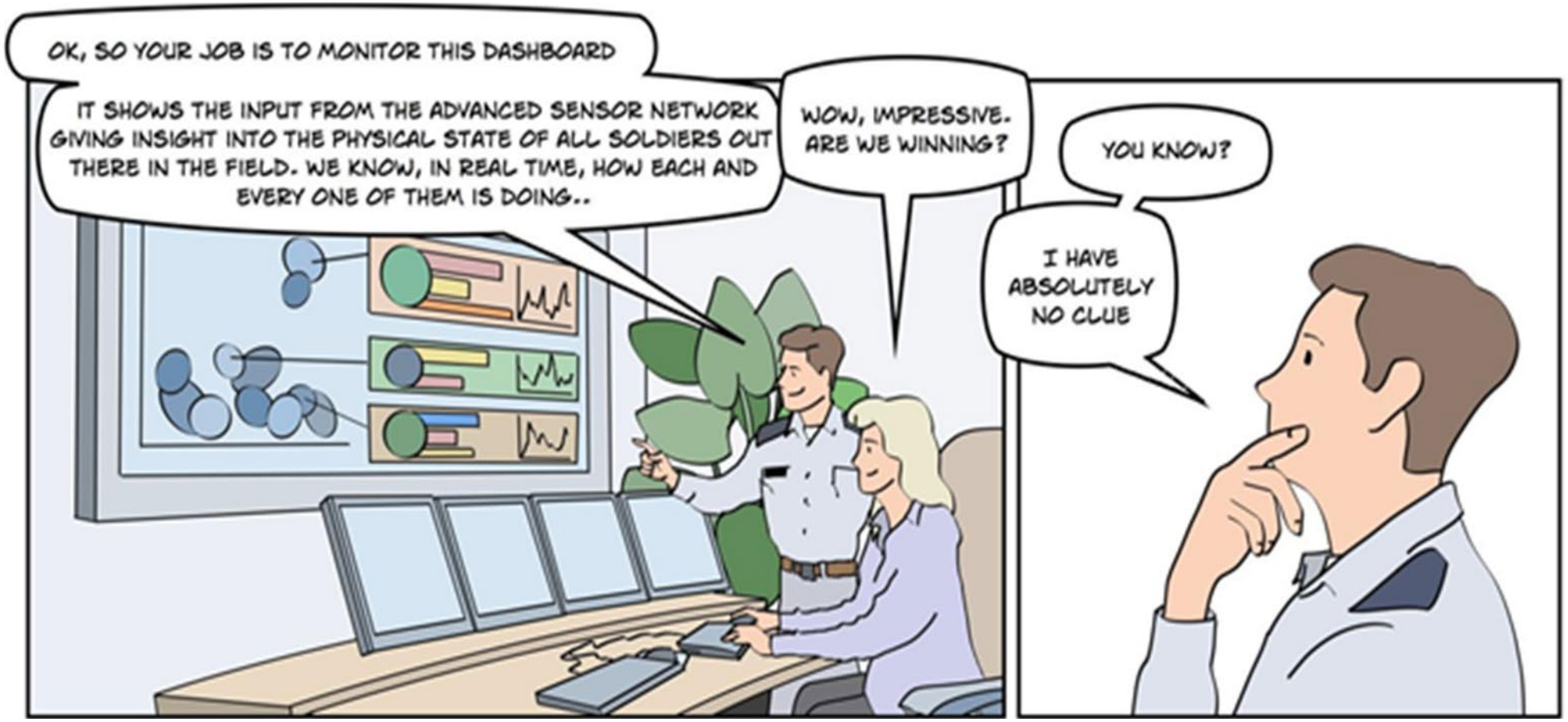
Summary

✓The HERO methodology delivers improved operational performance while enhancing overall health, fitness, resiliency and wellness

✓The HERO Digital Training Aides (DTA) uses data from wearable devices and sentiment surveys to enable evidence-based progression training and interventions to optimized overall performance and wellbeing

✓The HERO solution will enable effective personnel wellness, performance and life cycle management by providing real-time individual assessments via data analytics and recommending course of actions to the appropriate decision makers

Human Performance Monitoring?



Dr. John Flach, Mile Two, LLC; Emeritus Professor of Psychology at Wright State University