APTIMA®
Human-Centered Engineering®

Multi-Modal Data Collection System for Team Research: A Comprehensive Approach to Capturing and Measuring Team Processes

June 15th, 2022

Alexxa Bessey, Tara Brown, Robert McCormack, Kara Orvis, Michael Tolland

This work was supported by the U.S. Army Research Institute for the Behavioral and Social Sciences (W911NF-19-2-0173). The view, opinions, and/or findings contained in this session are those of the author(s) and should not be construed as an official Department of the Army position, policy, or decision.

Approved for Public Release

APTIMA®
Human-Centered Engineering®

Agenda

- Team Processes
- Unobtrusive Measures
- The TRAK Kit
- The RADSM Process
- Conclusion

APTIMA®
Human-Centered Engineering®

Team Processes

- Organizations are relying on teams to accomplish increasingly complex tasks.
- As a result, ample research has focused on team processes in order to better understand successful teams.
- Coordination has been identified as a team process that can impact important team outcomes.
  - Explicit Coordination
  - Implicit Coordination
- Within the military, coordination is important for mission success.

APTIMA®
Human-Centered Engineering®

Approved for Public Release

APTIMA®
Human-Centered Engineering®

Unobtrusive Measures

- Unobtrusive measures defined as measurements that are less intrusive and can be collected without utilizing subjective assessments of individuals.
- Elements of the military make utilizing unobtrusive measures especially desirable.
- Advancements in technology have created opportunities to use unobtrusive measures to examine different outcomes within organizational research and create a lot of data.

APTIMA®
Human-Centered Engineering®

Unobtrusive Measures and Data

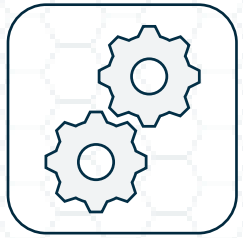
- While positive, unobtrusive data methodologies creates some problems:
  - They rely on custom-made hardware sensors that can be prohibitively expensive and unreliable.
  - They focus on single data modalities which fail to capture the larger context of the team.
  - They are tied to existing work systems and do not transfer well to novel environments and tasks.
  - They fail to accurately map onto constructs of interest at the measure level.

APTIMA®
Human-Centered Engineering®

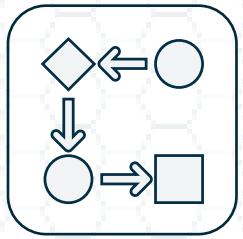
Approved for Public Release

APTIMA®
Human-Centered Engineering®

Research Objectives



Create a system to capture dynamic data

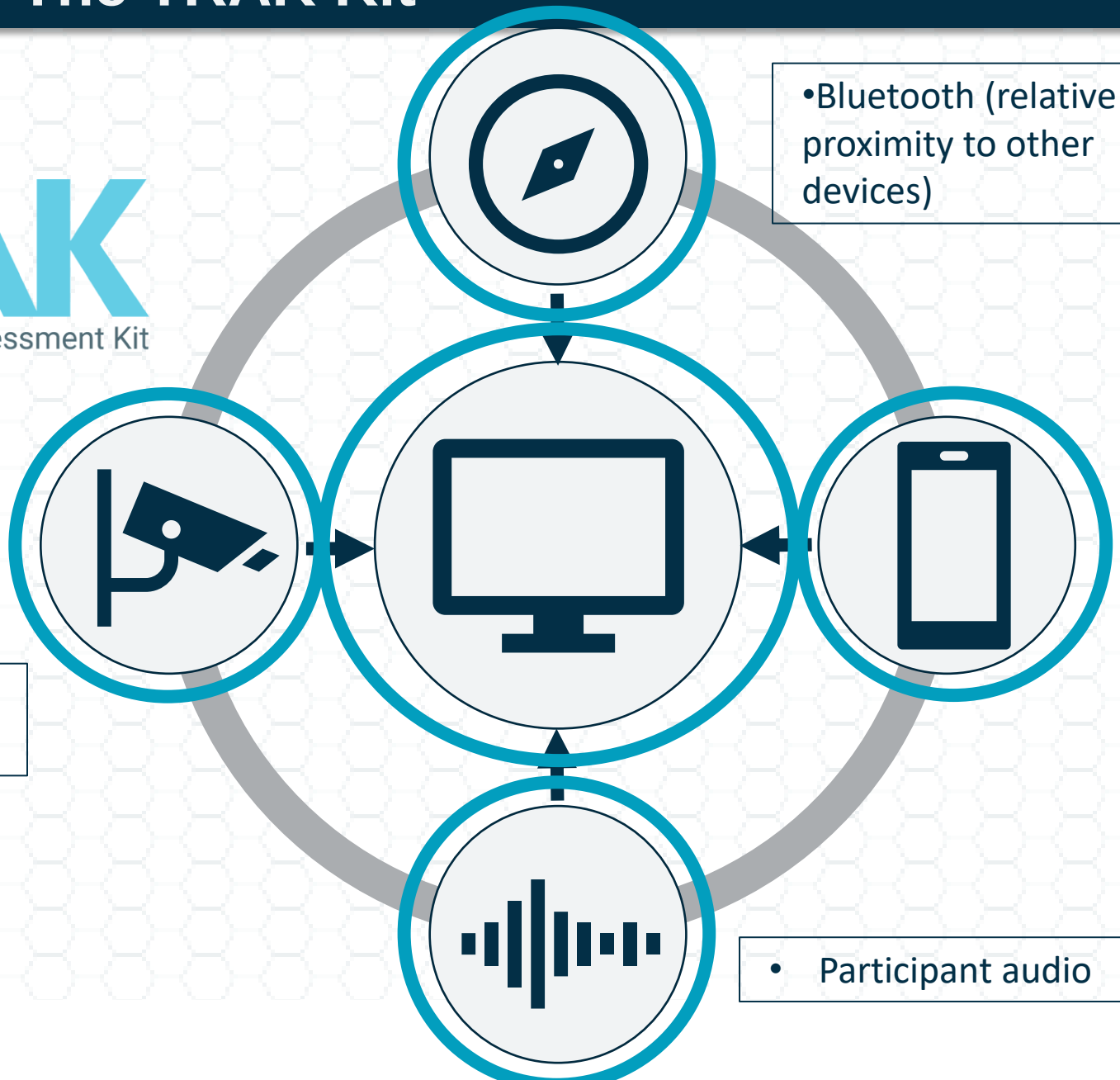


Create a process to analyze unobtrusive data

APTIMA®
Human-Centered Engineering®

The TRAK Kit

TRAK
Team Research Assessment Kit



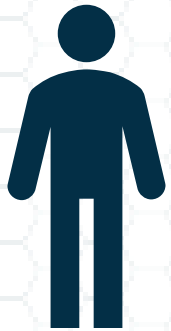
- Continuous video stream

•Bluetooth (relative proximity to other devices)

- GPS
- Bluetooth
- Accelerometer
- Gyroscope (angular velocity)

- Participant audio

APTIMA®
Human-Centered Engineering®



Approved for Public Release

APTIMA®
Human-Centered Engineering®

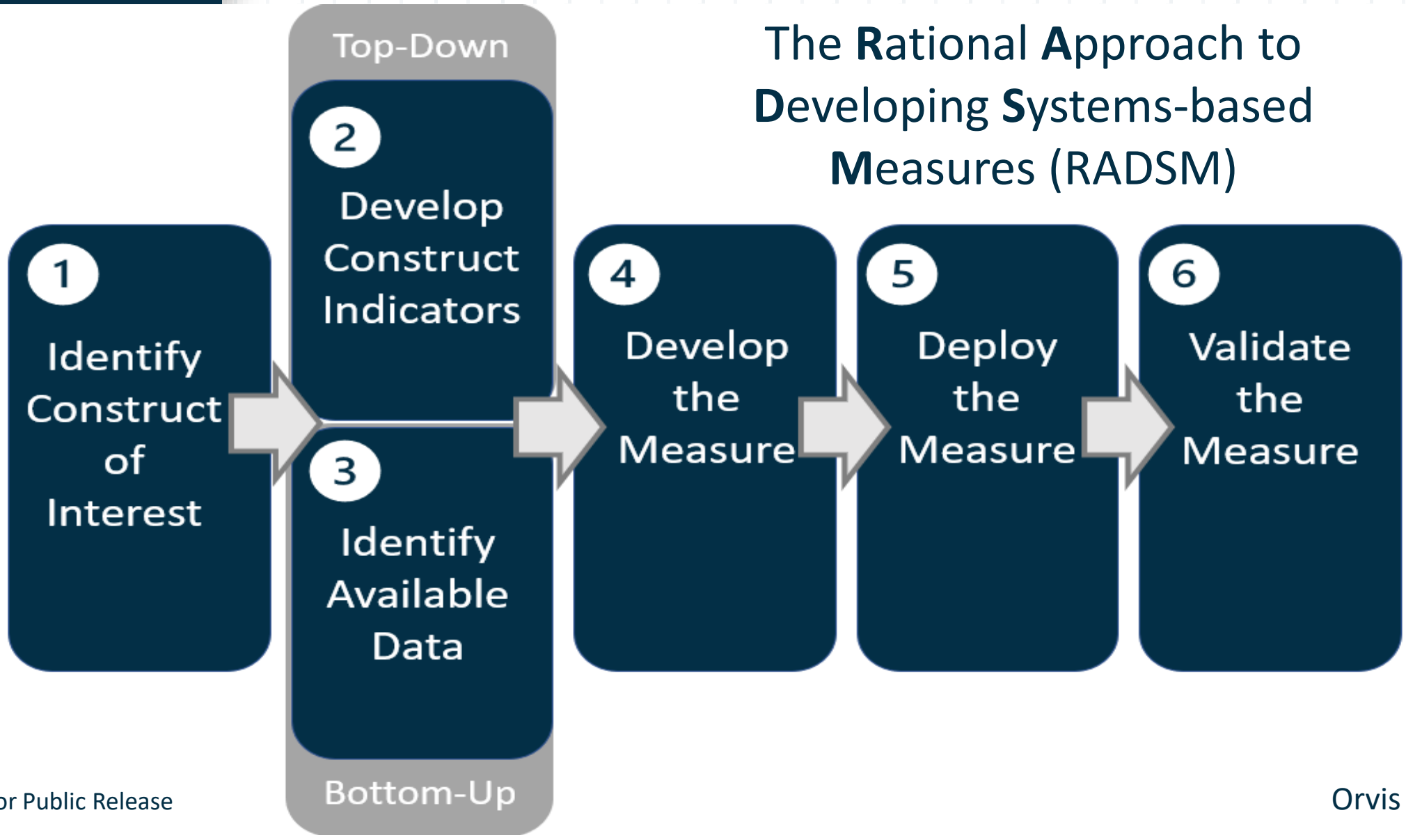
The TRAK Kit

Approved for Public Release

APTIMA®
Human-Centered Engineering®

The RADSM Process

The **R**ational **A**pproach to **D**eveloping **S**ystems-based **M**easures (RADSM)



Orvis et al., 2013

APTIMA®
Human-Centered Engineering®

The RADSM Process

- **Step 1**: Identify construct of interest
- **Step 2**: Complete a thorough literature review and develop construct indicators by identifying definitions of coordination and extracting attributes and behaviors of coordination

Attribute/Behavior	Type of Coordination
Makes plans	Explicit
Discuss strategy/priorities	Explicit
Communicates/defines responsibilities	Explicit
Communicate/negotiate deadlines/timelines	Explicit
Asks questions	Explicit
Asks for assistance/help/direction	Explicit

- **Step 3**: Identify available unobtrusive data sources
- **Step 4**: Develop measure
  - Communication
  - Proximity
  - Movement

APTIMA®
Human-Centered Engineering®

The RADSM Process

Audio

- Total team communication
- Proportional team communication
- Total role-specific information shared
- Proportional role-specific information shared
- Total acknowledgements
- Total questions

GPS/Bluetooth/ Accelerometer

- Total team movement
- Proportional team movement
- Total team proximity
- Proportional team proximity

APTIMA®
Human-Centered Engineering®

Conclusion

- Advancements in technology have provided new and innovative approaches to capturing different team processes.
- Previous research has highlighted concerns with current approaches to developing and implementing unobtrusive measures.
- The TRAK kit and RADSM process work together to offer a multi-modal data collection system as well as a systematic process to develop and validate unobtrusive measures.
- Project progress.

APTIMA®
Human-Centered Engineering®

Questions?

Alexxa Bessey, Scientist
Aptima, Inc.
abessey@aptima.com
630-624-5394

Dr. Tara Brown, Lead Scientist
Aptima, Inc.
tbrown@aptima.com
937-416-2136

www.aptima.com