

## Unobtrusive fNIRS sensors collect brain activity

Our noninvasive, miniaturized fNIRS sensors track cognitive state by measuring visible and infrared light reflectance in cortical tissue.



*fNIRS sensors can be integrated into standard gear, such as a helmet, and are easily worn without interfering with performance.*

We partnered with PLUX to create two miniaturized fNIRS sensors:

- **fNIRS Pioneer™** delivers all the necessary tools for single-channel fNIRS acquisitions in an affordable hardware kit
- **fNIRS Explorer™** ruggedized wearable records trainee performance in the field



*Typically applied on the forehead, fNIRS sensors estimate blood oxygen saturation level in brain tissue.*

Both fNIRS Pioneer and fNIRS Explorer capture high-quality signals at a fraction of the cost of current systems, and are available for purchase through PLUX (<http://plux.info>) or its resellers' network.

Charles River Analytics conducts cutting-edge AI, robotics, and human-machine interface R&D to create actionable, impactful solutions.

We were founded in 1983 to perform results-focused research for the US Government. We became an employee-owned company in 2012, setting the stage for the next generation of innovation, service, and growth. Today, our over 200 employees make a difference for a "who's who" in government and industry by delivering results on government programs and working with commercial partners.

We come to work every day because we want to advance technology to solve today's hardest problems. Our track record speaks for itself—our implemented solutions enrich the diverse markets of defense, intelligence, medical technology, training, transportation, space, and cyber security.

We owe our success to our expertise in advanced algorithms, machine learning, autonomous systems, advanced human-machine interfaces, agile software and hardware engineering, and to our enduring base of knowledgeable customers.

At Charles River Analytics, we turn research into results.

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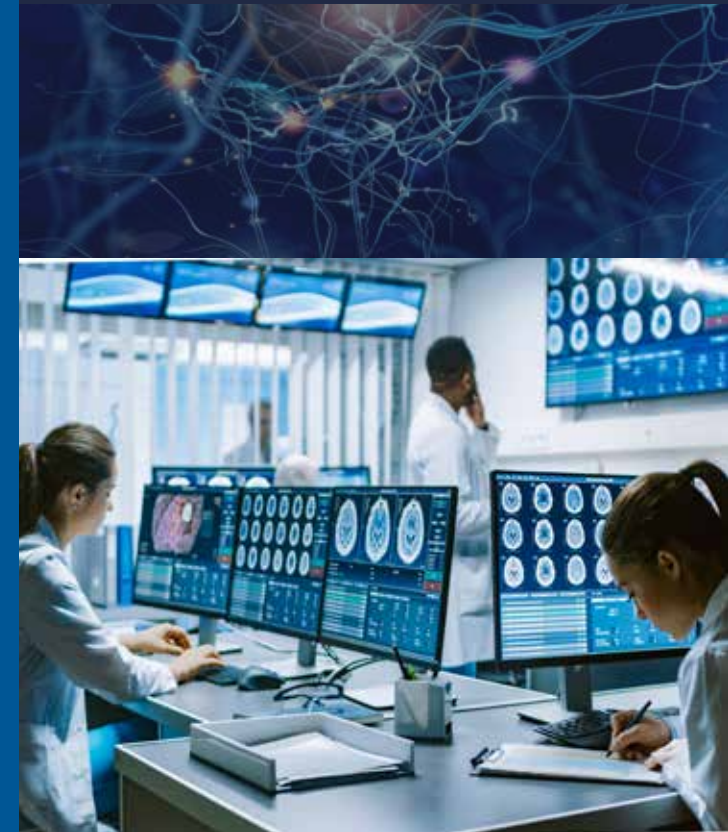
U.S. Prime Contractor



Employee-Owned Small Business

charles river analytics

# Assessing Human State



## Tracking cognitive workload for medical personnel

MEDIC's fNIRS sensors paired with our Sherlock™ software automatically sense indicators of cognitive workload that augment performance observations, offering insight into the factors underlying medical outcomes.



MEDIC uses fNIRS sensors mounted to a medic's helmet to measure indicators of cognitive load. A body-band device includes additional sensors to measure indicators of physical activity.

The sensors and Sherlock™ platform collect and process information about brain activity and deliver estimates of cognitive workload during training simulations.

In partnership with our collaborators across the country, we tested MEDIC both in the lab and in actual military medical simulations.

MEDIC will have far-reaching benefits for emergency management training groups, including FEMA, state and local governments, and first responder training.

## Measuring pilot physiology during flight training

PHARAOH uses fNIRS sensors to provide engineers with continuous, quantitative, and objective information on pilots during simulated flights. This information yields robust, high-quality assessments and insight into the experience of pilots via streaming physiological and contextual flight data.



We teamed with aviation subject matter experts from Rickard Consulting Group to unobtrusively test PHARAOH in simulated rotary and fixed-wing platform cockpits.

Modern rotary and fixed wing aircraft platforms pose unique decision-making challenges to the most important in-flight component—the pilot. Our PHARAOH platform alleviates cognitive burden for flight test pilots by:

- Measuring pilot physiology during flight with our unobtrusive fNIRS sensors
- Providing engineers with objective data on operator performance so they can design systems that alleviate cognitive workload
- Integrating seamlessly with live platforms and virtual flight simulators (by using the IEEE standard for distributed interactive simulation message format)

PHARAOH extends Sherlock™, our open and extensible software and hardware platform that lets users rapidly reason about human physiological, neurological, and behavioral data.

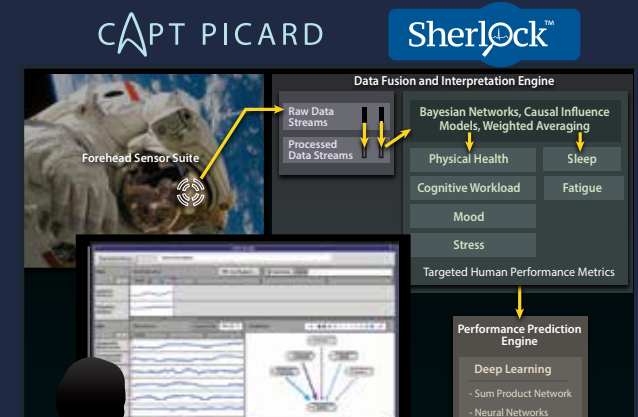
## Measuring astronauts' cognitive workload

CAPT PICARD uses the fNIRS Pioneer™ sensor to assess astronaut workload and performance during the testing and evaluation of new NASA systems.



We used the measurements from CAPT PICARD to determine how best to display space vehicle system status on the Orion space vehicle.

We implemented the fNIRS Pioneer in NASA workload assessment tests. The result: fNIRS Pioneer successfully identified real-time physiological measures that contribute to high workload. Detection early in the design phase makes redesigns more feasible and less costly.



CAPT PICARD is built on Sherlock™, which provides a unified, end-to-end solution to rapidly prototype applications.