



U.S. National Science Foundation
Directorate for Technology, Innovation
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Project Title

Field-Adaptable Chemosensors Solutions with Local Neuromorphic Intelligence

Awardee

Teledyne FLIR Defense, Inc.

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Directorate for Technology, Innovation and Partnerships

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Convergence Accelerator: Real-World Chemical Sensing Applications Track

Directorate for Technology, Innovation and Partnerships

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PROJECT ABSTRACT

Law enforcement and U.S. Customs and Border Protection (CBP) agents face an unprecedented challenge to reliably detect illicit substances in counterfeit pills at the point of seizure. Alarming, 70% of pills confiscated last year contained fatal doses of fentanyl. Complex mixtures used to mask minute amounts of lethal drugs and the ongoing creation of new illicit substances by bad actors challenges current analytical equipment. CogniSens is a computing platform that uniquely enhances chemical sensor function and usability in real-world scenarios. Cornell University has developed novel algorithms ported onto Intel's compact computing chip (Loihi 2) to create CogniSens. The algorithm and the chip leverage neuromorphic computing, designed to mimic how the brain rapidly learns, adapts to new environments and makes decisions using very little energy. When combined with a sensitive, portable chemical detector, the CogniSens platform will enable the in-field drug identification needed to disrupt the illicit substance supply chain.

In Phase 2, Teledyne FLIR and Cornell University will provide a solution by integrating the CogniSens platform into an equally disruptive and novel field-portable opioid monitor developed by Teledyne FLIR and the U.S. Department of Defense. The opioid monitor uses two-dimensional tandem mass spectrometry (2D MS/MS), which has proven sensitivity to low concentrations of fentanyl that other detectors lack and excels at examining complex mixtures in less than five seconds. The CogniSens-2D MS/MS combines chemical fingerprinting with cognition-like analysis to classify challenging samples on-device and provide automated answers for the end user. The resulting CogniSens-2D MS/MS instrument will represent a new generation of tools for operators and field agents fighting the war against illegal drug trafficking by enabling a user-friendly, portable detection and deconvolution of complex drug mixtures.