NICS: Streamlining Emergency Response Around The Globe

Massachusetts Institute of Technology Lincoln Laboratory

Wildfires set acres ablaze. Earthquakes decimate towns into rubble. People go missing in mountains and bodies of water. Coronavirus cases surge globally.

When disaster strikes, timely, cohesive emergency response saves lives, reduces property and resource loss, and protects the environment. Large-scale incidents can call into action thousands of first responders from multiple jurisdictions and agencies, national and international. To effectively manage response, relief, and recovery efforts, they must collaborate to collect, process, and distribute information from disparate systems. Lack of interoperability can hinder coordination and cause significant failures.

To enable coordinated response, the Massachusetts Institute of Technology (MIT) Lincoln Laboratory developed a web-based software tool: the Next-Generation Incident Command System (NICS). At its core is an incident map overlaying aggregated data from external and internal sources such as ground-based first responders, airborne imaging sensors, weather and traffic reports, census data, and satellite-based maps. Emergency personnel upload content on a computer or mobile app and communicate in real time through chat functions and traditional channels. Collaboration rooms host personnel focusing on specific needs (e.g., air drop support, search and rescue, wildlife rescue). With its open-standards architecture, NICS interoperates with organizations' existing systems and facilitates external sharing of internal data for enhanced visibility and awareness among users as a disaster unfolds.

Since its 2010 development, NICS has cultivated a global community of users and inspired spinouts to maximize impact. Its worldwide usage has continued expanding across natural disaster response, search-and-rescue operations, health crises management, public event management, and aviation safety.

Engaging with stakeholders to develop NICS

In 2007, Lincoln Laboratory partnered with California Department of Forestry and Fire Protection (CAL FIRE) to build an architecture for information sharing, situational awareness, and decision-making. CAL FIRE—which annually responds to thousands of wildfires in collaboration with police, medical, and other services—provided firsthand insight into what information is critical during emergency response and how it may be best viewed and shared.

With this insight, the Laboratory developed a NICS prototype. Under Department of Homeland Security Science and Technology Directorate sponsorship, the Laboratory team refined NICS, soliciting input from an organically formed users' group comprising more than 450 organizations across fire, law, medical, emergency services and management, border patrol, industry, utilities, nongovernmental organizations, and tribal partners. Thousands of training exercises and real emergencies employed NICS for disaster management, law enforcement, and special security response.

In 2014, CAL FIRE adopted NICS statewide, and Emergency Management Victoria, Australia, implemented NICS to manage large-scale crises like bushfires.

"We compressed the time of developing our situational awareness from 12 hours to 12 minutes." — CAL FIRE agency chief

Seeing NICS' early impact, the Laboratory explored options for technology transfer. The Laboratory's Technology Transfer Office (TTO) played a key role in evaluating and facilitating this transition. The TTO considered many traditional pathways and ultimately selected an open-source route to make NICS broadly available to the international community. The hope was to establish a diverse user community enabled to shape NICS into an impactful, application-targeted tool. The TTO coordinated the necessary steps to publish the code while ensuring compliance with institutional and government sponsor requirements. After the software base code was made available worldwide at no cost through an open-source release on Github and Google Play, it rapidly evolved to better meet user needs, including multilingual functionality and accessibility in regions without cellular coverage.

In 2016, under a NATO pilot program, NICS was deployed in Bosnia and Herzegovina (BiH), Croatia, North Macedonia, and Montenegro. A follow-on NATO program is now establishing NICS as the national disaster management platform in BiH and bringing NICS to Albania and Georgia for search and rescue, particularly in response to chemical, biological, radiological, and nuclear events. NICS has helped locate missing persons in BiH's Miljacka and Bosna Rivers; informed North Macedonia residents about COVID-19 cases and health resource locations; and shown utility in mine and unexploded ordnance detection and clearance in BiH, where an estimated 80,000 explosive war remnants threaten residents.

"Unlike other geographic information systems, NICS makes it possible for a large number of users to work in the system and to deliver and gather information within their jurisdiction in real time." — Mirnesa Softić, BiH Ministry of Security

NICS has also been used to direct ambulances to hypothermic runners at the Los Angeles Marathon and to provide situational awareness among the National Guard for Fourth of July Celebrations in Boston, Massachusetts. In 2021, the Massachusetts Department of Transportation Aeronautics Division introduced a new web-based version of NICS to monitor small uncrewed aircraft systems for statewide aviation security. Envisioned applications

include critical infrastructure (e.g., utilities) monitoring and integration with wearables to monitor first-responder health.

The TTO strategy to transfer NICS code to the largest user base also encouraged the creation of companies seeking to increase system access. In 2015, CAL FIRE personnel formed a public benefit corporation and transitioned NICS into a robust operational platform. In 2023, NICS lead developer Stephanie Foster co-founded Generation NYX, which renamed NICS as NYX DEFENDER.

"Our use of NYX DEFENDER during major City of Providence events has allowed us to integrate situational awareness between multiple public safety entities, private security, and event organizers and assisted us in ensuring our teams have the information they need to provide well-organized and coordinated public safety services to members of our community and visitors." —Clara Decerbo, Providence Emergency Management Agency

From a research lab prototype to a mature open-source tool with global humanitarian impact, NICS has fundamentally shaped how crises are managed, accelerating and streamlining response and ultimately saving lives.

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