

NATIONAL SCIENCE FOUNDATION
Proposal Abstract

Proposal:1937099

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Proposal Title: Convergence Accelerator Phase I (RAISE): The Urban Flooding Open Knowledge Network
Institution: University of Cincinnati Main Campus
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The NSF Convergence Accelerator supports team-based, multidisciplinary efforts that address challenges of national importance and show potential for deliverables in the near future.

The broader impact and potential societal benefit of this Convergence Accelerator Phase I project is to minimize economic and human losses from future urban flooding in the United States. Floods impact a series of interconnected urban systems (referred to in this project as the Urban Multiplex) that include the power grid and transportation networks, surface water and groundwater, sewerage and drinking water systems, inland navigation and dams, and other system, all of which are intertwined with the socioeconomic and public health sectors. This project uses a convergent approach to integrate these multiple interconnected systems and merges state-of-the-art practices in hydrologic and hydraulic engineering; systems analysis, optimization and control; machine learning, data and computer science; epidemiology; socioeconomics; and transportation and electrical engineering to develop an Urban Flood Open Knowledge Network (UF-OKN). The UF-OKN will be built by bringing together academic and non-academic researchers from engineering, computer science, social science, and economics. The UF-OKN is envisioned to empower decision makers and the general public by providing information not just on how much flooding may occur from a future event, but also to show the cascading impact of a flood event on natural and engineered infrastructure of an urban area, so that more effective planning and decision-making can occur.

The real impacts of flooding across the Urban Multiplex is currently unquantifiable because many of the systems, although interconnected, are independently designed and managed. Therefore, an open knowledge network that facilitates detailed understanding of the interconnectedness of these systems and how they impact each other is critically needed. An important gap that this Phase I effort will fill is the development of a common set of ontologies for describing and traversing the data relationships among Urban Multiplex subsystems. This Phase I effort will lay the groundwork for a production-scale UF-OKN in Phase II but will also make publicly available the prototype UF-OKN and its applications. The outcome of a potential Phase II project would be a fully functional UF-OKN that would respond to plain English Internet queries with actionable information on what infrastructure across the Urban Multiplex would be impacted during storms and flooding, facilitating both short-term and long-term planning with information on sustainability metrics associated with different decisions. This deliverable would be potentially transformative to researchers, decision-makers and the general public in terms of how they engage with and act upon information about urban flooding.

This award reflects NSF's statutory mission and has been deemed worthy of support

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through evaluation using the Foundation's intellectual merit and broader impacts review criteria.