

RISK AND RESILIENCE

\$31,150,000
-\$11,790,000 / -27.5%

Overview

The economic competitiveness and societal well-being of the United States depend on the affordability, availability, quality, and reliability of the infrastructure services provided. These infrastructure services include transportation (road, rail, air), energy (electricity, gas, oil, renewable), water, communications and networks (wireless and wired, including the internet), banking and finance, and many other components. The increased penetration and use of modern technologies have improved our Nation's productivity and quality of life. These technologies are now becoming deeply embedded into our society via wireless and wired networks, smart phones, and other edge devices, embedded systems, sensors, and social networks. As a result, the availability of real-time information about the state of these complex cyber-physical infrastructure systems is truly unprecedented.

Our increasing dependence on infrastructure services has increased the impact of risks that may cause these systems to fail. Risk severity can be understood as the product of the probability of an event and the magnitude of the event's consequences. These risks arise from at least two distinct sources: (a) extreme natural events such as tornadoes, hurricanes, storms, earthquakes, and space weather and (b) man-made events such as terrorist attacks and human errors. There are indications that extreme weather events may become more frequent in the future, which highlights the importance of quantifying the potential impacts.

Through the Risk and Resilience investment area, NSF aims to improve predictability and risk assessment and to increase resilience that will reduce the impact of extreme events on our lives, society, and the economy. NSF is uniquely positioned to support such advancements, as they require multidisciplinary expertise in science, engineering, social and behavioral sciences, and education.

The Risk and Resilience investment began in FY 2016 and is planned to continue through FY 2019.

Anticipated broad outcomes at the end of this initiative include:

- A comprehensive and integrated risk and resilience knowledge base useful for informed decision-making and risk mitigation;
- New, synthesized approaches that will improve resilience, interoperations, performance, and readiness in Interdependent Critical Infrastructures (ICIs), and;
- Advanced understanding of the organizational, social, psychological, legal, political, and economic obstacles to improving ICIs, the strategies for overcoming these obstacles and the role of these advances in the context of increasingly smart and connected communities.

Goals

- Goal 1: Advance knowledge of risk assessment and predictability through support for improvements in our ability to understand, model, and predict extreme events and natural hazards. This goal is supported by a focused research effort, Prediction of and Resilience against Extreme Events (PREEVENTS), that will help us to better understand and mitigate the risks posed to the U.S. by natural hazards.
- Goal 2: Support the creation of tools and technologies for increased resilience, including novel engineered systems solutions for resilient infrastructures, particularly those that leverage the growing infusion of cyber-physical-social components into the infrastructures. This goal is supported by the Critical Resilient Interdependent Infrastructure Systems and Processes (CRISP) program.

FY 2018 Investments

In FY 2018, PREEVENTS, at \$17.75 million, and CRISP, at \$12.90 million, will continue, as will some contributing activities, at \$500,000.

In the PREEVENTS program, awards have focused on earthquakes, sinkholes, volcanic activity, plate boundaries, tsunamis and tropical cyclones. Workshops have fostered community expansion on relevant but underdeveloped disciplinary and cross-disciplinary problems. Research Coordination Networks (RCNs) supported in FY 2017 have enabled groups of investigators to share information and ideas; coordinate research activities; foster synthesis and new collaborations; develop community standards; and advance science and education through communication and sharing of ideas across disciplinary, organizational, geographic, and international boundaries. These new networks are increasing understanding of current risk and resilience issues and knowledge gaps, thus informing FY 2018 solicitations. Going forward, emphasis will be placed on synthesis of results and identifying areas for needed research and improving dissemination of information to end-users.

CRISP projects supported new research on topics that included interdependent energy and water systems, decision making in emergency healthcare response systems, and resilience of financial infrastructures in response to extreme events. CRISP projects planned for FY 2017 will catalyze collaborations among researchers across the domains of engineering, computer and computational science, and the social/behavioral/economic sciences. These awards will create theoretical frameworks and multi-disciplinary models of ICIs, including in the context of smart and connected communities to inform future investments. In FY 2018, the CRISP program will promote research on ICI systems and processes and educate the next generation of scientists and engineers be able to improve the resilience of our infrastructures in the face of changing and increasing risks. The projects supported will make ICI services more effective, efficient, dependable, adaptable, resilient, safe, and secure, taking into account the human systems in which they are embedded.

In addition, \$500,000 for contributing activities includes two interagency activities, one with the Department of Energy on the modern power grid and the other with the National Geospatial Intelligence Agency (NGA) developing algorithms for analyzing large datasets.

**Risk and Resilience
Funding by Directorate**

(Dollars in Millions)

Dir/Office	FY 2016 Actual	FY 2017 (TBD)	FY 2018 Request
CISE	\$5.98	-	-
ENG	12.00	-	10.00
GEO	16.75	-	17.25
MPS	2.31	-	0.50
SBE	4.90	-	2.90
OPP	1.00	-	0.50
Total, Risk and Resilience	\$42.94	-	\$31.15