



ENGINEERING FOR CLIMATE EXTREMES PARTNERSHIP

STRATEGIC PLAN 2016 - 2021

Society is increasingly vulnerable to high-impact weather and climate events. In addition to potential changes in hazard intensity and frequency, societal vulnerability and hazard exposure are exacerbated by increasing populations, development in hazard-prone areas, loss of protective natural features, increasing pressures on limited natural resources, and fragmented risk mitigation activities. The Engineering for Climate Extremes Partnership® (ECEP®) is a multidisciplinary network between research scientists and those involved in resilient decision-making aimed at reducing this vulnerability.

ECEP® is a multidisciplinary network between academics and those involved in resilient decision-making aimed at reducing impacts from extreme events.

Hosted by the National Center for Atmospheric Research (NCAR), ECEP facilitates a more comprehensive understanding of the scientific advances required to address societal resilience to weather and climate extremes, together with the development of relevant community support. ECEP contributes to NCAR Imperatives to *conduct innovative fundamental research to advance the atmospheric and related sciences and*

develop, deliver and support a suite of advanced community models.

The core strengths of ECEP are its diversity of perspectives, collaborators, approaches, and public and private interactions - together with NCAR's world-class scientific capabilities and transformative leadership role in developing and hosting community modeling resources, data development, and communication capabilities. ECEP extends NCAR's role as an integrator of the earth science communities by incorporating earth science advances with impact management communication and support.

ECEP VISION

EMPOWERING RESILIENT DECISIONS FOR WEATHER AND CLIMATE EXTREMES THROUGH COLLABORATION

Partners are a critical component of ECEP, which is fundamentally community driven. ECEP brings communities of practitioners together to share support tools and to build resilient decision-making capacity. Partners drive the iterative interactions at the intersection between user-driven functional requirements and applied scientific research.

This strategic plan sets out ECEP's approach, priorities and resource requirements for the next five years. However, it should not be considered in isolation. Key to resolving the resilience challenges faced by society are: integration with

core scientific research; contributions to tool identification and development; targeted and nuanced outreach; and maintaining a diverse membership. Input from the ECEP Advisory Panel is also critical. The Advisory Panel provides advice on the strategic directions and major initiatives undertaken by ECEP, with a focus on community, scientific, engineering and business challenges. In particular, advice will be sought on improving the efficacy of ECEP, supporting initiatives to make leading-edge research available to the community at large, and achieving the ECEP goals through appropriate funding.

ECEP[®] MISSION

Enabling improved societal planning to reduce the impacts of weather and climate extremes through:

- Collaborative partnerships between academia, governments, businesses and local communities
- Exploring the potential application of cutting-edge engineering, science and technology
- Sharing and building upon available best practices to support community-led decision-making
- Reducing catastrophic impacts through a range of approaches to understand, communicate and manage risk, including graceful failure.

The Engineering for Climate Extremes Partnership[®] was established to support decision-makers with information and expertise, and to enable them to anticipate and make resilient choices in the face of changing environmental and societal realities. The path forward can be summarized by two Grand Challenges.

ECEP GRAND CHALLENGES

1. *Two-way communication of specialist knowledge and data to build capacity for resilience to extreme weather and climate impacts, and identifying scientific research that is societally relevant.*
2. *Capacity building through a well-informed and responsive community, that understands and embraces the dynamic and iterative nature of vulnerability, exposure, hazard, impact, and related natural and human responses.*

The first of these challenges relates to an issue that is common across disciplines and organizations – updating current decision protocols to account for the dynamic and changing nature of climate and weather extremes, exposure and vulnerability. While multiple sources of risk information exist, the accuracy and clarity varies widely and is not well framed to those who may benefit. Decision-makers often lack the support to move from identifying current risk, to implementing decisions to minimize the risk and enhance resilience. Further, they operate in complex decision-making environments with multiple overlapping demands, regulatory and financial constraints. Yet navigating the myriad of available information is complicated by a lack of:

- Basic understanding of where such knowledge and data may be obtained
- Technical and computing capabilities, and
- Appropriate tools that access the available information and deliver it in a manner relevant to societal planning.



The second challenge encapsulates approaches to provide such tools to help manage the multiple demands and constraints faced by decision-makers, in addition to developing approaches to communicate the inherent uncertainty in different sources of information.

By accepting that it is impossible to prevent all consequences of extreme events, ECEP advocates a **Graceful Failure** approach to strengthen societal resilience. Graceful Failure accepts that some failures are inevitable and seeks to incorporate strategies to manage them in ways that minimize loss of life or property and allow a rapid recovery. This approach balances societal, economic and environmental factors to advance resilience through integrated and dynamic decisions that leverage expertise from diverse institutions and individuals. Graceful Failure arose from initial ECEP meetings and more refined or alternative approaches may emerge through conversations with Partners over the course of the next five years. The underlying philosophy is to help plan for resilient and rapid societal response in a manner that reduces the overall impact of failure.

In addressing these Grand Challenges over the coming five years, ECEP will focus on the following major areas.

Collaborative Partnership

Partners are critical to the success of ECEP[®]. They come from the physical and social sciences, engineering, industry, government, and non-government organizations. Their combined expertise and experience enables solutions that reduce the adverse impacts of extreme events. Partners actively contribute to this dynamic and benefit through enhanced decision-making capacity or productive new research and funding proposals. This collaboration emphasizes:



- Engaging academics and practitioners with those involved in the decision-making process - from data development to implementation - in an on-going two-way dialogue
- Leveraging cultural and technical diversity
- Matching user needs and cutting-edge science, engineering and technology
- Facilitating equitable negotiations of acceptable risk, failure and loss, to enable rapid recovery.

Understanding and Communicating Risk and Impact Reduction Approaches

Communicating scientific advances, or changes in hazards, vulnerability and exposure is an important aspect of ECEP. However, the focus here is on utilizing related research into communication mechanisms rather than advancing the science of communication. ECEP aims to:

- Provide a forum for the exchange of ideas, issues and solutions to empower resilient decision making
- Communicate the scientific rigor behind decision-support tools and products
- Communicate approaches to enable Graceful Failure of critical systems
- Produce clear terminology and definitions.

Decision-Relevant Science

Understanding decision processes will both clarify the mechanisms by which information and its uncertainty can be better delivered, and identify related knowledge and gaps. This in turn will identify future basic- and applied-research needs. Thus, ECEP will:

- Contribute to the scientific understanding of the interactions between society and weather and climate extremes
- Enhance the understanding of potential impact information with assessments of certainty
- Transform how scientists and practitioners conceptualize and use potential impact information
- Identify gaps where research is needed to support user needs.

Decision Support

ECEP is the vehicle by which basic and applied scientific research becomes societally relevant. The communications and collaborations inherent to ECEP are a critical component of this transfer. But tools are also required to mine the very large databases and provide information relevant to decision and planning activities. Here ECEP partners support and provide feedback to the prioritization and development of tools within the NCAR-supported Global Risk, Resilience, and Impacts Toolbox (GRRIT). A separate document addresses the GRRIT strategy. In developing these tools, ECEP will prioritize:

- Understanding and simplifying complex decision-making environments to better support community needs
- Identifying possible entry points in existing decision protocols to further community resilience capability and capacity
- Identifying decision-support products and needs
- Exploring the incorporation of Graceful Failure approaches - or other emergent philosophies - to manage risk.