

Translating Research into Practice

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ABSTRACT

Civil engineering infrastructure including transportation networks, power distribution systems, communication grids, as well as buildings, need to be resilient to hurricanes, tornadoes and other severe windstorms. These infrastructures depend on codes and standards for their design. However, translating research results into standards and codes take many years and sometime a generation.

The National Science Foundation (NSF) provides grants to university faculty to pursue basic research in civil infrastructure. Basic research results are published in journals and proceedings. However, these results are not in a form ready for implementation by industry in practice. The Industry/University Cooperative Research Center (IUCRC) program at NSF is one vehicle through which research results are translated into practice quickly. The partnership between government, university and industry can lead to a powerful consortium, which produces research results useable by the industry. Concept of this partnership and flow of research into commercial deployment is in Figure 1.

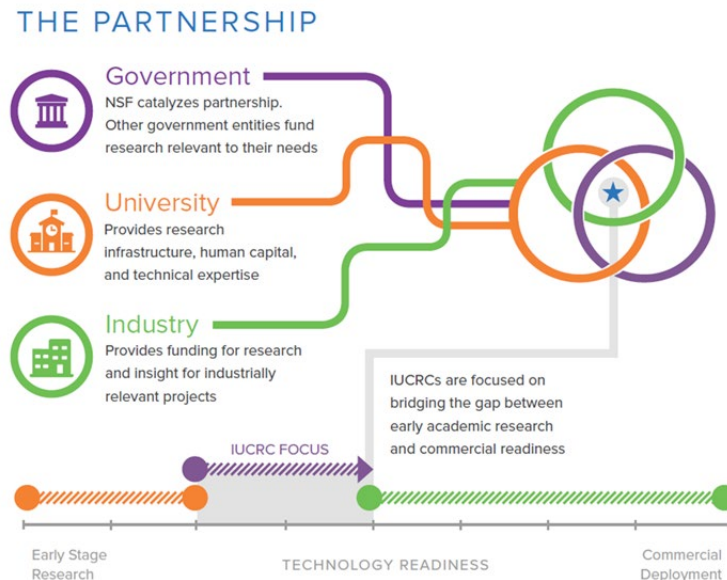


Figure 1. Flow of research to implementation (Source: NSF solicitation 20-570)

The figure shows that the university faculty through grants from NSF or other sources complete early stage research (orange line along abscissa). Under the IUCRC (purple line), university faculty advance that research with applications in mind. Industry members acting as mentors guide the research direction for its use by the industry. The results from the IUCRC research is adapted by industry for use in practice (green line). A Wind Hazard and Infrastructure Performance (WHIP) Center is established under the NSF IUCRC program to promote rapid deployment of windstorm resiliency research into practice.

The WHIP Center consists of three academic Institutions, Texas Tech University in Lubbock, Texas, Florida International University in Miami, Florida, Florida Institute of Technology in Melbourne, Florida and several industry members. The Center pursues research of interest to industry to enhance the resiliency of buildings and infrastructure to extreme windstorms such as hurricanes and tornadoes. The principal research themes of the Center are characterization of wind hazards, assessment of vulnerability of buildings and infrastructures, improvement of community resilience, and evaluation of societal impact by wind hazards/climate change.

Companies or agencies can belong to the WHIP Center by paying annual fees. Current company members are 1. AIR-Worldwide - A Verisk Business, Boston, MA, 2. Berkshire Hathaway Specialty Insurance, Boston, MA, 3. GAF Materials, Parsippany, NJ, 4. SCOR - The Art & Science of Risk, Chicago, IL, 5. State Farm Insurance, Bloomington, IL, and 6. USAA Insurance, San Antonio, TX.

The Center operates under the leadership committee, which includes the Center Director, University Site Directors, and elected Chair of the Industry Advisory Board (IAB). The IAB consists of one representative from each of the fees paying company. Two meetings of IAB are planned every year. At the annual meeting, projects to be pursued during the year are selected and funded. At the semi-annual meeting, project progress reports are discussed, and additions and changes to the scope or direction of the research projects are proposed. In addition, regular zoom meetings are conducted to review progress of research projects.

A five-year NSF award established the WHIP Center on February 1, 2019. The third annual meeting of the WHIP Center was held on April 1 – 2, 2021 through video conference (due to COVID 19). At this meeting, the IAB approved seven research projects for the third year. The projects are: 1. Fragility curves for tornadic loading on low-rise buildings, 2. Wind and surge damage to buildings by hurricane, 3. Installation and anchor requirements of roof systems for high wind conditions, 4. Probabilistic modelling of household recovery after hurricane and wind disaster, 5. Time related expenses model for exterior, interior, and contents damage, 6. Exploratory investigation of field damage data for potential use in risk models, and 7. Empirical vulnerability model to assess impact of windborne tree debris.

The combination of financial resources provided by the NSF and the industry and the intellectual resources provided by the university faculty has a strong synergy to produce research results that industry can implement in practice. The three universities have a varied facilities and expertise in many disciplines. Research problems of multidisciplinary nature can be pursued effectively. Mentorship provided by the industry assures that the research results will be implementable in practice. The paper will discuss the advantages and benefits of the WHIP Center.