

DHS Science and Technology Directorate

Flood Apex Program: Rethinking America's Costliest Disaster

Rising Flood Risks

The Department of Homeland Security (DHS) Science and Technology Directorate (S&T) developed the Flood Apex Program to bring new technologies and new thinking to how we cope with our #1 natural disaster.

Each year, floods kill more people and cause more economic damage than earthquakes, tornados, wildfires or severe storms. Every state suffers from at least one form of flooding. About nine million people live in flood hazard areas, and half of them are uninsured or underinsured. Over 200 people are killed in flash floods each year and another 80 by other types of floods.

Flood damages average \$7.9 million per year and are increasing at a rate of almost 2% annually. As more people and more development move into flood risk areas, the numbers are rising.

The goals of the Flood Apex Program are to reduce fatalities and property losses from future flood events, increase community resilience to disruptions caused by flooding and develop better investment strategies to prepare for, respond to, recover from and mitigate against flood hazards.

New Flood Sensors and Alerting

Emergency planners have traditionally relied on custom-installed "stream gauges" to measure the height of water as it flows. These are expensive, permanent installations costing thousands of dollars.

Today's advanced manufacturing tools can produce lightweight, cheap, internet-connected sensors to improve flood detection, monitoring and local flood safety programs. The Flood Apex Program is developing such sensors, which will cost a few hundred dollars each and can be deployed anywhere. Their signals will produce flood warnings to send to smartphones carried by people at risk, and new data to relay to flood forecasters and first responders in the field.

Smarter Remote Sensing and Situational Awareness

Flood extents and pathways are critically dependent on weather conditions, terrain contours and surface permeability. These factors are hard to map precisely, and they change year-to-year as development (i.e., paved-over land) spreads. Traditional surveying is costly and time-consuming, and produces an incomplete patchwork of risk information.

Two of today's technologies—LiDAR and synthetic aperture radar (SAR)—offer tremendous opportunities to drive down hazard mapping costs, increase accuracy and speed-up production. Flood Apex is also using historical satellite

imagery to detect areas outside designated high risk areas that have experienced flooding in the past. These new tools will make flood risk assessments more accurate and better prepare emergency managers.



High-Performance Computing and Artificial Intelligence

Floods damage structures, agriculture, public assets and other infrastructure. Strengthening community resilience depends on more effective understanding of flood risk. Expanding flood insurance and improving flood mitigation investment require knowing where community assets are, their elevation, who owns them and how much they are worth.

Such an inventory was impossible until now, and emerging technologies are providing breakthroughs. Flood Apex is applying facial recognition algorithms to detect physical structures from satellite images. These algorithms, accelerated by supercomputers and constantly improved by machine learning techniques, are on schedule to create the first complete structures' inventory of the entire U.S. within the next two years.

Realigned Economic Incentives and Risk Analysis

Better data and new technical tools will allow us to rethink the role of government, the insurance industry, non-profits and the private sector in managing flood risk and disaster-proofing society. Flood Apex is exploring new incentives for individuals and private industry to take on greater roles in flood preparation and response. The result will be communities that are inherently more resistant to floods and better insured against loss.

The Longer Term

Evolving technology will help us better anticipate where and when floods will strike, alert us sooner when they do, and better understand the damage potential. Thus, we can insure more wisely and invest more effectively in flood-proofing, from the personal to the community levels.

Floods cannot be fully defeated, but they can be managed far better with today's rapidly improving tools.

