



ShakeAlert® Technology Goes Interstellar

Automated actions provide out-of-this-world protection



ShakeAlert Ready ... Here and Beyond




While space exploration shoots for the stars, it still relies on Earth-bound technology for safety. NASA is no exception. NASA Deep Space Network's (DSN) massive antennas in the Mojave Desert of Southern California are now protected by the ShakeAlert® Earthquake Early Warning System, which is managed by the U.S. Geological Survey (USGS). When the ground shakes, ShakeAlert-powered technology automatically stabilizes DSN's interactive radio communications systems, keeping spacecraft miles above safely connected to the antennas "listening" below. ShakeAlert "going galactic" is among the increasingly novel ways EEW protects people and vital systems—on Earth and beyond.

What on Earth?




1 Managed by NASA's Jet Propulsion Laboratory (JPL), DSN hosts some of the world's largest, most sensitive scientific telecommunications system infrastructure. It includes giant radio antennas strategically placed on three continents (including in Goldstone, CA), enabling a communications tether to space. The antennas' precisely shaped, highly sensitive receivers pick up spacecraft signals beyond Pluto. ShakeAlert integration guards against communication disconnects, downtime, and expensive equipment damage.

2 Meanwhile, JPL, founded and managed by the California Institute of Technology, has integrated ShakeAlert EEW into its public address system to warn people of imminent shaking and to encourage them to take an immediate protective action. Also, ShakeAlert triggers fire facility bay doors to open, enabling easy vehicle access when shaking is expected.

Deep Space Network (DSN)

-  Giant radio antennas on 3 continents
-  Fort Irwin, CA site (earthquake country)
-  Three 112 ft. + one 230 ft. antennas protected by ShakeAlert

Jet Propulsion Laboratory (JPL)

-  Manages DSN for NASA
-  Pasadena, CA, Caltech campus (earthquake country)
-  5,000-person team

ShakeAlert triggers automated actions to protect vital assets – human and equipment.

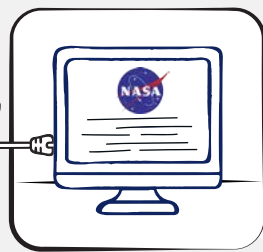


The JPL campus, pictured here, includes facilities for research, development, and testing of spacecraft. Image is courtesy of JPL.

ShakeAlert™

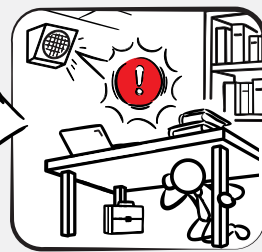


USGS ShakeAlert sensors detect earthquakes & package data



NASA receives & processes data

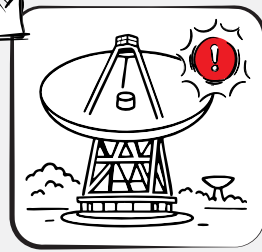
Minimum magnitude 4.0+
Weak Shaking or Greater (MMI III+)



Public alert system activated

At JPL, an automated system broadcasts “Drop, Cover, and Hold On!” campus-wide and opens fire facility bay doors.

Purpose: Protect people and enable rapid emergency response on a high-density campus.



Equipment safeguards activated

At DSN, ShakeAlert-powered automated actions stop high-powered antenna movement, cut power, and engage the safety lock.

Purpose: Protect multimillion-dollar equipment and maintain interstellar communications.

Integrating ShakeAlert to Bolster Safety

• Deep Space Network as a USGS Technical Partner

Under a USGS License Agreement, DSN engineers developed and tested software to autonomously stop transmissions when ShakeAlert detects an earthquake of magnitude (M) 4.0+ that will cause shaking of intensity MMI 3 or above at Goldstone. Studies show it is unsafe for antennas to track spacecraft above this threshold. ShakeAlert-protected antennas track as many as 40 space missions at any time. The cost of a new 112-foot antenna is about \$40 million, while a 230-foot antenna is at least \$120 million, so protecting these assets is vital.

“The goal is to leverage ShakeAlert to protect these valuable assets, since DSN is the only point of communication between Earth and deep space missions.”

James L. Buckley, DSN Operations Interface Engineer

• Jet Propulsion Laboratory as a USGS Technical Partner

“Integrating ShakeAlert to trigger automated actions is paramount to safety.”

Margaret Ayala, JPL Continuity of Operations Coordinator

Two ShakeAlert-powered automated protective actions have been integrated under JPL’s License Agreement with USGS. First, a public address system across its 150-building campus alerts people of imminent shaking and encourages them to protect themselves. The JPL Visitor Center features posters that describe alerting and recommended protective actions, which are also included in regular staff preparedness drills. A second ShakeAlert-powered action automatically opens two fire facility bay doors that store emergency response equipment to ensure access.

Note: Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the United States government.



Learn More About ShakeAlert Technical Partnerships

ShakeAlert is also being used to protect critical lifelines on Earth, such as water utilities, transit systems, and hospitals. Learn how: [ShakeAlert Technical Partner Resource Center](#) on [ShakeAlert.org](#)