

The AIR Model for Terrorism

Two decades after 9/11, terrorism remains a highly dynamic threat capable of causing significant insurance losses. The AIR model enables (re)insurers to estimate the potential property, business interruption, workers' compensation, and personal injury losses that can arise from acts of terrorism in the United States. The model also provides deterministic loss scenarios for 27 other countries to assist companies in prudently managing their terrorism risk.



The AIR Model for Terrorism enables you to view a range of high- and low-frequency losses and to compare alternative underwriting strategies and portfolio constructions to more fully and accurately estimate your exposure to terrorism risk. AIR's detailed software can be used to provide insight into underwriting and pricing, for portfolio modeling and capital allocation, and to support and populate regulatory reports.

Advanced Hazard Modeling Represents the Full Range of Potential Attacks

The terrorism model considers damage, including building damage and injuries, from a comprehensive array of conventional weapons, chemical, biological, radiological, and nuclear (CBRN) weapons, and airplane crashes (see box) used on a range of targets. More than 1 million simulated attacks in the model's 500,000-year catalog represent the complete probability distribution of losses—including losses from the most extreme events that have no historical precedent.

WEAPON TYPES MODELED BY AIR

Conventional

- Portable (1/4 ton TNT)
- Car (3/4 ton TNT)
- Van (2 ½-ton TNT)
- Small truck (6-ton TNT)
- Medium truck (10-ton TNT)
- Large truck (25-ton TNT)
- Small plane crash
- Large plane crash

Chemical, Biological, Radiological, and Nuclear (CBRN)*

Chemical (includes small, medium, and large)

- Sarin
- VX Nerve

Biological (includes small, medium, and large)

- Anthrax
- Smallpox

Radiological

- Cesium
- Cobalt

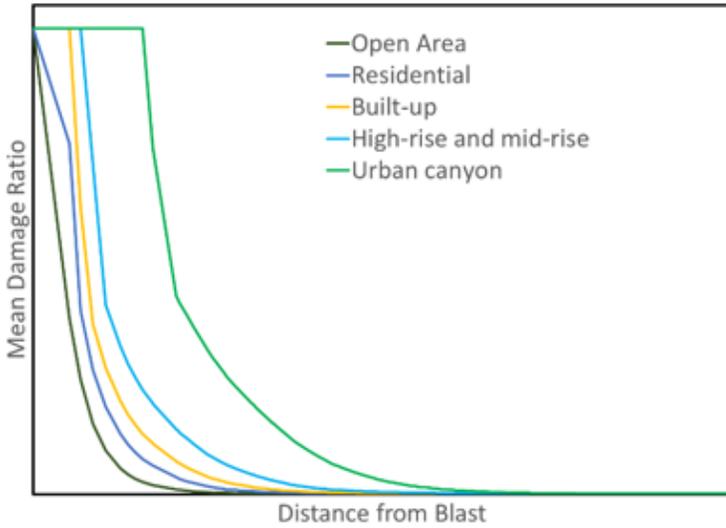
Nuclear

- Suitcase type
- 20 kiloton
- 50 kiloton

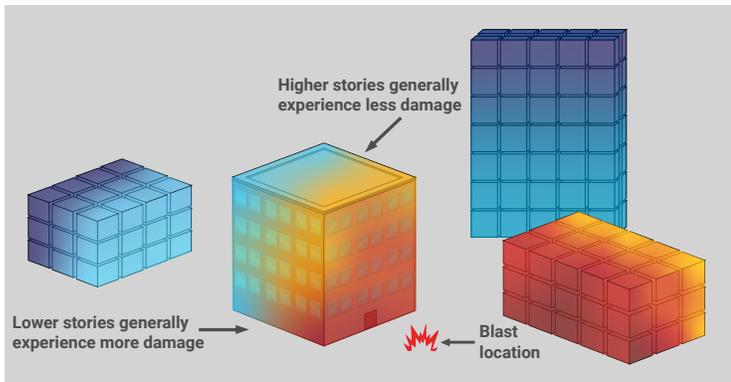
*CBRN weapon types are only supported for U.S. loss analysis

Rigorous Engineering-Based Approach to Estimating Damage and Injury

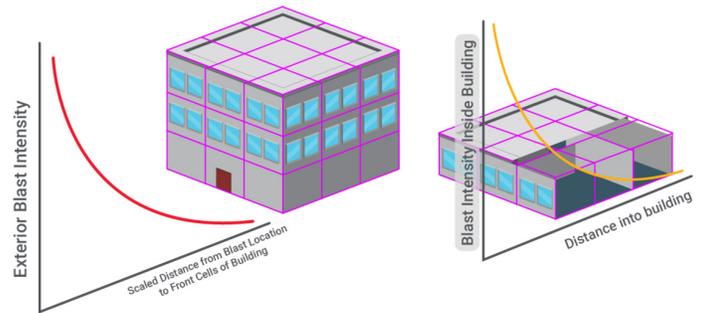
Starting with the size and location of the bomb, the model's engineering component propagates the appropriate blast intensity to yield damage and loss estimates, including property damage and workers' compensation, and personal injury.



Damage functions showing the blast impacts of a small truck bomb on reinforced concrete mid-rise buildings for five different urban densities.



The loss calculation framework and cellular damage aggregation approach permit detailed loss results for a specific floor of interest.



Example of blast intensity propagation in the AIR Terrorism Model.

The configuration and proximity of buildings in a dense urban location introduce complex propagation paths; reflections; diffractions (passages through narrow openings or across edges, typically accompanied by interference between the wave forms produced); and scattering of overpressure (excess of normal atmospheric pressure caused by an explosion's shock wave) in three dimensions. AIR researchers have used 3D Computational Fluid Dynamics simulations to ensure more accurate intensity propagation through a variety of urban environments in the model. Building vulnerability accounts for both overpressure and pressure impulse (wave impact-loading magnitude), which inform the modeling of both contents damage and personal injury. Because damage is calculated through the aggregation of cells and blast intensity is modified both as it enters the structure and as it travels through the interior, users can obtain detailed loss results for a specific floor of interest.

The deterministic event modeling capabilities in Touchstone® allow you to select a blast size and location to analyze the impact it will have on your specific book of business. This complements the exposure aggregation capabilities provided by Touchstone's Geospatial Analytics Module, which can leverage dynamic ring analysis to identify locations corresponding to maximum exposure concentrations. The workflow has been streamlined to enable users to seamlessly create and export a deterministic event set from a ring analysis. The ability to leverage both of these capabilities makes AIR's model best in class for estimating terrorism risk in the United States.

Complementary Capabilities Provide Best-in-Class Terrorism Modeling

Using the AIR Model for Terrorism, (re)insurers can estimate the potential property, business interruption, workers' compensation, and personal injury losses that can arise from acts of U.S. terrorism. The deterministic event modeling capabilities in Touchstone® allow you to select a blast size and location to analyze the impact it will have on your specific book of business.

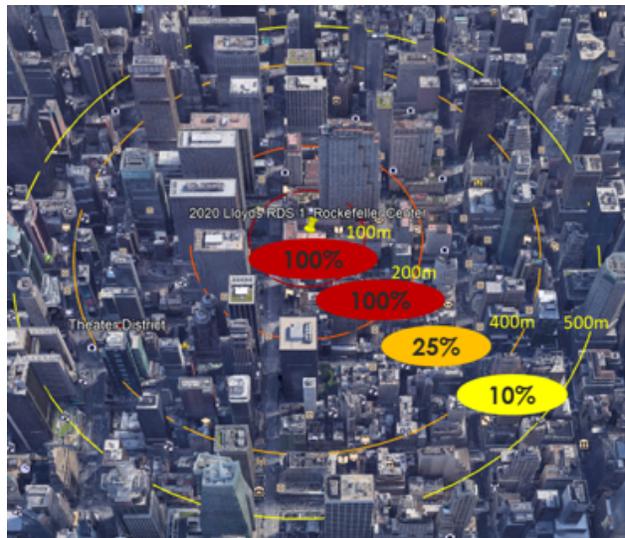
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Geospatial Analysis Supports Business Needs

Calculating accumulations within concentric rings around potential targets is particularly useful for estimating losses from terrorist attacks, whether the target is one from AIR's U.S. landmark database or a high value location in a portfolio. Complementing this capability, AIR's Dynamic Ring tool will identify the largest exposure concentration without the need to center analysis on a specific target or grid point. Ring analysis results can be exported to an international deterministic event set; by specifying gradually decreasing damage ratios for consecutively larger rings, users can assess potential losses to nearby properties resulting from a terrorist attack anywhere in the world.

Geospatial analysis also allows for easy configuration and analysis of various regulatory requirements such as the 2020 Lloyd's Rockefeller Center Scenario. Geospatial results can be visualized on a map or exported to create intuitive reports that can be shared with regulators, rating agencies, and other stakeholders.

Accumulations—whether of replacement values or exposed limits—can also be performed by importing layers. Geospatial analysis in Touchstone enables users to quickly assess their exposure concentrations—allowing more time to define and manage underwriting limits at any areas of potential concern.



Example of Lloyd's RDS Scenario with loss ratios (%) and distances (m) at Rockefeller Center, New York, NY, analyzed using concentric ring analysis.

MANAGE EXPOSURES ANYWHERE IN THE WORLD

Deterministic loss analyses (what-if scenarios) can be conducted in Touchstone for known or potential threats to assess the impact of certain types of weapons on buildings and workers in the U.S. and 27 other countries. You can select a property from within your portfolio, one of the targets in AIR's U.S. landmark database, or a newly defined potential target, and then select weapon type (conventional weapons only outside the U.S.) to test scenarios.

Touchstone Can Be Used to Satisfy the TRIP Data Call

A portion of the TRIP Data Call includes the analysis of terrorism scenarios against an insurer's book of business. The requirements of the Data Call can be satisfied in multiple ways using Touchstone, for example:

- Using the Geospatial Analytics Module, you can assign prescribed damage ratios to risks based on their proximity to the hypothetical blast; losses can be aggregated from the assigned damage ratios
- After running a deterministic simulation by specifying a size and location for the blast, you can obtain the expected event loss as well as detailed losses by coverage down to a specific floor of interest

A.M. Best Supplemental Rating Questionnaire

Companies can use AIR's terrorism modeling solution to demonstrate sound risk management practices for A.M. Best's Supplemental Rating Questionnaire, including the workers' compensation component, to identify:

- Insured's geocoded results for specific cities
- Largest single location terrorism exposure in designated tier cities as well as net of reinsurance and the Terrorism Risk Insurance Program (TRIP)
- Largest aggregate terrorism exposure and modeled loss in designated tier cities as well as net of reinsurance and TRIP
- Concentrations in excess of 20% and 10% of the policyholder surplus

Model at a Glance

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| Modeled Perils | Terrorism |
| Supported Geographic Resolution | Latitude/longitude, 1km covering entire United States, finer ZIP Code resolution for 15 metropolitan areas |
| Supported Construction Classes and Occupancies | 45 construction classes, 110 occupancy classes, 5 urban density classes |
| Stochastic Catalog | 500,000-year probabilistic catalog for the U.S. |
| U.S. Landmark database | Database of U.S. landmarks, or targets, includes prominent buildings, headquarters of Fortune 500 companies, transportation hubs, sports venues, government buildings, and many medical and educational institutions; also includes 100 "trophy" targets that have a much higher probability of being attacked |
| Countries Supported for Deterministic Loss Analyses in Touchstone | Australia, Belgium, Brazil, Canada, China, Colombia, France, Germany, Greece, India, Indonesia, Ireland, Israel, Italy, Japan, Kenya, Lebanon, Mexico, Netherlands, Philippines, Russia, Singapore, South Africa, Spain, Thailand, Turkey, United Kingdom, and the United States |
| Supported Lines of Business | Residential, commercial/industrial property, mobile home, automobile, and workers' compensation |
| Supported Policy Conditions | A wide variety of policy conditions are supported, including franchise deductibles, coverage limits, loss triggers, and risk-specific reinsurance |

Model Highlights

- Considers damage, including property damage and injuries, from a comprehensive array of conventional and non-conventional weapons and airplane crashes
- Enables companies using Touchstone to manage their terrorism accumulations anywhere in the world
- Estimates U.S. workers' compensation losses by number of employees injured, injury severity, work shift impacted, and by geographic region (to account for average annual wage by industry and by state)
- Hazard intensity and building vulnerability components validated with observations from historical events and published literature to ensure confidence in the modeled results
- Loss calculation framework and cellular damage aggregation approach permit detailed loss results for a specific floor of interest
- Modeling framework simulates damage at a fine and realistic resolution

ABOUT AIR WORLDWIDE

AIR Worldwide (AIR) provides risk modeling solutions that make individuals, businesses, and society more resilient to extreme events. In 1987, AIR Worldwide founded the catastrophe modeling industry and today models the risk from natural catastrophes, supply chain disruptions, terrorism, pandemics, casualty catastrophes, and cyber incidents. Insurance, reinsurance, financial, corporate, and government clients rely on AIR's advanced science, software, and consulting services for catastrophe risk management, insurance-linked securities, longevity modeling, site-specific engineering analyses, and agricultural risk management. AIR Worldwide, a Verisk (Nasdaq:VRSK) business, is headquartered in Boston with additional offices in North America, Europe, and Asia. For more information, please visit www.air-worldwide.com. For more information about Verisk, a leading data analytics provider serving customers in insurance, energy and specialized markets, and financial services, please visit www.verisk.com.