The AIR Model for Terrorism

More than a decade after 9/11, terrorism remains a highly dynamic threat capable of causing significant insurance losses. The AIR model takes a probabilistic approach to estimating property and casualty—including workers' compensation—life and health, and disability losses from possible future terrorist attacks in the U.S. and provides deterministic loss scenarios for the U.S. and 27 other select countries. The model supports pricing and underwriting decisions down to the individual policy level to assist companies in prudently managing their terrorism risk.

AIR

AIR's approach to catastrophe risk assessment embraces the entire risk landscape by estimating the likelihood of different levels of losses, rather than the likelihood of a specific attack on a particular location. This allows risk managers to view a range of high-frequency and low-frequency losses and enables comparisons of alternative underwriting strategies and portfolio constructions to more fully and accurately estimate their exposure to terrorism risk. AIR's detailed software allows companies to analyze their terrorism risk in three different ways—exposure concentration, deterministic loss, and probabilistic loss—for a comprehensive view.

Advanced Hazard Modeling Represents the Full Range of Potential Attacks

AIR's 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 precedence.

WEAPON TYPES MODELED BY AIR

CONVENTIONAL
- Bombs
  — Portable (1/4 ton)
  — Car (3/4 ton)
  — Van (2 ½-ton)
  — Delivery truck (6 ton)
  — Large truck (25 ton)
- Airplane crash
  — General aviation
  — Large commercial airliner

CBRN*
- Chemical (includes small, medium, and large)
  — Sarin
  — VX Nerve
- Biological
  — Anthrax
  — Smallpox
- Radiological
  — Cesium
  — Cobalt
- Nuclear
  — Suitcase type
  — 20 kiloton
  — 50 kiloton

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

Incorporates Judgment of a Team of Experts

AIR's terrorism model incorporates the detailed operational threat assessments made by a "Red Team" of counterterrorism specialists with decades of experience working for the FBI, CIA, Department of Defense, and other U.S. government bodies to determine event scenarios and their frequencies. With their input, AIR has developed a comprehensive database of potential targets, or landmarks, across all 50 U.S. states that include commercial, industrial, educational, medical, religious, and governmental facilities. A subset of "trophy" targets carries a higher probability of attack.

Rigorous Engineering-Based Approach to Estimating Damage and Injury

The engineering component of the model propagates the appropriate measure of intensity to yield damage and loss estimates, including property damage and workers' compensation, life and health, personal accident, and disability.

In the case of blast attacks, for example, the effects of multiple building geometries create a complex combination of pressure impacts in three dimensions. In a dense urban environment, the configuration and proximity of buildings introduces complex propagation paths, reflections, diffractions, and scattering of overpressure (the pressure caused by a shock wave over and above normal atmospheric pressure). In general, the denser the environment, the more severe the damage is to the target and buildings in the immediate vicinity of the blast.

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. And AIR's Dynamic Ring tool will identify the largest exposure concentration without the need to center analysis on a specific target or grid point. 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.

WORKERS' COMPENSATION

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 TRIPRA
— Largest aggregate terrorism exposure and modeled loss in designated tier cities as well as net of reinsurance and TRIPRA
— Concentrations in excess of 20% and 10% of the policy holder surplus

Geospatial analysis also allows for easy configuration and analysis of Lloyd's RDS and Prudential Regulation Authority requirements. 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, such as Verisk Maplecroft's sub-national terrorism risk map, which scores locations globally, utilizing data on reported terrorism incidents and their severity. 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.
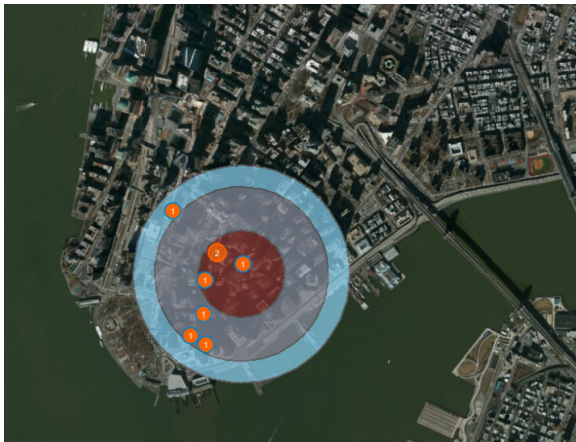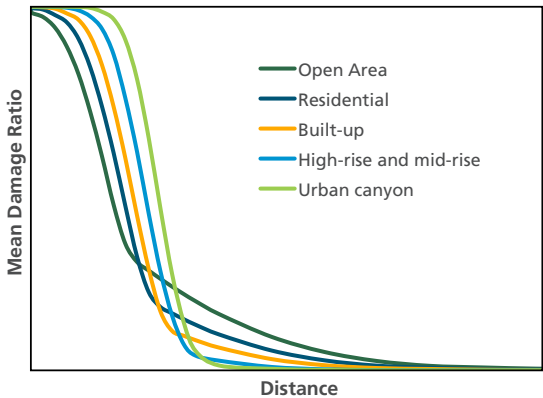
Example of Lloyd's RDS Scenario at 20 Exchange Place in Lower Manhattan analyzed using concentric ring terrorism analysis.

Probabilistic Loss Analysis

While deterministic loss analysis allows users to create their own potential scenarios, probabilistic loss analysis enables users to consider the likelihood and severity of hundreds of thousands of possible events that may not have been considered. The expert team assembled by AIR has estimated event frequency, severity, and intensity based on target, weapon, and attack type. Based on the nature of the group originating the attack, attacks may be coordinated—among the same or related terrorist groups—using a single weapon type. The model also reflects the impact of counterterrorism activities on the likelihood of a successful attack.

Deterministic Loss Analysis (What-If Scenarios)

Companies can conduct deterministic loss analyses for known or potential threats to assess the impact of certain types of weapons on their buildings and workers in the U.S. and 27 other countries. Users can select a property from within their portfolio, from one of the targets in AIR's U.S. landmark database, or a newly defined potential target, and then select weapon type to test "what-if" scenarios. AIR has developed robust damage functions to help companies understand the impact on their structures, given the size of the blast and the building density environment.

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

Verisk Maplecroft terrorism risk score in the Middle East and Asia.

SITE-SPECIFIC DETERMINISTIC AND PROBABILISTIC ANALYSES FOR TERRORISM RISK

For specialized or highly complex risks, whether inside or outside the U.S., AIR's Catastrophe Risk Engineering (CRE) consulting service combines site-specific engineering evaluation with deterministic and/or probabilistic loss analyses. Deterministic loss analyses produce physical damage and business interruption loss estimates for a property or portfolio of properties for various weapon types—explicitly accounting for the spatial distribution of assets and attack locations.

For probabilistic analyses, intelligence specialists provide event frequencies for the most likely types of attack modes, taking into consideration the capabilities and habits of the active terrorist groups within the selected country and the asset types involved. This information is integrated with the deterministic loss analysis to produce loss metrics, such as annual probability of occurrence associated with different loss levels.

Model at a Glance

Modeled Peril	Terrorism
Supported Geographic Resolution	Latitude/longitude
Stochastic Catalog	500,000-year probabilistic catalog for the U.S., of which more than 400,000 have one or more loss-causing events
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	Property, auto, workers' compensation, life and health, personal accident, and disability
Supported Policy Conditions	A wide variety of policy conditions are supported, including franchise deductibles, coverage limits, loss triggers, and risk-specific reinsurance terms.

Model Highlights

— Incorporates expert judgment of a Red Team of counterterrorism specialists with decades of experience working for the FBI, CIA, Department of Defense, and other U.S. government bodies
— Supports three levels of analyses: exposure concentration, deterministic loss, and probabilistic loss
— 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 for conventional or CBRN attacks by number of employees injured, injury severity, workshift impacted, and by geographic region (to account for average annual wage by industry and by state)

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, terrorism, pandemics, casualty catastrophes, and cyber attacks, globally. Insurance, reinsurance, financial, corporate, and government clients rely on AIR's advanced science, software, and consulting services for catastrophe risk management, insurance-linked securities, 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.

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