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# MEMORANDUM

To: Roundtable Participants

From: Bob Chen

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Subject: Notes on Data and Information Needs in Dealing with Multiple Threats

Part of the second day of the workshop will be focused on data, information, and communication issues. I'd like to address my comments to this topic, and in particular to the problems of managing data and information in the face of multiple, diverse threats.

The risk community is still largely segmented into distinct groups dealing with different types of risks. Natural hazards are considered separately from technological risks; health hazards are addressed primarily by a large medical and public health establishment; terrorism is the province of national security specialists. Despite the emergence of a formal risk assessment community during the past decade, terminology, concepts, and models still vary greatly, along with the time and space scales, units of analysis, and degree of acceptance of risk assessment approaches.

Even within a single community, e.g., the natural hazards community with which I'm most familiar, there remain tremendous barriers to communication and data sharing. Although the new Hazards center is working on this problem, the seismologists still have trouble communicating with the hydrologists and climatologists; the natural scientists, social scientists, urban planners, epidemiologists, and engineers all tackle problems differently from each other; and the researchers and practitioners still face major differences in technology, time scales, and institutional context.

One of the difficult problems is harmonization of data. Methods of assessing probabilities and associated uncertainties vary greatly between fields in which recurrence periods and spatial extent vary by multiple orders of magnitude; or when key assumptions differ about independence of events and stability of processes; or when different risk management approaches are placed into varied social and cultural contexts. As yet, there is no comparable, spatially detailed assessment of risk due to most major natural hazards, let alone other more divergent types of risk. The available databases, e.g., compiled by the insurance industry and groups like CRED, vary greatly in quality and lack much of the detailed spatial and temporal information needed for a consistent analysis.

Of course, the public is generally not aware of the difficulty of comparing risks. They can often be appeased with simple Wilson-esque statistics on the individual probability of dying from a nuclear power accident vs. a plane crash vs. an automotive accident vs. a meteor impact.

Risk managers clearly need more data and information. But they are often constrained by their institutional settings or delegated authority. For example, we were recently visited by a county-level analyst involved in regional emergency planning. He spread out a map showing 10-, 20-, 30-, 40-, and 50-mile circles around a nuclear power plant (guess which one!). The 50-mile circle included multiple states, counties, and other jurisdictions, millions of people, hundreds of schools, hospitals, and other critical facilities, and thousands of miles of roads, railroads, and other transportation infrastructure. The only formal evacuation plan covers the 10-mile radius, and effectiveness of even this plan is highly controversial. There is no single jurisdiction covering this region, no communication or coordination mechanism for all the different governmental and nongovernmental agencies and organizations in the region, and of course no region-wide hazard response plan or system. The I-Teams in the region are either organized by state or focused on New York City itself. For that planner, developing an intelligent emergency response plan is highly dependent on what is happening in neighboring jurisdictions, on interstate highways, in multiple regional utility and transportation companies and organizations, in Federally-controlled airspace, and in state and Federal law enforcement, regulatory, and emergency response agencies. Similarly, in thinking about their spatial data needs in the aftermath of September 11, New York City officials expressed strong interest in accessing spatial data for an area roughly 3° of longitude by 2.5° of latitude, extending as far north as Stewart Air Force Base in Newburgh NY and as far south as Fort Dix in central NJ.

Some agencies and organizations such as FEMA and the Open GIS Consortium (OGC) have begun to think about these needs, but there is still a long way to go before data and information systems and capabilities catch up to the needs of planners, decision makers, and decision support systems. Part of the problem is the ability of different data management systems to exchange and interactively access data, but a significant barrier is also the difficulty of integrating data *intelligently*, *intelligibly*, and *institutionally*. By this, I mean: *1)* putting data together in sensible, scientifically sound ways; *2)* presenting the data in understandable, usable form; and *3)* securing the necessary rights and agreement to make data accessible to appropriate sets of users. For example, in the case of spatial data, the OGC recently conducted a “testbed” for a suite of its Web-based interoperability standards focused on New York City. Significant progress was made in getting different types of software to communicate with each other, but this did uncover some underlying problems in integrating data of different resolution, in different geographic projections, and from different sources. Getting data from multiple online servers to display and align properly in multiple online clients was just the first step. On the presentation side of things, it was discovered that there is little consistency in map symbology—for roads, manholes, building types, boundaries, etc.—even across different agencies just within the City government. On the institutional front, there were both proprietary restrictions on sharing key datasets and of course a range of security concerns about access to potentially sensitive data.

These scientific, technical, and organizational problems are not insurmountable and are being addressed aggressively by a number of groups. Indeed, once greater interoperability is achieved for a wide range of spatial data—including real-time monitoring data (e.g., sensors, EZ-Pass records, video feeds), complex relational georeferenced data (e.g., individual, household, building, and corporate data), and high resolution imagery (satellites, aerial, ground-based)—there will likely be increased opportunities *and expectations* for cross-hazard data integration and decision support. Opportunities will include sharing of common data on vulnerability, including detailed information on demographic, health, and socioeconomic characteristics and public and private infrastructure; better understanding of cross-hazard interactions, e.g., access to real-time weather and soil moisture data for updating earthquake and landslide risk assessments; and improved coordination of emergency response across regions, jurisdictions, sectors, and functions.

However, these efforts only address a portion of the information and communications problems faced by risk managers. Other key issues include:

- *Lack of standardized loss estimates.* As highlighted by the National Research Council (1999) and others, there remains an important gap in the underlying data and information about direct and indirect losses due to natural disasters. The same clearly applies to other types of risk, including industrial accidents, acts of terrorism, and medical and public health hazards.

- *Inconsistent hazard estimates and incomplete understanding of uncertainties.* As noted previously, the inability of the risk assessment to provide comparable, spatially detailed estimates of hazards and associated uncertainties is an important barrier to cross-hazard risk management and to clear communication of risk issues to the general public.

- *Disparate decision support tools and frameworks.* Many different tools exist in varying stages of development. FEMA's HAZUS decision support system for earthquake hazard assessment remains a stand-alone GIS-based tool, not well integrated into real-time sources of data. HAZUS is being expanded with flood and wind modules, but the degree of cross-hazard integration remains to be seen. Clearly, the insurance industry has been at the forefront of developing cross-hazard risk models, but these have not been generally accessible to public and private decision makers. Companies like Visual Risk Technologies have only recently begun to provide tailored decision support tools and data to state and local emergency planners (including Rockland County, where we're located now!).

In summary, much work remains in order to address the questions about information and communications raised in the prospectus, e.g., about how information technology can contribute to delivery of public services, what advances in decision support services are required, and what critical data are needed. Some important initiatives are already under way, such as standards and technology development in support of hazard needs under the auspices of the OGC and some degree of regional data coordination via the I-teams and the new Geospatial 1-stop led by the Federal Geographic Data Committee. However, it seems clear that more effort is needed in the risk assessment community, building on these efforts,

to ensure the appropriate application and integration of new technologies, systems, and institutional frameworks to meet pressing, cross-hazard risk management needs.

I look forward to the discussions at this and future roundtables on these critical issues.