# : How could innovative DSS have assisted in specific crisis situations?

This Ask Dan! builds upon prior discussions of DSS for crisis planning, response and management. Rather than examine this broad topic from a general, abstract or theoretical perspective, there is an advantage to speculating about what might have been possible in specific exemplar situations. My sense is that this type of exercise can improve contingency planning and help us develop more sophisticated DSS.

According to the World Health Organization (WHO) website at URL www.who.int, more than 44 countries currently are experiencing a crisis. Not all crises are of equal magnitude and different computerized decision support is needed in different types of crisis situations. Grappling with the complexity of generalizing about DSS for crisis, emergency, disaster and hazard situations has been and is challenging.

According to the WHO website, "People are exposed to a crisis when local and national systems are overwhelmed and are unable to meet their basic needs. This may be because of a sudden increase in demand (when food and water are in short supply), or because the institutions that underpin them are weak (when government and local services collapse because of staff shortage or lack of funds)."

"Crises can be triggered by:

1. Sudden catastrophic events - like earthquakes, hurricanes and sudden toxic spills.

2. Complex and continuing emergencies - including over 100 violent conflicts, associated displacement and often dramatic political transformations.

3. Slow onset processes - such as the gradual breakdown of a country's social institutions due to economic downturn, populations affected by chemical poisoning, or the impact of an inflating level of a fatal disease.

People threatened by crises face heightened risks to their health primarily as a result of common illness made more dangerous by crisis conditions. Those who are most vulnerable experience excessive suffering and high death rates."

The following paragraphs primarily discuss sudden catastropic events like the Tri-State Tornado, Hurricane Georges, Exxon Valdez oil spill, the Bhopal gas leak, and the Uberlingen Midair Collision, continuing and recurring emergencies of various scales of magnitude, and private sector crises.

In much of the world, recurring emergencies of a small scale like traffic accidents are managed from centralized dispatch centers with computer-aided dispatch (CAD) tools and the first responders bring some decision support to the scene of an incident with them. There is a significant opportunity for expanding CAD to include more decision support while also enhancing its transaction processing role. More mobile decision support for triage and hazard management (like encountering dangerous chemicals) can also be developed. Improved data collection and sharing can also lead to more timely traffic safety and traffic management decision making at the management control level in local jurisdictions and enhanced monitoring and problem identification at more macro level government organizations.

The Firestone Tire recall associated with Ford Explorer crashes demonstrates a crisis that was mounting slowly for two large multinational companies. Data collected from traffic accidents was eventually used to demonstrate a cause and effect link that led the US National Highway Traffic Safety Administration (NHTSA) to advise the companies involved to issue a recall of 6.5 million tires. Estimates of the impact of the faulty tires are approximately 250 deaths and more than 3000 catastrophic injuries. Most of the deaths occurred in accidents involving the Ford Explorer which tended to rollover when one of its tires had a blow out. How could computerized decision support have helped? A data-driven DSS at NHTSA might have helped identify the problem sooner. In July 1998, a State Farm Insurance researcher had "advised the National Highway Traffic Safety Administration (NHTSA) that he had found twenty cases of tread failure associated with Firestone tires dating back to 1992." Bureaucracy, data inadequacy and the disbelief/denial by some decision makers delayed the identification of the problem and hence exacerbated a crisis situation at Ford Motor Company and at Bridgestone/ Firestone. Could DSS have helped decision makers at Ford and Bridgestone/ Firestone? Possibly. Managers at both companies had sufficient warning of an impending crisis to use computerized support to plan a crisis response. If it been available, managers could have used data at a much earlier stage to identify the problem and take action to avoid the problem. Business Intelligence systems would need to become much more sophisticated to help in this type of situation. Once the recall occurred, communications-driven DSS including simple bulletin boards could have improved coordination, gathered feedback and speeded decision-making.

Staying in the transportation sector, the Uberlingen Midair Collision on July 1, 2002 was a major tragedy. A Boeing 757-200 operating as DHL flight 611 and a Bashkirian Airlines Tupolev TU154 collided in midair over Uberlingen, Germany. Seventy one people died in the crash. Peter Ladkin (2004) analyzed the crash in a recent paper and a television documentary was made about the crash. Failures in the aircraft collision avoidance systems (decision support systems) and in the overall sociotechnical system led to the crash. Conceivably better computerized decision support and better procedures could have avoided this crash. Once the crash occurred, the crisis was poorly managed and eventually a second tragedy occurred when one of the Air Traffic Controllers was murdered by a bereaved parent of one of the Russian children killed on the Bashkirian Airlines flight. In disasters/crises like this, a document-driven DSS can help track the needs/responses for victims' families.

On an even larger scale, a 1984 gas leak in Bhopal, India, was a tragedy that continues to stimulate strong emotions. In the early hours of December 3, 1984, methyl isocyanate (MIC) gas leaked from the Union Carbide India Limited (UCIL) plant in Bhopal, India. According to the state government, approximately 3,800 people died, approximately 40 people experienced permanent disability, and approximately 2,800 other individuals experienced partial disabilities. Union Carbide provided immediate and continuing aid to the victims and set up a process to resolve their claims. All the claims arising out of the release were settled with the approval of the Supreme Court of India. Could computerized decision support have helped responders during the immediate crisis? Probably not. Computerized decision support could have assisted in managing, resolving and settling the claims. The goal must be to avoid this type of catastrophic accident.

When possible, it is also important to avoid environmental accidents and crises. For example, small oil spills are perhaps unavoidable and DSS can help first responders in clean up efforts by predicting the consequences of a spill and in managing the incident. The Exxon Valdez incident demonstrates the difficulties in responding to large scale spills. "On March 24, 1989, the Exxon Valdez grounded on Bligh Reef, and spilled nearly 11 million gallons of oil into the biologically rich waters of Prince William Sound. ... In the aftermath of the Exxon Valdez incident, the U.S. Congress passed the Oil Pollution Act of 1990, which required the Coast Guard to strengthen its regulations on oil tank vessels and oil tank owners and operators. Today, tank hulls provide better protection against spills resulting from a similar accident, and communications between vessel captains and vessel traffic centers have improved to make for safer sailing."

The Piper Alpha incident presents a different situation for computerized decision support. "On the evening of July 6, 1988, a fire broke out on the off-shore oil and gas platform Piper Alpha located in the North Sea. The fire was uncontrollable and evacuation plans inadequate. 167 men died and 62 men were pulled from the sea." The overwhelming magnitude and suddenness of incidents like this tragedy creates a sense of helplessness, but perhaps better monitoring and automated decision systems could have triggered equipment to avert the tragedy or provide some time for evacuation. Computerized planning support might help test scenarios for this and similar situations and develop evacuation plans.

Some hazards can not be avoided like earthquakes, tsunamis, hurricanes, flooding, wildfires, mudslides, avalanches, and tornados. Longer lasting natural events like heat waves and droughts require different decision support. The impact of natural disasters can be very large and civil emergency and not-for-profit agencies need to invest in many DSS for a wide range of disasters. For example, the Tri-State Tornado of March 18, 1925 was the worst tornado disaster in U.S. history. The tornado killed 695 people and injured 2027. From September 21-30, 1998, Hurricane Georges killed more than 600 people and the damage estimates for the U.S. including Puerto Rico were $5.9 billion. Although weather forecasting involves extensive computerized decision support, more can probably be done to provide computerized decision support for these situations. Better early warning and notification systems can be built and monitored. DSS can support Incident Management and First Responders and assist in the followup of such disasters. Web portals can help gather relief items and notify the public about facts following a natural disaster. Communications-driven DSS can be created to inform, notify and consult with individuals, including potential victims.

We have created a complex public/private infrastructure that can fail and lead to "man-made" disasters. New York City experienced electrical blackouts in 1965, 1977 and 2003. An earlier Ask Dan! (August 31, 2003) commented on the 2003 crisis. The Aug. 14, 2003 blackout demonstrated that a failure in control and decision support systems can have wide-ranging consequences. U.S. President Bush said the power outages across the Northeast and Midwest were a "wake-up call" to the antiquated state of the nation's electrical grid. David Talbot, a senior editor at Technology Review wrote recently that there are "computer models under development that could help avoid the kind of cascading blackout that occurred on Aug. 14, 2003 in North America. The key to this solution is rapidly throwing switches and rerouting power so that, when necessary, large parts of the grid that are ordinarily interconnected are quickly broken into isolated 'islands'." Decision automation and DSS will be built to help limit the consequences of infrastructure failures. The First Responders to such crises will continue to use computerized command centers and better incident management decision support to reduce the loss of life and property that might result. Chemical storage facilities create similar problems on a different scale. For an example, check the DSS case on Geographic Information Systems (GIS) and plume modeling by Tomaszewski at DSSResources.com.

Dam collapses have had an important place in the realm of crisis management and dam safety is an ongoing issue. The St. Francis Dam Flood in California on March 12, 1928 killed 306 people. The failure of the Teton Dam in southeastern Idaho resulted in the loss of 11 lives and millions of dollars in property damage. In February 2005, a newly built dam collapsed under heavy rain waters in southwestern Pakistan killing at least 135 people. In China in August 1975, the worst dam disaster occurred. The Chinese called it "Chu Jiaozi" (The river dragon has come!). Altogether 62 dams broke in this incident. Downstream the dikes and flood diversion projects could not resist the flood of water from the initial dam collapse. The flood spread over more than a million hectares of farm land throughout 29 counties and municipalities. Eleven million people throughout the region were severely affected and more than 85 thousand died as a result of the dam failures. According to Thayer Watkins (San Jose State economist) "there was little or no time for warnings".

What about terrorism and the resulting crises? Implementing structural solutions to reduce risks when possible are better than hoping that improved computerized decision support will identify and avoid terrorist threats. My Ask Dan! column of September 23, 2001 briefly discussed whether DSS and decision support technologies can help reduce the threat of terrorism. The United States has changed as a result of the 9/11 attacks (see www.9- 11commission.gov). More than 2,600 people died at the World Trade Center; 125 died at the Pentagon; 256 died on the four planes. The death toll surpassed that at Pearl Harbor in December 1941. The case study at DSSResources.COM by Matt Walton (2003) documents DSS used in response to the 9/11 crisis. During the 1970s, many terrorist attacks occurred in Western Europe. The Baader-Meinhof and the Red Army Faction (West Germany), the Red Brigade (Italy) and the Action Directe (France) created an ongoing terrorist threat. Improved Law Enforcement databases and improved communications helped reduce that threat and ended an ongoing crisis.

The number of crisis exemplars is large and diverse, but I'll end with only three more: public health crises, organizational crises of leadership and succession and large scale financial crises.

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Public health crises have been a problem for humankind for thousands of years. Plagues and epidemics have ravaged nations and communities. Collecting data has helped monitor the spread of disease and identify the causes of such events. Computerized decision support has taken on an increasing role in this crisis management and response domain. Severe Acute Respiratory Syndrome (SARS), Mad Cow Disease, and Bird Flu are modern pandemics. These crises have killed people, hurt trade and led to the destruction of millions of animals. Could DSS have avoided these crises? No, but the goal of new DSS must be to help decision-makers identify outbreaks sooner and respond faster and more appropriately.

Leaders die suddenly. Often such events create organizational or national crises. For example, in 2004 there were two sudden succession crises at McDonald's (www.mcdonalds.com). On April 20, 2004 McDonald's Chairman and CEO Jim Cantalupo, 60, died of an apparent heart attack. His successor Charlie Bell was quickly appointed. On November 23, 2004, a second abrupt succession crisis occurred at McDonald's. President and Chief Executive Charlie Bell resigned to battle colorectal cancer (Wall Street Journal). On January 16, 2005, Charlie Bell died of cancer. He was 44. Jim Skinner is the current CEO of McDonald's. Succession plans, computerized staffing support and crisis response teams can help in this type of situation, but is there a need for new type of DSS? Probably not. But a good Web site can help a crisis response team provide information to shareholders and other stakeholders.

Finally, financial crises occur. Depressions, financial collapses, bankruptcies and loan defaults occur. Risk management is an ongoing issue in banks and in financial regulatory organizations. Could DSS have helped avoid the 1929 Stock Market crash in the U.S.? One can only speculate based upon the 1989 crash and other recent financial debacles that DSS can both compound financial meltdowns and help reverse them. Let's begin with the Long-Term Capital Management (LTCM) crisis of 1998. The LTCM hedge fund was highly leveraged and regulators had to bail out the banks that had lent money to the fund managers. The Financial Times reported LTCM had built a total market exposure (in credit) of US$200 billion. "LTCM's notional gross market position, adding together the value of all outstanding derivative and other financial contracts, could be several times that" (28 September 1998). According to some estimates, the gross value of LTCM's contracts exceeded $1 trillion. "The proximate cause for LTCM's debacle was Russia's default on its government obligations." A case study about LTCM is on the Web at erisk.com. Computers and information technologies have created decision support capabilities for implementing hedging using derivatives. DSS and information technology are actually creating some crises. According to the case study, some lessons learned include: 1) "sophisticated financial models are subject to model risk and parameter risk, and should therefore be stress- tested and tempered with judgement" and 2) financial institutions must aggregate exposures to common risk factors. Both lessons learned suggest better computerized decision support is needed by various participants in the making and regulating of financial markets. The complexity of modern financial transactions means that more DSS are needed to manage the risks associated with lending operations and credit decision making. Check the Ask Dan! of July 18, 2004 titled "How can DSS help implement Basel II?"

Other crisis exemplars such as computer failures, computer virus attacks, hazardous material spills, product tampering and political crises like the overthrow of a government or the Cuban Missile Crisis may be discussed in a future Ask Dan! column.

What can we conclude? Only some emergencies and crises require or will benefit from elaborate computerized decision support. DSS are not especially relevant, helpful or useful in some crisis situations. We need a typology of crisis situations to analyze DSS needs and gaps for crisis planning, response and management. We need to critically examine who "owns" the crisis related DSS capabilities and how such capabilities should be funded and maintained. Also we need to critically assess what DSS are needed by public sector first responders, by both private and not-for-profit sector organizations, and by national and international government agencies.

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