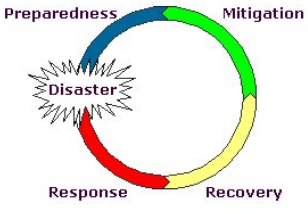
Disasters

Disasters are sudden, calamitous events that bring great damage, loss or destruction, whether through natural or technological causes. Typically, they cause loss of life and property and social and economic disruption. They can be classified as:

- exogenous (floods, drought, storms, landslides and avalanches),
- endogenous (volcanism and earthquakes); and
- anthropogenic or man-induced (collapse of structures, desertification, fires).



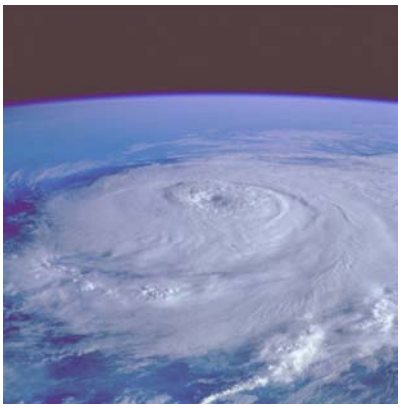
Courtesy of Tuscaloosa County

Disasters all follow a cycle (emergency management or disaster management cycle) which describes specific elements of a disaster, each with a different means of mitigation. The Emergency Management Cycle is an open ended process. The four phases comprising the cycle begin and end with mitigation, the on-going attempt to limited or prohibited the effects of a disaster.

Mitigation includes any activities that prevent an emergency, reduces the chance of an emergency happening or lessens the damaging effects of unavoidable emergencies.

Preparedness includes a variety of measures aimed at ensuring the community is prepared to react to any hazard that threatens the county.

Response is action taken immediately before, during and just after a disaster or major emergency. The goal of the responder is to save lives, minimize property damage and enhance the beginning of recovery from the incident.



Courtesy of NASA

Recovery is the activity that returns infrastructural systems to minimum operating standards and guides long-term efforts designed to return life to normal or improved levels after a disaster. This is a very daunting phase of Emergency Management because it requires personal and community motivation."[1]

One of the profound effects of climate change is a dramatic increase in unpredictable weather, and consequently, a rise in the number and severity of exogeneous disasters. The United Nations Environmental Program (UNEP) recently estimated that the global cost of disasters rose from $US 55 billion in 2002 to $US 60 billion in 2003. The European heat wave alone caused up to 20,000 deaths, most of which could have been avoided through better preparedness and response.

Courtesy of NOAA

According to the Office of the United Nations Disaster Relief Coordinator (UNDRO), approximately 90 percent of all reported natural disasters occur in Third World countries, where property damage is lower than in the developed world, but where loss of life can reach dramatic proportions.

Technological disasters are usually associated with man-made infrastructure, and are typically accidental, though the rise in global terrorism has awakened populations to the risk of purposeful calamities, whether nuclear, biological, radiological or chemical. Examples of technological disasters include chemical or nuclear plant explosions, mining accidents, and major train derailments involving hazardous materials.

[1] http://www.tuscoema.org/cycle.html

"Hot" Issues:

- Linkage between climate change and extreme weather events;
- Threat posed by terrorists seeking to cause nuclear, biological radiological or chemical disaster in the developed world (particularly in Western Europe – London, Paris, Brussels – and US);
- Large and rapid increases in coastal populations in developed and developing world;
- Ability/inability to access space data in near-real time in disaster contexts;
- Integration/convergence of technologies in support of disaster management, particularly space-based EO, communications and Geographic Information Systems;
- Funding for first response providers: police, fire departments, hospitals.

Key Players

Public Safety and Emergency Preparedness Canada: includes emergency preparedness, crisis management, national security, corrections, policing, oversight, crime prevention and border functions. This department is not only responsible for mitigating and preparing for disasters, organizations under its responsibility such as the RCMP or the Coast Guard are central to the response phase in Canada. http://www.psepc-sppcc.gc.ca

Provincial and local Emergency Management Organizations are responsible for first response in the event of disasters occurring in Canada.

The **Canadian International Development Agency** is responsible for humanitarian relief in the event of international disasters; the **Canadian Red Cross** manages this aspect of disaster response on contract to CIDA. http://www.acdi-cida.gc.ca/aid-e.htm

The **International Decade for Natural Disaster Reduction (IDNDR)**, based in Geneva, provides global coordination for disaster mitigation and preparedness. The **Canadian Committee for the IDNDR** assists in providing the leadership, development, and coordination of the Canadian program of action to mitigate the effects of natural disasters in Canada. http://www.rsc.ca/idndr

The **International Charter on Space and Major Disasters** aims at providing a unified system of space data acquisition and delivery to those affected by natural or man-made disasters through authorized users. Each member agency has committed resources to support the provisions of the Charter and thus is helping to mitigate the effects of disasters on human life and property. http://www.disasterscharter.org/main_e.html

The **Committee on Earth Observation Satellites**, is an international coordinating mechanism charged with coordinating international civil spaceborne missions designed to observe and study planet Earth. Comprising 23 Members (most of which are space agencies) and 21 Associates (associated national and international organizations), CEOS is recognized as the major international forum for the coordination of Earth observation satellite programs and for interaction of these programs with users of satellite data worldwide. Its Disaster Management Working Group has accomplished significant work in exploring how space assets can be used to predict disasters, particularly in the area of geophysical hazards. http://www.ceos.org

The **EU** and **ESA** have recently embarked on a Global Monitoring for Environment and Security program (GMES) which deals specifically with information systems for disaster managers; the **Indian Space Research Organisation** has worked on using satellites for operational disaster warnings for several years; they implemented an operational monsoon warning system in Eastern India which has saved thousands of lives;

Surrey Satellites Systems Limited (SSSL) of the UK has applied low-cost satellite technology to develop a constellation of four low resolution optical satellites to monitor disasters globally. The current partners in the program are Nigeria, Algeria, Turkey,and the United Kingdom. China is scheduled to join the program in May of 2005. (http://www.sstl.co.uk/index.php?loc=6)

The **US Federal Emergency Management Agency** which became part of the new Department of Homeland Security in March 2003 is at the forefront of using space assets in operational disaster management contexts. http://www.fema.gov

Space and Disasters

Space has offers varying contributions to disasters at each element of the disaster cycle:

Mitigation: in seeking to lessen the effects of an emergency, space-based EO data can be used to map critical infrastrucure (Ikonos data used in Canada to map border crossings by OCIPEP). The existence of digital elevation models of disaster prone areas, and Geographic Information Systems with space-based EO data, facilitates the overlay of new data during and after disasters, particularly with floods and earthquakes. This can offer disaster managers information on available infrastructure and most affected areas.

Preparedness: majority of disasters come unexpected or with little notice; there are exceptions however. Space-based EO has been used successfully to predict hurricane landfall and severity (saving thousands of lives) and is now used, experimentally, to determine periods during which earthquakes may be more likely to occur (allowing better coordination of disaster readiness efforts);

Response: during the response phase, most space systems are currently incapable of providing real-time access within hours of the event;

Recovery: space data is used by governments and insurance companies to estimate the total impact of disasters. In the United States, the Forest Service uses Landsat data to determine whether federal emergency funding should be initiated; a large insurance user for space data is Munich Re (http://www.munichre.com/default_e.asp), an EU based re-insurance company.

Canada was an early signatory to the International Charter: Space and Major Disasters, which groups together leading space agencies of the world to provide free access to space-based EO data in disaster situations.

Issues for CSA:

- Integration of space assets into PSEPC and provincial response cycles;
- Convincing disaster managers space can be relied on to save lives in a crisis situation;
- Generating products in formats disaster managers will use (they do not want to become EO specialists);
- Planning next-generation capabilities with better response times;
- Interface of public good objectives with commercial mandate for RADARSAT-2.

Related Themes:
Cities and Urban Issues
Climate Change and Variability
Coastal and Marine Ecosystems
International Development
Security and Surveillance
Weather
GMES
GEO

References:

Basic Information:
Disaster Cycle Overview http://footsteps.tearfund.net/english/pdf/18e_mid.pdf

Clear articulation of the disaster management cycle applied in a US County context
Tuscaloosa County Emergency Management Agency http://www.tuscoema.org/cycle.html

Natural Disaster Reference Database http://ndrd.gsfc.nasa.gov

US Federal Emergency Management Agency (FEMA) http://www.fema.gov

Awareness and Preparedness for Emergencies at a Local Level (APELL)
http://www.uneptie.org/pc/apell/disasters/lists/technological.html

Latest update:
NESDIS: US satellite service for all climate and environmental satellites http://www.nesdis.noaa.gov/

Center for International Disaster Information http://cidi.org

NOAA http://www.noaa.gov

Closer look:
The Use of Earth Observing Satellites for Hazard Support: Assessment and Scenarios, Final Report of the CEOS Disaster Management Support Group, 2002 http://disaster.ceos.org/pdf/CEOSDMSG.pdf

DA SILVA CURIEL Alex, BOLAND Lee, COOKSLEY John, STEPHENS P., SUN Wei, SWEETING Sir Martin, *First Steps in the Disaster Monitoring Constellation*, Surrey 2003
http://www.iaanet.org/symp/berlin/IAA-B4-1302.pdf

SCHLAGER Neil, *When Technology Fails: Significant Technological Disasters, Accidents, and Failures of the Twentieth Century*, 1994, pp. 659