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"Disasters"

by Andrew H. Wilson
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EIC HISTORY AND ARCHIVES

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Abstract

This paper discusses some of the natural and engineering disasters that have occurred over the past century and more. It is a somewhat lengthened version of a talk given by the author to the Ottawa Chapter of the Canadian Society for Senior Engineers in late May 2014.

Its purpose is to examine the different kinds of disasters that can occur, rather than to describe individual ones in some detail. Reference is made to several recently published books that do this, including one on engineering disasters by the late Don Lawson, formerly chair of the CSSE History & Archives Committee.

The discussion extends, in general terms, to the consequences of disasters, to actions taken to 'clean up' after them, to steps that can be taken to predict their occurrence and to prevent their recurrence. It may also provide the basis for the further discussion of natural and engineering disasters and the roles of engineers and their profession in regard to them.

About the Series

Principally, the Cedargrove Series is intended to preserve some of the research, writings and oral presentations that the author has completed over the past half-century or so but has not yet published. It is, therefore, a modern-day variant of the privately-published books and pamphlets written by his forebears, such as his paternal grandfather and grandmother and his grandfather's brother John.

About the Author

He is a graduate in mechanical engineering and the liberal arts and has held technical, administrative, research and management positions in industry in the United Kingdom and the public service of Canada, from which he retired over 25 years ago.

He became actively interested in the history of engineering on his appointment to chair the first history committee of the Canadian Society for Mechanical Engineering in 1975 and served both CSME and the Engineering Institute of Canada in this capacity for varying periods of time until 2003. He has researched, written and edited historical material for both organizations, as well as for the Canadian Society for Senior Engineers. He is also a past president of CSME and EIC.

Introduction...

This paper is really an experiment. The spate of natural and engineering disasters during the past year started me thinking about them and their causes and consequences. Incidentally, I have included natural as well as engineering disasters since both have 'messages' for engineers and engineering.

Over the years I have collected a goodly number of press clippings about disasters of all kinds and have acquired several books about them, some quite recently published. So I have reviewed some clippings and re-read a few of the books. Included was the late Don Lawson's book on *Engineering Disasters: Lessons to be Learned*, published by ASME in 2005. This time around, w*ikipedia* was a minor source and, since the media cover most disasters with plenty of pictures, none have been included.

What follows are some thoughts on the results of these exercises.

The Disasters...

Disasters are great misfortunes, events that cause much physical loss and human suffering. They happen on land or on the sea or up in the air, at home or abroad, any day of the week or any time of the day. They affect people as well as buildings and machinery and bits and pieces of the world around us. There are large disasters and relatively small disasters, depending on the amount of physical damage done and the numbers of lives lost. All of them involve risks and incur costs.

The causes of natural disasters such as earthquakes, avalanches, tsunamis, hurricanes, tornados, severe storms, rockslides and some fires have their origins in nature and have little to do with engineering - except in so far as engineering-type actions and scientific studies may have been taken and done in anticipation of the risks of them happening, in prevention, in mitigation of their effects and in cleaning up afterwards. Other natural ones may originate with populations, pandemics and famines, and they may also have potential engineering connections. Some, with engineering connections, have their origins in politics or in wars - for example, World War I, and the collapse of the World Trade Center in New York in 2001. Still others have economic origins, again with potential engineering connections, such as the Great Depression of the 1930s.

However, I consider three types of disaster to be beyond the scope of this paper. One is the potentially widespread natural/engineering disaster in which we currently find ourselves,

namely climate change. This will be world-wide in its effects, have controversial aspects, and may well do damage way beyond the scope of the disasters discussed in this paper. Another type is the political/social disaster, such as wars and genocide. And a third is the commercial failure of large companies - for example, Nortel in Canada.

Disasters associated with engineering have their origins in the breakdown of engineered facilities and equipment in use, as well as in the *mis*-assessment of risk and cost, inappropriate design and incompetent manufacture or in the *mis*-use, *over*-use or *under*-use of engineered equipment. Even plants and equipment with well-tried histories may fail, or something relatively small may go wrong that was not anticipated, detected or corrected, and have disastrous consequences. As well, they may be the result of technological innovations implemented too quickly - something today's public and private innovation promoters might remember.

It is also important to remember that disasters of both the natural and engineering kinds - and especially the latter - may be the results of human error or incompetence, and sometimes of sheer bad luck.

A *catastrophe* may be considered to be a larger form of disaster, so I have not used the word. Nor have I used the word *accident*, which may be defined as an unforeseen or expected event, or one without an apparent cause, and usually smaller than a disaster. It may also be called a *mishap* or an *incident*. And I have not included *fiascos*, which are usually more of an embarrassment and are relatively minor in terms of damage and/or effect.

The media's reaction to a disaster is usually to emphasise its most sensational and/or worst aspects. As columnist Eric Reguly wrote in the *Globe and Mail* on March 15, 2014, "nature abhors a bad news vacuum." Bad news is good news. Disasters are put on newspaper front pages with large headlines, and stay there until the next dose of bad news arrives. Disaster follow-up stories often appear somewhere inside the newspaper.

Occasionally, a particular disaster holds the media's attention for several weeks. One example of this was the Copiapò mine disaster in Chile. It has been billed as "the story that captured the world." On August 5, 2010 the mine collapsed underground, trapping 33 miners. Rescue attempts began immediately. Two days later there was a second collapse. The government sought International technical assistance, for example, from Canada and from NASA. Holes were eventually drilled from the surface into the cavity in which the men were trapped. On 22 August they were found alive. Capsules were designed to carry the men singly to the surface through one of the holes. On October 9, a drill broke through to where the miners were. By 13 October all of them had been brought to the surface. The media kept the world informed throughout the drama generated by the rescue attempt. The build-up to the climax was

enormous. It has been estimated that 1 billion people watched the final stage of the rescue on television. Nearly 2000 journalists from 40 countries were said to be present for it. It was a media triumph. The 33 became world famous. Not surprisingly, the engineering of the rescue played second fiddle to the human story.

A more recent example has been the disappearance of Malaysia Airlines Flight MH 370 over the Indian Ocean.

In most cases, enquiries are held after a disaster to fix cause, responsibility, blame and, if relevant, compensation. In some cases, usually after new evidence has been uncovered, cause and responsibility may be reassigned and compensation readjusted. In other words, the occurrence of a disaster leads naturally to the desire to know what really happened, to learn from mistakes made, and to prevent reoccurrence.

Incidentally, one of the uses of engineering *history* is to provide experience leading to better design, construction, maintenance and so on and, consequently and hopefully, to fewer disasters.

There are lots of lists of natural and engineering disasters larger and smaller that have happened in times past. What follows are brief listings of a number of those that were notable internationally and in Canada.

Internationally...

- the 'patched' boiler explosion on board the Mississippi steamboat *Sultana* in April 1865, while transporting two thousand Union ex-prisoners-of-war and commercial passengers northwards and resulting in a total death toll of 1,800;
- the wind-induced destruction of the first Tay Bridge, in December 1879, when the centre high girder section of the bridge fell into the river, carrying with it a train and its passengers; 75 people died; responsibility for the failure was attributed to the designer-engineer-builder, Sir Thomas Bouch;
- the 7.8 magnitude San Francisco earthquake of April 1906 that left the city in ruins, destroying 28,000 buildings and killing several thousand people;
- the sinking of the RMS *Titanic* - then the largest passenger steamship in the world and usually included in every list of international disasters - on April 10, 1912, after sideswiping an iceberg in the western North Atlantic, due to a variety of causes and with the loss of 1500 passengers and crew;
- the 1918-1919 'Spanish' flu pandemic infected an estimated one-third (500 million) of the world's population and led to the deaths of more than 50 million of them;
- the crash of the British *R-101*, then the world's biggest airship, in October 1931 near Beauvais in France, on its way to India, in which 48 lives were lost, due in very large