

# Mitigating Catastrophic Risks -- Priorities in Research and Communications

Richard L. Garwin  
IBM Fellow Emeritus  
IBM Thomas J. Watson Research Center  
Yorktown Heights, NY 10598  
[RLG2@us.ibm.com](mailto:RLG2@us.ibm.com)

URL (live link): <https://rlg.fas.org>

Please search in any browser with the green text, e.g., [site:rlg.fas.org](https://rlg.fas.org) **pandemic**

Permanent Monitoring Panel - Mitigation of Catastrophic Risk, World Federation of  
Scientists

PMP-MCR 4<sup>th</sup> Session (via Zoom): Session 2, Strategy and Emerging Risks

More on: *Communicating Risk to Governments and People*

October 18, 2021 15:10-15:40 GMT

Abstract:

1. Internal communication of our groups has been vastly aided by the internet and by Zoom meetings, and will be further improved by the PMP-MCR site.
2. External communication is provably difficult (Covid-19 in general and vaccination in particular) -- a problem we identified from the beginning, but that has become increasingly problematic.
3. The PMP structure, with long-time attention to different risks, and communication through the Chair and the PMP-MCR seems effective. Here, for example, is a novel idea to provide a considerable portion of Planetary Defense.

Our PMP's topics of August 2021 – Mitigating Catastrophic Risk:

1. Novel Coronavirus Mitigation
2. Engineering a Resilient Infrastructure
3. Planetary Resilience from Near-Earth Objects
4. Arms Control: A Role for Joint Risk Analysis?

To which I add

5. Cyberthreats, particularly ransomware.

Approximate additional spoken text:

**"Don't get it right; get it written." (by Jerrold Zacharias)**

Over the decades I have had specific or peripheral advice that has assumed increasing importance and salience. When there is more than one person working on a problem, and where it is a social problem or one that could be deemed a "catastrophic risk" it affects many people and, for the most part, requires more than one person to solve, I recall hearing from Jerrold Zacharias, Professor of Physics at MIT, early in my involvement with Project LAMP LIGHT, "Don't get it right; get it written." Zacharias meant that the group would benefit from having early assessments or ideas to share and mutually to develop, rather than waiting until the originator had all the references and an optimum approach to solving or even stating the problem or solution. That was in 1953, in a year-long "Summer Study" devoted to extending the US and Canadian lines of defense against Soviet nuclear-armed bombers.

**"E pur si muove" (by Galileo Galilei)**

Next, I turn to Galileo, and his famous 1632 publication only recently brought to my attention by Paul Dimotakis<sup>1</sup>, of which I provide an excerpt, blood-chilling in its insight,

*"Shut yourself up with some friend in the main cabin below decks on some large ship, and have with you there some flies, butterflies, and other small flying animals. Have a large bowl of water with some fish in it; hang up a bottle that empties drop by drop into a wide vessel beneath it. With the ship standing still, observe carefully how the little animals fly with equal speed to all sides of the cabin. The fish swim indifferently in all directions; the drops fall into the vessel beneath; and, in throwing something to your friend, you need throw it no more strongly in one direction than another, the distances being equal; jumping with your feet together, you pass equal spaces in every direction.*

*"When you have observed all these things carefully (though doubtless when the ship is standing still everything must happen in this way), have the ship proceed with any speed you like, so long as the motion*

---

<sup>1</sup> [https://en.wikipedia.org/wiki/Galileo's\\_ship](https://en.wikipedia.org/wiki/Galileo's_ship) and also "P.E. Dimotakis 1982-2019 Thermodynamics"

*is uniform and not actuating this way and that. You will discover not the least change in all the effects named, nor could you tell from any of them whether the ship was moving or standing still. In jumping, you will pass on the floor the same spaces as before, nor will you make larger jumps toward the stern than toward the prow even though the ship is moving quite rapidly, despite the fact that during the time that you are in the air the floor under you will be going in a direction opposite to your jump. In throwing something to your companion, you will need no more force to get it to him whether he is in the direction of the bow or the stern, with yourself situated opposite. The droplets will fall as before into the vessel beneath without dropping toward the stern, although while the drops are in the air the ship runs many spans. The fish in their water will swim toward the front of their bowl with no more effort than toward the back, and will go with equal ease to bait placed anywhere around the edges of the bowl. Finally, the butterflies and flies will continue their flights indifferently toward every side, nor will it ever happen that they are concentrated toward the stern, as if tired out from keeping up with the course of the ship, from which they will have been separated during long intervals by keeping themselves in the air. And if smoke is made by burning some incense, it will be seen going up in the form of a little cloud, remaining still and moving no more toward one side than the other. ...”*

Galileo suffered for his insights and teachings, but did not bend. What should we do?

**“First, draft the press release” (by Dick Garwin)**

Quoting myself, especially regarding the many studies of the National Academy of Sciences/National Research Council in which I have been involved, ranging from mitigation of global warming to the creation of a Solar Energy Research Institute, “First, draft the press release.” Early ideas of the outcome of the study may be wrong, and the draft of press release should not guide the substance, but it should focus on what must be done and who should do it, in order that the participants in the study bear this in mind.

These multi-person approaches are very different from what I have done, personally, over the decades -- ranging from the design of the first demonstration of the radiation-implosion concept for burning thermonuclear fuel -- demonstrated at 11 Mt

(megatons) with a liquid-deuterium-fueled device on November 1, 1952; to the design and demonstration of elements of laser printers; to the demonstration in the late 1970s and early 1980s of several touch-screen technologies.

Beyond the abilities of an individual or of a couple of people, one needs to have communications within the group, as summarized by Zacharia, as it prepares its report for maximum impact. Then there is the communications strategy for obtaining the desired action from the target audience — without compromising the credibility and integrity of the study organization.

The catastrophic risks that our panel has explored, with its sub-panels, are disparate. When they eventuate, some may permit weeks of reaction time, and others are over in seconds, minutes, or hours. These different time scales call for different communications techniques, not in preparation but in execution of the mitigation process.

Although the span of a pandemic may be years, it is most readily terminated in the very early stages, during which the illness and deaths are typically growing exponentially but are still in the few or at most a few hundred. This was the case, fortunately and laudably, with SARS-CoV-1 (i.e., SARS) in 2002-3. There is time for limited thinking as well as communication with those who must act to protect themselves and others in the case of pandemics. The matter is quite different with the advent of a bolide — a comet or asteroid entering our atmosphere at a speed typically of 20 or 30 km/s, such as occurred over Chelyabinsk on 15 February 2013.



Despite the absence of warning, this was well observed and photographed by many dashboard video cameras within the modern city. The bolide did not reach the ground destructively, but its hypersonic passage and breakup injured 1500 seriously enough to seek medical attention. By attracting people to watch through their windows, and then breaking those windows, the bolide caused many injuries that could have been avoided by a pre-programmed message and warning system to tell people to stay away from the windows and to avoid directly watching the bolide.

I have little to say and less time to say it on the topic of *strategy* or even topics for our sub-panels, and what I might say is probably well known to the experts on these topics. However, I mention the preprint of Philip Lubin of UCSB, on terminal planetary defense against relatively small and hence more frequent impact of asteroids or comets even if intercepted only within cis-lunar distance<sup>2</sup>. Protecting against a Chelyabinsk-size impactor of diameter ~20m and explosive yield some 570 kilotons at an altitude of ~30 km (an arrival rate of ~1% per year) seems feasible if one can fragment the impactor with a flight of multiple, spaced, long-rod penetrators, properly aligned<sup>3</sup>. Several “waves” of such intercepts may need to be launched, especially for larger impactors, to “peel the onion” so that the fragments are small enough to burn up in the Earth’s shielding atmosphere without forming an intense, merged, shock wave.

Tsunami warning systems can give, typically, hours of warning for very extensive tsunamis, and tens of minutes of warning in the case of the 2011 Tōhoku earthquake east of Japan, that led to the meltdown of three operating nuclear power reactors at Fukushima Daiichi.

### “First, get an editor” (by Frederick P. Brooks)

Regarding a major development in the 1960s -- the software for the bet-your-company IBM 360 series computers<sup>4</sup>, led by Fred Brooks, Brooks wrote,

*Bob [Evans] and I fought bitterly with two separate armies against and for the 8000 series. He was arguing that we ought not to do a new product plan for the upper half of the business, but for the total business. I was arguing that that was a put-off, and it would mean delaying at least two years. The battle ... went to the Corporate Management Committee twice. We won the first time, and they won the second time—and Bob was right. The wonder is that it developed at all.”*

**Frederick P. Brooks, Jr.**

PROJECT MANAGER S/360 AND OS/360

Annals of Computer History

1983

---

<sup>2</sup> <https://www.deepspace.ucsb.edu/projects/pi-terminal-planetary-defense>

<sup>3</sup> Computer simulations are urgently needed for the 20-30km/s closing speed. “Long rods” at these speeds may not be effective.

<sup>4</sup> <https://www.ibm.com/ibm/history/ibm100/us/en/icons/system360/words/>

was informed by the advice he later published in small book, *"The Mythical Man Month"* which he begins *"First, get an editor."* By that he didn't mean to find someone who would edit documents, but to choose a common editing app or program that everyone would use and by the discipline of fixing on one, one would have an easy way of communication among the individuals and even the various teams. One can't do this for a project lasting years, because new concepts facilitate editing, but one can freeze the editor for a period of months or a year and gain these benefits.

But this is no longer the 1960s. Before the reinvigoration of the PMP-MCR with the advent of the pandemic, forcing us to use Zoom and enabling us to meet frequently in depth, able to hear one another without echo and to see the slides as well from the very "back of the room" as from the front row — better, of course, than from any physical row! This enabled us to have more rapid progress and facilitated communication for preparation of the report and plan. Other means that should now be considered are the use of Slack, but each such tool has a learning curve, and although it may be right for a group more or less permanently involved, it might be tried and dropped when its purpose is to integrate, part-time, people who have other involvements and different tools.

Highly efficient “groupware” is now available for version control of a document, but learning to use it can be a serious barrier to its adoption by otherwise value participants.

### **“What to do until the (cyber) vaccine arrives?” (by Dick Garwin)**

For my half-hour talk to the Annual Meeting of the National Academy of Sciences, May 1, 2017, I was asked to discourse on strategic threats for the 2020s

- "[Strategic Security Challenges for 2017 and Beyond](https://rlg.fas.org/nas-challenges.pdf)" by R.L. Garwin. Presented to the members of the National Academy of Sciences, May 1, 2017, in Washington, DC. <https://rlg.fas.org/nas-challenges.pdf>

I emphasized the cyberthreat because it is so much practiced, in the form of ransomware, for which there are many adepts who can turn it to the service of any cause, in the professionalized approach of publicists, lawyers, and even some scientists and engineers.

Some, who may use cyber capabilities to counter the public communications aspect of solving a problem, may do so out of conviction, but they may have been recruited by amoral professionals in the service of a small group of highly motivated leaders. Few of us, myself included, are smart enough to form an independent judgment even on vaccination, on a question intentionally obscured by practiced argument. In these days of cyber tools augmented by social media, especially when one is communicating to the broad public that has had essentially no involvement with a particular risk, one is likely to face an organized, even if fringe, opposition that will attempt to discredit the most carefully stated course of action.

To return to the work done by the PMP-MCR, I refer to our origins in Erice in 1981-3, with the discussions on prevention of nuclear war, and specifically the intervention of Dr. John A. Wheeler, of Princeton University, whose brother Joe died in Italy in the U.S. Army in October 1944. At our session, Wheeler asked about the resources required to carry the flag in battle, noting that it might be criticized as a waste of effort that could better be used in turning those soldiers to combatants. But he then noted that if the flag were lost, morale could be compromised, and the battle lost.

When our very panel was working in the early 2000's on countering pandemics, perhaps instigated by terrorists, I welcomed Sally Leivesley's recruiting a publicist, perhaps a newspaper type, who emphasized the need to draft and test messaging, to ensure that the desired audience would understand and act.

Those of us who are consumed with understanding the substance and with formulating responses have little patience, typically, for efforts spent on communications, but it is clear they are essential. I recognize the irony posed by my arguments against the professionalism employed by others to counter our carefully composed messages, and my advocacy of professionals to help hone those messages on our side; I just need help in sorting this out.

Humility is in short supply among our colleagues. Many of us feel that we have something to contribute to the solution of pretty much any problem. But often we are missing essential elements.

**"How does this accord with Lanchester's Law?" (by Dr. Vincent V. McRae)**

For instance, I recall in the 1960s, the revelation brought to me and my Military Aircraft Panel of PSAC, when our Executive Secretary, Dr. Vincent V. McRae asked the simple question about our proposed recommendation, "How does this accord with Lanchester's Law?" LL might be called "the law of mass action in warfare." It notes that under many circumstances, the relative efficacy of a battle force is the product of the effectiveness of each unit, multiplied by the *square* of the number of units. None of the dozen or so "experts" on my panel had heard of Lanchester's Law, and our initial skepticism was quickly converted to understanding its essential nature and either to employing it or finding ways to counter it.

In the course of our work in the various PMPs, I am trying to empower us with an understanding of how to achieve improved internal communications in our deliberations, and, especially and with more difficulty, external communication and motivation, consistent with our obligation to tell the truth.

I leave further comment for our informal discussion, both at the session and perhaps in an interest group afterwards. [ END ]