Synchronic Disasters & 3.11, 2011

By Richard P. GREENFIELD

Author
Richard P. Greenfield

Remembrance of Catastrophes Past

The first U.N. Commission to reach Japan after the quake-tsunami-triple-meltdown termed the event a "synchronic disaster" and went on to note that this was a new and dangerous threat, more dangerous to developed countries than to developing countries.

Certainly there is no way to look at the events of 3.11 without seeing in them multiple disasters that could and should have been averted, whether it is people who ran for their cars rather than the high ground and were thus caught in narrow streets when the tsunami came, or any of the many errors (which begin with the location) concerning the Fukushima Dai-ichi Power Plant. *(Chart 1)*

But the idea of a synchronic disaster, one that knocks out all basic infrastructure, is, on the one hand new, because of the amount and type of infrastructure we have put in place, and, on the other hand, very old. The volcano that destroyed most of the island of Thera (present-day Santorini) in approximately 1628 B.C. destroyed most of an island and an entire civilization, spread across several islands in the Aegean. It destroyed so much that some of what has come down to us is neither science nor history but legend.

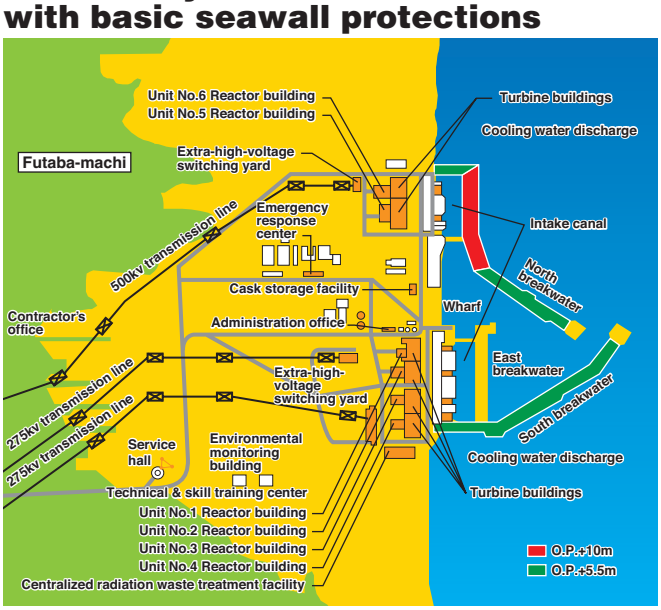
While that was a volcanic eruption, it caused earthquakes all around the Mediterranean Basin and generated tsunamis that struck and caused destruction and damage on many of the neighboring islands.

The destruction of an entire civilization may be the ultimate example of a synchronic disaster but there are certainly many examples that stop well short of that marker. The eruption of Mt. Vesuvius destroyed Pompeii and Herculaneum; however, it did not destroy the Roman Empire (which by that point covered most of Europe, North Africa, and the Middle East). The Great Lisbon Earthquake (1755) also generated a tsunami that almost completely destroyed Lisbon, but Portugal and its empire survived.

These examples, of course, are pre-industrial, a fact that strikes closer to the definition the U.N. report seems to be aiming at, but we can take an earthquake in modern times: the Tangshan Earthquake on July 27, 1976 in Tangshan, China destroyed the city and killed hundreds of thousands of people. It did not destroy the People's Republic of China, which then, as now, would have been considered a developing country.

CHART 1

General layout of Fukushia Dai-ichi with basic seawall protections



Source: Institute of Nuclear Power Operations

What Has Changed

There is one word that defines the change: connectivity. Connectivity should not be taken as being the same as electrification. There have been disasters and blackouts many times over the years since electrification. They turned off lights and refrigerators and stopped factories. They did not even cripple communications since old-style phones worked on a different and independent power source.

On 3.11, however, when electricity was lost in Northern Kanto (where I live) it took my lights, my refrigerator, my direct internet connection through which my internet connection and an internet phone operate, as well as my direct fax phone, all of which operate off the regular current mains. And since the mobile network throughout much of Eastern Honshu collapsed, so did what would have been my only alternative, my mobile phone (although, note well, even had the mobile network not collapsed, the power in my area was down for 40 hours, far longer than the life of the mobile phone battery unless it was used only for texting). Multiply that by tens of millions of people, by hundreds of large companies, by tens of thousands of small to medium-size companies and a picture emerges that, although many areas were far from the direct impact of the tsunami, or from Fukushima, they were crippled, without power, without connectivity. One way to visualize connectivity and all it entails is shown in *Chart 2*.

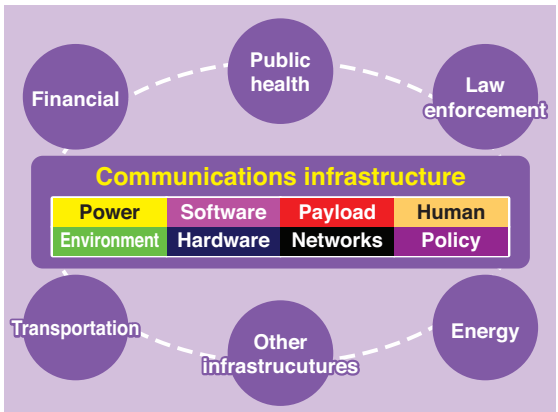
Without connectivity there is no "just-in-time" inventory or production, no electronic or mobile commerce; in fact, without connectivity, and a smart phone with 500 apps is basically a dumb paperweight.

For connectivity to function there are two prerequisites: bandwidth and power. For every smart phone and tablet computer there is a battery, and the battery must be recharged. Without a recharge (or a spare battery) there are simply more paperweights.

Recharging a battery requires electricity (as do all forms of connectivity). Electricity, like gas and water, is what we commonly call a "utility," something we use every day and expect to be there when we need it. It is not simply that our infrastructure requires connectivity, it goes much deeper than that. Our

CHART 2

Eight ingredient framework



Source: Lucent Technologies Inc.

TABLE 1

Comprehensive list of power system intrinsic vulnerabilities

	Power system component			
Intrinsic vulnerability	Distribution plant	Battery plant	Generator plant	Grounding
Loss of connectivity	■			■
Loss of potential	■			
Critical fuel characteristics		■	■	
Load limitations		■	■	
Interface limitations		■		
Chemical damage		■		
Wear			■	
Aging		■	■	
Physical damage		■	■	

Source: Lucent Technologies Inc.

civilization requires water. Most people can last days, even a week, without food. But not without water. And as water or perhaps even blood itself is to us, biologically, in much more than a metaphorical sense, power and connectivity are to an advanced industrial economy. Take them away, for even a short time, and the "heart" stops. We can see the essential truth of this by how long it took for Japanese companies to completely reestablish their supply chains, move or replace essential production and move forward.

Yet, if connectivity and power are so essential, there is a paradox, in that modern society uses more power, and the use of power continually goes up. There are occasional advances in efficiency (e.g., the LED light bulb), but for each of those, there are smart phones, tablet computers, portable game consoles (all of which have batteries that need to be recharged) and larger and more intricate home entertainment centers. A time traveler from 50 years ago, when devices were either on or off, might pause to wonder if we are running our devices or they are running us.

Who Watches the…?

A very famous quote in Latin translates to "who watches the watchers?" or "who guards the guards?"

The question is appropriate. Our devices, after all, are made by private companies that are not in the business of supplying either power or bandwidth. An adequate supply of both, or the means to obtain them are business assumptions shared by manufacturers and users (whether corporate or personal) alike.

Synchronic disasters first and foremost show us that those assumptions may be wrong. However, a wrong assumption is not the same as a new phenomenon and there is ample evidence to support the idea that, at the very least, some of these problems have been foreseen, and even dealt with in previous disasters.

The simple answer is that although the exact degree of connectivity and associated developments (e.g., "cloud computing") may not have been predicted to the extent they have developed, the general trend was obvious for years and has been pinpointed many times. *(Table 1)*

While the internet has always been cited for being robust in the sense of having many nodes and offering many ways of storing information, the fact remains that even in a development like cloud computing, without onsite immediately accessible power, in whatever form, data stored in the cloud might as well be in the clouds.

Chronicle of Synchronic Disaster Foretold

Despite the U.N. Commission's assertion, there has been at least one near perfect run-through of a synchronic disaster: Hurricane Katrina in New Orleans. There, although the warning time was longer than for the earthquake or tsunami, there was not adequate time to evacuate the entire city. There, as in many places in Tohoku, experts had long warned that tidal surges accompanying a very strong hurricane could easily breach the levees protecting the city. There was, as in many parts of Kanto, vital infrastructure, including mobile base stations, cable junctions, and back-up power generators for hospitals and other vital facilities.

That disaster generated stories that are as lurid as any from the Tohoku disaster: policemen convicted of murder for shooting unarmed men they claimed were looting, medical personnel investigated and charged for practicing real triage when the floodwaters encircled one hospital and it was clear that not all patients could be evacuated, broken lines of communication and connectivity, broken lines of command, the list goes on and on.

When the waters had finally receded and the immediate emergency ended a panel was formed to review and make recommendations to the US F.C.C. ("Federal Communications Commission"). The panel comprised people from telecoms, various high-tech companies, first responders and medical personnel and law enforcement agencies and various community leaders. Its charter was simple: to make recommendations for both policies and actions that could be taken to mitigate the consequences of a disaster as thorough as Hurricane Katrina was (they did not call it a "synchronic disaster" though it fits the definition well enough). Please note that these are not disaster prevention steps such as higher levees or higher seawalls. Rather these are the immediate steps that must be taken to restore connectivity and linkage between various locations and the outside world.

Some of the recommendations made by the panel (and subsequently endorsed by the F.C.C. and forwarded to the Department of Homeland Security) are worth looking at in light of the Tohoku earthquake and the meltdowns at Fukushima.

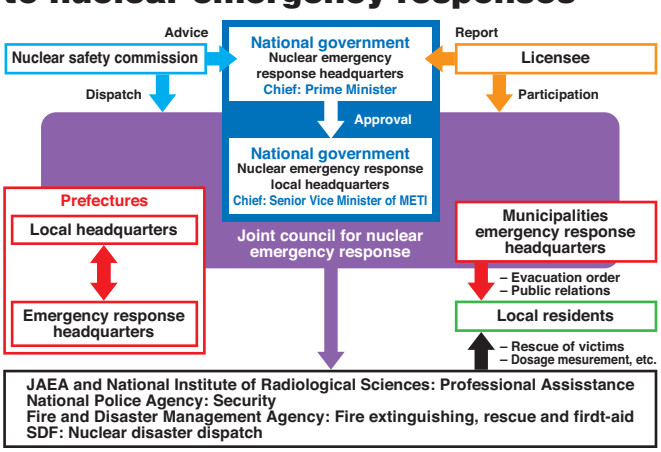
1) Unified command and control and clear lines of authority as well as compatible communications between various groups of emergency workers. The immediate chaos at Fukushima is perhaps the best example of why this is so necessary: not only was it unclear who was in charge, but when the Self Defense Forces were dispatched to help with the effort to get the reactors under control, they did not have immediate onsite cooperation from TEPCO ("Tokyo Electric Power Co."). That is a realworld example but in almost any large-scale disaster there will be a mix of local and national agencies, together

with necessary civilian specialists (e.g., telecoms or electrical engineers). Of course for unified command and control to work there must be compatible communications systems. *(Chart 3)*

2) Prepositioning of necessary emergency repair and replacement equipment. Although the sheer scale of the Tohoku earthquake and the distances between the furthest points hit by the tsunami make this seem extraordinarily difficult, it can be done, if not to the scale that would have been necessary. It is certainly possible to build non-redundant and resistant repositories for such items as emergency generators, diesel fuel, batteries (many mobile base stations that were not destroyed did run out of fuel or power), hoses, cabling and any other infrastructure-related equipment. Such stockpiles can be situated in ways to avoid redundancy, so that if one is unavailable because of local conditions, another will not be far away.
3) While many of the panel's recommendations refer to specific conditions in the US, it is worth noting that even in the US there were many examples of first responders and law enforcement personnel who did not know, and had no practice in, using systems that would have given them overriding priority on particular emergency networks.
4) The panel also recommended that people within a disaster area receive certain waivers or priority that would allow them to temporarily utilize whatever systems remained intact or whatever systems would be the first restored (in this case there is not an exact 1:1 because certain systems used in the US are not used in Japan; however, a somewhat analogous response in context here could consist of using the TETRA system for the public mobile phone carriers). Without getting deep into a discussion of telecommunications protocols, a part of the mobile system was simply swept away in the tsunami or base stations were compromised by the initial earthquake. However, what brought the mobile systems down was overload. More bandwidth could have helped. It would have been a bad day, in any case, for many of the ordinary uses of smart phones which require large chunks of bandwidth at high speed. In a disaster bandwidth may be limited, and uses might have to be limited as well to texting, voice, and perhaps certain location-based applications. (We should note though that there are reports that both Skype and Twitter remained usable on 3.11.)

CHART 3

Outline of the organizations relating to nuclear emergency responses



Source: Report of Japanese Government to IAEA Ministerial Conference on Nuclear Safety, June 2011

What Can be Done

The panel's recommendations were, of course, limited to conditions that were created by Hurricane Katrina and they are "top-down" in that they were made to a government commission charged with overseeing various communications protocols and issues. Thus, they do not address two other areas: steps that companies and individuals can take:

1) Computer hard-drive and cloud server back-ups can fail or become inaccessible in a synchronic disaster (in fact, lost data was a major problem at some companies and scientific research institutes). Small flash drives have enough storage for most working documents and are light enough that having and carrying a few will not be burdensome. That way if someone has to be relocated, they need not wait for connections to be reestablished to a company or remote cloud server.
2) Although many companies provide employees with company mobile phones and laptops, few, if any, require or provide for spare batteries to be kept at home and in the workplace. On 3.11, there were places that lost power for weeks due to the tsunami, and others where power was down for less than a day. Mobile phone service was also restored within days (but keep in mind the earlier note about Twitter, Skype and some mobile emails as well). Mobile battery life is finite, even using minimal power applications such as texting. One spare fully charged battery could provide the margin needed until power and connectivity are restored.
3) Companies need to have action and business continuity plans. These will include which employees can work remotely (whether from home or satellite facilities) what core functions can be relocated, and which ones cannot. Obviously, no single plan can include every possible contingency and managerial personnel should bear in mind the military axiom that "No plan of battle survives first contact with the enemy."
4) Individuals also need action plans, in some cases coordinated with the people they work with but also with family and friends. In parts of North Kanto it took 10 days before gasoline tankers and goods wagons got through in numbers. Bottled water was rationed for six weeks after the quake. Few people were prepared with the number of batteries, flashlights, staple foods, or non-electric means of heating and cooking needed (and this is an area very far from any part damaged directly by the tsunami, though the quake itself did serious, though localized, damage).

Epitaph for?

The U.N. Commission was correct to say that "synchronic disasters" in a modern society require specific steps that up till now may not have been possible or necessary. With all our technology, we are, in one way as "at risk" as the Therans were when the volcano blew their civilization into legend. Unlike the Therans we know this, and understand the processes. Our warning and predictive systems, though still poor, are improving. The most immediate steps that can be taken in Japan are to put into place the necessary materials and tools to ensure the quickest response and reconnection of all connectivity, a precondition of the restoration of economic and social life, and the restoration of anything that has been disrupted or destroyed. JS

Richartd Greenfield is a journalist, editor and consultant living in Japan.