

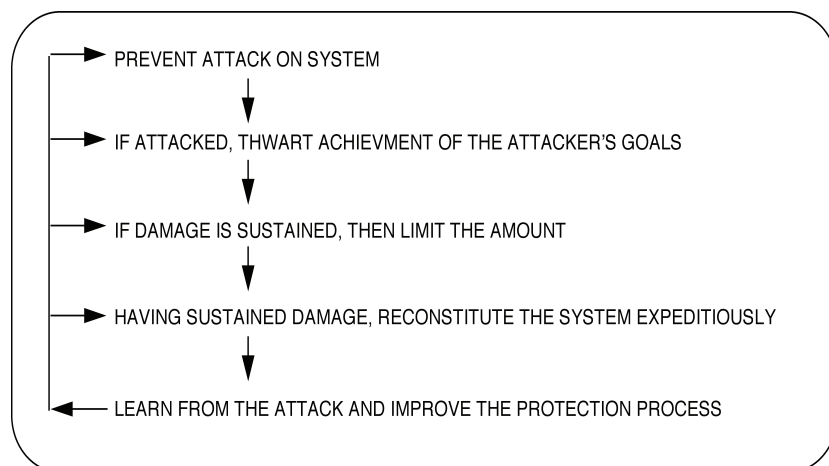
A Framework for Thinking About Cyber Conflict and Cyber Deterrence with Possible Declaratory Policies for These Domains

Stephen J. Lukasik
Georgia Institute of Technology

A. DETERRING CYBER ATTACKS

The Role of Deterrence in Defense Against Cyber Attacks

Defending against attacks includes actions during three periods. The pre-attack period is the most important, for it is here that deterrence can possibly be effective. The trans-attack period is one where actions can be taken to limit damage, assuming one has real-time systems for sensing events and undertaking responses. The post-attack period is one of reconstitution and learning from the attack to improve the protection process to forestall or blunt future attacks. Schematically:



The first line describes the pre-attack period; the next two describe the trans-attack period; and the last two describe the post-attack period. All must be addressed when considering declaratory policy, although post-attack period actions are, by their nature, a result of failures during the two earlier periods. The most attractive actions are those that dissuade an adversary from attacking. In practice this

includes deterring by detecting and defeating preparations for the attack, or preempting attackers before they can launch an attack.

Defeating attack preparations renders the attack ineffective. Hardening can serve either to deter, when hardening is seen by the attacker to be highly effective, or to reduce the effectiveness of the attack to the point where it is judged to be an inefficient way for the attacker to expend resources. Distributing facilities, thus increasing the number of aim-points, creating virtual facilities behind which real facilities are hidden, adding redundancy, and deception can also serve to defeat attack preparations.

When these fail to deter, one seeks to limit the amount of damage in real-time. This is also a time for the cyber equivalent of civil defense, making users aware of an attack so they can take individual protective actions beyond the direct control of central authorities. Disconnection, either to disconnect the defender from an on-going attack or to disconnect the attacker, can be useful, though difficult to implement on a national scale currently.

Post-attack the defender reconstitutes what was destroyed and undertakes analyses to understand how the attack succeeded, what warning signs were present that were disregarded, and how the defense can be strengthened to reduce the likelihood or effectiveness of a future attack.¹

Defense is a combination of all these, selected according to the technical capability of the defender, the value of assets to be protected, the costs to defend them, and the anticipated threat. All are part of the total picture. Deterrence, while attractive if one can pull it off, is not the only option open to a defender. The policy declarations proposed later address the full range of cyber defenses.

Defending What Against Whom

Defenders must deal with three kinds of attackers. *Nuclear states*, because they are cyber-capable as well, have global agendas, and may see the U.S. either as an obstacle or a military or economic threat to their agendas. *Non-nuclear states* are likely to see cyber weapons as an attractive counterbalance to U.S. conventional and nuclear capabilities. Cyber weapons are inexpensive, widely available, and relatively easy to master, and a cyberattack can be cost-free if attackers can remain anonymous. The attacker tier below states are *sub-state groups*. They can consist of terrorists and other criminal and extremist groups. The lowest level of attackers are *individuals*, the cyber equivalent of the Unibomber, but also including a wide range of "ankle-biters." The latter appear frequently in discussions of cyber defense although the threats they pose are not of a worrisome magnitude. Some individuals will, however, turn professional and thus can be viewed as potential recruits or as apprentice attackers.

Cyber technology has resulted in an active cyber underground and a commercial industry to write and distribute malware. Virus production has been automated and there is a malware market for goods and services to support spamming, phishing, and other potentially dangerous activities. A recent report notes:

Half (52 percent) of new malware strains only stick around for 24 hours or less. The prevalence of short lived variants reflects a tactic by miscreants aimed at overloading security firms so that more damaging strains of malware remain undetected for longer, according to a study by Panda Security. The security firm, based in Bilbao, Spain, detects an average of 37,000 new viruses, worms, Trojans and other security threats per day. Around an average of 19,240 spread and try to infect users for just 24 hours, after which they become inactive as they are replaced by other, new variants. Virus writers—increasingly motivated by profit—try to ensure their creations go unnoticed by users and stay under the radar of firms. It has now become common practice for VXers to review detection rates and modify viral code after 24 hours. The practice goes towards explaining the growing malware production rate. The amount of catalogued malware by Panda was 18 million in the 20 years from the firm's foundation until the end of 2008. This figure increased 60 percent in just seven months to reach 30 million by 31 July 2009.²

¹Stephen J. Lukasik, Seymour Goodman, and David Longhurst, *Protecting Critical Infrastructures Against Cyber-Attack*, Adelphi Paper 359, International Institute for Strategic Studies, London (2003).

²See <http://www.theregister.co.uk/2009/08/13/malware_arms_race/>.

Table 1

State-oriented cyber attacks	
Small attacks repeated frequently	1. Damage or bankrupt an economy 2. Defraud or extort parts of an economy
Large attacks repeated less frequently	3. Damage or destroy a single infrastructure 4. Exploit interdependencies among infrastructures
People-oriented cyberattacks	
Attacks on a large number of people	5. Destroy trust within a population 6. Wear down resistance to policy change
Attacks on individuals or small groups	7. Attack reputations of leaders 8. Destroy confidence in elites

State actors pose the greatest existential threat. They have resources and discipline, and can recruit and train numbers of personnel and manage large planned attacks. They have sovereign power to provide potential target intelligence and the means to acquire vulnerability information. They can have clear reasons for attacking other states. But against these advantages, they must have a realistic strategy for the use of force to achieve their larger objectives and to understand the role cyber force can play.

Sub-state groups pose a very different threat. They have more limited agendas than do states and must operate under everyone's radar. The fluid nature of their organizations, leadership, numbers, goals, and rapid changes in technology complicates assessing the threats posed by such groups. They may, in fact, represent the larger cyber threat to the U.S. because of their flexibility, the absence of a state organization to put at risk, and the attractiveness of cyber force because of its low cost and likelihood of success.

Cyber attacks are usually defined as software attacks, seen as arising from "outside" and to use the Internet or other network facilities to deliver attacker cyber force to the target. The attacker is seen as anonymous. The attack consists of transmitting software or data to the target such as to cause a computer to malfunction, or to enable the attacker to insert, destroy, copy, or modify data files contained therein. The modification can consist of encrypting the files so the attacker can hold them hostage for ransom. A network attacker can be part of the production and distribution supply chain for software and hardware as well, where the attack software is delivered "shrink-wrapped."

One can interrupt computer-enabled operations by attacking circuit board power supply logic, causing soft and hard failures. The target computer or system can be attacked by disabling the support systems on which operators depend: building security, fire protection, system power, and the like. One can induce soft or hard failures through electromagnetic pulse technology. Attacks on computer systems using physical force are attractive because, even in distributed systems, efficiency encourages concentrations of hardware: system control centers, server farms, and specialized facilities for manufacturing, maintaining, and distributing subsystems and components.

There are two kinds of targets to defend: the state and its people, either groups or individuals (Table 1). Attacks can be large or small, and repeated frequently or infrequently. The people-directed attacks have results that are similar to those of psychological operations, producing soft damage that is less easy to measure but is as central to warfare as physical damage.

Military doctrine calls for controlling strategic territory. Despite the distributed nature of public networks that seems to deny such a possibility, there are cyber analogs. The essence of a network is its connectivity. Controlling network connectivity thus amounts to control of strategic territory. International gateways will be important targets of such attacks.

Deterring Cyber Attacks by States

Cyber conflict between states is very different from conflict involving conventional and nuclear force. Concepts of deterrence formalized in the Cold War are of limited utility. Dissuading the Soviet

Union from launching an attack on the U.S. through fear of a certain and unacceptable response was the only plan that seemed to offer security early in the Cold War. Implicit was that both sides have comparable forces whose capabilities are known, that decapitating attacks can be made infeasible, that the survival of a retaliatory capability on each side is assured, and that firebreaks are fashioned so that escalation of the level of force in any conflict can be controlled. Deterrence had a psychological as well as a physical dimension.

Deterring cyber conflict requires expanding the concept of deterrence well beyond the framework of nuclear deterrence. When a conflict involves computers against computers, the psychological aspect of the threat is missing. National leaders may not even have a clear idea of the extent of the vulnerabilities of their computer networks.

Cyber attacks can have results similar to those of psychological operations. Sun Tsu said, "Those skilled in war subdue the enemy's army without battle." Commenting on Sun Tsu's strategy, Griffith explains, "Never to be undertaken thoughtlessly or recklessly, war was to be preceded by measures designed to make it easy to win. The master conqueror frustrated his enemy's plans and broke up his alliances. He created cleavages between sovereign and ministers, superiors and inferiors, commanders and subordinates. His spies and agents were active everywhere, gathering information, sowing dissension, and nurturing subversion. The enemy was isolated and demoralized; his will to resist broken. Thus without battle his army was conquered, his cities taken and his state overthrown. Only when the enemy could not be overcome by these means was there recourse to armed force."³ Were there computers in 400 B.C. Sun Tsu would have enthusiastically adopted their capabilities.⁴

Beyond dissuading through fear of retaliation, dictionaries offer other synonyms for "deter." It can mean to discourage an attacker through effective defense or thwarting actions that make attacker success too uncertain. It can mean preventing by preemption. These broader meanings of deterrence suggest defense will play a larger role in cyber deterrence than in the nuclear case, where defenses were seen as destabilizing to the nuclear balance.

Warning systems, both strategic and tactical, are central to cyber deterrence. Without them, and the near-real time response they potentially enable, cyber attacks are certain to succeed eventually as attackers learn and defenders are mired down by the vastness of their systems. In this regard, cost-imposing strategies are important if they can make the probe-and-prepare-in-advance character of cyber attacks more difficult.

Strategic and tactical warning in cyber conflict can provide elements of deterrence through the ability to influence adversary perceptions. Cyber war-fighting, more akin to crisis management than conventional conflict, is possible at a low level of physical violence. An important cyber response capability is near-real time control of network connectivity.

While the details of deterrence will be different, there are three aspects of deterrence that remain invariant. A defender's response must be seen as technically *feasible*. In the nuclear case, very visible weapon tests and well publicized images of nuclear detonations and measured global radioactive fallout provided convincing demonstrations of feasibility. Second, the defender must be seen as *credible*, willing as well as able to respond. U.S. nuclear weapon use in WW II established that, and equivalent Soviet nuclear capabilities left little doubt what its response to a nuclear attack would be. Finally, defense through deterrence requires being *able* to respond, with in-being offensive capability. While response to a cyber attack need not be a cyber counter-attack, international principles of armed conflict speak to proportionality of response and escalation control favors responding in kind. Thus cyber offense is a component of cyber deterrence.

³"*Sun Tsu and the Art of War*," translated and with an introduction by Samuel B. Griffith, Oxford University Press paperback, London (1973) pg. 39.

⁴The period Sun Tsu describes is uncertain; the date is for general orientation.

Deterring Cyber Attacks by Sub-State Groups

Deterring sub-state groups from cyber attacks differs from deterring sovereign states. With fewer fixed assets, sub-state groups have greater flexibility, and their independence from sovereign commitments insulates them from many types of sanctions or punishment approaches to deterrence. Their strength is in their followers and their commitment to an idea. Cyber weapons would seem to be attractive to them despite representing a departure from the simpler forms of violence and intimidation sub-state groups have employed to date. Nevertheless, the degree to which potential cyber capabilities are congruent with sub-state groups' operational code is relevant to U.S. planning.

To this end, it is illuminating to examine how one vocal sub-state group see the potential utility of cyber attacks. Jihadists, whose track record and declared antipathy to western values, provide one such example. Al-Qaeda, its affiliated terrorist groups, and its Jihadist supporters, like everyone else, use the Internet. There are currently at least 5,000 Jihadist websites.⁵ The most important, large forums that serve as hubs for the virtual Jihadist community and clearinghouses for terrorist propaganda and tactical materials, have tens of thousands of registered members.

In spite of the enthusiasm with which these individuals—active terrorists as well as sympathizers—have embraced the use of cyberspace, currently the bulk of their online activities are unrelated to “cyber terrorism” in the traditional sense of launching destructive attacks over the Internet. Instead, they use the Internet for coordinating various functions related to terrorism, including funding, recruitment, propaganda, training in tradecraft, and intelligence collection.⁶

In recent years, however, a growing interest in using hacking methods to achieve various Jihad objectives has emerged. “Jihad” in both its technical meaning of “struggle” and its use by militant Muslims refers to a range of activities associated with combating the enemies of Islam and defending the pan-Islamic nation. This includes not only militant-style attacks, but also proselytizing, recruitment, fundraising, psychological influence, economic warfare, and a number of other activities.⁷ Pursuant to the conception of Jihad as a holistic political struggle, the community's activities are broader than conventional cyber terrorism. Most fall into types of Jihad that is political but not immediately violent.

An illustrative example occurred during the online backlash to an incursion by Israel Defense Forces (IDF) into the Gaza Strip in December 2008. Hackers from the Muslim world self-mobilized to attack tens of thousands of Israeli websites. Most of these hackers executed simplistic attacks—defacing websites and leaving threatening messages, or they launched denial-of-service attacks to take the websites offline. Government, hospital, banking, and media sites were successfully attacked, in addition to the websites of thousands of large and small companies and organizations.⁸ The stated motivations for the attacks

⁵MSNBC. “Pentagon Surfing 5,000 Jihadist Websites,” May 4, 2006. See <<http://www.msnbc.msn.com/id/12634238/>>; Burleigh, Michael. “Some European Perspectives on Terrorism,” Foreign Policy Research Institute, May 2008. See <<http://www.fpri.org/enotes/200805.burleigh.europeanperspectivesterrorism.html>>.

⁶Kohlmann, Evan F. “The Real Online Terrorist Threat,” *Foreign Affairs*, Sept/Oct 2006; Timothy L. Thomas, “Al-Qaida and the Internet: The Danger of Cyberplanning,” *Parameters*, Spring 2003.

⁷See, for example, the popular pamphlet “39 Ways to Serve and Participate in the Jihad.” Variations on this document have been widely circulated on Jihadist websites since 2003. The pro-Jihadist translation service “Tibyan Publications” has published an English translation available at: <http://www.archive.org/details/39WaysToServeAndParticipate>. Indeed, the document supplies two definitions for “electronic Jihad:” one refers to organizing and distributing information on the Internet, the other refers to hacking. The hacking activities recommended involve taking offline American and other websites, and do not refer directly to any cyberterrorist scenarios.

⁸Project Grey Goose Phase II Report; available http://greylogic.us/?page_id=85. U.S. and NATO military websites were also attacked. A group of Turkish hackers defaced one of three subdomains of mdw.army.mil, the URL of the U.S. Army Military District of Washington, as well as the website of the Joint Force Headquarters of the National Capital Region. The same group left a threatening message on the NATO parliament site www.nato-pa.int. The message read: “Stop attacks u israel and usa! you cursed nations! one day muslims will clean the world from you!” See: McMillan, Robert. “Hackers Deface NATO, U.S. Army Web Sites,” *Computer World*, January 9, 2009. The NATO defacement is available at: <http://www.zone-h.org/content/view/full/15003/30/>.

fell under the rubric of supporting Jihad, but were not immediately violent. The four most commonly articulated motivations for the anti-Israel hacks were:

- *Inflicting financial damage to Israeli businesses, government, and individuals:* A message on the Arabic hackers' site Soqor.net exhorted hackers to "disrupt and destroy Zionist government and banking sites to cost the enemy not thousands but millions of dollars. . . ."
- *Delivering threats of physical violence to an Israeli audience:* One Moroccan hackers' team posted symbols associated with violent Jihadist movements and an image of explosion, along with a threatening message for Israelis.
- *Using cyber attacks as leverage to stop Operation Cast Lead:* Many of the defacements contained messages indicating attacks on Israeli sites and servers would stop only when Israel ceased its violence in Gaza.
- *Fulfilling the religious obligation of Jihad:* Some hackers couched their activities in religious terms, insisting that cyber attacks were tantamount to fighting Jihad against Islam's enemies. One hacker wrote, "Use [the hacking skills] God has given you as bullets in the face of the Jewish Zionists. We cannot fight them with our bodies, but we can fight them with our minds and hands . . . By God, this is Jihad."⁹

This sort of Jihadist "hactivism" has become a popular way for sympathizers to target perceived enemies of the faith. The Netherlands and Denmark have also been targeted by similar grass-roots campaigns in response to their newspapers' decisions to publish cartoons depicting the Prophet Mohammed in 2006.¹⁰ U.S. websites have been targeted.¹¹ A smaller-scale effort targeted Chinese websites during Uighur-Han Chinese violence in 2009.¹² Such attacks may be popular because they are approved by the mainstream of the Muslim world. The Islamic university al-Azhar in Cairo, the single most influential religious institution in the Sunni Muslim world, issued a fatwa in October 2008 approving cyber attacks against American and Israeli websites. "This is considered a type of lawful Jihad that helps Islam by paralyzing the information systems used by our enemies for their evil aims," read the fatwa.¹³ The fatwa explicitly endorsed attacks on websites, but it was not clear whether it could be extended to justify true cyber terrorist attacks.

While many of the Jihadist-hackers online have embraced a menacing form of hactivism, there are intimations that others seek to harness these skills for cyber terrorism purposes. The prominent al-Qaeda strategist Abu Ubaid al-Qureishi has discussed the potential of cyber-terrorism. Al-Qureishi was a bilingual analyst who exploited English-language western sources, including writings by U.S. military, in the strategic documents he wrote in Arabic for the al-Qaeda core group in Afghanistan.¹⁴

In his essay titled "The Nightmares of America," al-Qureishi describes the five terrorism scenarios he asserts frighten the U.S. most. He explains that the purpose of his exercise was to exploit Western security analysis to uncover the greatest vulnerabilities in U.S. security. Al-Qureishi believed al-Qaeda should let these analysts, who publish prolifically in the open source domain, lead the way:

In order to become acquainted with the enemy's hidden weak points, one must examine the studies that Western strategic analysts have written about the real or imagined security gaps and dangers threatening the security and safety of American society. Their fears must be studied carefully, because they usually point to weak points in American national security.¹⁵

⁹Motivations are excerpted from Project Grey Goose Phase II Report; available at http://greylogic.US/?page_id=85.

¹⁰Project on Jihadist Websites First Quarter 2008, International Centre for Political Violence and Terrorism Research, May, 2008, p. 24.

¹¹The Israeli portals of American companies were among those aggressively targeted in the response to Operation Cast Lead.

¹²There was a mild campaign against Chinese websites during this time on Jihadist hacking forums.

¹³AKI. "Sunni Scholars Sanction Electronic Jihad," October 16, 2008.

¹⁴Sources vary as to whether al-Qureishi is still alive.

¹⁵Al-Qureishi, Abu Ubaid. "The Nightmares of America," February 13, 2002. Originally obtained from the Jihadist website *al-Qal'ah* (now defunct) on June 6, 2005.

Cyber terrorism is one of the five methods of attack outlined in the essay. Al-Qureishi describes four advantages of attacking over the Internet: cyber terrorist attacks can be conducted anonymously from a distance; the technology required is inexpensive; cyber attacks do not require exceptional skill; and few people are needed. His target list is from U.S. reporting on the subject: "As for the targets that the Jihad movements might choose, they range, in the view of American experts, from huge electrical grids to nuclear power plants, financial institutions, and the 9-1-1 emergency telephone network."¹⁶

He describes previous successes by hackers and concludes that, based on the rapid dissemination of hacker knowledge over recent years and the transformation of the U.S. economy into "a basically informational economy . . . [there is] a possibility [of launching] repeated, focused attacks with a very considerable effect."¹⁷

It is rare to find a document like al-Qureishi's essay that includes both the method of attack and possible targets. In discussing possibilities for violent attacks, Jihadists in terrorist forums rarely provide targeting information. Instead, their discussions focus on the techniques and tactics available to carry out an attack against an unspecified target. Jihadists write prolifically on surveillance, recruiting, kidnapping, executions, bomb-making, and other methods of violence, but have few discussions of specific terrorist plots against expressly identified targets. Targeting selection is assisted by higher-level strategic and theological documents, which provide religious justifications and strategic guidance for striking large classes of targets—such as oil targets in the Arabian Peninsula, or American tourists in the Middle East—without specifying particular locations. The objective is to distribute the tactical knowledge necessary for an entrepreneurial terrorist group to plan and execute its own attack, while minimizing the risk that the plot will be anticipated and disrupted.

The same is largely true of the Jihadist-hacker forums. The forums provide advice, manuals, and information on hacking tools and skills, usually without directing individuals to specific targets. Attacks are usually advertised after they have been successful.¹⁸ A hacker will state his intention to use a certain hacking technique or tool against a general category of targets, such as "Zionist computers" or "Crusader websites."

The skills and knowledge observable in the forums must be considered in the context of intention. The forums are defined by explicit, overwhelming political motivations. While other hacking movements may be dominated by those professing criminal or ego-driven motivations, the Arabic-language hacking forums monitored consistently exhibit Jihadist-motivations.¹⁹ While some may be content to fulfill their obligation to wage Jihad by defacing the homepages of Dutch newspapers, others are likely to have more dangerous ambitions against the U.S.

As evidence of this, one can examine other materials available to Jihadist-hackers on one of the hacker forums examined. This hacker forum is one section of a larger extremist website called the Electronic Mujahideen Network. A member of the hacker forum is also granted access to the other sections, which contain items encouraging terrorist operations, including bomb-making manuals and theological treatises justifying mass casualty attacks against infidels. The membership of the Electronic Mujahideen Network is likely to be more extremist and violent by nature than members of the Soqor.Net network, which is devoted entirely to hacking and IT-related topics. Moreover, by placing a hacking forum side-by-side with other forums devoted to more traditional terrorist methods, the administrators of the website are implicitly suggesting the use of cyber means towards violent ends. Other violent Jihadist websites have also included hacker sections.

¹⁶Ibid.

¹⁷Ibid.

¹⁸This is not always true, certainly there are posts in which one hacker will urge others to help him attack a certain site, but it is the case most of the time.

¹⁹Zone-H poll shows that roughly 1/10th of defacements worldwide are politically motivated, with another 1/10th motivated by "patriotism." Presentation by Kenneth Geers and Peter Feaver. "Cyber Jihad and the Globalization of Warfare." Available at: http://www.chiefostation.com/pdf/Cyber_Jihad.pdf.

The skills and tools available in the hacking forums can be used to support conventional attacks. For example, Indonesian Jemaah Islamiya terrorist leader Imam Samudra organized the 2005 Bali bombings from his prison cell using a laptop provided to him by a prison guard. Samudra used the net to organize personnel and raise funds via online financial crime.²⁰ Samudra also authored a book in 2004 that contained a chapter advocating hacking for the sake of Jihad.²¹

Younis Tsouli, an aspiring terrorist living in the U.K., used his knowledge of cyber security to cover his tracks online while helping to coordinate the planning of potentially disastrous bombings in Canada, the U.S., Bosnia, and the U.K.²² He functioned as the linchpin of an international network of aspiring terrorists who used Jihadist websites to communicate and obtain tactical information. His colleague, Tariq ad-Dour, was in charge of terrorist financing. He used Trojan horses and phishing scams to obtain 37,000 credit card numbers, to which he charged \$3.5 million, including over 250 plane tickets. Ad-Dour laundered the money using online gambling websites.²³

Tsouli, Ad-Dour, and a third accomplice aspired to be the Osama Bin Laden and Ayman al-Zawahiri of the new generation of terrorists, operating as terrorist “venture capitalists” who facilitate and finance plot ideas proposed to them by different entrepreneurial terrorist cells—as Bin Laden and Zawahiri have been reported to do. When the three were arrested in late 2005, they were associated with terrorist plots against targets in Sarajevo, Washington D.C., southern Ontario, and undisclosed cities in the U.K. They were also involved in plots against military bases in Georgia and Florida.²⁴

Tsouli and his accomplices could have successfully combined their hacking skills. A hacking primer he authored, “The Encyclopedia of Hacking the Zionist and Crusader Websites,” is a popular download on the Electronic Mujahideen Network and other Jihadist websites.²⁵

An attack that combines conventional and cyberattack is an electromagnetic pulse weapon (EMP) attack. EMP has garnered increased interest on Jihadist forums, especially the Electronic Mujahideen Network, where four articles on the subject have been recently published. The articles contain descriptive information on the construction and impact of EMP weapons. They are not so detailed as to suggest engineering experience or experimentation with building a prototype; rather, they reflect open source research performed in English and translated into Arabic.²⁶

Another combination attack scenario is one in which terrorists exploit the timing of a natural disaster or economic downturn to amplify the impact of a cyber attack. During the severe downturn of late 2008, several Jihadist forum members urged their counterparts in the U.S. to take advantage of the country’s vulnerable position to launch a terrorist attack.²⁷ Although this did not occur, it reflects an awareness of the power to amplify the impact of an attack—either cyber or conventional—by timing it correctly. Some believe hackers can make a significant impact on the economy without carrying out a large-scale attack if done during an economic downturn.

Deterring sub-state groups from cyber conflict differs from deterring states. Sub-state groups provide few targets and have no country to hold at risk. Instead one must seek to make possible attacks less desirable by imposing costs. Sub-state groups have many ways to achieve their long-term goals.

²⁰AsiaNews.It. “Bali Terrorist Organised Attacks from Behind Bars,” *Indonesia Matters*. Aug. 24, 2006.

²¹Sipress, Alan. “An Indonesian’s Prison Memoir Takes Holy War Into Cyberspace,” *The Washington Post*, December 14, 2004.

²²NEFA Foundation, “Irhaby 007’s American Connections,” July 2007. Available at http://www.nefafoundation.org/miscellaneous/Irhaby007_AmericanConnections.pdf.

²³Krebs, Brian. “Terrorism’s Hook Into Your Inbox,” *The Washington Post*, July 5, 2007. Available at <http://www.washingtonpost.com/wp-dyn/content/article/2007/07/05/AR2007070501153.html>.

²⁴Katz, Rita and Josh Devon. “Web of Terror,” *Forbes*, July 5, 2007.

²⁵A translation of this manual is available from the CIA Open Source Center.

²⁶One of the articles was a paraphrased translation of this paper by Australian researcher Carlo Kopp, available from [global security.org](http://www.globalsecurity.org/military/library/report/1996/apjemp.htm). <http://www.globalsecurity.org/military/library/report/1996/apjemp.htm>.

²⁷Project on Jihadist Websites Third Quarter 2008. International Centre for Political Violence and Terrorism Research, October 2008, p. 5.

Their current program of kinetic attacks is cost-effective. Such attacks require little technical skill when directed against soft targets, they provide results immediately visible to supporters and adversaries, and they fit into the long Muslim pattern of using what is immediately at hand for jihad.

Imposing costs is a matter of careful choice. There are two steps involved. The first is to establish models of sub-state cyber attackers and from these compile a set of possible interventions that if implemented and successful would result in substantial setbacks for attackers. Since initial lists of possible interventions will be a mixed bag, one has to subject them to a second step where one looks for favorable cost-exchange ratios, sorting ideas into what hurts the attacker most for least cost to the defender.

Determining cost-exchange ratios requires one, for each possible intervention, to estimate the cost to a defender to implement what is needed to be effective against the threat envisaged; and one must then estimate the regret of the attacker should that intervention be successful. To do this with the precision needed for approval of any new idea runs the risk of paralysis through analysis. But if one simply wants to filter lists of ideas to separate potentially useful interventions, warranting more study, from those that *a priori* look like losers, one can adopt a less rigorous approach.

For this, defender costs and attacker regret estimates are quantized into three levels. A "3" is used to denote an intervention that could be undertaken within current defender budgets and technical capabilities, but it is one that results, if successful, in minimal regret to the attacker. A "2" is used to denote an intervention that would require new defender expenditures beyond current budgets, for such matters as equipment development and testing, training personnel, and operational test and evaluation. When used as an estimate of attacker regret, it is something that hurts to the degree that the attacker suffers a major setback. A "1" is used for an intervention that would require much larger defender expenditures, e.g. for R&D because one may not know how to do what is proposed. The cost reflects the time required, the uncertainty of success, and implementation costs. But a "1" for the attacker means a major regret such as being exposed and punished, being put out of business, or subject to a major defender counteraction such as discussed in the following proposed declarations.

A test use of this methodology to prioritize potential defensive programs and to reflect various levels of attacker capabilities was undertaken. Two attacker models were constructed. One was for state-sanctioned attack groups, giving to them the advantages a state can provide for recruitment, training, target information, and secure operating facilities. A second model was for non-official attack groups: individuals, criminal groups, Jihadists, and the like. Defensive strategies were outlined against each for each phase of a cyber campaign from decision to focus on a target set; acquisition of personnel; acquiring target information; setting up facilities for training, exercises, probes, and attack operations; formulating a campaign plan; deploying operational attackers to staging areas; and executing the campaign plan over a period of time.

The first six of these phases are pre-attack. This is the most desirable time to defeat an attacker. Interventions in the last phase, trans-attack actions, are less desirable since they leave too much to last-minute chance. Each possible intervention received, for each phase of an attack where it is relevant, a defender cost "n" and an attacker regret "m."

The most attractive interventions are 3:1, cheap for the defender and killers for the attacker. Of the 27 identified interventions, there were 57 opportunities where one of them was applicable in one or more phases of an attack. There were 3 of the 3:1 type. The next most attractive defender interventions are 3:2: cheap for the defender and having a substantial impact on the attacker. There were 21 of these for the interventions identified. The last class of interventions having an attractive cost-exchange is the 2:1: killer impact on attackers but more expensive for the defender in terms of money and time. There were 17 of this type.

Thirteen of the 27 identified interventions were applicable to and had a satisfactory cost-exchange ratio in the pre-attack period. There were 18 of the identified interventions that were applicable to and had a satisfactory cost-exchange ratio in the trans-attack period.

In this illustration of the prioritizing methodology, the 27 possible interventions examined are by no means exhaustive. Other defenders will identify more and different possible interventions depend-

ing on the specifics of their concerns. But such a method can assist in guiding both R&D and in the implementation of defensive interventions.

Cyber Deterrence in Practice

While many countries can look to their own resources and their own defense, the U.S. position has, since WW II, been that collective defense is important for strong and weak alike. Coalition actions, some under the UN, some under NATO, and some ad hoc arrangements represent current examples. Extended deterrence, to be viable, requires demonstrations of capability so that allies and adversaries can adjust their expectations.

Demonstration of cyber power is thus a part of extended deterrence. There are, however, difficulties in demonstrating cyber offense and defense capabilities. Demonstrations of cyber power could be counter-productive if they are sufficiently impressive. It is difficult to conceive of potentially nation-harming cyber demonstrations that are safe. The U.S. policy has been to keep secure the extent of our cyber attack and defense capabilities. This has been successful, to the point that attackers may not be adequately aware of U.S. offensive and defensive capabilities. While good defense, it weakens deterrence.²⁸

The current U.S. focus on protecting military computers, thus adhering to clear DoD areas of responsibility, is a politically sound course domestically, and it is fully justified as a force protection mission. But DoD "rides on" the economy and its interconnected infrastructures. Hence simply protecting itself is only the start of a wider set of necessary U.S. defensive actions.

Creating a cyber deterrent will depend on having something specific beyond the level of policy and doctrinal statements. One needs cyber plans of action. Talk depends on earned credibility, but executable plans of action are real. Plans of action can also serve to establish the level of "forces" required, the feasibility of specific attacks, targeting doctrine, intelligence requirements, consequences of execution, training and exercises needed, "cyber force" deployments, global situation awareness, and a host of practical matters. We need to know what the exercise cyber power means beyond the level of Power-Point charts.

Cyber power can effect both hard and soft results. Deterring the use of cyber force will depend on both forms of cyber power. Diplomatic and economic power are measured in ways quite different from the metrics of hard military power. Informational, i.e. cyber, power with aspects of both is not simply a subset of hard power. The integration of these three elements of power is not simple. The extension of military concepts and technologies devised for industrial war to counterinsurgency, counter-terrorism, and peace-keeping, all mixed hard and soft enterprises, reveal the difficulties in strategic integration.²⁹ DoD "Deterrence Operations Joint Operating Concept," issued December 2006, recognizes this:

Deterrence requires a national strategy that integrates diplomatic, informational, military, and economic powers. The Department of Defense must develop strategies, plans, and operations that are tailored to the perceptions, values, and interests of specific adversaries.

Power is measured in known strengths, but uncertainty has value also. Deterrence depends not only on firm measures of strength, but also on uncertainty in the use of that power. A potential aggressor is deterred because he is not certain whether the post-attack period will be better or worse for him than the present. Thus the creation of uncertainty is as important for deterrence as projecting certainty.

²⁸A recent NRC report, *Technology, Policy, Law, and Ethics Regarding U.S. Acquisition and use of Cyberattack Capabilities*, National Academies Press, Washington, D.C., April 29, 2009, makes substantially the same points. In Chapter 3, "Military Perspectives on Cyberattack," it notes, "At the date of this writing, an unclassified and authoritative statement of current joint doctrine for the use of computer network attack is unavailable, and it is fair to say that current doctrine on the matter is still evolving." In Chapter 9, "Speculations on the Dynamics of Cyberconflict," under Section 9.1, "Deterrence and Cyber Conflict," it notes, "It remains an open question as to whether the concepts of deterrence are relevant when applied to the domain of cyberconflict per se (that is, cyberconflict without reference to conflict in physical domains.)"

²⁹Rupert Smith, *The Utility of Force: The Art of War in the Modern World*, Random House/Vintage Books, New York (2007).

A Framework for Thinking About Cyber Conflict

Unless one has an understanding of cyber conflict, construction of policy declarations cannot lead anywhere. Cyber conflict is the delivery of “cyber force.” Cyber force is the application and control of the inherent power of information and its transmission through public networks to achieve national goals. It takes place not in kinetic space but in the space of a myriad of electrical and logical connections. In practice, a “cyber attack” consists of transmitting software or data from one computer to another. The strategy and operational doctrines attending the exercise of cyber force have much in common with the corresponding concepts of kinetic conflict.

Control can be of physical systems, or of people. In the latter case cyber force produces effects previously the province of “psychological operations.” This can include trust attacks, social alienation attacks, and exhaustion attacks. They have much in common with swarming attacks.³⁰

Control of the cyber “battlespace” requires control of the network connectivity that makes such attacks possible. Connectivity maps are the cyber equivalent of topographic maps for ground combat. At a minimum controlling the battlespace means an attacker can disconnect what he threatens and the defender can, in response, disconnect the attacker. But matters are unlikely to come to that point. In this both real and abstract battlespace, a more delicate minuet takes place continually: a cat-and-mouse game, the thrust and feint of chess, fencing, or boxing. It has a parallel to the war between spam and spam filters we all fight, and traditional electronic warfare of measure, CM, CCM, . . . CⁿM. Intelligence operations, particularly Sigint, cryptography, and deception are the essence. One might reasonably borrow the title of R.V. Jones’ account of British scientific intelligence in 1939-1945, *The Wizard War*, to describe cyber conflict.

In this framework, preemption takes on a very different meaning from preemption in kinetic conflict. Preemption need not be to pass a point of no return. It can simply be to take the next step in the wizard war, the Cⁿ⁺¹M to the CⁿM adversary measures.³¹

The Relations Between Cyber, Conventional, and Nuclear Conflict

What we call “conventional,” or more recently, “kinetic” conflict is conflict as conducted at least since Neolithic times. Nuclear conflict became a reality in WW II but nuclear states quickly mastered its conduct, or more importantly, how to avoid it. That understanding was based on an ordering of force, with conventional conflict seen as the normal, and preceding, form of conflict with escalation from the lesser to the greater inhibited by “firebreaks.” Nuclear conflict has entered a new stage with the appearance of regional nuclear powers with small numbers of nuclear weapons and limited delivery range. Sub-state groups add to nuclear conflict possibilities through presumed capabilities to acquire nuclear weapons or fissile material from state inventories.

³⁰A comprehensive study of swarming in kinetic conflict is the Pardee RAND Graduate School dissertation of Sean A. Edwards, “Swarming and the Future of Warfare,” 2005. In contrast to linear warfare, swarming tactics are a characteristic of modern conflicts where forces undertake non-linear dispersed operations. He notes that swarming tactics are of two types: cloud swarms where the forces arrive at the target as a single mass and vapor swarms where attackers are initially dispersed and converge on the target. There are cyber equivalents to these: distributed denial of service in the case of the former and slow build-up of attacks over time that enable an overwhelming blow on a target in the latter. Swarming attacks can be defeated by, among other means, superior situation awareness, undermining attack enablers, and using “bait” tactics. Examples of these can be found in the declarations suggested in the following discussion.

³¹Michael Schrage argues, in “A Softer Way to Preempt Hostile Attacks,” in the Washington Post, Aug 21, 2005 that “soft” preemption, consisting of disrupting information flows or other non-disruptive technical interference could arguably save lives if taken in lieu of conventional resorts to force. See <www.washingtonpost.com/wp-dyn/content/article/2005/08/20/AR2005082000108.html>.

The question then arises how cyber conflict “fits” into the current strategic and doctrinal structures that guide the management of force among state and sub-state actors. While the general question is examined elsewhere, a few conclusions are relevant.³²

The analysis of the interactions of the three forms of force and conflict based on their employment can be examined combinatorially. They can be treated as employed singly, two at a time, or the three together. The case of cyber (Cy) force used singly has been the subject of the preceding discussion. Conventional (Co) and nuclear (N) used singly are outside the scope of this discussion.

The combinations of two forms of force, where one is Cy, are Cy + Co and Cy + N, used in order, i.e. (CyCo or CoCy.) The Cy and Co combinations are to be expected. Cy can be viewed as a defense suppression technique for an intended conventional conflict, a business-as-usual expectation, or they can be employed simultaneously. The CoCy order does not appear to be quite as plausible as the reverse but this is immaterial to the argument. Cy can be an adjunct to Co in a variety of ways. States with an adequate conventional force balance can be expected to continue to wage war as they have been trained and equipped to do, although one can quite possibly expect Cy to replace some Co force as its lesser cost, potentially greater effectiveness, covert nature, its “softness,” and other characteristics come to be understood and appreciated. In this view, cyber force, and cyber conflict may be seen as preferable to conventional conflict by both attackers and targets. If this is the case, managing the CyCo firebreak may in the future take on the importance managing the CoN firebreak does currently. The low cost, combined with global reach, of cyber force may then make it the preferred choice of sub-state groups in the longer term also.

Granting the logic of these speculations, one can suggest the emergence of cyber force as a threat to the security of nations provides a certain counter-balance to nuclear threats. The direction the “balance” might move remains to be seen. The emergence of cyber force may simply add another terrible threat. Or it could result in reducing the attractiveness of nuclear weapons through the emergence of something “better” to an attacker.

B. DECLARATORY POLICY CONTRIBUTIONS TO CYBER DEFENSE

Perspectives on Declaratory Policy

Declaratory policies begin as words on paper. They can be ignored, overtaken by events, or become irrelevant under technological change. To be of value, there must be a plausible chain of events that could result in their implementation.

An example is the Universal Declaration of Human Rights adopted as UN General Assembly Resolution 217 A (III) in 1948. It asserts a number of human rights declared to be universal. Translated into 375 languages, it has spawned follow-on treaties dealing with elimination of racial discrimination (1969), elimination of discrimination against women (1981), a convention against torture (1984), and a convention on the rights of the child (1989). While many of these goals are still not universally recognized, the treaty structure has resulted in countless human rights watch groups, progress reports, political demonstrations, and international pressure to meet its ideals. It synthesizes widely felt concerns and stimulates action. To use a current expression, it is a declaration with “legs.”

The fact a declaration is unilateral is not a limitation to its broader adoption. A declaration can be seen as a warning; as laying down an invitation for others to embrace its goals; or as proposing normative standards of behavior to be furthered through the declaration’s logic and the appeal of its goals. When a few major states, supported by industry groups as well, undertake to implement its intent, the words begin to turn into actionable pressures and implementation decisions.

Apart from their possible adoption internationally, policy declarations serve internal purposes as well, to express needs so that divided parts of public and private bureaucracies can better see where

³²Stephen J. Lukasik and Rebecca Givner-Forbes, “Deterring The Use of Cyber Force,” December 14, 2009. See <www.cistp.gatech.edu/publications/files/cyber_deterrencev2.pdf>.

cooperation is needed on the national level. The ideas expressed can serve as a point of departure for refinement through further policy analysis and debate. They can guide R&D and allocation of resources. This is the sense in which the following declarations are offered. They should not be judged by whether a U.S. President would or would not be well-advised to adopt them at this point. They are to be seen as input to a policy process, not as output.

Recognizing that declarations could be a starting point on a path to formal international agreements, it is well to keep such a possibility in mind in considering them. There are four characteristics that would be important for more general international action:

(a) *Verifiable*—if declaratory policy is to effect change in something, actions taken or actions not taken, these should be observable. Being observable, parties to an international agreement can then decide if what is observed is consistent with the intent of the agreement. If it is not, the parties behaving in incompatible ways can be asked to clarify the events called into question, or the agreement itself can be amended to reflect changed circumstances.

(b) *Reciprocal*—all parties should be held to the same standards. A signatory wishing not to be a target of a prohibited action should be prepared to eschew that action itself.

(c) *Robust under change*—negotiating agreements is sufficiently complicated they should have more than a transitory period of applicability. A common driver of obsolescence is technology. In the cyber world, technology changes so rapidly that agreements must be capable of dealing with future capabilities very different from those existing when it was formulated.

(d) *Consistent with prior agreements*—prior agreements should be accommodated and their precedents recognized and used where possible. Consistency with prior agreements eases the acceptance of new proposals. Inconsistencies complicate reaching new agreement. On the other hand, if a new problem requires new frameworks and new solutions, states should be prepared to entertain that possibility.

Circumstances Addressable by Cyber-Related Declarations

The starting point for examining the domain of declaratory cyber policies is to define what concerns they could seek to address. Professional literature and the public media are rich in enumerations of concerns introduced by the convergence of digital technology, ubiquitous devices for manipulating digital representations, and the relative ease with which ideas can be communicated and widely accessed: the Internet, portable wireless devices, social networks, increasing bandwidth, and the educational, business, government, political, and social innovations that can be built on these capabilities.

The concern here is attacks of “national significance.” The Department of Defense uses as the definition of an “incident of national significance”:

An actual or potential high-impact event that requires a coordinated and effective response by and appropriate combination of Federal, state, local, tribal, nongovernmental, and/or private-sector entities in order to save lives and minimize damage, and provide the basis for long-term community recovery and mitigation activities.

In 2005 the Department of Homeland Security offered fifteen National Planning Scenarios for “plausible terrorist attacks and natural disasters that challenge the Nation’s prevention and response capabilities.” Four provide some calibration for what might be addressed by declaratory policies: detonation of a 10 kT nuclear device; a major earthquake; a major hurricane; and a cyberattack. A commonly expressed concern in the cyber community is a “cyber Pearl Harbor.” The 1997 report of the President’s Commission on the Critical Infrastructure Protection referred to “cascading events” in what are believed to be unstable systems of systems.³³

³³*Critical Foundations: Protecting America’s Infrastructures*, Report of the President’s Commission on Critical Infrastructure Protection, The White House, October 1997.

Equating “significant” cyber attacks to 10 kT nuclear detonations, major earthquakes, and hurricanes conveys some sense of what is under discussion, but a link between damage, death, and computers is needed. For computer-inflicted damage to be crippling in the sense of a national economy, it must be long-lasting. Interrupting the operation of computers, however inconvenient, does not rise to the level of crippling. Computers, power systems, and communication systems fail regularly and states do not collapse. If such failures were to be widespread and coordinated, a nation would sustain larger economic losses. But engineers design, build, and operate systems to be robust under stress through backups, hot standbys, redundancies, rapid repair plans, other approaches to damage limitation and service restoration. What is needed to create long-lasting social and economic impacts from cyber attacks is to cause physical damage to large, expensive equipment for which spares are not available and for which manufacturing replacements is lengthy. This will be the case with damage to electrical generators, high voltage transformers, pumping stations, communication switches, routers, and server farms supporting information utilities such as cloud computing.

There are several examples of technical and regulatory issues relating to what we now call cyber war. Following the invention of the telegraph in the 1840s, states realized that technical standards were needed if the full potential of the new technology were to be realized. The history of telegraphy, and its parallels to our current circumstances, is elaborated on by Standage.³⁴

The nineteenth century struggles for the regulation of international communications were renewed with the invention of radio and the introduction of wireless telegraphy in the early twentieth century. The history of this cyber war period is recounted by Rutkowski.³⁵ The parallels to today in both cases are striking and the measures adopted provide useful context for addressing present concerns. Rutkowski notes:

The first U.S. interagency committee dealing with wireless cyberwar was convened in 1904 and primarily led by the Navy Department.

As the years progressed during the 1900's, however, chaos emerged. Almost everyone was incented to get on the wireless internet. Commercial business, government, ordinary people, even the equivalent of “script kiddies” and hackers of today—the first radio amateurs—all got “on the net.” Enterprises constantly pushed the state-of-the-art; new digital protocols were developed; nations were competing; network architectures and applications were continuously evolving; wireless cyberwar was becoming real . . .

For years, the Washington political scene engaged in incessant wrangling as the wireless infrastructure and cyber security became progressively worse. Private enterprises claimed that technology and innovation would be impeded if the Berlin provisions [of 1906] were implemented, and argued that the infrastructure was overwhelmingly privately owned. Washington lobbyists warned against the dangers of Federal government involvement. There was a general antipathy against foreign nations and intergovernmental organizations. The military community wanted its own freedom of action to keep ahead of the rest of the world. And lastly, there was no consensus on what agency in Washington should act.

On 22 April 1912, President Taft ratified the first multilateral agreement to which the U.S. became a party—the 1906 Berlin Convention—ending more than a decade of cyber conflict that was implicated as a causal factor in the sinking of the Titanic eight days earlier on 14 April 1912. The sinking and the subsequent investigations so inflamed public opinion that the 1906 Berlin treaty was quickly signed and an additional set of domestic and international actions undertaken by the U.S. government, together with other nations, in London in 1912, to mitigate further cyber conflict.

It was the first acceptance of an international telecommunication treaty by the US—after refusing for nearly 50 years to become a party to any related agreements or instituting any regulation of the early wireless cyber environment.

Any bright entrepreneur with a modicum of knowledge and inventiveness could become part of the emerging global infrastructure. Fortunes were made overnight. However, the problem was that any wireless transmitter could wreak havoc on a network somewhere else in the world . . .

³⁴Tom Standage, *The Victorian Internet*, Walker and Company, New York (1998).

³⁵A. M. Rutkowski, “Lessons from the First Great Cyberwar Era.” Info, 12 Feb 2010.

The cybersecurity course proved cyclic over the years as each new cyber technology emerged, or administrations and appointees changed, or the U.S. global ambitions advanced or diminished. In general, however, the cycle remained the same. Excitement, euphoria, and innovation by geeks are followed by unfettered industry assimilation and exploitation, which gives rise to pervasive public implementations and then conflict among nations to maintain perceived advantages.

The lesson to take from this is that cyber security problems are not unique to our time. What are seen today as nearly insoluble problems, deriving from new technologies and complexities, have as good a chance of solution as did comparable earlier problems. The human mind can resolve problems the human mind creates.

Possible Policy Declarations

The following declarations are offered as a starting point for policy discussion, not an end point. They suggest one possible way that may reduce the problems that result from the interaction of computers existing under widely different state jurisdictions.

One type of declarations are those that establish a line past which we warn others not to venture. Drawing lines in the sand is treacherous, however, because they imply that anything not over the line is acceptable. Further, such a declaration must imply or define a threatened response, one intended to be serious enough to dissuade an attacker from the behavior defined. That carries with it the issue of credibility. How have individual states responded to similar situations in the past? It also binds a state to do something, or it loses credibility.

Another define normative behavior, goals we believe should serve as universal standards for all. Such declarations define ideal states that perhaps only a few states meet. There should be some reason to believe the proposed goals are realistic, as illustrated by the existence of at least some examples. As noted earlier, there should be some feasible path through which wider adoption can be facilitated. Because they call for changes in behavior, they must be viewed as long-term matters, but are important enough that any progress in these directions will be beneficial.

A third type of declarations serves to note ambiguous or unclear situations where further discussion and study is needed. These may be situations that identify matters requiring both domestic and international efforts. Or they can take the form of a statement such as "The state supports X under condition Y."

The following 11 possible declarations are suggested to encourage discussion of how declaratory policy might be employed in deterring cyber conflict. They are presented in an order from the possibly least controversial to those that are likely to engender the greatest barriers to adoption.

The set can be viewed as a logical package. All, individually and as a group, would aid in protecting users of the cyber commons, making it a safer place for the conduct personal and national business. But they are not inextricably linked. In this sense the set is a menu from which to select based on domestic and international priorities and opportunities.

1. Research and development of information technology should remain unfettered so that the greatest benefits can be secured for the well-being of all. To this end, potentially dangerous aspects of information technology should be openly discussed and international efforts undertaken to avert possible harm to all states and peoples.

Despite its flaws, it is clear that information technology has made major beneficial changes for people and for facilitating their interaction to exchange knowledge and to undertake economically important activities. This declaration simply says do not kill the goose that is laying the golden eggs. It is intended to head off the control or limitation of research and development in information technology. It does say, however, that the dark side of the technology, the misuse of the technology and the abuse

of the cyber commons, is a problem and it calls on all states to openly discuss the issues and to discuss and cooperate on solutions.

Openly discussing the problem will be more difficult than one might expect. Cyber flaws are concealed to the extent possible. Matters of fault, liability, and loss of trust are part of the problem. Avoidance of national blame is another. Much is concealed under the rubric of national security, some quite justified, as when it would reveal vulnerabilities that could be more widely exploited, and some covered up to minimize unrelated political problems.

So this is a two-sided declaration, one to not fetter the technology, but also a call to openly discuss the problems, both technical and procedural that impact security.

The next declaration related to the facilities and operators of global public communications network.

2. Computer and information system resources connected by public international telecommunications facilities are critical for global discourse that is a human right and provide a common good from which all benefit. To this end, the availability of these open information resources to legitimate users should not be impeded.

This is consistent with the vision of the International Telecommunication Union, to which the U.S. is a signatory, that states, "By connecting the world and fulfilling everyone's fundamental right to communicate, we strive to make the world a better and safer place." It is a direct repetition of a principle regulating international communication going back to the earliest days of wire and radio telegraphy. There is a good body of internationally accepted behavior: non-interference with legitimate users; prior rights of incumbency; state control of what comes into its jurisdictions through the licensing of operators; and an obligation to help users in distress, either to provide back-up facilities or to identify sources of interference.

A recent NRC report notes "Users of information technology . . . should be able to use the computational resources to which they are entitled and [the] systems that depend on these resources."³⁶

The declaration goes further, however, in that it declares open and unrestricted use of the public telecommunications facilities is a human right. This applies only to the public communication system, defined as the set of state-licensed carriers operating under the aegis of international communication agreements. There is flexibility in the declaration, in the word "legitimate." States are free to define "legitimate users" however they choose, but they should not interfere with the legitimate users of other states. Thus states maintain control of what their citizens do, but not what users over whom they have no jurisdiction can do.

The next two declarations begin to cut closer to the matter of identifying sources of abuse of the public network, particularly where the traffic is between computers.

3. Users of public international telecommunication facilities should, for the protection of all users, have a unique identifier supported by a verifiable mechanism available to them so that parties sustaining harm through misuse of those facilities can seek redress.

Attribution is impeded by the almost complete anonymity possible on the Internet and related TCP/IP networks. On the other hand, in many states this proposal would meet strong objections on grounds of privacy. In view of greatly varying needs for both privacy and security and the sensitivity of content of communications, it will be helpful to shift the security-privacy tradeoff to the user. The point of the declaration is to provide means for redress in the event of harm. Users willing to accept communications from unidentified users would do so at risk of denying themselves redress for consequent harm. The

³⁶Seymour E. Goodman and Herbert S. Lin, Ed., *Toward a Safer and More Secure Cyberspace*, The National Academies Press, Washington, D.C. 2007, p. 53 item I in a Cybersecurity Bill of Right, Chap. 3.

unique identifier may be made available only by user request in the case of alleged harm suffered and be provided subject to the laws of the jurisdiction within which the harm occurs.

Unspecified here is the definition of "harm." Harm is culturally and politically dependent and it is unlikely that there will soon be global agreement on what is allowed and what is harmful and should be prohibited. By leaving harm undefined, the default definition is the way it is defined in the jurisdiction in which the harm is seen to have occurred. As in all cases where adjudication of claims is necessary, harm will in the end be defined by precedent and developing case law.

4. States shall establish a system of technical standards openly arrived at for all equipment attached to the public infrastructure, and the adequacy of those standards monitored through proof of performance publicly available.

This is in analogy to what is mandated in all systems, public or private. The integrity of the network requires that there be technical standards relating to what can and cannot be connected to the network. Whether one is talking about data formats, voltages, or pipe pressures, there must be limits set by the design conditions used as a basis for constructing the system. Engineers can design for wide ranges of operating conditions; they can provide alternatives to take care of special situations; and older devices are replaced over time by newer and more fault-tolerant versions. But "anything-goes" is not technically feasible.

This can be accomplished in various ways. In the case of regulated infrastructure systems, there can be central certification laboratories. In the U.S. telecommunications systems much of this has been made a responsibility of the manufacturer with provision for verification of the process as needed. Another powerful technique is provided by markets. Error-prone, unreliable, and inflexible devices disappear from the market. Each jurisdiction will have its own certification mechanisms. International standards bodies help a great deal. International inconsistencies can be dealt with through standing or new resolution procedures.

The point is to address faulty hardware, such as might be the result of building in vulnerabilities during the manufacturing process to provide attack channels, or it could be applied to address embedded or bundled software containing malware. There are precedents in some classes of equipment such as medical devices where faulty software can result in unsafe operation.

The next two declarations are a set intended to address current practices that render public telecommunication networks insecure.

5. The distribution of malicious software is incompatible with the free and beneficial use of public international telecommunications facilities. All nations shall undertake efforts to eliminate such activities within their jurisdictions that violate the rights of people everywhere, or they can be held complicit.

Malware is produced somewhere, in some state's jurisdiction. This does not say that malware production is prohibited, for there are many reasons why malware might be produced: for defensive R&D, as an intellectual puzzle, as a student exercise in computer security training, and as a form of free speech. What the declaration says is that its *distribution* is prohibited. The declaration then says it is the responsibility of each state to prevent the distribution of malware. Clearly this can only refer to international distribution. A state is free to allow its citizens to suffer from domestically produced malware if it chooses.

6. Seeking and/or obtaining unauthorized access to or control of computers outside the jurisdiction of a state shall be prohibited. States shall be expected to undertake actions to prevent such unauthorized access from within their jurisdiction, or they may be held complicit, and they shall be required to render assistance to states who have detected such unauthorized access.

This declaration addresses botnets. They are to be prohibited, and like the malware declaration, their detection and elimination is a matter for each state to accomplish within its own jurisdiction. But the prohibition is only when a computer in another jurisdiction is captured. A state is responsible for what it allows its citizens to do and that is mediated by its own laws. As with malware, a state that allows its citizens to capture a computer in another state and fails to prevent or eliminate the violation can be held complicit. What the declaration goes on to say is that regardless of the local *mores*, a state is required to render assistance when other states become aware of the intrusion into a computer in their jurisdiction.

The next four declarations address circumstances where cyber conflict through the facilities of the public telecommunication network is the issue.

7. In the event an attack, consisting of placing malicious software in the computers of another sovereign state, is detected by the target state, the attacker shall be required to remove the offending software under such terms of verification as mutually agreeable to the target and attacker states. States shall assist in determining the origin of such malicious software when called upon by the state detecting such software.

This declaration relates to a characteristic of cyber attacks that is quite different from attacks employing conventional or nuclear force. While all attacks require a great deal of planning and preparation, conventional and nuclear attacks announce themselves in a very obvious way, and with very direct means of attribution. The use of cyber force involves that the attacker violate the sovereignty of the target state long in advance. The attacker must probe the computer networks to be attacked to determine what vulnerabilities will be exploited. Malicious code will be inserted into the systems to be attacked. Viruses can be released that can wait for a signal to initiate the attack. Insiders may have been recruited and placed in critical locations. They may be active in providing current information or they may be sleepers.

The upside of advance software preparations is they can, in principle, be detected by the target nation. In such a case it may be in the interest of both parties to restore the pre-attack conditions as quietly as possible, in essence a no-harm-no-foul response. The declaration says a state can respond in such a case with cyber or other forms of force if it chooses, but an alternative resolution may be to require the offending state to withdraw its software, and to inform the injured state of the nature and locations of all such malicious software.

This leads to a cat-and-mouse game. What does the injured party know and can the attacker leave some of its software agents in place? If a state knows the attacker has not been fully compliant, does it call the attacker on it, revealing sources and methods, or does the state leave the software in place and monitor it, or even "double" it? Implicit is the ability to detect malicious but passive software. At a minimum what will be needed is that all software carry a digital signature and that all computers on the network be clean *ab initio*. In essence this reduces monitoring software environments to the equivalent of public health monitoring.

This recognizes that cyber conflict is not a matter of sudden violence but is much more like traditional intelligence operations, with move and counter move. Cyber conflict will consist of continual moves, not episodes of violence. To this end the current role of NSA in the newly created Cyber Command is well advised.

The next declaration returns to the matter of attribution. A previous declaration called for assistance in identifying the source, at least to the point of state origin and of the states through which attacks are mounted. The declaration is phrased in terms of the U.S. but it can easily be generalized.

8. In the event the U.S. suffers a cyber attack of national significance that threatens its economy and security, it will undertake to ascertain the circumstances that enabled it. All states are called upon to

assist in this determination. The U.S. will hold any states it believes to be complicit in the attack subject to such responses as are within its capability. An attribution of complicity can include all states whose communications facilities were wittingly employed in the attack or were employed through the negligence of a state to prevent such electronic communications from it.

This declaration says several things. First all states are called upon to assist in determining attack attribution. It says the U.S. can respond by any kind of force within its capability. But then it takes a draconian position, that any state whose telecommunication facilities were employed in the attack *can* be held complicit. "Can" allows the U.S. to let truly innocent states, innocent in its view of course, off the hook. But what it really means is that all states are responsible for seeing that attacks do not use their telecommunication facilities unimpeded. Some states will lack the resources to do adequate monitoring. The novelty of the attack may truly astound all. But it says that if states are to benefit from advances in information and communication technology, they have a corresponding responsibility to police their neighborhoods.

9. A state is entitled to seek information for the purpose of warning of a planned or impending electronic communication attack. It may do so in any way possible provided it does no harm to any states holding that information.

This declaration is, in essence, about what is euphemistically called cyber exploitation, known as intelligence collection. Given the continual nature of cyber conflict, and the need for an attacker to pre-place software, it says that a defender not only should look within his own computers for attack warning, but also should look for attack preparations in the computers of potential attackers. This is, in practice, no different from intelligence collection. But in the set of possible declarations it is best made explicit. The "do-no-harm" condition is what intelligence collectors do anyway, since one never wants a target to know what one has found out about him.

10. A strategic attack on the U.S. based on an electronic communications will be considered a use of force under the UN Charter. The U.S. will be entitled to undertake self-defense through "such action by air, sea, or land forces as may be necessary to restore international peace and security."

This is the only "line-in-the-sand" declaration in the group. In one sense it says the obvious, that an attack of national significance will be taken for what it is, an attack by a sovereign state which will trigger a justified self-defense response. What is a departure from current policy is that it puts cyber force in the category of force to which an armed response is justified. The quote is from the UN Charter.

11. Adjudication of disputes arising from the circumstances identified shall be undertaken through such international mechanisms as exist and are appropriate. States are expected to respect the rights and obligations cited for the mutual protection of their sovereignty and security.

The previous declarations have any state "plaintiff" able to charge "harm," and assign "complicity." This declaration says that these charges, while unilateral, are not final. Rather they must be submitted for adjudication to an international body. Several such exist and one can expect plaintiffs to forum-shop but the point is that the plaintiff is not prosecutor, judge, and enforcer. The international mechanism is unspecified, aside from being "appropriate." One can imagine special international bodies having particular competence in cyber commons violations. It goes without saying that time-critical emergencies requiring immediate self-defense will be dealt with and post-emergency claims of collateral damage addressed later. These are implementation matters that will evolve as situations arise and as new circumstances deriving from new technologies present themselves.

Assessing the Potential Utility of the Declarations

The 11 declarations are related to the cyber conflict issues raised in Part A (Table 2).

Stepping back to understand the relative importance of the 11 proposed declarations, the following structure emerges.

Declarations #2, 8, 10, and 11 are the central core. The keystone is Declaration #2, the assertion that the availability of the public telecommunication network is a right that should not be abridged. It recognizes that a state can define the terms of access for its citizens, but denies that any state can define the access available to citizens of other jurisdictions. Declaration #8 is the matching statement of the responsibility that must be discharged if a state is to avail itself of the right of access for its citizens in Declaration #2. Declaration #10 defines the conditions under which a state can justify self-defense in the case the right of access to the public telecommunications network is denied or harm is sustained through the malicious actions of another. The definition of "harm" is left to the state that sees itself as a victim, but in invoking such a right the merit of its complaint will ultimately be judged by its peers and the public. This last is the subject of Declaration #11.

The next set of Declarations, #5, 6, and 1, relate to the regulation of cyber "weapons." The first two suggest what should be prohibited through actions of each state exercising its responsibility for the cyber commons within its jurisdiction while Declaration #1 warns that cyber technology per se should not be limited, despite its downsides, because of its substantial upsides.

Table 2

1	Protection of cyber R&D	Technology aids defense as well as offense; proposes not to restrict it at this early stage in its development
2	Availability of public telecommunications resources	Proposed as a human right for personal and economic benefits
3	Identity management	Addresses the current anonymity on the public telecommunications network that defeats deterrence by impeding responses
4	Technical standards for network attachments	Addresses the need for assurance that devices, when first connected to the public telecommunications network are free of malware
5	Ban malware distribution	Malware is a cyber weapon that should be eliminated through actions by each of the states in the part of the Internet over which they have jurisdiction
6	Ban botnets	Botnets are the cyber weapon delivery system that should be eliminated through actions by each of the states of the part of the Internet over which they have jurisdiction
7	No-harm-no-foul conflict termination	Proposes a termination process that can be effective before the initiation of cyber conflict
8	Attribution of attacker	Establishes right of a state to seek information relating to attack attribution and to hold complicit states used as transit for the attack
9	Enables early warning activities	Provides a way to prevent damage pre-attack through preemption and trans-attack through damage limitation
10	Defines justification for self-defense against use of cyber force	Establishes the circumstance under which a state can avail itself of its right to self-defense
11	Adjudication mechanism	Requires a process for the investigation and settlement of claims

Declaration #7 proposes a conflict termination process that can be helpful in controlling escalation of cyber conflict.

Declaration #9 establishes the right of a nation to assure itself that other states are not preparing to launch a cyber attack. There are two aspects to this right. The first is that a nation should look inside its own computers, not those of others, because that is where the early warning evidence will be found. How this is done can constitute a privacy violation absent further definition of the process. One possibility is to extend personal identifiers to computers, with communications from those not “cleaned” so labeled in the same way unidentified users are apparent. The declaration implicitly recognizes that intelligence collection will be a part of a warning process as well. This is already a well-established “right” subject to the consequences a state risks if discovered.

The remaining two Declarations, #3 and 4, address implementation measures that will increase the difficulty with which cyber attacks can be carried out. In effect they raise the bar for successfully initiating cyber conflict and are, in effect, a mild form of cyber “arms limitation.”

The eleven declarations can be assessed against the four characteristics proposed as measures of their potential for becoming part of multilateral agreements (Table 3).

Shown in Table 3 are some judgments regarding the degree to which the proposed declarations will meet the four conditions of being verifiable, whether all nations are likely to agree to the proposed limits on their activities, being robust under technical change, and being consistent with earlier international agreement that have been widely adopted in the past. “Y” indicates the characteristic can, in principle, be consistent with those metrics. “N” means it is not obvious that governments would accept such a limitation on their freedom of action.

The most promising are the declarations for protection of cyber R&D and the right of access to the global telecommunications systems. The other 9 declarations are problematic in varying degrees since they are likely to be seen as limiting future technical options for national security or commercial market positions. The easiest condition to satisfy is that of consistency with existing agreements, but this should not be surprising since the declarations proposed were formulated as logical extensions of existing international understandings.

The negatives in Table 3 should not be cause for discouragement. Declaratory policies are long-term enterprises. One chips away where one can and hopes that as time passes the need for the protections proposed will be more widely accepted. As a practical matter, the Internet is heavily influenced by the larger states so that even limited multilateral agreements can leverage a great deal of effective action. While not wishing ill, the frequent alarms over Pearl Harbor and 9/11 may have to occur before leaders and followers appreciate the seriousness of a wired global economy.

There remains the matter of plausible implementation processes. In much of the current discussion, there seems to be an acceptance that the problem of cybersecurity is too big for any but governments.

Table 3

	Declaration	Verifiable	Reciprocal	Robust	Consistent
1	Protection of cyber R&D	Y	Y	Y	Y
2	Availability of telecommunications resources	Y	Y	Y	Y
3	Identity management	Y	N	N	Y
4	Technical standards of network attachments	Y	Y	N	Y
5	Ban malware distribution	Y	N	Y	Y
6	Ban botnets	Y	N	Y	Y
7	No-harm-no-foul conflict termination	N	N	Y	Y
8	Attribution of attacker	Y	N	Y	Y
9	Enabling early warning activities	Y	N	N	Y
10	Self-defense against cyber force	Y	N	Y	Y
11	Dispute resolution	Y	Y	Y	Y

The enumeration of the difficulties then proceeds to point out that most of the world's cyber assets are privately owned, and that most owners see security as a cost rather than as a profit center. So the logic goes, not a great deal of substance will really happen.

This downward spiral into chaos need not be the way to read the situation. Governments are inevitably limited in what they can do: appropriations must compete with other needs; regulation is resisted; too strong a government hand is seen as big government and incursions on civil liberties and privacy. On the other hand, private owners of facilities and services can set their own rules, beholden only to market and shareholder expectations. This argues for purely private solutions. At each step those solutions will be limited but as the security situation worsens, more effective solutions will be demanded, and accepted, not because of government action but by market demands.

This oft-repeated call for "public-private" partnerships may be counter-productive, especially when each waits for the other to take action. Instead of private owners asking government what rules they must accept, faster progress may be possible if private owners tell governments what they need. It would seem to be worth a try. Meanwhile, the government can secure its own networks, fund the R&D it needs, and establish a market for strong security solutions. The declarations proposed can serve as directions for private actions. At the same time, developing voluntary technical standards, using the Internet and its social networks as a mechanism to encourage public and private exchange of solutions, and encouraging legally acceptable self-defense can be helpful.

THE BOTTOM LINE

Deterrence, on the Cold War retaliation model, is unlikely to be effective in dealing with cyber force. This model is a dead-end and continuing to pursue it simply distracts from doing something more useful. Deterrence itself is not impossible, but it must be based on broader concepts than retaliation and punishment.

Sub-state actors are not subject to deterrence based on threats of retaliation. They currently attack sovereign states, nuclear and non-nuclear, with impunity. Treating states and sub-state groups with a one-size-fits-all approach will result in addressing neither as well as they might. Sub-state groups are, for example, susceptible to cost-imposing measures.

Defense in cyber conflict is a critical part of cyber deterrence. It includes strategic and tactical warning, situation awareness, cyber order-of-battle, and the collection, retention, and analysis of cyber incident forensics.

Cyber force is quite unlike conventional and nuclear force. It can be "soft" in its effects, extended in time, and cumulative in its impact. Cyber attacks are not simply to be seen as the equivalent of strategic bombing without aircraft or missiles.

An important element of cyber defense will be real-time control of network connectivity. The cyber security problem arises from connectivity. Control of connectivity will be part of the solution.

Shared voluntary private efforts can contribute to cyber situation awareness and can provide a useful element of real-time cyber defense.

Declaratory policies are not ends in themselves. They are a beginning to a lengthy campaign to further a vision of a desired future. Declaratory policies are only useful to the extent that they leverage other forces and mechanisms to encourage beneficial use of the cyber commons. They are seeds, not trees.

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³⁷The full-text can be found in Stephen J. Lukasik and Rebecca Givner-Forbes, "Deterring the Use of Cyber Force," December 14, 2009. See <www.cistp.gatech.edu/publications/files/cyber_deterrencev2.pdf>.