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Playing for Time on the Edge of the Apocalypse:
Maximizing Decision Time for Nuclear Leaders

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Playing for Time on the Edge of the Apocalypse: Maximizing Decision Time for Nuclear Leaders

by

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Synopsis

This paper surveys post-Cold War disputes over the "de-alerting" of nuclear weapons, outlining critiques made of the launch-on-warning capabilities – and what are alleged to be the de facto *launch-on-warning* policies *– of the United States and Russia, as well as the deterrence-focused counter-narrative that has developed in response to these arguments. It offers an analysis of such debates as an expression of a dynamic tension within nuclear command and control systems between "Type A" risks of nuclear use (advertence) and "Type B" risks of nuclear accidents (inadvertence) – a tension that can be further understood with reference to theories of organizational behavior informed by Complexity Theory insights into the "fitness" of complex adaptive systems.*

Exploring the potential Type A and Type B implications of various proposed measures for reducing nuclear risks, the author suggests that the policy stalemate created by the need for tradeoffs between deterrent value and accident risk-reduction can perhaps be broken by focusing less upon de-alerting per se *and more upon the challenge of maximizing the effective decision-time available to national leaders in a nuclear crisis – a broader discourse of which de-alerting debates are merely a subset.*

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As a way of breaking the policy stalemate, the author suggests focusing less upon measures to make LOW technically or organizationally impossible *and more upon measures to reduce any* incentives *the nuclear superpowers may still feel to* exercise *whatever LOW option they may retain. Specifically, the author suggests that territorial ballistic missile defense (BMD) should be continued and improved, and especially that nuclear-related command, control, communications, and intelligence (C^3I) survivability be augmented in order to create – arguably for the first time in decades – a credible option of "riding-out" a nuclear attack at today's reduced armament levels. Even without any change in current launch-ready nuclear postures, these measures could go a long way toward reducing Type B risks, yet in ways that would not seem to entail significant Type A tradeoffs.*

I. *Introduction*

It is common in cinematic thrillers for some enterprising hero to face a terrible crisis in which he or she has bare minutes – or even seconds – in which to make decisions upon which the fate of humanity will hang. Happily, such scenarios are usually just moviemakers' conceits, dramatic plot devices with which to entertain and enthrall us on the way to an action-packed conclusion in which the lead character's seat-of-the-pants improvisation and heroism saves the day. The real world, we may be thankful, presents few such situations. But not none of them.

The tense environment of nuclear command-and-control decision-making is perhaps the closest analogue the real world presents to such apocalyptic scenarios in which a small group of people find themselves with the fate of their country and their world in their hands, and may have only moments in which to make an absurdly momentous decision. Yet these nuclear scenarios are not fiction. Nuclear-armed countries *have* faced each other in tense standoffs in the midst of broader crises, fingers poised perilously over the proverbial nuclear "button," and painfully alert for signs that they might have to press it. On other occasions, officials have confronted warnings of incoming enemy attack, wondering if these signals are a false alarm and trying to decide what to do. On one occasion, a commander-in-chief even got to the point of opening his "nuclear briefcase" in preparation for a possible retaliatory launch in response to what initially looked like an inbound missile – but was not.[1]

In nuclear warfighting, as the seminal nuclear strategist Herman Kahn once suggested, we are thankfully all just "theorists" and we hope to stay that way.[2] At least with respect to the United States and Russia, however – which, despite their vastly reduced post-Cold War stockpiles and the growing arsenals possessed by some other players, still remain the planet's nuclear superpowers, possessing between them the overwhelming majority of the nuclear weapons presently in existence – there is little that could be called "amateurish" about the countries' preparations for a possible nuclear crisis. Every minute of every day, expensive and

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1 *See, e.g.*, Lawrence Freedman, *The Evolution of Nuclear Strategy* (New York: Palgrave MacMillan, 2003), at 417.

2 Sharon Ghamari-Tabrizi, *The Worlds of Herman Kahn* (Cambridge, Massachusetts: Harvard University Press, 2005), at 83 (*quoting* Kahn: "In this field, everybody is a theorist").

sophisticated global information-collection systems manned by cadres of trained professionals watch the potential adversary for signs of an attack in preparation. Both countries also keep at least some of their nuclear forces in an alert status from which they could move into action on extremely short notice. Tensions between the two powers are today enormously less than in their long years of Cold War rivalry, but there is no getting around the persistent nature of this relationship as one with at least the *potential* for rapid nuclear escalation.

This continuing nuclear balance has engendered a lively literature on how to reduce its risks, and a great many arguments over the merits and demerits of specific proposals. Many critiques of the current state of affairs center on the dangers of what one might call "inadvertence" – especially the possibility, however remote, that a false alarm could trigger a nuclear holocaust by prompting one or both sides to unleash the nuclear forces that have been kept on ready alert. There has never been such a catastrophe, of course, but false alarms *have* occurred, the United States and Russia *do* maintain forces capable of being launched before an incoming enemy attack actually lands, and it is not all that hard to imagine things getting out of control. (This, too, has been the subject of cinematic fiction.) It is not always easy to tell what to make of past incidents in which false alarms have *not* produced launch decisions. This is what Scott Sagan has called "the catch 22 of close calls."[3] Do such events suggest that the two countries' systems really work in catching errors as they are designed to do, or do these incidents indicate that we are simply living on borrowed time – and that if we continue with current force postures our luck will eventually run out?

Perhaps not surprisingly, defenders of current U.S. and Russian nuclear force postures tend to be more comfortable with the risk-balancing inherent in existing early-warning systems and launch status. At the same time, critics of today's nuclear balance – and the disarmament community in particular, which desires nothing more than that no country have any nuclear force at all – have tended to draw the latter conclusion. A particular focus of the critics' ire has been the nuclear superpowers' retention of the capability to launch at least some forces on extremely short notice, such as in the handful of minutes that are likely to be available to a national leader between detection of what appears to be an incoming attack and its anticipated impact.

Rather than trusting warning systems and human discretion in such circumstances, it has been a particular focus of disarmament activists to demand measures for nuclear force "de-alerting," which would amount in various ways to a renunciation of the capability for immediate launch by the interposition of some delaying period before nuclear forces can be used at all. Whatever the method, in other words, the purpose of de-alerting is to impose unavoidable delays before nuclear use becomes possible, requiring possessors to take "several hours, days, or months to prepare for launch."[4] The idea is to

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[3] Scott D. Sagan, *The Limits of Safety* (Princeton: Princeton University Press, 1991), at 51-52.

[4] Interfaith Committee on Nuclear Disarmament, "How to Get to Zero" (undated), *available at* http://www.zero-nukes.org/howtogettozero3-dealerting.html.

> "eliminate the threat of an accidental nuclear conflict by allowing the top leadership of nuclear nations sufficient time to perform a comprehensive evaluation of the situation at hand and therefore to make adequate decisions."[5]

This paper will examine the ongoing debate over "de-alerting." It must be stressed at the outset, however, that analytically speaking, the issue is not nuclear force alert status *per se*, but rather the time available to top national leaders with nuclear release authority in which to decide what to do. High alert status is only really worrisome, even to its critics, when it exists in conjunction with extremely short warning times and a perceived incentive structure that might make a launch-on-warning (LOW) decision seem more attractive than waiting for more definitive attack confirmation (*e.g.*, the actual detonation of enemy warheads) or simply "riding out" an enemy assault. This is an important distinction to bear in mind, especially when one considers various possible ways to reduce false-alarm-related inadvertence risks. Whether one is speaking of "de-alerting" measures or other contending remedies, the objective is to increase the effective decision-making time available to national leaders – shifting, one might say, from a system based upon the old maxim of "he who hesitates is lost" to a system that safely operates more along the lines of "look before you leap."

These issues are, to a great extent, matters of first impression for the nuclear establishments of the United States and Russia. From the beginning of their nuclear rivalry, it has generally been the rule that forces were structured to permit use on as rapid a basis as existing technology permitted. When the advent of more rapidly-launchable missiles and then longer-range early-warning systems (and especially satellite-based systems) began to make LOW possible, such a capability – at least as an *option*, though not necessarily as a *policy* – was carefully developed and maintained.

It is sometimes argued by supporters of "de-alerting" measures that there is precedent for such steps, such as in the reciprocal steps taken in 1991 by U.S. President George H.W. Bush and Russian President Boris Yeltsin to stand-down thousands of warheads from high alert and to unload many of them from missiles.[6] Yet while de-alerting *did* occur at that time, it probably provides little help in struggling with modern dilemmas. For the most part, those 1991 steps were undertaken with forces that were felt to be no longer needed, and as a preliminary step toward elimination of the systems in question (*e.g.*, U.S. Minuteman II missiles and Poseidon ballistic missile submarines). U.S. strategic bombers were also then taken off their previous 15-minute alert and their nuclear weapons unloaded, but both sides retained potent land- and sea-based missile forces on an alert basis.

The 1991 de-alertings show that it is physically possible to take weapons off alert, of course, but that was never in dispute. It is easy to de-alert what one does not wish to keep at all –

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5 *See, e .g.*, A.G. Arbatov et al., "De-alerting Russian and US nuclear weapons: A path to reducing nuclear dangers" (Moscow: Institute of International Economy and Foreign Relations, Russian Academy of Sciences, 2001), *available at* http://www.ieer.org/russian/pubs/dlrtbk-e.html.

6 *See, e.g.*, Bruce G. Blair, "De-Alerting Strategic Forces," in *Reykjavik Revisited* (George P. Shultz, Steven P. Andreasen, Sidney D. Drell, & James E. Goodby, eds.) (Stanford, CA: Hoover Institution, 2008), at 47, 68-69; Bruce Blair, "Command, Control, and Warning for Virtual Arsenals," *Nuclear Weapons in a Transformed World* (Michael J. Mazarr, ed.) (New York: St. Martin's Press, 1997), at 55, 57.

which presumably explains why de-alerting is regarded by disarmament advocates as such an obvious answer to nuclear accident risks – and it is not hard to de-alert weapons that are in essence only surplus vis-à-vis some core of forces that one still retains *on* alert. The real conceptual and operational challenges arrive, however, with more recent proposals that *neither* side retain *any* nuclear forces on an "alerted" basis – moving their entire arsenals to de-alerted status – in a context in which nuclear forces are nonetheless to be retained for some indefinite (and potentially lengthy) period of time. The congenial de-alertings of 1991 provide no precedent and no guidance in this regard, and the challenges for the nuclear superpowers of having *no* nuclear forces on alert in a world in which such a capability is technically available are thus *sui generis*.

It is here, however, where the conceptual shift from de-alerting *per se* to a paradigm of seeking to maximize decision-making time is perhaps most useful – and may offer us some useful policy options. Let us explore these questions in more detail.

II. *The De-Alerting Debate*

The debate over so-called "de-alerting" of nuclear strike forces is one that has become a periodic subject of discussion in the Conference on Disarmament (CD) in Geneva, and at the U.N.'s First Committee and General Assembly in New York. (It was, for instance, the subject of a General Assembly resolution adopted in December 2007.[7]) De-alerting also features in the growing literature on disarmament planning that has blossomed in recent years, perhaps most prominently in the 1996 report of the Canberra Commission on Eliminating Nuclear Weapons – which recommended "[t]aking nuclear forces off alert" so as to "reduce dramatically the chance of an accidental or unauthorised nuclear weapons launch"[8] – and in the volume of papers produced by the "Reykjavik Revisited" conference at the Hoover Institution in 2007.

A. *The Critique*

As noted, de-alerting is generally advanced as a way to reduce the risk of nuclear war resulting from some kind of false alarm. As an indication of the need for such steps, advocates point to past incidents such as cases of erroneous readouts from U.S. warning systems in 1961, 1962, 1979, and 1980, a communications confusion between U.S. military components in 1963, and a Russian alert as a result of confusion over the innocuous launch of a research rocket in Norway in 1995.[9] But de-alerting is often described as being more than just a way to manage

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7 United Nations General Assembly Resolution A/RES/62/36 (10 January 2008), *available at* http://daccessdds.un.org/doc/UNDOC/GEN/N07/465/93/PDF/N0746593.pdf?OpenElement.

8 Canberra Commission on Eliminating Nuclear Weapons (August 1996), from the Executive Summary, at 11-12, *available at* http://www.dfat.gov.au/cc/cc_report_exec.html.

9 *See, e.g.*, CDR James R. Low, USN, "De-Alerting the U.S. and Russian Nuclear Arsenals: An Unlikely Method of Arms Control," Master's thesis submission to the U.S. Naval Postgraduate School (December 1999), at 97-100, *available at* http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA375929&Location=U2&doc=GetTRDoc.pdf; Arbatov, et al., *supra*.

nuclear forces with less risk. As one senior U.N. disarmament official put it, for example, de-alerting is also envisioned as a "stepping stone" toward achieving nuclear disarmament.[10]

The close connection between de-alerting and disarmament advocacy complicates the policy debate, however, by exacerbating suspicions in the minds of nuclear policymakers about whether de-alerting is even *intended* to be compatible with stable nuclear deterrence during whatever period of time even self-proclaimed abolitionists expect will have to pass before "zero" is achieved.[11] This makes it easier for skeptics to dismiss advocates as being disingenuous, and limits the degree to which genuine dialogue can occur about the management or avoidance of accident risks in nuclear policy. If de-alerting is meant to be taken seriously by nuclear decision-makers as a proposal for the avoidance of catastrophic nuclear accidents, it needs to be seen as more than merely an instrumental step one takes after having *already* made the decision to eliminate all one's nuclear weapons in short order: de-alerting needs to be able to stand on its own. More sophisticated proponents such as Bruce Blair and Scott Sagan indeed provide a thoughtful case in this regard – and one that will be examined closely herein – but the general tone of public debate is notably uneven.

Debates on the subject of de-alerting have also been complicated by a largely unnecessary conflict over whether the United States and Russia presently have a "launch-on-warning" (LOW) policy. In this regard, critics and defenders of current nuclear force postures often simply talk past each other, the former saying or implying that the nuclear superpowers operate on a LOW basis – being set and likely to launch on warning from a "hair-trigger alert" – and the latter denying it. In fact, both sides are both right *and* wrong, and much time and energy has been devoted to talking *around* the real issues.

It is certainly true that the United States and Russia appear to devote much energy and expense to maintaining some nuclear forces on an alert level that would permit launch in a very short period of time. In the late Cold War, some 90 percent of the U.S. land-based Minuteman missile ICBM force was said to be launchable within three minutes of receipt of an authenticated order, while the Soviets were by some accounts estimated to be able to launch up to 80 percent of their force in an equivalent time period. The Soviets first demonstrated the ability to launch an ICBM on tactical warning in 1982, had fully deployed a satellite-based early-warning system by 1987, and by 1988 possessed (and had exercised) the technical option of launching sizeable nuclear forces on warning of an incoming attack. By 1990, according to U.S. intelligence officials, "[m]ost, if not all, Soviet ICBMs could be launched within minutes of a valid launch order."[12] Years after the head of the Soviet Strategic Rocket Forces first publicly mused about LOW in 1967, there are "strong indications" that Moscow has ensured this option.[13]

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10 U.N. Under Secretary General for Disarmament Affairs Jayantha Dhanapala, "The De-Alerting of Nuclear Weapons: The International Political Context," remarks in Stockholm, Sweden (October 10, 1998), *available at* http://disarmament.un.org/speech/10Oct1998.htm.

11 *See, e.g.*, Remarks of President Barak Obama, Hradcany Square, Prague, Czech Republic (April 5, 2009), at http://prague.usembassy.gov/obama.html.

12 Blair, *The Logic of Accidental Nuclear War* (Washington, D.C.: Brookings Institution, 1993), at 111, 128, 148 & 207. Soviet mobile land-based missiles were felt to have slower reaction times than silo-based ICBMs, however, on account of their need to go through more complicated set-up procedures. Mobile units were believed to have a "scatter-on-warning" policy, dashing to pre-surveyed launch positions in the field from the garrisons in which most of them spent most of their time, and only thereafter preparing

It is also true that the U.S. officials have long refused absolutely to *rule out* launch-on-warning, apparently believing that ambiguity on this score complicates Russian planning scenarios and enhances deterrence.[14] To preserve the *possibility* of LOW, both the U.S. and Russian nuclear command-and-control systems were by the early 1980s "geared to disseminating launch authorization after enemy forces launched but before they had landed."[15] By some accounts, even as late as 2008, both countries still kept about one third of their total strategic arsenals on launch-ready alert.[16] In 2009, a spokesman for the U.S. Strategic Command confirmed that if the president gave such an order, it was indeed true that much of the American "ICBM force could be launched prior to [the] impact [of attacking warheads]."[17] To the extent that the deliberate retention of a LOW *option* means that some forces are indeed kept on a "hair-trigger" alert, the critics are correct.

But to retain a LOW *option* is not necessarily to have a LOW *policy*, and it is nonetheless the case that both powers have avoided *committing* themselves to LOW in any doctrinal fashion. In fact, both countries have spent many billions of dollars in order to build and maintain survivable second-strike forces – *e.g.*, U.S. and Russian ballistic missile submarines (SSBNs) firing submarine-launched ballistic missiles (SLBMs), and Russian mobile land-based intercontinental ballistic missiles (ICBMs) – that are designed to *avoid* the kind of "use-or-lose" pressures that lie at the heart of LOW logics.

Indeed, in the case of U.S. nuclear policy, it has long been the "conventional wisdom"[18] of the strategic policy community that even though it might be advantageous to preserve a LOW *capability*, a launch-on-warning *policy* would be inherently destabilizing for the very reasons that de-alerting advocates suggest: the very few minutes that LOW provides is a perilously short time in which to make momentous decisions about whether or not to launch one's own nuclear forces.[19] When Senator William Fulbright and others actually promoted LOW as part of their campaign against missile defenses, for instance, prominent nuclear strategists such as Albert Wohlstetter spoke out strongly against a presumption of quick-launch, warning that it would "increase the nightmare possibility of nuclear war by mistake."[20]

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themselves for actual launch, perhaps after an hour or more. *Id.* at 152-54. Soviet bombers were felt generally not be maintained on quick alert, with the possible exception of a period in 1983-84, but Soviet SSBNs on patrol could fire within perhaps between nine and 17 minutes. (The Soviets had a much lower patrol rate than U.S. submariners, but Soviet boats in port could launch missiles from pierside. This capability, Blair writes, was "frequently tested.") *Id.* at 154-56 & 161-65.

13 *See* Freedman, *The Evolution of Nuclear Strategy*, *supra*, at 253 & 372.

14 *See id.*, at 253 & 372.

15 Blair, *The Logic of Accidental Nuclear War*, *supra*, at 168.

16 Blair, "De-Alerting Strategic Forces," *supra*, at 47.

17 *Quoted by* Wade Boese, "Nuclear Weapons Alert Status Debated," *Arms Control Today* (December 2007), *available at* http://www.armscontrol.org/act/2007_12/NuclearAlert.

18 Freedman, *The Evolution of Nuclear Strategy*, *supra*, at 372.

19 *See, e.g.*, Boese, "Nuclear Weapons Alert Status Debated," *supra* (*quoting* New Zealand Disarmament and Arms Control Minister Phil Goff that with weapons ready to fire in minutes, "little time exists for dialogue to avoid" a nuclear war "sparked by accident or by technical malfunction as well as by a deliberate act").

20 *Nuclear Heuristics: Selected Writings of Albert and Roberta Wohlstetter* (Robert Zarate & Henry Sokolski, eds.) (Carlisle, Pennsylvania: Strategic Studies Institute, 2009), from the introduction by Zarate, at 41.

According to strategist Herman Kahn, in fact, it was not entirely clear than an ostensible launch-on-warning policy would in fact deter at all – either because one's opponent might develop clever ways to spoof or defeat early warning systems, or simply because it might not be *believed* that a U.S. President would in fact take the fateful step of "pressing the button" on the basis of what might be an error. As Kahn summed it up,

> "Sole reliance on warning and quick reactions may be an unreliable security measure … partly because dependence on some kinds of quick reaction so increases the chance for an unpremeditated war that the quick reaction schemes tend to be a façade; the buttons are not really connected. Additionally, quick reaction seems particularly susceptible to degradation by clever tactics on the part of the enemy that have been overlooked or underestimated."[21]

Because "the dangers of an accidental war would be greatest if one or both sides moved to 'launch-on-warning,'" Kahn described reliance upon LOW as having "many drawbacks" – to the point that it was basically "irresponsible."[22]

Richard Perle, then an Assistant Secretary of Defense, opined similarly in 1982 that LOW was imprudent because there was too little time "[a]s a practical and realistic matter" for a national leader to make a good decision under attack. He stressed the importance of freeing the President "from having to make a decision of that consequence in the small number of minutes available to him." Accordingly, said Perle, LOW "is not and never has been U.S. policy."[23] (In 1973, veteran arms control official Fred C. Iklé even argued that in order to prevent overhasty use, the United States and Russia should "jointly decide to replace the doomsday catapults invented in the 1950s with arms that are incapable for being launched swiftly."[24]) The distaste for LOW in the U.S. policy community helps explain why LOW has never been the official U.S. position.[25]

Nor does LOW – what is apparently called a "meeting strike" (*vstrechnyy udar*) in Russian[26] – seem to be official Russian policy, though some comments from Soviet officials in

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Fulbright had argued that rather than building systems to defend against nuclear attacks, LOW would provide the best deterrence: "the knowledge that these ICBMs, even part of them, would be released immediately without any fiddling around about it … would be the greatest deterrence in the world." *Id.* at 39.

21 Herman Kahn, *On Thermonuclear War* (Princeton, N.J.: Princeton University Press, 1961), at 256-57.

22 Herman Kahn, *Thinking About the Unthinkable in the 1980s* (New York: Simon & Schuster, 1984), at 50 & 138.

23 Blair, *Strategic Command and Control* (Washington, D.C.: Brookings Institution, 1985), at 235 (*quoting* Hearings on Military Posture and H.R. 5968 before House Committee on Armed Services, 97 cong. 2 sess. (GPO, 1982), pt.2, p.65).

24 *See* Fred Charles Iklé, "Forward," *in Nuclear Weapons in a Transformed World*, *supra*, at x-xi (citing earlier publication).

25 *See also generally id.*, at 235 (quoting various U.S. experts doubting that LOW is feasible because decision-making timeframes are so short).

26 Blair, *The Logic of Accidental Nuclear War*, *supra*, at 173. At the U.S. Strategic Air Command, it was known by the codename of "Midnight Express." *Id.*, at 185.

the 1960s and 1970s arguably implied this.[27] Russia's reliance during the Cold War (and since) upon ICBM missile silos hardened considerably beyond U.S. practice, extensive underground facilities for the protection of leadership assets,[28] an SSBN force capable of undertaking deterrent patrols, and a growing arsenal of mobile land-based ICBMs suggests that Moscow also wishes to reserve the option of "riding out" an attack rather than launching its weapons in response to "use or lose" considerations. Bruce Blair himself has argued that during the Cold War, LOW was probably philosophically incompatible with the collective decision-making culture of the Soviet Politburo, and in any event was not as "technically and politically robust" an option for the Kremlin as it was for U.S. planners.[29]

It seems likely, therefore, that both U.S. and Russian nuclear forces are structured to *preserve* a LOW option but not to *presume* it will be taken. Even the Canberra Commission Report of 1996, while unstinting in its advocacy of de-alerting, conceded that both U.S. and Russian forces were in fact "structured to be able to ride out a first nuclear strike," complaining merely that these forces possessed "'launch-on-warning' or 'launch-under-attack' *options*."[30] Both powers have devoted themselves to building and maintaining systems and institutions to maximize the (admittedly short) decision-making time available to national leaders without precluding LOW, hoping to minimize the risk of accidents while yet maximally deterring the opponent by denying him any conceivable basis for a conclusion that launching a first strike would elicit little or no retaliation. To the extent that the accusation of a "hair-trigger alert" is meant or presumed to imply a launch-on-warning *policy*, therefore, officials are probably right to contend – as the American Ambassador to the CD put it in 2007, for instance – that U.S. nuclear forces are not and have never been on 'hair-trigger alert.'"[31]

Yet this is not the end of the story, for sophisticated advocates of de-alerting measures do not necessarily contend that LOW is actually official *policy*. Rather, scholars such as Blair suggest that *no matter what official policy is*, U.S. and Russian decision-makers face formidable *incentives* to launch on warning *anyway* – as long as that option is technically available – because force and command-system vulnerabilities leave them with no alternative to LOW if they are to inflict the desired level of retaliatory damage on the enemy. Because both sides effectively lack a genuine "ride-out" option, the argument goes, they would be left, in practice, with little choice *but* to adopt a *de facto* LOW policy, which is indeed just as dangerously destabilizing and prone to accident as the more hawkish Wohlstetters and Kahns always believed. (Indeed, it is perhaps worse, insofar as the critics allege that the nuclear superpowers' command-and-control systems are very likely at some point to give rise to an uncaught false alarm or some other accident likely to trip their *de facto* LOW postures into catastrophic motion.) Through this prism, de-alerting is said to become necessary as a means to prevent vulnerabilities

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27 Freedman, *The Evolution of Nuclear* Strategy, supra, at 252-53 & 499 n.23.

28 *See, e.g.*, K.C. Bailey & F.D. Barish, "De-Alerting U.S. Nuclear Forces: A Critical Appraisal," UCRL-LR-132030 (Springfield, VA: National Technical Information Service) (August 21, 1998), Appendix A, at 19-20.

29 Blair, *The Logic of Accidental Nuclear War*, *supra*, at 214-16.

30 Canberra Commission Report, *supra*, from Part One (emphasis added), *available at* http://www.dfat.gov.au/cc/cc_report1.html.

31 Permanent Representative Christina Rocca, remarks at the Conference on Disarmament (October 9, 2007), *available at* http://www.accessmylibrary.com/coms2/summary_0286-33136748_ITM.

from giving rise to launch-on-warning decisions by making it technically *impossible* to launch during the very brief span of time between detection of what looks like an enemy attack and its presumed time of impact.

Let us examine this argument in more detail, for it lies at the heart of the de-alerting debate – and perhaps our way out of it. As indicated, the most sophisticated and articulate critiques of current nuclear force postures, in which at least some forces are set up for extremely rapid launch, are Bruce Blair and Scott Sagan, who offer different but complimentary arguments. Blair's account revolves around the incentives for a launch-on-warning posture he says are created by the vulnerability not just (or even principally) of nuclear forces themselves (*e.g.*, missile silos) but of the command, control, communications, and intelligence (C^3I) architectures upon which their employment in actual nuclear warfighting depends. In his view, in effect, both nuclear superpowers' longstanding investments in survivable second-strike nuclear weapons to some extent missed the point – or at least proved radically incomplete – insofar as they failed to provide Washington and Moscow with a genuine ability to mount and manage a retaliatory strike because national C^3I systems would be too damaged by a massive nuclear exchange to handle the demands of second-strike battle management.[32] Both countries are thus said to have faced tremendous incentives for launch-on-warning – in practice, at least, whether or not this was official policy – because it was presumably clear to their nuclear planners that C^3I degradation and outright force attrition (*e.g.*, high losses of silo-based ballistic missiles and non-alerted bomber forces) from an enemy attack would prevent its recipient from mounting the kind of retaliatory strike it deemed necessary.[33]

Particularly in the United States, Blair argues, the "myth" of assured destruction impeded open and honest discussion of these issues by encouraging the belief that it would be possible to absorb a Soviet attack before retaliating – that is, that a "ride-out" option actually existed – and obscuring the degree to which "the mundane realm of [U.S.] operational planning" and its doctrinal requirements for a certain degree of "coverage" of Soviet targets powerfully mitigated against "ride-out" and in favor of a LOW posture.[34] This pressure toward LOW, however, existed on both sides of the Cold War divide, with launch before enemy warhead impact "inexorably emerg[ing] as the apparent logical solution to the operational dilemmas" faced by planners in Washington and in Moscow. In time, Blair argues, LOW emerged as "the primary mode of command system operation for both postures."[35]

This critique has been echoed by other advocates of de-alerting, among them Steven Starr, who has written that under the conditions of Cold War nuclear competition, "the only

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32 *See, e.g.*, Blair, *The Logic of Accidental Nuclear War*, *supra*, at 113-14 (noting that "command vulnerability" was common denominator of U.S. and Soviet postures during the Cold War, making "the idea of strategic flexibility almost meaningless").

33 Blair, *The Logic of Accidental Nuclear War*, *supra*, at 8-9, 20, 36, 43, & 53-55; Blair, *Strategic Command and Control*, *supra*, at 209.

34 *See* Blair, *The Logic of Accidental Nuclear War*, *supra*, at 176-77. According to Blair, the Soviets' priority was the preservation of strict centralized control over nuclear forces, while the U.S. planning system prioritized Soviet "target coverage." *Id*. at 36. In neither case, however, could these objectives be adequately served *after* sustaining an enemy attack.

35 Blair, *The Logic of Accidental Nuclear War*, *supra*, at 8 & 185.

military 'solution' seemed to require the launch of ICBMs from their silos *before* they were destroyed." This turned LOW – despite its well-understood instabilities – into "standard operating procedure, written into warplans and operational manuals."[36] To be sure, Blair admits that these operational incentives for launching upon warning of attack would not *necessarily* have produced an actual launch decision. While "the structure, procedures, and biases" of the command system created *pressure* towards LOW, the actual choice would presumably be that of the senior political leadership. It is true that U.S. Strategic Air Command chief Curtis LeMay once blurted out at a meeting with an advisory committee that if he understood a Soviet attack to be coming, he might well order an immediate preemptive strike himself – that is, to undertake launch on warning on his own volition[37] – but even Blair stops short of arguing that military planners could or would have overridden contrary political direction in time of crisis.[38] Nonetheless, what one might call the "hydraulic pressure" critique of U.S. and Soviet/Russian launch postures remains a powerful one.

This account of pressure toward launch-on-warning postures coincides with a critique – found in the analyses offered both by Blair and (especially) by Scott Sagan – of early-warning and launch-control systems. This critique argues that such systems became steadily more brittle and accident-prone throughout the Cold War, in large part precisely *because* of the powers' gravitation to LOW postures that required extraordinarily quick reaction times, notwithstanding the considerable effort and expense devoted to preventing false alarms and other accidents.

Sagan's account builds upon an analytical contrast between approaches to "high-reliability" management of high-risk industries (*e.g.*, nuclear power plants or aircraft carriers) and the work of Charles Perrow and others on the degree to which such organizations may be inescapably subject to "normal accidents." "High-reliability" theorists generally believe it possible to manage complicated organizations in dangerous lines of work by means of redundant safety mechanisms, flexible and responsive decentralized organizational autonomy, the creation of a comprehensive "culture of safety," and other expedients. A counterpoint to this thinking, however – which Sagan concludes is more applicable to the context of U.S. and Russian early-warning and command-and-control architectures – may be found in Perrow's work on how for some types of organization, "serious accidents are inevitable, no matter how hard we try to avoid them."[39]

Through the prism of Perrow's analysis, high interactive complexity and "tight" organizational "coupling" – that is, the degree to which, respectively, a system's components interact in non-linear ways capable of producing unexpected consequences, and its activities are time-dependent and without the sort of slack in their operational sequencing that would permit improvisational responsiveness to unanticipated events – make organizations highly accident-prone regardless of the intentions of their leaders and operators, and irrespective of the precautions they may take. (The redundancy, decentralization, and intense safety training beloved of "high-reliability" theorists, it is suggested, cannot much reduce these problems.

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36 Steven Starr, "High-alert nuclear weapons: examining the risks," *SGR Newsletter*, no.36 (Autumn 2008), at 1-2.

37 Ghamari-Tabrizi, *The Worlds of Herman Kahn*, *supra*, at 189.

38 Blair, *The Logic of Accidental Nuclear War*, *supra*, at 51.

39 Sagan, *The Limits of Safety*, *supra*, at 31.

Redundancy is seen as increasing a system's complexity and perhaps also its opacity, leading some errors to remain unfixed longer and increasing the odds of common-mode failures and simultaneous failures of multiple components. Decentralization can cut against the need for discipline and order in tightly-coupled organizations, while training in routine safety procedures may not help against truly unanticipated problems, and organizational learning may be impeded by secrecy, bureaucratic politics, and leaders' avoidance of personal accountability.) Organizations that have many complex interactions, in other words, will almost inevitably encounter unexpected glitches, and if these organizations also happen to be tightly coupled, they will be unable to react appropriately to them.[40]

In his analysis of the U.S. nuclear command-and-control system, Sagan argues that this system became more tightly coupled and more organizationally complex over the course of the Cold War – evolving from a system that was *not* maladaptively tightly coupled during the Cuban Missile Crisis, but that became more so with the advent of better early warning sensors, computerization, and the development of a force posture capable of launch on warning.[41] This closely parallels Blair's analysis, which stresses that despite the addition of satellite-based early-warning systems in the 1970s – which in the U.S. case added about 15 minutes to the anticipated warning time of Soviet ICBM attack, as well as offering the possibility of comparing data from two or more sensors in order to reduce the risk that a single faulty reading would lead to war[42] – the American warning and launch-control system became more brittle over time, particularly with its computerized semi-automation at the North American Air Defense Command (NORAD) at the beginning of the 1980s.[43]

In effect, therefore, Blair and Sagan make much the same complaint about ready-launch force postures. Even two decades after the end of the Cold War, both the U.S. and Russian nuclear systems, they argue, remain structured in such a way as to create potentially catastrophic instability in the face of "inadvertence" challenges.[44] Because of the coincidence of nuclear force and C^3I vulnerability with the technical availability of launch-on-warning as an operational "answer" to this vulnerability, both powers have chosen to preserve a LOW option for their leaders – who would face formidable incentives actually to *exercise* this option in the face of an attack warning. This is felt to be not merely unstable in the classical deterrence-theory sense of creating incentives to use nuclear weapons in a crisis, but also dangerously susceptible to the kind of uncaught false alarms or other accidental launch problems that are said to be, over time, well-nigh inevitable in such interactively complex and tightly-coupled systems. This argument, then, is the intellectual core of the case for "de-alerting," insofar as it is posited that such inadvertence-instability can be greatly reduced by removing the *option* of launching upon

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40 *See id.*, at 32-36, & 39-46; *see also* Scott D. Sagan, "The Problem of Redundancy Problem: Why More Nuclear Security forces May Produce Less Nuclear Security," *Risk Analysis*, vol. 24, no. 4 (2004), at 935, 936-38 (noting the existence of a "dark side of redundancy," in that "efforts to improve nuclear security can inadvertently backfire," and that in complex systems, adding extra elements into a system for safety reasons might inadvertently increase the risk of "a catastrophic common-mode error").

41 Sagan, *The Limits of Safety*, *supra*, at 154 & 225-32.

42 Blair, *The Logic of Accidental Nuclear War*, *supra*, at 186.

43 *Id.*, at 189 & 194.

44 Blair, "De-Alerting Strategic Forces," *supra*, at 61-62.

warning by setting things up so that it is basically impossible – for physical, technical, or organizational reasons – for either side to launch its nuclear forces on short notice.

B. *The Counter-Narrative*

Not surprisingly, given that – notwithstanding nuclear strategists' frequent acknowledgement of the likely strategic instability of launch-on-warning as *policy* – both U.S. and Russian officials have continued to go to considerable trouble and expense to preserve a LOW *capability* and have persistently refused formally to rule out its exercise, there exists a counter-narrative to the inadvertence critique's unhappiness with quick-launch postures. Fundamentally, this counter-narrative asserts the deterrent value of being able to launch on very short notice – which is said to make *advertent* war less likely by removing incentives for preemption and ensuring that any attacker would face a formidable retaliatory strike. (According to the U.S. Strategic Command, for instance, maintaining missiles able to deliver a "rapid response" is "an important aspect of our deterrent because it complicates an opponent's pre-emptive strike planning."[45]) It acknowledges the existence of a danger of accidental launch in response to a false alarm, but prefers to stick with approaches to reducing this (*e.g.*, increasing sensor redundancy and cross-verification) that do not compromise the deterrent value that quick-launch capabilities are presumed to provide.

The counter-narrative in no way disagrees with de-alerting proponents that it is important to maximize the effective decision-making time available to national leaders. It does, however, conceptualize this problem quite differently. In this regard, the disagreement between the two positions in large part relates to each side's identification of the most worrisome risk, and its differing view of what sort of "effective decision-making time" is really at issue.

De-alerting advocates focus upon the extremely short timeframes in which decisions must be taken between the arrival of information suggesting that an enemy attack is in progress and the point by which national nuclear forces must be sent on their way if they are by this method to escape that same incoming attack. These timeframes are very short indeed. U.S. officials, for example, are thought likely to have only about 20 minutes after a NORAD threat briefing until the impact of Russian ICBM warheads – which leaves perhaps only ten minutes in which to make a potential launch decision before devoting a further five to ten minutes to the transmission of launch orders and the execution of missile ignition sequences at the Minuteman missile fields.[46] (A submarine-launched ballistic missile [SLBM] attack could shorten these times further, since the first incoming warheads would have to travel much shorter distances if launched from deployment areas not far from U.S. coasts.) De-alerting measures seek to lengthen the time that must pass between attack warning and the launch of one's own missiles so that this period *exceeds* the flight time of incoming warheads, thus eliminating the option of launching until it has become clear – presumably by the presence or absence of nuclear detonations – whether or not the warning was a false alarm.

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45 *See* Boese, "Nuclear Weapons Alert Status Debated," *supra* (*quoting* Strategic Command spokesman LT Denver Applehans).

46 Blair, *The Logic of Accidental Nuclear War*, *supra*, at 191.

While acknowledging that quick-launch postures entail real risks, the counter-narrative *against* de-alerting suggests that the de-alerters have misconceived the situation by assuming that the period between warning and attack impact is the only relevant timeframe. From the skeptics' perspective, the de-alerters' critique of current nuclear postures pays insufficient attention to a *different* timeframe: the length of time in a developing geopolitical crisis between nuclear-armed adversaries prior to the point at which one of them feels it necessary to take some overt step that could convince the other that it is likely to launch a first-strike. Where the de-alerters focus upon the challenges of stability within the constrained time-horizons of *tactical* warning (*i.e.*, of a potential incoming attack), the skeptics thus focus also upon the problems of stability within the framework of *strategic* warning (*i.e.*, of the potential inevitability of hostilities) in the context of a broader crisis.

De-alerting skeptics worry that de-alerting could prove a medicine worse than the disease it seeks to cure by making crises harder to resolve and provocations harder to avoid by actually *lessening* the time available to national leaders before they feel compelled to take some step that could "prove" their ill intentions to a nervous potential adversary – thereby touching of an escalatory spiral. There might be occasions when moving to a higher alert level would be considered *desirable* in a crisis – as a signal of commitment intended to deter an adversary from a particular course of action, as the U.S. intended with its move to a heightened nuclear alert in response to Soviet Premier Leonid Brezhnev's suggestion of the possibility of Moscow's "unilateral" intervention on Egypt's behalf in the Yom Kippur War of October 1973[47] – but the skeptics tend to be horrified by the idea that de-alerting could encourage leaders to feel *forced* into such escalation when it would be maximally destabilizing, and much earlier in a crisis than would otherwise have to be the case. (By contrast, having some nuclear forces *always* ready to launch reduces, even if it does not necessarily eliminate, the perceived need to change one's alert status in a crisis *except* as a deliberate signal.[48])

As the skeptics view it, by making it take longer to ready nuclear forces for use, de-alerting measures would exacerbate pressures to undertake *re-alerting* as a crisis worsened, as each side would fear being caught unprepared if things indeed came to blows.[49] This could

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47 *See, e.g.*, Letter from Leonid Brezhnev to Richard Nixon (October 24, 1973), *available at* http://www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB98/octwar-71.pdf (observing that "if you find it impossible to act jointly with us in this matter [of stopping Israel's counter-offensive in that conflict], we should be faced with the necessity urgently to consider the question of taking appropriate steps unilaterally").

48 Conceivably, it may be an awareness of this potential to use re-alerting as a means of deliberate signaling that helped lead the "New START" strategic agreement with Russia, which at the time of writing was still pending before the U.S. Senate, to count each strategic bomber as a single treaty-limited "warhead" no matter how many nuclear warheads it actually carries. Under these counting rules, nuclear warheads may be freely loaded or unloaded from such bombers – an activity likely to be observed by the other side's "national technical means" (*i.e.*, reconnaissance satellites) – as a mode of intra-crisis strategic communication without running afoul of "New START" limits.

49 Skeptics agree with de-alerters that it is precisely in the midst of a crisis when false information about a likely attack will be most destabilizing, for it is in times of tension when leaders will presumably be most prone to believe such an attack is indeed coming. *See, e.g.*, Blair, *The Logic of Accidental Nuclear War*, *supra*, at 234. They suspect, however, that this is no less true with respect to strategic warning than with respect to tactical warning (*e.g.*, a false alarm of incoming attack). A crisis will tend to make leaders more susceptible to believing the worst of the other side, and thus also to make the inherently somewhat

produce a dangerous "re-alerting race," and would create deeply troubling incentives for the winner of such a race actually to *use* nuclear weapons against the side that got started second, or which moved more slowly.[50] Because it would thus become *very* important which party could "re-alert" more quickly, de-alerting might also ignite a new arms race in re-alerting technology and procedures, as well as creating strong incentives for each party to cheat by trying to maintain some nuclear assets on clandestine launch alert.

(These game theory dynamics also play into the debate over the *verifiability* of de-alerting measures. Skeptics worry that de-alerting steps that are verifiable are to this same degree potentially destabilizing, because this very visibility would ensure an adversary's quick knowledge of such moves – thus encouraging him to "race" to re-alert lest he otherwise be caught by a first strike before his own forces had similarly regenerated. The more informative and reliable the de-alerting verification regime, the more quickly such feedback could set off destabilizing escalatory dynamics in a crisis. De-alerting steps that are *not* verifiable, however, could be even *more* destabilizing, for they would be more likely not fully to be trusted by the other side, thus leaving each with an incentive to cheat on a de-alerting regime[51] – also opaquely. The worst possible situation might thus be one in which *both* sides cheat by maintaining some forces on secret alert, yet believe the other to *lack* this capability. This could tempt one of them into preemptive attack, resulting in a sizeable nuclear exchange as the recipient of such a surprise assault responds by immediately launching the forces it has itself maintained on clandestine alert.)

The conceptual model for this counter-narrative is thus the preemption-engendering mobilization dynamics at the outset of the First World War – epitomized in particular, by the German "Schlieffen Plan," the notorious war plan strategy of Wilhelmine Germany under which the Kaiser's forces felt it imperative to rush to mobilize and achieve certain major wartime

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ambiguous data of potential *strategic* warning seem more portentous. If this dynamic were coupled with the pre-existence of incentives on both sides to "win" any "re-alerting race" that might occur, one should expect the parties in a de-alerted rivalry to remain very jumpy, and prone to order provocative re-alerting.

50 This has also been described as a "regeneration" race. *See* Bailey & Barish, "De-Alerting U.S. Nuclear Forces: A Critical Appraisal," *supra,* at 19-20. Herman Kahn wrote similarly of the dangers of competitive mobilizations in races toward a dominant military position – which he referred to as a "mobilization war." Kahn, *Thinking About the Unthinkable in the 1980s*, *supra,* at 156. Even Bruce Blair, in fact, concedes that force-regeneration in a nuclear crisis is unstable – with the parties in such circumstances being "prone to breakneck re-alerting during a crisis and would severely undermine crisis stability." Blair, "De-Alerting Strategic Forces," *supra,* at 47, 49 – and this logic would seem to apply as well to the very de-alerting measures he urges as a replacement for current ready-launch force postures.

51 Quite apart from verifiability, a de-alerting regime would presumably also have to ensure a very precise symmetry in re-alerting *rates* between the participating parties. This would surely be very difficult given asymmetries in the types of systems they employ (*e.g.*, SSBNs versus land-based mobile missiles). To the extent that specific de-alerting measures would have a greater delaying impact upon some types of system than others – such as by requiring deployed submarines, upon which the United States disproportionately depends for deterrence, to return to port in order to upload warheads – such steps might themselves become much-contested tools of strategic competition and relative advantage. The relative vulnerability of strategic systems, including to *non*-nuclear attack, during the process of "re-mating" would also be of critical importance in this regard. *Cf.* East-West Institute, *Reframing Nuclear De-alert: decreasing operational readiness of U.S. and Russian arsenals* (New York: EWI, 2009), at 7 (recounting Russian view that "[e]nsuring symmetry (equality of time for reconstitution) and implementation of control measures at the same time is an almost insoluble task").

objectives before Tsarist Russia was able to complete its own ponderous mobilization.[52] With the rival European powers having powerful incentives for reciprocal mobilization in order to avoid being caught unprepared, and Germany fearing that it would lose the military advantage if it waited until the larger Russian army reached full readiness, any one power's decision to mobilize made the escalatory process basically unstoppable and was therefore functionally equivalent to a decision for total war. The skeptics' argument against de-alerting is a classical deterrence-theory critique of crisis stability dynamics, with the Schlieffen Plan as its paradigmatic classical illustration of the catastrophic war-inducing incentives of a mobilization race.

Just as Germany's perceived need to beat its potential opponents to the punch in mobilizing ground troops helped precipitate the ghastly trench warfare of World War One, so the de-alerting skeptics fear that de-alerting measures could ignite a crisis-exacerbating race to re-alert nuclear forces. To be sure, most such skeptics acknowledge real early-warning and control-system accident risks, but – particularly to the extent that some de-alerting steps, such as "de-mating" and separate storage of missile warheads, arguably create *more* first-strike incentives for a potential adversary able to "win" a re-alerting race – they tend to feel that de-alerting could exacerbate crisis instability enough to make this particular remedy more dangerous than helpful.[53]

Interestingly, despite his ostentatious sympathy for the cause of disarmament and achieving "a world without nuclear weapons"[54] and campaign pledge to "take nuclear weapons off hair-trigger alert,"[55] President Obama's administration has recently come squarely down on the side of the skeptics. In its *Nuclear Posture Review* (NPR) of 2010, the administration joined the de-alerting debate, recounting that it had "considered the possibility of reducing alert rates for ICBMs and at-sea rates of SSBNs." While the United States intended to continue "efforts … to diminish further the possibility of nuclear launches resulting from accidents, unauthorized

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52 Writing well before today's de-alerting debates, Herman Kahn used the 1914 mobilization scenario as an example in illustrating how seemingly implausible and unsought war scenarios can nonetheless come to pass as a crisis develops. *See, e.g.*, Kahn, *On Thermonuclear War*, *supra*, at 368-70; Kahn, *Thinking About the Unthinkable in the 1980s*, *supra*, at 128. The 1914 analogy, however, is alive and well today. Kenneth Waltz, "Thoughts on Virtual Arsenals," *in Nuclear Weapons in a Transformed World*, *supra*, at 309, 314 (voicing concerns about the dangers of great power nuclear force-regeneration races by citing example of First World War mobilization).

53 Oddly, even Bruce Blair seems to concede that in a crisis, having some forces *already* on ready alert may actually be more stabilizing than de-alerted forces that would have to race to regenerate themselves. He has defended "virtual nuclear arsenals" against the charge of crisis instability for instance, by arguing that a crisis would likely unfold through phase with "a gradual heightening of combat readiness for some forces." This, he contends, "could have the effect of moderating the instability of the subsequent phase, as alert forces already in place, combined with invulnerable inactive weapons, would provide ballast." (By contrast, raising the alert levels of a nuclear force that is *already* largely alerted is a less provocative, and perhaps even invisible, step – a point he illustrated by pointing to Soviet alerts during the Cold War, which were apparently missed by U.S. intelligence.) *See* Blair, "Command, Control, and Warning for Virtual Arsenals," *supra*, at 65 & 69.

54 Remarks of President Barack Obama, Hradcany Square, Prague, Czech Republic (April 5, 2009), *available at* http://prague.usembassy.gov/obama.html.

55 Obama-Biden Campaign, "Barack Obama and Joe Biden on Defense Issues" (undated), *available at* http://www.barackobama.com/pdf/issues/Fact_Sheet_Defense_FINAL.pdf.

actions, or misperceptions and to maximize the time available to the President to consider whether to authorize the use of nuclear weapons," however, it had nonetheless concluded that de-alerting steps "could reduce crisis stability by giving an adversary the incentive to attack before 're-alerting' was complete."[56] Accordingly, the NPR declared that

> "the current alert posture of U.S. strategic forces – with heavy bombers off full-time alert, nearly all ICBMs on alert, and a significant number of SSBNs at sea at any given time – should be maintained for the present."[57]

The two sides in the de-alerting debate thus seem to have reached something of a stalemate – albeit one that favors the *status quo* of launch-ready postures, because the principal nuclear weapons holders seem to feel that de-alerting would cause more problems than it would solve.

III. *A Conceptual Framework*

As the foregoing discussion suggests, one can thus conceptualize the current debate as taking place between groups that put differing emphases upon two distinct types of risk and instability. De-alerting skeptics tend to worry most about what one might call "Type A" risks that revolve around the sort of nuclear escalation and use-incentives that are the subject of classical deterrence theory. Type A problems involve instability in a deterrent standoff as seen through the prism of potential *choices* to use nuclear weaponry (*e.g.*, in preemption) – what might thus generally be termed the challenges of "advertence." "Type B" problems, in turn, relate more the sort of false-alarm or accident risks emphasized by Blair and Sagan. Type B challenges, in other words, are those of *inadvertence*.

These types of concern are neither entirely separate nor mutually exclusive, of course, and neither side of the debate dismisses one risk category and focuses exclusively upon the other. Blair's critique, for instance, involves both dynamics. For him, the problem is that force and command-and-control vulnerabilities that create incentives for a *de facto* launch-on-warning posture (a Type A worry) coupled with the vulnerability of brittle C^3I systems to false alarms and other errors (a Type B problem). And de-alerting skeptics – including the Obama Administration, with its worries about and commitment to reducing accident risks – are greatly concerned with the danger of false alarms and loss of control over nuclear forces. Nevertheless, it is analytically useful to think of these as separate categories because differences in emphasis and prioritization go a long way toward explaining the different substantive positions of the two sides.

Those who worry greatly about Type A problems worry less about inadvertence *per se* than about the structure of incentives that could make *deliberate* war – even deliberate *nuclear* war, with all its easily imaginable horrors – seem rational. Such theorists have long worried that deterrence could fail not because anyone necessarily *really* wants war but rather simply when a situation arises in which one side feels that the harm it is likely suffer from attacking would be

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56 U.S. Department of Defense, *Nuclear Posture Review Report* (April 2010), at 26, *available at* http://www.defense.gov/npr/docs/2010%20nuclear%20posture%20review%20report.pdf.

57 *Id.*, at x.

less than that it would face by *not* doing so. Through this prism, as Herman Kahn once put it, deterrent calculations must look not merely to a party's likely "gain" from belligerence – which may, in this context, seem encouragingly small – but also to its estimation of "risk" in times of stress or crisis.[58] In this respect, the paradigmatic case may be Japan's fateful decision to attack the U.S. Pacific Fleet in 1941. Japanese leaders are said fully to have appreciated the perilous risks involved in awakening and infuriating the slumbering American colossus, but it was felt worthwhile to gamble on a bold debilitating surprise attack – even at the risk of starting a protracted war Japan could not win – because the anticipated alternative was seen to be Tokyo's guaranteed defeat through economic strangulation.

Those who worry most about Type B risks prioritize accident-avoidance. The sophisticated critiques of quick-launch postures and tightly-coupled organizational complexity offered by scholars such as Blair and Sagan speak most clearly to Type B issues. Type B worries, however, are also a paradigmatic fixation of the nuclear disarmament community. For the proponents of "Global Zero," for instance, *any* risk of nuclear war, given its potential to wreak havoc on a planetary scale, is unacceptable, and the persistence of any Type B risk whatsoever – even if deterrence "works" in making nuclear attack un-choosable – is a sound argument for abolition.

In truth – as the disarmers seem to intuit, whatever one thinks of the feasibility of their proposed remedy – both Type A and Type B risks are to some degree inherent in *any* system for maintaining and potentially employing nuclear weapons. Indeed, this may be true even in the event that nuclear weapons are eliminated, for while abolition would presumably all but eliminate Type B risks, it could *not* be said entirely to eliminate Type A concerns. (Because disarmament would in some sense increase the attractiveness of even a small "entry-level" arsenal by giving its possessor a 1945-style monopoly upon nuclear weaponry, it would thus produce incentives for proliferation. Countries within a disarmament regime might therefore face troubling *reconstitution* incentives – even to the point, as Thomas Schelling has observed,[59] of engendering reconstitution "racing" and creating incentives for nuclear preemption in order to forestall another power from catching up to a race "winner.") The operational challenges and substantive debates arise largely over what degree of what sort of risk is felt to be acceptable, and whether and to what extent one must make trade-offs between categories of risk-minimization.

Another way of thinking about such risk-balancing is suggested by the analytical framework of Complexity Theory – a young and rapidly-developing field that has contributed greatly to evolutionary biology, chemistry, computer science, and other subjects, and which may have some utility in helping us understand the decidedly nonlinear dynamics of the complex adaptive systems of human society. Much of the "normal accidents" theorizing of Charles Perrow, for instance – upon which Scott Sagan relies so heavily in his critique of the organizationally complex and tightly-coupled systems of nuclear command-and-control – can be expressed in such terms, and indeed seems to derive from modern explorations of Complexity Theory. The collapse of organized systems into disordered "chaos" is more likely as the number

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58 *See, e.g.*, Kahn, *On Thermonuclear War*, *supra*, at 134.

59 *See* Thomas C. Schelling "A world without nuclear weapons?" *Daedalus* (Fall 2009), at 124.

of system variables increases, and where variables "follow different periodicity patterns and are highly coupled with each other." As one study of applied Complexity put it, these conditions are "frequently met in organizations," underlining Perrow's conclusion that "crises are more the result of complex, tightly coupled relationships than the outcome of inadequate human actions."[60]

As Complexity Theorists also explain it, however, organizational fitness is a function of a managed tension – of a system's ability to hover at a sort of "sweet spot" in organizational dynamics, thereby to taking advantage, to some degree, of the advantages both of tight coupling *and* decoupling. According to Russ Marion, for example, fit systems operate at the "edge of chaos … at a certain point between tightly coupled and loosely coupled." Their coupling is loose enough that they can "dissipate the impact of perturbations," because each component can absorb and neutralize small pieces of perturbation "because of the nature of the relationships among units (*e.g.*, redundancy, overlap) and because the individual units have excess resources." At the same time, such organizations are tightly coupled enough that they avoid being maladaptively "sluggish in response to manipulation. " ("[L]oosely coupled systems devour change agents.") From an organizational perspective, therefore, a fit system is tightly coupled enough to be able to respond *as an organization* to direction from its leadership, while yet not being so rigidly interconnected that it cannot "resist unanticipated, potentially destructive perturbation" as disruptions cascade destructively through the system. A fit organization thus maintains itself at the point where its coupling is "sufficiently tight to allow the emergence of stable structures but sufficiently loose to allow flexibility and change." It is "coupled at the Edge of Chaos where it risks dramatic cascading damage but reaps the benefit of maximum fitness in taking that risk."[61]

The prism of Complexity Theory can thus help us better understand the tensions inherent in nuclear command and control systems, which aim to be tightly coupled enough to prevent nuclear release *unless* verifiably so directed by the relevant officials, but loosely coupled enough to be able to handle actual warfighting and ensure a successful retaliatory strike – in the face of force attrition and C^3I degradation – if push were finally to come to shove. These incentives exist to some degree at cross purposes with each other, forming what Peter Feaver, for instance, has called the "always/never dilemma" of contradictory pressures facing a military command.[62]

In a sense, neither "always" *nor* "never" is the right answer in itself. As Herman Kahn once wrote, all possessors of nuclear weapons must be

> "fearful of starting an accidental war, so fearful that they will be willing to accept large peacetime operating costs and substantial degradations of capability in order to decrease the possibility of accidents and to increase the likelihood of error-free behavior."[63]

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60 R.A. Thiétart & B. Forgues, "Chaos Theory and Organization," *Organization Science*, vol.6, no.1 (January-February 1995), at 19, 25.

61 Russ Marion, *The Edge of Organization: Chaos and Complexity Theories of Formal Social Systems* (Thousand Oaks, California: Sage Publications, 1999), at 162 & 167-69.

62 *Quoted by* Sagan, *The Limits of Safety*, *supra*, at 278.

63 Kahn, *On Thermonuclear War*, *supra*, at 183.

At the same time, however, nuclear weapons must remain easily usable enough that their possession, and the assurance of such use in response to aggression, can deter. It is precisely the dynamic tension between "always" and "never" values that policymakers must skillfully manage – and perhaps adjust to shifting circumstances – if their nuclear command-and-control systems are to dance successfully on the "edge of chaos" without drifting into dangerously maladaptive behaviors.

This perspective adds a gloss upon our conceptual framework of Type A (advertence) and Type B (inadvertence) risks. Tight coupling support Type B risk reduction *before* and at the *outset* of a conflict by ensuring that nuclear weapons are *not* used unless this is precisely the intention of the leadership, while addressing Type A concerns to the extent that it helps an adversary know both that one *can* command weapons release if one wants to, and that one remains in control of one's own movement up (or down) the escalatory ladder. Loose coupling, however, can reduce Type B risks by increasing resilience in the face of false alarm or accident, as well as reducing Type A problems by enhancing deterrence through facilitation of a degree of nuclear force "usability" for purposes of second-strike assurance (*e.g.*, resistance to C^3I degradation and command "decapitation") as well as an improved capacity for improvisational nuclear battle management.

This is another way of saying that Complexity Theory can enhance our understanding of various tensions inherent in nuclear force management, and the dynamics that must be balanced as one hovers at the "sweet spot" where these factors represent a balance appropriate for the circumstances.[64] It is, through this lens, the *wrong* answer monomaniacally to pursue *either* type of risk-minimization: successful systems may exist at different balance points at different times, but neither Type A nor Type B risk can be eliminated without provoking some kind of system failure.

Something of this balancing act may be seen in Bruce Blair's description of how – despite his belief in the importance of changing prevailing alert levels – the movement of both the U.S. and Russian nuclear forces to postures of increased nuclear readiness was *not* an unmitigated disaster. Indeed, he writes, this shift had "mixed implications for deterring adverting war," insofar as even as it increased these systems' vulnerability to false alarm and accident (a Type B problem), it also "diminished the penalty for ceding the attack initiative to the adversary" as each party's mutual readiness for quick launch deprived the other of any meaningful option of preemption.[65] (This is a classic form of Type A risk reduction.) Historically, it would indeed seem that "[m]easures that would facilitate the speedy, deliberate use of nuclear weapons [have] competed with measures that would minimize the risk of their aberrant use, and vice versa."[66] Sagan has similarly noted a tradeoff between Type A and Type

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64 "[D]eductively speaking," as Sumit Ganguly and Paul Kapur have suggested, the two sides of the conventional debate offer "equally plausible" arguments: "there is no purely logical reason to believe that either deterrence-based [stability] or organizational arguments [on instability and accidents] are more powerful." Ganguly & S. Paul Kapur, India, Pakistan, and the Bomb (New York: Columbia University Press, 2010), at 20. The right answer, if there is one, will be contextual, and may change according to the circumstances.

65 Blair, *The Logic of Accidental Nuclear War*, *supra*, at 172-73.

66 *Id.*, at 8.

B risks: while the deterrent dynamics of nuclear weapons possession "may well have made *deliberate* war less likely," the "complex and tightly-coupled nuclear arsenal we have constructed [for this purpose] has simultaneously made *accidental* war more likely."[67]

Nor is this sort of risk-balancing something that occurs only at the level of basic system structure: such tradeoffs are also made on a dynamic basis in the day-to-day operation of command-and-control systems. As Sagan has also observed, while nuclear control systems become more tightly coupled in times of crisis – thus increasing accident risks – they do so *deliberately*, because it is important at such times that leaders be especially confident of their tight control over the forces at their command.[68] The dance between the steps needed to manage Type A and Type B risks seems to some extent to be endemic to the nuclear weapons enterprise. Is there any way to reduce *both* types of risk?

IV. *A Way Forward?*

One of the reasons the de-alerting debate has remained stalemated – even under the more ostentatiously disarmament-minded Obama Administration – is because de-alerting measures seem to entail a significant tradeoff between Type A and Type B risks. As long as the sides in this debate speak to each other from positions that differently prioritize each type of risk reduction, agreement is hard to achieve because of the quasi-zero-sum nature of such assumed tradeoffs. As suggested by the conclusions of the 2010 NPR, de-alerting may not in fact *ever* be able to meet the concerns of those who prioritize Type A risks – while at the same time, essentially *no* preservation of a LOW option is likely to satisfy many proponents of de-alerting. Is it possible to imagine a policy agenda that can assuage both types of concern, or even simultaneously reduce *both* Type A and Type B risks by expanding the effective decision-making time available to national leaders in ways that are not felt to compromise – or may even enhance – deterrence?

A. *De-Alerting Measures*

Most measures proposed by critics of current nuclear postures have little appeal to Type A prioritizers. The classic remedy propounded by the Canberra Commission, for instance, is "removal of warheads from delivery vehicles."[69] Sagan has similarly suggested that such removal would merely return the United States to a "late 1940s" model of nuclear stewardship, in which warheads are stored in special sites – perhaps by a civilian agency – and are only turned over to the military in wartime.[70] For his part, Bair has suggested transitioning to a "reserve

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67 Sagan, *The Limits of Safety*, *supra*, at 264.

68 *See id.*, at 60. Blair refers to this shifting as the balance between positive control (to enable coordinated use) and negative control (to prevent accidental or unauthorized use), and also notes that the balance between these priorities shifts as tension mounts in times of crisis. Blair, *Strategic Command and Control*, *supra*, at 68-69.

69 *Canberra Commission Report*, *supra*.

70 Sagan, *The Limits of Safety*, *supra*, at 277.

nuclear force" of de-mated missiles and warheads, each stored in dispersed and protected positions.[71]

Such "de-mating" remedies, however, seem likely to impose formidable Type A risks, not only by precluding any deterrent value that might derive from preservation of a LOW option but by creating new force vulnerabilities and perhaps even incentives for adversary preemption.[72] Blair's "reserve nuclear force" envisions SLBM warheads being stored on land, for instance, which would require submarines to return to port – where they would be extremely vulnerable to attack even with conventional weapons – in order to upload warheads. He concedes, moreover, that consolidated warhead storage depots could incite attack, perhaps even by a small nuclear force stealthily brought back to launch-ready alert, by because they would concentrate an adversary's strategic targets into a small number of locations.[73] De-mating would also add a new level of difficulty and uncertainty about second-strike survivability, for the possessor of de-alerted forces would have to ensure adequate protections not just for its de-mated warheads and their associated delivery vehicles themselves but in fact also for the re-mating *process* itself – the integrity of which would of course have to be ensured against adversary efforts to degrade and disrupt it.[74]

De-alerting measures short of full de-mating present less extreme difficulties in these regards, but they are still unattractive to Type A prioritizers because, as they are intended to do, they preclude the option of launching on warning. Some have other difficulties as well. Having ballistic missile submarines deploy without their missiles' guidance sets, for example – that is, keeping this equipment "detached from the submarine" – would raise force-vulnerability and re-alerting survivability problems similar to those presented by de-mating. "Safing" missiles within their silos by flipping a switch to isolate them from outside launch signals in order to impose a few more minutes delay[75] sounds less problematic, but also seems both easily reversible and quite unverifiable from the perspective of a potential adversary – not entirely unlike the mutual Russo-American "de-targeting" of the 1990s, at which some de-alerting proponents simply sneer as being a merely symbolic gesture[76] – and thus is likely to create distrust, cheating incentives, and potentially destabilizing crisis dynamics. Removing "inverters" from submarine-launched

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71 Blair, "De-Alerting Strategic Forces," *supra*, at 47, at 51, 87-88, & 94-96.

72 *Cf.* Thomas H. Karas, "De-Alerting and Deactivating Strategic Nuclear Weapons," *Sandia Report SAND2001-0835* (April 2001), at 8 ("It is very difficult to identify specific de-alerting measures that appear practicable when the following criteria are applied rigorously: verifiability, expense, net effects on force survivability, equivalence in re-alerting capabilities, and non-interference with START negotiation.").

73 Blair, "De-Alerting Strategic Forces," *supra*, at 93 & 97.

74 *See, e.g.*, East-West Institute, *Reframing De-Alert*, *supra*, at 7 (recounting Russian view that "one cannot rule out preventative measures by an adversary (diversion, sabotage) hindering … rapid reconstitution of operational readiness of missile systems"). Thomas Schelling has also observed that de-mating, consolidated warhead storage, and other de-alerting approaches would increase force vulnerability by raising the number of "disabling points" at which a particular weapons system could be taken out of action. Schelling, "A World Without Nuclear Weapons?" *supra*, at 128.

75 Blair, "De-Alerting Strategic Forces," *supra*, at 51 & 79.

76 *See, e.g.*, William Arkin, "Why Detargeting Accords Make No One Safer," JINN, no.4.13 (June 29, 1998), *available at* http://www.pacificnews.org/jinn/stories/4.13/980629-disarmament.html; Blair, "Command, Control, and Warning for Virtual Arsenals," *supra*, at 59 (describing 1994 de-targeting policy as "practically meaningless").

missiles[77] might permit onboard re-alerting after somewhat more significant delays, but with similar potential problems and likely opacity to an adversary.

B. *Other Accident-Risk Reduction*

(1) *Innocuous Default Targeting*

Yet not *all* proposals that have been advanced for reducing inadvertence problems and increasing the effective decision-making time available to national leaders seem to require tradeoffs between Type A and Type B risks. The United States (and apparently Russia) already practice "open-ocean targeting," for instance, which does not meaningfully reduce the time needed to launch ballistic missiles, but which helps ensure – as the 2010 *Nuclear Posture Review* put it – "that in the highly unlikely event of an unauthorized or accidental launch, the missile would land in the open ocean."[78] This is only a modest step, of course, and does not squarely address the false-alarm issues raised by Blair and Sagan, but it should not be dismissed.

(2) *Destroy-after-Launch*

Some have proposed another possibility as well: the installation of radio-controlled self-destruct devices aboard nuclear-armed missiles – not unlike those used to destroy errant missiles on test ranges – so that national leaders could abort a launch *after* it occurs and before it lands.[79] According to Bruce Blair, Soviet SLBMs during the Cold War were fitted with self-destruct devices. (Apparently, they lacked entire confidence in their submarines' ability to ascertain the precise location of the point of launch, and retained a command-destruct capability that could be employed during the missile's boost phase in the event that a missile – potentially lacking accurate starting-point data – strayed from the course it was suppose to take.)[80] Such approaches have been suggested as a model for *all* nuclear missilery, not in order to prevent inaccuracy but in order to allow for the possibility of in effect calling off an attack *after* a mistaken launch-on-warning decision.

Such command-destruct proposals still seem to make Type A prioritizers somewhat uneasy, and not unreasonably so. In part, this is because such a system would have to overcome significant surety and command-authentication challenges, and would presumably tend to elicit adversary efforts to compromise and manipulate the self-destruct command process. In an era of long-range early warning networks, moreover, a missile's mere failure to *land*, on account of having received a self-destruct command, would not necessarily be enough to avoid escalation if the other party opts to launch its own missiles upon confirmation of the incoming barrage. (Such retaliatory weapons could conceivably be command-destroyed as well, after the mistakenly-launched incoming missiles were themselves confirmed to have been destroyed in flight, but here one risks duplicating the alleged frailties and instabilities of the existing LOW-capable command

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77 Blair, "De-Alerting Strategic Forces," *supra*, at 78-79.

78 *Nuclear Posture Review Report*, *supra*, at x.

79 *See, e.g.*, Sherman Frankel, "Aborting Unauthorized Launches of Nuclear-armed Ballistic Missiles through Postlaunch Destruction," *Science and Global Security*, vol.2 (1990), at 1-20; *see also* Sagan, *The Limits of Safety*, *supra*, at 277; Blair, *The Logic of Accidental Nuclear War*, *supra*, at 282.

80 *See* Blair, *The Logic of Accidental Nuclear War*, *supra*, at 169.

systems on an even *shorter* timescale – and one in which indecision or inaction equates to warhead impact, rather than merely a failure to launch in the first place.)[81] Nevertheless, proponents of improved "destruct-after-launch" capabilities offer this as a way to increase effective decision-making time in ways that might seem sensible to all parties, by making available for nuclear missiles something analogous to the "call-back" capability that has long existed with slower-flying strategic bomber forces.

(3) *Information-Sharing and Cooperative Early Warning*

The United States and Russia have also worked for years to improve communications, reduce misunderstandings, and develop ways to lessen the risk of inadvertent launch or other errors in their strategic relationship. Most readers will be familiar with the Direct Communications Link (the famous "hotline") established in 1963.[82] Fewer, however, will know that in 1962, in the midst of Cold War, U.S. experts met with their Soviet counterparts to pass along information on how the United States handled nuclear weapons safety and tried to prevent accidental use, and to encourage Moscow to take similar steps. By some accounts, this U.S. initiative was instrumental in prompting the Kremlin to improve nuclear weapons safety.[83] In 1971, moreover, Washington and Moscow signed an agreement establishing basic procedures to increase mutual consultation and notification regarding relatively innocent but potentially alarming activities – thereby reducing the risk of accidental nuclear war.[84]

Since 1987, the two parties have also operated securely-linked 24-hour communications centers – the U.S. node of which is the Nuclear Risk Reduction Center (NRRC) operated by the State Department[85] – which specialize in transmitting such things as the notifications required under arms control treaties. Pursuant to a 1988 memorandum, NRRC transmittals, which go directly to the Russian Ministry of Defense, include ballistic missile launch notifications. This link also proved useful to help prevent strategic tensions after the terrorist assault of September 11, 2001 – at which point U.S. officials used the NRRC to reassure their Russian counterparts that the sudden American security alert in the wake of the Manhattan and Pentagon attacks was not in any way an indication of impending U.S. belligerence vis-à-vis Russia.

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81 *See also generally* Karas, "De-Alerting and Deactivating Strategic Nuclear Weapons," *supra*, at 48-49.

82 *See* Memorandum of Understanding Between the United States of America and the Union of Soviet Socialist Republics Regarding the Establishment of a Direct Communications Link (June 20 1963), *available at* http://www.state.gov/www/global/arms/treaties/hotline1.html. The "hotline" was subsequently expanded and modernized. *See* Agreement Between the United States of America and the Union of Soviet Socialist Republics to Improve the U.S.A.-U.S.S.R. Direct Communications Link (September 30, 1971), *available at* http://www.state.gov/www/global/arms/treaties/hotmoder.html; Agreement Between the United States of America and the Union of Soviet Socialist Republics to Expand the U.S.-U.S.S.R. Direct Communications Link (July 17, 1984), *available at* http://www.state.gov/www/global/arms/treaties/hotexpa.html.

83 *See*, e.g., Kahn, *Thinking About the Unthinkable in the 1980s*, *supra*, at 193.

84 Agreement on Measures to Reduce the Risk of Outbreak of Nuclear War between the United States of America and the Union of Soviet Socialist Republics (September 30, 1971), *available at* http://www.state.gov/www/global/arms/treaties/accident.html.

85 *See, e.g.*, the NRRC webpage, *at* http://www.state.gov/t/vci/nrrc/.

The idea of improved mutual transparency as a way to reduce accident risks – and to help manage the escalatory potential of any problems that do occur – is thus well established. The two powers have also explored additional methods to increase their reciprocal confidence levels and provide a means by which to make false alarms less likely. The United States and Russia for a time pursued the development of a joint reconnaissance satellite program, for instance, the purpose of which was to track potential ballistic missile launches and feed data directly to *both* governments in order to help prevent errors and misunderstandings. This Russian-American Observation Satellite (RAMOS) project originated in discussions between the first President Bush and Russian President Boris Yeltsin, and led to an agreement between the two governments in 1997 to create two satellites for the provision of shared warning data on ballistic missile attacks.

The RAMOS program had collapsed by 2004 – when the U.S. Department of Defense declined to request further funding for Fiscal Year 2005[86] – but its failure seems to have been the result principally of such things as cost overruns, friction between counterpart organizations, and a failure by the two governments to prioritize the effort.[87] The demise of the satellite project does *not* appear to have about on account of any perception of fundamental strategic unwisdom or technical unfeasibility. If a firm commitment were made further to reduce accident risks, there would seem no reason, in principle, why something along such lines could not actually be implemented in the future.

Another effort to ameliorate some of the same accident risks that advocates of de-alerting seek to address began in 1998, with a U.S.-Russian statement pledging to share information about ballistic missile and space vehicle launches in order to "promote increased mutual confidence in the capabilities of the early warning systems of both sides."[88] In 2000, Presidents Bill Clinton and Vladimir Putin signed a memorandum establishing a Joint Data Exchange Center (JDEC) in order to "minimize the consequences of a false missile attack warning and to prevent the possibility of a missile launch caused by such false warning" by providing joint monitoring of ballistic missile and space vehicle launches.[89] Later that same year, another memorandum was signed between U.S. and Russian officials, establishing a protocol for launch notifications – including the provision of data to JDEC, eventually to include "the preparation and maintenance of a unified database for a multilateral regime for the exchange of notifications" that might at some point also include "the participation of other countries."[90]

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86 *See, e.g.*, Richard Weitz, "Russian-American Security Cooperation After St. Petersburg" (Carlisle, Pennsylvania: Strategic Studies Institute, April 2007), at 14.

87 *See* Victoria Samson, "Prospects for Russian-American Missile Defense Cooperation: Lessons from RAMOS and JDEC," *Contemporary Security Policy*, vol.23, no.3 (December 2007), at 4-8 *available at* http://www.cdi.org/pdfs/SamsonLessonsFromRAMOS.pdf.

88 Samson, "Prospects for Russian-American Missile Defense Cooperation," *supra*, at 9.

89 Memorandum of Understanding Between the United States of America and the Russian Federation on the Establishment of a Joint Center for the Exchange of Data from Early Warning Systems ad Notifications of Missile Launches (JDEC MOA) (June 4, 2000), *available at* http://www.state.gov/t/ac/trt/4799.htm; *see also generally* Freedman, *The Evolution of Nuclear Strategy*, *supra*, at 417.

90 Memorandum of Understanding on Notifications of Missile Launches (PLNS MOU) (December 16, 2000), at ¶ 16, *available at* http://www.state.gov/t/ac/trt/4954.htm.

President George W. Bush endorsed the JDEC concept in 2001, and he and President Putin pledged to bring into force the joint center for exchanging data from early warning systems. Since then, however, the JDEC effort has moved neither smoothly nor quickly, being repeatedly held up over a myriad of frustrating issues such as disputes over how to handle legal liability matters related to U.S. contractors stationed in Russia as part of Center operations.[91] It is noteworthy, however, that – as with the reasons RAMOS collapsed – the things that have held up JDEC did not appear to be enormous, unworkable issues. They were, rather, the sort of things that the two governments presumably could work through if they really wished to do so. The liability issues for JDEC, for instance, were roughly analogous to those involved in the U.S.-Russian plutonium disposition program. Those problems were difficult, and held up the plutonium program for years, but they were ultimately resolved in 2006.[92] Liability is not now considered to be a problem for JDEC, and indeed Moscow has apparently now designated a facility that could be used for this purpose. In theory, after all, both JDEC and RAMOS *already* have the support, in principle at least, of the United States and Russia.

At present, JDEC, at least, may be moving forward. In a June 2009 joint statement, Presidents Obama and Dmitry Medvedev declared that their experts had begun "intensifying dialogue on establishing the Joint Data Exchange Center, which is to become the basis for a multilateral missile-launch notification regime."[93] Particularly in view of the apparent success of NATO work in recent years to develop a coordinated European air traffic system with Russia – a project funded by NATO and supported by U.S. and Russian experts that envisions routine sharing of air traffic information and will create considerable mutual transparency without actually giving participants an operational role in each other's air traffic control decisions[94] – there is reason for optimism about analogous mutual-transparency efforts in missile launch awareness. Routine exchanges of early-warning information would by no means address all of the concerns raised by quick-launch critics such as Blair and Sagan, but it would provide an additional means by which to reduce the likelihood, or impact, of false alarms or misinterpretations of early-warning data.

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91 *See generally* Samson, "Prospects for Russian-American Missile Defense Cooperation," *supra*, at 12-14.

92 *See* "Signing of US-Russian Plutonium Disposition Liability Protocol,: statement of U.S. State Department spokesman Sean McCormack (September 15, 2006), *available at* http://www.state.gov/r/pa/prs/ps/2006/72291.htm; *see also generally* Stimson Center, *Plutonium Disposition* (undated issue briefing), *available at* http://www.stimson.org/cnp/?SN=CT200705231272#end16. For an account of the liability disputes that plagued the plutonium program, and cooperative programs in Russia more generally, *see* Amb. Michael Guhin, testimony before the Strategic Forces Subcommittee of the House Armed Services Committee (July 26, 2006), *available at* http://www.globalsecurity.org/wmd/library/congress/2006_h/060726-guhin.pdf; Stimson Center, "Liability Issues in Cooperative Nonproliferation Programs in Russia" (undated issue briefing), *available at* http://216.197.111.238/print.cfm?SN=CT200706011307.

93 "Joint Statement by Dmitry A. Medvedev, President of the Russian Federation, and Barack Obama, President of the United States of America, on Missile Defense Issues" (July 6, 2009), *available at* http://www.whitehouse.gov/the_press_office/Joint-Statement-by-Dmitry-A-Medvedev-President-of-the-Russian-Federation-and-Barack-Obama-President-of-the-United-States-of-America-on-Missile-Defense-Issues.

94 *See, e.g.*, Nicholas Fiorenza, "Eyes on the Sky," *Defense Technology International* (July/August 2010), at 36.

C. *The Political Context*

One aspect of nuclear risk reduction that is often overlooked in discussions of Type B risk relates to the lessening of tensions in the broader geopolitical context in which nuclear decision-making takes place. Significantly, this is true not merely in the obvious sense that countries in a less tense environment makes are presumably less likely to choose to launch an attack in the first place. In addition to that likely reduction in Type A risks, tension-reduction also serves the interests of Type B reduction by coloring how parties are likely to interpret incoming early-warning data.

It has long been observed that "[t]he likelihood of serious accidents is highest during a crisis, when nuclear forces are placed on a heightened state of alert readiness."[95] This is true, however, not just because crisis alerts may bring more forces to a state of advanced readiness, lead operational commanders to relax peacetime some safety standards in order to be maximally prepared for immediate launch should the order come, and make the system more vulnerable to cascading errors in the event that some mishap occurs.[96] It is also because leaders interpreting potentially ambiguous or false-alarm-prone early-warning data are more likely to conclude that their sensors show a real attack when they are *worried* about being attacked or are primed to *expect* one from a hostile adversary in the teeth of a crisis. This makes the ambient political temperature of the strategic environment, as it were, a critical variable in the vulnerability of nuclear command-and-control systems to accident and mistake. Lessening tensions between the parties in a nuclear deterrent standoff, therefore mitigates *both* Type A *and* Type B risks.

As Scott Sagan has observed, "it appears much less likely after the Cold War that Russian or American political or military authorities would react to a false warning of an attack against their country with rash orders to retaliate immediately."[97] Though it is advanced principally in order to justify the imposition of de-alerting measures – rather than in order to identify a separate way to go about reducing Type B dangers – Bruce Blair's analysis provides a persuasive explanation for this connection between political tensions and accident risk. Blair points out that "subjective expectations" are critical to how judgments are made on the basis of early-warning data:

> "What [officials] think of any sensor report is inevitably and appropriately weighed by the background information they bring to it that attunes them to the inherent possibilities of war and the potential adversary's intentions. … [As a result, a reasonable commander would] take a broader view of the situation and would not rely on warning reports to the exclusion of prior information or

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95 Sagan, *The Limits of Safety*, *supra*, at 9.

96 *See, e.g.*, *id.*, at 153 & 233.

97 *Id.*, at 9. Bruce Blair agrees that the lessening of Cold War tensions in the period of Soviet Premier Mikhail Gorbachev helped make leaders in Moscow much more concerned about inadvertence dangers and the control problems associated with high readiness. *See* Blair, *The Logic of Accidental Nuclear War*, *supra*, at 213. One thus imagines that to this same degree, Kremlin officials also became *less* likely to interpret early-warning data as genuinely indicating a U.S. attack – an idea with which Blair has agreed in more recent writing, noting that there is now a lower risk of false alarm-related nuclear launch because post-Cold War circumstances have increased the "propensity to discount tactical warning indications." Blair, "De-Alerting Strategic Forces," *supra*, at 47, 47-48.

> opinion. The commander combines the reports with prior expectations of attack to produce his revised expectation."[98]

Depending upon prior information and opinion, in fact – that is, the mental states and expectations that leaders bring to the interpretive process – the same incoming data can, in different contexts, produce *opposite* decisions (*e.g.,* to launch or not to launch). Particularly where launch-on-warning is an available option – thus providing the opportunity for only a sharply limited number of what Blair calls deliberative "judgment cycles" – "initial subjective expectations often strongly determine judgment at the point of forced truncation." Crises thus make command-and-control systems more fragile and susceptible to launch decisions in response to false alarms because they predispose officials to conclude, and to conclude more quickly, that they are indeed under attack.[99] This is presumably the insight that underlies Lawrence Freedman's conclusion that

> "the balance of terrors rests upon a particular arrangement of political relations as much as on the quantity and quality of the respective nuclear arsenals. Movement on these political relations could prove far more disturbing to nuclear stability than any movements of purely military factors."[100]

The corollary of this, however, is that a *lessening* of tensions in the broader strategic environment will *reduce* the risk of nuclear use in response to a false alarm, *even if launch on warning remains no less available than before*. This suggests that countries could do much to reduce Type B risks – even *without* actually changing anything to do with their force posture – by working more assiduously to resolve outstanding disputes, augment mutual transparency and confidence-building measures, and otherwise lessen tensions between them. (Even Blair admits that destabilizing pressures toward launch on warning "should gradually diminish as relations continue to improve."[101]) Given the controversial nature of de-alerting measures, and the tradeoffs they entail with regard to Type A risks, it may thus be that the pursuit of improved transparency and confidence-building measures between nuclear weapons possessors – coupled with more conventional conflict-resolution work – deserves more emphasis.

D. *Be Careful What You Ask For*

To some extent, the Blair/Sagan critique provides an argument for approaching Type B risk-reduction issues with *greater* urgency than the actual reduction of aggregate stockpile numbers. Writing when U.S. and Russian arsenals were still at a level thousands of weapons higher than they are today, for instance, Sagan suggested that arms control efforts should *deemphasize* the actual reduction of weapons numbers in favor of reducing the vulnerability of nuclear command and control systems to the sort of "bizarre random events that could produce an unanticipated accident," such as by "try[ing] to reduce the characteristics of interactive

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98 Blair, *The Logic of Accidental Nuclear War*, *supra*, at 221 & 224.

99 *Id.*, at 224, 226-27, 235, & 249. Blair offers analysis in Bayesian terms of cycling of judgment through iterative revision of expectations to converge on correct final judgment of attack warning. Bayesian "updating" thus underlies his search for ways to increase effective decision time.

100 Freedman, *The Evolution of Nuclear Strategy*, *supra*, at 462.

101 Blair, *The Logic of Accidental Nuclear War*, *supra*, at 275.

complexity and tight coupling in modern nuclear arsenals," the complexity of feedback loops, the degree to which many coordinated actions must take place simultaneously in order for the system to function, and the physical proximity of vital components.[102]

Viewed through the prism of nuclear risk reduction, in fact, it may be that recent trends in deemphasizing the importance and status of nuclear weapons within the modern American military may have the unintended side effect of increasing accident risks. Theorists of high-reliability management have stressed that it is important to devote considerable resources to risk-management if complicated and dangerous tasks are to be approached with minimum risks. (As Aaron Wildavsky has put it, "richer is safer.") It is also understood both that error rates can be reduced by clear leadership focus and a commitment to safety, and that institutions with an organizational culture committed to elite-caliber discipline and to continuous and rigorous training are better positioned to handle demanding safety challenges than less "elite" organizations. Sagan recounts, for instance, that the "elite" Strategic Air Command had fewer safety problems during the prolonged stresses of the 1962 Cuban Missile Crisis than the less-elite – but also nuclear-armed – Air Defense Command. Sustained and focused attention upon a demanding task is also valuable: civilian air traffic control and Navy aircraft carrier flight operations are apparently *safer* at times of peak activity than in slack times, when attention is paradoxically *more* inclined to wander.[103]

This suggests that incautious disarmament may have unanticipated consequences in terms of strategic stability. Herman Kahn warned years ago that in some respects, a rivalry between countries with large weapons establishments might be more stable than a rivalry between ones with small ones. In part, this was because even after high attrition from a preemptive attack, a large nuclear force would still be able to impose a formidable retaliatory cost upon the aggressor, whereas a small force might have too few weapons left, after the same proportional losses, for the prospect of *its* post-attrition second strike to deter preemption. More importantly, however, and more relevant from a Type B perspective, Kahn observed that deterrence "between two large military establishments" might be "much more stable against crises, accidents, cheating, minor changes in technology or posture, or miscalculations – for example, of the effect of arms control measures on performance of equipment" – than a similar balance "stabilized with small establishments," because larger arsenals would be more likely "to include mixed forces with overlapping functions" capable of handling unforeseen problems and other stresses.[104]

But there would seem to be more to the problem than merely the challenge of preserving diverse and overlapping capabilities as arsenals shrink. Sagan's observations about safety-related organizational culture suggest the counter-intuitive possibility that progress since the end of the Cold War in reducing the perceived importance and strategic centrality of nuclear weapons

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102 Sagan, *The Limits of Safety*, *supra*, at 275-76. Among other steps Sagan has suggested is the implementation of "more vigorous and more independent review of nuclear operations and safety" in order to help avoid blind spots, reduce impact of narrow self-interest conceptions within relevant organizations – perhaps even performed by a civilian organization, with military assistance. He also suggests more "vicarious" learning, including joint Russo-American work in sharing information on safety issues, as well as the greater use of exercises specifically aimed at safety (instead of just weapons use). *Id.*, at 268-72.

103 *Id.*, at 24, 58, 70-71, 91, 102, & 151; *see also id.* at 18 (*quoting* Wildavsky).

104 Kahn, *On Thermonuclear War*, *supra*, at 233.

and delivery systems, and the attention given them within the military hierarchy, may *itself* be increasing accident risks. Already, for instance, it would appear that the gradual attenuation of the perceived importance of nuclear missions within the U.S. military – and the degree to which nuclear specialties have gone from being considered a badge of elite distinction to a career backwater relative to "real" warfighting or exotic emerging arenas such as outer space and cyberspace – has helped produce a more accident-prone culture in the nuclear components of the U.S. military. As even Bruce Blair has admitted, after all, rusty command systems suddenly moving to high alert "without the benefit of recent experience ... in generally managing high-tempo operations, would be more prone to errors and accidents"[105]

After an incident in 2007 in which nuclear-armed cruise missiles were mistakenly loaded aboard a B-52 bomber and flown for several hours across the United States – an episode which led to the sacking of the Secretary and the Chief of Staff of the Air Force – official inquiries and Congressional testimony indicated that Air Force nuclear safety standards had begun to slip in the early 1990s, in step with the military's de-emphasis upon nuclear missions at the end of the Cold War. In 1992, Chief of Staff Merrill McPeak warned of "worsening practices regarding the safe handling and storage of nuclear weapons and directed commanders at every level to review surety programs."[106] This apparently did not work, and America's post-Cold War loss of interest in nuclear weaponry led to further problems. According to the head of the blue ribbon Air Force panel looking into the B-52 incident in 2007, its investigators found "a diminished focus on the nuclear mission" that can be traced "back to 1991 and the end of the Cold War."[107] Paradoxically, therefore, it may be that the progress of disarmament and the clear decline of U.S. interest in nuclear capabilities have been increasing Type B risks, at least in the United States.

This need not inherently be so, for there would seem to be no intrinsic reason that a nuclear force could not remain doctrinally and institutionally "important," superlatively trained and endlessly drilled, well-funded and supplied of state-of-the-art technology, and prized as an "elite" service, even if it shrinks to a small size. Nevertheless, ensuring such continued care, attention, and high-reliability operational effectiveness is apparently not easy, nor is it likely to be anything but expensive. Maintaining such focus and such standards is also hard to reconcile with the prevailing disarmament rhetoric and politics of the current U.S. administration. The post-1991 decline in U.S. nuclear care and attention is thus worrisome – and suggests important lessons for us in *managing* our shrunken nuclear capabilities, especially if we intend safely to shrink them further. Reductions can be challenging and costly, and however attractive a diminished interest in nuclear weaponry might seem from a disarmament perspective, we should beware its impact upon Type B risks.

E. *Reducing LOW Incentives vs. Reducing the Capability*

As we have seen, de-alerting proposals approach the problem of Type B risks by seeking to remove the *capability* of launching nuclear weapons under warning of attack. Such approaches, however, are controversial because they entail tradeoffs with Type A risks. The

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105 Blair, "Command, Control, and Warning for Virtual Arsenals," *supra*, at 67.

106 *Quoted by* Michael Hoffman, "Nuclear safety slipped for years before Minot," *Air Force Times* (February 26, 2008), *available at* http://www.airforcetimes.com/news/2008/02/airforce_250208_nukesafety/.

107 *Quoted by* Hoffman, "Nuclear safety slipped for years before Minot," *supra*.

most obvious of these tradeoffs is in the effect de-alerting would have in taking away whatever general deterrent value LOW provides by making preemptive attack seem futile. Type A risks would also increase, however, to the degree that de-alerting would tend to worsen the vulnerabilities and operational uncertainties of retaliatory strike forces, to encourage cheating (*e.g.*, clandestine alerting), to spark an arms race in re-alerting technology and procedures, and to increase the likelihood of crisis-escalatory re-alerting competitions (or pre-emptive *non*-nuclear moves against warhead depots or de-alerted delivery systems[108]) in times of tension. Perhaps worst of all, de-alerting might even provide new incentives for preemptive nuclear attack on the part of whoever manages to re-alert most rapidly, or in secret.

Another way to describe the problem, therefore, is that de-alerting seeks to reduce LOW *capabilities* without reducing LOW *incentives*. This lack of focus upon LOW incentives is curious, since the heart of the de-alerting critique of current nuclear postures is precisely that formidable operational incentives have pushed both the United States and Russia towards a *de facto* LOW policy that they would find it very hard to resist implementing if confronted with an attack warning. If the de-alerters' critique of the "hair-trigger alert" is sound, however, a better way to reduce Type B risks may be directly to address the incentives that have created this dilemma and which confront de-alerting advocates with the unpleasant challenge of asking nuclear weapons possessors to accept more Type A risk as a cost of reducing Type B dangers. For it may be that there are ways to reduce LOW *incentives* without precluding the LOW *option*, thus neatly sidestepping some of these troubling risk tradeoffs. Ideally, in fact, an incentive-based approach might be able to reduce both Type A *and* Type B risks, thus forming a policy upon which both sides in these debates should be able to agree.

(1) *Missile Defenses*

Ballistic missile defense (BMD) has received insufficient attention in disarmament circles as an approach to Type B risk reduction. Ever since U.S. officials first learned that Soviet SSBNs lacked blocking devices that would have precluded launch without coded input from higher authority, concern about the possibility of a "Red October" scenario of rogue action by a renegade submarine commander – an idea named after the bestselling Tom Clancy thriller[109] – there has been interest in ballistic missile defense as a way reducing inadvertence risks. (There are other reasons that BMD has garnered support, of course, but they are less relevant here.) By about 1991, a consensus within the U.S. Congress had developed in support of limited national BMD in part for this reason.[110]

One of the classic examples of a nuclear false alarm frequently offered in arguments in favor of de-alerting, in fact, has already been mentioned: Russian officials' confusion of a January 1995 Norwegian meteorological research rocket for an incoming U.S. SLBM strike perhaps seeking to "decapitate" the centralized Russian nuclear C^3I system. Though none of the early warning system false alarms during the Cold War had apparently ever led to the

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108 *See, e.g.*, East-West Institute, *Reframing Nuclear De-alert*, *supra*, at 7 (recounting Russian view that "[d]e-alerted weapons in storage would be an attractive target for a first strike, including with conventional weapons.").

109 Tom Clancy, *The Hunt for Red October* (Annapolis: Naval Institute Press, 1984).

110 *See* Blair, *The Logic of Accidental Nuclear War*, *supra*, at 12 & 97-98.

notification of top national leaders on either side[111] – let alone to the commencement of deliberations about a nuclear counterstrike – the launch of the Norwegian rocket was not reinterpreted as an innocuous event until *after* Russian President Boris Yeltsin had already opened his "nuclear briefcase" for the first time.[112]

This episode demonstrates the potential utility – from a Type B risk-reduction perspective – of the possession of BMD. A country with credible BMD capabilities would have far less reason to contemplate launching its own weapons in response to detection of a small-scale nuclear attack (or a false alarm suggesting one). Provided that incoming data does not seem to indicate an attack large enough to overwhelm its defensive systems, a country's possession of BMD would therefore go a long way toward removing the *incentive* to use whatever launch-on-warning capability that country may have. This, in turn, would have the effect of greatly increasing the effective decision-making time available to the leadership of the putative victim.

To such an end, Scott Sagan suggested cooperative U.S.-Russian BMD as early as 1991,[113] and indeed Russian and American officials have fitfully discussed cooperative BMD possibilities for years. (In May 2006, the U.S. House of Representatives even passed an amendment to the FY2007 National Defense Authorization Act calling for more U.S.-Russian BMD cooperation.)[114] Within NATO, much pioneering work has already been done in developing procedures for multinational BMD cooperation, beginning at the theater-defense level (*e.g.*, for deployed forces) and perhaps eventually also moving to the larger challenge of defending national territory. Already, for instance, NATO's project on Active Layer Theater Ballistic Missile Defense (ALTBMD) has been underway for five years, resulting in the development of an equipment suite and system of procedures for integrating nationally-provided missile defense systems into a common network. By end of 2010, ALTBMD's second phase is expected to provide the NATO command structure with real-time situational awareness from sensors such as sea-based radars and the U.S. Defense Support Program (DSP) satellites. Sensor-specific data feeds will be brought together into a mobile facility in order to permit operational integration of existing nationally-owned theater defense assets such as the Patriot Advanced Capability-3 (PAC-3) missile.[115] Conceivably, such sensor integration could provide a model upon which to build some aspects of a more broadly multinational BMD system.

The prospects for such cooperative U.S. BMD with Russia, as opposed merely to NATO allies, are uncertain, for a variety of both technical and political reasons. Even the independent development of entirely separate national BMD infrastructures capable of defeating some accidental launches, however – and here one should not forget that despite its complaints about American BMD, Russia has itself had operational anti-ballistic missiles (ABMs) for decades, even to the point of arming them with nuclear weapons – would reduce the risk presented by accidents and false alarms. For the possessor of a defense system, launch on warning would seem far less "necessary," because the most obvious way to respond to an accidental launch or

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111 *Id.*, at 233.

112 Freedman, *The Evolution of Nuclear Strategy*, *supra*, at 417.

113 *See, e.g.*, Sagan, *The Limits of Safety*, *supra*, at 277.

114 *See, e.g.*, Weitz, "Russian-American Security Cooperation After St. Petersburg," *supra*, at 13 & 18.

115 *See, e.g.*, Robert Wall, "Alliance Umbrella: NATO seeks to build up a missile defense capability," *Aviation Week and Space Technology* (October 4, 2010), at 61.

false indications of a small-scale attack would simply be to shoot it down. BMD, therefore, can valuably augment Type B risk reduction efforts.

That said, unless one is willing and able to develop defensive systems capable of handling an attack by *all* the forces an adversary keeps on ready-alert status – a point at which some Type A tradeoffs could resurface, inasmuch as the first country to reach a truly comprehensive level of protection might feel some incentive toward preemptive attack against a less-defended adversary – BMD-related Type B risk reduction will have limits. If the critics are right that the United States and Russia might still face incentives for launch on warning, therefore, can these incentives be attacked even more directly?

(2) *Ensure Genuine Survivability*

It is a fundamental assumption of U.S. and Russian nuclear weapons policy – and has been for decades – that survivable second-strike forces are an essential component of deterrence because they make it much harder for an adversary to conclude that he could "get away with" a preemptive strike. Long after the improved accuracy of ballistic missile guidance systems eroded hopes that hardened missile silos on land would be able to survive attack, both countries have continued to spend billions of dollars on submarine fleets armed with SLBMs – and Russia also on a growing force of land-based mobile ICBMs – in the hope of ensuring that an adversary knows that enough of them will survive to ensure fearsome retaliation after any imaginable first-strike attack.

In theory, therefore, the existence of survivable second-strike forces cuts powerfully *against* the logic of launch-on-warning, and thus increases strategic stability. With them, one does not necessarily "have" to launch everything upon warning of attack, because one's weapons and delivery systems will survive the impact of enemy warheads in sufficient numbers to inflict devastating harm upon the attacker nonetheless. Second-strike forces thus aim to accomplish much the same goal as the powers' preservation of a LOW capability, inasmuch as both LOW and the maintenance of survivable forces reduce Type A risks by making preemptive attack upon their possessor seem suicidal because retaliation is guaranteed.

In sharp contrast to a LOW posture, however, possession of survivable forces also reduces *Type B* risks by giving the victim of an attack the option of "riding out" the initial assault without a complete sacrifice of retaliatory effectiveness. This maximizes the effective decision-making time available to him by allowing him the opportunity to acquire something approaching complete certainty about whether or not it is a false alarm. At this level, therefore, it might appear that the U.S. and Russian development of survivable second-strike forces has preemptively addressed the problem of LOW-derived Type B risk by reducing the powers' incentives actually to *use* any LOW capability they may retain.

Crucially, however, it is an important part of Blair's critique that the situation in this regard is actually not as reassuring as it might seem. By his account, grave and LOW-provoking vulnerabilities still exist on both sides notwithstanding their possession of survivable nuclear forces. Specifically, as we have seen, Blair argues that vulnerabilities in the command-and-control systems of both nuclear superpowers have long precluded "ride-out" as an effective

option, thus greatly increasing pressures toward the adoption of *de facto* launch-on-warning policies, because even if submarines and mobile land-based missiles survived an assault, they could not thereafter be used effectively on account of C^3I degradation and disruption.[116]

There are certainly those who think Blair overplays the idea of command-and-control vulnerability, but it is worth taking seriously because of its importance to the de-alerting argument – and to a potential way out of the zero-sum tension between Type A and Type B risk reduction. As Blair tells it, the Soviets came to pose a severe threat to U.S. retaliatory capabilities in the mid-1960s, from which point U.S. C^3I remained in what he has called a "creaky condition" likely to suffer catastrophic disruption in the event of large-scale nuclear attack. By the mid-1970s, in fact, he claims that the U.S. system "seemed almost designed to collapse under the weight of attack." The neglect of C^3I survivability meant that even by the early 1970s, estimates of American second-strike capabilities were "misleading" because number of *survivable* weapons exceeded the number of *controllable* second-strike weapons "by a factor of two or more."[117]

This problem was admitted with remarkable candor by U.S. officials such as Secretary of Defense Caspar Weinberger, who conceded in 1983 that prior strategic analysis had been lamentably "blind to command and control" issues, and that repair to fragile U.S. systems was "perhaps the most urgently needed element" in Reagan-era plans for strategic revitalization. In the name of bolstering deterrence, his defense department sought to develop command, control, and communications systems capable of surviving attack and enabling "controlled nuclear counterattacks over a protracted period while maintaining a reserve of nuclear forces sufficient for trans- and post-attack protection and coercion."[118]

Despite considerable efforts, however, it is not at all clear that this program succeeded. Some progress was apparently made in addressing weaknesses in what the U.S. Air Force Chief of Staff described as the "initial communications" needed at the outset of war, but not much seems to have been done beyond that. Blair contends that these efforts were never enough to create a credible "ride-out" option for U.S. planners. Even with Reagan-era augmentations, American C^3I remained perilously vulnerable, and this – coupled with the likely attrition in delivery systems that would result from a sizeable enemy attack – ensured that powerful LOW pressures remained. Nor, he argues, were Soviet (and thereafter Russian) leaders in much of a better position, for despite investing much more than the Americans in deep command posts hidden in subterranean mazes, supported by redundant communications systems that included radio communication sites with buried antennae in a huge nationwide grid, the Soviets too would have faced crippling disruption, especially after U.S. Trident D-5 SLBMs came on line. All in

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116 Blair, *The Logic of Accidental Nuclear War*, *supra*, at 33. Blair believes that acute C^3I vulnerability has also made "launch under attack" (LUA) unrealistic: waiting for warheads to hit before making a launch decision "ignores the effects of massive nuclear detonations on the command and communications network." Blair, *Strategic Command and Control*, *supra*, at 236.

117 Blair, *Strategic Command and Control*, *supra*, at 116, 129, & 177; *see also id.* at 4 & 182. As of 1985, Blair writes, the Soviets could quickly have overwhelmed all ground-based American C^3I.

118 *Id.*, at 5-6, 26-28, 37, 42-45, & 207; *see also, id.*, at 39 n.43, & 72 (noting that until the early 1980s, nuclear warfighting exercises commonly assumed non-degradation of communications, and that the Defense Departments FY1981 annual report admitted that then-current strategic posture "does not … reflect the uncertainties resulting from the attacks on our C3 systems").

all, Blair argues that both powers' C^3I "lacked the resilience necessary to meet the classic textbook requirements of deterrence based on second-strike retaliation," and both lacked the effective option of ride-out in response to an enemy first strike "that threatened to demolish the opponent's command centers and communications tentacles." As a result, retaliation after "ride-out" was "not a viable option in the real world" for either side.[119]

Such conclusions presumably did not surprise those analysts who had wondered for years whether it was even *possible* to ensure sufficient nuclear force and C^3I survivability in the face of the enormous nuclear barrages that were possible at the height of the Cold War. Desmond Ball and John D. Steinbrunner, for instance, argued in the early 1980s that such survivability was, for practical purposes, a fool's errand.[120] During the era of high Cold War arms competition, it seemed easier to overwhelm such improvements than to implement them in the first place – as U.S. planners discovered with the "Sanguine" system for communicating with submerged SSBNs. Sanguine was supposed to be a network of underground antennae and transmitters, hidden away in stout concrete capsules in order to be able to transmit low-frequency messages in wartime to submarines in a way highly resistant to enemy jamming and the electromagnetic distortions from nuclear detonations. As the Soviets put more and more warheads on their missiles, however, it seemed increasingly likely that no such system would be able to survive a full-scale attack – and Sanguine was canceled.[121] Domestic U.S. civil defense preparations were also discontinued for similar reasons: the Kennedy Administration had proposed an extensive civil defense program in 1961, but it soon became clear that most defensive measures could be far more easily and cheaply neutralized by the enemy than created in the first place.[122]

During the Cold War, with the nuclear stockpiles of each side running to tens of thousands of warheads on thousands of delivery vehicles, C^3I survivability thus seemed a poor way – by virtue of its arguable impossibility – to address either Type A or Type B concerns. Significantly, however, it is not a given that this remains true today, or that it will be so in the future, particularly if arsenals fall still further.

In today's post-Cold War context, C^3I survivability may be less Quixotic an aspiration. By way of comparison, one should remember that in 1985, the number of Soviet targets in the U.S. Single Integrated Operational Plan (SIOP) was reportedly about 16,000, and that this had reportedly fallen to only about 2,500 in 1995.[123] Today, only 5,113 American nuclear warheads remain in service at all,[124] with operationally deployed weapons – those potentially available for

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119 *Id.*, at 242-49; Blair, *The Logic of Accidental Nuclear War*, *supra*, at 115-17, 119, 121, 127, 166-67 & 212.

120 *See, e.g.*, Desmond Ball, "Can Nuclear War Be Controlled?" *Adelphi Papers*, no. 169 (London: IISS, 1981), at 37; John D. Steinbrunner, "Nuclear Decapitation," *Foreign Policy*, no.45 (Winter 1981-82), at 26. Paul Bracken also "warned that the interactions of the alert and command systems in a high-level nuclear crisis were imperfectly understood and could well be disastrous." Freedman, *The Evolution of Nuclear Strategy*, *supra*, at 389.

121 *See, e.g.*, Blair, *Strategic Command and Control*, *supra*, at 183-84.

122 *See generally* Freedman, *The Evolution of Nuclear Strategy*, *supra*, at 237-38.

123 *See, e.g.*, Blair, "Command, Control, and Warning for Virtual Arsenals," *supra*, at 58; Blair, *The Logic of Accidental Nuclear War*, *supra*, at 52.

124 "5,113 nukes in U.S. arsenal," *UPI* (May 4, 2010), *available at* http://www.upi.com/Top_News/Special/2010/05/04/5113-nukes-in-US-arsenal/UPI-33381273001894/.

relatively quick employment, as opposed to a more laborious return to service from U.S. "reserve" stockpile – already slated to come down to a maximum of 1,550 on each side under the pending "New START" agreement, and with the numbers of immediately ready-to-launch warheads being even smaller. This, in turn, could make it possible for both sides to develop a credible "ride-out" option – arguably for the first time in decades – thus promoting both Type A and Type B risk reduction by simultaneously ensuring retaliation *and* reducing incentives to implement launch on warning.[125]

The development, at long last, of a credible "ride-out" option would not necessarily lead the nuclear superpowers to abandon their LOW-capable postures. In the interest of providing added assurance against preemption, one or both might retain at least some forces on immediate alert, though perhaps fewer than before. Even were present LOW capabilities to remain entirely unchanged, however, the development of a genuine "ride-out" option on *either* side would seem likely to lessen Type B risks considerably, by reducing the pressure its possessor would feel – *e.g.*, in the event of a false alarm – actually to *use* its LOW capability. This would also serve Type A interests, by avoiding the perils described by Herman Kahn in advocating against "sole reliance" for deterrence on apocalyptic quick-launch decisions that an adversary might suspect that a president would never actually make.[126]

Significantly, the Obama Administration has made noises that suggest that it may be open to doing something along these very lines. Right on the heels of its rejection of de-alerting, the most recent U.S. *Nuclear Posture Review* recommends "further strengthening the U.S. command and control system to maximize Presidential decision time in a nuclear crisis."[127] The Report recounts that U.S. officials had examined the effectiveness of "command and control of U.S. nuclear forces as an essential element in ensuring crisis stability, deterrence, and the safety, security and effectiveness of our nuclear stockpile," and that Defense Secretary Robert Gates had accordingly "directed a number of initiatives to further improve the resiliency of the NC3 [nuclear command, control, and communications] system and the capabilities for the fully deliberative control of the force in time of crisis." The Fiscal Year 2011 budget request, the Report claimed, had been "strengthen[ed]" in order to improve these systems,

> "including modernizing 'legacy' single-purpose NC3 capabilities to meet current and projected challenges, and continuing to invest in secure voice conferences for NC3. An interagency study is being initiated to determine the investment needed and the organizational structure best suited to further strengthen the NC3 capabilities. This study, led by DoD, will begin in 2010 and provide a long-term

125 Indeed, writing well before most of the post-Cold War nuclear reductions, Blair argued for steps to reduce LOW incentives by "pursuing increasingly secure (invulnerable) command systems and forces" and doing more to protect warning systems against potential enemy interference. This was to include improving C^3I in order to withstand massive attack and continue to function "long afterwards," including through the utilization of reconstitutable post-attack communications links. Blair, *Strategic Command and Control*, *supra*, at 291-92; Blair, *The Logic of Accidental Nuclear War*, *supra*, at 275-76. More recently, he has also argued in favor of creating "an unmistakably second-strike posture geared to riding out an attack before retaliating." Blair, "De-Alerting Strategic Forces," *supra*, at 49. He presumably, therefore, thinks this possible.

126 Kahn, *On Thermonuclear War*, *supra*, at 256-57.

127 *Nuclear Posture Review Report*, *supra*, at x & 26.

strategy that will inform out-year budget submission to Congress."[128]

(The Report also declared that U.S. officials were "exploring new modes of ICBM basing that enhance survivability and further reduce any incentives for prompt launch."[129])

This interest in C^3I effectiveness is notable, and provides a fascinating complement to the Administration's commitment to ongoing nuclear reductions. To be sure, it is not yet clear how seriously the Obama Administration takes such ideas, or whether they would survive the rumored departure of Secretary Gates. Nor have such ideas yet been articulated in terms that would clearly suggest any commitment to "ride-out" and the degree of *de facto* nuclear warfighting capability that real C^3I survivability necessarily entails. Nevertheless, these comments suggest an American receptivity to the challenge of reducing incentives for launch on warning even while continuing to reject de-alerting measures designed to preclude its availability. This indicates that it may be possible to develop C^3I survivability as a policy option capable of reducing both Type A and Type B risks while garnering support from both sides in today's de-alerting debates.

V. *Conclusion*

Building upon the critique of nuclear accident risks suggested by scholars such as Blair and Sagan, this paper has suggested that measures intended to reduce Type B (inadvertence) risks are by no means always costless in terms of Type A (advertence) risks. Effective command-and-control involves maintaining a dynamic balance between usability and non-usability, between tight and loose coupling, and between the acceptance of Type A and Type B risks. Tradeoffs between accident risk-types are therefore to a great degree inherent in nuclear weapons management, as control systems seek to adjust the balance according to circumstances. Some degree of Type A risk probably therefore *should* be tolerated in the interest of preventing egregious Type B problems, just as some Type B risk is probably unavoidable for so long as nuclear weapons are to be retained at all, and are to be kept "usable" in the interests of deterrence. It is the challenge of sound nuclear weapons policy to manage such tradeoffs in a way that reflects prevailing geopolitical circumstances and the soundest solutions made available by modern technology and organizational understanding.

Nuclear weapons risk management thus requires attention to both types of danger, and measures that reduce one type may be controversial – or simply ruled out – if they entail significant tradeoffs in augmenting another. This is the case, in particular, for nuclear de-alerting that seeks to preclude the option of launch on warning (LOW). Advocates of de-alerting suggest that – especially in this post-Cold War era of lessened superpower tensions, in which one might presume the idea of preemptive attack to have become less attractive irrespective of the other party's force posture – some greater tolerance of theoretical Type A risks is necessary in order to avoid the real Type B dangers presented by time-constrained and relatively error-intolerant LOW

128 *Id.*, at 26.

129 *Id.*, at x & 26.

postures.[130] Because de-alerting would reduce Type B instabilities at the cost of raising additional Type A challenges, however, it has proven controversial, and has been rejected by the major nuclear weapons possessors, even the disarmament-minded Obama Administration.

If measures can be found to reduce nuclear dangers that do *not* entail such sharp risk-type tradeoffs, therefore – and, ideally, that reduce advertence and inadvertence instabilities at the same time – this would seem to offer a much more promising approach, for such steps would no longer require that either Type A or Type B prioritizers "lose" the public policy debate. It is the contention of this paper that remedial measures are best addressed to reducing the *incentives* that encourage the maintenance and potential use of the LOW option, rather than in trying to prohibit the possession of the option itself. The best way to reduce nuclear risks, therefore, may lie in the continued development of territorial missile defenses and in the improvement of C^3I and force survivability with an eye to creating a credible "ride-out" capability. Such measures offer an approach to risk reduction that has been, as yet, too little explored in post-Cold War literature.

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130 *See, e.g.*, Blair, *The Logic of Accidental Nuclear War*, *supra*, at 257 (arguing need in post-Cold War era to balance adjustments between positive and negative control in nuclear command systems, in ways that do more to avoid prioritizing operational requirements that undermine safeguards against inadvertence).