

## U.S.-Russian Ballistic-Missile Early-Warning Cooperation

### I. The Issue

#### Background

The United States' combination of space-based sensors and land-based radars provides reliable assurance that a missile attack from Russia would be detected, verified, and tracked with a high degree of confidence. Consequently, Russia is assured that the U.S. will not perceive an attack erroneously and launch a retaliatory blow by mistake.<sup>1</sup> Russia's early-warning (E-W) network as originally constructed by the Soviet Union was similarly designed to provide notice of a missile attack from multiple sources providing overlapping verification. Today, more than a decade after the Soviet collapse, that now-Russian E-W system is so riddled with gaps and potential defects that a May 2003 RAND study described it as being "in tatters."<sup>2</sup>

For example:

- Russia's satellite system has deteriorated to the point where it cannot reliably detect U.S. land-based missile launches and has no ability to view U.S. submarine patrol areas.<sup>3</sup>
- Russia's land-based radar coverage has two gaps that would allow U.S. submarines in the Atlantic and Pacific Oceans to launch nuclear warheads that could travel undetected all the way to Moscow without being detected until the last minute or two.
- In May 2001, a fire at a Russian satellite control center temporarily knocked out Russia's entire space-based component of its early-warning network.<sup>4</sup>

The deficiencies in Russia's E-W system create dangers for the U.S. ironically because of the more capable U.S. strategic force and the nuclear posture that Russia may believe it must maintain. We have a nuclear force ready for launch in a very few minutes—about 1,300 submarine-based nuclear warheads deployed at sea that could reach targets in Russia within 10 to 15 minutes,<sup>5</sup> along with 500 land-based intercontinental ballistic missiles with multiple warheads<sup>6</sup> that could reach Russia in about 30 minutes.<sup>7</sup> Most of this nuclear force (primarily our submarine-based missiles) would survive a Russian first strike. By contrast, Russia has only about 20 to 200 nuclear weapons that could survive a U.S. attack; and it may consider this an insufficient deterrent. To counter this vulnerability, Russia may adopt a "launch-on-warning" strategy, particularly during a period of international tension, making about 1,900 strategic nuclear warheads ready for launch within minutes of an attack order being given.<sup>8</sup>

Thus, if Russia were to detect an incoming missile attack—or erroneously conclude that one likely was underway—the Russian president would have, at best, only about 10 minutes in which to try to obtain verification and decide either to order an immediate counterattack or to run the risk that attacking warheads would destroy Russia’s ability to retaliate on a massive scale. While making this decision whether to “use them or lose them,” the Russian leadership would be confounded by the knowledge that its E-W system could be providing false information that an attack was underway or, by virtue of the gaps in its coverage, leave them with no way to verify whether a suspected attack was real.

The above-mentioned RAND study ascribes the resulting dangers for the U.S. to two main reasons:

First, without a clear, accurate picture of what is happening around the globe, Russia may confuse a benign event (such as a space launch) for a nuclear attack, possibly prompting a decision to launch a nuclear strike. Second, without a properly functioning, two-tiered E-W system, Russia will have less time available to decide ... whether to launch a retaliatory response.<sup>9</sup>

Consider also, for example, how Russia might have to deal with a situation in which cyber-terrorists hack into its E-W system and generate false indications of an attack. The resulting confusion could create an extremely dangerous situation, because Russia likely would lack the back-up information it would need to satisfy itself that the perceived attack was not real.<sup>10</sup>

The most recent incident illustrating why back-up systems are necessary occurred on January 25, 1995, when technicians at radar stations across northern Russia saw a troubling blip on their screens. A rocket, launched somewhere off the coast of Norway, was rising rapidly through the night sky. Aware that a single missile from a U.S. submarine in those waters could hit Moscow with eight nuclear warheads within 15 minutes or could blind Russian radars by detonating warheads high in the atmosphere, the radar operators immediately alerted their superiors. The message passed swiftly from Russian military authorities to President Boris Yeltsin, who hurriedly conferred by telephone with his top advisers. For the first time ever, the "nuclear briefcase" that would be used to order the firing of nuclear missiles was activated for emergency use. Radar crews continued to track the missile; and less than four minutes short of the procedural deadline to respond to an impending nuclear attack, senior military officers determined that it was headed far out to sea.<sup>11</sup>

The unidentified rocket turned out to be a U.S. scientific probe. Weeks earlier the Norwegians had duly informed Russian authorities of the planned launch from an offshore island, but word of the experiment had not reached the right ears. A potentially catastrophic nuclear launch by Russia on the United States was averted.

#### Russian American Observation Satellites

Recognizing these kinds of dangers, Russian and American officials have agreed that it is in the best interests of both nations’ security to ensure that Russia has the capability to accurately detect and track missile launches. In 1992, the Ballistic Missile Defense Organization (BMDO), now the Missile Defense Agency (MDA), initiated discussions with the Russians on a joint technology demonstration program that could assist both

nations in developing effective E-W technologies.<sup>12</sup> These discussions led to a 1997 agreement between Presidents Clinton and Yeltsin to proceed with the Russian American Observation Satellites (RAMOS) program.

Early on, collaboration between the scientific communities of the two countries proved fruitful. Over time, however, cooperation became mired in bureaucracy and mistrust. Here in the United States, officials came to focus more heavily on the prospects for operational benefits to the U.S. and downplayed the equally important goals of building trust and enhancing our own national security by enhancing Russia's E-W systems.<sup>13</sup> As a result, in 1998, BMDO concluded that the program did not provide the U.S. with sufficient missile defense technological benefit to warrant continuing with the original plan.<sup>14</sup>

In July 2000, the Pentagon proposed a revised plan, and Russian officials were said to "adamantly oppose" the changes. Pending the execution of a new government-to-government agreement reflecting whatever changes were agreed to, BMDO for a time slowed the commitment of funds appropriated for RAMOS.<sup>15</sup>

In November 2002, the MDA director, Air Force Lt. Gen. Ronald Kadish, stated that the RAMOS talks on a new agreement were "coming close" to producing one.<sup>16</sup> Also, in June 2003, the Senate Appropriations Committee in its report on the fiscal year 2004 defense appropriations bill stated that it was "encouraged by the progress made toward obtaining" an agreement and directed that "the funds identified for the RAMOS Program [in the budget request] shall be used for the RAMOS program only."<sup>17</sup> In addition, section 3024 of the National Defense Authorization Act for Fiscal Year 2004 (Public Law 108-136) states the sense of the Congress that while negotiations for the new agreement proceed, FY 2004 funds appropriated for RAMOS should be used to provide "for the satisfactory continuation" of the program.<sup>18</sup>

Nevertheless, despite these congressional pushes, as of April 2004, the negotiations had still not been concluded, and the United States appears to have abandoned the effort. The MDA stated in its FY 2005 budget submission:

Due to lack of progress on the RAMOS ... agreement with Russia, and the uncertainty this causes, MDA intends to terminate the RAMOS program. MDA received the Russian Government's draft MOU in July 2002 and despite 17 months of discussions, have been unable to complete a government-to-government agreement. Without this agreement, which includes the fundamental issue of taxes and liabilities, the RAMOS program cannot be executed beyond the design stage.<sup>19</sup>

Ultimately, RAMOS promised to provide the United States with an important opportunity to make our own and the world's citizens safer and build a relationship with Russia that is based on trust and confidence. In fact, the above-noted RAND report recommended committing to continuing the RAMOS program as one of the "immediate" steps that the U.S. should take.<sup>20</sup>

## Joint Data Exchange Center

In addition to the need to sustain and deepen cooperation on the RAMOS program, the U.S. and Russia also have considerable work to do to make an effective reality of the Joint Data Exchange Center (JDEC) that they agreed in principle to build more than five years ago. At a September 1998 summit in Moscow, Presidents Clinton and Yeltsin agreed that steps should be taken to ensure that false alarms did not take place in the E-W systems of the two countries<sup>21</sup>; and on June 4, 2000, they signed an agreement to establish the JDEC.<sup>22</sup>

Under the JDEC agreement, the two sides have agreed to share on a continual basis and in near real time, their surveillance data (from satellites and ground-based radars) on all U.S. and Russian ballistic missiles and all space launches.<sup>23</sup> U.S. and Russian military personnel will continuously and jointly operate the center, which is to be housed near Moscow. The JDEC agreement is supplemented by a December 2000 Memorandum of Understanding providing for a pre- and post-launch notification system for ballistic missiles and space launches.<sup>24</sup>

Problems may arise from the JDEC because the raw data from E-W satellites is unintelligible until interpretive algorithms are applied. Unless both parties know those algorithms and the raw data is provided continuously and very close to real time, it may not be possible for them to trust the interpretive process; and if they do not, the JDEC could itself contribute to a catastrophic miscalculation. For example, if during a period of intense international tension, Russia were to suspect that an attack might have been launched against it, any concern on Russia's part that the JDEC data might have been manipulated, could itself feed Russian confusion and suspicion and make an attack resulting from miscalculation more likely than it otherwise would have been.

National security expert John Steinbruner has stated the issue as follows:

The difference between an arrangement that conveys reassurance and one that breeds suspicion turns primarily on the scope and timing of the information that is exchanged. If the parties ... were to share all warning sensor data as it is generated, if they were to apply exactly the same interpretive algorithms at exactly the same time, and if they were completely confident of the integrity of the system—that is, that it could not be subverted or suddenly terminated ... [in order to conceal a surprise attack]—the possibility of deliberate deception or inadvertent confusion would be minimized.... To the extent that there are categorical restrictions, interpretative filters, and/or time delays imposed on the exchange, however, then the scope for suspicion and the risk of perverse effects would increase ....

As currently formulated, the JDEC system would not necessarily pass the crucial test of providing reassurance rather than breeding suspicion. The information being reported will have been "processed and filtered" according to specifications that do not require a great deal of precision.<sup>25</sup> Thus, it is critically important that in the implementation of the JDEC, the U.S. corrects this deficiency by providing data of such a quality and in such a way as to give Russia the level of confidence that our own national security requires that it have. This means that the U.S. will have to place a higher premium on providing reassurance than on protecting the secrecy of our surveillance processes and algorithms. Given the possible repercussions for the United States of a Russian miscalculation, this

would appear to be any easy judgment to make, but residual Cold War distrust may tip the balance toward secrecy, and that could be a tragic mistake.

At present, the issues of how the JDEC can fulfill its promise of making a nuclear conflict less likely and avoid contributing to one are moot as the process of even establishing the JDEC seems to have been stalled.

A March 2002 update of a Congressional Research Service Issue Brief described the delays in getting the JDEC established as follows:

Most experts hoped the center, which is to be based in an old school building near Moscow, would begin operations in 2001. However, the building's renovations have not yet begun. Disagreements between the United States and Russia about tax issues, along with a general cooling in the relationship between the two countries, have been cited as reasons for the delay. Congress authorized funding for the JDEC in 2002, but withheld 50% of the funds until Russia and the United States reach a cost-sharing agreement and an agreement on taxes and liability for U.S. participants.<sup>26</sup>

Nevertheless, in a May 24, 2002, joint declaration, Presidents Bush and Putin stated their intention to “take the steps necessary to bring [the JDEC] into operation; and on November 18, 2002, Under Secretary of State for Arms Control and International Security John Bolton described the JDEC as one of a number of “prospective areas of cooperation with Russia that have real potential.”<sup>27</sup>

The challenges remain both of establishing the JDEC and then operating it in a way that—in the interest of U.S. safety from a nuclear attack as the result of miscalculation—provides Russia with the quality of missile surveillance data that it needs in order to be reassured that an apparent or suspected attack is not real.

#### Other Early-Warning Cooperation Possibilities

The 2003 RAND report, concluding that the “risk of accidental or unauthorized nuclear use is too high,”<sup>28</sup> attached special importance to “improving Russia’s access to reliable, accurate early-warning information.”<sup>29</sup> In addition to the RAMOS and JDEC programs, the report recommended two additional areas of U.S.-Russian cooperation with respect to E-W systems. First, it recommended funding Russian E-W radar and further improving Russian E-W systems, which would give Russia its own improved means of detecting, verifying, and tracking ballistic missile launches/potential attacks.<sup>30</sup> Second, it recommended installing E-W sensors on ICBM silos, data from which would provide the quickest means of detecting ICBM launches.<sup>31</sup>

Other related recommendations for reducing the chances of strategic nuclear attacks as the result of mistake, miscalculation, or unauthorized use included immediately standing down U.S. nuclear forces to Moscow Treaty levels, pulling our nuclear-missile submarines away from Russia, and reducing the launch readiness of one-third of U.S. ICBMs.<sup>32</sup>

Taking these steps would convey to Russia and the international community the idea that the United States is ready to commit to actions that will provide a greater degree of safety from a nuclear catastrophe. This action could also signal a U.S. desire to develop

with Russia a security relationship that does not involve threatening each other with a massive nuclear attack.

## II. Recent Legislation

- Section 3624 of the National Defense Authorization Act for Fiscal Year 2004 (Public Law 108-136) states the sense of the Congress that the President, to the extent consistent with the national security interests of the United States, should--
  - (1) encourage joint U.S.-Russian efforts to reduce the probability of accidental nuclear attack as a result of misinformation or miscalculation by developing the capabilities and increasing the reliability of Russian ballistic missile E-W systems;
  - (2) encourage the development of joint U.S.-Russian programs to ensure that Russia has reliable information regarding launches of ballistic missiles anywhere in the world; and
  - (3) pending the execution of a new U.S.-Russian agreement providing for the conduct of the RAMOS program, ensure that funds appropriated for that program for fiscal year 2004 are obligated and expended in a manner that provides for the satisfactory continuation of that program.
- Section 1203 of the Bob Stump National Defense Authorization Act for Fiscal Year 2003 (Public Law 107-314) provided that not more than 50 percent of the FY 2003 funds made available for activities associated with the Joint Data Exchange Center may be obligated or expended for any such activity until the U.S. and Russia:
  - enter into a cost-sharing agreement for the JDEC;
  - enter into an agreement or agreements exempting the United States and any U.S. person from Russian taxes, and from liability under Russian laws.

## III. Obstacles

- U.S.-Russian cooperation on E-W systems and data exchanges on missile launches touch on some of the most sensitive elements of the strategic weapons systems of the two countries. Leadership will be needed from the U.S. and Russian Presidents, as well as Congress, to ensure that Russia has reliable early warnings of missile launches that it can trust in stressful crisis situations. This is an essential step in minimizing the risk of a catastrophic miscalculation by Russia.
- The need for mutual trust is evident with respect to the Joint Data Exchange Center, where the need for the United States to provide missile surveillance data as close to real time as possible, along with the algorithms by which the raw data are interpreted, may conflict with the desire to protect the secrecy of the algorithms. If the decision is made in favor of secrecy, the resulting suspicions regarding the data could present a risk that the operation of the JDEC will contribute to the launching of a nuclear attack on the United States based on erroneous or missing information.

#### IV. Q&A

**Q: If the U.S. helps Russia strengthen its E-W system, will this make Russia more capable of launching a nuclear attack against the U.S.?**

A: No. Both the U.S. and Russia rely on their E-W systems to ensure that they are not under nuclear attack. As long as the Russian early warning system remains inadequate, the possibility will remain too high that Russia will erroneously conclude that it is under nuclear attack. The bottom line is this: the more capable the Russian E-W system is, the less likely it will be that Russia will mistakenly launch a nuclear attack against the U.S.

**Q: How much will it cost for the U.S. to help Russia strengthen its E-W system?**

A: The total will probably be in the tens of millions of dollars, a relatively small sum compared to how much an improved Russian early warning system would benefit U.S. national security.

**Q: Why has progress been so slow in putting together the Joint Data Exchange Center?**

A: According to a Congressional Research Service report, the delays are due to “disagreements between the United States and Russia about tax issues, along with a general cooling in the relationship between the two countries.”<sup>33</sup>

**Q: Why haven’t the U.S. and Russia had greater cooperation on RAMOS?**

A: The causes have likely been a general cooling of relations between the two countries and disagreements as to specifically which country would bear the costs of particular components of the RAMOS system. Also, it now appears from DOD’s FY 2005 budget submission, that the issue of liability may have proven to be a stumbling block.<sup>34</sup>

#### V. Talking Points

- By helping Russia strengthen its E-W systems, the U.S. will help reduce the likelihood that Russia will mistakenly launch a devastating nuclear strike—a strike that could lead to an all-out nuclear war.
- A 2003 RAND study recommended a commitment to RAMOS as one of the immediate steps that the U.S. should take in order to reduce the chances of a Russian nuclear attack as a result of miscalculation or accident.
- For years, the U.S. and Russia have recognized the need to cooperate on strengthening Russian E-W systems and on providing for a data exchange center on missile launches. However, for a variety of reasons, the two sides have not made as much progress as they should. This situation must change, for the safety of the American people.
- For relatively small sums, the U.S. could help the Russians dramatically improve its E-W system and establish a Joint Data Exchange Center on missile launches.

## VI. Factoids

- Russia's land-based radar coverage has two gaps that would allow U.S. submarines in the Atlantic and Pacific Oceans to launch nuclear warheads that could travel undetected all the way to Moscow.<sup>35</sup>
- In 1995, Russian nuclear officials thought that a scientific rocket fired from Norway might have been a missile headed for Moscow. For a few tense minutes, the Russians considered launching a preemptive nuclear strike against the U.S.
- In September 1983, a new Soviet E-W satellite system, U.S. missile fields, and the sun were aligned in such a way that the reflection of sunlight off high clouds caused the satellite to indicate the launch of five U.S. missiles. Apparently a Russian retaliatory strike was avoided by the decision of the officer in charge not to report the launches because, in his mind, the number of missiles being fired off was too small to be an actual attack.<sup>36</sup>
- Russian satellites can monitor U.S. missile fields only six or seven hours per day, at most.<sup>37</sup>
- In May 2001, a fire in the ground control center for the constellation of Russia's main E-W satellites rendered them useless for an extended period.<sup>38</sup>
- On seven occasions during the fall of 1996, operations at some Russian nuclear weapons centers were severely disrupted when thieves tried to "mine" critical communications cables for their copper and other minerals.<sup>39</sup>

## VII. Applicable Treaties, Legislation, and Other International Agreements

- Memorandum of Agreement 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 and Notifications of Missile Launches, signed June 4, 2000.<sup>40</sup>
- Memorandum of Understanding on Notifications of Missile Launches, signed December 16, 2000.<sup>41</sup>

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<sup>1</sup> John Steinbruner, "The Significance of Joint Missile Surveillance," *An Occasional Paper of the Committee on International Security Studies, American Academy of Arts and Sciences* (July 2001) p. 4, accessed at: <http://www.amacad.org/publications/missile.pdf>.

<sup>2</sup> David E. Mosher, Lowell H. Schwartz, David R. Howell, and Lynn E. Davis, *Beyond the Nuclear Shadow: A Phased Approach for Improving Nuclear Safety and U.S.-Russian Relations* (RAND 2003), p. iii.

<sup>3</sup> *Ibid.*, pp. 5, 28.

<sup>4</sup> "Russia Blaze Hits Satellite Network," *BBC News* (May 10, 2001), accessed at: <http://news.bbc.co.uk/1/hi/world/europe/1322700.stm>; and Paul Podvig, "Our Comment: The fire may be serious, but there is not reason for concern," Center for Arms Control, Energy and Environmental Studies (May 10, 2001), accessed at: <http://www.armsconrol.ru/start/comments/pp051001.htm>.

<sup>5</sup> *Ibid.*, pp. 2 and 4.

<sup>6</sup> Center for Defense Information website, "The World's Nuclear Arsenals," updated February 4, 2003, accessed at <http://www.cdi.org/issues/nukef&f/database/nukearsenals.cfm>.

<sup>7</sup> Commission on Engineering and Technical Systems, *Hypersonic Technology for Military Application* (National Academy of Sciences, 1990), p. 11, accessed at: <http://www.nap.edu/books/0309042291/html/index.html>.

<sup>8</sup> *Ibid.*; Back from the Brink Campaign and the Project on Participatory Democracy, *Short Fuse to Catastrophe*, February 2001, p. 2.

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Although the U.S. also has the ability to launch a nuclear strike within a very few minutes of the command being given, in July 11, 2001, testimony before the Strategic Subcommittee of the Senate Committee on Armed Services, Admiral Richard W. Mies, commander-in-chief of the Strategic Command, testified that it is U.S. policy not to “launch on warning” but to ride out a nuclear attack and sort out the facts before retaliating. Whether a U.S. president—who, of course, is not bound by that policy—upon being informed that nuclear bombs are about to hit targets in the U.S., would follow that course in any given circumstances cannot be predicted with certainty. The testimony can be accessed at:

[www.ceip.org/files/projects/npp/pdf/Mies71101.pdf](http://www.ceip.org/files/projects/npp/pdf/Mies71101.pdf).

<sup>9</sup> David E. Mosher, Lowell H. Schwartz, David R. Howell, and Lynn E. Davis, *op. cit.*, note 2, p. 30.

<sup>10</sup> Bruce G. Blair, “Hair-Trigger Missiles Risk Catastrophic Terrorism,” Bruce Blair’s Nuclear Column on the Center for Defense Information website, accessed at: [www.cdi.org/blair/hair-trigger-dangers.cfm](http://www.cdi.org/blair/hair-trigger-dangers.cfm).

<sup>11</sup> Hall, Brian “Overkill Is Not Dead.” *New York Times Sunday Magazine*, March 15, 1998; Lachlan Forrow, Bruce G. Blair, Ira Helfand, George Lewis, Theodore Postol, Victor Sidel, Barry S. Levy, Herbert Abrams, Christine Cassel, “Accidental Nuclear War—A Post-Cold War Assessment,” 338 *The New England Journal of Medicine* 1326, 1327, April 30, 1998; and Geoffrey Forden, “False Alarms on the Nuclear Front,” *Russia’s Nuclear Warriors*, NOVA online (October 2001), accessed at:

<http://www.pbs.org/wgbh/nova/missileers/falsealarms.html>.

<sup>12</sup> G. Wayne Glass, “U.S. and Russian Cooperation on Missile Defense: The Troubling Story of the Russian American Observation Satellite Program,” Center for Defense Information Issue Brief, May 29, 2002, accessed at: [www.cdi.org/missile-defense/ramos.cfm](http://www.cdi.org/missile-defense/ramos.cfm).

<sup>13</sup> *Ibid.*

<sup>14</sup> *Ibid.*

<sup>15</sup> *Ibid.*

<sup>16</sup> Kerry Gildea, “Agreement for U.S.-Russian Joint Program In Sight, Kadish Reports,” *Defense Daily International* (November 8, 2002).

<sup>17</sup> S. Rept. No. 108-87, p. 175.

<sup>18</sup> The MDA FY 2004/FY2005 Biennial Budget Estimates include \$25.6 million for FY 2004 and \$77.4 million for FY 2005 for RAMOS and state that the “satellites are scheduled for launch in FY 2007-08.” MDA Exhibit R-2 (PE 0603884C). This document can be accessed at:

[http://www.dod.mil/comptroller/defbudget/fy2004/budget\\_justification/pdfs/rdtande/MDA\\_RDTE.pdf](http://www.dod.mil/comptroller/defbudget/fy2004/budget_justification/pdfs/rdtande/MDA_RDTE.pdf).

<sup>19</sup> MDA Exhibit R-2 RDT&E budget Item Justification, accessed at:

[http://www.defenselink.mil/comptroller/defbudget/fy2005/budget\\_justification/pdfs/rdtande/MDA.pdf](http://www.defenselink.mil/comptroller/defbudget/fy2005/budget_justification/pdfs/rdtande/MDA.pdf).

<sup>20</sup> David E. Mosher, Lowell H. Schwartz, David R. Howell, and Lynn E. Davis, *op. cit.* note 2, p. 136.

<sup>21</sup> John Steinbruner, *op. cit.*, note 1.

<sup>22</sup> Office of the Press Secretary, The White House, “FACT SHEET: Agreement on the Establishment of a Joint Warning Center for the Exchange of Information on Missile Launches and Early Warning,” June 4, 2000, accessed at: <http://www.clw.org/coalition/summit050400launch.htm>.

<sup>23</sup> The two countries will also share such data on ballistic missile launches of third states that could either pose a direct threat to the U.S. or Russia or create ambiguity and lead to misinterpretation.

<sup>24</sup> Memorandum of Understanding on Notifications of Missile Launches (PLNS MOU), accessed at:

<http://www.state.gov/t/ac/trt/4954.htm#mou>.

<sup>25</sup> John Steinbruner, *op. cit.*, note 1, p. 9.

<sup>26</sup> Amy F. Woolf, *CRS Issue Brief for Congress*, “Nuclear Weapons in Russia: Safety, Security, and Control Issues,” (Congressional Research Service, updated April 12, 2002), p. 15.

<sup>27</sup> Remarks to the Fourth Royal United Services Institute’s Missile Defense Conference, accessed at:

[www.state.gov/t/us/rm/15224.htm](http://www.state.gov/t/us/rm/15224.htm).

<sup>28</sup> David E. Mosher, Lowell H. Schwartz, David R. Howell, and Lynn E. Davis, *op. cit.* note 2, p. xvii.

<sup>29</sup> *Ibid.*, p. 136.

<sup>30</sup> *Ibid.* This option is discussed at greater length in the report at pp.44-53

<sup>31</sup> *Ibid.*, p.136. This option is discussed at greater length in the report at pp. 53-62.

<sup>32</sup> *Ibid.*, p. 136.

<sup>33</sup> Amy F. Woolf, *op. cit.*, note 27, p. 15.

<sup>34</sup> See note 19 above and the accompanying text. As to the liability issue, see issue paper #20, entitled “Liability Issues in WMD Threat-Reduction and Nonproliferation Programs in Russia,” in this publication.

<sup>35</sup> David E. Mosher, Lowell H. Schwartz, David R. Howell, and Lynn E. Davis, *op. cit.*, note 2, pp.28-29.

<sup>36</sup> Geoffrey Forden, *op. cit.*, note 13.

<sup>37</sup> David E. Mosher, Lowell H. Schwartz, David R. Howell, and Lynn E. Davis, *op. cit.*, note 2, p. 28.

<sup>38</sup> *Ibid.*

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<sup>39</sup> Bill Gertz, "Mishaps put Russian missiles in 'combat mode,'" Washington Times, May 12, 1997, p. A-12, accessed at: <http://www.fas.org/news/russia/1997/bmd970512b.htm>.

<sup>40</sup> Accessed at: <http://www.state.gov/t/ac/trt/4799.htm>.

<sup>41</sup> Accessed at: [http://www.state.gov/www/global/arms/treaties/mou\\_msllaunch.html#text](http://www.state.gov/www/global/arms/treaties/mou_msllaunch.html#text).