Monitoring Road-Mobile Missiles Under START: Lessons from the Gulf War

JILL L. JERMANO and SUSAN E. SPRINGER

Mobile missiles pose a difficult challenge to US intelligence collection capabilities. The use of a mobile launcher, unlike a fixed site or silo, enables a missile unit to employ unique operational practices and exploit natural surroundings in order to elude satellite detection. During Operations Desert Shield and Desert Storm, US intelligence capabilities supporting military targeting missions had limited success in detecting Iraqi mobile missiles. This raised concerns in the immediate aftermath of the Gulf War that US national technical means of intelligence—the primary arms control verification asset—would be insufficient to satisfy Strategic Arms Reduction Treaty (START) verification requirements for the SS-25 road-mobile intercontinental ballistic missiles (ICBMs) deployed in the former Soviet Union. One critic stated, "The intelligence-gathering apparatus that can't find Scuds in California-size[d] Iraq is the same technology we depend on to enforce arms control agreements."[1] This implied that the SS-25 force, operating in the expansive landmass of the former Soviet Union, would prove to be even more elusive to US reconnaissance capabilities than did the relatively smaller and less technologically sophisticated Iraqi missile force.

The dissolution of the Soviet Union, moreover, raises an important question: will US national technical means be sufficient to verify Russian compliance with START provisions for road-mobile missiles, given the likelihood of changes in the size, deployment, structure, and perhaps operations of the SS-25 force?

In order to answer this question, it is necessary to look more closely at the role and functions of intelligence in the mobile missile context. Although Operations Desert Shield and Desert Storm demonstrated that mobile targets do pose a difficult intelligence challenge, it is not evident that the problem is linked solely to the capabilities, numbers, or types of reconnaissance assets used to search for missiles. US intelligence performance during the war, moreover, does not serve as a precedent of probable US verification capability under START. Intelligence collection tasks and the types of information required to support mobile missile targeting operations in a wartime environment differ significantly from the requirements for monitoring treaty-limited items in a peacetime arms control context. The Gulf experience underscored the premium that a crisis places on precise and timely intelligence data, and it also demonstrated how limited understanding of a target set can substantially degrade detection capabilities. US efforts to monitor START, however, will be somewhat facilitated by a familiar, less time-urgent collection environment, regardless of the political changes that have occurred in the former Soviet Union.

A close study of START mobile missile provisions also reveals that the treaty significantly limits any adverse impact on US monitoring capabilities resulting from the alteration of SS-25 deployments or operations. START tightly restricts mobile missile basing and deployment practices and mandates notification of certain SS-25 activities and changes in data related to deployed SS-25s and associated facilities. The treaty also includes cooperative measures and inspections that are designed to enhance monitoring confidence. All of these provisions are applicable to the January 1993 US-Russian START II accord, which is directly linked to the START framework. Furthermore, practical considerations beyond START will create disincentives for large-scale changes to the SS-25 force.

In order to evaluate the US ability to monitor SS-25s under START, it is useful to return to the basic issue of the US intelligence capability against mobile missiles, using the Iraqi experience as a case study.

Jill L. Jermano is a defense analyst with Meridian Corporation in Alexandria, Virginia. She previously served as the Bonn correspondent for *Eye on the East* and as a national security analyst for Pacific-Sierra Research Corporation. She is a graduate of the University of Illinois and holds a master's degree in national security policy from the University of Maryland. Her publications include *U.S. and Soviet Assessments for the Conventional Balance in Europe* (coauthored), PSR Note 951, March 1990, and "Post-INF Prospects for the Atlantic Alliance," *Public Agenda*, fall 1987.

Susan E. Springer is a national security analyst with Pacific-Sierra Research Corporation in Arlington, Virginia. Formerly she served as an intelligence analyst with the US Department of Defense. She is a graduate of the University of Pennsylvania and holds a master's degree in national security studies from Georgetown University. Ms. Springer is coauthor of "The Soviet Army to the Year 2000," published in the *Journal of Soviet Military Studies*, June 1990.

The Iraqi Mobile Missile Intelligence Challenge

The Iraqi Al Hussein—or Scud—medium-range ballistic missile was a key coalition target during the Gulf War. The Al Hussein is a liquid-fueled system with an approximate range of 600 kilometers and a 500-kilogram high-explosive warhead with a circular error probable of about 1000 meters. The missile's inaccuracy and limited payload restricted Iraqi use of the Al Hussein in both the Iran-Iraq and Gulf wars to striking large urban targets and population centers. By comparison, the SS-25 is intended for use against specific military targets.[2]

The Al Hussein and the SS-25 do share some similarities, however. Both are road-mobile descendants of the Soviet Scud-B, the first modern tactical ballistic missile that dates from the 1950s. The Al Hussein is a single-warhead, Iraqi-constructed missile that is made from the parts of several Soviet-supplied Scud-B missiles. The SS-25 also has a single warhead but it is a more modern, technologically advanced strategic system.

Both types of missile are also subject to some similar operational practices that are designed to promote force survivability. For the Al Hussein, these include long-duration field deployments, frequent and prompt relocation following launch, reload and refire capability, and extensive deception techniques including camouflage and concealment. Available information suggests that SS-25 forces operate in a similar manner.[3] Iraqi operational practices successfully degraded US intelligence performance during the Gulf War, despite a substantial reconnaissance effort to locate Al Hussein mobile launchers.

The United States used a large number and variety of national and tactical intelligence assets to support the coalition targeting effort against the Iraqi missile force. US reconnaissance satellites reportedly provided extensive support to military operations and bomb damage assessments.[4] One important asset used to detect Iraqi missile launches was the Defense Support Program satellite, a missile warning vehicle equipped with infrared sensors to detect launch ignition or the rocket plume of a missile's trajectory during flight.[5] In addition to satellite systems, approximately 15 percent of coalition aircraft were used to search for mobile missile units.[6] Surveillance of suspected Al Hussein operating and launch areas helped to detect missile activity and launches and passed targeting information to F-111, F-15, F-16, and A-10 fighter aircraft.[7] Key platforms included the Airborne Warning and Control System (AWACS), the TR-1 and RF-4 tactical reconnaissance aircraft, and the E-8A Joint Surveillance Target Attack Radar System (JSTARS).[8] It also was reported that US and British special operations forces were inserted behind enemy lines to halp locate and target mobile missile units.[9] Special Forces evidently helped to coordinate air strikes against mobile launchers by identifying them with hand-held laser devices.[10]

Despite this level of effort, the Iraqi mobile missile forces were extremely difficult targets to locate and destroy. Based on warning and launch impact data received from reconnaissance assets, the US Patriot air defense system was targeted against incoming Scuds in Saudi Arabia and Israel. Yet the US Army believes that only about ten missiles were actually destroyed.[11] The use of intelligence assets to support targeting, however, appears to have helped the coalition suppress the missile threat. An initial Iraqi average of four Al Hussein launches per day was reduced to an average of one launch per day after armed reconnaissance patrols were increased in the second week of the war.[12] The coalition's inability to halt Iraqi missile launches completely, however, reflects the difficulties associated with locating the mobile targets. In particular, Iraqi deception practices, communications security, and the desert environment all complicated detection efforts.

The Iraqi deception effort associated with mobile missiles used many Soviet-style techniques.[13] For example, Al Hussein launches usually occurred at night, under the cover of darkness. The few launches that did take place in the early morning hours were conducted under cloud cover to minimize detection by coalition reconnaissance assets. The Iraqis also adeptly used dummy launch sites and decoy missiles. Some sophisticated dummy sites, for example, used heat generators to simulate active missile engines. The Iraqis also constructed a network of drive-through trenches that might have served as dummy hide positions.[14] These sites, most likely intended to confuse US targeting efforts, were covered by metal plates and a layer of camouflage netting. The metal plates probably were intended to simulate hide positions for missiles or missile-related equipment, thereby attracting and wasting US fire assets.[15]

Iraqi use of strict communications security during missile launch procedures might also have complicated coalition targeting efforts.[16] The coalition expected to be able to intercept radar signals during the final stages of launch preparations, which would be tipped off by the release of weather balloons to collect meteorological data for missile calibration. Instead, the Iraqis evidently maintained complete radio silence. The lack of electronic

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signatures suggests that the Iraqis might have relied on the use of previous missile launch trajectories instead of balloons for missile calibration.[17]

Surprisingly, the desert background also complicated US efforts to detect mobile missiles. A number of Gulf War commentators assumed that the Al Hussein's desert surroundings would facilitate missile detection, especially compared to the problems posed by the forested terrain in which SS-25s operate.[18] While the desert offered a less-canopied terrain in which to hide mobile missiles, the Iraqis successfully complicated coalition targeting efforts by making the most of their surroundings, typically by using broken ground and groves of trees to provide cover. Destroyed vehicles and equipment also complicated detection by providing additional clutter. General Norman Schwarzkopf and others noted that pinpointing mobile launchers in the desert was like the proverbial search for a needle in a haystack.[19]

Despite a focused targeting operation that used a substantial number and variety of intelligence resources to detect Iraqi mobile missile launchers, the outcome of the coalition effort was mixed. Iraq continued to launch missiles against Israel and Saudi Arabia, albeit at a diminished rate, throughout the duration of the war. One strike against US forces in Dhahran in late February resulted in 28 deaths and 100 injuries.[20] Thus, the Al Hussein forces managed to evade even the most sophisticated of US intelligence detection and targeting capabilities.

Wartime Targeting Versus Arms Control Monitoring

Although the Al Hussein and the SS-25 share some similarities, one should not infer from the coalition targeting effort against the Iraqi force that the United States is incapable of verifying Russian compliance with START mobile missile provisions. This is the case for two reasons: First, the United States knew less about Iraqi missiles than it does about the Russian SS-25 force. Second, requirements for wartime targeting and peacetime arms control monitoring differ greatly in terms of the type, specificity, and timeliness of information required.

Comparing Knowledge Bases

The hunt for Iraqi Scuds in the Gulf War represents the first time a modern intelligence infrastructure was used to target mobile missiles in a wartime environment.[21] By comparison, the US intelligence community has monitored the SS-25 since its initial deployment in the mid-1980s. Before then, the intelligence community had acquired considerable expertise in monitoring the Soviet road-mobile SS-20, subsequently banned under the INF Treaty. Judging from the information released over the past several years in the Department of Defense's publication *Soviet Military Power*, it appears that the intelligence community follows all aspects of the SS-25 life cycle

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from planning for acquisition, through research and development, to production and deployment.

In contrast to its knowledge of the SS-25 threat, the US intelligence community apparently lacked familiarity with the doctrinal, organizational, technical, and operational details of the Iraqi missile systems. A Pentagon report to Congress on the Gulf War indicated that the intelligence profile on Iraqi mobile missiles and other equipment was prepared from scratch during mobilization for Operation Desert Shield.[22] The intelligence community focused on collecting information about Iraqi weapon research programs, missile capabilities and characteristics, and military facilities.

During Operations Desert Shield and Desert Storm, the intelligence community was unable to establish the exact number of Iraqi mobile missiles and launchers. US intelligence agencies estimated that the Iraqis had 30 fixed launchers, more than 20 mobile launchers, and from 300 to 1000 missiles at the outset of the war.[23] General Schwarzkopf, however, remarked that "we went into this with some intelligence estimates [about Iraqi missile forces] that . . . I have since come to believe were either grossly inaccurate or our pilots are lying through their teeth."[24]

Wartime and Peacetime Requirements

The Iraqi experience also differs from the SS-25 arms control monitoring problem because the intelligence requirements to support an arms control agreement differ substantially from those to support crisis or wartime conditions. During wartime, intelligence collection is focused on the use of mobile missiles on the battlefield. Perishable information about the number of deployed systems, their status, and their locations at any given time must reach military commanders in a time-urgent fashion. Locational data must be accurate enough to support targeting against launch and support units or command and control elements. Moreover, military leaders need timely battle damage assessments and knowledge of changes in the enemy's order of battle.

During peacetime, however, the intelligence problem is broader-based. There is no requirement for precise and timely information about the

exact location of treaty-limited missiles and launchers. Instead, the intelligence community focuses on changes in force status and readiness, force-size estimates, and system characteristics, doctrine, and operations. The intelligence community is able to monitor compliance with arms control treaty provisions, moreover, by observing daily activities at missile production, testing, deployment, training, and maintenance facilities. The objective is to detect anomalous behavior related to the size, capability, and status of the force.[25] The purpose of this type of monitoring is to gain confidence over time that a country is not violating the treaty in any militarily significant way.

Monitoring START

The basic START requirements for monitoring the deployed SS-25 force include verifying compliance with numerical limits on road-mobile missiles and launchers and detecting any cheating activity.[26] National technical means will play the primary role in satisfying these requirements. Treaty provisions such as mandatory data exchanges and notifications, basing and movement restrictions, inspections, and cooperative measures will support US monitoring efforts and effectively complicate any Russian noncompliance activities. This verification regime will enable the United States to maintain a robust intelligence base on the SS-25 force, even if Russia alters SS-25 force structure or operations.

The SS-25 force will undergo some changes. The May 1992 Lisbon Protocol to START, signed by the four republics with strategic missile forces, designates Russia as the sole nuclear successor of the former Soviet Union and commits Ukraine, Belarus, and Kazakhstan to accede to the Nonproliferation Treaty as non-nuclear states.[27] The two SS-25 divisions that are deployed in Belarus will be relocated to Russia by 30 December 1994, which will increase Russian SS-25 deployments to ten divisions.[28] This probably will involve the construction of new bases and possibly some alteration of SS-25 operations, both of which could temporarily complicate US monitoring efforts. START II's ban on multiple-warhead ICBMs, which include the heavy SS-18 ICBM and the rail-mobile SS-24 ICBM, suggests that the SS-25, and an improved SS-25 follow-on, are likely to become the primary elements of the Russian ICBM force. Russia would be able to field many more than the 288 SS-25s it currently has deployed—up to 1100 warheads on 1100 deployed SS-25s. Severe budgetary constraints, of course, could make it difficult for Russia to invest in the production, training, security measures, and building materials needed to make such changes possible. But even if radical changes in SS-25 force structure and operations did occur, several START treaty provisions (that are also applicable to START II) would enable the United States to rebuild its SS-25 intelligence collection base and to preserve a strong monitoring capability.

Data and Notifications

One key treaty provision is a mandatory data exchange that includes detailed information on the number and location of deployed SS-25s. An initial data exchange on strategic forces took place after START was signed. An update will occur 30 days after the treaty enters into force, and regular updates will occur approximately every six months thereafter. The United States will verify the accuracy of SS-25 data with inspections of SS-25 facilities. Russia is obligated to notify the United States of any changes in the Memorandum of Understanding data, including the number of SS-25s and their locations. When the SS-25s in Belarus are relocated to Russia, Russia must provide site diagrams and photographs of any new bases that are opened to accommodate the forces.

Basing and Movement Restrictions

One concern resulting from the Gulf War experience is that the SS-25s are deployed in an area many times larger than the localized regions in which the Iraqi Al Husseins operated.[29] A peacetime situation is easier to verify, however, because most of the SS-25 force remains in garrison during non-alert conditions.[30] The treaty also facilitates verification by imposing a number of basing restrictions on the force. For example, SS-25s may be based only in identified restricted areas, which may be no larger than five square kilometers and which may contain no more than ten SS-25 missiles and their launchers. The number of fixed structures situated within the restricted area, moreover, may not exceed the number of SS-25s based there. SS-25s may leave the restricted area for relocations or exercise dispersals, but these types of movement are subject to strict requirements including pre- and post-movement notifications, time limits to complete the activity, and annual quotas. In addition, START predefines the areas where SS-25s may be legally located when they depart their garrison for routine activity. This area is known as the deployment area, which surrounds the restricted area. The deployment area may cover up to 125,000 square kilometers per division. Although this is a sizable area, the deployment area does provide the intelligence community with a bounded region within which to search for mobile missiles.[31] Road-mobile ICBMs may leave the deployment area only for relocations, which require notification.[32] The sighting of any missile outside the deployment area boundary without prior notification would provide relatively unambiguous proof of illegal activity.

Inspections and Cooperative Measures

Inspections, another key provision, are designed to help verify the accuracy of data, supplement coverage by national technical means, and complicate evasion activities. Baseline inspections will confirm the initial Memorandum of Understanding data, and 15 annual data update inspections

will help to verify any changes. If new SS-25 facilities are opened to accommodate any divisions moved from Belarus to Russia, for example, then the United States will have the right to conduct new facility inspections as well as close-out inspections to verify the elimination of the old bases. Conversion/elimination inspections are also permitted to confirm the destruction of SS-25 missiles and launchers. Inspections may also take place following an exercise dispersal to ensure that the actual number of SS-25s does not exceed the number of SS-25s declared for the base in question.

Open displays of SS-25 launchers at road-mobile missile bases, a START cooperative measure, will also help the intelligence community to monitor the number of missiles at ICBM garrisons by increasing the visibility of the force. The United States may request an open display of up to 25 launchers or ten percent of the entire force, whichever is larger. During an open display, the roof of the SS-25 single-bay garages must remain open, and the launchers must be located either halfway outside their garages or adjacent to them so that the SS-25s are readily visible to satellite reconnaissance. Concealment measures are prohibited during a display, which could last up to seven hours.

The United States currently possesses a strong intelligence base on the number and deployment practices of SS-25s. Assuming that Russia does not change SS-25 standard operating procedures in peacetime, the United States should be able to successfully verify the quantitative restrictions on deployed road-mobile ICBMs. Changes in deployment practices that might adversely affect US monitoring capabilities—at least in the short-term—include the deployment of SS-25s outside of declared deployment areas, or an increase in the number of SS-25s out of their garrisons at any one time. These types of activities, however, would violate the treaty. In crisis or wartime, of course, it is likely that SS-25 deployment practices would change in order to impede US targeting efforts.

Lessons Learned

One important lesson from the Gulf War is that effective mobile missile monitoring in peacetime or targeting during war requires a long-term collection effort to create a sound intelligence base and improve target familiarity. US knowledge of the SS-25, supplemented with restrictive treaty provisions and inspections, will enhance the role of national technical means in START verification. Although a targeting mission requires more accurate information about the number, status, and location of deployed systems and their support units, a high degree of familiarity with peacetime force size and deployment and training practices can be invaluable during wartime. In Iraq, coalition forces might have fared better against the Al Hussein threat if they

had had a robust knowledge base similar to that developed for Soviet mobile missiles.

Another key factor is time. The speed with which intelligence data must be disseminated to support a targeting operation differs significantly from that needed to support arms control verification. Effective Iraqi use of deception techniques, communications security, and the desert terrain reduced the coalition's ability to detect, and thus target, the Al Hussein units before missile launch. In peacetime, arms control monitoring does not require time-critical data dissemination. Instead, evidence is gathered in a more cooperative environment with the objective of building confidence in force monitoring over an extended period. Thus, even if it were feasible for the Russians to implement significant changes to the SS-25 force, they would not permanently undermine US monitoring capabilities under START.

Missile technology is spreading rapidly throughout the developing world. The increasing popularity of longer-range mobile systems, in particular, suggests that a dedicated collection effort against Third World missile programs would have considerable utility to preclude problems in a future crisis. Close attention must also remain focused on Russian strategic forces. Changes in the deployment, command and control, force structure, doctrine, and operations of the road-mobile missile force might be inevitable. The United States must continue its monitoring effort to preserve the soundness of its verification capability under START as well as to ensure a timely response in the event of crisis instability.

NOTES

1. Michael R. Boldrick, "The Message of the Scuds," *The Wall Street Journal*, 7 February 1991, p. A14. See also Jesse Helms, Letter to President Bush, 25 January 1991.

2. Although Russian President Boris Yeltsin has stated that US cities are no longer on the Commonwealth of Independent States' strategic target list, he did not mention the status of US military targets. "Yeltsin Drops U.S. Cities as Nuclear Targets," *International Herald Tribune*, 27 January 1992, p.1.

3. See, for example, Michael Brower, "Targeting Soviet Mobile Missiles: Prospects and Implications," *Survival*, 31 (September/October 1989), 438.

4. US Department of Defense, *Conduct of the Persian Gulf Conflict: An Interim Report to Congress*, July 1991, p. 14-1. See also Craig Covault, "Reconnaissance Satellites Lead Allied Intelligence Effort," *Aviation Week and Space Technology*, 4 February 1991, p. 25; and R. Jeffrey Smith, "Compactness, Simplicity of Iraq's Scuds Complicate U.S. Search," *The Washington Post*, 20 January 1991, p. A31.

5. R. A. Mason, "The Air War in the Gulf," *Survival*, 33 (May/June 1991), 217. See also Vincent Kiernan, "War Tests Satellites' Prowess: Military Space Systems Put to Work During Desert Storm Conflict," *Space News*, 3 February 1991, p. 1.

6. Gene I. Rocklin and Chris C. Demchak, "The Gulf War: Technological and Organizational Implications," *Survival*, 33 (May/June 1991), 260-73.

7. Mason, p. 217.

8. Ibid., p. 171. See also John Boatman and Barbara Starr, "Eyes of the Storm," *Jane's Defence Weekly*, 4 May 1991, p. 735.

9. British Prime Minister John Major publicly acknowledged that Special Forces operations included targeting and destruction of mobile launchers behind enemy lines. See Michael Evans, "How the SAS Took Out the Scuds—By Major," *The Times* (London), 15 May 1991, p. 1.

10. Michael R. Gordon, "Desert Missions By Commandos Aided in Victory," *The New York Times*, 1 March 1991, p. A1. See also R. Jeffrey Smith, "U.S. Special Forces Carried Out Sabotage, Rescues Deep

in Iraq," *The Washington Post*, 4 March 1991, p. A15, and Tony Capaccio, "Roving Royal Commandos Fingered Scuds for F-15Es," *Defense Week*, 28 May 1991, p. 6.

11. The US Army maintains, albeit to a lesser degree of confidence, that 70 percent of incoming Scuds in Saudi Arabia and 40 percent of those in Israel were successfully engaged. These figures are somewhat lower than the Army's original claims in early-to-mid 1991 that the Patriot successfully intercepted 80 percent of incoming Scuds in Saudi Arabia and 50 percent in Israel. These statistics were revised downward to the current figures in response to allegations by government officials, industry professionals, and academics that the estimations were not supported by the available data. George Lardner, Jr., "Army Cuts Claims of Patriot Success: Reduced Figures on Missile's Precision During Gulf War Are Ordered," *The Washington Post*, 8 April 1992, p. A1; and John Aloysius Farrell, "Pentagon Reduces Its Success Rate for Patriot in War," *Boston Globe*, 8 April 1992, p. 1.

12. Edward Cody, "Control of the Skies Eases High-Tech Hunt for Scud Launchers," *The Washington Post*, 4 February 1991, p. 13. See also Joseph S. Bermudez, Jr., "Iraqi Missile Operations During 'Desert Storm'—Update," *Jane's Soviet Intelligence Review*, 3 (May 1991), 225.

13. DOD, *Conduct of the Persian Gulf Conflict: An Interim Report to Congress*, p. 24-1.

14. Bill Gertz and Rowan Scarborough, "Iraqis Literally Dig In to Fortify Kuwait Defenses," *Washington Times*, 17 December 1990, p. A8.

15. Molly Moore, "Bombing Damage Hard to Assess: Officials Say They Can't Tell All They Know," *The Washington Post*, 7 February 1991, p. 21.

16. Smith, "Compactness, Simplicity of Iraq's Scuds Complicate U.S. Search," p. A31.

17. Ibid. It is also possible that the Iraqis were less concerned with maximizing missile circular error probable, given that the Al Hussein was used to attack urban areas.

18. Senator John Glenn of Ohio, for example, stated, "We couldn't even find those Scuds in the desert in a perfect sand background situation. What would we ever do if they were in a jungle or a forested area?" See "Testimony of General Norman Schwarzkopf Before the Senate Armed Services Committee Hearing on the Conduct of the Gulf War," *Federal News Service*, 12 June 1991, p. 9-13.

19. "The U.S. Commanders: Excerpts from Briefing By 2 Generals on War's First 36 Hours," *The New York Times*, 19 January 1991, p. 11.

20. William Claiborne, "Iraqi Scud Kills at Least 12 GIs," *The Washington Post*, 26 February 1991, pp. A1 and A9.

21. Allied intelligence did conduct an extensive search for German mobile missiles during World War II. At that time, however, photo-reconnaissance—the preeminent form of intelligence tasked against the V-2—was in its early stages of development. The hunt for the V-2 using photographic intelligence is documented in Constance Babington Smith, *Air Spy: The Story of Photographic Intelligence in World War II* (New York: Harper and Brothers, 1957).

22. DOD, *Conduct of the Persian Gulf Conflict: An Interim Report to Congress*, p. 14-1.

23. Smith, "Compactness, Simplicity of Iraqi Scuds Complicates U.S. Search," p. A31.

24. "Schwarzkopf Answers Reporters' Questions," *The Washington Post*, 28 February 1991, p. A37.

25. Office of Technology Assessment, *Verification Technologies: Measures for Monitoring Compliance with the START Treaty*, December 1990, pp. 7-8.

26. The Soviet Union declared 228 deployed SS-25s and launchers. US Arms Control and Disarmament Agency, *START: Treaty Between the United States of America and the Union of Soviet Socialist Republics on the Reduction and Limitation of Strategic Offensive Arms*, 1991, p. 123.

27. The Lisbon Protocol, Article V, 23 May 1992.

28. Dunbar Lockwood, "Russia Ratifies START, Ukraine Reaffirms Conditions for Approval," *Arms Control Today*, 22 (November 1992), 32. But see Virginia I. Foran, "Ukrainian Holdout: The Real Problem With the Treaty," *The Washington Post*, 3 January 1993, p. C3.

29. Iraqi mobile Scuds appear to have been launched from three areas: the area in southeastern Iraq bounded by Basrah, Al Amarah, Al Nasiriyah, and Kuwait City; the area in central Iraq around Baghdad and Kirit; and the area in western Iraq bounded by Al Qaim, Al Haditha, and Al Rutba. Joseph S. Bermudez, Jr., "Iraqi Missile Operations During 'Desert Storm,'" *Jane's Soviet Intelligence Review*, 3 (March 1991), 131.

30. Brower, p. 438.

31. According to a former commander of Strategic Air Command, General Jack Chain, in "But Can it Find A Scud in Russia? B-2 Critics Ask," *Defense Week*, 1 April 1991, pp. 11.

32. Road-mobile ICBMs may also leave the deployment area for an operational dispersal, a rare situation which would occur during a crisis to protect force survivability. See START, Art. VI.9.