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REPORT OF THE STRATEGIC PANEL OF THE 1977 DSB SUMMER STUDY ON CRUISE MISSILES

77 4052

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SECTION 1. INTRODUCTION

This report summarizes the deliberations and findings of the Strategic Panel of the DSB Summer Study on Cruise Missiles held in San Diego during the first two weeks of August 1977. The panel's overall goal was 1) to examine U.S. strategic cruise missile programs and assess their ability to be launched and penetrate current and reactive Soviet defenses, and 2) to suggest modifications to current programs and new R&D initiatives which would ensure effectiveness now and in the future. The panel was also asked to illuminate critical SALT issues bearing on the effectiveness of strategic cruise missiles.

The Strategic Cruise Missile panel was chaired by Dr. Michael May and included James Beebe, James Drake, Hua Lin, Oliver Boileau, Abe Goo, and John Walsh as members. The panel relied on data provided from a variety of sources including the Navy, Air Force, DIA, CIA, ARPA, DMA, and others.

This report begins with a section presenting major conclusions in regard to the cruise missile programs and threats. This is followed by a section discussing these conclusions and a section on SALT implications.

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SECTION 2. PRINCIPAL FINDINGS

Overall, the panel finds the Strategic Cruise Missile program to be a highly desirable new direction for the strategic bomber force to ensure its continued viability as the air breathing leg of the Triad. The panel, however, identified a number of concerns which, while easily fixed if acted upon now, could otherwise become substantial worries towards the mid- to late 1980's. Several longer term technological threats were also conceptualized for which R&D initiatives are warranted, but none of these, in the panel's view, should or need delay the earliest possible deployment of a strategic cruise missile quite similar to those designs now in development.

Specifically, with regard to the cruise missile design:

- The present ALCM and Tomahawk designs survive and penetrate well against present national estimates of Soviet defenses and probably against those defenses augmented by the confirmed, but not those steps which the Soviet Union might take in reaction to the bomber-cruise missile threat.
- These cruise missile designs would probably decrease in effectiveness gradually against reactive Soviet defenses. Such defenses could be operational by the mid-80's.

We estimate lethal radius of these improved defenses will be on the order of 5-20 nm. The cost exchange ratio, however, still remains very much in the U.S. favor, although this fact has not prevented the Soviet Union from deploying defenses in the past.

- [redacted] 25X4, E.O.13526 However, the [redacted] 25X4, E.O.13526 These changes should be and can be incorporated into the program while maintaining a mid-80s FOC.

- [redacted] 25X4 and 5, E.O.13526

- The essential ingredient in maintaining continued effectiveness of the bomber-launched cruise missile leg of the Triad is sufficient cruise missile range. We estimate "sufficient" to be [redacted] taking into account the target structure, a prudent standoff distance, and operational

25X4 and 5, E.O.13526

range degradations. An effective maximum operational range of

25X4 and 5, E.O.13526

- Deployment of a modified cruise missile with "sufficient" range capability is needed by the time the Soviet defenses are able to prevent penetration of most B-52 bombers to within a few hundred nautical miles of their coastline. We estimate this could occur as early as 1985. We, therefore, recommend starting appropriately phased programs with a planned operational capability of 3000 modified cruise missiles by that date so that at least all alert bombers can be fully armed (20) with cruise missiles.

With regard to the B-52:

- In view of the B-1 cancellation and of the possible lack of timely intelligence indicators of a depressed trajectory SLBM threat, we recommend developing a plan to provide adequate B-52 reaction time. This plan will involve the proliferation of interior alert strips and may involve modifications to the B-52s. Decision onwhether to put some or all of the plan into effect can be deferred until realistic estimates of the time available to modify the aircraft and bases are in hand.

- The residual penetrating B-52/SRAM threat requires that the Soviets maintain much of their existing defenses. We, therefore, recommend maintaining a portion of this B-52/SRAM force. This force need not necessarily be always alert, and it could provide NATO with a survivable theater nuclear capability.

With regard to R&D:

- A number of technologies could prove essential should threat developments call for a second generation strategic cruise missile. Another order of magnitude or more reduction in RCS and other observables is thought possible. Advanced airframe and propulsion technology could lead to a practical two-stage (subsonic cruise/supersonic dash) missile or to the proliferation of very small subsonic cruise missiles.

- At some point, a new design bomber/cruise missile launcher may be needed to cope with threats to base escape and mid-course flight. A successful new design, however, requires as high a degree of interactivity with potential threats as is common in ballistic and cruise missile designs.

To reach conclusions more quantitative than those presented above, integrated studies, under consistent assumptions, of the capabilities of present and future cruise missiles and cruise missile carriers against likely reactive Soviet defensive systems need to be carried out. These studies should be done under the cognizance of a central office responsible for strategic cruise missile development. Realistic testing of the results of these studies will be needed.

SECTION 3. DISCUSSION OF CRUISE MISSILE PROGRAMS

In the sections that follow, the characteristics of existing and modified cruise missile programs and defenses are described and key issues with regard to their relative effectiveness are defined. In this discussion, we have adopted the following nomenclature for describing each element:

C_o Current cruise missile program

D_o Current Soviet Defense augmented with systems confirmed to be in development

D_1 Reactive defense options using present building blocks

C_1 Modified cruise missile; evolutionary from C_o and reactive to D_1.

Note that in examining a particular cruise missile against a defense, both qualitative and quantitative aspects must be considered; namely, the extent of the deployment of each element must be as consistent with the time period in question as are their detailed performance characteristics. For example, C_o will not be deployed in large numbers until 1985 while much of D_o is widely deployed today. Similar imbalances will probably occur if modified cruise missile (C_1) or reactive defenses (D_1) are developed.

In discussions that follow, C_o and D_o will first be described and then considered against each other. Since C_o will not exist in large numbers until about 1985, a reactive defense (D_1) can also be postulated and gamed for that time. However,

C_o could itself be modified which results in a C_1 vs D_1 confrontation. Each combination will be considered (Chart 1).*

Before beginning the discussion, some comments concerning issues not covered are appropriate (Chart 2). In particular, B-52 ECM effectiveness, hardness, and performance improvements (reengining) are not evaluated. Also, the effects of barrage balloons or other physical barriers on penetration were not assessed. The cruise missile itself is assumed to be air-launched from a B-52 and is armed with a nuclear warhead. The advantages and disadvantages of other launchers (wide-body jets, submarines, ships, etc.) were not carefully addressed nor was the utility of a nonnuclear warhead. The all supersonic cruise missile options were not taken up this summer. Some of these issues will be evaluated in a continuing cruise missile Task Force.

3.1 CURRENT CRUISE MISSILES AND DEFENSES (C_o and D_o)

Charts 3 and 4 summarize the characteristics of C_o and D_o as understood by the panel. C_o is the current U.S. cruise missile program while D_o is a nonreactive Soviet defense using existing components including those forecast to be in the field in the next decade. In summary, C_o is a subsonic, low-altitude, low RCS vehicle launched from a B-52 with a range capability of 25X4, E.O.13526 D_o, by the mid-1980's, could include many hundreds of low-altitude SAMs (SA-3 and SA-X-10, in particular), modern interceptors (MIG-23 and MIG-25M), as well as SLBMs capable of attacking B-52 bases from the current SSBN patrol zones with minimum energy trajectories.

*Briefing charts summarizing the key points are presented at the end of this section. The relevant chart for particular discussions is noted in the text.

In examining the effectiveness of C_o vs D_o (Chart 5), the panel concludes that neither base escape nor mid-course survival poses a significant problem. In addition, there is no Soviet system with significant effectiveness against the ALCM after its launch, due to its low-altitude flight profile and low signature.

However, while survival of the B-52s to the SRAM launch points inside the Soviet Union is good in 1977, it degrades to poor in 1985, unless the B-52 ECM remains effective. As a result, the overall effectiveness of the bomber leg of the Triad degrades due to poor B-52 penetrativity and the limited number (1500) of ALCMs planned.

3.2 REACTIVE SOVIET DEFENSE (D_L)

Chart 6 summarizes the characteristics that a defense might have if designed to be a reaction to the B-52/A.CM threat during the mid- to late 1980s. Key aspects of this defense are to modify or fix those technical features which prevent the cruise missile from being engaged, e.g., SAM fuzing, and to place stress on attriting the B-52 during base escape and mid-course flight. Specific major steps may be:

—It has long been known that both the SS-N-6 and SS-N-8 could, technically, be depressed during flight and shorten flight times substantially. Further, Soviet SSBNs can approach significantly closer to the U.S. coastline than they do now, thus shortening flight times still further.

—The possibility of sabotage or paramilitary attack on nodes of the warning and C^3 net (DSP ground station, in particular, which could prevent the scramble order from even being generated.

—By 1985 or so, the Soviets could stiffen their coastal approach defenses out to several hundred miles mainly by operating MOSS, FOXBAT and FIDDLER (possibly augmented by the MIG-25M) to their full technical capability. They may also be or become aware of the B-52's use of its radar during rendezvous prior to refuel and could conceivably take advantage of this passively to direct an attack.

—Current Soviet SAMS, even those designed for low-altitude targets, all have defects which prevent their successful interception of cruise missiles. Some of these defects are easy (by U.S. standards) to fix and some are not. By about 1985, the Soviets could deploy a thousand or so SAM batteries having a useful effective lethal radius against cruise missiles, particularly if the cruise missiles do not operate at the lowest feasible altitude. These SAMS could be versions of the SA-3, -4, -6, -7, -8, -9, or -10. Another alternative would be to deploy the Clam-Shell radar with a nuclear-armed SA-2; the radar seems capable of detecting very small objects close to the horizon. While it is not designed as a tracking and engagement radar for conventional SAMs, it is able to provide tracking accuracy compatible with the large lethal envelope of a nuclear warhead.

—The relatively high power, unsophisticated and insecure design of the current radar altimeter could lead to passive detection and perhaps jamming.

The panel concludes that D_1 significantly alters the effectiveness of C_o. Specifically, base escape goes from good to poor with a possible catastrophic risk from unconventional attack. Escaping B-52s probably would survive well to within 1000 Km of the Soviet Union but poorly after than. In the panel's view, no confident statement can be made with regard to the penetrativity of the cruise missiles themselves of D_1 by C_o. The requisite studies and tests have not been done. As was the case with C_o vs D_o, the overall effectiveness of the bomber leg of the Triad is down, but even more so. The bomber effectiveness is down due to the base escape problem and the ALCMs have insufficient numbers and range (Chart 7).

3.3 MODIFIED U.S. CRUISE MISSILE PROGRAM (C_1)

The C_1 program is designed to cope with the reactive Soviet defense (D_1) in the mid- to late 1980's. Its elements are summarized in Chart 8.

The program has two parts: (1) changes to B-52 basing and operations to maintain survivability to the launch point, and (2) cruise missile design improvements to increase penetrativity. Note that not all of these improvements need be implemented simultaneously. In fact, some could await the appearance of threat indicators, but plans and appropriate provisions for all of them should be thoroughly thought through.

Shortened flight time SLBM attacks on the B-52 bases call for measures which increase readiness, shorten reaction time and proliferate aim points. Continuous surveillance of Soviet SSBNs, proliferated interior B-52 alert strips, shortened B-52 reaction time and 360° flyout during EWO base escape are all responsive to this problem. They are, however, of varying cost and lead time.

The danger from unconventional attacks can never confidently be eliminated, but there are a number of obvious current vulnerabilities. There is only one ground station for DSP west, and it is exceedingly vulnerable to both electronic jamming and to direct attack. The B-52 bases are small in number and the B-52's are soft to a variety of hand-held weapons. Finally, timely action like a positive control launch of the B-52's which might save them from certain unconventional attacks has not been practiced for over ten years to avoid the danger of a crash and subsequent dispersal of radioactive contaminants. The third, fourth and fifth items on Chart 8 are three of many suggestions to reduce vulnerability to paramilitary or sabotage attacks.

Mid-course defenses and their impact deserve to be given serious consideration. Specific suggestions include reducing or changing the emissions needed during refueling to negate localization at that time. Refueled escort fighters can provide an active defense of the bombers if needed, and would provide a hedge against being surprised too early in the flight. Bomber defense missiles (BDMs) could also be employed but would reduce the number of cruise missiles carried per bomber. Such DBMs may be difficult to field by this period.

Modifications to the cruise missile program itself should include a design having the longest possible range consistent with 1) carrying 20 per B-52, 2) having 3000 in inventory by 1985. This number allows for 20 on each of 100 alert B-52s, plus spares, reserves, etc. Additional design features which are needed and which the panel believes would not compromise the above carriage and timing constraints are

1) low-altitude launch to allow the B-52 to proceed as deeply as possible into potential defenses, 2) changing the altimeter's observables to prevent passive detection, 3) incorporation of a salvage fuze on the nuclear warhead to enforce real (and psychological) one-on-one effectiveness against systems with short lethal radii compared to their nuclear hardness, 4) reduction of RCS and flight altitude as low as possible to shrink SAM and AAM effectiveness, and 5) setting aside 10 to 20 lbs of weight and space provisions for later incorporation of some selected penetration aids, such as a passive receiver that senses SAM or AAM lock-on and triggers evasive action.

25X4 and 5, E.O.13526

The evaluation of the modified cruise missile's (C_1) effectiveness against the reactive defense (D_1) concluded that base escape probability and survival to the ALCM launch point (500 nm out) would be good. B-52 penetration is not improved, i.e., it remains poor. Cruise missile penetration is good. In particular, AAA and manned interceptors are ineffective against the cruise missiles and SAMs would have a lethal range of a few nautical miles, at best (Chart 9).

3.4 ADVANCED CRUISE MISSILES AND DEFENSES

The panel's studies emphasized evolutionary developments of the cruise missile program and reactive defenses up to the late 1980's time frame. There are, however, a number of threats which could appear in the 1990's which could warrant a second generation cruise missile design (and launcher), and for which R&D is thus indicated. Three possible U.S. responses and the threats that require their deployment are described in the paragraphs that follow. Chart 10 presents a summary of these points. They are not recommended for deployment, at present, but for further technology development.

3.4.1 Ultra-Low Observable Cruise Missile

An ultra-low observable cruise missile could be required if the Soviets deployed an overland AWACs with a Soviet equivalent of the F-14 or advanced SAMs, or a helicopter- or balloon-borne SAM, or unconventional surveillance systems [redacted] 25X4, E.O.13526 An order of magnitude reduction in RCS and other observables may be possible and would stress all such systems. The problems (cost and technology) faced by the Soviets in developing and deploying these defensive systems are considerable, but they may do so anyhow.

3.4.2 Two-Stage Cruise Missile

Against a Soviet SAM defense capable of operating at its horizon (~20 nm), a two-stage cruise missile consisting of a subsonic cruise stage and supersonic dash stage might be deployed. This vehicle could defeat the SAM through leverage in reaction and response time. It requires an aggressive improvement in airframe and engine technology, however, to offset the "virtual attrition" of its much larger size.

Alternatively, smaller cruise missiles could be deployed in larger numbers so that saturation tactics could be used more effectively. Both possibilities should be explored technologically and their effectiveness assessed in simulated engagements.

3.4.3 New Bomber/Cruise Missile Designs

Concentration on base attack and mid-course intercept would force an entirely new bomber (cruise missile carrier) design. Possible threats include optimized SLBM, FOBS or MOBS designs; satellite-aided ICBM/IRBM barrage or intercept; new long-range manned interceptors with either autonomous or external target localization; and a surface-ship- or submarine-based SAM system. The above threats would force changes in bomber basing and reaction, and favor greatly increased flyout capability (speed in particular), increased hardness, reduced observables, and increased low-altitude range capability.

CHART 1. TIMELINES AND FORCE CHARACTERISTICS

	1981	1985
C_0	~100	~1500
D_0	LIKE NOW	LIKE NOW + SA-X-10's + GROWTH IN NUMBERS OF MIG-23 AND MIG-25M
C_1	FEW, IF ANY	~3000
D_1	SOME PART OF TOTAL DEFENSE	BEST REACTIVE POSTURE USING PRESENT BUILDING BLOCKS
C_0 vs. D_0	NOT RELEVANT DUE TO SMALL DEPLOYMENTS OF CRUISE MISSILES	RELEVANT IF PRESENT PROGRAM DOESN'T CHANGE
C_0 vs. D_1		RELEVANT IF ONLY SU REACTS
C_1 vs. D_1		RELEVANT IF BOTH REACT

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CHART 2. STRATEGIC ISSUES NOT COVERED

1. B-52 ECM EFFECTIVENESS
2. B-52 HARDNESS
3. B-52 REENGINING
4. BARRAGE BALLOONS
5. SEA-LAUNCH LAND ATTACK MODE
6. NONNUCLEAR STRATEGIC MISSION

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CHART 3. C_0 - THE PRESENT U.S. CRUISE MISSILE PROGRAM

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- RANGE: [redacted]
- RCS: [redacted]
- NUMBERS: 100 BY 1980, OVER 1000 BY 1985
- ALTITUDE: [redacted]
- SPEED: 0.55 - 0.7 M (3)
- OTHER OBSERVABLES: ALTIMETER
  IR
- NUMBER OF B-52 BASES: 25 - 50, DEPENDING UPON ALERT STATUS (MEDIAN DISTANCE FROM COAST: 200 NM)
- B-52 REACTION TIME: [redacted]
- B-52 FLYOUT:

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NOTES:

(1) CAPABILITY, SPEC HIGHER FOR MODELS WITHOUT RAM

(2) CAPABILITY, SPEC > 100 FEET

(3) HIGHER IF MAXIMUM RANGE REDUCED

CHART 4. D_0 (1985-90)

THESE ARE SIGNIFICANT FEATURES OF A SOVIET DEFENSE, NONREACTIVE TO CRUISE MISSILES, USING EXISTING COMPONENTS, PLUS THOSE FORECAST TO COME INTO THE FIELD OVER THE DECADE OF THE EIGHTIES ON THE BASIS OF CLEAR INTELLIGENCE INDICATORS:

- SLBM MINIMUM ENERGY BARRAGE ~600 NM STANDOFF
- MOSS/FIDDLER - DEMONSTRATED CAPABILITIES ONLY
- GCI CONTROLLED MIG 23'S AND 25M'S
- 200 SA-X-10'S
- OTHER PVO STRANY GROWTH, E.G., SA-3'S
- TACTICAL INTERCEPTORS, SAM AND AAA PARTICIPATION UNKNOWN
- OTH RADARS (NOT LIKELY TO AFFECT OUTCOME - NOT LIKELY TO SURVIVE INITIAL HOURS OF WAR)

CHART 5. C_0 vs. D_0 (1985)

- ALERT B-52'S ESCAPE FROM BASE AND SURVIVE TO HIGH ALT GCI DETECTION LINE
- SURVIVAL TO ALCM LAUNCH POINTS GOOD
- SURVIVAL TO SRAM LAUNCH POINTS INSIDE USSR GOOD IN '77 AND POOR IN '85 (THIS ASSUMES B-52 ECM DOES NOT REMAIN EFFECTIVE)
- NO SOVIET SYSTEM IN D_0 HAS SIGNIFICANT EFFECTIVENESS AGAINST ALCM
- OVERALL EFFECTIVENESS OF BOMBER LEG OF TRIAD DEGRADES SIGNIFICANTLY OWING TO POOR PENETRATION OF B-52 AND LIMITED NUMBERS OF ALCMs

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CHART 6. D_1 REACTIVE DEFENSE

THESE ARE FEATURES OF A SOVIET DEFENSE WHICH COULD BE OPERATIONAL IN THE MID- TO LATE EIGHTIES IF THE SOVIETS REACT SPECIFICALLY TO THE B-52/LONG RANGE ALCM THREAT:

- COORDINATED DEPRESSED TRAJECTORY SLBM AND ICBM BARRAGE (SLBMs NEAR SHORE)
- UNCONVENTIONAL ATTACKS ON BASES, C^3, AND WARNING SYSTEMS
- SIGNIFICANT BARRIER OUT TO 500 NM (MOSS WITH FIDDLER OR MIG-25M - FULL USE OF TECHNICAL CAPABILITIES)
- B-52 TANKER RENDEZVOUS RADAR INTERCEPT
- ~1000 MOBILE SAMs WITH EFFECTIVE LETHAL RADIUS ~5 - 10 NM AGAINST C_0 (INCLUDING TACTICAL ASSETS)
- SA-2 WITH NUCLEAR WH AND CLAMSHELL RADAR TO PROVIDE EFFECTIVE LETHAL RADIUS OUT TO 20 NM
- EQUIPMENT TO DETECT OR JAM CRUISE MISSILE ALTIMETER
- ~~PROLIFERATED GCI RADARS WITH ADDITIONAL INTERNETTING~~

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CHART 7. C_0 vs. D_1

- BASE ESCAPE GOES FROM GOOD TO POOR DUE TO SLBM/ICBM ATTACKS
- CATASTROPHIC RISK FROM UNCONVENTIONAL ATTACKS
- ESCAPING B-52'S SURVIVE WELL TO WITHIN 500 NM OF SU; SURVIVAL DEGRADES TO POOR BEFORE REACHING TARGETS.
- SURVIVAL OF C_0 ALCM AGAINST D_1 DEFENSE HIGHLY UNCERTAIN. MORE COMPLETE GAMING AND TESTS OF POSSIBLE D_1 OPTIONS MUST BE CARRIED OUT IN CONSISTENT FASHION TO DETERMINE OUTCOME.
- OVERALL EFFECTIVENESS OF BOMBER LEG OF TRIAD DOWN CONSIDERABLY BECAUSE OF BASE ESCAPE PROBLEM, PROBABLE INABILITY OF B-%@S TO PENETRATE, INSUFFICIENT NUMBER OF ALCMs, AND INADEQUATE ALCM RANGE.

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CHART 8. C_1--MODIFIED CRUISE MISSILE PROGRAM (1985)

THIS IS A MODIFIED U.S. PROGRAM, DESIGNED TO COUNTER A REACTIVE SOVIET DEFENSE IN THE MID- TO LATE 1980's.

B-52 BASING AND OPERATIONS:

- CONTINUOUS STRATEGIC WARNING OF SSBN DEPLOYMENT
- PROLIFERATED ALERT STRIPS, SHORTENED REACTION TIME, AND 360° LOCAL FLYOUT
- SAC BASE SECURITY PROGRAM
- PROLIFERATE DSP RECEIVERS AND POSSIBLY COASTAL RADARS
- COMPLETE SYSTEM EXERCISE ON ALARM - CRASH-PROOF WARHEAD
- EMISSION CONTROL DURING REFUELING
- F-15 ESCORT OR POSSIBLY BOMBER DEFENSE MISSILE

CHART 8. C_1--MODIFIED CRUISE MISSILE PROGRAM (1985) (CONT.)

CRUISE MISSILE DESIGN:

- ALCM DESIGN SHOULD BE COMPATIBLE WITH
  - CARRYING 20 ON EACH B-52
  - COVERING EVERY PART OF SU WITH 500 NM STANDOFF (REQUIRED RANGE ABOUT [redacted] 25X4 and 5, E.O.13526
  - 3000 UE BY 1985
- LOW-ALTITUDE LAUNCH
- FIX ALTIMETER OBSERVABLES
- [redacted]
- RCS AS LOW AS POSSIBLE, ALL ASPECTS
- [redacted] NOMINAL COMMAND ALTITUDE 25X4 and 5, E.O.13526
- WEIGHT ALLOWANCE SHOULD BE SET ASIDE FOR PENETRATION AID (10 - 20 LBS)

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NOTE:

INTRODUCTION OF SOME OF THESE ITEMS DEPENDS UPON APPEARANCE OF APPROPRIATE THREAT INDICATORS.

CHART 9. C_1 vs. D_1

- BASE ESCAPE PROBABILITY GOOD (ASSUMING C^3 AND BASE SECURITY IS MAINTAINED)
- SURVIVAL TO LAUNCH (500 NM OUT) GOOD
- B-52 PENETRATION POOR
- CRUISE MISSILE PENETRATION GOOD
  - INTERCEPTORS INEFFECTIVE
  - SAMs HAVE FEW MILES LETHAL RADIUS AT BEST
  - AAAs INEFFECTIVE

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CHART 10. MORE ADVANCED U.S. SYSTEMS AND THE THREATS THAT MIGHT REQUIRE THEIR DEPLOYMENT

ULTRA-LOW OBSERVABLES CRUISE MISSILE:

- OVERLAND AWACS OR GCI DIRECTED SUF-14 OR SAM
- HELO (OR BALLOON) BORNE SAM
- UNCONVENTIONAL SURVEILLANCE

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TWO-STAGE SUBSONIC CRUISE/SUPERSONIC DASH

- HORIZON LIMITED SAM

NEW BOMBER AND/OR CRUISE MISSILE DESIGN

- OPTIMIZED SLBM OR FOBS/MOBS
- SATELLITE AIDED ICBM/IRBM BARRAGE
- LONG-RANGE INTERCEPTOR (NEW, MODIFIED BACKFIRE, MODIFIED BEAR)
  - AUTONOMOUS
  - AWAC, SHIP, SUB, SATELLITE AIDED
- SHIP/SUB BASED SAM

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