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I would like to talk about NMD, and about its likely operational effectiveness.

When thinking about MD, I like to recall Churchill's admonition that "it is sometimes necessary to take the enemy into account."

IOW, we must anticipate likely reactions of adversaries, assume they will try to thwart our objectives, and plan accordingly. An obvious point, perhaps, but one that is not adequately reflected in our plans for NMD.

The proposed NMD system relies on hit-to-kill intercept of IC-range warheads in midcourse phase, as they travel through space. This is so challenging that US has not been able to do it consistently, even when the defense knows exactly what is coming, and when and where it is coming.

With enough time, money, and effort, the proposed system probably will work consistently against cooperative targets. But I believe it is unlikely to work against a real adversary.

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Real adversaries will do their best to defeat the system, and they will have substantial technical capabilities. After all, NMD must work against adversaries who can build ICBMs and RVs; and who can arm these missiles either with reasonably compact and light nuclear warheads or efficient and deadly biological warheads.

Any state that could do all of this would be capable of deploying conceptually simple but effective countermeasures.

We can't have it both ways: if a country is able to pose a threat that NMD would address, then that country would also have the capacity to develop countermeasures.

BTW, if the country in question did not develop the missiles or warheads alone, but received help from other countries, such as Russia or China, then we'd also have to assume that they could get help with countermeasures, too.

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Last year, MIT and UCS convened a study group to examine the vulnerability of the proposed NMD system to CMs within the technical capacity of an emerging missile state.

I am a coauthor of that study, along with ten other physicists and engineers, many of whom have substantial experience in missiles, radar, and other defense technologies. This report is available on the web.

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Many CM are possible. We chose to examine three in detail, to show that it is not difficult to defeat a defense that relies on HTK intercept in MC: BW SM released on ascent; NW w/antisim balloons; and NW w/cooled shroud

Each can be developed without flight testing, so we might not know what CM an adversaries employs. As Rumsfeld report noted, standards of reliability and confidence are much lower in rogues, and they have demonstrated ability to conceal their development activities from US intel.

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The first countermeasure we examined in detail is BW submunitions. This is not really a CM, since submunitions are the preferred method for delivery CB agents against populations. Indeed, when the US developed CBW warheads for its missiles in the 1950s and 1960s, it used submunitions.

Submunitions are more effective than unitary whs because they give better coverage of target, and allow more efficient dispersal of the agent. Single missile with 100 bomblets containing 2 kg of anthrax slurry each could lead to casualties comparable to those resulting from a nuclear detonation.

In order to counter the proposed NMD system, the attacker would only have to release the SM soon after the boost phase ended, above the atmosphere but well before any interceptors could reach the payload.

In the report we describe two possible mechanisms to dispense the bomblets, and two possible designs for the bomblets themselves. We found no technical barriers to implementing this concept, which certainly would be within the capability of any country able to build an ICBM and RV.

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Also examined two CMs applicable to NW. The first is antisimulation: the wh is enclosed in a mylar balloon, released along w/100+ empty balloons.

Radar, IR sigs of an empty balloon and similar balloon with wh inside are almost identical. Any differences that might be detectable can be hidden by making the empty balloons various sizes, shapes, colors, masses, spins.

The defense will see a large number of balloons with variety of radar and IR signatures, but it won't be able to tell which balloon contains the warhead—at least while the balloons are above the atmosphere.

And even if the defense got lucky and picked the right balloon, a direct hit on the balloon would not necessarily destroy the warhead, particularly if the balloon was much larger than the warhead.

The empty balloons will be stripped as they enter the atm. But then it is too late to intercept. The XBR may be able to detect the deceleration of the empty balloons at a few 100 km, but as we explain in the report, unless two or three XBRs have the balloons in view it will be impossible to guide the KV to the correct balloon.

Again, implementing this concept should not be too difficult for any country that can build an ICBM and a nuclear warhead.

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Finally, we considered placing the NW inside a shroud cooled with liquid nitrogen. By cooling the shroud to 77 K (-200 C), we reduce its IR signal reduced at 10 μm by a factor of a million (and by much more at shorter wavelengths).

All else being equal, this would reduce the range at which the KV could acquire the warhead by a factor of a thousand, and increase the acceleration the KV would need to intercept the WH by a factor of a million. For all practical purposes, intercept would be impossible.

In the report, we discuss how an attacker could deny the use of reflected sunlight or earthshine for homing purposes. Again, none of this seems beyond the capacity of a state that can build ICBMs and nuclear warheads.

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Of course, we might be wrong...there might be some easy way to defeat these CM.

But DoD should demonstrate that the system can cope with countermeasures *before* a deployment decision is made.

We're told that they system must "walk before it can run." But if the basic concept contains fatal flaws, if it has a genetic defect that makes running impossible, then it makes no sense to invest tens of billions of dollars in it.

If the proposed system can't cope with CM, we should focus R&D on concepts that might, such as boost-phase interceptors based on ships or aircraft.

Slide 9 (if there's time)

Two final thoughts.

First, ICBMs aren't the only way to deliver WMD. An attacker could also use short-range ballistic missiles or longer-range cruise missiles launched off ships. Every day thousands of ships pass within 200 km of US shores. Or an attacker could use a variety of covert means of delivery. This would be particularly attractive for BW. It is estimated that less than 1% of drug shipments to this country are interdicted. Why would we do better against WMD?

Second, Russia and China, whose nuclear arsenals are the real and present danger to our security, will respond to NMD by deploying CM. This by itself won't threaten us, but it will mean that the NMD won't offer any protection against an accidental or unauthorized Russian attack, or a deliberate Chinese attack.

In addition, China is likely to respond by increasing the size of its strategic nuclear forces, and Russia is likely to respond by increasing the launch-readiness of its forces.

Returning to Churchill, it is necessary to take the enemy into account. When we do this, we see that the proposed NMD system would not, on balance, increase our security.