

ARMS CONTROL ASSOCIATION  
THE STATUS OF IRAN'S NUCLEAR AND MISSILE PROGRAMS

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GREG THIELMANN: Welcome to you all on this Monday morning, on behalf of the Arms Control Association. In the unlikely event that any of you are not intimately familiar with the ACA, I would just mention that we're a nonpartisan public organization – public education organization. We publish a monthly magazine, Arms Control Today. There were a number of free copies on the table if you wanted to take

one along. The magazine provides an authoritative source of information on arms control issues.

My name is Greg Thielmann. I'm a senior fellow at ACA and head of our realistic threat and response project. I'm your moderator this morning as we kick off the first in a four-part series of briefings under the ambitious rubric "Solving the Iranian Nuclear Puzzle". An outline of the series is available on the table outside.

In today's session, we're going to be focusing on the status of Iran's nuclear and missile programs. Before we can get into detailed discussions about policy options for dealing with the Iranian proliferation threat, we need to construct a solid foundation of facts and consider judgments about the status quo. And we have a distinguished panel of authorities on this subject to help us with this task.

Before we turn to the panel, let me make the usual request that you silence any electronic devices you may be carrying. This session is being taped and will be on the record. We're going to be inverting the order of participation we had originally planned because our third speaker has to leave us soon to join a meeting with the vice president later this morning.

You have biographic material on each of the speakers, but I'll review a little bit of the background information in introducing the speakers. We're first going to hear from Professor Paul Pillar who is now a director of graduate studies at the Center for Peace and Security Studies at Georgetown University. I first heard Paul's name when I was serving in the State Department's intelligence bureau 10 years ago and he was national intelligence officer for the Near East and South Asia.

But I really became familiar with his contributions later when I was serving on the Senate Intelligence Committee. During the committee's extensive investigation of intelligence-community failings on Iraq, the committee discovered the prescient analyses he produced in January 2003, describing the likely impact of invading Iraq.

And I would characterize his pieces as bright lights of insight in a very dark firmament. Moreover, his later testimony about the analytic process helped senators on the intelligence committee gain a realistic understanding of the potential and the limits of intelligence. So as we seek to shed light on the mysteries of Iran's nuclear missile programs, we invite Paul to set the stage.

**PAUL PILLAR:** Good morning and thanks, Greg, for that very kind introduction. And I want to apologize, first of all, to everyone in the room, including my fellow panelists, for having to peel off early and not stay for the whole proceedings.

Greg asked me to address two different topics. One is the intelligence community's contribution to this whole subject. And the second is relevant issues involving Iran and its region and more specifically Iranian attitudes toward its neighbors, the neighbors' attitudes toward Iran and how Iran moving toward a nuclear weapons capability might affect regional dynamics.

First of all, the role of intelligence. And I want to start by saying I know absolutely nothing about what's in the mill with regard to this estimate or that paper, whatever. I don't walk the corridors anymore. I haven't walked them for five years of the agencies who do those sorts of things. I don't have a security clearance. So I am blissfully ignorant of what's going on. I do have some things to say in a more general vein, though, about the role of intelligence on this topic. And they are mainly things that I would describe as cautions.

One is to caution against an excessive focus on national intelligence estimates, or NIEs. People wait with bated breath – well, when is the next NIE on this topic? Well, that's an art form that's been around for a long time, so everyone's heard of it. And I guess I can understand the focus, but the fact is that it is one of only many different channels through which the intelligence community produces its work, its assessments. There are many different art forms even if you are talking about strategic assessments and even if you are talking about multiagency intelligence community assessments, there are other art forms.

I expect that numerous judgments have been flowing all along over the last couple of years from the intelligence agencies to the policymakers with regard to this topic, and that the White House and the Department of Defense and others concerned are well-informed of whatever is the state of thinking by intelligence community experts on this. So it is a mistake to wait with bated breath for any one document, even if it has a label that is a label we've all heard of.

Another major caution about the role of intelligence is – the main issue here is not, in the end, an intelligence issue. It involves questions of what costs and risks we want to incur in order to try to achieve certain results with regard to Iranian programs and behavior and what are the best strategies for trying to achieve those results. Those are not questions that intelligence agencies can answer for us.

The bated-breath approach carries the hazard and it encourages the mistaken notion that the presumed existence of some state of affairs, such as an unconventional weapons program that could exist in some other country, is to be equated with a particular approach for doing something about it.

That's exactly the trap that we collectively in this country all fell into with regard to the Bush administration's selling of the Iraq war with the false equation of a presumed unconventional weapons program on the one hand, the need to eradicate it by invading a country and overthrowing the regime on the other.

And that's exactly the kind of trap that I hope we will collectively avoid with regard to any other countries, including Iran. And it's a trap to avoid, not only with regard to military action, although that is the most important one, but also with regard to any other course of action – sanctions or anything else. It is not to be equated with a certain judgment that comes out of the intelligence community.

And finally, with regard to cautions, as to what we can or cannot expect from the intelligence community, we're talking about Iranian decisions, I think, that have yet to be made. Or so far as we know they have yet to be made. And in this case, the decisions, whether to proceed to a weapons capability or how close to come to it, will depend in large part, among other things, on what the United States does vis-à-vis Iran. And again, these are all questions about which we cannot expect answers from the intelligence community, which among other things is not charged with assessing the future direction of U.S. policy.

Now, there was this one estimate, which was called an NIE, back in 2007, that got a lot of attention. So it's helpful to recall what was said back then. And what got most of the headlines regarding that document was a lead judgment that Iran had suspended or had stopped weapons design or weaponization work four years earlier, in 2003.

And this got equated, partly through some unfortunate use of terminology in the estimate itself, with Iran having stopped working on nuclear weapons four years ago. Now, a couple of words about why that estimate was constructed the unfortunate way it was. It was not originally intended to have an unclassified version. It was originally put together with the intention that there would only be a classified estimate.

So the estimate writers were writing for their sophisticated, inside audience that was well-versed in what was going on with regard to uranium enrichment. And so they led with what was the news for that sophisticated audience, this business about the weapons-design work allegedly being suspended in 2003.

But then between the White House and the intelligence community, they realized, well, the chance for a leak is very, very high, so we might as well preempt that by putting together an unclassified version of the judgments, which they did. And once they decided to do that, they were stuck with the original organization, which this thing about "weapons design work suspended in 2003" was the lead item.

If they started rearranging things for the public audience, they would be justly accused of massaging the message for the public. So they were kind of stuck based on this unfortunate sequence of events with what they got. And then what happened was a big public reaction to the effect that, well, this takes the military option off the table, this changes things enormously, there was all kinds of speculation about what the intelligence community was really up to in terms of its motives and trying to subvert policy, and so on and so forth.

It was a vastly overblown reaction to what was, really, in the end, a kind of unfortunate way in which the product evolved and was designed. And President Bush was quite correct in pointing out in response to some of this reaction that the most important thing, the uranium enrichment program, had not stopped in 2003, and that that program is what the analysts would describe as the pacing factor, the one aspect of the program that most determines when Iran would be capable of producing a nuclear weapon.

Well, given that unfortunate experience in 2003, I suspect the intelligence community has little appetite these days for more unclassified papers on the subject. In fact, for a lot of intelligence officers, if they had their way, they would have nothing to do with any unclassified products, ever, on anything.

That doesn't happen to be my view, but I think you can perhaps sympathize with it when something like this happens. But you've still got the leak problem to deal with. So what they're going to do with the next waiting-with-bated-breath estimate on this topic in terms of classified/unclassified products, I simply don't know and I'm glad I'm not trying to make the decisions on this.

Whatever the intelligence community does on this topic, all it can do is provide, at best, a snapshot of the physical state of programs insofar as there's information available on those programs. And we can expect that the information, as usual, is going to be fragmentary and incomplete.

And if we need a reminder of this, we can just think about how some of the – what is today's knowledge of the Iranian nuclear activities has come to light, some of it based on tips from none other than the Mujahideen-e-Khalq. I mean, it's almost embarrassing to point out that some leads have come from a group like that, but that's the case.

The community is on far shakier ground when it tries to offer – and there's the expectation of this, so maybe it will offer this – judgments about what this snapshot of the physical state of a program implies with regard to Iranian decision-making. That's a whole lot harder to do, mainly because of the factor I already mentioned. We're talking about decisions yet to be made.

One can look at, say, weaponization work, and analysts will give you some inference. In fact, analysts may consider that this is part of their mission; this is part of what they're paid to do – that they will give you inferences about what this probably means or might mean or likely means with regard to decision-making at top levels in Iran. But we don't really know that and neither do the analysts.

We don't know whether there is weaponization work going on. It reflects a decision already made to go all the way to the last few screwdriver turns of putting a bomb together or just short of that, keeping those last turns unturned. Or maybe it's all just kind of on a contingency basis. And decisions haven't even been made to get to a short fuse, few turns of the screwdriver away from a bomb. We simply don't know based directly on whatever this fragmentary, physical evidence may say.

Well, that's all I'm going to say about intelligence. Now, to turn to the regional-relations topic and where nuclear weapons fits into this. Iran has major tensions with its neighbors on a number of things including with its Arab neighbors, a number of things that have nothing to do with nuclear weapons. Iran is the big kid on the Persian Gulf block. It likes to think of itself as the successor to the old empire going back through millennia of history.

And by the way, as one possible motivation for developing a nuclear weapon, I think part of it is just the vague view that the major power in the Persian Gulf region as the Iranians see themselves ought to have, as a proper accoutrement of being the major regional power, a nuke. That would be one of several motivations. That's just speculation on my part, but I think it's reasonable speculation.

You have various lines of contention that have underlain these tensions with neighbors for quite some time. The ethnic one: Persian versus Arab. The sectarian one of Shia versus Sunni which, by the way, has been accentuated and underscored by the sectarian violence of the last several years and continued political strife in Iraq, which has made people throughout the region, not just in Iraq, more conscious of these things. And you've got specific territorial disputes. You had one that was one of the things at stake in the Iran-Iraq War and of course today, you have disputed islands in the Persian Gulf.

One thing Iran is not appearing to do right now is foment revolutions amongst its neighboring states. That is a change in Iranian behavior from the first few years of the Islamic Republic. During those first few years, there was an almost Trotskyite kind of view of permanent revolution that if similar revolutions did not break out and take hold in the region, that the revolution in Iran would fail, that the new regime would fall. And then as the years went by the leaders in the Islamic Republic realized, well, that wasn't happening.

So they didn't see it as essential to their own survival anymore to, say, overthrow the regime in Bahrain. So they're not trying to do that. I think their current strategy in Iraq for example, which is one of not trying to install a Khomeini-like regime but instead to place all kinds of bets on the Iraqi chessboard so that the Iranians can maximize their influence and increase the chance that whatever regime is in Baghdad is not going to be a hostile regime as Saddam Hussein's was.

The Gulf countries do not want to see an Iranian nuke and they do express a vague concern about it. But they don't have any particular ideas to what to do about it. If you talk about the topic of military attack, they're opposed to that and I think there was a lot of misinterpretation, by the way, of Ambassador Otaiba's remark.

I was in the UAE as well as in Saudi Arabia in the spring and that's certainly not the message that I got. The message was, yeah, this is a source of concern and you Americans ought to figure out something to do about it, but if you raise the military-attack issue oh, no, no, no don't do that. I think the statement that Prince Turki made in a Carnegie event just a couple of weeks ago, along those lines, was fairly reflective of Saudi thinking as well as Gulf thinking in general.

Finally, what would be the effect of an Iranian nuclear-weapons capability in the region? And I have to say there's an awful lot of fuzzy thinking on this. The more sophisticated commentators realize that the specter of a bolt out of the blue in time of

peace would be very unlikely; it would be suicidal, it would be absolutely contrary to Iranian interests.

But even the more sophisticated commentators still express the kind of vague sense that somehow, an Iranian nuclear weapon even if it's never fired is going to make a difference in encouraging troublesome Iranian behavior in the region. It's sort of a sense that Tehran would feel its oats more in ways that we wouldn't like. But if one thinks more precisely about just how this would work it's hard to see – it's hard for me to see how this would be the case.

Ultimately, nuclear weapons affect behavior only insofar as the possible use of those weapons comes into play in thinking, somehow, about the strategic logic of a situation. And I think what you need for them to come into play is three things. You need to envision some kind of Iranian behavior that the Iranians are not doing already or at least not to the same degree.

Secondly, you'd have to envision some likely response to that behavior that somebody else would take as long as Iran did not have a nuclear-weapons capability that would be detrimental to Iran. And finally, you'd have to envision that that response would be so detrimental to Iran that an Iranian threat to bring nuclear weapons into play would be credible.

Well, I find it hard in thinking about the ways in which Iran might be interacting in the future with the states of the region to envision any situation where those criteria which you could get straight from Tom Schelling or Herman Kahn as far as rigorous thinking about nuclear weapons and escalation is concerned would come into play.

And let me close by just contrasting it with another situation elsewhere in the world where I think nuclear weapons had made a difference and that's Pakistan and India and specifically the Pakistani nuclear weapon. Pakistan has faced – and this is why the nuclear weapon is relevant – a situation of severe, conventional military threat from India. You know, the so-called “cold start” doctrine and everything.

Pakistan faces the threat that if they behave in a way that's going to get the Indians too angry, the Indians are quite capable of launching a conventional armed strike that, in short order, would slice Pakistan in two. That's pretty darn serious and it certainly makes credible the idea of Pakistan bringing nuclear weapons into play. And this may well have been behind and encouraged some Pakistan behavior like Pervez Musharraf's cargo offensive up in the Kashmir region. Nuclear weapons, I think, have made a difference there.

But translate that strategic logic to the Iranian situation and the question becomes who plays the role of India? Is it us? Is it Saudis? Is it the Israelis? Is it the Iraqis? Who's going to have the armed invasion that slices Iran in two or the existential equivalent to that? And I just don't see it. So I will leave it at that and Greg, I don't know how you wanted to proceed at this point. I can stick around for a few minutes and take some questions.

MR. THIELMANN: Well, what I'd like to do is break our usual routine by stopping at this point and allowing you to ask Paul Pillar some questions. We probably only have five minutes or so. So let me just start with one question and then we'll go to you. Is there anything, any generalization you would make about whether there are deep differences between our friends and allies on the facts that we're going to be getting into on nuclear and missile issues in Iran? The press sometimes gives the impression that the Europeans are much more convinced that Iran is closer to a nuclear weapon than the United States is. Do you have any impressions you want to share on that?

MR. PILLAR: Well, again, I'm not walking the corridor so I – you know, the specifics that analysts and intelligence services might get into – some of which this talk that you mentioned, Greg, may reflect – I simply don't know. My overall sense is since everyone, for the most part, is looking at the same information and for the most part, information is shared on a liaison basis among friends and allies.

I think some of the commentary probably overstates the actual analytical and judgmental differences. And some of the things, especially when you talk about the Israeli perspective vis-à-vis the U.S., I think some of what comes out publicly is more politically driven than driven by differences between experts and intelligence services.

MR. THIELMANN: Thank you. Try to be more concise than I was and give your name and ask questions. Michael.

Q: Michael Adler from the Wilson Center. Just, if I can, two quick questions. One, I know you're not walking the corridors, but how much better do you think the intelligence is now than it was, say, 10 years ago? Because certainly they made an effort to get better intelligence.

And the second thing is, when you speak about who plays the role of Pakistan; wouldn't it be all of the above? And wouldn't one thing the Iranians would get out of a nuclear weapon would be a certain immunity from attack? From attack on their country? And wouldn't that, some fear, embolden them to be more active in small regional disputes such as things about islands in the Persian Gulf?

MR. PILLAR: On the first one, this has clearly been a major topic for all the services involved for quite some time and the same reasons that have made it a tough nut to crack have been there all along. And that's true not just of Iran but other nuclear programs and I'm thinking of North Korea which I think you're going to get into with some of my fellow panelists later on.

And Sig Hecker coming back with this story about this plant and there were some statements by, you know, U.S. officials that, well, we really weren't so surprised about that. I don't know, that's a tough nut to crack too. (Laughter.) And I wouldn't be surprised if Sig Hecker, when he was invited to visit, discovered some things that we simply didn't know.

On your second one, let me just go back to the logic that I was trying to lay out. What would we or anyone else do that would pose an existential threat in the same way Pakistan is threatened by India to Iran? Are we going to launch an armed invasion of Iran that's going to slice that country in two or anything remotely resembling that? I just don't see it.

Are we going to do anything like that or will the Emiratis or the Saudis do something like that with regard to the islands dispute which you mentioned? It simply doesn't raise up to that level. So insofar as a forceful, highly threatening response against Iran doesn't come into play, then an Iran counter threat in which the nuclear weapon is brandished doesn't come into play either.

MR. THIELMANN: Mr. Kessler.

Q: Glenn Kessler with the Washington Post. How credible do you think the theory is that if Iran gets a nuclear, that it would unleash an arms race of other countries eager to have their own nuclear weapons such as the Saudis and the Egyptians?

MR. PILLAR: I think that's not likely to happen. Mainly, they've had the Israelis around for years and years, of course, and this hasn't happened. They've had the Iranian conventional superiority, in many respects, in the Gulf region for quite some years and it still hasn't happened.

And mainly for those reasons as well as for reasons of capability, I think that the image of a proliferation, a nuclear-proliferation race in the Middle East as being touched off by something that the Iranians – a threshold the Iranians would cross sometime in the next year or two is overblown.

I think our focus on this as a legitimate concern reflects our collective tendency to over-speculate on such matters. It's the same thing that led President Kennedy many years ago to talk about, you know, we were going to have 25 nuclear-weapon states or whatever he said it was, you know, 20 years from now and that never materialized. I think it's the same sort of thing.

It is an important issue. I don't want to minimize the significance of it; I'm just saying my bottom-line judgment is it's not going to touch off quite the race toward nuclear weapons that is often talked about.

MR. THIELMANN: Patrick, Abner (ph).

Q: Patrick Clawson, the Washington Institute for Near East Policy. Iran's supreme leader, for 20 years said that we [the United States] constitute an existential threat to the Islamic Republic and has organized hundreds of thousands of his basij to deal with what he sees as our efforts to overthrow his regime through promoting a velvet revolution and soft overthrow and he sees 3 million people out in the streets of Tehran as the product of our imaginations and he repeatedly states that only a militarily strong

Iran can prevent this and that only through Iranian greater strength can the regime be sustained.

Are you suggesting that we should ignore the supreme leader's 20-year record of saying that we constitute an existential threat to his regime because you don't think that there's a possibility that we might invade Iran? Or should we pay attention to what the supreme leader has to say about what constitutes an existential threat to the Islamic Republic?

MR. PILLAR: No, Patrick, I'm saying we should pay attention to that and draw the appropriate implication as to what U.S. threatening statements and behavior does and not what the Iranians would do if they actually got a nuclear weapon. What you pointed also underscores an additional prime motivation for the Iranians to get a nuclear weapon if they proceed to that step which is deterrence of the United States. Deterrence means not using it, it means preventing the other guy from using it.

MR. THIELMANN: Avner.

Q: Avner Cohen. You, I think, somewhat put too much emphasis on the word, on the idea of decision, that a safe decision has to be made, political decision. You may be right that no political decision has been made in Iran about the bomb, so to speak, grand political decisions.

However, we know that very often, nations can reach the bomb or almost the bomb without making decisions. There's a drift and there is all sorts of decisions to make much lower-level, nonpolitical decision that ultimately lay the foundations. So I think that just to qualify that the emphasis on the decision is, in my view, a little bit misguided.

MR. PILLAR: That's an excellent point and I was speaking at shorthand. The basic point I was trying to make in talking about the intelligence contribution was that by looking at the state of a program and trying to infer from that what decisions had been made is risky business and I think the same would apply, taking into account your very correct comment, that it's also difficult to infer, well, who's making the decisions or what bureaucratic processes are being reflected in the program that we see.

I think, in fact, everything you point is an additional set of complications. We're trying to make those sorts of inferences and it's all the more reason why it's difficult. But thank you for pointing that out.

MR. THIELMANN: In the front.

Q: Gareth Porter, Inter Press Service. I'd like to ask you, Paul, to think with us about the implications of the history of other states that have, in fact, gone to have nuclear weapons: Pakistan, India, North Korea – or had a program at one time, and compare what the intelligence community was able to figure about those situations with the situation with regard to Iran.

One of the things that strikes me is as I read the history of various nuclear states, or would-be nuclear states, is that the U.S. intelligence community, in fact, picked up very clear, hard evidence early on in these other cases that, indeed, the country was – had a nuclear-weapons program. That does not appear to have happened in the case of Iran.

At least, you know, the hard evidence didn't appear for the decades of the past. Could you tell me if this is completely wrong? Do you have other – another interpretation of what the intelligence community knew about the other cases? Is there something to be gleaned from this history?

MR. PILLAR: Gareth, I think there are other people in the room who are better qualified to, sort of, review the other cases. I would just say – I won't attempt to answer your question simply because I'm not that knowledgeable about it. I would just reiterate in my point that these sorts of programs are always tough intelligence nuts to crack and perhaps the Iranian one has been a little bit tougher than some of the others.

But it reflects the nature of the programs; it reflects a lot of the things that Avner Cohen just mentioned where, you know, it's – you've got different bureaucracies and different elements within a regime that are involved and in most cases, a strong desire to keep all this secret. But I just am not conversant enough with the other programs to respond.

MR. THIELMANN: I think we have –

MR. PILLAR: One more question.

MR. THIELMANN: – one more in the back. Miles.

Q: Miles Pomper from Monterey Institute – two questions. One, I mean, you kind of emphasized, kind of, the military aspect of whether or not Iran developed a nuclear program. There's a lot of people who look at the political argument, for example, on the peace process with Hezbollah and Hamas vis-à-vis Fatah and other groups, and they are, sort of, emboldening the hardliners in the peace process? (inaudible) and I've got the regional cache that I feel like we need to combat.

Secondly, you sort of talk about the – when you talk about the Iranian decisions on these issues you tend to emphasize the rational calculation of Iranian leaders. Presumably, the Israelis are making rational calculations, too, and they tend to emphasize this question of Iran's influence on other groups, if it should get a nuclear weapon. So you are then basically saying that the Israelis are irrational but the Iranians aren't? (Laughter.)

MR. PILLAR: Your words, not mine. (Laughter.) You know, you're quite correct to underscore the sort of vaguer nonmilitary, political dimensions of Iranian motivations. I got into this a little bit when I talked about nuclear weapons – being seen

as a proper accoutrement for the dominant power in the Middle East – or in the Persian Gulf, which is the way they like to see themselves.

I think what you talk about is part of the mix of motivations, along with deterring the United States and perhaps some internally driven ones of the sort that we talked about a moment ago. That is not the same as the question of, what difference would it make if they got a nuclear weapon and how would they use it?

So with regard to things like relations with Hezbollah and how it would affect events farther west from the Persian Gulf, you have to ask yourself the same strategic questions about how exactly do they come into play. Or is it just this kind of vague feeling-your-oats kind of thing? And when you come down to actual Iranian leaders making actual decisions about interacting with Hezbollah, interacting with anyone else, how do nuclear weapons come into play?

It's really hard to lay out a chain of events where you can make the case that they would behave differently from the way they're behaving right now. But you're absolutely right to emphasize the range of motivations – which are probably political, at least as much military – if they do proceed to get a bomb. And with that, my apologies again for having to run off, but thank you.

MR. THIELMANN: I'm thinking maybe we should have constructed this with Paul going first at any rate because now our appetites are whetted to hear some of the judgments on what exactly the status of the nuclear and missile programs are.

We are very fortunate to have our next speaker join us from Harvard's Belfer Center for Science and International Affairs. For many of us in Washington, Olli Heinonen's name is much more familiar than his person. And that's partly because he spent 27 years in Vienna at the International Atomic Energy Agency, not always directly in the limelight but always behind the scenes, serving his last five years as deputy director general and head of the IAEA safeguards department.

In our circles, anyway, he's certainly the most famous Finn that we know. Few outside Iran know the personalities and the facilities of Tehran's nuclear program better than Olli Heinonen. He will not be able to share all he knows but enough, I'm sure, to leave us considerably more enlightened than when we began.

And as Paul alluded to in his remarks, I would like to offer one additional prompt concerning the recent news from North Korea. And I'm sure we would benefit from a little bit of commentary on how we should think about the comparative threat of the Iranian and North Korean nuclear programs.

OLLI HEINONEN: So good morning and thanks for the nice words. I don't think that I'm the most famous Finn because – (laughter) – Formula 1 racers are so popular here. In Europe, it's a different thing.

Well, let me start by saying something about the IAEA reports and Iran. During this period since 2003, IAEA has produced 30 technical reports. The 31st one will come tomorrow [Nov. 23], I was told. It was supposed, actually, to be out today, but for some reason there are – they're a bit delayed. Actually, I was worried when I prepared the presentation because maybe this would be immediately obsolete when we walk out from this room.

These reports have been written for the [IAEA] board of governors and certain of them, also for the U.N. Security Council. And they have been written to comply with the requirements of comprehensive safeguards agreements. So these reports don't have assessments. They don't measure intentions. They just provide facts on how the state might or might not be in compliance with its safeguards agreements and undertakings or Security Council resolutions.

But at the same time, you can read a lot from them when you look it on different way. My father used to be a lawyer, and he said that the law is how it is read, not how it is written. (Laughter.) So you can also read these reports on some other way, and there's a wealth of information which tells where Iran is today with its nuclear program.

Iran's ambitions for enrichment started already in the 1970s. That's also the time when they probably started to have difficulties in compliance with their safeguards undertakings under the comprehensive safeguards agreements because the first step on the uranium enrichment, which stated practical, involved laser enrichment, which they failed to report to the IAEA all the way until 2003.

Many Western countries were involved on that part of program. And Iran didn't hide at all its intentions to get to the fuel technology, and in particular in the beginning, to the enrichment. They also started to look at that point of time at heavy-water reactors as one alternative. Then came the revolution which changed everything. They lost all their Western partners for quite some time, and they tried to compensate this with the know-how from Russia and China and then later from Pakistan.

This concealment which was in place went on for two decades, so it was a daily business, I would say. And then from '80s, they forget to tell about the uranium conversion activities, and then from 1990s, the uranium enrichment.

And then let's look at where we are today. Iran continues, actually, on all of these areas of nuclear technology with the exception most likely of reprocessing. There doesn't seem to be any ongoing [reprocessing] activities.

With regard to uranium exploration and mining – the mining compaction [audio unclear] is operating. It's a small mine, produces perhaps 20, 25 tons of yellow cake per year. This is minimal. If you look at the needs of Bushehr nuclear power plant, you need to have maybe 20, 30 caches to feed that one. So this is a very special effort there, but it's very rich in uranium, so that might – the ore – so that might be one of the reasons why they were looking it.

A second mine which has been under construction last 15 years with the help of Chinese doesn't seem to be yet operational. You see from satellite imagery that they are digging there, dirt is coming out, but this is still probably preparation for the time they'll start construction. Somewhat puzzling why it takes so long time.

Uranium conversion, Esfahan – this is an industrial-scale operation. The facility's able to produce 200 tons of uranium hexafluoride per year. It has been running for the last few years with half of the capacity. Today, if I remember correctly, it's about 360, 370 tons of UF<sub>6</sub> there. That's quite a lot. If you look at the needs of Natanz, maybe you can feed some 20 tons, in a good case, now through that facility. So this will be enough for quite a few years in front of us, in terms of the uranium needs of Iran.

They brought from South Africa a little bit more than 500 tons yellow cake in early 1980s. The contract was just done, actually, just before the revolution. So that's why they got that one. If you look now how much is left of that yellow cake – I think they have now turned roughly half of it to UF<sub>6</sub> or little bit more. So they still have yellow cake also for quite some time. So it's not the bottleneck for the nuclear program.

They may need something for Arak research reactor, which I'll now talk next. They are constructing, as you know, a heavy-water reactor in Arak. It's a 40-megawatt research reactor. When Iran announced- research reactor or kind of test reactor –the reactor in 2003, actually, it came with a caveat. They said at that point of time that this reactor is to replace the aging research reactor in Tehran – TRR – the one where they now want to have 20-percent enriched uranium.

So in 2003, they said that they were phasing it out. They say that it's not safe, it's in the city of Tehran and it's about 40 years old. Now that thing has apparently changed, maybe because Arak is delayed or some other reasons to have that reactor in Tehran. Actually, if you look at technically the way this reactor is designed, these type of reactors are designed, they are ill-suited for isotope production. They are not the best machines.

If you really go seriously to produce isotopes for medical and agricultural purposes, you need much more powerful neutron sources. And with the natural uranium reactor, you cannot achieve such kind of neutron flux. So if Iran wants to produce medical isotopes, the best way is actually to abandon this project, build a research reactor based on the principle of light-water reactor and have much more powerful neutron source.

The uranium enrichment in Natanz continues. I will come later to that, as I do with the -- Qom plant.

Bushehr – they are loading the fuel on to the light-water reactor at Bushehr with the help of Russians.

Actually, this operation is practically all done by the Russian engineers. It's not too well-known, but during commissioning of such a reactor, first two years normally, the Russians are running the whole facility. And only at the end of that period, when it's the first refueling – after that, the full responsibility goes to the state or the owner of the reactor.

And then Iran has also announced that they will construct a light-water reactor at Darkhovin. This place is the same place where the French were planning to build one of their reactors in early '80s. And actually, there was some groundwork already done for that. I know you have seen satellite image of its – has a kind of concrete platform which has been staying there for decades. How successful they are with this project, I don't think anyone really knows. But apparently they have a lot of people involved on that project.

And let's go, then, what we don't know. First of all, Iran is not implementing the additional protocol. It doesn't provide early information about the design of new facilities and construction. The agency will face them only when the chance is come. And then it's not heeding to the requests by IAEA Board of Governors and U.N. Security Council resolutions. They require Iran to provide IAEA with original information.

So therefore, it's a very difficult to forecast, what happens next in Iran. Where are they going, whether it's to do with uranium enrichment, whether it's to do with the laser enrichment. You might remember that few months ago, President Ahmadinejad said that they are also owner of the laser enrichment technology, but at this point of time, they have put their efforts in using gas centrifuges.

R&D on reprocessing is not known. And what's happening with those four new research reactors they announced few months ago? Where they are, what kind of reactors are they – heavy-water reactors or are they using enriched uranium as a fuel? And then, the questions related to nuclear weapon design and manufacturing – those allegations remain to be answered.

These are the numbers of centrifuges which have been spinning in Natanz. And in last one year or so, actually, the number of operating centrifuges has not changed very much. This had gone little bit down. At the same time, the production of UF<sub>6</sub> has been about the same, which means that there is a slight improvement in the operation of the centrifuges.

But having said that, they are not performing the way they should. They run only perhaps at 60 percent of their design capacity. They have been doing it now for one year, so it doesn't look that things are okay. You might also recall that the number of centrifuges which were installed a year – a half [year] ago – was higher than what is today. And the operating centrifuges at one point of time, they boasted that more than 4,000 machines were operating. Today, about 3,000 or little bit more.

So there has been a substantial reduction at one point of time. Actually, you can see from the IAEA records that they removed a lot of centrifuges. There was a time when

almost 1,000 centrifuges which had been installed were taken away entirely from the facility and the new ones brought back. This indicates that there is a problem.

And what is the reason for that problem is difficult to say. Most likely, this has to do with the design itself. These are the so-called IR-1 centrifuges, which you see here. The original Dutch design was then copied or was taken by A. Q. Khan, modified little bit, and then he passed this information in its totality to Iran.

And Iran got the full information on those centrifuges: how you machine, how you put it together, how you test them, how you build your gaskets – all in documentary form. We have seen the same information also in electronic form from the A.Q. Khan network, people who were working with the Libya project. And this is most likely the stuff, which then also went to North Korea around 1990 – or 1999 or 2000.

And this is firm informations that they got it. President Musharraf has written it in his memoirs – what's the name, "In the Line of Fire". There's a small paragraph which talks about it. And the Pakistani authorities have confirmed that.

But the information which went to North Korea most likely had more to do with the P-2 centrifuges rather than the P-1s. And I saw the P-2 here. This is from the video. This was shot during the national nuclear day in Natanz. This is actually half of a P-2. This is called "IR-2" in their language.

So what Sig Hecker saw there a few weeks ago was probably twice higher than this one. This is about this high. A little bit more than a meter. So he should have seen about this-high machine. The rotor here – you see the black one is made of carbon fiber or Kevlar. The speed of that is much higher than the speed of the IR-1 centrifuge. Plus that the radius is higher and as a result of that, the separation power is much, much bigger. These are all indigenously produced in Iran.

With ElBaradei, we visited once in 2006 the laboratory where they were manufacturing them. And that's the only time when IAEA has ever seen the laboratory where these things have been developed. Their goal at that point of time, Aghazadeh told us, was to have everything indigenously produced.

Anything what you see here should have come from Iran. And that's now the problem for the international community. And when I say that, we don't know where they are heading. Because once you call for indigenous design, it's very difficult for intelligence and others to find out what happens. It is done in secrecy in a country.

There's no export-control information. None of that. The only thing what it has impact the nuclear program: it ties a lot of resources. You need to do these things using, most likely, reverse engineering, every screw and bolt you need to produce yourself.

So it takes a lot of talented resources. It's a quality-control problem. Reverse engineering: people think it's easy. Actually, it's not because many of these components

and machines, they have very special things which come only through the experience – how you manufacture them, how you maintain the quality, how it operates.

So it's not an easy undertaking. And maybe this is what we see here now in Iran's nuclear program – tremendous slowing down. It doesn't progress whether you look at the IR-1 in Natanz, the underground facility or you look the R&D which is there.

If we saw R&D in 2006 that they had already rotors, they were spinning, they had got them tested – 2006. There is a thumb rule here which says that if you have that, let's say, that year, the first machine, you do the enrichment test. Next year, you should have about 10 machines and a fairly small cascade running, according to the thumb rules.

And then on the third year, you should be able to have a full cascade, maybe 100 to 200 machines testing. And then on the fourth or fifth year, you should have a kind of semi-industrial demonstration facility with maybe 1,000 machines or 2,000 machines. We don't see it for these new centrifuges. They are still – when you read the IAEA reports, they are doing single-machine tests, small cascade, et cetera. So the question is, what's the reason?

There can be several reasons. First, certainly, is that they still have a problem with the design of these machines. Most likely not, because if you look the experience which they have, and the kick start they got from information provided by A.Q. Khan, by this time they should be able to handle the centrifuge bit.

The next thing is, maybe they don't have raw materials. That's probably the most likely thing because if you look, there's no sign of exports of big amounts of carbon fiber, high-strength aluminum. Most likely, they depend from foreign services. And this might be where the sanctions are biting. It's difficult to buy big quantities. Small quantities you can have and those you see probably on these experiments. So it may be also a combination of those two.

Then, there is a third one. This is certainly the scary one. That this whole thing happened somewhere else. We just don't know. On the other hand, that might be less likely for a number of reasons. First of all, you don't have information pointing to that direction. For Qom facility – for Qom facility was a case in time.

But there was no evidence that – or there's no big evidence that they have got this raw materials and they are building them in big quantities. So I think that what we see here is perhaps more on this first part, which is that they are still struggling with the final design and they have a limitations in getting raw materials.

And then if you'll turn, then, it to the program, Paul Pillar talked about the breakout scenarios. It looks like there might be still time for the negotiations. Since IR-1 seems to be a cul-de-sac, they made there those 3,000 machines. They produced 120 kilos of UF<sub>6</sub> per month. Constant – and even if they put them all in operations, it's only 200 kilos per month.

Who breaks away with one nuclear weapon? I think it's a very simple question. Unless there is a place which we don't know. And into that direction, they should have materials. Then, these are the IR-2s there at the background. You see those machines, this Aghazadeh who was the previous head of Atomic Energy Organization.

This work in Qom is a bit puzzling in the sense that, you know, it's a fairly small facility. Three thousand machines – there's a space. And they said that they started in 2007 when they stopped the implementation of Code 3 of the additional protocol which provides facility information.

However, there is quite a lot of information which points to the direction that this project has been started earlier. When you talk about the 3,000 IR-1 machines, they don't produce very much even in the ideal conditions. Production of – from such kind of installation is very modest. But you can any time put there an IR-2 which is more powerful – or P-2. It doesn't take more space.

So in reality, that floor space is enough to run an IR-2 or P-2 facility if the people so desire. Since then, they have also, as you know, announced that they are building 10 additional facilities. But – and the first one should be – construction should start sometime next year.

I don't think people have much of idea where these places might be. The Agency has repeatedly asked for access to these locations where the R&D is taking place, but Iran has not heeded to those.

The Tehran Research Reactor. I mentioned that originally the idea was to actually replace this with a heavy-water reactor, but then they seem to have changed their mind. This 1200 kilos, which is here on this screen at the low end, is uranium. This is actually what you need if you just want to produce fuel for next 10 years for Tehran Research Reactor. You don't need more.

I think this is good to keep in mind. Because the discussions are going on that so technically, Iran is correct when they say that – 1200 kg. I think it – this is – I don't want to call to this nuclear-weapon related R&D. We seem to have no more time so I look forward to your questions.

MR. THIELMANN: Thank you. (Applause.) And we'll try to hold our questions until after we've heard from our last speaker. Completing our portrait of the Iranian threat is Michael Elleman, a senior fellow for missile defense at the International Institute for Strategic Studies in Washington. Soon to be moving to Bahrain – and at least Mike is going to be moving. A veteran of UNMOVIC inspections in Iraq, Mike worked on DOD cooperative threat reduction programs as a consultant for Booz Allen Hamilton.

And I might say as a participant in earlier national intelligence estimates on foreign ballistic missile threats, I am no longer easily impressed by expert opinion on

this subject. But I am impressed by Mike's empirical approach to missile development programs and would recommend his IISS study on Iran's missile programs as the best available in the open literature.

And I think – I had one to wave here, I guess Mike does also. But I think it's worth looking at. Many things are not rocket science, as the saying goes. But our next presentation will be. (Laughter.)

MICHAEL ELLEMAN: Which button do I hit to advance? That one, there? Okay. Great, thank – thank you very much for that nice introduction. I would also like to indulge in a bit of self-promotion. (Chuckles.) The dossier that we did produce – and I had a lot of help with it with Mark Fitzpatrick and others – is available for order at the [iiss.org](http://iiss.org) website. So enough of that.

Over the course of time, we've seen a number of projections as to what Iran may or may not be able to do with respect to their missile programs. And to date, really, the worst-case scenarios that have been put forth by the intelligence community just haven't come to be.

So this drove us to take a different approach in looking at Iran's missile programs. The dossier – although I was the lead author, so if there's any mistakes I'm responsible for them – did benefit from the participation of experts from around the world including Russia, Germany, France, Israel and of course, the United States.

The key – or the principal contributors all have had experience in either building, doing research or fielding ballistic missiles. So we kind of introduced a new perspective in assessing capabilities. What I'm going to walk you through today is kind of a current picture of what Iran's arsenal looks like, the utility of the missiles that Iran does have. I try to assess their industrial capabilities and look to the future – what might they develop and how long would it take and what signals would they generate.

Now, the basic philosophy we took in conducting this study was to look at capabilities, not threat. In other words, we ignored intention. We wanted to strictly focus on capabilities. And we tried to construct a most-likely outcome picture – not worst-case scenarios, not best-case scenarios.

So with the next slide. This is just an overview of the missiles that Iran does have or is currently working to bring to an operational status. The top four are all solid-propellant systems. And these are all produced in Iran itself. The liquid systems – which is, I guess, the six or seven there below that – are all based on imported technologies. And I'll talk about that in a little more detail.

In terms of numbers, they probably have hundreds of these Zelzals and Fateh-110s. They're still developing the Sajjil and I'll discuss that. With regard to the Shahab-1s and -2, they probably have somewhere in the neighborhood of two (hundred) to 300. Really, the limitation is the number of launchers that they possess. That number's believed to be in the neighborhood of 12 to 18. And then for the Shahab-3 or the Ghadr-

1, they have six launchers that we know of. And the total number is really hard to estimate. But it's probably on the order of 25 to 50.

This is just an overview of the range capabilities. I wouldn't pay too much attention to it. But I would note two things: one, the original Shahab-3, or the Nodong that they imported, lack the range capabilities to strike Israel unless launched from right on the border with Iraq. So they undertook a lot of effort to extend that range. And secondly – and I'll discuss this in more detail – is the range estimates for the Sajjil-2 which appear to indicate that it's capable of hitting targets in Southern Europe.

The liquid-propellant family of missiles they have are really based on two things: either the Scud engine in the case of the Shahab-1 and -2 – which in reality are the Scud-B and Scud-C missiles that were originally developed in Russia. And then you have this series of missiles and space launchers. All of them are based on the Nodong engine. And I'll discuss each of these systems a little bit more detail.

What I wanted to focus on is the development route that Iran took and what it tells us about their indigenous capabilities. Originally, they started with the Shahab-1 and -2 which had ranges of three (hundred) and 500 kilometers, respectively.

Then they procured a new system: the Shahab-3. And as I mentioned, the Shahab-3, which is essentially the Nodong, lack the range capabilities to threaten targets in Israel. So they undertook a program to modify the Shahab-3. They introduced a new airframe, lengthened the propellant tanks so that it could carry more propellant, and reduced the weight of the warhead.

There were some other modifications they undertook. They replaced the steel with aluminum and et cetera. But they were able to extend the range to approximately 1500 kilometers depending on the size of the warhead. If it's the new baby-bottle shape, as some have called it – the triconic design – it probably holds about 600, 650 kilograms of high explosive. So the overall reentry vehicle is 750 kilograms. And that's the point I've indicated on this chart.

What's interesting about this development program – and that was undertaken in the late 1990s and early 2000s – is Iran already had in their possession the Scud missiles. They could have clustered four Scud engines to form a new missile system which is much more capable than the Shahab-3 or the Ghadr-1. So why didn't they take this approach?

We believe that during the late '90s, early 2000, they just did not have the indigenous capabilities to make the modifications necessary to create such a missile. They probably now have that capability. But this is a good indication that they were still very reliant on imports up till about 2000, maybe even as late as 2004.

Last February, they introduced a model of a new space launcher, the Simorgh – if I'm pronouncing that correctly. And it is, in fact, based on the cluster of four Nodong engines. The mock-up presented – there's a lot of inconsistencies with what Iran said it

was capable of doing, how much it weighed, et cetera. They claimed it was 85 tons in weight, 27 meters long. And that it was intended to launch about a 100-kilogram satellite into an Earth orbit about 500 kilometers above the surface of the Earth.

If you take those projections as a ballistic missile – if they underwent the modifications and tested the system, they could toss a 700-kilogram warhead about 5,000 kilometers. But I want to make sure that you understand that, one, this is as mock-up. This hasn't even been tested as a space launcher. And it is not a missile waiting to happen, if you will.

But they do have – in the bottom photo, you'll see – they have invested greatly in infrastructure. And we see this across the full realm of Iran's missile programs. And this is its launch site for this rather large space-launch vehicle. They've claimed that the Simorgh will be initially flight-tested or launched in February of next year. But we'll wait to see if that happens.

Now, what I think is the more significant developments in Iran is the introduction of these solid-propellant systems. In the late 1990s, they began producing the Zelzal rockets. They are on the order of about two-tonned rocket motors. The overall rocket probably weighs about three-and-a-half tons. Then they started converting the Zelzals into a semi-guided system, the Fateh-110.

There have been a number of reports coming out of the Middle East press saying that the Fateh-110 is extremely accurate. Those reports are probably wrong. There's no indication that this system has an ability to terminate the thrust precisely nor does it really have the ability to do any guidance after the boost phase so it is very likely highly inaccurate. But is an improvement over the unguided Zelzal rocket.

Now, the Sajjil-2, this is the most important development that I've seen in Iran. There were rumors or statements made by the Iranian military leaders that they had successfully tested the rocket motor for what would become the Sajjil-2. They first flight-tested this in, probably, late 2007 but it failed, so in 2008, 2009 we've seen a number of tests of this two-stage system.

What's problematic, at least from my perspective is that Iran has now created the tacit knowledge within their own country to produce solid propellant rocket motors and rather large ones. The first stage here is probably on the order of 13 tons. This means that if Iran wants to develop longer-range systems, they have the capacity to do so with very little outside help. However, it will take a lot of time and involve a lot of testing and I'll discuss that in a moment.

So what could Iran use its missiles for? In other words, what's the utility? The missiles they have remain highly inaccurate, therefore militarily, they have very little utility. These two charts just show – I very generously assigned a circular-air probability for the Shahab-1 and the Ghadr. They're probably twice as inaccurate. Is that the proper phrase?

But nonetheless, if you look here you'll see that in order to destroy a hardened target, some kind of fixed-site target, the Shahab-1 has between a 1-in-a-100 and 1-in-a-1,000 chance of probability of actually striking that target. If you convey that same information in a different way, how many missiles would they have to assign to a specific target to have a level of confidence that that target would be destroyed?

You see, again, with the Shahab-1, in order to have, say, a 75- or 80-percent confidence that they could destroy a single target they'd have to allocate a thousand missiles which is more than they have. So in terms of being able to affect the battlefield with their missiles, it's just – it's not possible. They could conduct harassment operations on oil facilities and airfields but, again, the utility would be quite limited.

As a terror weapon, of course, they could be used to strike cities. We've seen this in the past but I would also –looking at it in a very cold-hearted analytical fashion, historically, we see that missiles when they do strike cities they kill typically only around two to three people per missile. In other words, if they unleash their entire arsenal, the casualty levels would probably be in the hundreds not in the thousands or tens of thousands.

Now, nuclear weapons obviously – or warheads, obviously, make a lot more strategic logic. The challenge Iran will face in trying to develop a nuclear warhead for their missiles is it's going to have to be quite small. The warhead or reentry-vehicle design is 600 millimeters in diameter, therefore they're going to have to create a bomb in size and weight that was really, you know, basically consistent with the nuclear weapons that the United States was making in the early 1960s or 15 years after the first test in 1945.

However, I would urge a little bit of caution in kind of accepting this description because there are a number of weapons designs out there and I'm sure Olli can talk about this much more authoritatively than I can. So we have to bear in mind that it is within the realm of possibility that Iran has access to designs that could fit into the Ghadr-1 or the Shahab – or the Ghadr-1 or the Sajjil warhead.

As I noted, there's been a lot of debate in the public realm about the range capabilities of the Sajjil. Uzi Rubin has one view, Ted Postol has another and essentially the arguments they have it's as I say is the tail wagging the dog. What I've tried to do here is, based on what we know about the Sajjil now, the range payload capabilities really could vary from a maximum to a minimum, try to look at what the most likely outcome would be. We see that the Sajjil can fly with a 750-kilogram warhead about 2,000 to 2300 kilometers.

What's interesting is if the initial design of the Iranian nuclear warhead is closer to, say, one ton, which is something on the order of what A.Q. Khan was looking at and some of the other bomb designs, say, Iraq was looking at. The range capability of the Sajjil suddenly falls to about 1600 kilometers which is fine. They can still launch the missile from the middle of the country and strike as far away as Israel.

However, but if you put that same heavy warhead on top of the Ghadr-1, it only flies about 1100 kilometers which means it would have to be launched very close to the border with Iraq. So there is some thought that this Sajjil was actually tailored to accommodate a heavier warhead in the likelihood that, that's what they'll be faced with, you know, coming out of their industries if they so chose to develop a nuclear warhead.

Now, Iran is invested very heavily, obviously, in its indigenous production capabilities and they've made great achievements. However, on the liquid-propellant side, they are still reliant on importing, probably, engines, definitely guidance and control systems. I think they are approaching a capability to actually produce the Nodong engine but we just don't know if they're actually producing them now. If they are, the reliability would be quite low and we'd be seeing a large number of tests and we're just not seeing that.

And the solid-propellant industries are much more self-capable and they can produce larger rocket motors if they chose to do so, which means they can build longer-range systems if they chose to do so. I think the most impressive thing that we observed in looking at the Iranian program was really the disciplined, robust engineering processes that they've adopted in running their programs.

They take a very sophisticated approach in developing new systems. You don't see that in North Korea. In fact, I would argue that they're much more capable than the North Koreans at this stage. But their missiles still are inaccurate and they will remain so for the foreseeable future.

In terms of what they can develop in the future: They are simply constrained that they only have access to the Nodong engine and the Scud engines. They do not have the capacity to design their own engine based on higher-energy propellant formulations, et cetera.

As a result, any large long-range missile they attempt to build with these technologies, the resulting missile will be extremely large. An ICBM, for example, would weigh over 100 tons. That's very problematic because you can't make it mobile, you'd have to launch it from a static site, you can't be above ground because it would be very vulnerable, so you'll have to put in a silo. Silo-launching a 100-ton missile is not simple and they would have to develop some very sophisticated technologies in order to actually launch such a large missile from a silo.

It's our belief that liquid-propellant systems that Iran is using now will eventually be used to sustain their space-launch programs. They have some very great ambitions, in fact, they've talked about putting a man in space before the end of the decade and they just might be able to do that. I suspect that it'll be closer to 2022 or 2025 but bear in mind it is possible if they wanted to take certain risks.

In terms of extending the range of the Sajjil, this is a system that has not been proven and they still have a number of years of flight testing required before that can go operational. They could conceivably make a three-stage system out of this missile.

Would require two to five years of flight testing and that would most likely occur after the Sajjil-2 is brought operational. So a 3500-kilometer range missile is many years away.

Now, they could develop a second generation intermediate-range missile based on a larger engine or motor. But if you look historically at the pace of such developments in other countries like China, France, Russia, the United States, that's probably six to 10 years away. Anytime they introduce a new missile, especially the solid-propellant ones, you're looking at a four-year test program minimum. In other words, we will have a lot of advanced notice of any new capabilities because it's very difficult to hide flight tests.

Based on Iran's history and the very methodical approaches they take to missile development, they will most likely develop an intermediate-range missile before they develop a ICBM so any notion of a 9,000-kilometer ICBM is at least a decade away. Now, some of the recent developments we've seen, well, Iran has not tested any missiles this year except for this one Qiam missile that they tested a few months ago.

I'm not quite sure why they're not testing this year whether it's lack of materials, they're having technical difficulties with their systems or they just don't want to be provocative. I don't know, I don't have any insights to it. But this Qiam test is quite interesting because it's essentially a Scud-C but they've taken the fins off and they've replaced the warhead with something that's very similar to the warhead we see on the Ghadr-1 and the Sajjil.

Why would they take the fins off? Well, it's possible that they want to introduce or start launching these missiles from silos or from canisters where if you remove the fins it's a simpler process, or they're trying to reduce the radar cross section of the missile. The warhead design is very interesting because it essentially makes the warheads interchangeable with the Ghadr-1 or the Sajjil, which have a 1.25-meter diameter.

The separation plane on the Ghadr-1 and the Sajjil has interestingly always been midway up this first flange that you see and the diameter of that separation area happens to be 880 millimeters, which is the diameter of the Scud. So for some reason, they've decided they want to have a common warhead for all their missiles.

Yes, okay, just – I want to touch on something that we saw in North Korea earlier or actually, late last month. They paraded what appears to be the Ghadr-1. This is probably just a mock-up but more interestingly, they paraded the Musudan or BM25 which has been rumored to be in Iran as well.

It is based on the R-27. The comments on the launcher vehicles, I don't know why they've adopted this six-axis launcher for the Musudan because it's the same weight as the Nodong. It's just an interesting – just real quickly want to say something about the R-27 or BM25.

Originally, this is a Russian missile capable of 2400 kilometers with a 650-kilogram warhead. It does use an enhanced-performance propellant combination. However, if Iran or North Korea want to use this missile as a mobile platform, they're going to have to introduce some very significant changes.

It'll no longer be contained in a nice, benign environment of a submarine. Structural reinforcements are required; probably three (hundred) to 400 kilograms worth. And the oxidizer used, in this missile as opposed to the ones used in the Scud and Nodong systems is very temperature sensitive so you have to protect it from outside environment.

It appears the Musudan is about two meters longer than the original R-27. This is probably done to increase the tank space for the propellants so they can overcome the added, inert weight of the structural changes and such. So the range payload performance of this new Musudan is probably very similar to what the original R-27 is. I've seen some reports out there talking about it being capable of 4,000 kilometers. I believe those to be wrong.

Last thing to say: The Musudan or BM25 is a new missile. We've not seen it flight tested in North Korea nor have we seen it tested in Iran. So because it's a new missile it's at least three years away from development once we see them start to test. So I'll conclude with that.

MR. THIELMANN: Thank you, Mike. (Applause.) Okay, we'll move right to questions. We're coming close to the end of our scheduled session, but I think we can go a few minutes over. Yes, sir.

Q: Hi. I'm Allan Krass, formerly with ACDA in the State Department. This question is for Olli Heinonen. Thank you very much for a very, very informative talk first of all. I'm curious about the centrifuges that made the 19.75-percent uranium which I assume was the facility at Qom. And can you tell me, did they use the same basic cascades as they use at Natanz or were these reconfigured cascades?

And the second question I have is when they made this 19.75-percent LEU, do they have any capability that you've seen for fuel fabrication so that they could make the fuel for the Tehran reactor themselves?

MR. HEINONEN: First of all, you know, the production of 19.75 percent takes place in this power plant in Natanz which is above ground. And they started to use the first cascade in February this year with just putting 3.5-percent enriched uranium from one end and from the other end you get 19.75 out. There was no change to the cascade, per se, it's the same 164-machine cascade. You can read it perhaps on the IAEA report.

MR. : (Off mike.)

MR. HEINONEN: Yeah. It seems to be the same thing. But then a change came in during the summer when they – because when you fit in you can – you put in 3.5

percent enriched uranium and you get 20 percent out from the other end. But your tail is still 2 percent enriched so you – really, when you produce 20 percent enriched uranium this way you lose your previous enrichment effort which you have been doing.

So what they did then in summer time was that they turned this 2-percent enriched uranium to another cascade and then when you put it into the other one, you get 10-percent enriched uranium from the other end on that second cascade which you then feed in the middle of the first cascade.

And then as a total you put in 3.5 (percent) you get, practically, natural uranium as a tail and then 20 percent out. And this is important from the economical point of view but also if you want to go to higher enrichments that you gain and you learn a lot. So that's what has taken place there.

Then what we know about the fuel-fabrication capabilities. When they could use this conversion facility from China, the design actually had a very small laboratory-scale plan to produce uranium metal 19.75 percent enriched. So that part of the process, they know what to do. But the fuel for Tehran research reactor, actually, it's a fairly complicated thing to do. It's not simple. It's, I would say, rocket science. (Laughter.)

So to have a homogeneous high-quality fuel is not easy and you have to make, instead of uranium metal you have to have a certain alloy. Whether they have that knowledge from Argentina, we don't know because in early 1990s when they got fuel from Argentina, they certainly went to see how this is done. But this is still sometime away before they can produce that fuel indigenously.

When you read the September IAEA report, they say there that they have undertaken some pre-steps which are actually to produce oxide from UF<sub>6</sub>, using depleted uranium as a test matter. So I would say a year to two for sure will go before this is in that stage and then you need to make sure that the fuel is of high quality because any leaking of it or whatever will jeopardize the whole isotope-production process with it taking place almost in the middle of the town.

MR. THIELMANN: All right, next to.

Q: Norman Wulf, formerly with ACDA in State. First, could I just a quick word about Olli. He did the North Korean account back in the '90s and ended in Iran and now five years as a DDG for Safeguards. He really, I think, epitomizes what we think of as an effective international civil servant.

Two quick questions: On Iran, could you say a word about all the newspaper speculation about this, I don't know how you pronounce it, Stuxnet computer virus, whatever it's called. (Laughter.) And secondly, comment about the utility in your view of the IAEA seeking a special inspection in Syria if we can go there for a moment? Thank you.

MR. HEINONEN: So I am of the opinion, like (Carthage ?) was in Rome, old Rome which says – (in foreign language). So every speech he started – ended by saying that he's of the opinion that Carthage would be destroyed regardless what he was talking. So I guess should start to talk in such a way that I finish every time that, you know, and that we need to have a special inspection in Syria. (Laughter.)

I will return later to Stuxnet. But why special inspection? Because I think that the agency has now hit the wall in order to rectify the situation and to find out whether that was a reactor and whether there have been undeclared nuclear material and activities in Syria.

And there are number of reasons I think it's time Syria has to consider. First of all, information is deteriorating. We have to remember that the destruction took place three years ago. All the corrosion, erosion, people moving – it's more and more difficult to find out what really was there. Every sandstorm which blows over the place will mix and take the uranium away. That's one reason.

The second reason is that I think it's a flagrant violation, maybe the biggest if this turns out to be a reactor. It's probably the biggest violation of the safeguards agreement ever. Iran is more modest – you can't compare. They've had centrifuges, they have small amounts of material. But these guys went and they're planning to build a nuclear reactor which had it not been destroyed would be producing plutonium today – probably under IAEA safeguards but nevertheless.

So and you know, if the international community cannot rectify this situation, this I think is also erosion for the NPT regime because if the regime is not able to solve it, then individual states will think the task is on their own hand – like Israel in this occasion. So do we want that? And then what's the purpose of IAEA? What's the purpose of NPT if that's the case?

And then there are other reasons. Think about the prospect where perhaps North Korea's involved. What are these engineers and scientists doing today? Are they doing this or are they doing something else?

And there are quite a few questions out there which need to be rectified. Was the uranium – what were these experiments done in Damascus? What's the relation of Homs uranium recovery or yellow cake production experiments to this – which all point to a direction that they might be or might have been undeclared nuclear material and activities.

So I think we have come to – like Caesar to the Rubicon River. And now it's time to decide whether to cross the river or continue like it is. And every day which passes from here on, I think there are less opportunities to verify what is there and what took place.

The Stuxnet, I think it's very difficult to say whether this is the one which is causing the troubles with the Iranian nuclear program. There are people who are better

off in touching it than me ever. I'm not computer scientist, but, well, this kind of processors are used to control nuclear processes, so it may be possible that they are also in Natanz or Bushehr or elsewhere.

But to get it going there, that's a hard thing because if you do it, you need to have a lot of insider information in order to do that – how to get the centrifuges to go out of balance and run too fast. It's also dangerous because if you sell this to some other process in some other country, doesn't go to Iran.

It may cause a lot of havoc. These controllers are used widely in industry, so I'm personally a little bit skeptic that whether this was really aimed solely for that purpose. But I don't think that there is any evidence and inside knowledge in the IAEA or from the IAEA reports. It could be one of the factors.

And I go back to some of the statements by the Iranians, and I think was in 2006 – January – when Aghazadeh said that they have had problems with the frequency converters. So he gave an interview to one of the newspapers in Tehran. And this the time when he started to advocate that they need to have more indigenous production in order to keep things under their control. So that's my answer to the Stuxnet.

Q: Thank you very much. (Inaudible) – university. I'd like to ask Mr. Elleman to say a few words perhaps about Iran's defensive-missile capabilities. I think much of what you said were – offense systems. In your opinion, how much they have advanced and specifically – I think, a couple days ago, it was mentioned that Iran has – or trying or planned or decided on developing their own S-300 systems. What do you think about that? Thank you.

MR. ELLEMAN: Very interesting question. Want to say two things about Iran's current air-defense capabilities. I mean, they're very – they're highly reliant on Hawk missiles which they acquired before the revolution. And I believe they have SA-2 and SA-5 systems.

Unfortunately for Iran, they don't have a central architecture for their missile – their air-defense systems, so they're quite limited in capability, and they're very vulnerable to electronic countermeasures and anti-radiation missiles, et cetera.

Now, Iran has been attempting, as we all know, to purchase the S-300 from the Russians. That sale apparently has not gone through. Their acquisition of a Russian-built S-300 would not significantly improve their overall air-defense capabilities because they just lack the architecture to really build an effective system which would be kind of centered around the S-300.

Recall that the S-300 is more than just missiles. It's seekers, all sorts of radar systems, et cetera. So if Iran is claiming to have made indigenously their version of the S-300, I would be dubious of such claims. It's more likely they have been able to produce a booster rocket that's very similar to the S-300's booster rocket.

But I would question whether they have developed the sensors and controllers that are in the Russian version of the S-300, let alone the integration of that missile into an overall radar and air-defense architecture. So I think the – their claims are very boastful and not grounded in reality.

MR. THIELMANN: I've been favoring this side of the room. Let's go to Andrew.

Q: Andrew Pierre, USIP. At the NATO meeting just completed, the alliance sort of adopted in general the notion of creating a European-wide missile defense. I gather that Iran was not specifically sort of mentioned at that point, in the justification that the last months – if not year or two – Iran has been cited for that.

I gather from your presentation, Mr. Elleman, that you see some intermediate-range capabilities developing – but perhaps slowly and with problems – and I'm not going to ask you whether – I welcome your advice or your thoughts on the problems with developing missile defense, European-wide. But more generally, I'd be interested in whether you think that the alliance is correct or wise to focus its notion of missile defense on the Iranian threat. And if it's not the Iranian threat, what is it?

MR. ELLEMAN: Well, I believe for political reasons they – the announcements coming out of Lisbon specifically – they did not explicitly mention the Iranian threat. And I think this was done to appease some of the NATO members, especially Turkey, who fought very hard to have that language dropped.

But I don't see any missile programs anywhere else that would necessarily be capable of reaching Europe. The Syrians have some nascent programs. It appears that they may have an ability to produce the M-600, which is really a copy of the Fateh. It has a maximum range of something like 250 kilometers. So they're a very long way away from being able to develop anything that could even approach targeting Europe.

Pakistanis have some missiles, but they certainly lack the range for now. The Indians have some systems which they have tested, but they don't really deploy them. But again, I don't see them being an issue for NATO.

So just by deduction, I think that the whole system is centered around the Iranian threat which – there is no indication that Iran is trying to develop a missile capable of striking Europe. That means to date, everything they've done looks to be consistent with developing a force capable of threatening targets as far away as Israel.

If they decide to build longer-range systems, it's going to take time and they're going to have to undergo a series of test programs that will be very visible to outside observers, which will provide some advance warning – at least three to five years of advanced warning of a new capability – which allows NATO to adjust their missile defense strategies accordingly.

MR. THIELMANN: Right here in the middle. Wait for the microphone.

Q: With respect to the IAEA's inspection regime, I was wondering if all of you could elaborate on how robust do you think that is and how reassuring the entire regime is with respect to non-diversion since the Iranians have made quite a lot of noise as to the cameras and the unannounced inspections and so forth. So given the fact that the talks are coming up and this is a key issue with respect to transparency, could you shed some light on that, please?

MR. HEINONEN: Thank you. If we go to the very basics of NPT and safeguards agreements, the job for IAEA is to make sure to detect the diversion of declared nuclear material and to make sure at the same time that all nuclear material in a state has been declared at least under the IAEA precaution.

So in other words, you need to also to confirm the absence of clandestine material or clandestine processes. And this is where the IAEA has now a difficulty. While the inspection regime in Natanz is really robust – I think it's almost impossible to divert material from there – certainly small quantities, you can always – you cannot make sure that someone takes away one gram or a hundred grams. But in terms of tens kilos or something like that, it's not very likely. They probably will be caught.

The problem in the case of Iran, and therefore no matter how much you inspect Natanz, it doesn't provide any assurances what happens elsewhere in Iran. And that's where the problem of IAEA is because Iran doesn't implement the additional protocol, so our agency doesn't know much about the R&D, doesn't know anything about the mining – what they are doing, where the yellow cake goes, et cetera.

The Agency has also limited access rights to the sites because no additional protocol and no provisional early information is another [inaudible] which is reducing the probability to find clandestine activities or to provide credible assurances that those don't exist.

So what's happening now when you look at – over the period of time – yes, Natanz is in a good control. Yes, Esfahan is in a good control. But the overall knowledge: when Iran's nuclear capabilities goes this way, the agency's understanding of the nuclear program goes that way – until they agree to implement the additional protocol and provide the necessary access rights.

MR. THIELMANN: I think we'll take one more question – maybe Dean – and then we'll have the room for just a few more minutes, but you can catch the speakers afterwards maybe for – if you have a burning issue. Thank you. Dean Rust –

Q: We hear a lot of speculation in the press about a breakout capability all the time. And we sort of – there's speculation about how long that is, with the suggestion that if we don't either solve it by that time, that we either have to attack them or live with an Iranian nuclear weapon.

But what's wrong with the scenario that Iran just continues to produce only LEU for as long as it prefers and just kind of keeps the international community at bay from the standpoint of solving it from the current perspective?

As long as they only produce LEU, they never reach a breakout for development and if they go breakout, they're only going to invite strong reaction anyway. So I don't quite understand why there's so much of an impression that we have to do this quickly or else – and if we don't solve it, then we either have to attack or we end up with nuclear weapons.

MR. HEINONEN: Thank you. This is actually about risk assessment which Peter talked before. (Laughter.) But when you look at testing from this declared P-1 program, as I said, I don't think it's a realistic scenario at this point of time that they break away with 3.5 percent enriched uranium (inaudible) – so low is this uranium because of the poor performance of the centrifuges, for that simple reason.

Certainly, two years, three years from now, situation is perhaps different because you have – start to have a stockpile plus you may have this more advanced centrifuges available. So the game will, so to say, change at that point of time. I think that in a short, foreseeable future it's not very likely scenario to go for breakout.

MR. THIELMANN: We thank you for your good questions and your attendance. And let's give a round of applause to our speakers.

(Applause.)

(END)