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Going Nowhere Fast:
The Debate Over the Time Required for Iran to Produce a Nuclear Weapon's Worth of Highly Enriched Uranium and ISIS's Refusal to Publish Its Calculations

Since 2008, I have written extensively on Iran's centrifuge enrichment program describing how Iran is moving ever closer to a nuclear weapons capability. A key element in many of my papers has been the calculation of the time required for Iran to produce a nuclear weapon's worth of Highly Enriched Uranium (HEU) should Iran decide to do so. In 2008, I estimated that it might take Iran two to four years to produce the HEU needed for a nuclear weapon but by June 2011 this time had shrunk to only two months.[2] On August 9, 2011, I published a comprehensive look at Iran's push towards nuclear weapons which contained this two month calculation.[3]

On September 20, 2011, the Institute for Science and International Security (ISIS) and its President, David Albright, published a critique of my calculations set forth in my August 9, 2011 paper.[4] Among other things, this critique said: "ISIS found on balance no justification to change its earlier breakout estimate of six months at the FEP."

On October 19, 2011, I published a response to ISIS's September 20 critique.[5] I pointed out that the ISIS critique was entirely qualitative, with ISIS presenting no calculations of its own. After extensively reviewing prior ISIS writings I concluded that ISIS had not published any "earlier…six month" estimate applicable to Iran's current centrifuge enrichment capabilities and stockpiles of enriched uranium. I noted that many of the assertions in the ISIS critique represented a significant change from statements that ISIS had published in 2009 and 2010. I also noted that previously published ISIS calculations contained a number of errors.

On October 27, 2011, ISIS published a response to my response.[6] Though claiming to "debunk" me, ISIS has actually confirmed much of what I said in my October 19 paper. In ISIS's latest piece, the only reference to any prior ISIS calculation regarding how quickly Iran could produce HEU is to a February 2010 document. In this document, ISIS estimates that using 3.5% enriched

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[2] Gregory S. Jones, "Out of the Spotlight Iran's Rate of Enriched Uranium Production Continues to Increase: Centrifuge Enrichment and the IAEA May 24, 2011 Update," June 2, 2011, http://npolicy.org/article.php?aid=1043
[3] Gregory S. Jones, "An In-Depth Examination of Iran's Centrifuge Enrichment Program and Its Efforts to Acquire Nuclear Weapons", August 9, 2011, http://npolicy.org/article.php?aid=1092&rt=&key=Greg%20Jones&sec=article This paper was summarized in the article: Greg Jones, "No More Hypotheticals: Iran Already Is a Nuclear State," *The New Republic*, September 9, 2011 http://www.tnr.com/article/environment-and-energy/94715/jones-nuclear-iran-ahmadinejad
[4] David Albright, Paul Brannan and Christina Walrond, "Critique of Gregory Jones's Breakout Estimates at the Natanz Fuel Enrichment Plant (FEP), September 20, 2011.
[5] Gregory S. Jones, "Recalibrating Tehran's Nuclear Breakout Capability: A Response to ISIS's Critique of NPEC Calculations Regarding the Time Required for Iran to Produce a Weapon's Worth of HEU," October 19, 2011 http://npolicy.org/article.php?aid=1105&rid=4
[6] David Albright and Christina Walrond, "Debunking Gregory Jones Again," Iran In Brief, October 27, 2011.

uranium feed, Iran could produce enough HEU for a nuclear weapon "in less than six months."[7] Such an estimate could hardly be applicable to Iran's situation today. In the intervening 21 months, Iran: (1) has greatly increased the separative capacity of the FEP (from 2,500 SWU per year to 4,300 SWU per year); (2) has increased its stockpile of 3.5% enriched uranium (from 1,190 kilograms to 3,070 kilograms); (3) has started producing 19.7% enriched uranium; (4) has begun an expansion of it centrifuge facilities in order to triple the production of 19.7% enriched uranium; and (5) has produced a stockpile of 48 kilograms of this material. Yet despite these advances in the Iranian enrichment program, in their October 27, 2011 paper, ISIS's estimate is now "at least six months."

Indeed, in its October 27, 2011 paper ISIS says, "Over a year and a half ago, ISIS decided to modify its approach…" thus confirming that it has changed its views since 2009 and 2010. ISIS goes on to say "Since then, ISIS has applied more sophisticated calculations by a well-known centrifuge expert who uses a fixed plant production model in the case of FEP breakout." As in their September 20, 2011 paper, ISIS provides no link or reference to any publication containing these calculations, which demonstrates that they are unpublished. It is with unintended irony that the current ISIS paper says about me, "In his August 9, 2011 paper, he does not appear to be aware of ISIS's newer calculations…" This is hardly surprising since the first public mention of these "newer calculations" was in ISIS's September 20, 2011 paper. Further in some sense I am still unaware of these calculations because ISIS *still has not published them*.

In their September 20, 2011 paper, ISIS raised various qualitative objections to my calculations but presented no calculations of their own. Yet in ISIS's latest paper they chide me for not presenting "a detailed calculation" to refute their unsupported verbal assertion that the method I use for my calculation is "unreliable." Apparently ISIS feels that only I must actually support my estimates with calculations. It is small wonder that while ISIS complains about the "inordinate length" of my October 19, 2011 paper, theirs is very short.

ISIS cites U.S. Government and Israeli estimates as contradicting my current estimates but these estimates are about a year and a half old. They can hardly be relevant to Iran's current situation given Iran's substantial increase in enrichment capacity and enriched uranium stockpiles. This raises one of the many problems caused by ISIS's refusal to publish its "newer calculations". How new are they? If ISIS believes that year and a half old U.S. Government estimates can be compared to my much more current estimates, then it is clear that ISIS has failed to appreciate just how dynamic Iran's nuclear program is which is all the more surprising given that ISIS has chronicled Iran's rapid progress in its own publications.

ISIS claims that a mistake in their March 3, 2010 paper is not really a mistake.[8] ISIS claims that when they said "uranium" what they were really saying was "uranium hexafluoride." ISIS attempts to blame me for not figuring this out. Though ISIS using the wrong chemical term is already a serious error, their problem is more fundamental than just that. In the paragraph in

[7] David Albright and Christina Walrond, "Iran's Gas Centrifuge Program: Taking Stock," February 11, 2010, p.12.
[8] This is a mistake that I pointed out in my October 19 paper. See: Gregory S. Jones, "Recalibrating Tehran's Nuclear Breakout Capability: A Response to ISIS's Critique of NPEC Calculations Regarding the Time Required for Iran to Produce a Weapon's Worth of HEU," October 19, 2011, p. 5. http://npolicy.org/article.php?aid=1105&rid=4 The ISIS paragraph in question is located on p.4 in: David Albright and Christina Walrond, "Supplement to *Iran's Gas Centrifuge Program:* Taking Stock," March 3, 2010

question, ISIS presents calculations of the possible annual HEU production rate at the FEP. These calculations are given for three different starting materials: natural uranium, 3.5% enriched uranium and 19.75% enriched uranium. For the calculation starting from natural uranium, the results are only correct if ISIS meant "uranium" when it said "uranium" but for the other two starting uranium enrichments the results are only correct if the ISIS meant "uranium hexafluoride" when it said "uranium." Clearly ISIS cannot consistently distinguish between uranium and uranium hexafluoride and this is not the only ISIS paper where ISIS has confused these two substances.[9] Indeed, ISIS tacitly admits this in their October 27, 2011 paper: "we have sometimes been guilty of not specifying which units we are using" and "we have since instituted a policy to clearly state the units."

ISIS states regarding my calculations "Jones merely used a separative work calculator and later attempted to justify his choice by citing Glaser." Whether I found Glaser's article before or after I performed my calculations should hardly be of intense interest to those whose main concern is when Iran might obtain nuclear weapons.[10] That ISIS focuses on this detail illustrates ISIS's tendency to get lost in minutia. More importantly it again demonstrates that ISIS cannot keep the facts straight. On September 12, 2011, David Albright sent me an ostensibly friendly email asking how I had performed my calculations. That same day I sent him this response:

> "Yes, I assumed that the cascades are ideal. When I first started doing these calculations in 2008, I didn't make this assumption since it was obvious that the cascade shape going from natural U to 3.5% enriched U wasn't proper for taking 19.7% to 90%. However, **Glaser's work showed** that one could change the flow through the cascade to increase the enrichment achieved in each batch recycle step without losing separative work …" [Emphasis added]

In other words, I specifically told Albright the opposite of what ISIS claims in its October 27, 2011 paper. Other observers have had no trouble noticing that in 2008 I was not using separative work calculations.[11] Though the ISIS has suggested that NPEC should "seek additional review of Jones's work before they publish it," it seems that ISIS's concerns over quality control should actually be focused much closer to home.

How quickly Iran could produce a nuclear weapon should it decide to do so is an issue of critical importance. I have calculated that Iran could produce the HEU for a nuclear weapon in just two months. On September 20, 2011, ISIS said that it has calculated that it would take Iran six months instead. In their October 27, 2011 paper, this statement has morphed into "at least six months," though in February 2010, ISIS was estimating "less than six months." I have been very explicit about how I performed my calculations and what my starting assumptions are. ISIS however, has refused to publish its calculations. ISIS apparently feels that its wondrous verbal descriptions of its calculations are sufficient justification for them. However, ISIS's refusal to

[9] Indeed, this problem is so pervasive that when reading ISIS publications I have found it necessary to perform my own independent calculation to determine each time when they use the term "uranium" whether they actually mean uranium or uranium hexafluoride. Can ISIS really expect such diligence from all of its readers?

[10] The article in question is: Alexander Glaser, "Characteristics of the Gas Centrifuge for Uranium Enrichment and Their Relevance for Nuclear Weapon Proliferation", *Science and Global Security*, Vol. 16, 2008.

[11] Michael A. Levi, "Drawing the Line on Iranian Enrichment," *Survival*, Vol. 53, No. 4, August-September 2011, pp.180-181.

publish its calculations raises numerous questions. When exactly did the ISIS perform these calculations? Are their starting assumptions current? Is their six month estimate intended to be a "best-estimate" or a "worst-case?" Since the ISIS has demonstrated that they cannot be relied upon to consistently differentiate the simple difference between uranium and uranium hexafluoride, are ISIS's calculations even correct? Until ISIS decides to actually publish its calculations, making its methods and starting assumptions clear, there is no way to resolve these issues. Instead the current debate between us is "going nowhere fast."