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Furthering Non-Proliferation through Program Coordination

Introduction

The task is put before the world: *To stop the global threat of nuclear terrorism.* In response, the nuclear superpowers have implemented several important and far-reaching programs. These programs point the way assuredly to a safer future, but, in many instances, they are hampered by a lack of adequate resources. The program to disposition excess Russian military plutonium is a case in point, as it struggles to corral the needed financial and political support.

Though funding limitations certainly can inhibit progress, I believe that more can be done to maximize the value of the funds that are available, by taking a broader view of program goals and by finding and leveraging common ground between programs, both non-proliferation and other programs. At this time, potential synergies between programs are not systematically identified, budgets are not combined, shared goals are not elucidated. To the contrary, the inter-program culture often appears to be competitive, as rival projects vie for limited resources, recognition, and control.

It's not a stretch to conclude that a narrow viewpoint jeopardizes the non-proliferation goals, rendering us passive when we could be making real progress and thereby protecting ourselves and our children and our children's children from the threat presented by nuclear weapon materials.

My presentation today proposes that synergies can be identified, even between existing programs, and that a new and coordinated way forward for fighting nuclear terrorism on an international scale could be defined to the benefit of all concerned. It involves identifying the mission overlaps and actively partnering the existing non-proliferation and other nuclear infrastructure programs to leverage their financial and technical resources, while maintaining each program's individuality and independence.

Potential Synergies

To illustrate the concept, consider three of the key non-proliferation and related programs sponsored by the U.S. and Russia:

1. Global Nuclear Energy Partnership Program

- GNEP's vision is the recycle of spent nuclear fuel without the separation of plutonium, and the use of fast reactors to burn down the waste products. The intent is to maximize the energy extracted from nuclear fuel, minimize the amount and radio-toxicity of waste for disposal, and minimize the risks of nuclear proliferation. The vision extends to an international fuel-leasing concept, such that spent fuel is repatriated to an existing fuel cycle country.

- GNEP is actively seeking the involvement of other countries including Russia, the United Kingdom, France, and Japan, to help develop the needed technologies.

- There are two key reprocessing technologies on the GNEP list: UREX Plus and pyroprocessing. Neither has yet been demonstrated at the industrial scale with spent fuel, though Russia is developing a pyroprocessing technology for oxide fuel fabrication.

- At face value GNEP could be well-funded, with a U.S. budget proposal of $250 million in fiscal year 2007, though the final appropriation may be less. However, the need to develop, design and construct a suite of new fuel cycle facilities and reactors will require funding rates to be substantially increased over the next decade or so. Even with full funding, it is unlikely that the full suite of new facilities could be up and running in the U.S. much before 2025. Any funding shortfall would push this milestone further into the future.

2. Joint U.S.-Russia Plutonium Disposition Program

- This program is intended to degrade or destroy the weapon-grade plutonium withdrawn from dismantled weapons pursuant to the START treaties. The concept is simple: use the plutonium as the fissile component of nuclear reactor fuel, irradiate it. This would reduce both the quantity and quality of the plutonium, and protect it with a potent radiation barrier. What remains can then be safely stored along with the conventional spent uranium fuels.

- The program emerged from bilateral agreements between the U.S. and Russia in 1998 and 2000, but eight years along significant issues still hinder progress in Russia: Not least is sticker shock. At around $3 billion, the overall costs of the Russian plutonium disposition program far exceed the total pledges to date from the international community. U.S. congressional support is mixed, and future support for the program remains up in the air.

- Another potential “fly in the plutonium disposition ointment” is that while the program seeks the destruction of plutonium in thermal reactors, Russia’s current plans for its BN-800 fast reactor could produce new inventories of high-grade plutonium. This runs counter to the goals of the Plutonium Disposition Program, and already has blunted enthusiasm for the program in some quarters.

- Although the program will run for some 30 years, it cannot embrace advanced reactor systems for two major reasons: 1) the prohibitive cost of construction of new reactors, and 2) the technical and time-scale risks inherent in advanced, unproven systems.

3. Hydrogen Fuels Program

- The International Partnership for the Hydrogen Economy launched in 2003, envisions vehicles running on clean-burning hydrogen rather than oil. However, to gain the energy independence and pollution benefits, fossil fuels must be eliminated from hydrogen production. The new high temperature nuclear reactors promise to be the most cost-effective and deployable energy source for this purpose.

- Substantial funding has been identified, with a request for almost $290 million in FY 2007. However, that includes less than $20 million for the development of the nuclear technology, which seems small compared with the demands of designing and building not only new reactors, but also a new generation of specialized fuel fabrication and waste processing facilities.

As you can see, the next-step challenge for all the above programs is to have both reactors and fuel cycle facilities up and running as soon as feasible. This creates a huge demand for both technology development funds, and funds for

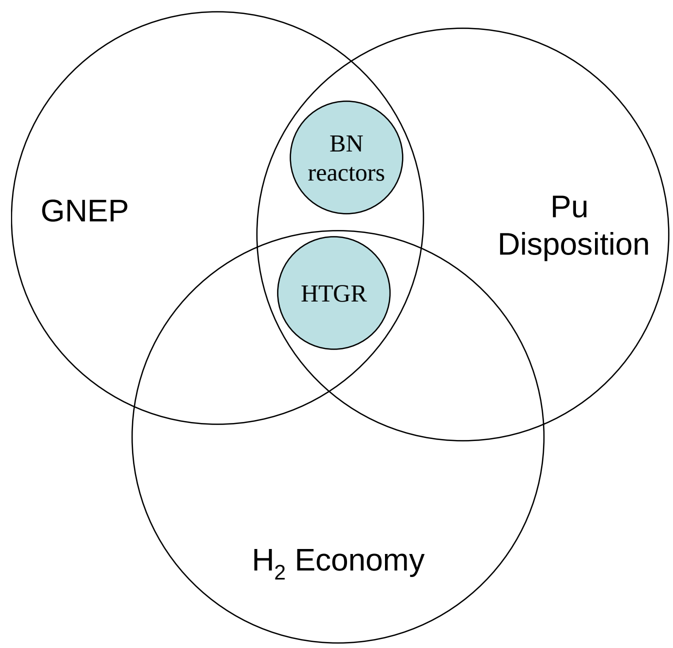

Figure 1: Progam Overlap

construction of major new capital facilities. The expectation in all cases is that funds availability will be the rate-limiting issue.

A key observation here is that there are overlaps in goals and in the facilities required. See Figure 1. For example: the BN-600 and BN-800 reactors are both potentially compatible with the GNEP mission, and could help the plutonium disposition mission. The high temperature gas reactor can disposition plutonium, it can also burn actinides, and it runs hot enough to produce hydrogen. As such it could contribute to all three programs.

There are potential synergies, but little, if any attempt is being made to realize them. What is needed is a new approach.

Introducing the Beloyarsk International Science Center

As an example of what might be possible, consider the creation of an International Science Center at Beloyarsk in Russia. The Beloyarsk NPP is home to the BN-600 fast reactor, and, from 2012, will be home to the larger BN-800 fast reactor. These reactors are far from “experimental”. The BN-600 has a lifetime load factor of over 73%, exceeding the performance of many of Russia’s thermal reactors.

The BN-600 is presently fueled with high enriched uranium, but the BN-800 will burn MOX fuel, as part of a closed fuel cycle, At this time, Russia has neither the MOX fuel fabrication nor the reprocessing facilities needed to support the BN-800. New fuel cycle facilities must be constructed, and this opens possibilities for cooperation.

Construction of conventional Purex reprocessing facilities, which separate plutonium, could endanger one of the largest and most important non-proliferation efforts as mentioned earlier. But consider: What if the opportunity were taken to build advanced fuel cycle facilities instead, inviting international participation under the GNEP, plutonium disposition, and GEN-IV banners? The facility could conceivably be operated as an International Science Center, modeled on Russia’s proposed International Enrichment Center, under IAEA safeguards with international participation in the science related aspects. There could be significant benefits to Russia in terms of international funding, and even technology transfer.

There could also be significant benefits for the international community, see Table 1. Let’s take a closer look at the International Science Center (see Figure 2). The center may or may not include reactor operations themselves, but certainly could include all fuel cycle and technology development activities, as well as irradiation programs in the reactors. The facilities created for the International Science Center would benefit at least three major international programs: Russian plutonium disposition, GNEP, and GEN-IV. Although these programs would independently pursue their own goals and objectives, they would be able to share in the costs of facility construction and operation.

The BN reactors could conceivably become a GNEP platform for testing actinide fuels, supported by advanced fuel cycle facilities, thus helping to blaze the trail for advanced, proliferation-resistant fuel cycles. The reactors and their supporting facilities could be available substantially earlier than the new facilities to be constructed in the U.S., giving an important jump-start to the GNEP mission. Both the BN-600 and the BN800 reactors could cost-effectively destroy weapon-grade plutonium, and, if plutonium from the blanket were not to be separated, a potential deal-killer for the plutonium disposition program would be removed.

Table 1: Shared Facilities and Benefits

GNEP	**Plutonium Disposition**	**GEN-IV**
Shared Facilities		
Fast Neutron Reactors	Fast Neutron Reactors	Fast Neutron Reactors
Fuel Fabrication Facility	Fuel Fabrication Facility	
Advanced reprocessing facility		
Benefits		
Acceleration of overall program objectives	Access to the BN-800 as a plutonium burner	Test bed for fast neutron reactor studies
Early facilities for advanced fuel cycle development	Removal of the BN-800 as a program inhibitor	
International Participation		

The Russian reactors exist or are under construction, and a fuel fabrication facility will be constructed simultaneously with the BN-800 reactor. Reprocessing facilities are likely to be constructed before 2020. In contrast, the U.S. GNEP facilities are expected somewhere in the mid 2020s.

Through shared costs and the availability of multi-tasking facilities, the Center would allow individual program managers to benefit from the combined financial resources, putting them in a better position to achieve their overall program goals.

Additionally, the Center could later be integrated or affiliated with the International Enrichment Center to enable the leasing of nuclear fuel to newly emerging nuclear countries.

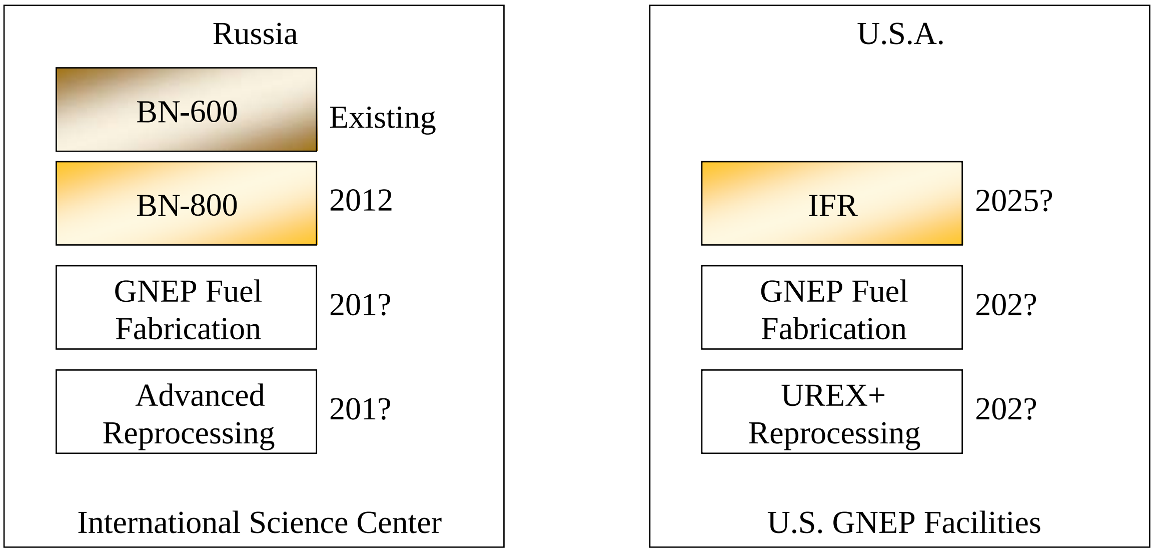

Figure 2: Advanced Fuel Cycle Facilities

Where are the downsides? Would the creation of an International Science Center slow down the BN-800 project and thereby harm Russia's plans for expansion of its nuclear power industry? I would argue that the answer to this question is undeniably "*no*."

A MOX fuel fabrication facility is needed immediately, but none exists at present. If this facility were to employ the Russian pyroprocessing/Vibropak technology, as is currently being tested for BN-600 fuel, and provided with adequate shielding, it could be later adapted to actinide fuel types.

A spent fuel reprocessing facility is not an immediate requirement because the stockpiles of plutonium are overly plentiful. Using stockpiled plutonium initially would allow time to develop the technology for an advanced facility.

Of course, the Beloyarsk reactors are not R&D facilities but rather commercial power reactors. The use of large power reactors in international research and development programs was pioneered by France with the Superphenix and Phenix projects. Although there are tensions between scientific research and electricity production, the French experience shows that these issues can be managed.

The Next Challenge

It is easy to concede that the mechanics of program funding and control do not lend themselves readily to program coordination. Every program manager could produce a list of obstacles to program coordination. However, it is important to recognize that these obstacles are artificial, whereas the potential benefits are real.

As we all know, nothing succeeds like success, and success breeds success. Early successes build momentum for subsequent work. You do not have to be a nuclear engineer to figure out that the ultimate rewards of such a cooperative non-proliferation venture could be enormous in terms of reducing global security risks — the overarching goal that we can't afford to lose sight of. These programs are far too important to our anti-terrorism efforts to let them stumble.

So the challenge becomes: How can we best realize those rewards?

Let us take on the challenge!