Outline

• Introduction and background
• Progress to date
• Issues for NSAC
• In 2001, our field gave RIA highest priority for new construction.
• In 2003, the DOE Office of Science gave RIA very high ranking in its 20 Year Vision.
• In 2006, DOE announced that they would not proceed with the construction of RIA, but were interested in a lower-cost facility to be constructed early in the next decade.
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**Programs:**
- ASCR = Advanced Scientific Computing Research
- BES = Basic Energy Sciences
- BER = Biological and Environmental Research
- FES = Fusion Energy Sciences
- HEP = High Energy Physics
- NP = Nuclear Physics
Background

• In 2001, our field gave RIA highest priority for new construction.
• In 2003, the DOE Office of Science gave RIA very high ranking in its 20 Year Vision.
• In 2006, DOE announced that they would not proceed with the construction of RIA, but were interested in a lower-cost facility to be constructed early in the next decade.
This letter requests that the Department of Energy (DOE)/National Science Foundation (NSF) Nuclear Science Advisory Committee (NSAC) establish a task force to perform an evaluation of the scientific ‘reach’ and technical options for the development of a world-class facility in the United States for rare isotope beam studies within the funding envelope described below, and in the context of existing and planned research capabilities world-wide.

The results of this study should determine whether a forefront facility that will produce outstanding science in an international context within the suggested funding envelope can be defined, and if so, should identify the best option(s) for this facility. The report should contain sufficient details of the scientific capabilities and reach of the facility to inform the scientific community and NSAC in their development of the Long Range Plan, and sufficient technical detail so as to provide the guidelines to define such a facility in a request for proposals.

Please submit your final report to the DOE and the NSF by the end of March 2007. We realize that the development of this report during the period that NSAC is embarking on its long range planning exercise introduces an additional burden; however, it is believed that the information and guidance that emerges from this exercise on the requested timetable will be valuable to both the agencies and NSAC in its planning exercise.
Task Force Members

- Ewart Blackmore, TRIUMF
- Rick Casten, Yale
- David Dean, ORNL/UT
- Ed Hartouni, LLNL
- Claude Lyneis, LBNL
- Brad Meyer, Clemson
- Jerry Nolen, ANL
- Thomas Roser, BNL
- Brad Sherrill, MSU
- James Symons, LBNL, Chair
- Bob Tribble, Texas A&M, ex officio
- Sherry Yennello, Texas A&M
What we have done so far

• We met with the agencies and clarified the budget guidance and other matters.
• We held a three day meeting in Chicago during which, we:
  – heard detailed presentations from MSU and ANL describing ISF and AEBL, each of which is based on a 200MeV, 400kW HI Driver;
  – learned about upgrade plans of existing RIB Facilities;
  – learned of the challenges of using existing light ion drivers such as SNS.
  – were briefed by the Chairs of the RISAC study.
• Two hard-working subcommittees were formed
  – Cost Analysis, Thomas Roser, Chair
  – Scientific Reach, David Dean, Chair
• We met for two days in Berkeley to discuss recommendations.
What we have not done

• Rework the analysis of RISAC
Committee membership

- A committee with broad membership was sought in order to critically examine the scientific stakes
  - Experts both inside and outside of rare-isotope science were included
  - To balance the need for expertise and objectivity, known enthusiasts and known skeptics were also included
  - To help understand the global perspective, three international members were recruited
  - To ensure independence, committee co-chairs came from outside the immediate field but were broadly familiar with the science and policy of nuclear physics

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<th>John Ahearne, Sigma Xi / Duke</th>
<th>Stuart Freedman, Berkeley</th>
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<td>Ricardo Alarcon, Arizona State</td>
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<td>Adam Burrows, Arizona</td>
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<td>Gerry Garvey, Los Alamos</td>
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<td>Robert Jaffe, MIT</td>
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<td>Steve Libby, Livermore</td>
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<td>Michael Romalis, Princeton</td>
<td>Paul Schmor, TRIUMF</td>
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<td>Shoji Nagamiya, J-PARC</td>
<td>Michael Wiescher, Notre Dame</td>
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<td>Stan Woosley, Santa Cruz</td>
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What did RISAC say

“Nuclear science is entering a new era of discovery in understanding how nature works at the most basic level and in applying that knowledge in useful ways.”

“This report identifies a compelling scientific agenda for a future facility.”

“The committee believes that studies of nuclei and nuclear astrophysics constitute a vital component of the nuclear science portfolio in the U.S. Failure to pursue such a capability will not only lead to the forfeiture of U.S. leadership but will likely erode our current capability and curtail the training of future American nuclear scientists.”

“The committee concludes that a next generation, radioactive beam facility of the type embodied in the US FRIB concept represents a unique opportunity to explore the nature of nuclei under conditions that previously only existed in supernovae and to challenge our knowledge of nuclear structure by exploring new forms of nuclear matter.”
What did RISAC say?

• “As a partner among equals, a U.S. rare-isotope facility constructed in the next decade could be well matched to compete with the new initiatives in Asia and Europe and would support world-leading thrusts within the United States.”

• “Instead of arriving early on the science with a new facility, the United States might arrive last with FRIB, although the facility could have unique capabilities compared to other facilities available at that time.”
Technical Options for a World-Class facility

• the facility must address at least some of the outstanding scientific opportunities endorsed by RISAC;
• it must be complementary to other facilities, worldwide;
• it must have a compelling day-one science program.
• Comparable reach to RIA, at half the cost
• Two questions come to mind:
  – How can this be?
  – Is there another factor of two to be found?
How can this be?

- Beam Power is an important parameter for isotope production
- Linac costs scale with energy
  » If we can decrease the energy of the driver but maintain the power, costs can be saved
- Success of the RIA R&D Program
  - Multi-charge state acceleration
  - Performance of VENUS Ion Source
- ANL (AEBL) and MSU (ISF) have developed designs for drivers with half the energy of RIA and twice the current
Comments on the cost review

- Two comprehensive, thorough, different estimates
- Both AEBL and ISF have demonstrated that a high intensity RIBF can be constructed at a much reduced cost relative to RIA
- If you take 60% out of the budget, something has to give:
  - Multi-user capability
  - Top energy (EOS Physics)
  - Trust fund for detectors
  - ‘Soft elements’ e.g. Pre-ops
Comments on Scientific ‘Reach’

• Interesting Questions
  – How should we compare reach of different facilities?
  – How does reach vary with energy (and cost)?

• Teaser:
  – FRIB will be worth waiting for
  – Below 200MeV/nucleon, Heavy Ion Drivers lose ‘reach’ rapidly
  – Further significant cost-cutting will require a different technology or a different approach
What remains to be done

• Finish our Report
• Submit it to NSAC ‘by the end of March’

• This will be done in time for discussion at the LRP Meeting in Galveston
So

• No details today, but . . .
In anticipation, the LRP Group may wish to

• Read the RISAC report; others will
• Think hard about timelines, budgets, and the history of the past 6 years

• “Insanity: doing the same thing over and over again and expecting different results.”
  – Albert Einstein

• We have to get it right this time