Response to PPAC Report on Director's Vision for 5-Year Plan

The Director's Kitchen Cabinet (DKC) was requested to review the recommendations of the Policy and Planning Advisory Committee (PPAC) for the contents of the next TRIUMF Five-Year Plan. In particular, the DKC was asked to provide a first-stage reality check on the endorsements of the PPAC before detailed technical reviews can take place. In addition, the DKC was asked to provide a list of the greatest strengths and weaknesses of the Five-Year Plan as viewed by the TRIUMF Engineers and Scientists. The PPAC report was discussed at a DKC meeting on March 17, and a first draft was circulated to all KDC member, both past and present, and then discussed at a following meeting on March 19. This is a summary of the points raised.

The PPAC essentially endorsed all six points of the Director's Vision, those being the E-Linac, Life Sciences, Fundamental Symmetries, Ultracold Neutrons (UCN), High-Energy Physics and SNOLAB.. While PPAC represents a broad cross section from the university user community, it identified the highest priority to be the substantial increase in beam availability at ISAC.

The greatest strengths of the Director's Vision were identified as:

- It represents a balanced approach to achieving the most urgent scientific objectives that are accessible to TRIUMF. The PPAC's prioritization of these scientific objectives is also balanced, and the DKC is in agreement with it.

- It builds on the strengths of TRIUMF as the nation's center of accelerator science and technology, while greatly increasing the productivity of the ISAC facilities through the addition of new production targets and beam lines. Not only are the existing beam lines heavily oversubscribed, but the high-priority scientific goal of studying fundamental symmetries with beams of rare isotopes will require careful studies of systematic effects that can be expected to consume longer periods on targets stations than is typical for present experiments. Adequate resources and scheduled time will be needed on the new beamline in order to develop the target technology required to exploit the expanded facility.

- It is well balanced between the on-site and off-site programs, maintaining TRIUMF as Canada's Laboratory for Nuclear and Particle Physics in its own right as well as placing TRIUMF in a strong position in the arena of international collaborations such as the ILC, LHC, SNOLAB and smaller university-driven projects, enabling them to leverage TRIUMF expertise and facilities.

The greatest weaknesses of the Vision were identified as:

- It cannot succeed without substantial hiring, particularly in the area of On-site Accelerators, given that the Accelerator Division is presently over 90% committed to the operational responsibilities of the current program. The construction period of ISAC-I absorbed 80 FTEs.

- It relies on the construction of a building with funds from the Provincial Government to house the new ISAC target stations, without which the top items in the 'Accelerators On-Site' and 'Subatomic Physics On-Site' categories cannot be implemented.

- The timeline of the plan appears unrealistic on first inspection by the DKC, which consists mainly of TRIUMF personnel that will be responsible for the execution of the plan. The '5-Year Plan' seems more like a long-term Vision, given the experiences of the last two plans and taking into account rising construction costs and timescales. It is agreed that stating a long-term vision is good, but greater care should be taken in defining what can and will be *completed* in this 5-Year Plan.

The overall response of the DKC was that the Director's Vision, as modified by the PPAC, was generally accepted. It was recommended by most present that Senior Management now implement a more detailed costing and reality check of technical issues involved in the higher priority large items in the Vision. Management should now also move forward to review different budget scenarios, being clear as to what comes under 'General Infrastructure' and what are highlighted projects. They should be particularly careful at this point not to over-commit accelerator/physics manpower. In particular, the DKC seemed to reach the consensus that the ultimate goal of delivery of 3 RIBs to ISAC would be the optimum scenario to exploit the facilities on the floor for a world-leading physics program. Management should focus on detailed studies for the major items relevant to attaining this on a reasonable timescale, and what can be achieved in this 5-Year Plan, including what can be achieved under different funding scenarios. Management should now choose the optimum scenario to present to the Advisory Committee on TRIUMF (ACOT) meeting in May. While attention needs to be paid to the details mentioned in this document, the DKC felt there is no more need to come back to the TRIUMF community after this point.

Summary of points raised during discussion

Some technical and global points were raised during the DKC meeting that should be heeded by management before proceeding with the next phase of the plan, and are summarized below.

1. Accelerators On-Site
    a. The DKC takes issue with one comment made by PPAC, which designated the 400 uA capability of the cyclotron as less urgent than the other elements of onsite beam delivery. It seems that the PPAC may have assumed that protons would never be delivered to two ISAC targets simultaneously at full intensity; instead only running the E-Linac while protons were delivered to one of the other targets, which would in fact result in undesirable limitations. The new proton beamline is intended to be independent of the E-Linac, in that the flexibility to run any combination of BL4N, BL2A, and the E-Linac should be inherent. This

will allow the most efficient operation of the ISAC facility, including servicing multiple experiments and beam/ion-source development (at full intensity) while paving the way for simultaneous 3-RIB operations. In order to achieve this, the cyclotron must be capable of delivering 100 uA to each of BL1A, BL2A and BL4N simultaneously, not forgetting BL2C and the important isotope production program, which brings revenue to the lab. Since the cyclotron really requires a 300 uA capability to run the *present* program efficiently, something which has not been achieved yet, it is clear that to support the intended new program, 400 uA must be the critical operating capability. Furthermore the DKC see only relatively small resource requirement differences between a 300 uA and 400 uA upgrade and the benefits of the 400 uA upgrade vastly outweigh the extra effort, cost and manpower. We strongly recommend that the 400 uA upgrade be given high priority alongside the new proton beamline, in place of the suggested 300 uA 'upgrade'.

b. The DKC considers the combined set of proposed activities related to the development of accelerators and beam lines to be too ambitious to fit within one five-year plan, given that about 90% of the present resources of the accelerator division are fully occupied in operating the existing facilities. Management might review what is actually achievable in a realistic scenario. For example, is the capability of producing new beams at full intensity more important than providing simultaneous delivery to low-, medium- and high-energy experiments at ISAC? If so can the proposed new DTL and RFQ be postponed until the next plan, leaving the capability of new full-intensity beams simultaneously delivered to the low-energy and either ISAC I or ISAC II experiments?

c. According to the preliminary resource estimates given to PPAC, development and then operation of all of the new ISAC beam lines in addition to the endorsed off-site accelerator development would require an increase of the TRIUMF staff by about 20%. It seems doubtful that it would be feasible to make this many quality hires on the time scale required for this 5-year period. The alternative would be to divert resources from ongoing beam delivery (as was done in the case of ISAC-I). The DKC believes the ongoing program to be too valuable for that, and so would prefer to interpret the mentioned "staged approach" to mean that the new facilities will be built within the schedule allowed by the above constraints. Those projects that would logically be built first should be selected for detailed costing.

d. Related to the above point, the question of housing new staff should be addressed. Is there a plan to temporarily house new staff while construction is underway? Will this affect how current staff members, who are also fighting for space, are housed? (The existing `temporary' containers may be approaching the end of their lifespans.) Also, if the

goal is to triple the number of graduate students, where will they find desks? If it is really contemplated that so many people be added in order to complete the proposed program in 5 or even 10 years, will they all be needed to operate the enhanced facilities? Can the number be reduced substantially, by converting builders into operators?

e. The Vision schedule depends on early funding of the required buildings by the province. It was pointed out that, if the buildings aren't started until 2010, then they won't be ready for occupancy until 2013, as the architectural design itself takes about a year. The expansion of the ATLAS Tier-1 centre beyond 2011 also heavily depends on the new buildings.

f. A challenge associated with the two new production targets is that they are intended to be based on a new much-improved conceptual design that is still under development. This design will reduce the downtime for target changes from two weeks to two days. Hence it will not be a matter of simply building more targets similar to the present pair. Also, the feasibility of the design for actinide targets won't be known until completion of the forthcoming 2 uA test. A minor cautionary note here is that it seems unwise to mention any large beam current like 200uA as a goal for the actinide target, as it is well justified at much lower currents, and becomes useful even at a few uA. The present priority for fundamental symmetries is more shifts of beam time to study systematic effects, not high fluxes. However, the capability to put 200 uA down that tunnel should be built in from the start; this is essential not only for essential high-current tuning of the cyclotron, but for the long-term future of the facilities.

2. Accelerators Off-Site
    a. The Vision calls for investing at least some intellectual effort into machine studies for both ILC and sLHC, The DKC would like to suggest caution here, as the ILC schedule is subject to increasing uncertainty, especially until some results emerge from LHC. Unless adequate manpower is available, it will be difficult to work on both the ILC and sLHC.

3. Life Sciences
    a. The DKC notes that, while the Vision calls for the accelerator division to dominate new hires in the next five years, the life sciences, as endorsed by PPAC, comes second with 17 new hires, with relatively few elsewhere. The DKC is not alarmed by the emphasis on life sciences, as this might be seen as compensating for recent hiring emphasis on nuclear and particle physics in the present 5 years.

4. Molecular and Material Sciences
    a. The DKC endorses the positive recommendations of the PPAC. In

particular, the helium liquifier is recognized as urgent, and as it will be almost cost-neutral to TRIUMF in the longer term, should be scheduled early in the next 5-year cycle.

b. One opportunity that PPAC was not in a position to recognize is that only a relatively modest effort spent on improving the design of the present muon production targets on BL1A could yield about 50% more muons, either increasing the scientific output of the CMMS program, or relieving the scarcity of proton beam current for all uses. (Present maintenance problems of these targets may anyway mandate a redesign.

5. Subatomic Physics
   a. On-site: The DKC agrees with PPACs assessment that costs of the UCN project and its impact on other meson hall activities are presently poorly known, and require detailed engineering study. Comments were made to the effect that UCN could be seen as a direct competitor for target design resources with the initial BL4N beamline construction. However. the PPAC appear to have prioritized the projects such that the new proton beamline will be considered the top priority, in line with the Director's Vision.

   b. Off-site: The Vision calls for some detector development for ILC. The above cautionary note about the ill-defined ILC schedule applies here also. Peer-reviewed NSERC funds appear to be more appropriate as the main support for this activity. In addition it was also noted that in view of the importance of simulations to both Off-site and On-site experiments, TRIUMF should at the very least maintain a strong base of expertise in terms of detector simulation (i.e. GEANT4).

6. Generalized Infrastructure
   a. Curiosity-driven detector development can be most fruitfully pursued in collaboration between universities and TRIUMF. While it would be difficult for a university to support all the technical expertise, experience and infrastructure needed for such efforts, TRIUMF can share these resources with the design and construction of instruments for ongoing experiments, with both activities benefiting. Hence, care should be taken to complement rather than compete with university efforts.

   b. New personnel will be required at all levels, not just junior ones. This would include administrators, engineers, supervisors and technicians, and they must be given time to become trained and familiar with TRIUMF way of doing things and its unique technologies, including working in a radiological environment. Management should consider the processes involved in hiring and training all these core personnel and factor this in to the relevant timescales of the plan. The resources of many groups are currently stretched and diluted. With the advent of new projects it may be

time to consider a fundamental restructuring of support groups i.e. 500 MeV Safety Systems and ISAC Safety Systems. The differing technologies may justify this in some instances.

c. The impact and large overhead of the recent additional regulatory requirements of CNSC were not present during the last 5YP.. The long-term resource plan must take this into account.

d. DAQ Support: There appears to be increasing reliance on in-house and University-built electronics systems, and a movement away from traditional commercial suppliers. TRIUMF should ensure within its next 5-Year Plan that we are in a strong position in this arena and not allow it to become a bottleneck for our projects/facilities.

Appendix A: DKC membership (current and former)[1]

Phil Gardner	Paul Delheij	Lothar Buchmann
Chris Ruiz	Matt Pearson	Greg Hackman
Igor Sekatchev	Jens Lassen	Shane Koscielniak
Yuri Bylinksy	Fred Bach	Colin Morton
Rolf Keitel	Phil Jones	John Drozdoff
John Ng	Achim Schwenk	Makoto Fujiwara
Reda Tafirout	Andy Miller	Chris Oram
Mike Adam	Bassam Hitti	Stan Yen
Nigel Lockyer	Jean-Michel Poutissou	Paul Schmor
Rick Baartman	Gordon Ball	John Behr
Pierre Bricault	Barry Davids	Jens Dilling
Akira Konaka	Syd Kreitzman	Robert Laxdal
Mark Clive	Glen Marshall	Art Olin
Marcello Pavan	Roman Ruegg	Tom Ruth
Isabel Trigger	Anne Trudel	Pat Walden
Richard Woloshyn	Rolf Keitel	Byron Jennings
Ewart Blackmore		

[1] This list represents past and current members of the DKC who were given the opportunity to comment on the PPAC report but who were not necessarily in attendance at the DKC meetings of 17th and 19th March.