Snowmass2021 Letter of Interest

"Nurturing the Industrial Accelerator Technology Base in the US"

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Problem Statement

There is a widespread perception within the Industrial sector that the United States DoE and National Laboratories do not transfer accelerator technology to US Industry and thence to market as well as they should. The US SBIR program is a great asset to help small businesses to develop new capabilities, and it is the envy of many other countries, but the DoE does little to nurture its small businesses across the "Valley of Death". Consequently, the US winds up developing accelerator technology and then often finds itself buying back from abroad for its home projects because US firms are not cost competitive (e.g. LCLS-II SRF cavities). This is generally not the case in Europe or Asia which understandably work to nurture their home Industrial bases. This also tends to create an uneven playing field when US firms attempt to compete overseas.

Discussion

Now, this does not mean that there is no successful US Accelerator Technology Industrial base. There are in fact at least four successful US Accelerator Technology (AT) Industrial models. Firstly, there are small business SBIR houses specializing in software, diagnostics and other mostly one-off products. Secondly, there are many mid- to large-sized firms for whom Accelerator Technology is a successful sideline but not their mainstream business. Thirdly, there are companies that specialize in power supplies, magnets, high-vacuum products, electronics and so on for whom Accelerator R&D projects are a secondary business. Finally, there are established medical X-ray and oncology accelerator suppliers generally utilizing older technologies. What is missing are modest-sized US companies that retain leadership in niche markets, such as undulators, SRF cavities, and other high-tech AT components. Pavec, AES and the undulator portion of STI Optronics are all out of business, Niowave is focused on medical isotopes and Roark is strongly engaged with FRIB but not yet a general supplier capable of competing with the likes of Research Instruments, GmbH.

US companies in virtually any technical field lead the rest of the word by example and in market share. Yet, this is not the case in the DOE ecosystem where domestic Industry barely exists and continuously falls behind its foreign counterparts. When we (AT community) need to purchase high quality magnets we are referred to Buckley (New Zealand), we buy SRF cavities from Research Instruments (Germany), scientific grade lasers from Amplitude and Thales (France), top of the line klystrons from Toshiba/Canon (Japan), and solid state modulators from Scandinova (Sweden). When this equipment is being installed and commissioned, we use Cosylab (Slovenia) consultants to connect it to the control systems, and this list goes on. These companies are the leaders in their technical fields, and nobody can possibly blame the US project managers for wanting to buy from the best, rather than take chances with less prominent domestic suppliers. However, how did we in the US find ourselves in this backward position vis-à-vis industry, while our National Labs have been leading the technology development for decades? The need and market for an industrial base are clearly there (as is exemplified by the success of the European and Asian companies), but at the same time the domestic industry is not adequately supported to serve this need, nor is nurtured to evolve along with it.

This problem may extend well beyond the AT field, and any structural macroeconomic roots are definitely beyond the scope of this paper. However, microscopically, within the AT community it is clear that there is simply lack of initiatives, instruments, and incentives within DOE/Labs ecosystem to support domestic AT industry in any systematic way; and in such environment the gap with foreign AT industry is

only destined to grow. The goal of this LOI is not necessarily to offer definitive policy guidelines, but to start a long overdue conversation, by first recognizing the problem, and then trying to learn from the AT community in the countries which have been much more successful in addressing this issue.

Giovanni Anelli, Knowledge Transfer (KT) Group Head, CERN has provided the Snowmass 2021 A&I subtopic group with an excellent reprise of CERN's procedures. He has noted the importance of siting the KT group within the Industry, Procurement and KT department at CERN to maximize the impact to Industry. Secondly, he stressed that maximizing licensing money was the wrong metric for technology transfer (TT) success and that rather the goal of the KT group is to "maximize the technological and knowledge return to society in particular through Member States industry". We strongly endorse this vision which does not appear to be the driving force for present DoE and US National Laboratory TT.

With respect to the DoE SBIR program, there are many aspects that make crossing the "Valley of Death" difficult. A key issue encountered in the current process is developing a product and not just a prototype for a Lab, and then bringing that product to a marketplace that just consists other Labs. If a market can be found, converting a prototype to a product will typically require a reliability demonstration and technology/design optimization to develop a production line. A small R&D company needs strong collaboration with a Lab to accomplish these tasks and requires additional infrastructure funding which is generally not available. The difficulties is that Labs tend to invest resources only if they have a strong interest in applying the technology to their project, and only if they have their own R&D along the way. Meanwhile a company has to protect its IP and find some way to share the final product IP with the Lab. This is not easy.

Goal

There is a two-pronged goal of this LOI which suggests that DoE revisit its TT processes and metrics and better nurture its on-shore Industrial base to bring more AT-derived products to market. The first goal is to develop a stronger US Accelerator Technology Industrial base, capable of competing with International competitors for overseas business, that consequently also better supports the HEP mission, National Laboratories and the US economy. Secondly, it is hoped that additional Laboratory-derived applications and technologies, going beyond direct accelerator technology relevance, will be brought to market to benefit the US economy.

Recommendations

Review National Laboratory technology transfer, licensing processes and successes. Modify the Laboratory IP metric system to align with the CERN model and to reward market insertion over dollars accumulated by the Labs. Ensure that there are no regulatory headwinds in National Labs wider engagement with the domestic industrial suppliers in supporting the Laboratories procurement needs.

Study National Laboratory in-house fabrication across the board and find ways to push much more of this work to Industry, when it is appropriate. Minimize Laboratory in-house design efforts that reduce non-R&D procurements to build-to-print solicitations.

Adopt a more "European" approach to nurturing smaller on-shore high-tech accelerator technology companies and engage them into policy making as equal and important stakeholders while preventing subsidized and/or not always performance-liable foreign entities from competing purely on the basis of cost with domestic industrial suppliers.

Address the frequent lack of downstream markets for SBIR widgets, more accurately value market insertion from the SBIR program, expand the I-Corps Program to help address the "Valley of Death" problem, and consider expanding SBIR Phase 2b / Phase 3 and beyond programs to aid in commercialization.