

**Snowmass 2021 Letter of Interest: US Particle Accelerator School Long Term Needs  
to Support Training Accelerator Scientists and Engineers**

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The [U.S. Particle Accelerator School](#) (USPAS) is a national graduate-level program that provides training and workforce development for scientists and engineers working on, or aspiring to work on, charged particle accelerators and associated systems. We have carried out two intensive format sessions (Winter Session in January; Summer Session in June) per year in roughly the same format since 1987. Our sessions are two weeks in duration and “host” universities award graduate-level academic credit to students enrolled. Sessions are typically held in hotel/conference centers and include 8 classrooms with 10-14 courses (a mixture of full-courses and topically paired half-courses that are half-session duration) serving the specialized topics of our field that are impractical to cover at any single university. Locations of the sessions move around the country and connect to regional accelerator centers. Students from universities, laboratories, private companies, medical facilities, government, and the military attend. Students are primarily from university graduate programs or early-career status from domestic national labs, but are a diverse group. By convening a critical mass of focused and engaged students targeted to their topics, we attract leading scientists to deliver high-quality courses. Our grading and academic rigor distinguishes us from seminar and workshop series. Our short duration sessions make it easier for national lab instructors to teach, and students enroll expecting an intense, but rewarding experience. Students and instructors at our sessions make valuable professional contacts which are career enhancing. USPAS course materials are valued resources in many sub-fields and have resulted in an ever-expanding library of 17+ books. The school is managed by Fermilab as a service to the broader field with input from the full community. A large fraction of workers in the field, including many distinguished leaders, have been to USPAS sessions as a student and/or instructor.

The basic framework of the USPAS continues to work well. Over the last two years, our pre-pandemic sessions have consistently drawn record highs. This likely results from: healthy accelerator programs with new facilities and upgrades; the USPAS using more and larger coordinated teaching teams which increases contacts and draws in students; our strategy to link more courses to key topics and accelerator centers; as well as expanded student programs from the DOE traineeships, the IU/USPAS MS program, and the Cornell CBB. Our students have little trouble finding work in field – particularly in key DOE need areas like accelerator systems and modeling, RF engineering, SRF, and cryogenic engineering. Students are being drawn more to high-tech industry (~1/4) enhancing shortages. Workforce needs are likely to remain high given demographics in the national labs and program needs. Having the best quality training is also key to maintaining technical leadership. The USPAS cannot easily expand beyond 8 concurrent classes with ~175 students due to limitations in typical lower-cost venues that we can afford and office limitations given the high setup load associated with coordinating a distributed academic school serving credit. Students also report problems securing funding to attend our sessions. The USPAS offers limited financial aid (registration, including ½-board, and shared room; but no travel). University grants and lab project funding are usually not structured to reflect training needs. Session setup is also becoming increasingly technical with courses and our web site exploiting cloud-computing resources, and course augmentations expanding in various technical directions. This enhanced effort has also been compounded by pandemic-related stresses inducing much rapid reworking/planning and transitioning at least one 2021 session to online.

We have the following long-term recommendations to enhance the USPAS:

1. **Enhanced staffing** to enable needed school initiatives/extensions and improve stability.
  - **Increased Director Time.** (\$70-135k/year) Post our 2016 DOE reorganization, USPAS director time was reduced from a historically full-time position to ½-time. Increasing this to ¾- to full-time, would allow addressing strategic needs (see 2-5 below) and new initiatives such as: coordination of shared materials for classes, better evaluation of workforce and school performance, outreach to HBCUs and women's colleges to address diversity issues, etc.
  - **½ - 1 FTE Increased Office Help.** (\$80-160k/year) The school presently has 2 FTEs of experienced office staff at Fermilab. This is insufficient at recent higher student/instructor counts and leaves no margin for contingencies, extended roles, and long-term planning/transitions. Training periods would be long since tasks are broad. Additions should be targeted to assist in increasingly technical areas (cloud computing services, database, website extensions, classroom management software, etc.).
  - Increased staffing (with technical alignment for office help) enables 2-5 below and also improves contingency for situations like the ongoing pandemic which has dramatically increased loads while attempting to rapidly reconfigure sessions.
2. **Carry out long-range evaluations of workforce needs and school performance metrics** to allow better targeting of courses and guide DOE and the labs on needs.
  - Workforce data needs consistent yearly gathering: the USPAS is well situated to do so.
  - USPAS has been gathering limited hiring data from the ten collaboration labs governing the school. This has been useful, but much benefit is possible from extensions.
  - Positions of former USPAS students and school gender & diversity could also be better tracked to assist planning and evaluation of school performance.
3. **Shared materials initiative** to develop and maintain shared archives of core topic notes, problem sets, etc. to increase course quality while reducing preparation load and time for instructors.
  - Provides a natural collaboration opportunity with international accelerator schools.
4. **Assist instructors to post videos/tutorials and other course augmentations** as a community service.
  - Use/configure Fermilab SharePoint resources with the USPAS web site to archive course materials with augmentations (extensions, videos, etc.). This avoids losing valuable community-resource materials when external servers disappear.
5. **Cloud computing** to bring enhanced performance to students both in and outside of sessions.
  - Use vendor cloud computers with loaded software accessed via a browser interface on each student personal laptop or tablet (\$30 k/year).
  - Use of RadiaSoft Sirepo cloud installed codes/ GUI with enhanced support to maintain examples/problems for the school (\$20 k/year) and additional class software (\$10 k/year).
  - Cloud software can allow students to access codes and their examples (including those linked to augmentations) outside of the sessions to enhance their research/work.
  - Reliance on cloud computing necessitates an enhanced venue network (\$40-60 k/year).
6. **Extension of synergistic student travel awards** now provided by the APS Division of Physics of Beams in a program integrated with USPAS financial aid, which cannot generally support travel.
  - Present APS DPB awards (5-8/session) only part alleviate common difficulties that students experience funding travel. This program is also structured to stimulate DPB membership – which is needed to maintain vital division status for the field.
  - Encourage industry to augment DPB travel support.