**BUDGET JUSTIFICATION**

**University of Pennsylvania**

**Personnel:**

**Benjamin Pierce**, Professor,Principal Investigator (2 months annual effort) The PI will oversee all aspects of the project and will directly supervise the two PL-focused PhD students and the engineer. See the Management and Coordination plan for more details.

**Andrew Head**, Assistant Professor,Co-PI (2 months annual effort). The co-PI will directly supervise the two HCI-focused PhD students.

**Engineer**, TBD (12 months annual effort) The engineer will lead the technology-transfer tasks described under the Diffusion theme and will support the implementation-oriented research tasks led by PhD students. See the Management and Coordination plan for more details.

**4 Graduate Research Assistants**, TBD (Y1: 3 GRA each 12 months annual effort; Y2-Y5: 4 GRA each 12 months annual effort)) Four doctoral candidates will be recruited to lead the various proposed research tasks. See the Management and Coordination plan for details.

**10 Undergraduate REPL Students**, TBD (2 students per year, 3 months annual effort). Two undergraduate students will be recruited each summer as hourly lab assistants, as part of the project’s BPC activities. See the Broadening Participation in Computing supplement for details.

The University of Pennsylvania reports the effort of the faculty and graduate students as a percentage of monthly effort. The University does not report or record hours or hourly rates for these positions. The effort detailed in this budget is based on an historical estimate of projects of this nature by the PI’s.Funded effort is requested in monthly increments. Therefore 1.0 equals 1 month, 0.5 equals 1/2 month and so on. For purposes of estimating, partial months can be calculated on the basis of an average 22 working days per month. Hourly rates for other categories are based on a 40 hr work week.

**Employee Benefits:**

The employee benefits rates are proposed at **30.5%** for faculty and staff and 9.0% for undergraduate students. These rates are based on our federal rate agreement dated June 24, 2022 and are subject to change. In lieu of any employee benefits, graduate students receive tuition and associated fees (including health insurance) which are also treated as a direct expense to this project.

**Domestic Travel ($9,000/year):**

Funds are budgeted for the principal investigators and/or other project personnel to travel to scientific meetings relevant to the project; the precise conferences and locations below are estimates based on projected conference publication targets and past locations where these conferences have been held. The purposes for the travel include dissemination of results and direct interaction with peers in the field. Included in the budget estimate is airfare, registration, hotel, and per diem.

Travel expenses have also been included for annual PI meetings near Washington D.C.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Year** | **Purpose** | **Destination** | **# of People** | **# of Days** |
| Yr. 1 | Annual PI Meeting | **Washington, DC** | **2** | **2** |
| Yr. 1 | Working Group 2.8 Meeting | **New York, NY** | **1** | **8** |
| Yr. 1 | Speaking Engagement | **Boston, MA** | **1** | **2** |
| Yr. 1 | PLATEAU Workshop | **San Diego, CA** | **2** | **2** |
| Yr. 2 | Annual PI Meeting | **Washington, DC** | **2** | **2** |
| Yr. 2 | ICSE Conference | **Austin, TX** | **3** | **7** |
| Yr. 2 | PLDI Conference | **Santa Barbara, CA** | **3** | **6** |
| Yr. 2 | POPL Conference | **St. Petersburg, FL** | **3** | **6** |
| Yr. 2 | CHI Conference | **San Jose, CA** | **3** | **6** |
| Yr. 2 | PLATEAU Workshop | **Pittsburgh, PA** | **2** | **2** |
| Yr. 3 | Annual PI Meeting | **Washington, DC** | **2** | **2** |
| Yr. 3 | Strange Loop Conference | **St. Louis, MO** | **2** | **2** |
| Yr. 3 | CHI Conference | **Denver, CO** | **3** | **6** |
| Yr. 3 | PLATEAU Workshop | **San Diego, CA** | **2** | **2** |
| Yr. 4 | Annual PI Meeting | **Washington, DC** | **2** | **2** |
| Yr. 4 | ICFP Conference | **St. Louis, MO** | **4** | **6** |
| Yr. 4 | Working Group 2.8 Meeting | **Snow Bird, UT** | **1** | **8** |
| Yr. 4 | POPL Conference | **Los Angeles, CA** | **3** | **6** |
| Yr. 4 | PLATEAU Workshop | **Pittsburgh, PA** | **2** | **2** |
| Yr. 5 | Annual PI Meeting | **Washington, DC** | **2** | **2** |
| Yr. 5 | PLATEAU Workshop | **San Diego, CA** | **4** | **2** |
| Yr. 5 | UIST Conference | **New Orleans, LA** | **3** | **5** |
| Yr. 5 | Working Group 2.8 Meeting | **New Orleans, LA** | **1** | **8** |
| **Total Travel Costs** | | | | |

**Foreign Travel ($8,000/year):**

Funds are budgeted for the principal investigators and/or other project personnel to travel to scientific meetings relevant to the project; the precise conferences and locations below are estimates based on projected publication targets and past locations where these conferences have been held. The purposes for the travel include dissemination of results and direct interaction with peers in the field. Included in the budget estimate is airfare, registration, hotel, and per diem.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Year** | **Purpose** | **Destination** | **# of People** | **# of Days** |
| Yr. 1 | ICFP Conference | **Vancouver, Canada** | **3** | **6** |
| Yr. 1 | Lambda Days | **Krakow, Poland** | **2** | **2** |
| Yr. 1 | TFP Conference | **Sophia-Antipolis, France** | **3** | **4** |
| Yr. 1 | POPL Conference | **Mumbai, India** | **3** | **6** |
| Yr. 1 | CHI Conference | **Seoul, South Korea** | **3** | **6** |
| Yr. 2 | ICFP Conference | **Nara, Japan** | **3** | **6** |
| Yr. 2 | Working Group 2.8 Meeting | **Rejkyavik** | **1** | **8** |
| Yr. 2 | Yow! Lambda Jam | **Melbourne, Austrailia** | **2** | **2** |
| Yr. 3 | FSE Conference | **Bergamo, Italy** | **3** | **5** |
| Yr. 3 | HATRA / OOPSLA | **Vancouver, Canada** | **4** | **6** |
| Yr. 3 | UIST Conference | **Quebec City, Canada** | **4** | **5** |
| Yr. 3 | Working Group 2.8 Meeting | **Paris, France** | **1** | **8** |
| Yr. 3 | POPL Conference | **Paris, France** | **3** | **6** |
| Yr. 4 | UIST Conference | **Berlin, Germany** | **3** | **5** |
| Yr. 4 | CHI Conference | **Montreal, Canada** | **3** | **6** |
| Yr. 5 | ICFP Conference | **Berlin, Germany** | **3** | **6** |
| Yr. 5 | Yow! Lambda Jam | **Melbourne, Austrailia** | **2** | **2** |
| Yr. 5 | Koli Calling | **Koli, Finland** | **3** | **4** |
| Yr. 5 | POPL Conference | **Lisbon, Portugal** | **3** | **6** |
| Yr. 5 | CHI Conference | **Glasgow, United Kingdom** | **3** | **6** |
| **Total Travel Costs** | | | | |

**Materials and Supplies** **($4,000/year):**

Funds are requested for materials, set-up and testing of the various experiments, and other expenses related to the specific tasks detailed in the text of the proposal. This includes purchase of instrumentation, and other laboratory materials including glassware, chemicals, etc. as well as computer, computer supplies, peripheral devices, and software to meet the project goals.

We assume that every PhD student and the engineer will need individual laptops in the year they begin (either Y1 or Y2), while the PIs will need new laptops to replace their current ones in Y3. We will purchase one additional laptop in the first year for use in the lab space where our user studies will be carried out.

We will also purchase a compute server, to be set up in the department’s machine room, for running larger empirical studies (e.g., the benchmarking study in Y1-Y2 and the generator automation task in Y4-Y5). The price listed is for a Rackform A331.v9 RAID configuration, 2x32-core processors, 16x32Gb RAM, 2x960Gb SSD, 5-year warranty.

Funds are requested to purchase the following for the project:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Items** | **Year 1** | **Year 2** | **Year 3** | **Year 4** | **Year 5** |
| Computers for PIs, PhD Students, and Engineer | $12000 | $8000 | $8000 |  |  |
| Lab Computer for User Studies | $4000 |  |  |  |  |
| Page charges for conference publications | $1000 | $1000 | $1000 | $1000 | $1000 |
| Compute server | $16057 |  |  |  |  |
| Miscellaneous Supplies | $ | $ | $ | $ | $ |
| **Total Supply Costs** | **$4,000** | **$4,000** | **$4,000** | **$4,000** | **$4,000** |

**Other Direct Costs - Graduate Student Tuition and Fees ($60,045 Y1, $83,264 Y2, $86,596 Y3, $90,060 Y4, and $93,664 Y5):**

Tuition is included for the graduate research assistant(s) for the equivalent of 3 courses per term in the academic year for each student. As explained in the salary & benefits section, tuition and fees are provided to graduate research assistants in lieu of employee benefits.

**Indirect Costs (F&A):**

Indirect costs are budgeted at **62.5%** per agreement dated June 24, 2022. Indirect costs are applied to a modified total direct cost base. The base is the sum of total direct costs, less the cost of equipment, tuition and that portion of any subcontract that exceeds $25,000. *(There are no subcontracts proposed for this project.)*