**A. SENIOR PERSONNEL**

**A1. Timothy Bartholomaus, Co-PI**: Funds are requested for the Co-PI to lead the research effort from the University of Idaho. Co-PI Bartholomaus will supervise the University of Idaho graduate student in the detailed analyses of passive seismic data to infer subglacial water discharge, meteorological analyses to infer water input to the glacier, and modeling subglacial conduit evolution. Dr. Bartholomaus will train the graduate student researcher in research performance and ethics. He will lead the field work and ensure coordination of all project elements with project collaborators, meta-data preparation, and communication of results. Dr. Bartholomaus is budgeted for at 1.0 summer months per year in each of 3 years. $8,544 FTE monthly base salary (with 4% estimated salary increase in Years 1, 2, & 3).

**A2. Flavien Beaud, Research Scientist**: Funds are requested for the Dr. Beaud to carry out data analyses and assist Co-PI Bartholomaus in leading the research effort from the University of Idaho. Dr. Beaud will lead the subglacial hydrologic modeling project components, the acquisition and processing of radar data, and participate in field work. Dr. Beaud will co-advise the graduate student with Dr. Bartholomaus. Dr. Beaud is budgeted for at 3.0 calendar month per year in each of 3 years. $5,833 FTE monthly base salary (with 4% estimated salary increase in Years 1, 2, & 3). Dr. Beaud is transitioning from a postdoctoral researcher position to a research scientist position without committed institutional salary. As such, and in light of the significant research commitment for Dr. Beaud, we request an exception to the NSF’s policy of not funding more than two months of senior personnel salary.

The University of Idaho has determined the salary year for senior personnel to be based on the calendar year.

**B. OTHER PERSONNEL**

**B1-B2. Postdoctoral Scholars and Other Professionals:** N/A

**B3. Graduate Students:** Funds are requested for a University of Idaho Ph.D. student (to be determined) for each of the three years. The student will be involved in all aspects of the research process, including field work. The graduate student will carry out analyses of seismic data and model development to test hypotheses through the joint interpretation of seismic data, melt modeling, and subglacial hydrologic modeling. The Ph.D. student will communicate results at national and international meetings, publish results, and participate in outreach. The student will be appointed to a full-time research assistantship during the academic year (0.5 FTE) and will be paid full-time in the summer. Salary is increased by 3% per year.

**C. FRINGE BENEFITS:**

The University of Idaho’s federally-negotiated consolidated fringe benefit rates for fiscal year 2019-20 are 30.9% for faculty, 40.5% for staff, and 3.4% for students. These rates were used for all years of the project. Rates are subject to change annually, and the rate in effect for each particular year will be charged.

**D. EQUIPMENT:**

N/A

**E. TRAVEL:**

**E1. Domestic:** Field-collected data are the foundation of project analyses. As such, we include sufficient funds to ensure that an extensive array of seismic, GNSS, and other instruments span the study reach of Turner Glacier, and that these instruments are operating as planned. As such, we plan field work in each of the 4 summers of the project, spanning project years 1, 2, and 3.

We include funds for helicopter charter with Yakutat Coastal Airlines, quoted at $900 per hr, with estimated usage of 4 hrs per work day. We budget for a field team of two to work with collaborators at Boise State University. Commercial airfare between Moscow, Idaho, and Yakutat, Alaska, is estimated at $550 per round trip; per diem is estimated at $40 per person; ground transportation at $150 per trip; and lodging at $170 per person per night. To allow for poor weather in coastal Alaska, that can prevent flying, during each field trip to Yakutat, we allow approximately a 70% buffer in the number of days, beyond those strictly required to accomplish project goals. Expenses for each trip are described below.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Helicopter charter | Commercial airfare | Ground transportation | Per diem | Lodging | Total |
| Y1: Aug ‘20 | $21,600 | $1100 | $150 | $880 | $3740 | $27,470 |
| Y1: Oct ‘20 | $10,800 | $1100 | $150 | $480 | $2040 | $14,570 |
| Y1: May ‘21 | $14,400 | $1100 | $150 | $640 | $2720 | $19,010 |
| Y1: Jul ‘21 | $14,400 | $1100 | $150 | $640 | $2720 | $19,010 |
| Y2: Jul ‘22 | $14,400 | $1100 | $150 | $640 | $2720 | $19,010 |
| Y3: Jul ‘23 | $18,000 | $1100 | $150 | $720 | $3060 | $23,030 |

Total field expenses for year 1 are $80,060, for year 2 are $19,010, and for year 3 are $23,030. The project total for field work is $122,100.

The budget includes funds for travel to present results at AGU in San Francisco in years 2 and 3 of the project, for 3 people (Co-PI, Research Scientist, and graduate student researcher). Costs are based on airfare ($450 per person), 6 days per diem ($51 per day per person), ground transportation ($40 per person), hotel ($190 per day for 6 days per person), and registration fees ($560 for PI and $310 for student). The total per year is $7,238 for each of the second and third years. Meetings will facilitate dissemination of results and collaborative meetings for the project team.

Additionally, the budget includes funds for travel to present results at the regional Northwest Glaciologists meeting during years 2 and 3, nominally in Seattle, Washington, although the location rotates throughout the northwest. Costs are based on airfare ($250 per person), 4 days per diem ($51 per day per person), ground transportation ($150 per person), hotel ($150 per day for 3 days per person), and registration fees ($40 for PI and $20 for student). The total per year is $3,262 for the second and third years.

**E2. International:** No international travel is required for this project.

**F. PARTICIPANT SUPPORT COSTS:**

N/A

**G. OTHER DIRECT COSTS**

**G1. Materials and Supplies:**

1. **Weather stations:** Costs for two weather stations, including instruments to record incoming and outgoing shortwave radiation, temperature, precipitation, relative humidity, barometric pressure, snow depth, and wind speed and direction amount to $8,412 in the first year of the project, for the purpose of measuring weather conditions on the glacier. Additionally, $1,198 is included in year two to purchase replacement parts, budgeted here as wind speed and direction kits.
2. **Ice auger flights:** Four Kovacs, 1 m, ice auger flights are budgeted to augment UIdaho’s existing equipment at $199 per flight, plus tax and shipping (totaling $900). Flights will ensure we have sufficient capability to install seismometers and GNSS stations at sufficient depth to prevent meltout over the course of the summer.
3. **Batteries and enclosures for seismic stations:** Due to the extreme snow loads and poor weather at Turner Glacier, we plan to use non-rechargeable, air-alkaline batteries to power all seismometers. Previous work by Co-PI Bartholomaus has successfully maintained uninterrupted data records in similar coastal Alaskan glacier environments. We budget $1300 per station per year, for each of the 10 seismic stations provided from the University of Idaho instrument pool, totaling $13,000 in each of the three years. Additionally, we budget $380 per station for station enclosures sufficient to hold the large-volume batteries and seismic digitizers, to which vents will be affixed necessary to operate the air-alkaline batteries. These enclosures total $3,800, only in year 1.
4. **Computer workstation:** A computer workstation ($2,600) is requested in year 1 for the graduate student researcher. This workstation will be the primary analytical and writing tool for the student researcher’s contributions to this project.
5. **Field supplies**: Field supplies including specialized clothing for the student researcher and expendable materials is estimated at $2,000 in year 1

**G2. Publication Costs:** Publication costs are budgeted as $3,000 in Year 2 and $5,000 in Year 3.

**G3. Consultant Services:** N/A

**G4. Computer Services**: Computer Services through the University of Idaho’s high performance computing cluster, iBest. The computer cluster will host image processing and data storage, and project data analysis. Hardware and network support for the PI and student is presently $1,740 (year 1). Increases at 5% per year are budgeted in Years 2 ($1,827) and 3 ($1,918).

**G5. Subawards/Consortium/Contractual Costs:** N/A

**G6. Other:**

1. **Tuition and fees**: Tuition and fees for graduate students are a standard part of their employment package (presently $4,938/semester, $624 for summer credit, and $200 for course fees, with an anticipated 10% increase each year). Year 1 is budgeted at $11,770, year 2 is $12,947, and year 3 is $14,242.
2. **Insurance:** Health insurance for the student researcher is covered for each year, with an anticipated 10% increase per year. Year 1 is budgeted at $1,991, year 2 at $2,190, and year 3 at $2,409.
3. **Shipping costs**: Shipping costs between Moscow, Idaho, and Yakutat, Alaska, for seismic equipment, weather stations and other equipment are estimated at $1,000 in the 1st and 3rd years, and $400 in the 2nd year.

**I. INDIRECT COSTS:**

|  |  |  |  |
| --- | --- | --- | --- |
| Grant Year | IDC base | F&A rate | IDC |
| Year 1 | $181,726 | 47.5% | $86,320 |
| Year 2 | $118,152 | 47.5% | $56,122 |
| Year 3 | $126,171 | 47.5% | $59,931 |

Indirect costs are calculated based on the University of Idaho Federally Negotiated Indirect Cost Rate using a modified total direct cost base. The University currently has an approved Indirect Cost Rate of 47.5%. Modified total direct costs in this budget exclude student tuition/fees.

**J. TOTAL DIRECT AND INDIRECT COSTS:**

Year 1: $281,272

Year 2: $188,598

Year 3: $201,616

Total: $671,486