**Project Title:** WWU Scanning Electron Microscope Replacement

**Department/Organization:** Scientific Technical Services (STS)

**Project Applicant(s):**

<table>
<thead>
<tr>
<th>Name</th>
<th>MS</th>
<th>Email</th>
<th>Phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clint Burgess</td>
<td>9079</td>
<td><a href="mailto:Clint.Burgess@wwu.edu">Clint.Burgess@wwu.edu</a></td>
<td>650-3511</td>
</tr>
<tr>
<td>Dr. Kathleen Kitto</td>
<td>9038</td>
<td><a href="mailto:Kathleen.Kitto@wwu.edu">Kathleen.Kitto@wwu.edu</a></td>
<td>650-2884</td>
</tr>
<tr>
<td>Charles Wandler</td>
<td>9079</td>
<td><a href="mailto:Charles.Wandler@wwu.edu">Charles.Wandler@wwu.edu</a></td>
<td>650-2831</td>
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<tr>
<td>Erin Macri</td>
<td>9160</td>
<td><a href="mailto:Erin.Macri@wwu.edu">Erin.Macri@wwu.edu</a></td>
<td>650-7482</td>
</tr>
</tbody>
</table>

**Amount Requested for Project**

- **Proposed Budget:**
  1. Equipment total $275,000
  2. Plus site preparation (not STF funded) + $0
  3. Total Project Cost (spreadsheet total from part IV of this form, Total Project Budget) = $275,000
  4. Less organization’s contribution – $235,000
  5. Less site preparation – $0
  6. **STF Grant Request** = $40,000

**IMPORTANT NOTE**

1. THE STF Committee will accept only complete proposals by the announced deadline. Every section (I–IX) and all items of this proposal format must be addressed.

**I. Executive Summary (800 words max)**

Provide a summary of the project and the benefits to be derived. Explain what the students would gain from the project, and how the acquisition would meet the Student Technology Fee mission.

**STF Mission:**

The Student Technology Fee provides Western students with adequate and innovative technology experiences by:

- Broadening/enhancing the quality of the academic experience
- Providing additional student access to technology
- Increasing integration of technology into the curriculum
In 2003, Scientific Technical Services submitted a proposal and received STF funding to purchase a new Scanning Electron Microscope (SEM). Since its purchase, the microscope has seen ever-increasing usage by Western students and faculty. It is used for classroom instruction as well as individual research. There were 1,758 documented hours of use for AY 14-15 for an average of about 50 hours/week. Departments that use it include Geology, Chemistry, Biology, Advanced Materials Science & Engineering Center (AMSEC), Environmental Sciences, Engineering and Design, and Shannon Point Marine Center (SPMC) to name a few. In the expanding world of nanotechnology, the SEM is an essential tool for analyzing materials.

After 13 years of constant use, the existing SEM is at the end of its useful life. The vendor that manufactured it no longer actively supports it or provides software updates. As a result, it is being operated off the network (which limits its accessibility) and a hardware failure may mean it will be permanently disabled.

Since August 2015, STS has been planning the acquisition of a new SEM and is proposing that the STF committee make a contribution towards its purchase as they did in 2003. A proposed budget of $275,000, with $40,000 from STF, is our target based on some preliminary quotes from SEM vendors.

For the last 12+ years, STS has elevated the level of technology at Western with its SEM program. The microscope is an integral part of scientific disciplines that investigate the properties of the "nanoworld" and a valuable tool to the students in those programs. The SEM has been integrated into 13 class offerings in 7 departments and numerous research projects. And it has been accessible to all students who have a need for its capabilities in their classroom, research, or career pursuits.

The technological advancements in SEM designs that have taken place since 2003 make the purchase of a new SEM an exciting project. The SEM selection committee hopes that STF chooses to be part of this process.

II. Relationship to STF Objectives / Impact on Current Academic Programs

The STF Committee will use as its primary assessment criteria the three objectives—quality, access, and integration—defined in the STF mission (above). Given this criteria, describe your proposed project in detail.

1. Tell us—focusing on what the students will gain from the project—how the project would provide positive benefits to specific courses or instructional programs. Specifically, answer at least one of a, b, and c below:

   a. How would this project provide additional student access to technological resources?

   While this project involves the replacement of existing technology at Western, it is much more than that. It is about replacing an aging, end-of-life instrument with the newest technology available in SEM design. With that comes advancements in ease of use, data collection, and data analyses. These will reduce the time each student needs to perform their work, leaving more time for additional students to have access to the microscope beyond what is available now. This holds true for every student in every class and research project listed below in Section III - Utilization.

   Furthermore, a new SEM would not experience the same frequency of instrument downtimes currently being seen with the existing SEM. Several hundred hours of downtime occurred during Fall Quarter 2015 due to hardware failure. This was not the
only recent occurrence, but it had the effect of disrupting a Geology lab class at a crucial period in time.

b. How would this project **broaden or enhance the quality** of the student’s academic experience through the proposed technology?

One of the benefits from a new instrument is the improved data quality due to SEM design improvements. In addition, students will get the benefit of a better academic experience that more closely matches what they would find if they continue with electron microscopy in their career or graduate studies.

Another important facet of Western’s SEM program is that students actually get hands-on experience with the instrument. In many universities of Western’s size and most large universities, undergraduate students wouldn't have direct access to such an expensive instrument. They might only get "canned" data to analyze. STS makes sure all students have direct exposure to operating the SEM if the course instructor or research advisor wishes that to be part of the studies.

c. How would this project **increase integration** of technology into coursework?

As shown below in Section III, the SEM has already been incorporated into the coursework for at least 13 classes in multiple departments. With the new advances previously mentioned, we would expect the microscope to be more available for additional classes.

Furthermore, a new instrument means a current operating system such as Windows 10 would be installed (currently running XP) so remote access to the SEM would be restored. With that capability, access to the instrument would be 24/7 without the requirement of being seated in front of it.

We are also pursuing the possibility of remote data analysis software for the university computer labs (we actually just removed this capability for the existing SEM due to the instrument running XP). One vendor has already said this is doable. Therefore, even more projects could be incorporated into coursework with access to data analysis tools readily available in locations other than the SEM room (and freeing up the microscope at the same time).

2. Would other departments be involved with this project?

   **No** ☐   **Yes** ☒   If yes, describe.

   Indirectly, several departments will be involved with the replacement of the SEM. These include Geology, Chemistry, Biology, Environmental Sciences, AMSEC, Engineering/Design, Psychology, and SPMC. Member(s) from each of these departments have agreed to serve on the SEM Selection Committee. Through this collaboration, STS seeks to make sure that the majority of the SEM users have a say in the configuration of the new instrument and ensure that it will meet the needs of their respective departments and students.

3. Has any part of this project previously been funded by the Student Technology Fee?

   **No** ☐   **Yes** ☒   If yes, describe.

   This proposal to the STF committee is for partial funding for the replacement of our existing SEM. If you consider this project to be an extension of the original purchase in 2003, then the answer is yes. That instrument was purchased entirely with STF funds.
4. Is the proposed project a pilot project?

No ☒ Yes ☐

III. Utilization

List the anticipated number of times and duration per each use—per quarter or per academic year—that students would use the proposed technology. The committee is looking for total student hours and total number of unique students who would use the technology in that time period. Explain how you arrived at this utilization.

Because this is a replacement project, we already have documented usage information available to help determine an estimate for the total student hours and number of unique students that would use this technology. STS was the first department at WWU to utilize an online reservation system to schedule scientific instruments and log hours used. The system is the Facilities Online Manager (FOM) developed by FOMNetworks.com.

Using AY14-15 as an example, the SEM was in use for just under 1800 hours (see attached spreadsheeet). As a side note, it was also in use for 565 hours during Summer Quarter 2015. The hours during the academic year were a mixture of classroom and research hours, while the summer hours were nearly all research. For the SEM, there is no summer break.

It is somewhat difficult to determine the total number of unique students that access the SEM from this data due to the fact that instructors typically log into FOM for their entire class. For that reason, a different approach to determining the number of unique students was used.

Using AY15-16 statistics from Western’s Classfinder, the attached report lists the number of students that could be enrolled in an academic year for the classes that have previously used the SEM as part of their coursework. From this report, one can see that around 400 students could be expected to log nearly 700 hours on the instrument. Certainly, one or two of these classes might not use the SEM in a particular year due to instructor preference, but nearly all of them have a long history of including the SEM as part of their curriculum. STS approaches each quarter assuming they will and contacts faculty to make sure they reserve time in advance while the schedule is mostly open.

With regard to research student hours, the FOM data shows entries for 38 individual researchers for AY14-15 with an additional 12 during Summer 2015.

Putting this all together, one might expect to see about 450 unique students using the SEM for a total of 1800 hours in a typical academic year, increasing to 2300 hours for a calendar year. Of course this is based on the existing SEM. We expect the see these numbers increase with an instrument based on the newest technology as improvements reduce the time required to acquire data. This should be especially true for the number of students and the number of courses that utilize the SEM.

IV. Total Project Budget

This section details the estimated total cost of the project. Include costs that would be covered—by your department or another source—for ongoing costs such as personnel or operating expenses.

1. For assistance in preparing your budget, please consult with relevant campus support departments (ATUS, Purchasing, Space Administration, etc.).
2. For more information about these contacts and helpful tools/links: from the STF website home page (http://www.wwu.edu/stf), choose “STF Tech Initiatives” on sidebar, then section "II. Tech Initiatives Forms and Instructions."

Attach an Excel spreadsheet if you have additional details.

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<th>Item</th>
<th>Quantity</th>
<th>Item Cost</th>
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<tbody>
<tr>
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<td>1</td>
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<td>275,000</td>
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<td>Should we attach one of the Tescan preliminary quotes as an example?</td>
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<td>Subtotal</td>
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<td>Tax (8.7%)</td>
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<tr>
<td><strong>Total</strong> <em>This budget total (or your attached spreadsheet total) should match the projected budget figure on page 1 of this proposal. (See box on page 1, line 3.)</em></td>
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<td>275,000</td>
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Important Notes from the STF Committee:

- We recognize your proposed budget as an estimate. Final funding for successful projects will be established after thorough technical review; some costs may need adjusting due to price changes.
- We recommend that you include a 3 percent cushion to allow for price increases.
- We may impose special conditions on a proposal before approval. See STF Proposal Guidelines.
- *Funding is not provided directly to departments for purchases. All purchasing is done via the Office of the VPIT/CIO and savings are retained in the STF fund.*

3. What funding or contributions are available from your department or other sources?

Note: “Contribution” is defined as a monetary contribution. A vendor discount, for example, is not considered a contribution.

At the time of this proposal, $225,000 has already been budgeted for this project. Of this amount, $200,000 has been allocated by the Provost's office. $25,000 comes from a FY15 carryforward from STS. STS expects to contribute an additional $10,000 from FY16 funds.

4. Could this project be divided into discrete elements that could be funded separately?

Note: A “no” response to this question creates an “all or nothing” proposal. That is, if the STF Committee decides against funding your entire proposal, it will not consider any elements for
partial funding. If elements could be funded separately, the applicant is responsible for prioritizing them before submitting the proposal.

No ☒ Yes ☐ If yes, summarize and prioritize project elements with cost estimate for each.

5. Are course or lab fees charged for any of the courses that will use this equipment?

No ☒ Yes ☐ If yes, describe. Please note: The total funding requested from the Student Technology Fee must reflect the amount collected from course fees for equipment replacement and/or equipment acquisition.

Historically, STS has not collected course or lab fees from students, faculty, researchers, or departments to cover the expenses associated with operating and maintaining its inventory of scientific instruments. If a department has a fee associated with a particular class that utilizes an STS resource, that fee stays within the department.

V. Impact on Existing Resources

Your proposal must address the project's potential impact on existing resources. Give special attention to the impact on data transmission networks (e.g., sources accessed, networking equipment, etc.), and personnel (e.g., staffing, administrative support, faculty support, etc.).

1. Describe how existing equipment is used. Contrast this to projected use if your project were funded.

Because this project is the replacement of an existing electron microscope, the impact on existing resources will be minimal. Data transmission networks are used, but no more than 2-3 desktop computers would normally use. There will be no additional building utilities required. And STS currently has two technicians that operate and maintain the existing SEM and provide training to all users.

2. Is similar equipment or technology available elsewhere on campus—such as the Student Technology Center, Classroom Services, Video Services, Western Libraries, a college lab?

No ☒ Yes ☐ If yes, describe why the existing equipment does not meet the needs outlined in this proposal.

3. If this project involves the replacement of equipment, including computers:

a. Describe the “before and after” configuration changes. (A spreadsheet reflecting these changes may be attached.) Or, write “N/A.”

The basic SEM uses a secondary electron detector to give a simple image. The power of a research-grade instrument lies in the ability to add additional detectors that extend the microscope's capabilities to analyze samples based on the properties of that sample. The current SEM has a back-scatter detector (BSE) that can determine that there are different elements present for a somewhat qualitative analysis. There is also an energy-dispersive X-ray spectroscopy system (EDS) that works with the BSE image to then identify the elements and quantify them for a fairly accurate elemental analysis. Finally, there are two cathodoluminescence detectors (CL) which are used to examine the internal structure of the sample.

At the least, the new SEM will have the same capabilities. In additional, options being considered include 1) an advanced variable-pressure column and a temperature-
controlled sample stage which will increase accessibility to users with biological and environmental samples, 2) a EDS micrometer that will greatly decrease the time required to analyze a sample, and 3) an active vibration-isolation system built into the microscope to help increase resolution by isolating the sample chamber from building vibrations. There is also an option to allow the SEM to somewhat approximate a transmitting electron microscope (TEM). In this setup, the electron beam is passed through the sample (instead of being scattered and reflected) which allows an examination of the internal structure of a sample (different from CL studies). TEM’s find many uses in biological and life sciences.

The final configuration will depend on the vendor chosen and their quotes.

b. Describe the costs and benefits of replacing vs. upgrading. Or, write “N/A.”

Upgrading the existing SEM isn't an option. The vendor has more or less stopped providing support and has stopped providing any operating software upgrades to match new computer operating systems (Windows XP is last OS supported).

4. Would this equipment be available to students outside of your department?

No ☐ Yes ☒ If the proposed technology would be used by students outside of your department, describe how they would gain access, how equipment availability would be publicized, the hours/week when equipment would be available, and any costs that would apply.

The existing SEM is already available to all students at WWU as long as they have a class or research project that requires its use. There would be no change in this policy with the new SEM. Access is gained by completing hands-on training (provided by STS personnel) and utilizing the on-line instrument reservation system found at STS’s website. The availability of the SEM is generally publicized by 1) faculty and researchers found in the departments that use the instrument, 2) the STS website, and 3) an electron microscopy exhibition that STS presents at the poster sessions during Scholar's Week.

5. Does this project involve the check-out of equipment to students?

No ☐ Yes ☒ If yes, discuss whether or not the Student Technology Center/ATUS Loan Pool could be assigned this task.

6. Does the department have adequate operating funds to provide ongoing maintenance and support?

No ☐ Yes ☒ If yes, describe.

STS has an annual operations budget that currently covers ongoing maintenance for the existing SEM and other STS instruments.

7. Does the department have adequate personnel funds to provide ongoing staff support for the project?

No ☐ Yes ☒ If yes, describe.

There also is a salary/benefits budget for the personnel assigned to support all instrument operations.

VI. Space and Site Information
This section addresses any space alteration or site preparation necessary for the proposed project. Site alterations include painting, holes in walls, security systems, carpeting, construction, lighting changes, or conversion of a lab or office.

Special Note: If this project would require any site preparation, or if this project would use any space not currently under your department’s control:

a. You must submit a draft proposal to Space Administration by March 28, 2016.

b. Space Administration and Facilities Management will then conduct a site survey and respond to you by April 4, 2016 about project feasibility, cost, and schedule.

c. You must include the site survey response with your final proposal.

1. Location for installation of equipment or technology:

   ES314

2. Would site modification be required?

   No ☒ Yes ☐ If yes, describe the modifications (e.g., electrical, air, painting, lighting, security, network access, etc.).

3. Would this project use space not currently assigned to your department or area?

   No ☒ Yes ☐ If yes, describe.

VII. Project Schedule

Describe your overall implementation schedule. (Remember that project awards are announced during spring quarter, and that projects are to be substantially completed by the end of the calendar year.) If any site preparation is involved (see section VI above), align your project schedule with the schedule provided by Space Administration and Facilities Management.

SEM vendors are being contacted from late March through the middle of April to request preliminary quotes and schedule on-campus presentations to members of the SEM selection committee. From this information, the committee will determine the final instrument configuration to be used for the request to submit bids. That request will be submitted to Purchasing with a timeline in mind to place the order and encumber funds by the end of the fiscal year (6/30/2016).

VIII. Constraints

List or describe any external or internal factors/constraints that could affect your project schedule, project objectives, or the project budget (e.g., if external approval is required for curricular changes, or if funding must be received by a certain date).

None anticipated at this time. The only concern is the timeline for the announcement of the STF awards. It is currently listed as May 31, 2016. It is anticipated that the SEM order will be placed sometime around mid-June so this shouldn't be a problem unless the award announcement is delayed by several weeks.

IX. Submitting the Proposal
1. Make sure your proposal does not exceed 12 pages (not including Tech Initiatives Summary Sheet).

2. Complete top portion of a 2016 Tech Initiatives Proposal Summary Sheet for the front of the proposal.

3. (for proposal submitters) Electronically submit Word versions only of the proposal and summary sheet for prioritizing:
   a. **Faculty and staff:** Submit by internal due date, per your unit’s process, which must be before proposal due date of April 11.
   b. **Students:** Submit by April 8 to AS VP for Academic Affairs at ASVPforAcademicAffairs@wwu.edu.

4. Submit prioritized proposals:
   a. **(faculty and staff proposals)**
      *College Dean/unit head:* Ensure appropriate approvals and priority are on Summary Sheet, then email proposal (Word version) and summary sheet (PDF version) to diane.bateman@wwu.edu (the STF Committee secretary) no later than April 11.
   b. **(student proposals)**
      *AS VP for Academic Affairs:* Ensure AS President approval and priority are on Summary Sheet, then email proposal (Word version only) and summary sheet (PDF version only) to diane.bateman@wwu.edu (the STF Committee secretary) no later than April 11.

**Note:** Paper copies of proposals are no longer required; please do not send.