

Report of the Review Committee for Earth and Space Sciences (ESS)

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Committee members

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Executive Summary

The committee gives recommendations and impressions for ESS, with the all-important caveat in this evaluation that the last two and a half years have been anything but normal for interactions, communications at all levels, and establishing advancement, research, and education goals. Many of the concerns we observed may result from the isolation forced on everyone by the COVID-19 pandemic. ESS is a distinguished department with a national and international reputation. Many excellent recent faculty hires and strong growth in grant and award funding (both as a whole and per FTE) have placed the department on a promising trajectory and afforded the opportunity to re-envision the department's research, teaching, and service. Our recommendations focus on solidifying and communicating department policies and guidelines and on strategies for meeting financial challenges. The sections below provide detailed assessments of and recommendations for department components.

I. Governance, administration, and climate

The review committee encountered considerable differences in understanding regarding department government, function, and policies. Although the website has extensive documentation of department structure and function, department members consistently indicated that they were outdated and too lengthy to serve as efficient sources of information. Most department knowledge seems to be transmitted through word of mouth. Still, conveying information has been difficult with limited pandemic interactions and the retirement of many faculty and staff. We recommend that the department work together to devise or confirm policies and guidelines and to construct short and simple documents to convey the information, which should be posted on the website. There appears to be some department concern that codifying policies will limit the flexibility that is needed for the function of a broad and varied department, but we concluded the policies can outline flexibility and are needed as outlined below. We are encouraged that a committee to craft policies is planned.

One area needing policy consideration is the function of the executive committee, as discussed below. Individual research groups and centers within the department are thriving and collaborating, but there is a need to restore a sense of cohesion and shared mission following recent disruptions. The staff appears to be working hard and efficiently to keep up with an

immense workload and is affected by the recent retirements of longtime staff. The division of labor among current staff should be examined, clarified, and disseminated. We hope that department budget limitations will ease and allow the department to consider whether the current staffing level is adequate.

Clear policies and guidelines should improve transparency and help resolve department communication issues. Improved communication should start with department leadership. The committee heard multiple reports of discontent, even distrust, regarding department administration. The graduate students presented an organized list of concerns to the visiting committee, with a common tone that their concerns were not heard or addressed. We were also told that some department members (of varying ranks) were unwilling to speak their minds for fear of retaliation. Some discontent may be expected in any collection of intelligent, driven, and educated individuals, especially given the impact of COVID-19. Still, the committee felt that the intensity of the discontent was burning brighter than might be expected.

In our discussions with the department chair, we found that he was open about the challenges facing the department and clear about the rationale behind various decisions regarding departmental administration. He could also constructively consider and address concerns that we related to him. The committee struggled to square the concerns expressed with our discussion with the department chair, suggesting that part of the problem may arise from communication issues and, perhaps, insufficient attention to important administrative tasks such as mentoring and transparent dissemination of policies, procedures, and guidelines.

Many in the department appreciate that the department chair commendably stepped up to lead when the need arose and has led the department through unprecedented and challenging pandemic conditions. In particular, efforts in recent faculty hiring are appreciated. However, concerns with department leadership were sufficiently consistent that we recommend the Dean take these concerns into consideration for the chair reappointment process and discuss ways to address leadership concerns with the chair. We are optimistic that many of the concerns can be resolved with improved communication and community building within the department. The chair indicated that he would serve the remainder of the academic year and possibly one more. There is an immediate need for establishing a leadership transition plan, especially with the pressing issues regarding departmental communication and the redesign of the Space Physics major and Capstone experience.

Concerns with department climate at least partially stem from inevitable challenges associated with the disruptions of recent years. The department should continually assess climate successes and concerns for groups across the department. One area of climate concern relates to perceived differences in attentiveness to diversity, equity, and inclusion (DEI) across the department. Again, we are hopeful that improved communication will lessen the concern. However, a committee that includes representatives across career stages should be empowered to act with clear statements of its charge, strategy, and planned activities. This committee must devise and implement strategies to improve DEI across department activities.

We note that some department activities, including faculty hiring, already follow best practices, assisted by input from a past DEI committee.

Recommendations

1. The department should devise and disseminate pathways to increase communication and transparency. These are crucial to restoring department trust and a sense of welcoming open and critical dialog. We heard varying reports about whether and when an anonymous reporting tool was recently reinstated. Efforts should be made to ensure that an anonymous reporting tool is available and known.
2. The department governance system should be refined and disseminated, particularly given the different understanding of the executive committee's function across the department. We recommend that the executive committee be elevated from an entity that occasionally meets at the chair's discretion to advise the chair to an entity that meets regularly with the ability of all members to raise topics of discussion. Further, the executive committee should return to a past practice of encompassing diverse representation with respect to seniority and other demographics.
3. The division of labor among current staff should be examined, clarified, and disseminated. Given high staff workloads, the department should continually review staffing levels.
4. There is currently no succession plan for departmental leadership. The department should consider expanding faculty mentoring to prepare junior and mid-career faculty to take on leadership positions in the department and college.
5. The structure and purview of the DEI committee should be clarified. The department should ensure that the DEI committee is empowered to take a multifaceted approach.
6. The department should devise or confirm policies and guidelines and construct short and simple documents to convey the information, which should be posted on the website and cover at least the following topics: department governance; DEI initiatives; requirements and timelines for masters and doctoral degrees; and the promotion, merit, and tenure process.
7. The department should conduct regular climate surveys across levels of seniority. We concluded that sufficient resources were available from the graduate school, college, and other departments on campus for surveys to be implemented within the university instead of hiring an outside consultant.

II. Faculty composition and future directions

The self-study documents a decrease in faculty size from 30 two decades ago to less than 20 recently, to a return to about 23 with the completion of the current hiring plan of six new faculty. The recent hiring was presented to the committee as plugging holes within the focus research areas of the department. The only change to the six focus areas is from space physics to planetary science to take into account the death of a key space physics faculty member, which has motivated a shift to a subject more closely aligned with the ESS mission.

The self-study uses a critical mass model to describe the hiring strategy, wherein each focus area has sufficient faculty to define a community that can provide support to graduate students

and not be vulnerable to the departure of any individual faculty member. The critical mass model, applied to six focus areas, is an effective approach provided there is excellence in each focus area, effective collaboration among faculty, and a willingness to stretch to cover essential teaching obligations. This approach has been highly effective at UW for decades.

Once the last “holes are plugged” in the six focus areas (with two hires in surface dynamics), ESS can evaluate their future direction. It is all too easy to continue supporting the existing focus areas when there may be an opportunity to creatively adjust the department composition such that UW ESS continues to lead research and education in earth and space sciences.

Questions to be considered are:

- (i) Is the critical mass model working well? Does it effectively promote collaboration across the department in important emerging areas of ESS?
- (ii) Are the six focus areas appropriate? Are there emerging focus areas that may be more productive?
- (iii) With the faculty rebound to 23 FTE, what is the right size for ESS to address all of its obligations and opportunities?
- (iv) What role does applied earth science play in the department’s future?

Recommendations

1. Given the numerous and excellent recent hires that have filled in department gaps in topics and teaching, we hope ESS will seize the opportunity to develop a compelling vision for elevating an already strong department reputation for innovative and impactful science. This should include developing a strategic hiring plan, emphasizing engagement by the junior faculty.
2. The department should ensure that the faculty mentoring plan for junior faculty is put in place and supported by staff and administration.

III. Funding wants, needs, and new sources

Developing a long-term funding plan should be a priority for the department. Currently, the immediate needs surrounding startup costs for recent hires have led to a medium-term situation with insufficient funding for other departmental needs.

Infrastructure needs. The buildings in which ESS is housed are older, and several key issues need to be addressed. These include substantial outlays required to refurbish existing lab spaces, including moving extremely large and specialized equipment used by former faculty so that incoming faculty and their graduate students have appropriate space for their work that is safe to work in. A long-standing issue is the refurbishment of the downstairs former freezer spaces, currently underway. In addition, there is no central hub for social gatherings, such as a lunch space where informal gatherings can occur, which would help with departmental cohesion. Indeed, a shortage of potable drinking water throughout the building was highlighted as one practical item of need in infrastructure.

Staffing requirements. A shortage of funding also affects the number and availability of administrative staff, burdening staff with too much work. This fuels the perception among some faculty and staff that there is too much turnover in staff and insufficient help with administrative matters, grant writing, and budgeting. A large burden was identified as coming from purchases by the Pacific Northwest Seismic Network (PNSN), which suggests that some portion of the money that supports PNSN should be set aside to assist with the departmental administrative burden. Large groups or centers within the department have staffing needs that seem above and beyond staff support that would normally be expected to be covered by indirect costs, given that their staffing needs differ from that of other groups in the department.

Startup and retention costs. The single greatest source of costs was identified as startup costs for new faculty. The addition of six new faculty in the last three years has placed an unprecedented burden on departmental finances, especially given the large startup packages relative to available departmental funds. Part of the long-term budgeting and planning process should include a survey of typical startup costs at other similar public universities and an identification of the funds that are available to pay for startups to ensure that packages offer a reasonable balance between recruitment requirements and available funds.

Cultivating new sources of funding. Given the department's long history (established in 1890) and the large number of graduates, funds available from endowments are relatively small. This represents a huge untapped opportunity that could be used to fill in the abovementioned gaps in infrastructure, staffing, and faculty startup costs. The department needs to track alums or reach out to them for fundraising requests. Endowments can be used to offer entry fellowships, fund infrastructure for specific high-visibility projects (glaciers, earthquakes, etc.), and fund endowed professorships that are useful for the retention of faculty. The College of the Environment has an Advancement group that should work closely with the department to identify fundraising opportunities, advancement priorities, and alumni engagement.

Recommendations

1. The department should develop a long-term funding plan for the proportion of funds allocated towards various departmental needs, including infrastructure, staffing, students, and faculty startup.
2. There is a need to identify appropriate sizes of startup packages that balance the need for attractive recruitment against available funds. The department should consider options beyond the current indirect cost partial funding model. We hope that an additional monetary return from the department's substantial teaching contributions will reduce the amount of indirect costs that need to be applied to instruction and free up money for research needs such as startups.
3. The department should engage with the college to promote fundraising to build the departmental endowment, especially among past alumni.
4. There is a need to strengthen linkages with the college. We were surprised by the perception of some in the department that it was challenging to align department priorities and messaging with that of the college due to the ESS field linking to extractive

industries. Many aspects of the ESS vision are well aligned with that of the college, and we hope both parties will be able to work toward improved, mutually beneficial communication and collaboration.

5. There is a need for university investment in infrastructure. A clear space policy would help ensure equitable allocation of quality space.

IV. Undergraduate program

The ESS undergraduate program is strong and has maintained an impressively large and stable enrollment of 150 to more than 200 majors over the past decade. Among the four BS options, the Geology major has decreased to less than half its peak of 120 in 2015/2016, consistent with decreased geology enrollments across most universities. The decrease in geology majors has been offset by strong enrollment increases in the more flexible Geoscience track and in the Space Physics track. The Space Physics track has previously attracted students interested in rocketry and space exploration, but the loss of a key faculty member and the associated switch in research focus to planetary science will pose challenges for maintaining this major, which accounted for more than 40% of ESS majors in 2020 and 2021. As discussed in the self-study, reorganization of this major is underway, and there is a risk of losing some majors.

Perhaps the most striking element of the undergraduate program is the exceptional number of Student Credit Hours (SCH) generated by the department. Most of the SCH are delivered by the non-science introductory courses ESS offers. These courses are exceptionally successful but burden faculty and require a large TA pool. It was reported to us that the TA demands exceed the available graduate students in ESS, and students from other departments must be hired. Remarkably, part of the cost of TA support is paid from indirect cost returns (ICR).

In an Activity-Based Budgeting (ABB) system, it seems inappropriate that SCH-generated funds are insufficient to support these successful classes. The self-study states that there is “very little transparency from the College with respect to the allocation of ABB funds,” making it hard to manage and plan large SCH courses. The Dean reported that a new, transparent system for determining department ABB funding is in place. In our observation, it is odd that ICR must partly support an undergraduate teaching effort of importance to the college and university. Support for teaching faculty and TAs should be commensurate with the exceptional SCH delivered. We note that an additional teaching faculty position would contribute and could also be positioned to help with capstone teaching and professional preparation.

It was reported that key classes had not been offered due to the loss of faculty. The recent hire of four faculty and two planned hires in surface processes is expected to fill the immediate gaps. Nonetheless, gaps may remain, particularly in providing upper-level majors with professional preparation. The department recognizes that the “great majority” of their undergraduate majors will not continue in academia. Still, it was reported to the committee that ESS BS graduates were not fully prepared to join the workforce (especially in contrast to MESSAGE students). Concerns reported to us included not only that required courses are not offered but there was little instruction on professional practice and preparation for the Professional Geologist exam.

A key factor in professional preparation is the capstone class, which is in a state of transition. The standard intensive field geology summer course can no longer be offered due to university changes in funding summer classes. Although detrimental to many geology majors, the loss of field camp and a redesign of the capstone experience responds to the changing demographic of ESS undergraduates and their ability to attend a remote six-week class. Successful redesign of the capstone experience is essential to the continued success of the ESS undergraduate program.

The self-study indicates that the department takes pride in the rigor of its undergraduate program (“we teach the fundamentals”) but, at the same time, acknowledges that the current program falls short in important ways. In addition to professional preparation, classes in professionally important topics, such as economic and petroleum geology, surface processes geomorphology, and engineering geology, are not fully supported by faculty expertise. In the committee’s view, a rigorous Earth Science curriculum and strong professional preparation are consistent and appropriate for Washington’s flagship university. An additional teaching or professional practice faculty member would be a valuable addition to the ESS faculty to ensure that the undergraduate program provides what is needed for successful professionals.

Recommendations

1. The change in research focus from Space Physics to Planetary Science suggests that the Space Physics BS track is likely to change. This represents a significant risk in that a large fraction (more than 40% in 2020 and 2021) of ESS majors are in that track. Modifying the Physics track to include more terrestrial geophysics and instrumentation may or may not maintain the same enrollment. A clear plan for the future of this major is needed immediately.
2. Professional preparation for ESS majors needs strengthening. Redesign of the capstone experience is an urgent task that is essential for the continued success of the ESS undergraduate program. Substantial intellectual and financial resources will be needed to pull this off. The planned hiring of two surface processes faculty should help complete filling instructional gaps and may help in improving the professional preparation of ESS graduates. A dedicated teaching or professional practice faculty member would be very helpful in this regard.
3. The exceptionally large SCH provided by the Department and the large number of majors for an Earth Science program warrant additional central funding to support this successful undergraduate enterprise.

V. Graduate program

The graduate program is strong and of high quality. The program has seen some decline from its historical levels of around 100 graduate students. This decline is correlated with the loss of faculty over the last few years. The number of graduate students has started to increase with the arrival of new faculty. Because faculty typically mentor an average of 4 to 5 students, the total graduate student population is expected to grow back to its normal level with the addition of six new faculty members. Students can also be supervised by research faculty and work as

graduate assistants for them. For example, there are typically two students supported by the PNSN.

The department supports all of the graduate students they admit. Support includes teaching assistantships (TA), research assistantships (RA), and some fellowships. Students are typically admitted into a Ph.D. program, although some go into a more applied M.S. program. This program, MESSAGE, typically accounts for around 10% of the graduate enrollment. MESSAGE is discussed below in a separate section.

Although supported, the graduate students consider the support to be spread unevenly and inconsistently. Some students serve as a TA for their entire program, while others desire teaching experience but do not get any. They are also concerned that the pay rate varies greatly across the graduate student population. The students expressed the desire for a more standardized pay structure. The committee is unsure whether this constitutes a significant problem or is a necessary by-product of the various ways support is generated. It is common for grant funds to come with different rates of support that last for different periods. The fact that all students receive financial support is a positive aspect of the department.

A significant concern of the committee is the lack of uniformity in student evaluation and procedures. Students uniformly expressed the view that they are given conflicting and incomplete guidance from department policy and rules. Rules need to be better stated and are sometimes not uniformly enforced. The department needs to review its posted documents for graduate student progression to degree, make them consistent, and ensure that they provide clear pathways. The students would like a straightforward handbook to help guide them through their degree program.

There was also general concern about the exams students must take to progress through their Ph.D. The students report a need for more transparency on what is required of the exams and are concerned there are no posted rubrics. The nature and difficulty of the Ph.D. exams reside entirely with each committee, and there needs to be a formalized and clear process. The students requested that the preliminary exams become more formalized. Students were also confused about the non-uniform nature of exam results and post-exam requirements, with many possible outcomes.

Some of this lack of uniformity may be intentional. The department's self-study stated, "Our chief challenge for the graduate research program is that there is no set curriculum. This presents the potential for students to be under-served by the breadth and depth of expertise available on the faculty. How rigorous an education students receive can depend very much on the individual advisor." So it is clear that the faculty recognize this shortcoming but, in part, have put it in place to allow flexibility in the graduate programs, which can be tailored to the individual students.

MESSAGE. The MESSAGE program was reported to the committee as a success, graduating roughly twelve students per year with a 95% placement rate. Satisfaction is reported to be high

by both participants and employers. Based on applications, the program could grow in size from both alumni and external applicants. The self-study says that most undergraduate ESS students are not headed for academic careers. We received anecdotal reports that ESS undergraduates were generally not considered well-prepared for a professional career. In contrast, MESSAGE students were seen as well-prepared and quickly employed. Given the success of MESSAGE and the possibility that CoEnv may start other applied MS programs, it is disappointing that ESS has paused the program for the current year and is considering its termination. A key limitation is the large amount of time and effort required of a limited number of faculty to ensure the program's success. Are budgeting algorithms getting in the way of something that works well and could be of much greater service to both the ESS undergraduates and the State of Washington?

The success of an applied MS program requires dedicated support for positions outside the tenure track. These include teaching faculty and program administration, especially in developing capstone projects. An important part of the success of the MESSAGE program is the requirement for individual capstone projects. This kind of "high-touch" endeavor is demanding of faculty time, yet also essential for a successful capstone experience. Management of these individual projects should not be part of tenure-track faculty requirements, although participation in advising the projects could well be. A professional practice faculty position would appear to be appropriate here.

Some faculty appear to draw a strong line between "pure" vs. "applied" earth science. Many "applied" questions demand answers at or beyond our current understanding and can be fully consistent with a research-dominant university department. Participation in MESSAGE instruction and capstone project evaluation would seem to be compatible with the research of some ESS faculty. It could be accommodated by appropriately defining their teaching and service roles. In addition to hiring sufficient non-tenure-track faculty to support the program, a willingness and ability to engage in relevant "applied" topics to support the undergraduate and applied MS programs can be a factor in planning the future of the ESS tenure-track faculty.

The review committee questions why the financial return to the department of MESSAGE tuition is not sufficient to motivate growth. Without sufficient tuition return, the department faces a zero-sum choice between growing the MESSAGE program and other essential department needs, such as increasing TA funding. If MESSAGE is successful, can support a larger enrollment, and provides valuable service to both ESS undergraduates and the State of Washington, why can program finances not be structured in a way to support quality and growth?

The Department posed the options of replacing MESSAGE with a 5-yr BS/MS program or dropping the program altogether. A high-quality professional preparation program (whether 5-yr or MESSAGE) requires individual feedback on professional conduct, communication, and critical thinking. Quality requires a "high-touch" approach. A 5-yr BS/MS program is largely consistent with the existing MESSAGE program, and both could be run using common requirements whether the student is a current ESS major or not. The question is whether the department is willing to commit to a high-quality program and whether tuition returns can adequately support that program. MESSAGE has shown that such a program can succeed and be viewed as a

model for an expanded program rather than a candidate for elimination. Program expansion would seem to be a favorable step for the undergraduate program and for the contribution made from gown to town.

Recommendations

1. The department should immediately review and revise documents related to expectations and procedures for progression through the graduate degree. There needs to be a single source of consistent information and guidance given to the students.
2. The preliminary examinations for the Ph.D. programs should be made more uniform to the extent it better serves the students. This does not mean we recommend that a single, uniform exam be the goal. This would take away flexibility in designing individual programs best suited to the student. Instead, this would attempt to place similar expectations on students to progress successfully through the exam.
3. A limited set of exam outcomes should be constructed. This could be something like pass, fail, pass with stipulated coursework or other contingencies, or simply a retake instruction. Again, this will not limit flexibility but at least give a set of expected outcomes.
4. One of the clearest messages was that department policies and their enforcement are not communicated with sufficient transparency to graduate students. The department chair, committees, and advisors should strive to inform better and educate the students on what is going on with the ESS graduate program.
5. The department needs to engage in a planning process to determine whether it is willing to commit to a high-quality applied MS program. Collaboration with the college to devise sufficient financial return for viability is essential. Further integrating with the BS program, reducing the research requirement including the emphasis on the research paper, and reconsidering the curriculum to include in-demand skills related to the expertise of newer faculty seem like potential trajectories toward an expanded and sustainable program.

VI. Conclusions

The Review Committee recommends that all degree programs be continued and that the program next be reviewed in 10 years. However, we recommend that the department be asked to provide concise, written evidence of solidifying and communicating policies and guidelines addressing department governance; DEI initiatives; requirements and timelines for masters and doctoral degrees; and the promotion, merit, and tenure process. We recommend evidence of documents we feel should be available to the department rather than an interim report. If the department can not complete the document within the timeline for a departmental response, they should provide them to the graduate school during the interim period.

VII. Process

The Review Committee received its charge in June 2022. The Department of Earth and Space Sciences delivered its self-study in September 2022. The two-day site visit took place on 17-18 October 2022. The schedule encompassed conversations with most department constituencies,

including faculty, staff, and graduate and undergraduate students. Recommendations were delivered and discussed with department leadership and University administrators. The review committee also considered documentation from the 2010-2011 review.

VIII. Responses to questions

Key questions

1. Are the unit's degree programs of high quality? Do they meet the university's expectations of quality and reputation?

Yes, the ESS department and its degree programs have strong national and international reputations. We found the degree programs to be of high quality, but curriculum review, planning, and additional hiring, particularly of teaching professors, are needed for sustained excellence. The department has produced many exceptional alums across its long history. Additionally, despite its short tenure, the applied master's program seems to have developed a strong reputation and excellent career placement.

2. How does the unit compare with that of peer and aspirational institutions in terms of educational programs and scholarship?

The department compares well with premier earth and planetary science departments nationally and internationally. Recent hires have filled in gaps opened by the aging demographic of the department, and the department is now well poised to envision a future of educational programs and scholarships with the potential to elevate an already strong department.

3. How can the unit improve the quality of its educational programs and scholarship? What does the unit need to do to increase its national prominence?

As outlined above, the primary constraint the department faces is financial. The department has succeeded in maintaining strong scholarship and educational programs despite the relatively low financial return from the college on their extensive investment in educating an immense number of students from across the university in 100-level courses. Recent retirements have posed a challenge to the department maintaining its education program and excellence in many areas within earth and space sciences. Rising start-up costs for recruiting top faculty are a particular challenge. The department needs financial returns from the college commensurate with its teaching contributions to continue and increase its national prominence. The department should not need to expend indirect costs from research grants to support its educational mission. With more appropriate financial returns, the department should be well poised, led by its impressive group of junior faculty, to develop a strategic hiring plan to build on its already strong national prominence.

Additional questions

1. Do students, faculty, and staff find the department a supportive and welcoming environment in which to pursue their degrees and careers as scholars, teachers, and administrators?

While department constituents generally appreciated the collaborative and interactive nature of the department, a concerning number of department members across constituencies raised concern over the departmental climate. We are optimistic that worries were exacerbated by unprecedented times over the last couple of years and that they can be rapidly and readily alleviated with improved communication. There is a need to rebuild department trust, a sense of shared mission, and a culture of open dialog.

2. Are students, faculty, and staff from groups that are underrepresented fully included in the intellectual life of the department?

There is a need for the department to refine and collectively commit to efforts to promote diversity, equity, and inclusion (DEI). Shifting DEI committee structures and unclear mandates have undermined some strong initial department efforts. The DEI committee should be empowered to take a cross-cutting and multifaceted approach, building on a strong precedent of following best practices in faculty hiring and graduate recruitment. Stronger partnerships with the college on messaging and outreach should help increase the diversity of the pool of graduate applicants. Some concerns were raised over the extent to which undergraduates of color felt welcomed by the department. Increasing their sense of belonging is crucial to the department's climate and increasing diversity in earth and planetary sciences.

3. To what extent do the unit's current facilities and building space meet its needs?

Department members expressed frustration over being separated in two buildings with other interspersed units. Funding and re-envisioning are needed to repurpose extensive laboratory space that has become available over recent years. Some basic infrastructure crucial to earth sciences (e.g., rock-crushing rooms) are in decaying, unusable, or unsafe states. We are hopeful that a recently revised staff support structure will improve building management and address some alarming safety concerns raised. There is a need for investment in replacing major infrastructure such as a microprobe and freezers.

4. To what extent is the unit preparing students at all levels for careers and future academic pursuits?

The unit appears to be preparing students well for a variety of careers and academic pursuits. There was some tension at the undergraduate level regarding academic and applied training and balancing the demands of state licensing exams with emerging areas. Developing a smoother integration and continuum between pure science and application should be a department priority. Exposing students to possible careers and applied approaches earlier to inspire and direct their studies should be a priority. There is great potential to build on classic earth science curriculum elements to encompass exciting emerging areas. Recent faculty hires are providing excellent opportunities for students to receive additional training in emerging areas such as sensing and data science.

Unit defined questions

Education:

1) *Are the structures and content of our undergraduate and graduate programs appropriate? In particular,*

a) Are we meeting the practical needs of undergraduates (particularly the majority who will pursue job opportunities outside academics) while capitalizing on faculty expertise?

Professional preparation for ESS majors needs strengthening. Redesign of the capstone experience is an integral and urgent task. Substantial intellectual and financial resources will be needed to bring professional preparation up to the quality of the rest of the undergraduate program. A dedicated teaching or professional practice faculty member would be helpful in this regard; funding for such a position would be consistent with ABB allocations from the exceptional SCH delivered by the department. Career opportunities and professional skills can be incorporated more broadly across the undergraduate curriculum using activities such as career panels, field experiences using professional techniques, and noting licensing exam topics when they appear in regular coursework. Emerging areas of faculty expertise should allow for training students to excel in a changing geosciences landscape. Strengthening professional preparation for undergraduates is consistent with improving and growing the graduate MESSAGE program.

b) How does our graduate program need to evolve to ensure our students have the access to the best, cutting-edge science?

The graduate program is already providing access to cutting-edge science. Increased faculty-student interactions and collaborations among groups, including with centers and initiatives within the department, should help ensure access.

c) How can we make our applied Masters program financially sustainable without compromising its excellence in training and job placement? How does this program complement or detract from the graduate research program?

We concluded that the applied Masters program complements the graduate research program, provides important linkages with industry, and provides something of a model for improved professional preparation for ESS undergraduates. The program's strong reputation and job placement history provide a solid foundation to build on. Mentoring individual research or capstone projects requires considerable faculty time and appears to be an important part of the success of the program. Perhaps some savings could be achieved if some MESSAGE projects were conducted by small groups, rather than individuals. Perhaps opportunities to engage practitioners in teaching could be expanded. The success of the program appears to be related to its "high touch" approach, suggesting that increased funding for a teaching or professional practice faculty member is an investment required for continued success. We cannot specify how the budget algorithm must be changed to support this investment, although a position supporting professional preparation of both graduate and undergraduate students would seem to be an appropriate application of central ABB instructional support.

Research:

2) *Looking to the next decade, how can the department best position itself to pursue emergent research and funding opportunities, given current expertise and reputation but limited resources for new hires? In particular:*

a) *We have identified planetary sciences as a near-term growth area of interest. How can we build in this area strategically, while retaining critical mass in other strong research areas and maintaining core teaching expertise?*

b) *Some areas of historical strength (widely recognized externally) are at risk of losing ground owing to retirements. Which areas should be prioritized for reinvestment, and Why?*

The review committee concluded that we are uncomfortable answering these questions since the department can best address them. Based on input during the review, we concluded that there is a need/opportunity for the department to develop a hiring plan collectively. The department seems to currently be in a good position to refine a hiring plan after recovering from the very low faculty levels a couple of years ago, emerging from the pandemic, and incorporating the perspective of six new exciting hires. The committee notes that strengthening faculty capabilities in remote sensing and spatial analysis could be a good strategy to help the instructional program.

c) *What opportunities exist for joint programs or faculty hires with the other departments in the College of the Environment or beyond?*

Revisiting and strengthening the department's relationship with the college should help recognize opportunities. New faculty in both ESS and Atmospheric Sciences seem to expand opportunities for interactions. The increased focus among department faculty on sensing and computational approaches should open up opportunities for collaboration with the UW College of Engineering, the Allen School of Computer Science and Engineering, and the Physics and Oceanography departments. Existing linkages with the UW Aeronautics and Astronautics Department seem beneficial to maintain and enhance as the department's space science constituency declines.