THE UNIVERSITY OF WYOMING
BOARD OF TRUSTEES'

SUPPLEMENTAL MATERIALS

June 10, 2020
Conference Call Meeting

The final report can be found on the University of Wyoming Board of Trustees Website at http://www.uwyo.edu/trustees/

University of Wyoming Mission Statement (July 2017)

We honor our heritage as the state's flagship and land-grant university by providing accessible and affordable higher education of the highest quality; rigorous scholarship; the communication and application of knowledge; economic and community development; and responsible stewardship of our cultural, historical and natural resources.

In the exercise of our primary mission to promote learning, we seek to provide academic and co-curricular opportunities that will:

- Graduate students who have experienced the frontiers of scholarship and creative activity and who are prepared for the complexities of an interdependent world;
- Cultivate a community of learning energized by collaborative work among students, faculty, staff and external partners.
- Nurture an environment that values and manifests diversity, internationalization, free expression, academic freedom, personal integrity and mutual respect; and
- Promote opportunities for personal health and growth, physical health, athletic competition and leadership development for all members of the university community.

As Wyoming's only public university, we are committed to scholarship, outreach and service that extend our human talent and technological capacity to serve the people in our communities, our state, the nation and the world.

TRUSTEES OF THE UNIVERSITY OF WYOMING AGENDA
June 10, 2020
Conference Call Meeting

Note: Only topics that have support materials provided in advance of the meeting are contained within this report. Topics that will be discussed with only a verbal report do not have information included.

WORK SESSIONS

Consideration and Action: COVID-19 update and draft plan to reopen campus – Theobald *[materials previously uploaded]*
Consideration and Action: WWAMI/WYDENT Loan Forbearance – Ratification of Executive Committee approval- Evans
Consideration and Action: Academic and Student Affairs Committee – Sullivan

- Geospatial Information Science & Technology (GIST) Undergraduate and Graduate Program – Alexander 4

Consideration and Action: Annual Operating Budgets for FY21 – McKinley *[materials provided as supplemental]*
Consideration and Action: Facilities Contracting Committee – McKinley/Mai

- Science Initiative Change Orders, Research and Mechanical Scope Additions (GE Johnson Wyoming) and Additional Design Services (GSG Architecture)
- Construction Manager Selection for Student Housing and Dining
- Lewis St. Corridor delivery method (CMAR)
- United States Forest Service Lease Amendment 109
- UniWyo Federal Credit Union Campus Branch Lease Extension.....157
- Cheyenne Family Medicine- Security, ADA and Mechanical Renovations

Consideration and Action: Fiscal and Legal Affairs Committee – Moore

- Annual internal audit plan (per Trustee Bylaws) – Salmans *[postponed from May meeting]* 169

Consideration and Action: Modifications to UW Regulations – Brown/Evans

- UW Regulation 2-106 (Assignment of Grades) and UW Regulation 2-121 (Change of Grades).....171
- UW Regulation 11-4 (Student Organizations) and UW Regulation 11-6 (Student Media).....186

Proposed Items for Action

a. Contracts, agreements, procurements over $1 million or 5 years in length
b. Personnel

AGENDA ITEM TITLE: Geospatial Information Science & Technology (GIST) Program Request for Authorization, Sullivan,/Alexander

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Summary statistics and information for recommended GIST programs roll out

Recommendation:

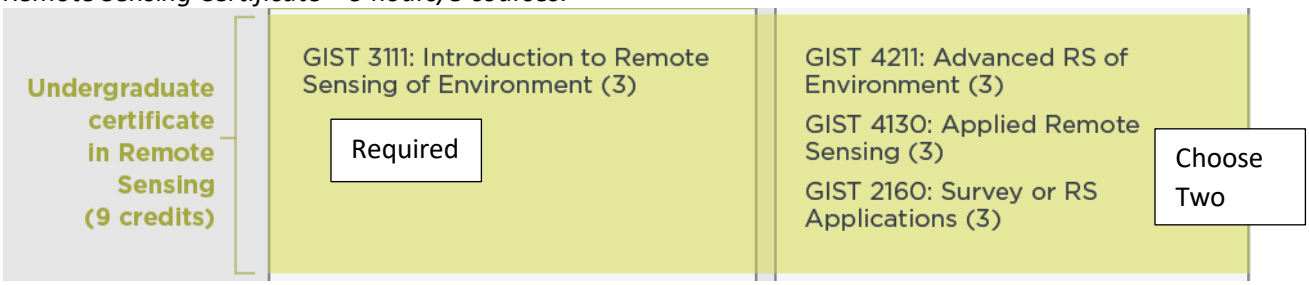
1. Immediate establishment of an online professional M.S. in Geospatial Information Science and Technology (no thesis), along with three online graduate certificates (GIS, remote sensing, and unmanned aerial systems), and two undergraduate certificates (GIS and remote sensing).
2. Contingent Approval of a B.S. in Geospatial Information Science and Technology to be established in Fall 2022 conditional on evidence of favorable student demand and enrollment trends in courses offered for the undergraduate certificates.

Two Undergraduate Certificates Curriculum

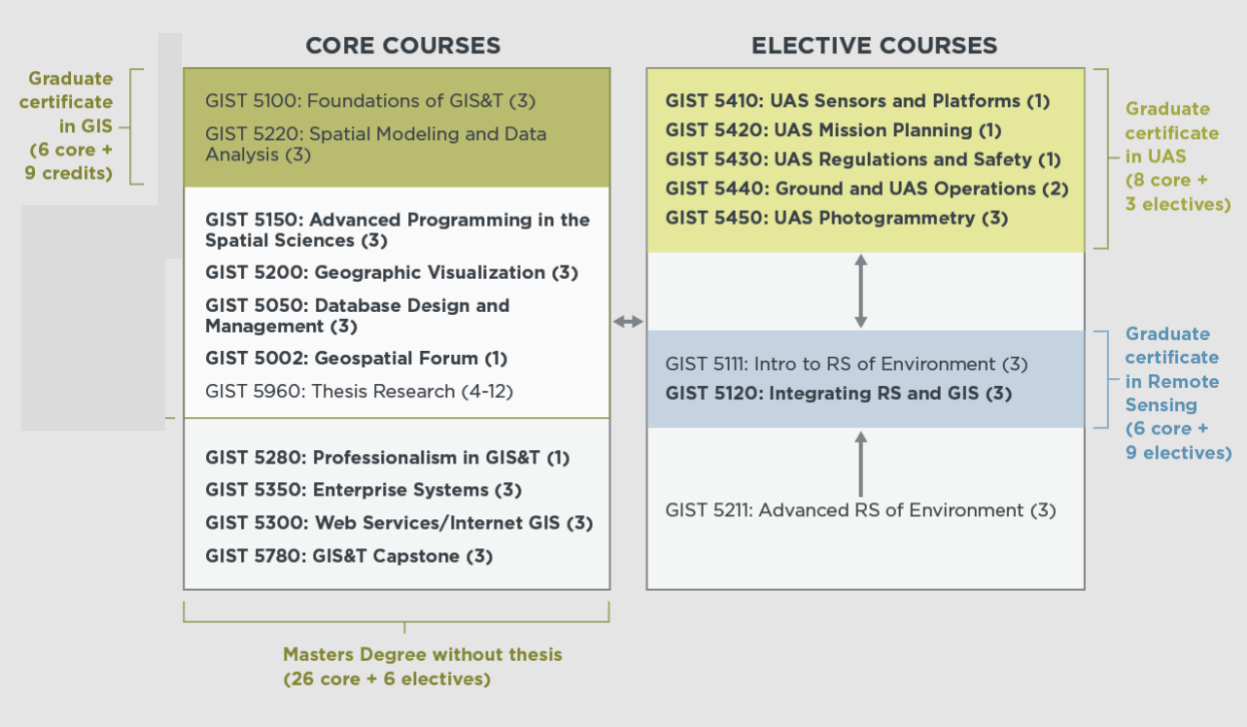
GIS Certificate: 9 credit hours/3 courses

:

Remote Sensing Certificate – 9 hours/3 courses:



Three Graduate Certificates *(GIS, Unmanned Aerial Systems, Remote Sensing)*
+ Online Professional M.S. in GIST Curricula:



B.S. GIST Curriculum:

CORE COURSES (31 CR.)	**ELECTIVE COURSES** (30 CR.)
GIST 1001: Introduction to GIST and Digital Portfolios (1) GIST 1100: Foundations of Spatial Thinking (3)	Discipline specific electives, for example: ANTH 4160: GIS in Anthropology STAT 4360: Spatial Statistics LS 2XXX – 4XXX: Surveying Courses GIST RS courses (see below)
GIST 2100: Introduction to GIS (3) **GIST 2200: Introduction to Spatial Data Visualization (3)** **GIST 2150: Introduction to Programming in GIS&T (3)**	
GIST 3111: Introduction to Remote Sensing of Environment (3)	GIST 4211: Advanced RS of Environment (3) GIST 4130: Applied Remote Sensing (3) GIST 2160: Survey or RS Applications (3)
GIST 2250: Digital Map Design (COM2) (3) **GIST 3050: Spatial Database Design and Management (3)** **GIST 4780: GIST Capstone (COM3) (3)** **GIST 4990: Internship/Research in GIS&T (6)**	

Projected Financial Results of Recommendation:

Projected Financial Results for New Program GRAD	**20/21**	**21/22**	**22/23**	**23/24**		
Total Expenses	$129,048	$216,922	$193,755	$193,755		
Total New Revenues Generated by NEW Program	$121,800	$281,622	$445,026	$519,939		
New Program's Total Surplus or Deficit	**($7,248)**	**$64,700**	**$251,271**	**$326,184**	**Stabilized Surplus at $326,184 thereafter**	
Projected Financial Results for New Program B.S.	**20/21**	**21/22**	**22/23**	**23/24**	**24/25**	**25/26**
Total Expenses			$69,490	$164,066	$200,564	$228,661
Total New Revenues Generated by NEW Program			$6,934	$43,482	$91,061	$141,779
New Program's Total Surplus or Deficit			**($62,556)**	**($120,584)**	**($109,503)**	**($86,882)**
	20/21	**21/22**	**22/23**	**23/24**	**24/25**	**25/26**
Total New Program Surplus/Deficit	**($7,248)**	**$64,700**	**$188,715**	**$205,600**	**$216,681**	**$239,302**

GIST Courses offered to date in AY 19-20

- GIST 1100 –Geospatial Foundations (30/31 seats filled)
- GIST 2100 – Introduction to GIS (29/30 seats filled)
- GIST 2150 - - Introduction to Programming in GIST (18/18 seats filled)
- GIST 2160 – Survey of Remote Sensing (19/25 seats filled)
- BOT/GEOG 4111 (now GIST 3111) – Introduction to Remote Sensing of the Environment (25/25 seats filled)
- GIST 5100 – Foundations of GIST (25/25 seats filled).
- GIST 4440/5440 – UAS Ground School and Operations (10/10 seats filled)

GIST Courses developed to be offered starting in Fall 2020

- GIST 1001 – GIST Orientation and Portfolio
- GIST 3111 – Introduction to Remote Sensing
- GIST 4130/5130 – Remote Sensing in Agricultural Management
- GIST 4410/5410 – UAS Sensors and Platforms
- GIST 4420/5430 – UAS Regulations and Safety
- GIST 5111 – Introduction to Remote Sensing
- GIST 5120 – Integration of Remote Sensing and GIS Data
- GIST 5150 - Advanced Programming for Spatial Sciences
- GIST 5200 – Geographic Visualization

Recommended metrics for evaluation in decision point to offer/not offer the B.S. in GIST

1. The number of students in the undergraduate certificates by year. By the time of evaluation by the Board, the undergraduate certificates should have student headcounts of at least 25 students in each certificate.
2. Current undergraduate certificate courses or requirements that are:
    a. Routinely oversubscribed (high enrollments/large wait lists)
    b. Routinely undersubscribed (low enrollments/cancelled due to low enrollments)
    c. Have high D/F/W rates
3. Does the mission of the proposed new B.S. GIST degree program fit with the mission and current resource capacity of the university?
4. Substantial and structured collaborations with other programs, such as dual, double or joint degrees, and any planned 2+2 articulation agreements with Wyoming or other community colleges.

This template is intended to be used as a basic guide to generate a projection of additional expenses and revenues at the University.

Cells in orange are variables which can be updated as needed. Please enter information in numerical tab order.

Cells in gray calculate automatically

	Fiscal Year 1	2	3	4	
Revenue					
Cummulative Total NEW Laramie campus headcount enrollment	7	19	33	47	*Cumulative enrollment over time (not 1-year enrollment)*
NEW Resident enrollment (# of new students entering the program each year)	4	7	8	8	*Based on other programs (5 to 33 from EAB; 40 UTex; 20 MSU; 168 Geog @ CU Boulder)*
NEW Non Resident Enrollment (# of new students entering the program each year)	3	5	6	6	*EAB reports 8-15 completions nationally per year per institution*
NEW Resident distance enrollment (ONLY use this field if the Program is 100% delivered online)	*0*	*0*	*0*	*0*	*No distance delivery for this degree*
NEW Non Resident distance enrollment (ONLY use this field if the Program is 100% delivered online)	*0*	*0*	*0*	*0*	*No distance delivery for this degree*
Resident (credit hours delivered outside of NEW Program)	116	263	421	583	*This is based on new courses*
Resident (credit hours delivered in NEW Program)	4	67	149	227	*This is based on new courses*
Resident Distance (credit hours delivered in NEW Program through Distance)	0	0	0	0	*No distance delivery for this degree*
Non Resident (credit hours delivered outside of NEW Program)	87	190	312	432	*This is based on new courses*
Non Resident (credit hours delivered in NEW Program)	3	50	108	168	*This is based on new courses*
Non-Resident Distance (credit hours delivered in NEW Program through Distance)	0	0	0	0	*No distance delivery for this degree*
Total Resident credit hours generated**	120	330	570	810	
Total Non Resident credit hours generated**	90	240	420	600	
Per Credit Tuition*					
Resident (Posted Tuition Rate)	$139	$145	$150	$156	*Tuition revenue caculated based on std. UW tuition rates*
Nonresident (Posted Tuition Rate)	$537	$558	$581	$604	
Prior Year's Non Resident Discount Rate (updated annually by the budget office)	30%	30%	30%	30%	
Estimated Actual Non Resident Per Credit Tuition	$376	$391	$407	$423	
Total Resident Tuition generated outside of NEW Program	$16,124	$38,019	$63,294	$91,156	
Total Resident Tuition in NEW Program	$556	$9,686	$22,401	$35,493	
Total Non Resident Tuition outside of NEW Program	$32,703	$74,278	$126,851	$182,665	
Total Non Resident Tuition in NEW Program	$1,128	$19,547	$43,910	$71,037	
Total Distance Tuition in NEW Program					
Total Tuition from NEW Enrollment	$50,511	$141,529	$256,456	$380,350	
Fees					
Program Per Credit Hour	$25	$25	$25	$25	*Fee revenue based on UW standard*
Program Fee Revenue	$5,250	$14,250	$24,750	$35,250	
Advising Fee Per Credit Hour	$6.00	$6.00	$6.00	$6.00	
Advising Fee Revenue	$1,260	$3,420	$5,940	$8,460	
Mandatory Fee (Per Full Time Student)	$705.47	$705.47	$705.47	$705.47	
Mandatory Fee Revenue	$4,938	$13,404	$23,281	$33,157	
Distance Fee	$100	$100	$100	$100	
Total New Revenue Generated Within New Program	$6,934	$43,482	$91,061	$141,779	
Total New Revenue Generated Outside of the Program	$55,026	$129,121	$219,366	$315,438	
Total Distance Revenue Generated	$0	$0	$0	$0	
Total Distance Revenue Remaining with College	$0	$0	$0	$0	
Total Distance Revenue Remaining with Provost	$0	$0	$0	$0	
Total New Revenue Generated	$61,959	$172,603	$310,427	$457,217	
New Program Expense Assumptions					
Compensation and benefits					
Faculty	$36,448	$109,344	$153,467	$175,439	*Based on 4-year teaching schedule and excluding existing faculty and currently funded faculty resources.*
Other administrative staff	$0	$7,472	$7,472	$7,472	*1/4th of 50% staff person (see graduate pro forma for other 3/4)*
Graduate Assistants	$18,375	$24,500	$24,500	$30,625	*Assume MS level GAs at $6,125/semester*
Supplies	$1,250	$1,250	$1,250	$1,250	*Office supplies*
Travel	$3,000	$3,000	$3,000	$3,000	*$12K/yr for director and instructor travel split over all credentials*
Marketing	$1,750	$1,500	$875	$875	*$20K for 4 years spread across credentials*
Software	$4,000	$4,000	$4,000	$4,000	*UAS photogrammetry software maintenance, Erdas, etc., split across pro formas*
Community College articulation	$3,000	$3,000	$1,000	$1,000	*Articulation summits first 2 years, then visits to CCs*
New course development	$1,667	$10,000	$5,000	$5,000	*Based on Nasser est. of $5000/new course supplemental pay*
Capital expense					

Other (specify)				

Projected Financial Results for New Program	**FY1**	**FY2**	**FY3**	**FY4**
Total Expenses	$69,490	$164,066	$200,564	$228,661
Total New Revenues Generated by NEW Program	$6,934	$43,482	$91,061	$141,779
New Program's Total Surplus or Deficit	**-$62,556**	**-$120,584**	**-$109,503**	**-$86,882**
Operating margin (surplus or deficit / revenues)	-9.02	-2.77	-1.20	-0.61

B.S. is revenue negative, but costs are covered by revenue positive graduate credentials

* UW's Board of Trustees' current working policy is to raise tuition by 4% each year
Last updated 4/29/19

Enter Course of Study, Credit Hours, indicate if the course is new and if the course will be offered through distance education			
Freshman Fall	13	NEW Course	Distance Option
GIST 1001 Intro. GIST and digital portfolio (Jeff)	1		
Q	3		
USP C1	3		
USP FYS	3		
GIST 1100 Foundations of spatial thinking (APL)	3		
Freshman Spring	17		
STAT 2050	4		
MATH 1405 Trig	3		
USP V	3		
GIST 2100 Intro GIS (Chen)	4		
Minor core course	3		
Sophmore Fall	15		
USP PN Elective	3		
USP H	3		
GIST 2200 Spatial Visualization (CPM2)	3		
GIST 2150 Intro Programming (Chen)	3		
Minor core course	3		
Sophmore Spring	15		
USP H	3		
GIST 2250 (C2) Digital map design (APL)	3		
Minor core course	3		
GIST elective	3		
GIST elective (PN) (APL)	3		
Junior Fall	15		
GIST 3111 Intro to RS of env.	3		
GIST elective (CPM1)	3		
GIST elective	3		
Minor elective	3		
Minor elective	3		
Junior Spring	15		
GIST 3050 Spatial database design & mngmt.	3		
GIST upper division elective (CPM 2)	3		
GIST upper division elective	3		
Upper division elective	3		
Minor elective	3		
Senior Fall	15		
GIST 4990 Internship/research in GIST	6		
GIST upper division elective (CPM 2)	3		
GIST upper division elective	3		
Minor elective	3		
Senior Spring	15		
GIST Capstone (USP C3)	3		
GIST upper division elective	3		
GIST upper division elective	3		
Upper division elective	3		
Upper division elective	3		
Total Hours	120		

NEW CREDIT HOURS OFFERED BY ACADEMIC YEAR

			1		2		3		4	
Freshman Fall	New Course hours	Fall		Spring	Fall	Spring	Fall	Spring	Fall	Spring
GIST 1001 Intro. GIST and digital portfolio (Jeff)	TRUE	1	1		1		1		1	
Q	FALSE	3	0		0		0		0	
USP C1	FALSE	3	0		0		0		0	
USP FYS	FALSE	3	0		0		0		0	
GIST 1100 Foundations of spatial thinking (APL)	FALSE	3	0		0		0		0	
Freshman Spring										
STAT 2050	FALSE	4		0		0		0		0
MATH 1405 Trig	FALSE	3		0		0		0		0
USP V	FALSE	3		0		0		0		0
GIST 2100 Intro GIS (Chen)	FALSE	4		0		0		0		0
Minor core course	FALSE	3		0		0		0		0
		30	1	0	1	0	1	0	1	0
Sophmore Fall					0		0		0	
USP PN Elective	FALSE	3			0		0		0	
USP H	FALSE	3			0		0		0	
GIST 2200 Spatial Visualization (CPM2)	TRUE	3			3		3		3	
GIST 2150 Intro Programming (Chen)	TRUE	3			3		3		3	
Minor core course	FALSE	3			0		0		0	
Sophmore Spring						0		0		0
USP H	FALSE	3				0		0		0
GIST 2250 (C2) Digital map design (APL)	TRUE	3				3		3		3
Minor core course	FALSE	3				0		0		0
GIST elective	TRUE	3				3		3		3
GIST elective (PN) (APL)	TRUE	3				3		3		3
		30	0	0	6	9	6	9	6	9
Junior Fall										
GIST 3111 Intro to RS of env.	FALSE	3					0		0	
GIST elective (CPM1)	TRUE	3					3		3	
GIST elective	FALSE	3					0		0	
Minor elective	FALSE	3					0		0	
Minor elective	FALSE	3					0		0	
Junior Spring								0		0
GIST 3050 Spatial database design & mngmt.	TRUE	3						3		3
GIST upper division elective (CPM 2)	TRUE	3						3		3
GIST upper division elective	FALSE	3						0		0
Upper division elective	FALSE	3						0		0
Minor elective	FALSE	3						0		0
		30	0	0	0	0	3	6	3	6
Senior Fall									0	
GIST 4990 Internship/research in GIST	FALSE	6							0	
GIST upper division elective (CPM 2)	TRUE	3							3	
GIST upper division elective	FALSE	3							0	
Minor elective	FALSE	3							0	
Senior Spring										0
GIST Capstone (USP C3)	TRUE	3								3
GIST upper division elective	TRUE	3								3
GIST upper division elective	FALSE	3								0
Upper division elective	FALSE	3								0
Upper division elective	FALSE	3								
		30	0	0	0	0	0	0	3	6
Total Hours		120	1	0	7	9	10	15	13	21

Standard faculty teaching load 15

0.39

Compensation (based on teaching hours)	Salary	Benefits	1	2	3	4
Salary: Asst. Professor	$79,300	$31,006	-$14,708	$22,061	$66,184	$66,184
Salary: APL	$72,400	$28,308	$14,387	$43,161	$43,161	$43,161
Total Faculty Salary			-$321	$65,222	$109,345	$109,345

Based on proportion of full tenure-track teaching load (15 credits) (After discussion with Alex Keane)
Base on proporton of full APL teaching load (21 credits)

NEW CREDIT HOURS OFFERED BY ACADEMIC YEAR

			1		2		3		4	
Freshman Fall	New Course	hours	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring
GIST 1001 Intro. GIST and digital portfolio (Jeff)	FALSE	1	0		0		0		0	
Q	FALSE	3	0		0		0		0	
USP C1	FALSE	3	0		0		0		0	
USP FYS	FALSE	3	0		0		0		0	
GIST 1100 Foundations of spatial thinking (APL)	FALSE	3	0		0		0		0	
Freshman Spring										
STAT 2050	FALSE	4		0		0		0		0
MATH 1405 Trig	FALSE	3		0		0		0		0
USP V	FALSE	3		0		0		0		0
GIST 2100 Intro GIS (Chen)	FALSE	4		0		0		0		0
Minor core course	FALSE	3		0		0		0		0
		30	0	0	0	0	0	0	0	0
Sophmore Fall					0		0		0	
USP PN Elective	FALSE	3			0		0		0	
USP H	FALSE	3			0		0		0	
GIST 2200 Spatial Visualization (CPM2)	FALSE	3			0		0		0	
GIST 2150 Intro Programming (Chen)	FALSE	3			0		0		0	
Minor core course	FALSE	3			0		0		0	
Sophmore Spring						0		0		0
USP H	FALSE	3				0		0		0
GIST 2250 (C2) Digital map design (APL)	FALSE	3				0		0		0
Minor core course	FALSE	3				0		0		0
GIST elective	FALSE	3				0		0		0
GIST elective (PN) (APL)	FALSE	3				0		0		0
		30	0	0	0	0	0	0	0	0
Junior Fall										
GIST 3111 Intro to RS of env.	FALSE	3					0		0	
GIST elective (CPM1)	FALSE	3					0		0	
GIST elective	FALSE	3					0		0	
Minor elective	FALSE	3					0		0	
Minor elective	FALSE	3					0		0	
Junior Spring								0		0
GIST 3050 Spatial database design & mngmt.	FALSE	3						0		0
GIST upper division elective (CPM 2)	FALSE	3						0		0
GIST upper division elective	FALSE	3						0		0
Upper division elective	FALSE	3						0		0
Minor elective	FALSE	3						0		0
		30	0	0	0	0	0	0	0	0
Senior Fall									0	

GIST 4990 Internship/research in GIST	FALSE	6							0		
GIST upper division elective (CPM 2)	FALSE	3							0		
GIST upper division elective	FALSE	3							0		
Minor elective	FALSE	3							0		
Senior Spring											0
GIST Capstone (USP C3)	FALSE	3									0
GIST upper division elective	FALSE	3									0
GIST upper division elective	FALSE	3									0
Upper division elective	FALSE	3									0
Upper division elective	FALSE	3									
		30	0	0	0	0	0	0	0	0	0
Total Hours		120	0	0	0	0	0	0	0	0	0

Teaching load	fall	spring								
faculty line 1	9	6	0	0	0	0	0	0	0	0
faculty line 2	9	6	0	0	0	0	0	0	0	0
faculty line 3	9	6	0	0	0	0	0	0	0	0
faculty line 4	9	6	0	0	0	0	0	0	0	0

		0.39				
Compensation	Salary	Benefits	1	2	3	4
faculty line 1	$65,000	$25,415	0	$0	$0	$0
faculty line 2	$65,000	$25,415	0	$0	$0	$0
faculty line 3	$65,000	$25,415	0	$0	$0	$0
faculty line 4	$65,000	$25,415	0	$0	$0	$0
			$0.00	$0	$0	$0

For more specific salary and benefit data please contact the Budget Office at 766-9028

NON-RESIDENT

FY11 2010-11	FY12 2011-12	FY13 2012-13	FY14 2013-14	FY15 2014-15	FY16 2015-16	FY17 2016-17	FY18 2017-18	FY19 2018-19	FY20 2019-20	FY21 2020-21		
$ 376	$ 395	$ 413	$ 432	$ 454	$ 477	$ 496	$ 516	$ 537	$ 558	603	8%	**Non-Resident UG Per Student Credit Hour Tuition Increase**
	5%	5%	5%	5%	5%	4%	4%	4%	4%	8%		Non-Resident UG Per Student Credit Hr (SCH) Tuition Percent Increase over Prev. Yr.
$ 11,280	$ 11,850	$ 12,390	$ 12,960	$ 13,620	$ 14,310	$ 14,880	$ 15,480	$ 16,110	$ 16,740	$ 18,090		**30Student Credit Hours (SCHs) - Full-time**
$ 478.73	$ 502.61	$ 548.94	$ 582.19	$ 627.86	$ 660.75	$ 667.31	$ 673.73	$ 689.79	$ 705.47	$ 705.47		UG Mandatory Fees per Semester (Full-time)
	5%	9%	6%	8%	5%	1%	1%	2%	2%	0%		UG Mandatory Fees Percent Increase over Previous Year
$ 957	$ 1,005	$ 1,098	$ 1,164	$ 1,256	$ 1,322	$ 1,335	$ 1,347	$ 1,380	$ 1,411	$ 1,411		**UG Mandatory Fees Per Year (Full-time, 2 Semesters)**
$ 12,237	$ 12,855	$ 13,488	$ 14,124	$ 14,876	$ 15,632	$ 16,215	$ 16,827	$ 17,490	$ 18,151	$ 19,501		**Total Non-Resident UG Tuition & Mandatory Fees (30SCHs & 2 Semesters of Fees)**

0.0%	**Fee Increase**	

RESIDENT

FY11 2010-11	FY12 2011-12	FY13 2012-13	FY14 2013-14	FY15 2014-15	FY16 2015-16	FY17 2016-17	FY18 2017-18	FY19 2018-19	FY20 2019-20	FY21 2020-21		
$ 99	$ 104	$ 106	$ 108	$ 113	$ 119	$ 124	$ 129	$ 134	$ 139	139	0%	**Resident UG Per Student Credit Hour Tuition Increase**
	5%	2%	2%	5%	5%	4%	4%	4%	4%	0%		Resident UG Per Student Credit Hr (SCH) Tuition Percent Increase over Prev. Yr.
$ 2,970	$ 3,120	$ 3,180	$ 3,240	$ 3,390	$ 3,570	$ 3,720	$ 3,870	$ 4,020	$ 4,170	4,170		**30Student Credit Hours (SCHs) - Full-time**
$ 478.73	$ 502.61	$ 548.94	$ 582.19	$ 627.86	$ 660.75	$ 667.31	$ 673.73	$ 689.79	$ 705.47	$ 705.47		UG Mandatory Fees per Semester (Full-time)
	5%	9%	6%	8%	5%	1%	1%	2%	2%	0%		UG Mandatory Fees Percent Increase over Previous Year
$ 957	$ 1,005	$ 1,098	$ 1,164	$ 1,256	$ 1,322	$ 1,335	$ 1,347	$ 1,380	$ 1,411	$ 1,411		**UG Mandatory Fees Per Year (Full-time, 2 Semesters)**
$ 3,927	$ 4,125	$ 4,278	$ 4,404	$ 4,646	$ 4,892	$ 5,055	$ 5,217	$ 5,400	$ 5,581	$ 5,581		Total Resident UG Tuition & Mandatory Fees (30SCHs & 2 Semesters of Fees)

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Cells in gray calculate automatically

	Fiscal Year 1	2	3	4	
Revenue					
Cummulative Total NEW Laramie campus headcount enrollment	23	70	134	204	*This is not the number of students enrolled in any one year. It is cumulative across 4 years.*
NEW Resident enrollment (# of new students entering the program each year)	13	27	37	41	*Adds up all graduate credentials.*
NEW Non Resident Enrollment (# of new students entering the program each year)	10	20	27	29	*Adds up all graduate credentials.*
NEW Resident distance enrollment (ONLY use this field if the Program is 100% delivered online)	*13*	*27*	*37*	*41*	*Online credentials only*
NEW Non Resident distance enrollment (ONLY use this field if the Program is 100% delivered online)	*10*	*20*	*27*	*29*	*Online credentials only*
Resident (credit hours delivered outside of NEW Program)	0	0	0	0	*Adds up all graduate credentials.*
Resident (credit hours delivered in NEW Program)	96	210	301	343	*Adds up all graduate credentials.*
Resident Distance (credit hours delivered in NEW Program through Distance)	94	208	299	341	*Adds up all graduate credentials.*
Non Resident (credit hours delivered outside of NEW Program)	0	0	0	0	*Adds up all graduate credentials.*
Non Resident (credit hours delivered in NEW Program)	72	164	268	297	*Adds up all graduate credentials.*
Non-Resident Distance (credit hours delivered in NEW Program through Distance)	70	162	266	295	*Adds up all graduate credentials.*
Total Resident credit hours generated**	96	210	301	343	*Calculated from rows above*
Total Non Resident credit hours generated**	72	164	268	297	*Calculated from rows above*
Per Credit Tuition*					
Resident (Posted Tuition Rate)	$700	$728	$757	$787	*Variable tuition depending on whether online or on campus (this line not used in revenue calc.)*
Nonresident (Posted Tuition Rate)	$700	$728	$757	$787	*Variable tuition depending on whether online or on campus (this line not used in revenue calc.)*
Prior Year's Non Resident Discount Rate (updated annually by the budget office)	0%	0%	0%	0%	*Graduate students don't get discounted tuition*
Estimated Actual Non Resident Per Credit Tuition	$700	$728	$757	$787	*Variable tuition depending on whether online or on campus (this line not used in revenue calc.)*
Total Resident Tuition generated outside of NEW Program	$0	$0	$0	$0	*Adds up all graduate credentials.*
Total Resident Tuition in NEW Program	$67,200	$152,880	$227,893	$270,080	*Adds up all graduate credentials.*
Total Non Resident Tuition outside of NEW Program	$0	$0	$0	$0	*Adds up all graduate credentials.*
Total Non Resident Tuition in NEW Program	$50,400	$119,392	$202,908	$233,859	*Adds up all graduate credentials.*
Total Distance Tuition in NEW Program					
Total Tuition from NEW Enrollment	$117,600	$272,272	$430,801	$503,939	*Calculated from rows above*
Fees					
Program Per Credit Hour	$25	$25	$25	$25	*Standard fee*
Program Fee Revenue	$4,200	$9,350	$14,225	$16,000	*Calculated from rows above*
Advising Fee Per Credit Hour	$0.00	$0.00	$0.00	$0.00	*Graduate students don't pay advising fees*
Advising Fee Revenue	$0	$0	$0	$0	*Graduate students don't pay advising fees*
Mandatory Fee (Per Full Time Student)	$705.47	$705.47	$705.47	$705.47	*For Master's degrees but not certificates*
Mandatory Fee Revenue	$4,233	$11,993	$21,870	$33,157	*Sum of mandatory fee revenue for MS degrees only*
Distance Fee	$25	$25	$25	$25	
Total New Revenue Generated Within New Program	$121,800	$281,622	$445,026	$519,939	*Calculated from rows above.*
Total New Revenue Generated Outside of the Program	$4,233	$11,993	$21,870	$33,157	*Calculated from rows above.*
Total Distance Fee Revenue Generated	$4,100	$9,250	$14,125	$15,900	*Adds up all graduate credentials.*
Total Distance Revenue Remaining with College	$80,360	$188,552	$299,441	$350,553	*Calculated from rows above.*
Total Distance Revenue Remaining with Provost	$38,540	$90,058	$142,457	$166,137	*Calculated from rows above.*
Total New Revenue Generated	$249,033	$581,475	$922,919	$1,085,686	*Calculated from rows above.*
New Program Expense Assumptions					
Compensation and benefits					*Faculty cost is for all credentials considered together because courses overlap*
Faculty	$52,122	$118,306	$118,306	$118,306	*Based on 4-year teaching schedule excluding existing and previously committed faculty resources.*
Other administrative staff	$0	$22,415	$22,415	$22,415	*Grad program share of office associate*
Graduate Assistants	$24,660	$24,660	$24,660	$24,660	*Based on 2 TAs per year for teaching support.*
Supplies	$3,124	$3,124	$3,124	$3,124	*Adds up all graduate credentials.*
Travel	$12,000	$12,000	$12,000	$12,000	*Adds up all graduate credentials.*
Marketing	$4,475	$3,750	$2,250	$2,250	*Adds up all graduate credentials.*
Software	$11,000	$11,000	$11,000	$11,000	*Adds up all graduate credentials.*
New course development	$21,667	$21,667	$0	$0	*Based on course schedule for all grad credentials combined.*
Capital expense					
Other (specify)					

Projected Financial Results for New Program	**FY1**	**FY2**	**FY3**	**FY4**	
Total Expenses	$129,048	$216,922	$193,755	$193,755	*Calculated from rows above.*
Total New Revenues Generated by NEW Program	$121,800	$281,622	$445,026	$519,939	*Calculated from rows above.*
New Program's Total Surplus or Deficit	**-$7,248**	**$64,700**	**$251,271**	**$326,184**	*Note that bottom line is for all graduate credentials considered together (not sum of individual credentials) due to savings from overlapping courses.*
Operating margin (surplus or deficit / revenues)	-0.06	0.23	0.56	0.63	
				$634,907	

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	Fiscal Year 1	2	3	4	
Revenue					
Cummulative Total NEW Laramie campus headcount enrollment	6	17	31	47	*2 year program, so one-time enrollment never exceeds 30 students; Largest cohort = 16 students (year 4)*
NEW Resident enrollment (# of new students entering the program each year)	4	6	8	9	*EAB comparitors have 12-150 students; U. Denver 42; CU Denver 10; GrayData 44 completions in Laramie 360*
NEW Non Resident Enrollment (# of new students entering the program each year)	2	5	6	7	
NEW Resident distance enrollment (ONLY use this field if the Program is 100% delivered online)	4	6	8	9	
NEW Non Resident distance enrollment (ONLY use this field if the Program is 100% delivered online)	2	5	6	7	
Resident (credit hours delivered outside of NEW Program)	0	0	0	0	*MS credits are all in new program (except some elective options)*
Resident (credit hours delivered in NEW Program)	28	94	134	167	*MS credits are all in new program (except some elective options)*
Resident Distance (credit hours delivered in NEW Program through Distance)	28	94	134	167	*This is an online degree, so all credits delivered online*
Non Resident (credit hours delivered outside of NEW Program)	0	0	0	0	*MS credits are all in new program (except some elective options)*
Non Resident (credit hours delivered in NEW Program)	14	50	107	127	*MS credits are all in new program (except some elective options)*
Non-Resident Distance (credit hours delivered in NEW Program through Distance)	14	50	107	127	*This is an online degree, so all credits delivered online*
Total Resident credit hours generated**	28	94	134	167	
Total Non Resident credit hours generated**	14	50	107	127	
Per Credit Tuition*					
Resident	$700	$728	$757	$787	*Less expensive than competitors*
Nonresident	$700	$728	$757	$787	*Less expensive than competitors*
Prior Year's Non Resident Discount Rate (updated annually by the budget office)	0%	0%	0%	0%	*No standard discount for grad students*
Estimated Actual Non Resident Per Credit Tuition	$700	$728	$757	$787	
Total Resident Tuition generated outside of NEW Program	$0	$0	$0	$0	
Total Resident Tuition in NEW Program	$19,600	$68,432	$101,454	$131,497	
Total Non Resident Tuition outside of NEW Program	$0	$0	$0	$0	
Total Non Resident Tuition in NEW Program	$9,800	$36,400	$81,012	$100,000	
Total Distance Tuition in NEW Program					*This line blank in template*
Total Tuition from NEW Enrollment	$29,400	$104,832	$182,466	$231,497	
Fees					
Program Per Credit Hour	$25	$25	$25	$25	
Program Fee Revenue	$1,050	$3,600	$6,025	$7,350	
Advising Fee Per Credit Hour	$0.00	$0.00	$0.00	$0.00	*No advising fee for grad students*
Advising Fee Revenue	$0	$0	$0	$0	
Mandatory Fee (Per Full Time Student)	$705.47	$705.47	$705.47	$705.47	
Mandatory Fee Revenue	$4,233	$11,993	$21,870	$33,157	
Distance Fee	$25	$25	$25	$25	*UW standard distance fee*
Total New Revenue Generated Within New Program	$30,450	$108,432	$188,491	$238,847	
Total New Revenue Generated Outside of the Program	$4,233	$11,993	$21,870	$33,157	
Total Distance Fee Revenue Generated	$1,050	$3,600	$6,025	$7,350	*Distance credits x distance fee*
Total Distance Revenue Remaining with College	$20,580	$73,382	$127,726	$162,048	*70% of distance credits x tuition*
Total Distance Revenue Remaining with Provost	$9,870	$31,450	$54,740	$69,449	*30% of distance credits x tuition (+ all of distance fee)*
Total New Revenue Generated	$66,183	$228,857	$398,851	$510,851	
New Program Expense Assumptions					
Compensation and benefits					
Faculty	$51,476	$147,075	$147,075	$147,075	
Other administrative staff	$0	$3,736	$3,736	$3,736	*1/8th of 50% staff person split across pro formas*
Graduate Assistants	$0	$0	$0	$0	*Online students are not recruited with Gas*
Supplies	$625	$625	$625	$625	*1/8th of office supplies spread across all credentials*
Travel	$3,000	$3,000	$3,000	$3,000	*1/4 th of $12K/yr for director and instructor travel split across all credentials*
Marketing	$875	$750	$450	$450	*1/8th of marketing budget spread across all credentials*
Software	$2,500	$2,500	$2,500	$2,500	
New course development	$11,667	$21,667	$0	$0	*Based on Nasser est. of $5000/new course supplemental pay*
Capital expense					
Other (specify)					

Projected Financial Results for New Program	**FY1**	**FY2**	**FY3**	**FY4**	
Total Expenses	$68,768	$195,978	$173,561	$173,561	
Total New Revenues Generated by NEW Program	$30,450	$108,432	$188,491	$238,847	
New Program's Total Surplus or Deficit	**-$38,318**	**-$87,546**	**$14,930**	**$65,286**	*This net is for this credential considered in isolation from other credentials.*
Operating margin (surplus or deficit / revenues)	-1.26	-0.81	0.08	0.27	

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	Fiscal Year 1	2	3	4	
Revenue					
Cummulative Total Enrollments in Certificate Program	6	14	22	24	*One year program, so our one-time enrollment (single cohort) never exceeds 24*
NEW Resident enrollment (# of new students entering the program each year)	4	8	13	14	*EAB survey reports enrollment of 15-43; U. of Denver has 94;*
NEW Non Resident Enrollment (# of new students entering the program each year)	2	6	9	10	
NEW Resident distance enrollment (ONLY use this field if the Program is 100% delivered online)	*4*	*8*	*13*	*14*	*For online certificates, these numbers = numbers in row 8*
NEW Non Resident distance enrollment (ONLY use this field if the Program is 100% delivered online)	*2*	*6*	*9*	*10*	*For online certificates, these numbers = numbers in row 9*
Resident (credit hours delivered outside of NEW Program)	0	0	0	0	*Should all be 0 since all courses are in program*
Resident (credit hours delivered in NEW Program)	36	72	117	126	*Underestimates because it counts existing courses as outside program.*
Resident Distance (credit hours delivered in NEW Program through Distance)	36	72	117	126	*Same as row 13 because all are in program and distance!*
Non Resident (credit hours delivered outside of NEW Program)	0	0	0	0	
Non Resident (credit hours delivered in NEW Program)	18	54	81	90	*Underestimates because it counts existing courses as outside program.*
Non-Resident Distance (credit hours delivered in NEW Program through Distance)	18	54	81	90	*Same as row 16 because all are in program and distance!*
Total Resident credit hours generated**	36	72	117	126	
Total Non Resident credit hours generated**	18	54	81	90	
Per Credit Tuition*					
Resident (Posted Tuition Rate)	$700	$728	$757	$787	*Less expensive than most competitors*
Nonresident (Posted Tuition Rate)	$700	$728	$757	$787	*Less expensive than most competitors*
Prior Year's Non Resident Discount Rate (updated annually by the budget office)	0%	0%	0%	0%	*No discount for online grad students*
Estimated Actual Non Resident Per Credit Tuition	$700	$728	$757	$787	
Total Resident Tuition generated outside of NEW Program	$0	$0	$0	$0	*All courses are in the program*
Total Resident Tuition in NEW Program	$25,200	$52,416	$88,583	$99,213	
Total Non Resident Tuition outside of NEW Program	$0	$0	$0	$0	*All courses are in the program*
Total Non Resident Tuition in NEW Program	$12,600	$39,312	$61,327	$70,866	*All courses are in the program*
Total Distance Tuition in NEW Program					
Total Tuition from NEW Enrollment	$37,800	$91,728	$149,910	$170,079	
Fees					
Program Per Credit Hour	$0	$0	$0	$0	
Program Fee Revenue	$0	$0	$0	$0	
Advising Fee Per Credit Hour	$0.00	$0.00	$0.00	$0.00	*No advising fee for grad students*
Advising Fee Revenue	$0	$0	$0	$0	
Distance Fee	$25	$25	$25	$25	*UW standard fee*
Distance Fee Revenue	$1,350	$3,150	$4,950	$5,400	
Total New Revenue Generated Within New Program	$37,800	$91,728	$149,910	$170,079	
Total New Revenue Generated Outside of the Program	$0	$0	$0	$0	
Total Distance Revenue Generated	$39,150	$91,728	$149,910	$170,079	*Tuition + distance fee revenue*
Total Distance Revenue Remaining with College	$26,460	$64,210	$104,937	$119,056	
Total Distance Fee Revenue Generated	$12,690	$27,518	$44,973	$51,024	
Total New Revenue Generated	$76,950	$183,456	$299,820	$340,159	
New Program Expense Assumptions					
Compensation and benefits					
Faculty	$66,184	$66,184	$66,184	$66,184	*Based on proportion of full teaching load (Alex)*
Other administrative staff	$0	$4,981	$4,981	$4,981	*1/6th of 50% office staff*
Graduate Assistants	$0	$0	$0	$0	*Based on Master's level GA stipend of $6,125/semester*
Supplies	$833	$833	$833	$833	*1/6th of office supplies spread across all credentials (Ken)*
Travel	$3,000	$3,000	$3,000	$3,000	*1/4th of $12K/yr for director and instructor travel split across all credentials (Ken)*
Marketing	$1,200	$1,000	$600	$600	*1/6th of marketing cost spread across credentials*
Software	$1,500	$1,500	$1,500	$1,500	
New course development	$10,000	$0	$0	$0	*Based on Nasser estimate of $5K/course;*
Other (specify)					

Projected Financial Results for New Program	FY1	FY2	FY3	FY4
Total Expenses	$83,350	$77,665	$76,665	$76,665
Total New Revenues Generated by NEW Program	$76,950	$183,456	$299,820	$340,159
New Program's Total Surplus or Deficit	**-$6,400**	**$105,791**	**$223,155**	**$263,494**
Operating margin (surplus or deficit / revenues)	-0.08	0.58	0.74	0.77

This net is for this credential considered in isolation from other credentials.

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	Fiscal Year 1	2	3	4	
Revenue					
Cummulative Total Enrollments in Certificate Program	5	8	10	10	*One year program, so one-time enrollment (cohort) never exceeds 10*
NEW Resident enrollment (# of new students entering the program each year)	3	5	6	6	*No EAB comparitor data. CU Boulder reports 15 per semester. George Mason reports "10 or less" for on-campus but stronger demand for online; strong interest in UW remote sensing courses historically*
NEW Non Resident Enrollment (# of new students entering the program each year)	2	3	4	4	
NEW Resident distance enrollment (ONLY use this field if the Program is 100% delivered online)	*3*	*5*	*6*	*6*	*Same as row 8--all courses are distance*
NEW Non Resident distance enrollment (ONLY use this field if the Program is 100% delivered online)	*2*	*3*	*4*	*4*	*Same as row 9--all courses are distance*
Resident (credit hours delivered outside of NEW Program)	0	0	0	0	*All credits are in the new program*
Resident (credit hours delivered in NEW Program)	18	30	36	36	
Resident Distance (credit hours delivered in NEW Program through Distance)	18	30	36	36	*Same as row 13--all credits are in program*
Non Resident (credit hours delivered outside of NEW Program)	0	0	0	0	*Same as row 13--all credits are in program*
Non Resident (credit hours delivered in NEW Program)	12	18	24	24	
Non-Resident Distance (credit hours delivered in NEW Program through Distance)	12	18	24	24	*Same as row 16--all credits are distance*
Total Resident credit hours generated**	18	30	36	36	
Total Non Resident credit hours generated**	12	18	24	24	
Per Credit Tuition*					
Resident (Posted Tuition Rate)	$700	$728	$757	$787	*Less expensive than most competitors*
Nonresident (Posted Tuition Rate)	$700	$728	$757	$787	*Less expensive than most competitors*
Prior Year's Non Resident Discount Rate (updated annually by the budget office)	0%	0%	0%	0%	*No discount on online tuition*
Estimated Actual Non Resident Per Credit Tuition	$700	$728	$757	$787	
Total Resident Tuition generated outside of NEW Program	$0	$0	$0	$0	*All tuition in program*
Total Resident Tuition in NEW Program	$12,600	$21,840	$27,256	$28,347	*All tuition in program*
Total Non Resident Tuition outside of NEW Program	$0	$0	$0	$0	*All tuition in program*
Total Non Resident Tuition in NEW Program	$8,400	$13,104	$18,171	$18,898	*All tuition in program*
Total Distance Tuition in NEW Program					*Blank in template*
Total Tuition from NEW Enrollment	$21,000	$34,944	$45,427	$47,244	
Fees					
Program Per Credit Hour	$0	$0	$0	$0	*No program fees for grad students*
Program Fee Revenue	$0	$0	$0	$0	
Advising Fee Per Credit Hour	$0.00	$0.00	$0.00	$0.00	*No advising fees for grad students*
Advising Fee Revenue	$0	$0	$0	$0	
Distance Fee	$25	$25	$25	$25	*Std. distance fee*
Distance Fee Revenue	$750	$1,200	$1,500	$1,500	
Total New Revenue Generated Within New Program	$21,000	$34,944	$45,427	$47,244	
Total New Revenue Generated Outside of the Program	$0	$0	$0	$0	*All courses are in program*
Total Distance Revenue Generated	$21,750	$34,944	$45,427	$47,244	
Total Distance Revenue Remaining with College	$14,700	$24,461	$31,799	$33,071	
Total Distance Fee Revenue Generated	$7,050	$10,483	$13,628	$14,173	
Total New Revenue Generated	$42,750	$69,888	$90,854	$94,489	
New Program Expense Assumptions					
Compensation and benefits					
Faculty	$44,123	$44,123	$44,123	$44,123	*Based on proportion of full teaching load*
Other administrative staff	$0	$4,981	$4,981	$4,981	*1/6th of 50% office staff*
Graduate Assistants	$0	$0	$0	$0	*Based on Master's level GA stipend of $6,125/semester*
Supplies	$833	$833	$833	$833	*1/6th of office supplies spread across all credentials (Ken)*
Travel	$3,000	$3,000	$3,000	$3,000	*1/4th of $12K/yr for director and instructor travel split across all credentials (Ken)*
Marketing	$1,200	$1,000	$600	$600	*1/6th of marketing cost spread across credentials*
Software	$4,500	$4,500	$4,500	$4,500	
New course development	$10,000	$0	$0	$0	
Other (specify)					

Projected Financial Results for New Program	**FY1**	**FY2**	**FY3**	**FY4**	
Total Expenses	$61,289	$55,604	$54,604	$54,604	
Total New Revenues Generated by NEW Program	$42,750	$69,888	$90,854	$94,489	
New Program's Total Surplus or Deficit	**-$18,539**	**$14,284**	**$36,251**	**$39,885**	*This net is for this credential considered in isolation from other credentials.*
Operating margin (surplus or deficit / revenues)	-0.43	0.20	0.40	0.42	

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	Fiscal Year 1	2	3	4	
Revenue					
Cummulative Total Enrollments in Certificate Program	6	14	18	20	*One year program, so one-time enrollment (cohort) never exceeds 20*
NEW Resident enrollment (# of new students entering the program each year)	2	8	10	12	*EAB does not provide estimate; UND has 48 in undergrad UAS certificate*
NEW Non Resident Enrollment (# of new students entering the program each year)	4	6	8	8	
NEW Resident distance enrollment (ONLY use this field if the Program is 100% delivered online)	*2*	*8*	*10*	*12*	*Online certificate*
NEW Non Resident distance enrollment (ONLY use this field if the Program is 100% delivered online)	*4*	*6*	*8*	*8*	*Online certificate*
Resident (credit hours delivered outside of NEW Program)	0	0	0	0	*All courses are in program*
Resident (credit hours delivered in NEW Program)	14	14	14	14	*All courses are in program*
Resident Distance (credit hours delivered in NEW Program through Distance)	12	12	12	12	*2 credits of ground school are on-site*
Non Resident (credit hours delivered outside of NEW Program)	0	0	0	0	*All courses are in program*
Non Resident (credit hours delivered in NEW Program)	28	42	56	56	
Non-Resident Distance (credit hours delivered in NEW Program through Distance)	26	40	54	54	*2 credits of ground school are on-site*
Total Resident credit hours generated**	14	14	14	14	
Total Non Resident credit hours generated**	28	42	56	56	
Per Credit Tuition*					
Resident (Posted Tuition Rate)	$700	$728	$757	$787	*Less expensive than most competitors*
Nonresident (Posted Tuition Rate)	$700	$728	$757	$787	*Less expensive than most competitors*
Prior Year's Non Resident Discount Rate (updated annually by the budget office)	0%	0%	0%	0%	*No discount for online grad students*
Estimated Actual Non Resident Per Credit Tuition	$700	$728	$757	$787	
Total Resident Tuition generated outside of NEW Program	$0	$0	$0	$0	
Total Resident Tuition in NEW Program	$9,800	$10,192	$10,600	$11,024	
Total Non Resident Tuition outside of NEW Program	$0	$0	$0	$0	
Total Non Resident Tuition in NEW Program	$19,600	$30,576	$42,399	$44,095	
Total Distance Tuition in NEW Program					*Blank in template*
Total Tuition from NEW Enrollment	$29,400	$40,768	$52,998	$55,118	
Fees					
Program Per Credit Hour	$0	$0	$0	$0	*No program fees for grad students*
Program Fee Revenue	$0	$0	$0	$0	*No program fees for grad students*
Advising Fee Per Credit Hour	$0.00	$0.00	$0.00	$0.00	*No advising fees for grad students*
Advising Fee Revenue	$0	$0	$0	$0	*No advising fees for grad students*
Distance Fee	$25	$25	$25	$25	*Standard UW fee*
Distance Fee Revenue	$950	$1,300	$1,650	$1,650	
Total New Revenue Generated Within New Program	$29,400	$40,768	$52,998	$55,118	
Total New Revenue Generated Outside of the Program	$0	$0	$0	$0	
Total Distance Revenue Generated	$27,550	$37,856	$49,970	$51,969	
Total Distance Revenue Remaining with College	$18,620	$26,499	$34,979	$36,378	
Total Distance Fee Revenue Generated	$8,930	$11,357	$14,991	$15,591	
Total New Revenue Generated	$56,950	$78,624	$102,968	$107,087	
New Program Expense Assumptions					
Compensation and benefits					
Faculty	$51,476	$51,476	$51,476	$51,476	*Based on proportion of full teaching load; Cost estimates are for tenure-track, but currently using adjunct*
Other administrative staff	$0	$4,981	$4,981	$4,981	*1/6th of 50% office staff*
Graduate Assistants	$0	$0	$0	$0	*Based on Master's level GA stipend of $6,125/semester*
Supplies	$833	$833	$833	$833	*1/6th of office supplies spread across all credentials*
Travel	$3,000	$3,000	$3,000	$3,000	*1/4th of $12K/yr for director and instructor travel split across all credentials*
Marketing	$1,200	$1,000	$600	$600	*1/6th of marketing cost spread across credentials*
Software	$2,500	$2,500	$2,500	$2,500	
Course Development Cost	$5,000	$0	$0	$0	*Based on Nasser estimate of $5K/course*
Other (specify)					

Projected Financial Results for New Program	**FY1**	**FY2**	**FY3**	**FY4**	
Total Expenses	$63,642	$62,957	$61,957	$61,957	
Total New Revenues Generated by NEW Program	$56,950	$78,624	$102,968	$107,087	
New Program's Total Surplus or Deficit	**-$6,692**	**$15,667**	**$41,011**	**$45,130**	*This net is for this credential considered in isolation from other credentials.*
Operating margin (surplus or deficit / revenues)	-0.12	0.20	0.40	0.42	

* UW's Board of Trustees' current working policy is to raise tuition by 4% each year
Last updated 4/29/19

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REQUEST FOR AUTHORIZATION

Interdisciplinary Undergraduate and Graduate Curricula

Geospatial Information Science & Technology (GIST)

UNIVERSITY OF WYOMING

WYOMING GEOGRAPHIC INFORMATION SCIENCE CENTER · WyGISC ·

Introduction

This document is a Request for Authorization (RfA) to establish two nested sets of interdisciplinary credentials in Geospatial Information Science and Technology (GIST), one undergraduate and one graduate, to be managed by the Wyoming Geographic Information Science Center (WYGISC), an education, research and service/engagement unit independently situated in the Division of Academic Affairs. Specifically, this request includes an undergraduate B.S. degree with 2 stackable certificates and a graduate M.S. degree (with and without thesis) with 3 stackable certificates—in GIS, remote sensing, and Unmanned Aerial Systems (UAS a.k.a. drones).

This RfA references a detailed GIST Feasibility Study and two *pro forma* budgets, one for the undergraduate credentials and the other for the graduate credentials. Together, these provide additional details regarding the proposed program. The RfA contains minor updates to some information provided in the Feasibility Study in cases where new information has become available or where there was a need for clarification.

Figure 1 presents a complete 3-year timeline of the process undertaken in developing these new programs. The Feasibility Study acknowledges the more than 20 individuals who provided input. The feasibility study and *pro forma* budgets were provided to the UW Faculty Senate's Academic Planning Committee and Graduate Council, and ASUW for their review in early September 2019. The college and school deans and School of Energy Resources Executive Director have also recently reviewed the documents.

Similarly, this fall, the feasibility study was independently shared with external stakeholder groups for their feedback, including the State of Wyoming Office of the Chief Information Officer, the Wyoming Department of Workforce Services, the Wyoming Geospatial Professionals Organization, the Wyoming State GIS Technical Advisory Group, and representatives from Casper College and Central Wyoming College. Their letters of support are included with this document (Appendix A).

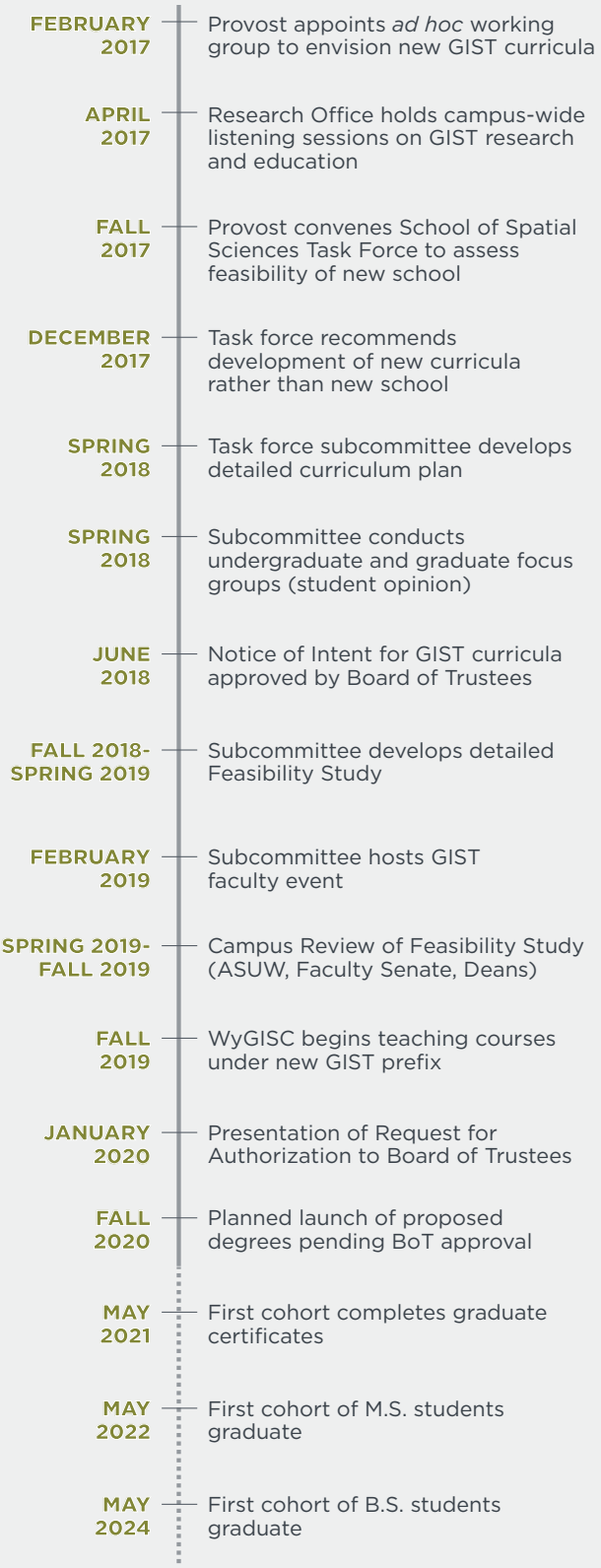


Figure 1. 3-year timeline of the process undertaken in developing GIST

1 Purpose and need for proposed program

Drawing on knowledge from geography, data science, computer science, mathematics, statistics, psychology, design, and other fields, geospatial information science is a multidisciplinary endeavor that addresses the nature of geospatial information and the application of geospatial technologies to basic scientific questions and real-world problems (fig. 2). Geospatial information technology is a specialized set of information and communication technologies that support the acquisition, management, analysis, and visualization of geo-referenced data. Examples include geographic information systems, global navigation satellite systems, and satellite, airborne, shipboard, and ground-based remote sensing and image processing systems. Geospatial science contributes to everything from mapping applications in our mobile phones to place-aware Google searches to global-scale scientific and socio-economic challenges.

Expanded GIST curricula support a need in Wyoming and the Rocky Mountain region for well-trained geospatial professionals with skills contributing to academics, governmental agencies, and private industry. UW does not currently offer students and working professionals coordinated, logical pathways for becoming experts in GIST, even as this discipline grows in importance.

Sinton (2012)[1] notes that in addition to technical skills, spatial science teaches students core components of critical thinking, a key learning outcome at UW and other universities. Sinton further points out that GIS&T education is being incorporated into schools of business, health and medicine, law enforcement, natural resources, and other disciplines, and is supporting multidisciplinary research challenges in the data sciences.

The program proposed here provides opportunities for undergraduate and graduate students to earn certificates and degrees in GIST while also exploring multidisciplinary connections. By offering an undergraduate degree and certificates on campus and graduate degrees and certificates both on-campus and online, we will reach traditional and non-traditional students and serve workforce needs in Wyoming.

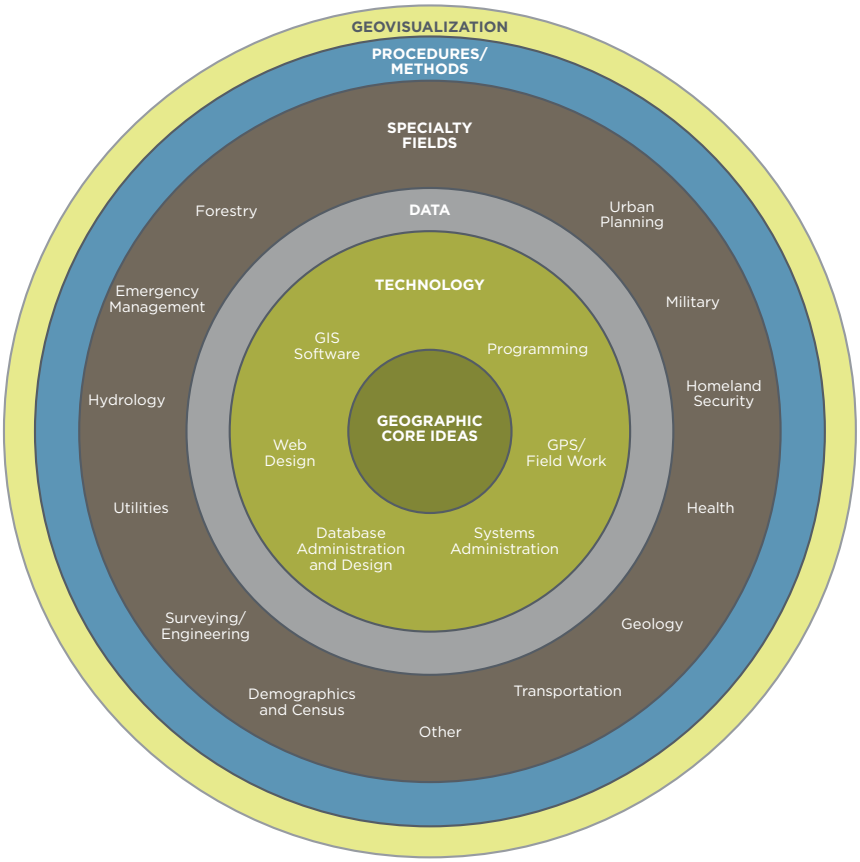


Figure 2. Graphical representation of GIST components. Source: GISLounge, 2006.

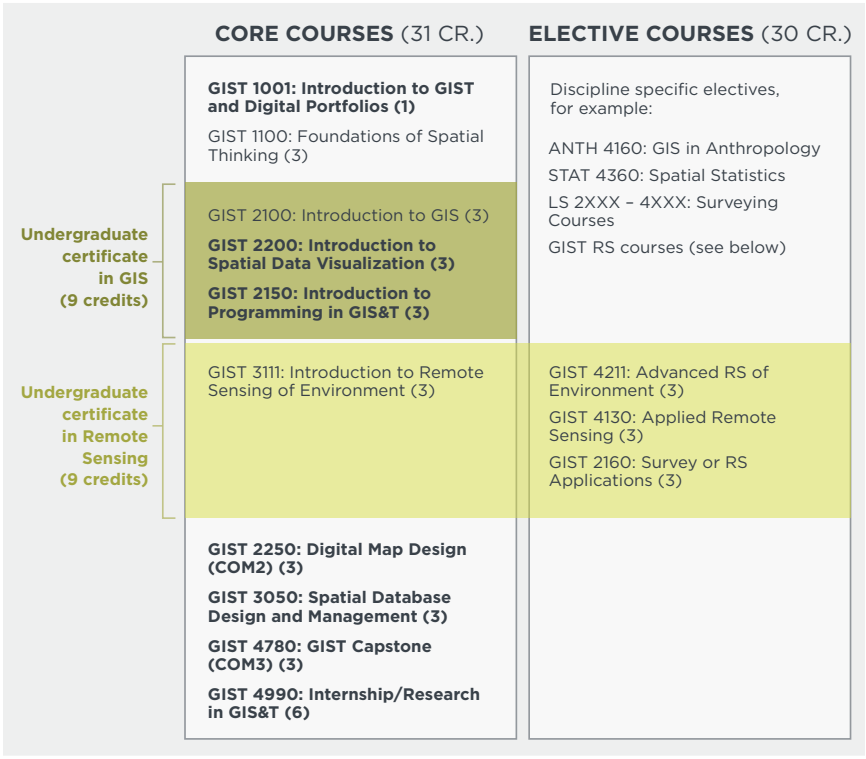
1 Sinton, D. S. 2012. "Making the case for GIS&T in higher education." In D.J. Unwin, K.E. Foote, N.J. Tate, and D. DiBase (eds), Teaching Geographic Information Science and Technology in Higher Education, Wiley-Blackwell, Oxford, pp. 17-36.

2 Proposed curriculum

We propose nested and stackable interdisciplinary undergraduate and graduate credentials in GIST. These include a Bachelor's of Science (B.S.) degree requiring a targeted minor in another discipline and with opportunities for students to earn embedded undergraduate certificates in GIS and remote sensing; a Master of Science (M.S.) degree in GIST (on-campus with thesis or online without thesis); and three stackable graduate certificates in: (a) GIS; (b) remote sensing; and (c) UAS. The graduate certificates are comprised of courses that contribute to the master's degree (core or elective credits). Detailed course plans for each credential are included in the Feasibility Study, and the structure of the nested credentials is illustrated in figures 3 and 4.

Together, these credentials provide opportunities for traditional on-campus undergraduate and graduate students while also using innovative distance delivery to reach professionals and non-traditional students in the region and nationally.

Figure 3. Proposed Bachelor Of Science In GIS&T



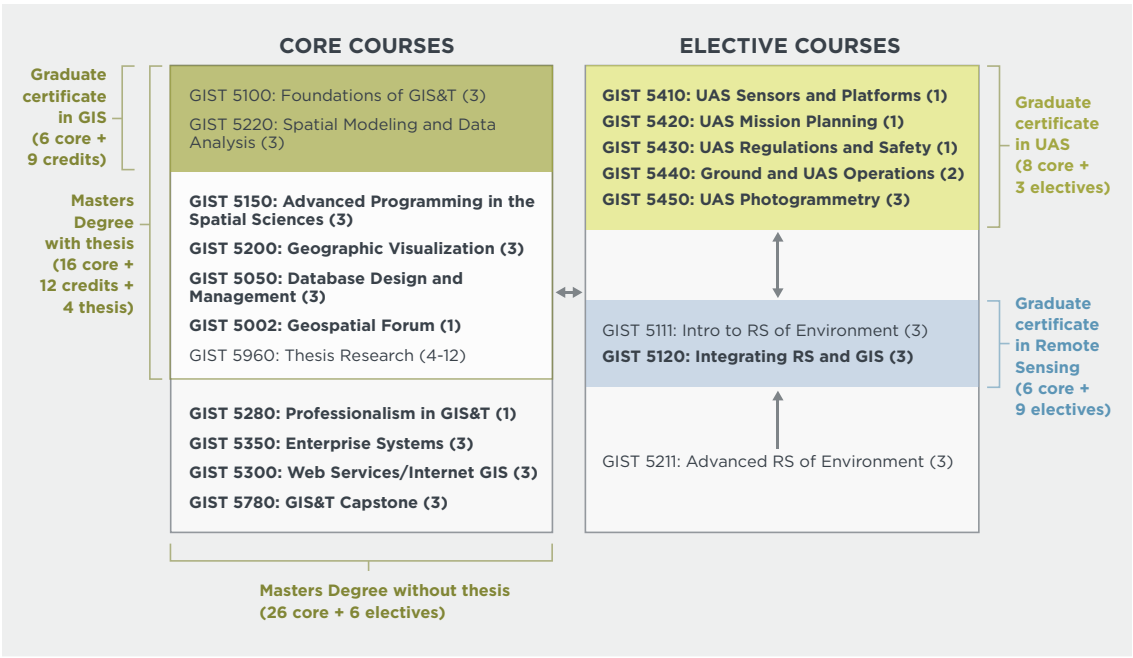


Figure 4. Proposed Graduate Credentials in GIS&T

Bold: New Courses

3 Assessment plan

Assessment of the proposed credentials and of the program as a whole will be based on student attainment of core competencies borrowed from the AAAS Vision and Change[2] initiative and discipline-specific learning objective articulated by the geospatial community in the UCGIS GIS&T Body of Knowledge[3] and in the U.S. Department of Labor geospatial competency model (fig. 5).

Specific assessment activities for the undergraduate and graduate credentials and the program as a whole are described in detail in the Feasibility Study and summarized below (table 1).

2 AAAS. 2011. Vision and Change in Undergraduate Biology Education: A Call to Action. Final Report. Carol A. Brewer and Diane Smith (Eds.). American Association for the Advancement of Science.

3 University Consortium for Geographic Information Science. https://gistbok.ucgis.org

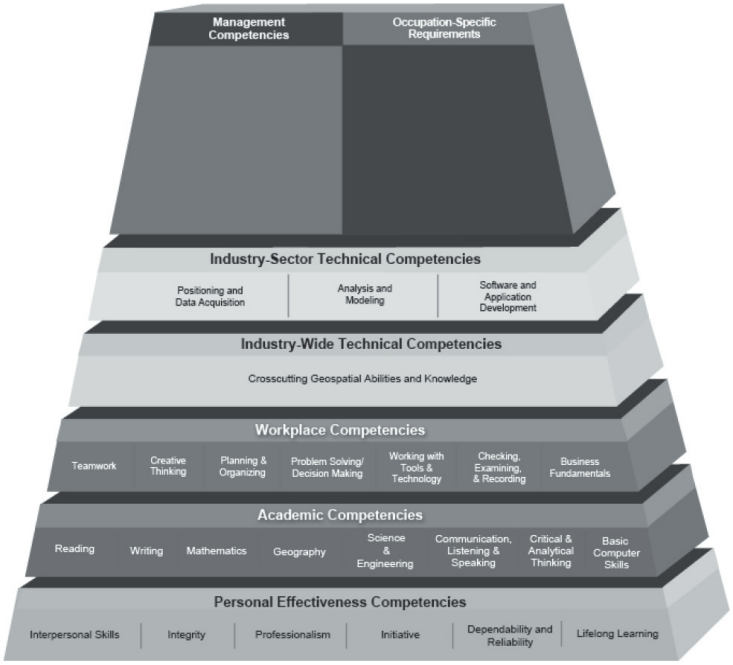


Figure 5. The U.S. Department of Labor geospatial competency model. The proposed program addresses competency across tiers.

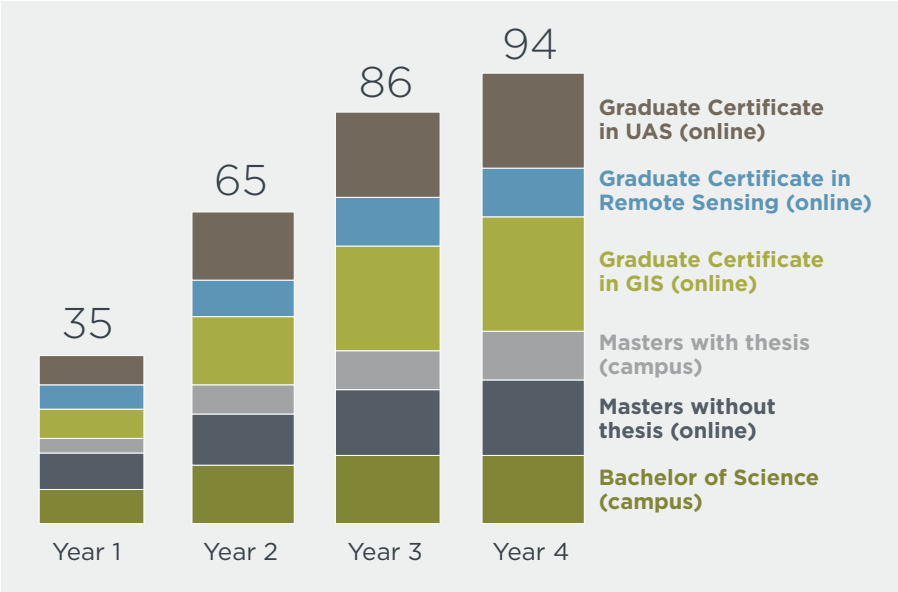
Table 1. Planned assessment activities for undergraduate and graduate curricula and for the program as a whole.

UNDERGRADUATE PROGRAMS	GRADUATE PROGRAMS	OVERALL GIST PROGRAM
Pre- and post-degree exams on core GIS&T concepts and competencies	Pre- and post-degree exams on core GIS&T concepts and competencies	Use of an advisory board to assess program success in accomplishment of mission, objectives, and curriculum
Capstone course with assessment of final projects, including critical thinking and communication	Annual graduate student reports	Analysis of enrollment data over time
Use of internship management programs (e.g., Handshake) to assess effectiveness of internships	Assessment of thesis students at time of defense by committee members	Collection and analysis of student exit surveys
Student course evaluations	Tracking of student and faculty publications	Tracking and analysis of DFW rates for undergraduate students
Exit interviews with graduates	Evaluation of capstone projects	Collection of data on post-program employment of students
	Student course evaluations	

4 Anticipated enrollment

Enrollment estimates for each credential (fig. 6 + table 2) are based on data from market research (EAB, Gray Associates), on-campus student focus groups, a survey of regional employers, and data from other institutions with analogous programs (*e.g.*, University of Denver, University of Colorado). We also visited other institutions (Harvard University, North Carolina State, University of Redlands, University of Denver) with successful program analogs, and we consulted with leaders in geospatial curricula at the University of Southern California and the University Consortium for Geographic Information Science, and at ESRI, an international GIS company. Each of these data sources are described and evaluated in the Feasibility Study for individual credentials and for the program more broadly.

Estimating specific enrollment is difficult because no program is exactly the same as any other, and enrollment depends on the quality of each program, the size of the institution offering the program, the intensity of marketing, and the program's reputation, among other factors. We feel that our estimates are realistic based on available data, but we understand that uncertainty in enrollment estimates introduces uncertainty into revenue estimates.



	Year 1	Year 2	Year 3	Year 4	Supporting enrollment data
B.S. Degree	7	12	14	14	**EAB:** 5 - 33 **MSU:** 20 **CU Boulder:** 168 (Geography)
M.S. Degree w/ thesis	3	6	8	10	**EAB:** 19 – 28
M.S. Degree w/o thesis	6	11	14	16	**EAB:** 12 – 150 **U. of Denver:** 42 **CU Denver:** 10
Graduate Certificate in GIS	6	14	22	24	**EAB:** 15 – 43 **U. of Denver:** 94
Graduate Certificate in Remote Sensing	5	8	10	10	**EAB:** No data **CU Boulder:** 15 **George Mason:** 10 or less
Graduate Certificate in UAS	6	14	18	20	**EAB:** No data **UND:** 48 in undergrad UAS certificate

Figure 6 and Table 2. Enrollment estimates for the first four years after program launch based on evidence discussed in the text and in the Feasibility Study and anecdotal data from other institutions. The B.S. and the M.S. with thesis are traditional on-campus degrees. All other credentials will be delivered online.

5 Budget Narrative and Resource Requirements

Where possible, the new program will use existing WyGISC resources, including an increase of one faculty member and a realignment of four existing WyGISC faculty facilitated by the reorganization of the Geography Department. Two additional faculty lines, representing a commitment of $215,606 (salary + fringe) by Academic Affairs, have been granted to WyGISC for FY21 through the CPM process. These new faculty will contribute directly to teaching in the new program and to geospatial research at WyGISC.

During AY18-19 and AY19-20, WyGISC allocated approximately $95,000 of its existing departmental budget toward developing this program. Annually, the WyGISC *in-kind* match will minimally include $25,000 in enterprise-level software licenses. The UW Office of Distance Education Support provided $75,050 in FY20 to support development and marketing of GIST distance courses. This support may be ongoing in the first several years of the program.

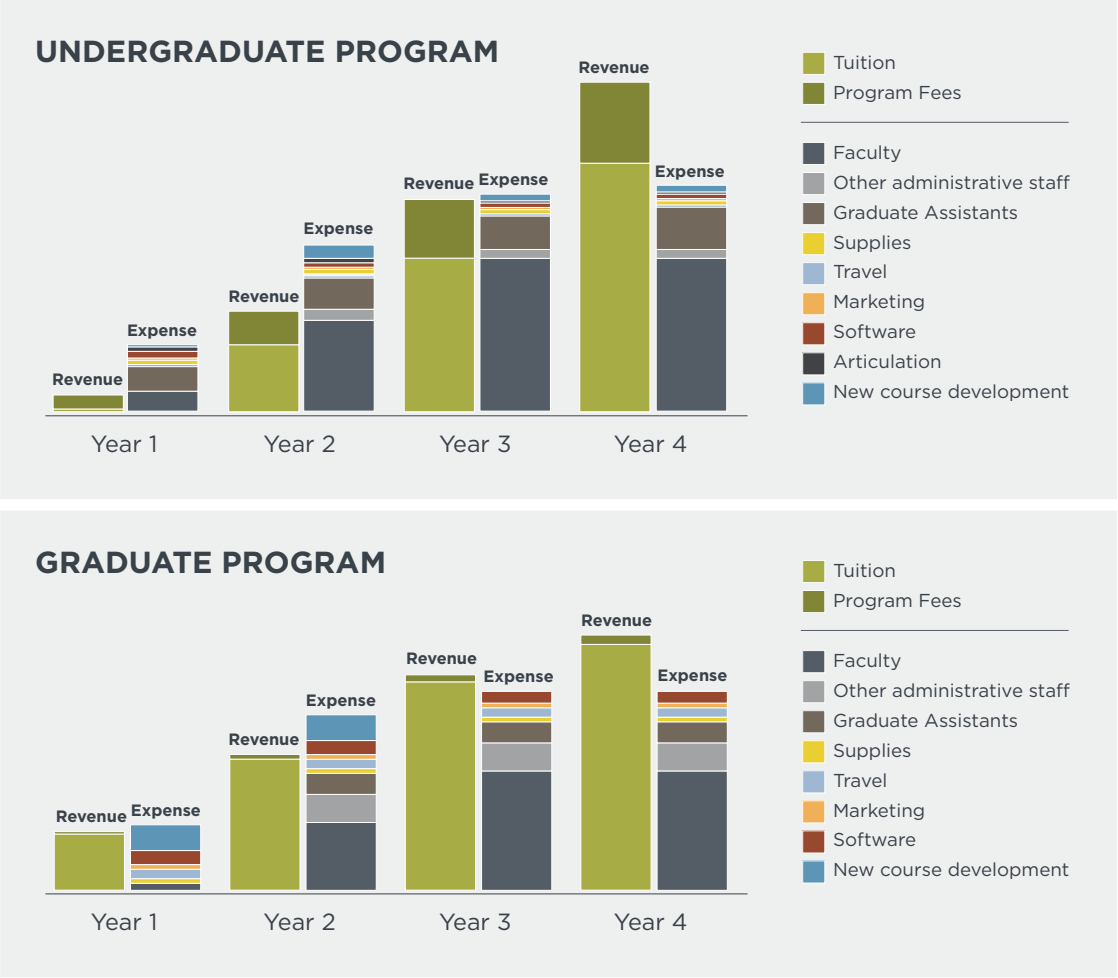


Figure 7. Revenue and expense estimates for the first four years after program launch.

Pro forma budgets are provided for 1) the undergraduate B.S. degree and certificates and 2) the graduate M.S. degree and certificates. Graduate degrees and certificates are aggregated into a single *pro forma* budget because expenses are lower for the program as a whole than for the sum of the individual parts. Single courses often contribute to more than one credential (table 3).

Revenues for all credentials are based on estimated enrollment, while expenses include faculty and staff salaries, graduate assistants (GAs), supplies, travel, marketing, and new course design (fig. 6). We propose a $700 per credit differential tuition for online graduate credentials to generate revenue while remaining competitive for both in- and out-of-state students. This tuition is based on analysis of tuition at other institutions in the region and is discussed in more depth in the Feasibility Study.

Faculty and instructional staffing

Estimates of new faculty and instructional staffing are based on new credit hours taught and standard faculty teaching loads (15 credits/year for tenure track faculty and 21 for APLs). They do not include reallocation of existing Geography faculty or teaching by our new faculty lines. We estimate that by year 4, we will need 1 new tenure track faculty line and 2 new APLs with expertise in geospatial information science (GIS) and remote sensing, the latter including UAS (drone) expertise. Some of these may be joint appointments that will teach GIST courses for our program and courses for other academic departments. It is also likely that faculty hired in other academic departments will contribute GIS&T teaching (e.g., data science hires).

GA Support

Delivery of new courses will benefit from 3-10 new GAs per semester during the first four years of the program, primarily to support undergraduate teaching and recruitment of students for the on-campus master's degree if approved. The need for GA support will depend partly on enrollment in these courses and in the on-campus M.S., for which GA support will be needed for recruitment. Ultimately, income generated by online courses will contribute to funding GAs for recruitment and for facilitating distance delivery of graduate courses.

Table 3. Revenue and expense estimates for the first four years after program launch.

UNDERGRADUATE

	FY1	FY2	FY3	FY4
Expense	$47,429	$119,944	$156,442	$162,567
Revenue	$6,934	$43,482	$91,061	$141,779
Net	-$40,495	-$76,462	-$65,381	-$20,788

GRADUATE

	FY1	FY2	FY3	FY4
Expense	$91,456	$203,887	$249,203	$273,863
Revenue	$130,368	$306,204	$483,116	$572,152
Net	$38,912	$102,317	$233,913	$298,289

Program administration and staff support

Administration of the new GIST programs will require 50% of one new FTE staff person at WyGISC, with expertise in marketing, recruitment, and academic program support. This new staff position has been approved by Academic Affairs. WyGISC will support this person in FY20 using their operating budget. Accounting support will be provided by existing WyGISC staff.

Technology

Delivery of an interactive, online, master's program and graduate certificates requires that students access UW's virtual (remote) lab system to complete lab exercises and projects. UW currently has 45 remote lab nodes. UWIT reports that, based on historical concurrent usage reports, the remote lab system has the capacity to serve 100 additional online students (a number we used to explore the potential new load), assuming that all of them do not use the system concurrently. New GIS&T courses will use proprietary and open source software.

We are exploring (with UWIT) technical requirements for using these in online delivery of courses, but we don't anticipate that this will require additional resources or present roadblocks.

UAS Infrastructure Development

Unmanned Aerial Systems (UAS or drones) are an enormous growth area across disciplines and for Wyoming's economy, and we are collaborating with other groups on and off campus to explore and develop infrastructure and training opportunities for students and faculty. With key faculty in the College of Engineering and Applied Science (CAES), we have recently formed a UAS working group to survey existing campus UAS resources, make recommendations for new UAS and sensor purchases, develop plans for building a UAS practice facility near the Laramie Regional Airport, and work with off campus groups (e.g., the Laramie Airport) that are exploring an expanded drone data transfer and fueling site for large drones. Separately, WyGISC and the CAES sponsored two successful five-day UAS workshops in May and June 2019 and we taught a 3-day workshop in September to jump-start training in key skills so that students and faculty will be better prepared to take advantage of new opportunities in UAS.

Marketing

Program success will depend on aggressive marketing to both undergraduates and graduate students. Direct marketing of the B.S. degree will include outreach to

new potential undergraduate students in and out of state. We plan to contact 1,000 students during each of the first 4 years of the program. We will also develop printed promotional materials and advertise in relevant media and online, and will host an on-campus GIST seminar series to promote faculty participation and engage current students. We will also leverage marketing opportunities available through the Office of Graduate Education and Office of Distance Education Support. The latter has provided $7,500 in marketing support for FY20. Marketing costs should drop after year 4 when the program has become established.

Space Requirements

The GIST program will leverage existing WyGISC space on the 3rd floor of the Agriculture Building, including one shared PC lab and one dedicated PC lab (which underwent a $100,000 remodel in 2016). A need exists to secure additional office space on the 3rd floor of Agriculture Building C to support new faculty and graduate students identified as part of the program. A proposal for such an expansion is currently being evaluated by the UW Space Allocation Committee. The need for a third lab, designed specifically for active learning pedagogy, is being explored.

6 Timeline for implementation

Development of the proposed program has been ongoing for about two and a half years, beginning with an *ad hoc* task force in February 2017 and culminating in the Feasibility Study and this Request for Authorization (fig.1).

Because there is a need for core education in geospatial science on the UW campus even in the absence of formal credentials, we have established a new course prefix (GIST) and successfully proposed and implemented new courses for both undergraduate and graduate students. These courses will facilitate the launch of new credentials, if approved, beginning in fall 2020. Based on this launch date, the first cohort of B.S. students could graduate in May 2024. M.S. students typically take two years to complete their degrees (May 2022). Undergraduate and graduate certificates will typically require one academic year to complete (May 2021).

Program marketing, establishment of a faculty advisory board, continued articulation discussions with community colleges, new course development, and other activities described in more detail in the Feasibility Study will be ongoing as we proceed to program launch and rollout.

7 Plan for accreditation (if applicable)

There is no formal accreditation body for GIS&T at this time.

8 Benefits of program to UW

The proposed program will raise UW's stature regionally and nationally, while attracting new students. In Wyoming, students with a solid understanding of GIST in a multidisciplinary framework can play central roles in addressing natural resource management, energy development, rural development, and other place-based challenges. Further, there is a growing need across the UW campus for students well-trained in GIST who can contribute to research.

GIST programs will equip students with the academic knowledge and practical tools needed to succeed in a broad variety of disciplines, to catalyze economic development in Wyoming, and to engage collaboratively with stakeholders in many contexts. It will also serve professionals in Wyoming and beyond, especially with online course offerings. Our primary objective is to provide new courses and credentials that will increase the level of geospatial competency among our students.

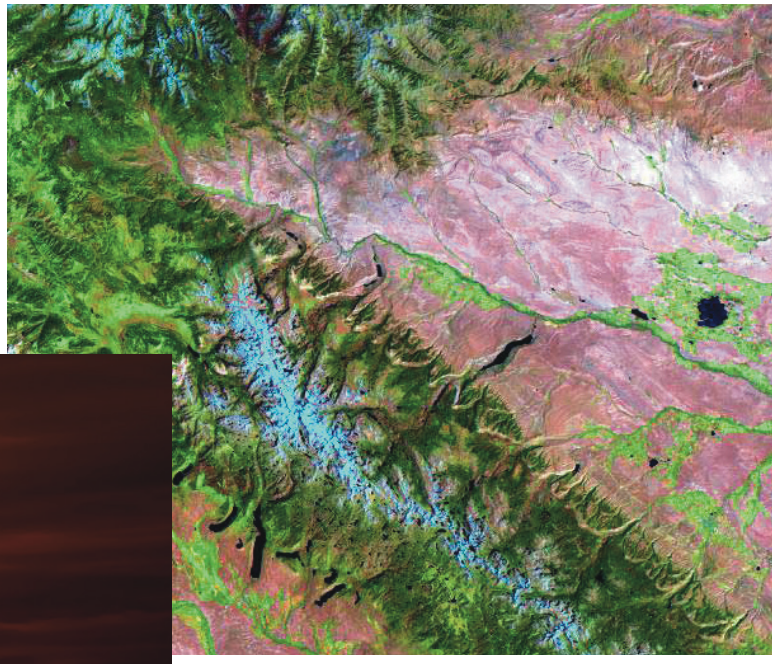
The new GIST program also helps fill the void in geographic science at UW left by the dissolution of the Department of Geography last year. UW remains committed to delivering geographic sciences to its students even without a standalone geography department. While geography encompasses many important areas of study besides geospatial sciences, UW geography students demonstrated interest in GIST with enrollment in existing geospatial courses, particularly in GIS and remote sensing, and expressed interest in GIST credentials during the undergraduate focus group we convened.

A robust graduate program in geospatial sciences will serve to catalyze basic research at UW in this important subdiscipline of data science. Many UW graduate students and faculty use geospatial science in their research, but targeted courses to help them efficiently build this capacity are currently limited. The proposed graduate certificates give students from many programs a way to earn credit for adding important skills to their toolboxes.

Finally, some Wyoming community colleges (Casper College, Central Wyoming College) offer credentials or courses in geospatial sciences, and the proposed Bachelor's degree will give those students a pathway for continuing their education while also supporting the programs at the colleges. Letters of support (Appendix A) speak to this synergy.

9 Ability of UW to carry out the program

Delivering new undergraduate and graduate curricula and credentials, including a substantial online component, requires an investment by the university in faculty, staff, technology, and marketing, and a commitment to WyGISC where these credentials will be managed. Academic Affairs and the Office of Distance Education Support have demonstrated strong material support for development of the proposed programs and a commitment to supporting them in the future if approved. Specifically, Academic Affairs has funded a Program Director to continue program and curriculum development and to manage launch of the new credentials in Fall 2020 pending approval. Additionally, WyGISC has been granted two tenure-track faculty lines for FY21. These new faculty will contribute to teaching of GIST courses contributing to the new credentials if they are approved, but even without new credentials, they will teach some geospatial courses needed by students from across campus. They will also augment WyGISC's research mission in geospatial sciences. The Office of Distance Education has provided (FY20) $75,050 to support development and delivery of online geospatial courses, and they have expressed interest in ongoing support for two to three additional years pending program approval. Finally, a new full-time administrative support staff member has been funded to support the Center and delivery of the new curricula.



10 Value to and impact on students and residents of Wyoming

Training in GIST provides UW students with the knowledge to tap into a fast-growing job market across disciplines. As professionals, graduates apply their knowledge and skills in fields ranging from environmental management and public health to civil engineering and urban planning to economic analysis and marketing.

The U.S. Bureau of Labor Statistics reports that employment for "cartographers and photogrammetrists" (includes GIST professionals) is expected to grow 19% from 2016-2026. This is much faster than average growth (7.5%) in other occupations. They also report that typical entry-level positions require a bachelor's degree and that GIS managers often require a graduate degree. A 2012 National Geospatial Advisory Committee white paper[4] noted that the rapidly growing geospatial technology and research industry faced a shortage of qualified workers and that academia should work to prepare students for these new job opportunities. This remains true today.

Wyoming students will also benefit from opportunities to apply their training in GIST to issues unique to Wyoming and the Rocky Mountain Region. Increasing population and changing demographics, energy development, wildlife management, infrastructure development, and economic diversification are just a few examples of areas where students trained in geospatial sciences can play important roles. A strong program in geospatial science and technology will give students the knowledge and skills to have meaningful and valuable careers (see letters of support in Appendix A for examples).

4 O'Connell, Matt, D. McKay, J. Gabrynowicz, and U. Dinh. 2012. The administration's STEM education initiatives from a geospatial workforce development perspective. National Geospatial Advisory Committee (www.fgdc.gov/ngac). January 2012.

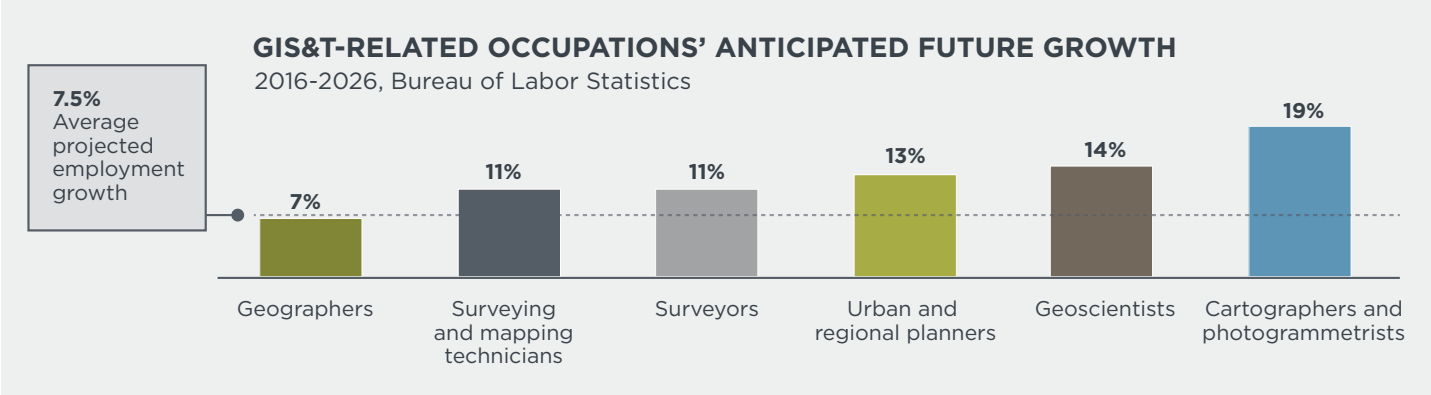


Figure 7. Anticipated future job growth in GIS&T related occupations from the EAB report. Bureau of Labor Statistics growth estimates are based on national data. Regional 12- month growth from Gray Associates Data supports these trends. Source: Education Advisory Board, 2018

APPENDIX
A

Letters of Support

Mark Gordon
Governor

Gordon Knopp
State Chief
Information Officer

Department *of*
Enterprise Technology Services

October 28, 2019

To: Dr. Neil Theobald and Members of the UW Board of Trustees

From: Gordon Knopp

Subject: Proposed curricula in geospatial information science and technology from WyGISC

The University of Wyoming serves a leadership role in the State of Wyoming by providing services to grow people to shape the future. We currently produce and consume more data than at any time in our known history. However, data by itself, without analysis, context, and visualization has minimal use to people. Helping people learn how to process, analyze, and visualize data enhances the usefulness of data for people. I believe the proposed GIST (Geospatial Information Science & Technology) undergraduate and graduate programs provide opportunities for people to make better use of data.

In preparing students for their future, data analytics, data security, and data privacy are often touted as critical themes. The proposed programs could be part of preparing people to lead in a data rich world. I encourage the University of Wyoming to strongly consider the proposed programs, and other similar data programs, to provide services to our youth enabling them to lead in the future.

I am pleased to understand the proposed programs include distance education aspects. Pedagogy and andragogy have changed over time. While the human connection is essential to learning, it no longer needs to be a physical face to face environment. Working adults and current K12 students seek alternatives to traditional learning approaches. I am pleased to see the University of Wyoming looking at options to keep the human connection while adapting to learner needs. I believe the potential flexibility being considered for these programs will attract more students.

Thank you for your time. I wish you the best as you consider the GIST program proposals and the future direction for the University of Wyoming.

Gordon Knopp

Mark Gordon
Governor

State of Wyoming
Department of Workforce Services

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Cheyenne, Wyoming 82002
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www.wyomingworkforce.org

Robin Sessions Cooley
Director

October 29, 2019

University of Wyoming
Board of Trustees
206 Old Main
Laramie, WY 82071

RE: Letter of Support, Wyoming Geographic Information Science Center's (WyGISC) Geospatial Information Science and Technology (GIST) program

Dear Trustees:

I had the pleasure of meeting Mr. Hamerlinck and learning about the GIST program several months ago. I am happy to offer this letter of support for the program for three reasons: 1) the structure of the program follows trends developing across the country that allow stackable credentials to lead to a degree, and the online offering of the Master of Science GIST degree follows similar trends; 2) the program provides support to move the needle toward Wyoming's lofty educational attainment goals relating to postsecondary education; and 3) this is an opportunity to create business and opportunity for Wyoming's future.

The WyGISC is proposing to establish new undergraduate and graduate degree programs in Geospatial Information Science and Technology (GIST). This program will include a Bachelor of Science degree in "GIST" with three certificate programs, one in geographic information systems (GIS), one in remote sensing, and one in Unmanned Aerial Systems (UAS; i.e., drones). The requirement for a targeted minor will also facilitate these connections by providing breadth in targeted application areas, and the certificates will add marketability for graduates who pursue GIST as a set of ancillary skills to their major field of study.

Moreover, the concept around allowing students to successfully obtain certificates that apply toward the completed degree fits with similar concepts I have heard about elsewhere. Stackable credentials allow students to achieve milestone successes which provides additional momentum and incentives for students to continue toward the final goal of acquiring a degree. The distance education aspect of the Master of Science program will be particularly attractive to students already in the workforce, as it affords a greater degree of accessibility supportive of non-traditional students' schedules. I have followed the trends and the successes around the country in providing

online Master degree programs like that proposed, and this online program would help move the needle toward the State's ultimate college attainment goals of 67 percent of Wyoming's working population 25 – 64 years of age possessing a valuable post-secondary credential (certificate or degree) by 2025, and a secondary goal of 82 percent attainment by 2040.[1]

To that end, as a member of the Education Attainment Executive Council,[2] the WICHE Task Force to Close Postsecondary Attainment Gaps,[3] and as member of Governor Gordon's team working with the National Governor's Association on the Education 4 Opportunity grant, this program presents an opportunity to assist the State to reach the aforementioned lofty education attainment goals.[4]

It is also my understanding that this program to expand GIST course offerings at UW supports a long-standing need in Wyoming and the region for well-trained geospatial professionals. Mr. Hamerlinck indicated the United States Bureau of Labor Statistics identified geospatial employment demands growing at more than double the average rate for other occupations between 2016 and 2026. To that end, there are certainly numerous opportunities for UW to work with participating businesses and the Wyoming Department of Workforce Services to utilize our Workforce Development Training Fund to connect businesses and students with training, possible future employment, and business development opportunities. Finally, this program presents an opportunity for students in Wyoming and will provide them with skills that will make them competitive for state workforce opportunities.

Thank you for the opportunity to support this proposed new program for UW. If I can be of further assistance, please do not hesitate to contact my office directly at 307-777-8728.

Regards,

Robin Sessions Cooley, JD
Director

CC: Jeffrey D. Hamerlinck, PhD.
Director, Wyoming Geographic Information Science Center
File Ref: RSC-19-044

[1] In November of 2017, the University of Wyoming Board of Trustees and the Wyoming Community College Commission (WCCC) formally adopted, by joint board resolution, a statewide higher education attainment goal. Shortly thereafter, then Governor, Matthew H. Mead issued an executive order establishing the goal that 67 percent of Wyoming's working population 25 – 64 years of age will possess a valuable post-secondary credential (certificate or degree) by 2025, and a secondary goal of 82 percent attainment by 2040. These goals were codified in 2019 at SEA 61.
[2] The EAEC was codified at SEA 61, by the 2019 Legislature.
[3] The Task Force is funded by a $400,000 grant from Indianapolis-based Lumina Foundation, whose goals include increasing the proportion of American adults with postsecondary credentials to 60 percent by 2025.
[4] *Id.*

September 10, 2019

To whom it concerns:

I am a Professor of geospatial information science and technology (GIST) at Central Wyoming College and am writing this letter in support of the proposed GIST program at the University of Wyoming. The career opportunities in this realm are numerous, and the need for trained technicians only continues to grow.

At present, our GIST program consists of two undergraduate certificates (16 and 30 credits), an Associate of Applied Science, and an Associate of Science in Expedition Science that includes an embedded 16 credit GIST certificate. The missing piece for CWC is a well thought out and fully articulated 2 + 2 program with that includes not only appropriate 1000 and 2000 level course equivalents, but advanced 3000 and 4000 level courses. The program being proposed by UW will fill that niche and – through communication, and a well-developed articulation plan – will provide a solid transfer destination to complement and enhance CWC offerings.

An additional area of interest for CWC is in respect to potential opportunities to partner in the delivery of summer GIST programs, and to work with UW as a supportive collaborator for NSF grants. CWC is currently planning to submit a GIST based proposal for an Advanced Technical Education (ATE) Grant. While this grant targets two year colleges, ATE grant requirements include an identified transfer partner for junior and senior year work, with strong evidence of legitimate communication across institutions.

It is thus with great excitement and support that I write this letter to confirm my enthusiasm for the new GIST programs at the University of Wyoming. I have already been in active communications with Ken Driese about how best to articulate the new program to compliment and support CWC's programs, and am very excited about all levels of instruction (through to the MS) being proposed for the UW program.

Please feel free to contact me with any questions.

Sincerely,

Jacki Klancher

Professor Environmental Science

Alpine Science Institute Director of Instruction and Research

Central Wyoming College 120 Enterprise Blvd Lander, WY 82520

October 16, 2019
To whom it may concern:

My name is Jeff Sun and I am the Geographic Information Systems (GIS) Instructor at Casper College. I am writing this letter to show my support for the proposed Geospatial Science and Technology (GIST) program at the University of Wyoming.

I graduated from UW and received a Bachelor's of Science degree in Geography in May of 2001. I also worked for 3 years after graduation at The Wyoming Geographic Information Science Center (WyGISC) and know many of the people behind the newly proposed GIST Program, including Ken Driese and Jeff Hamerlinck. I am happy they are the ones spearheading the program and I am excited to work with both of them should the new GIST Program get approved.

Casper College currently offers a 2 year Associate's Degree in GIS as well as a 5 course certificate that can be completed in 1 year. As you hopefully understand, GIS skills are highly sought after by potential employers and higher education institutions. The students coming out of the program at Casper College often have no trouble finding employment using their GIS skills either in Wyoming or out of state. However, more and more of my students are finding that continuing on with their education and receiving a Bachelor's and a Master's degree, is to their advantage both personally and certainly professionally. One of the biggest questions I get now is: What schools can I attend after Casper College to continue on with my GIS and further my education. Reluctantly I have not been able to say that UW offers much in the way of GIS and my students have gone to other institutions. Either online or in the traditional sense, even though most of them would much rather stay in Wyoming to continue their education.

Therefore it is with great enthusiasm that I offer my support for the proposed GIST Program at UW. I recently met with Ken Driese and others from WyGISC at the Articulation Summit in Laramie on Oct. 4. Ken went over the proposed degrees and classes that will be taught in the program and asked for the thoughts from the different community college instructors that were in attendance. I have to say I am excited about the classes that will be offered at UW both traditionally and online. I'm equally excited about the prospect of being able to inform my students that UW offers a great GIST Program and they can continue on in gaining GIS skills right here in Wyoming. Finally, I think there is a real opportunity here for UW and the community colleges (especially LCCC, Casper College, and CWC) to work with UW in developing articulation with respect to freshman and sophomore level GIS courses to make the transfer process easier for students. Ken and the folks at WyGISC seem to be open and excited about this as well. Thus I fully support the proposed GIST Program at UW and what it can do for GIS students in Wyoming.

Please feel free to contact me with any questions

Sincerely,
Jeff Sun
Casper College GIS Instructor
O: 307-268-3560
C: 307-277-6778
Email: jsun@caspercollege.edu

October 14, 2019

Members, UW Board of Trustees
206 Old Main
University of Wyoming
Laramie, WY 82071

Dear Board of Trustees,

On behalf of the Wyoming Geospatial Organization (WyGEO), I am writing to express our support for the University of Wyoming to establish new undergraduate and graduate curricula in Geospatial Information Science & Technology (GIST). WyGEO is comprised of a diverse representation of GIS professionals spanning multiple levels of government, industry, education, natural resource management and planning. We see the GIST curriculum as an opportunity that should not be missed or delayed any longer for the benefit of Wyoming's economic diversity and development.

The projected demand for professionals educated in the geospatial sciences is expected to grow significantly into the future. This makes sense considering the exponential increase in the use of drone technology for sectors such as agriculture, energy development and infrastructure, as well as emergency management and response. Providing advanced degrees and certifications for these fields will only bolster the expanded use of these technologies. The requirement for a targeted minor will facilitate these connections by providing breadth in targeted application areas, and the certificates will add marketability for graduates who pursue GIST as a set of ancillary skills to their major field of study. WYGEO also enthusiastically supports creation of the Masters of Science program in GIST. The fact that the program will be almost 100% distance-based will be particularly attractive to professionals who are already in the workforce but wish to expand or update their technical skills.

We encourage you to approve the GIST curricula proposal. We can only see a win-win outcome for state government, the private sector and students across the country who seek to take advantage of online course offerings. We are excited for professionals throughout the state to be able to take advantage of continued learning opportunities. Thank you in advance for your support of this diverse and dynamic field.

Sincerely,

Karen Rogers, President of WyGEO

On behalf of the entire WyGEO Board of Directors:

Karen Rogers, President, Laramie Co. • Jalynda Mckay, Vice-President, Albany Co.
Joy Hill, Secretary, Park Co. • Renee Hardy, Treasurer, Natrona Co.
Brian Clarkson, Northwest Region Director, Park Co. • Katrina Patton, Southwest Region Director, Lincoln Co.
Jason Boucher, Northeast Region Director, Sheridan Co. • Jordan Evans, Southeast Region Director, Laramie Co.
Brett Governanti, Director at Large, Natrona Co.

The Wyoming Geospatial Organization • P. O. Box 2075 • Casper, WY 82602 • www.wygeo.org •
wygeo1@gmail.com

Chad Kopplin, Chairman WY-GIS TAG
200 W. 17th St, Suite 400
Cheyenne, WY 82002

October 14, 2019

Members, UW Board of Trustees
206 0ld Main
University of Wyoming
Laramie, WY 82071

Dear Board of Trustees,

On behalf of the Wyoming GIS Technical Advisory Group (TAG), I am writing to express our support for the University of Wyoming establishing new undergraduate and graduate curricula in Geospatial Information Science & Technology (GIST). TAG is comprised of two representatives from each of the following groups; Federal, State, County, Municipal Government, Private Industry, Education, and Tribal. The purpose of the TAG is to provide technical resources to GIS policy initiatives, collaboration on multi group statewide projects, and provide technical information to the public in general.

Since the inception of GIS in the late 60's to the early 70's the use of GIS has expanded to include most disciplines, GIS has expanded the way a business functions. GIS has allowed businesses to reach into sectors that previously were unreached. Recent advancement in areas such as the use of drone technology for sectors such as agriculture, energy development and infrastructure, as well as emergency management and response, and the use of Lidar for mapping invasive species, have started to shape policy at a federal, state, and local level. As a result, we expect the demand for professionals educated in the geospatial sciences to grow significantly over the coming years. Providing advanced degrees and certifications, and the requirement for a targeted minor, along with the range of targeted communities that WyGISC works with across the state and Rocky Mountain Region will give the students a head up in the job market. In addition, by providing certificates gives students in other fields of study the GIS and the credential needed to help them with job searches.

We are in support of the proposed undergraduate and graduate curricula. We look forward to working with WyGISC in create potential internship and employment opportunities for students enrolled in these new programs. Thank you for your consideration of these new programs, we are excited to see the potential that they will provide.

Sincerely,

Chad Kopplin

On behalf of the entire WY GIS TAG

Academic Affairs
1000 E. University Avenue, Laramie, WY 82071
(307) 766-4286

December 19, 2019

Board of Trustees:

This letter serves as a Letter of Commitment for a new set of nested academic programs in Geospatial Information Science and Technology (GIST). These credentials would be managed by the Wyoming Geographic Information Science Center (WYGISC), and include an undergraduate Bachelor of Science degree with two stackable certificates and a graduate-level Master of Science degree (with or without thesis) with three stackable certificates. The proposers have spent considerable thoughtful time and effort collecting feedback from constituents statewide and internally, from student focus groups to professional organizations and higher education partners, as well as visiting peer institutions with aspirational programs in GIST.

Needs

The proposed degree aligns with the UW Strategic Plan Goal One: Foster entrepreneurship and collaboration in research and teaching. The study and practice of geospatial science is cross-disciplinary and has strong employment prospects, hones critical thinking skills, and can contribute to the understanding of everything from wildlife migrations to the use of drones in agricultural business. The area requires collaboration in research, teaching, and practice.

Requirements

The core requirements for the undergraduate degree consist of 31 credits, along with 30 credits of elective courses along with the requirement that students earn a targeted minor in another discipline. The total undergraduate program would come in at around 120 total credits, the standard for an undergraduate degree. The coursework can be articulated with existing coursework at relevant community colleges. Within the undergraduate degree option are nested two 9-credit (three courses) certificates that will attract students from across all colleges. Course descriptions can be found in the Request for Authorization and Feasibility Study documents for this degree.

The masters degrees proposed include both a campus thesis-based option and a fully online non-thesis option. Nested within these are the opportunity to earn one or more of three

certificates in GIS, unmanned aerial systems, and remote sensing. Course descriptions can be found in the Request for Authorization and Feasibility Study documents for this degree.

Resources

The required resources are fully outlined in the attached pro-forma budget. Given the proposed tuition structure for the program, the graduate programs are estimated to generate net positive revenue streams, underwriting the undergraduate programs. The four-year projection for the undergraduate net profit is -$203,126; the four-year net profit projection for the graduate programs is $673,431; this yields a net revenue four-year projection of a little over $470,000. Proposed expenditures would be shared across the graduate and undergraduate program, including faculty, GA support, program administration, and technology.

Please see the accompanying pro forma budget for details of projected financial results for this program over a four-year span.

Timeline

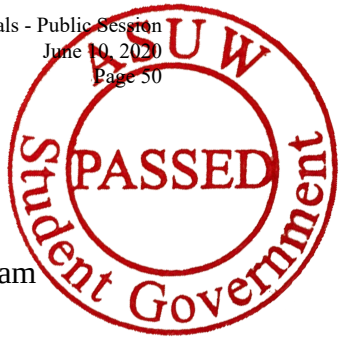
The present implementation timeline is designed to enable students to enroll in this degree in the Fall of 2020.

Best,

Kate C. Miller

Kate C. Miller

Provost and Vice President, Academic



SENATE RESOLUTION #2673

TITLE: ASUW Support for the Implementation of GIST Program and Certificates

DATE INTRODUCED: October 22, 2019

AUTHOR: President Wilkins

SPONSORS: Senators Mulhall, Pierson, Titus, Trent, and Welsh; Director Savage

1. WHEREAS, the purpose of the Associated Students of the University of Wyoming
2. (ASUW) Student Government is to serve our fellow students in the best manner possible; and,
3. WHEREAS, the University of Wyoming (UW) strives to improve our land grant and flagship
4. mission by offering top-tier programs that are compatible with our peer institutions; and,
5. WHEREAS, the Provost created the Spatial Sciences Initiative Task Force; and,
6. WHEREAS, this task force has been instrumental in creating the feasibility study for the
7. Geospatial Information and Science & Technology (GIST) undergraduate and graduate
8. curricula; and,
9. WHEREAS, the University of Wyoming Board of Trustees (BOT) approved the notice of
10. intent in May of 2018; and,
11. WHEREAS, the proposed degree program and certificates would give students a path of
12. study that has not yet existed at UW; and,
13. WHEREAS, many of our peer institutions offer similar degree programs; and,
14. WHEREAS, graduate certificates in GIST, Remote Sensing and Unmanned Aerial Systems
15. (UAS) and undergraduate certificates in GIST and remote sensing are highly sought after by
16. employers; and,
17. WHEREAS, these certificates would be offered for all UW students and are applicable to

18. many areas of study such as agriculture, engineering, education, business, and more; and,

19. WHEREAS, offering a completely online graduate degree and certificate program would

20. further UW's goal of increasing its distance education abilities and programs; and,

21. WHEREAS, the UW Faculty Senate Graduate Council voted to support the GIST curricula

22. as shown in Addendum A; and,

23. WHEREAS, according to the feasibilty study, the program is projected to create revenue

24. in its first four (4) years as shown in Addendum B.

25. THEREFORE, be it resolved by the Associated Students of the University of Wyoming

26. (ASUW) Student Government that we support the implementation of the Geospatial

27. Information Science & Technology (GIST) program for both undergraduate and graduate

28. education and its accompanying degrees and certificates for the Acadamic Year 2020 by the

29. Board of Trustees.

Referred to: Programs and Institutional Development

Date of Passage: 10/29/2019 **Signed:** _____

(ASUW Chairperson)

"Being enacted on 10/30/2019 **, I do hereby sign my name hereto and approve this Senate action."** _____

ASUW President

Addendum A

UNIVERSITY
OF WYOMING

Carolyn M. Pepper, Ph.D.
Department of Psychology
Biological Sciences Building, Rm. 121
Laramie, WY 82071-3415
(307) 766-2951
fax (307) 766-2926
cpepper@uwyo.edu

October 11, 2019

Dear Senators Alexander and Chestek:

As Chair of the Graduate Council, I am writing to you in your capacities as Chairs of the Academic Planning Committee and the Faculty Senate to update you on the Graduate Council review of the Geospatial Information Science & Technology (GIST) curricula proposal. After reviewing the New Degree Program Feasibility Study and meeting with Professors Jeff Hamerlinck and Ken Driese, we found the proposed curriculum had academic rigor appropriate for a graduate degree, strong job placement prospects upon program completion, excellent consultation with programs across campus, and sufficient resources requested to meet the program goals. Council members from varied colleges and programs were enthusiastic about the potential for their own graduate students to benefit from the proposed courses and certificates. Moreover, the feasibility study document was clear and compelling in presenting data in support of the program and should serve as a model for future proposed degree programs.

Following our evaluation, the Graduate Council has voted to approve the graduate curriculum portion of the GIST proposal.

Sincerely,

Carolyn M. Pepper, Ph.D.
Professor, Chair of Graduate Council

cc. Jeff Hamerlinck
Ken Driese

Addendum B

***Startup Cost of Degrees and Certificates*:**

These are the projected expenses and revenues from the consolidated *pro forma* budgets for all credentials combined and assuming multi-phased rollout.

Year	Expenses	Revenues	Net
AY 2020-21:	$ 92,795	$137,302	$ 44,507
AY 2021-22:	$259,246	$349,687	$ 90,441
AY 2022-23:	$316,400	$574,177	$257,777
AY 2023-24:	$322,525	$713,931	$391,406

Faculty Senate Resolution 369 **Introduced by Faculty Senate Executive Committee**

RESOLUTION ON GEOSPATIAL INFORMATION SCIENCE & TECHNOLOGY (GIST)

WHEREAS, the Office of Academic Affairs has proposed the addition of eight new programs in Geospatial Information Science & Technology (GIST), to be housed academically in the Wyoming Geographic Information Science Center (WyGISC); and

WHEREAS, both Faculty Senate's Academic Planning Committee (APC) and the Graduate Council have reviewed the proposal; and

WHEREAS the Graduate Council has approved the graduate components of the GIST proposal, as shown on the attached letter dated October 11, 2019 from Dr. Carolyn Pepper, chair of the Graduate Council; and

WHEREAS the APC has recommended approval of five certificate programs and a Master's program (without thesis), all to be delivered via distance education, but did not recommend approval of an undergraduate Bachelors of Science degree or an on-campus Master's program (with thesis) to be delivered on campus, as show in the attached report from the APC;

THEREFORE, BE IT RESOLVED by Faculty Senate that it supports the recommendation of the Academic Planning Committee to approve six of the proposed programs and not approve two programs, as specified in the report of the Committee attached hereto.

Academic Planning Committee

Associate Provost Anne Alexander referred a proposal for 8 new programs in Geospatial Information Science & Technology (GIST) to the Academic Planning Committee (APC) for review and recommendation. These include a B.S. degree, 2 undergraduate certificates, 2 different M.S. degrees, and 3 graduate certificates. These programs, with relatively minor changes, were previously submitted to the APC last spring. The 8 new programs represent an ambitious undertaking. Offering a GIST program or two provides clear benefit, teaching a valuable skill and enabling existing and prospective students to take advantage of predicted GIST job growth. Launching 8 new GIST programs, however, entails considerable cost that does not appear justified given limited evidence of student demand or state need and current fiscal realities. Accordingly, the APC voted to:

- RECOMMEND approval of the: (1) undergraduate certificate in GIS, (2) undergraduate certificate in Remote Sensing, (3) Masters in GIST, without thesis, online (4) graduate certificate in GIST, (5) graduate certificate in Remote Sensing, and (6) graduate certificate in Unmanned Aerial Systems (UAS)

- NOT RECOMMEND approval at this time of the: (1) undergraduate Bachelors of Science in GIST, or (2) Masters in GIST, with thesis, on campus. The APC would, however, welcome reconsideration of these programs in future years if robust student demand is shown and other potential concerns are addressed.[1]

These votes reflect the APC's conclusion that spending close to one million dollars per year on numerous GIST programs with uncertain student demand does not accord with the state and the university's most pressing academic priorities and current budget limitations.[2] The APC would still welcome efforts to decrease the scope or scale of the certificate offerings.

Setting aside reservations about magnitude, the recommended programs have several positive attributes. They reflect a well-articulated and carefully constructed multidisciplinary vision for collaboration and research at the university. They also provide more distance accessible programming to residents throughout the state. Further, these programs offer new credentials that should enable students to capitalize on predicted GIST job growth. Some cost-efficient GIST programming provides value to the university and state.

Adopting all 8 new programs does not appear prudent at this time, however, given limited evidence of student demand and significant costs. Less than a year ago, the APC was asked to eliminate two existing GIS programs at UW, a certificate program and an undergraduate minor,

[1] All votes were unanimous except for the on campus Masters, which was 8-1.
[2] $933,187 (March 2019 Executive Summary p.i). The latest GIST proposal lists expenses of $322,525 by year 4, but this figure does not include the hires that were made for the program prior to approval, the existing faculty lines that have been moved to support the program, and other expenses described in the proposals' narrative.

largely as a result of insufficient student demand. Over a five-year period (2012-2017), only 1 student graduated with the GIS certificate. Over that same period, only 7 students graduated with a GIS minor, an average of 1.4 per year. This real world experience suggests very limited student demand for on campus GIST programing.[3] Gray's data reinforces this conclusion. Gray's data rates both undergraduate and on campus masters programs a -2 on student demand, a bleak forecast. The experience of a regional competitor, University of Northern Colorado (NCo), reinforces enrollment concerns. NCo has placed its on campus graduate GIS certificate on hold indefinitely, due in part to low enrollment. As the chair of NCo's department concluded, "if we had it to do all over, we would do it fully online, without in person courses, because the courses are too specialized to draw numbers." The EAB report likewise recommends prioritizing online programs (EAB p.6).

Even online, there are student demand challenges. Seventy-five percent (75%) of students enroll in an online program within 100 miles of home (EAB p. 16). That is a small market for UW, and several well-established, low cost online programs already exist (EAB p. 13). It may be difficult to compete with these established programs. Moreover, students desiring graduate certificates may not qualify for federal financial aid if they are not enrolled in a master's program. These factors, coupled with the specialized nature of each GIS program, presage low enrollment.

Employer demand appears more promising but remains uncertain. The Feasibility Study (FS) presents compelling evidence of predicted GIST job *growth*. However, the linkage between available jobs and the 8 proposed programs remains unclear. The EAB report states that only 16% of jobs require completion of a GIST program (EAB Report p. 9). Almost half of GIST jobs require a degree in computer science or engineering, 26% and 21% respectively. Gray's data lists employer demand at -2. Given these statistics, a leaner, more conservative approach to GIST programming seems judicious.

Yet, the 8 proposed programs entail substantial cost. By year 4, annual expenses are over $900,000 per year. This is a considerable risk for a university operating with significant budget constraints and could limit opportunities to adequately fund well-established programs.[4] While the new GIST programs should generate some offsetting revenue, the extent of any offset will depend on student demand for all 8 programs. Even accepting the relatively optimistic projected revenues in the FS, the proposed programs will not pay for themselves.

---

[3] While the Feasibility Study suggests that a GIST bachelor's degree could fill the void left by the popular geography major, the lack of significant course overlap suggests that these programs likely appeal to different students. Moreover, the University of Utah, a much larger institution, reports only 5 students in its bachelor's program.

[4] To place such financial trade-offs in perspective, at the same time the APC was asked to consider 8 new GIST programs, it was also asked to recommend approval of a plan by the College of Business (COB) to eliminate a minor in business that currently has 50 students enrolled, due largely to insufficient faculty.

Furthermore, this financial risk does not appear to be offset by a narrative of pressing state need. WyGISC and other existing programs serve the state. The recommended online certificate programs and masters provide new distance learning opportunities and support the existing workforce. Foregoing the bachelors degree and on campus masters eliminates some expense without materially decreasing state benefit.[5] Moreover, because on campus GIST programs cost more and have weaker student demand, foregoing these two programs would decrease the overall financial commitment, while still providing students throughout the state with several opportunities for GIST credentials at the graduate and undergraduate level.

In conclusion, the APC recommends approval of the undergraduate and graduate certificate programs and the online masters. Evidence of GIST job growth merits some GIST programming. The recommended programs provide new opportunities to residents throughout the state and appear better targeted to student demand. The APC does not recommend approval of the bachelors or the on campus masters at this time, given real concerns regarding student demand and cost.

[5] Part of the proposal that was not recommended contemplates providing a 2+2 pathway from community college. Such pathways are important, but only one Wyoming community college, Central Wyoming, currently offers a GIS associates' degree and that program only graduated 6 (EAB p. 15). Of those 6, any who are interested in a GIS bachelors degree would have to relocate to Laramie. Other 2+2 pathways could be developed to serve any such student(s).

UNIVERSITY
OF WYOMING

Carolyn M. Pepper, Ph.D.
Department of Psychology
Biological Sciences Building, Rm. 121
Laramie, WY 82071-3415
(307) 766-2951
fax (307) 766-2926
cpepper@uwyo.edu

October 11, 2019

Dear Senators Alexander and Chestek:

As Chair of the Graduate Council, I am writing to you in your capacities as Chairs of the Academic Planning Committee and the Faculty Senate to update you on the Graduate Council review of the Geospatial Information Science & Technology (GIST) curricula proposal. After reviewing the New Degree Program Feasibility Study and meeting with Professors Jeff Hamerlinck and Ken Driese, we found the proposed curriculum had academic rigor appropriate for a graduate degree, strong job placement prospects upon program completion, excellent consultation with programs across campus, and sufficient resources requested to meet the program goals. Council members from varied colleges and programs were enthusiastic about the potential for their own graduate students to benefit from the proposed courses and certificates. Moreover, the feasibility study document was clear and compelling in presenting data in support of the program and should serve as a model for future proposed degree programs.

Following our evaluation, the Graduate Council has voted to approve the graduate curriculum portion of the GIST proposal.

Sincerely,

Carolyn M. Pepper

Carolyn M. Pepper, Ph.D.
Professor, Chair of Graduate Council

cc. Jeff Hamerlinck
Ken Driese

Academic Planning Committee

Associate Provost Anne Alexander referred a proposal for 8 new programs in Geospatial Information Science & Technology (GIST) to the Academic Planning Committee (APC) for review and recommendation. These include a B.S. degree, 2 undergraduate certificates, 2 different M.S. degrees, and 3 graduate certificates. These programs, with relatively minor changes, were previously submitted to the APC last spring. The 8 new programs represent an ambitious undertaking. Offering a GIST program or two provides clear benefit, teaching a valuable skill and enabling existing and prospective students to take advantage of predicted GIST job growth. Launching 8 new GIST programs, however, entails considerable cost that does not appear justified given limited evidence of student demand or state need and current fiscal realities. Accordingly, the APC voted to:

- RECOMMEND approval of the: (1) undergraduate certificate in GIS, (2) undergraduate certificate in Remote Sensing, (3) Masters in GIST, without thesis, online (4) graduate certificate in GIST, (5) graduate certificate in Remote Sensing, and (6) graduate certificate in Unmanned Aerial Systems (UAS)

- NOT RECOMMEND approval at this time of the: (1) undergraduate Bachelors of Science in GIST, or (2) Masters in GIST, with thesis, on campus. The APC would, however, welcome reconsideration of these programs in future years if robust student demand is shown and other potential concerns are addressed.[1]

These votes reflect the APC's conclusion that spending close to one million dollars per year on numerous GIST programs with uncertain student demand does not accord with the state and the university's most pressing academic priorities and current budget limitations.[2] The APC would still welcome efforts to decrease the scope or scale of the certificate offerings.

Setting aside reservations about magnitude, the recommended programs have several positive attributes. They reflect a well-articulated and carefully constructed multidisciplinary vision for collaboration and research at the university. They also provide more distance accessible programming to residents throughout the state. Further, these programs offer new credentials that should enable students to capitalize on predicted GIST job growth. Some cost-efficient GIST programming provides value to the university and state.

Adopting all 8 new programs does not appear prudent at this time, however, given limited evidence of student demand and significant costs. Less than a year ago, the APC was asked to eliminate two existing GIS programs at UW, a certificate program and an undergraduate minor,

[1] All votes were unanimous except for the on campus Masters, which was 8-1.
[2] $933,187 (March 2019 Executive Summary p.i). The latest GIST proposal lists expenses of $322,525 by year 4, but this figure does not include the hires that were made for the program prior to approval, the existing faculty lines that have been moved to support the program, and other expenses described in the proposals' narrative.

largely as a result of insufficient student demand. Over a five-year period (2012-2017), only 1 student graduated with the GIS certificate. Over that same period, only 7 students graduated with a GIS minor, an average of 1.4 per year. This real world experience suggests very limited student demand for on campus GIST programing.[3] Gray's data reinforces this conclusion. Gray's data rates both undergraduate and on campus masters programs a -2 on student demand, a bleak forecast. The experience of a regional competitor, University of Northern Colorado (NCo), reinforces enrollment concerns. NCo has placed its on campus graduate GIS certificate on hold indefinitely, due in part to low enrollment. As the chair of NCo's department concluded, "if we had it to do all over, we would do it fully online, without in person courses, because the courses are too specialized to draw numbers." The EAB report likewise recommends prioritizing online programs (EAB p.6).

Even online, there are student demand challenges. Seventy-five percent (75%) of students enroll in an online program within 100 miles of home (EAB p. 16). That is a small market for UW, and several well-established, low cost online programs already exist (EAB p. 13). It may be difficult to compete with these established programs. Moreover, students desiring graduate certificates may not qualify for federal financial aid if they are not enrolled in a master's program. These factors, coupled with the specialized nature of each GIS program, presage low enrollment.

Employer demand appears more promising but remains uncertain. The Feasibility Study (FS) presents compelling evidence of predicted GIST job *growth*. However, the linkage between available jobs and the 8 proposed programs remains unclear. The EAB report states that only 16% of jobs require completion of a GIST program (EAB Report p. 9). Almost half of GIST jobs require a degree in computer science or engineering, 26% and 21% respectively. Gray's data lists employer demand at -2. Given these statistics, a leaner, more conservative approach to GIST programming seems judicious.

Yet, the 8 proposed programs entail substantial cost. By year 4, annual expenses are over $900,000 per year. This is a considerable risk for a university operating with significant budget constraints and could limit opportunities to adequately fund well-established programs.[4] While the new GIST programs should generate some offsetting revenue, the extent of any offset will depend on student demand for all 8 programs. Even accepting the relatively optimistic projected revenues in the FS, the proposed programs will not pay for themselves.

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[3] While the Feasibility Study suggests that a GIST bachelor's degree could fill the void left by the popular geography major, the lack of significant course overlap suggests that these programs likely appeal to different students. Moreover, the University of Utah, a much larger institution, reports only 5 students in its bachelor's program.

[4] To place such financial trade-offs in perspective, at the same time the APC was asked to consider 8 new GIST programs, it was also asked to recommend approval of a plan by the College of Business (COB) to eliminate a minor in business that currently has 50 students enrolled, due largely to insufficient faculty.

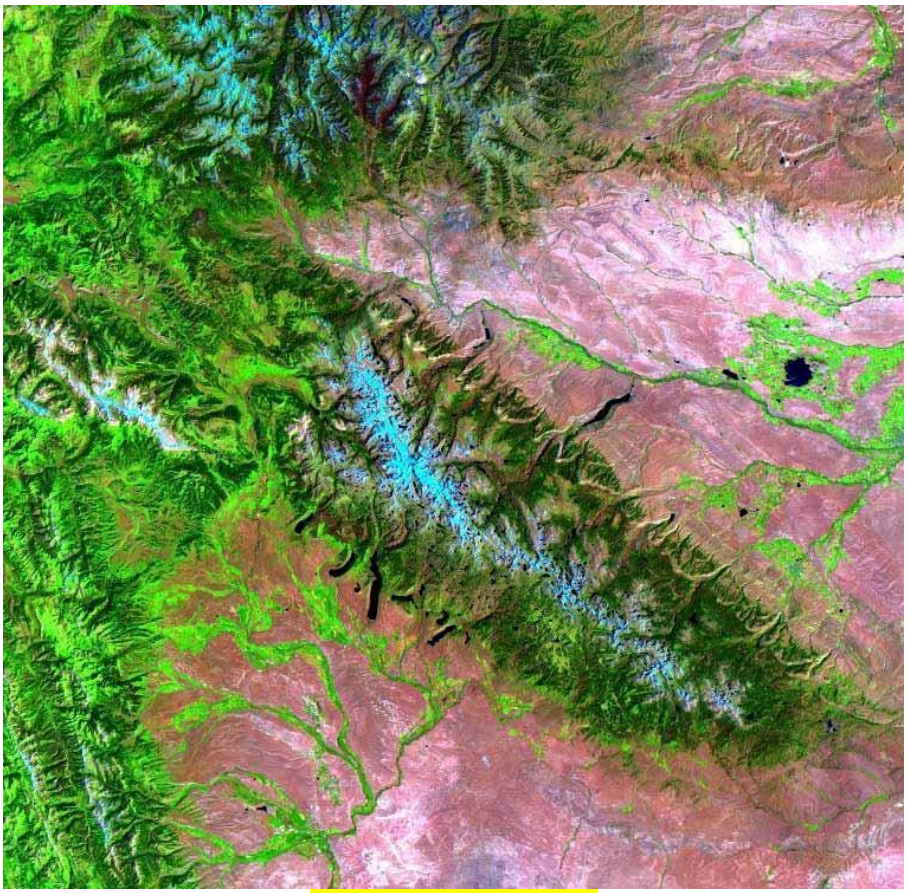
Furthermore, this financial risk does not appear to be offset by a narrative of pressing state need. WyGISC and other existing programs serve the state. The recommended online certificate programs and masters provide new distance learning opportunities and support the existing workforce. Foregoing the bachelors degree and on campus masters eliminates some expense without materially decreasing state benefit.[5] Moreover, because on campus GIST programs cost more and have weaker student demand, foregoing these two programs would decrease the overall financial commitment, while still providing students throughout the state with several opportunities for GIST credentials at the graduate and undergraduate level.

In conclusion, the APC recommends approval of the undergraduate and graduate certificate programs and the online masters. Evidence of GIST job growth merits some GIST programming. The recommended programs provide new opportunities to residents throughout the state and appear better targeted to student demand. The APC does not recommend approval of the bachelors or the on campus masters at this time, given real concerns regarding student demand and cost.

[5] Part of the proposal that was not recommended contemplates providing a 2+2 pathway from community college. Such pathways are important, but only one Wyoming community college, Central Wyoming, currently offers a GIS associates' degree and that program only graduated 6 (EAB p. 15). Of those 6, any who are interested in a GIS bachelors degree would have to relocate to Laramie. Other 2+2 pathways could be developed to serve any such student(s).

For Review

New Degree Program Feasibility Study
Interdisciplinary Undergraduate and Graduate Curricula in Geospatial Information Science & Technology (GIST)



December 11, 2019

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Wyoming Geographic Information Science Center

UNIVERSITY OF WYOMING

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Executive Summary

***Title and Level of Degrees and Certificates*:**

Program in Geospatial Information Science & Technology (GIST) including:

- B.S. degree with a required minor selected from a set of approved affinity disciplines
    - Including 2 undergraduate certificates, stackable toward the B.S. degree
- M.S. degree with thesis (Plan A) and without thesis (Plan B)
    - Including 3 stackable graduate certificates.

The new credentials represent 2 nested sets. At the undergraduate level, the B.S. degree includes the courses that students can take to earn certificates in either GIS or Remote Sensing. At the graduate level, the online M.S. degree includes all of the requirements (except a thesis) that comprise the on-campus M.S. and the 3 graduate certificates. Students taking any of the graduate certificates can use the credits towards a master's degree.

***Delivery Modes*:**

- Undergraduate: Mostly on campus with some distance delivery
- Graduate: On campus M.S. with thesis + online professional M.S. without thesis and stackable online graduate certificates.

***Startup Cost of Degrees and Certificates*:**

These are the projected expenses and revenues from the consolidated *pro forma* budgets for all credentials combined and assuming multi-phased rollout.

Year	Expenses	Revenues	Net
AY 2020-21:	$138,885	$137,302	-$ 1,583
AY 2021-22:	$323,831	$349,687	$ 25,856
AY 2022-23:	$405,645	$574,177	$168,532
AY 2023-24:	$436,430	$713,931	$277,501

Matching Funds:

1. Personnel
    a. Beginning in FY20, Academic Affairs has funded a full-time 9-month GIST Program Director position within WyGISC to oversee new course offerings (and future anticipated credentials).
    b. Geography and WyGISC faculty lines have been reallocated to support of this program. One full-time Geography faculty has moved to WyGISC to support this program. Three partial appointments in Geography (and WyGISC) will now be 100% WyGISC and will contribute to this program. One 50% faculty appointment in Botany has been moved to WyGISC.
    c. WyGISC has been offered CPM allocations for 2 new faculty members (FY21) who will contribute to teaching in the proposed programs. These represent a commitment of $215,606 (salary +

fringe) to the program.

2. WyGISC Operating Budget
    a. For both AY18-19 and AY19-20, WyGISC allocated approximately $95,000 of its existing departmental budget toward developing the program. In future years, WyGISC *in-kind* match will also include $25,000 in enterprise-level software licenses annually
3. In FY20, WyGISC received a grant from the UW Office of Distance Education Support for $75,000 to support online program development. This award represents funding for year 1 of what is likely to be ongoing support in years 2 and 3.
4. In AY19-20, UW Institutional Marketing is donating production of a GIST course marketing video, valued at ~$5,000.
5. Additional information on other existing and pending commitments of fiscal resources and in-kind matching contributions are discussed in this report.

***Anticipated Launch Date*:**

A phased rollout is proposed, with course development and credential start-up initiated over three semesters:

- Fall 2019: begin developing and offering undergraduate and graduate courses
- Fall 2019: seek Board of Trustees approval for new credentials
- Spring 2020: continue development and increase offerings of new courses
- Spring 2020: pending approval, begin aggressive marketing of new program
- Fall 2020: Launch new undergraduate and graduate credentials

Note: An initial set of courses has been approved by the University Course Approval Committee and are being offered under the approved GIST prefix beginning in fall 2019 to support the existing Geography Minor and the Geography Department program reorganization 'teach-out' plan. Other new courses are being proposed for spring 2020.

***Description*:**

We propose to create new nested and stackable interdisciplinary undergraduate and graduate programs in Geospatial Information Science & Technology (GIST). These include a Bachelor's of Science (B.S.) undergraduate degree requiring a targeted minor in another discipline and with opportunities for students to earn two undergraduate certificates that contribute to their degree; a Master of Science (M.S.) degree in Geospatial Information Science & Technology (on-campus with thesis or online with no thesis); and three stackable graduate certificates in: (a) geospatial information science; (b) remote sensing; and (c) unmanned aerial systems. The graduate certificates are comprised of courses that contribute to the master's degree (core and elective).

It is anticipated that many of the courses will be in high demand not only by students enrolled in the various credentials, but also by students outside the programs who want to gain new proficiencies in certain aspects of the geospatial discipline.

Key Points:

- Phase-in beginning in Fall 2019
- Undergraduate and graduate student opportunities across colleges
- Online graduate offerings support existing workforce
- Targeted undergrad. program enrollment: 47 (incl. certificates; cumulative by year 4)
- Targeted graduate program completions: 76 in year 4 (incl. M.S. and certificates)
- Innovative active learning and technology-enabled distance delivery
- 19 new or re-designed course offerings in GIST by Year 4 (undergraduate and graduate combined, not including electives)
- Need for 1 additional tenure track faculty member and 2 APLs over 4 years; and 0.5 staff in Year 1
- Need for 3-10 new GTA lines per semester over 4 years to support teaching and recruitment
- Differential tuition model for online graduate credentials
- Links to EPSCoR, HPC, STEM, Science Initiative, Tier 1 Engineering, and Data Science investments
- Leverages existing courses in Arts & Sciences, Engineering, and Agriculture & Natural Resources
- Cross-campus representation on Faculty Advisory Committee

Supported by:

Provost's Spatial Sciences Initiative Task Force
WyGISC
UW Office of Distance Education Support
Wyoming EPSCoR
UW Science Initiative
Wyoming Geospatial Organization
State of Wyoming GIS Technical Advisory Group
Wyoming Business Council
Wyoming Department of Workforce Services

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Thanks to the UW undergraduates and graduate students who participated in our student focus groups, and to the employers responding to our workforce needs survey. Input from the memberships of the Wyoming Geospatial Organization (WYGEO) and the Wyoming Planners Association (WYOPASS) have also improved this document. Thanks also to the Faculty Senate Academic Planning Committee for suggestions that have strengthened this proposal.

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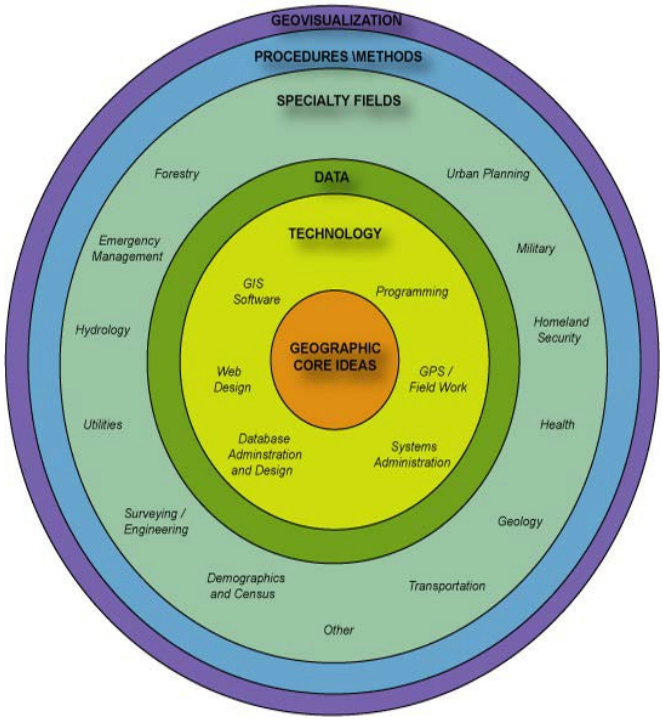
Overview and Description of Degree or Certificate, Purpose, Strategic Plan Overlay

Introduction

Drawing on domain expertise from geography, data science, computer science, mathematics, statistics, psychology, design, and others, ***geospatial information science*** refers to the multidisciplinary research enterprise that addresses the nature of geospatial information and the application of geospatial technologies to basic scientific questions. ***Geospatial information technology*** is a specialized set of information and communication technologies that support the acquisition, management, analysis, and visualization of geo-referenced data.



Examples include: geographic information systems; global navigation satellite systems; and satellite, airborne, shipboard and ground-based remote sensing and image processing systems.

Successful students in **Geospatial Information Science and Technology (GIST)** combine proficiency in spatial thinking and geospatial data science analysis with fluency in geographic information systems, remote sensing, data analytics, and visualization. As professionals, graduates apply their knowledge and skills in a wide range of fields, from environmental management and public health, to civil engineering and urban planning, to economic analysis and marketing.

Figure 1. Graphical representation of GIST components.
Source: GISLounge, 2006.

Background and Process

In February 2017, Provost Kate Miller convened an *ad hoc* working group tasked with envisioning a new, centrally coordinated interdisciplinary curriculum in geospatial science and technology (including geographic information systems and remote sensing). During this same time, UW's Office of Research & Economic Development convened a pair of campus-wide listening sessions focused on spatial science research and education. Attracting participation by

30 to 40 faculty across campus, the sessions included presentations from both academic and industry representatives and revealed strong interest in building more capacity in this area.

In fall 2017, Provost Miller established a School of Spatial Sciences Task Force to assess the feasibility of creating a new school within the Division of Academic Affairs to more broadly advance spatial sciences research and education, including a framework to administer a new suite of undergraduate and graduate GIST curricula. In their December 2017 preliminary report, the Task Force concluded that while the immediate creation of a new school was not feasible, development of the new GIST curricula would be an appropriate and valuable first step toward building capacity in spatial sciences education and research, and that the program could maximize its interdisciplinary benefit across campus by being housed in the already existing Wyoming Geographic Information Center (WyGISC).

During the spring of 2018, a subcommittee of the original Task Force refined a plan for a comprehensive set of GIST curricula that would serve University of Wyoming students and professionals in the region with undergraduate and graduate degrees and certificates delivered on campus and over distance. This culminated with a Notice of Intent (NOI) that was presented by WyGISC to the Board of Trustees Academic Affairs and Student Affairs Committee for consideration in May 2018 and was unanimously approved by the full Board in June 2018.

A small committee working during the 2018 – 19 academic year developed this feasibility study that describes the proposed programs in more detail than in the original Notice of Intent. It is presented here for cross-campus review, with a goal of delivering a Request for Authorization (RfA) to the Board of Trustees at their November 2019 meeting.

Specifically, this proposal is for undergraduate and graduate degrees with stackable certificates in Geographic Information Science and Technology (GIST):

1) An on-campus, Bachelor of Science degree requiring a minor in another discipline and with opportunities for students to earn two certificates, and 2) a master's degree offered on campus with thesis or online without thesis, with three supporting stackable online graduate certificates that can contribute to requirements for the master's degree. GIST programs will be coordinated through the existing WyGISC. If the RfA is approved on schedule, the new credentials will be launched beginning in Fall 2020.

Parallel to the degree and certificate approval process, an initial set of courses have been approved by the University Course Approval Committee and others are currently going through the course authorization ("CARF") process. Some of these are existing courses that are being updated, while others are new offerings. Regardless of RfA status, these courses will be taught by existing faculty under a newly established GIST prefix beginning in fall 2019 to support the existing Geography Minor and the Geography Department program reorganization 'teach-out' plan, and to address existing unmet demand for GIST coursework among existing UW students.

Collectively, the curricula that comprise this proposal address a twenty-year need to comprehensively modernize, expand, and make more accessible UW's education and training opportunities across the increasingly interdisciplinary geospatial domain. The nested multi-credential approach described in this proposal reflects the unique integrated nature of GIST specialty areas (e.g., geographic information systems, remote sensing and image processing, geospatial data science and visualization), and acknowledges that demand for more and better GIST course offerings exists among both undergraduate and graduate students at UW, as well as from professionals across the state and in the region. The proposal is the product of two years of research and deliberation informed by faculty, current students, prospective employers, national experts, and independent market and labor analyses. Though ambitious in its scope, the program holds great potential for immediately and significantly strengthening UW's capacity in this increasingly vital growth area.

Objectives

This program will equip students with the academic knowledge and practical tools needed to succeed in many disciplines, to catalyze economic development in Wyoming, and to engage collaboratively with stakeholders in many contexts. It also serves professionals in Wyoming and beyond, especially through online course offerings. Our primary objective is to provide new courses and credentials that will increase the level of geospatial competency among our students.

Fit with the unit's current offerings

As an Academic Affairs unit operating alongside the Division's colleges and schools, WyGISC is uniquely positioned to integrate and expand upon existing geospatial courses, realizing the full interdisciplinary potential of the proposed credentials across the University. Geospatial courses previously taught in the Department of Geography will be modified for incorporation into the expanded program. The new GIST credentials will address unmet student demand associated with the Geographic Information Science undergraduate credential options in Geography eliminated as a result of the Geography Department's closure in July 2019. Remote sensing courses currently taught by the Department of Botany and others will also contribute to the new GIST programs. The Botany Minor in Remote Sensing will be eliminated if it becomes redundant. Relevant courses taught by other departments will also contribute to this program. We will articulate with Wyoming community colleges, some of which have strong GIST programs.

Rationale

Expanded GIST curricula support a long-standing need in Wyoming and the Rocky Mountain region for well-trained geospatial professionals with skills contributing to academics, governmental agencies, and private industry. UW has fallen short in offering students and working professionals coordinated, logical pathways for becoming experts in GIST, even as this discipline has grown in importance. In the wake of the elimination of UW's Geography Department and reduction of traditional geography-oriented credentials, the GIST program elements – and particularly the BS degree, will address this void by delivering new degree options that ensure students retain access to learning opportunities in the geographical sciences.

The proposed programs will raise UW's stature regionally and nationally, while attracting new students. In Wyoming, students with a solid understanding of GIST in a multidisciplinary framework can play central roles in addressing natural resource management, energy development, rural development, and other place-based challenges. Further, there is a growing need across the UW campus for students well-trained in GIST who can contribute to research, including the new EPSCoR project studying microbiomes across Wyoming.
To explore student interest in expanded GIST opportunities at UW, we convened undergraduate and graduate focus groups in the spring of 2018, and student response was overwhelmingly positive. Undergraduates emphasized that GIS and remote sensing are important for jobs across disciplines, from the energy sector to geospatial intelligence to resource management, and in both private industry and government. They were excited about our proposed degree structure, because it would allow them to focus on specific geospatial skills while they also gain expertise in another discipline. For example, students studying botany require different geospatial skills than those studying energy management.

Graduate students participating in their focus group were all currently studying in UW graduate programs in other disciplines, and consequently, they saw an expanded geospatial curriculum (more geospatial courses and workshops) as being more valuable to them than the standalone master's degrees. They expressed enthusiasm about graduate certificates that would add new tools to their disciplinary toolboxes. Many of these students noted that geospatial competency is important in their disciplines and that having more geospatial experience would enhance their success in the job market.

A survey of potential employers in the region, including universities; federal, state, and local agencies; and private companies, conducted in spring 2018, supported the students' intuition that GIST skills are important in the job market. Of 29 respondents, 21 (72%) anticipated growth in their GIST activities in the next 5 years in areas including, but not limited to, unmanned aerial system ("drone") remote sensing, geodatabase management, enterprise GIS, web mapping, and data visualization.

This was also highlighted in the Educational Advisory Board (EAB) report that we commissioned in spring 2018, which noted that job postings for GIS&T professionals among regional employers increased 24% from 2013 to 2017, and that this regional trend is mirrored nationally (22% increase). The U.S. Bureau of Labor Statistics (BLS) expects employment of "cartographers and photogrammetrists" to increase 11%, faster than the average growth (7.5%) across all occupations (Fig. 2). This demand reflects growing need for digital map design skills in Web browser environments (i.e., cartographers) and the rapid growth of the unmanned aerial systems field (of which photogrammetry plays an important role. The BLS O*NET database indicates that "most of these occupations require a four-year bachelor's degree".[1]

Additional detailed information on GIST market and labor trends, as well as regional program comparisons including enrollments and tuition analyses, may be found in

[1] https://www.onetonline.org/link/summary/17-1021.00
Last accessed 11 August 2019.

the final section of this report.

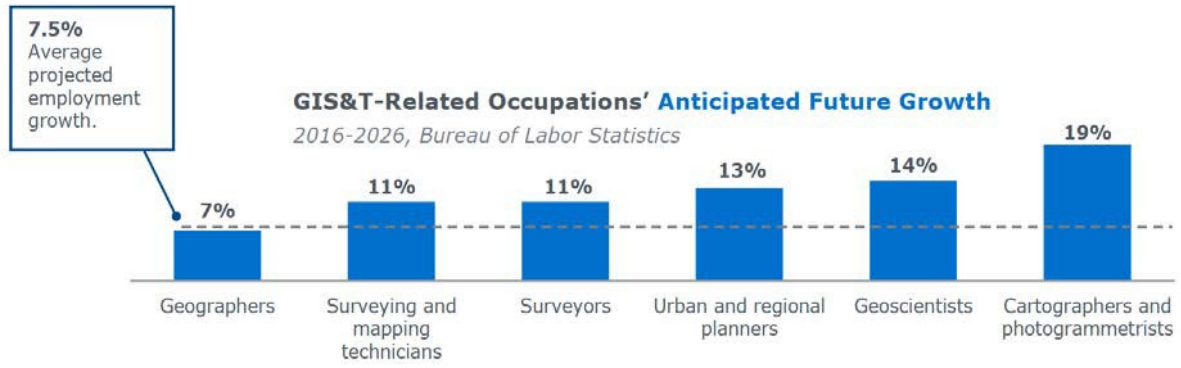


Figure 2. Anticipated future job growth in GIS&T related occupations from the EAB report. Bureau of Labor Statistics growth estimates are based on national data. Regional 12-month growth from Gray Associates Data supports these trends. Source: Education Advisory Board, 2018.

Strategic Plan and Articulation

Strategic plan: Proposed programs align with Goals 1 and 2 of the UW 2017-2022 Strategic Plan. GIST contributes to our intellectual community by producing high quality scholarly work from new faculty and graduate students, garnering additional research funding, and by instituting a new interdisciplinary degree program that leverages existing resources to create new opportunities. Given regional demand, these programs should also increase enrollment for first-time, first-year students and transfer students with associate degrees in GIS from Wyoming's community colleges. The proposed programs are supported by WyGISC's strategic goal to expand the Center's education mission through curricula and undergraduate and graduate education-based research.

Articulation: Community colleges in Wyoming teach GIS&T courses at the 1000- and 2000-levels, with some colleges offering well-developed programs. Casper College, for example, offers a Certificate in GIS, and students at Central Wyoming College can earn an Associate of Applied Science Degree in GIS&T and in Environmental GIS, as well as three certificates. Introducing a new undergraduate degree in GIS&T at UW presents the challenge of articulating UW courses and degrees with these courses, certificates, and degrees. This is not a new problem. For example, some courses (*e.g.*, Introduction to GIS) currently taught at the 4000-level at UW are equivalent to courses taught at community colleges at the 1000- or 2000-level and will be renumbered and modified. Instructors at Casper College and Central Wyoming College may play key roles in articulation, given their active GIST programs.

The first step will require comparison of syllabi across institutions for each GIST course and adjustment of course content and course level both at UW and at community colleges. Ultimately, 2+2 plans will be developed and approved for each community college in Wyoming that has a GIST credential. It is likely that some students will complete much of the core of the proposed UW concurrent degree *en route* to their Associate's Degree and then focus at UW on remaining core courses, electives, and degree requirements for the minor discipline that they choose. As noted above, the BS in GIST fills a gap left by recent elimination of UW's Geography Department in providing a path toward a bachelor's degree in the geographical sciences for community college transfer students with associate's level credentials in variations of the discipline.

To facilitate articulation, we will hold articulation summits with representatives of all Wyoming community colleges in each of the first two years of the program, and we will follow-up with individual meetings in subsequent years, working toward completion of 2+2 plans and specific course articulation, as well as other elements of UW's new Graduate Wyoming Initiative including reverse transfer, development of Transfer Planning Guides, and direct student support including peer mentoring. We have arranged to lead a session at the Fall 2019 Wyoming Articulation Summit to begin this process, and we have had preliminary discussions with community college primary instructors Jeff Sun at Casper College and Jacki Klancher at Central Wyoming College (see letter of support in Appendix 1).

Learning Outcomes

Six core competencies borrowed from the AAAS Vision and Change initiative help guide curriculum development[2]. These include: 1) applying the process of science, 2) using quantitative reasoning, 3) using modeling and simulation, 4) tapping into the interdisciplinary nature of science, 5) communicating and collaborating with other disciplines, and 6) understanding the relationships between science and society. While our curricula leverage existing UW courses, we will also design new courses addressing core competencies and specific GIST learning objectives guided by the U.S. Department of Labor's Geospatial Technology Competency Model and the University Consortium for Geographic Information Science GIS&T Body of Knowledge (Fig 3).

GIS curricula that include 1) positioning and data acquisition (GPS, remote sensing, mobile GIS), 2) analysis and modeling, and 3) software and application development will be competitive nationally (Fig. 3 and 4). Students balancing these skills with knowledge of underlying theory and problem-solving capability in the context of specific disciplines are most likely to be successful.

[2] AAAS. 2011. Vision and Change in Undergraduate Biology Education: A Call to Action. Final Report. Carol A. Brewer and Diane Smith (Eds.). American Association for the Advancement of Science.

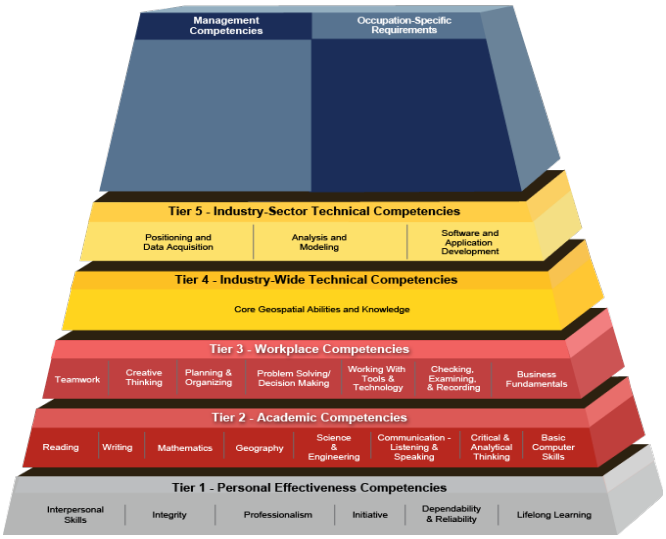


Figure 3. The U.S. Department of Labor geospatial competency model. The proposed program addresses competency across tiers.

Another guiding principle for these curricula is that courses incorporate active- and inquiry-based learning. GIST is a hands-on, problem-centered endeavor, and exposing students to practical experiences will equip them to solve real-world problems. We anticipate combining traditional courses (1-4 credits) with hands-on research and internship opportunities to give students exposure to a wider range of skills during their degree experiences than would otherwise be possible.

Each of the proposed degrees or certificates addresses geospatial competency by requiring a selection of core courses aimed at critical geospatial knowledge, analysis, and technical skills. These core courses are augmented by electives, allowing students to build greater depth in aspects of GIS&T that are particularly relevant to their personal goals and interests. Specifically, core courses are designed to address learning outcomes from Tiers 3-5 of the geospatial competency model (Fig. 3) while the program as a whole addresses Tier 1 and 2 competencies.

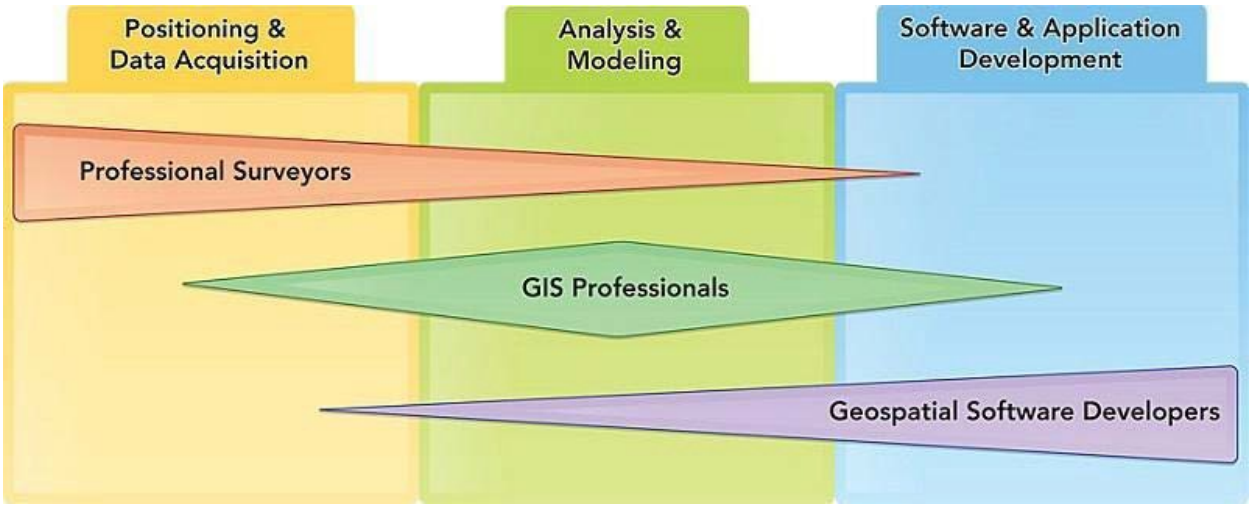


Figure 4. Relationship between three primary competencies from Tier 5 of the U.S. Department of Labor geospatial competency model. These three competencies are addressed in the proposed program.

Curriculum Map and Program Structure

Curriculum maps and course sequences are included below. All courses will be delivered either on the University of Wyoming main campus in Laramie or online. Some courses that are equivalent to our proposed undergraduate courses are taught at some Wyoming community colleges, and we will work to articulate with these. We are working closely with the Office of Distance Education Support and we will continue to do so, both for developing fiscal and administrative structures and at the level of individual course development.

We emphasize that this proposal is for an undergraduate bachelor's degree and a master's degree (with or without thesis) with nested undergraduate certificates that are comprised of portions of the bachelor's degree requirements (Fig. 5a) and graduate certificates that can be stacked to contribute to the master's degree (Fig. 5b). Although this represents 8 new credentials, they nest within the primary undergraduate B.S. and graduate M.S. degrees.

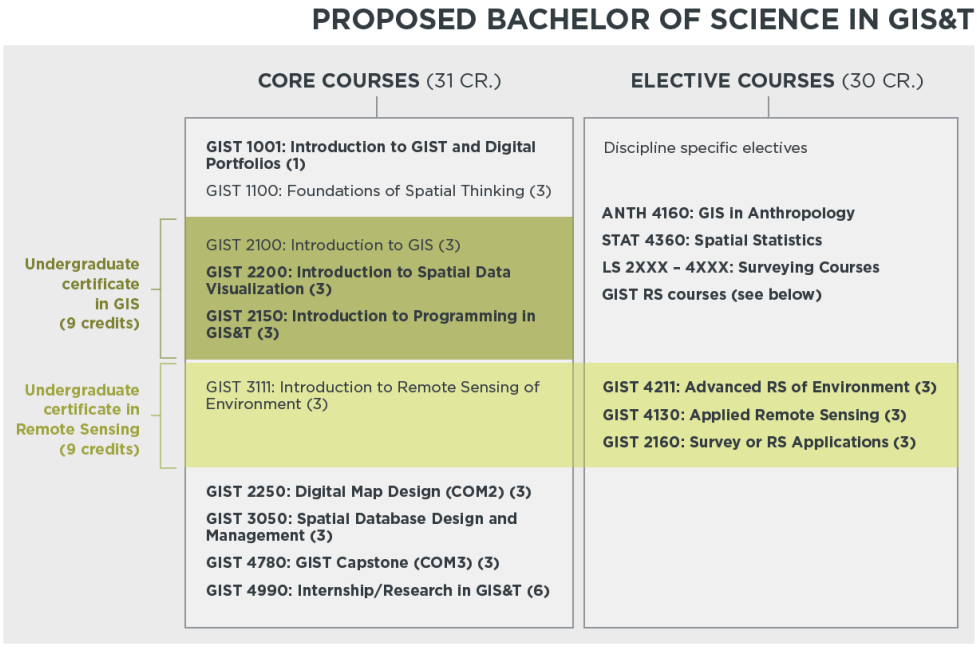


Figure 5a. Requirements for the proposed bachelor's degree with nested undergraduate certificates in GIS and remote sensing. Certificate courses contribute to the bachelor's degree requirements and vice versa.

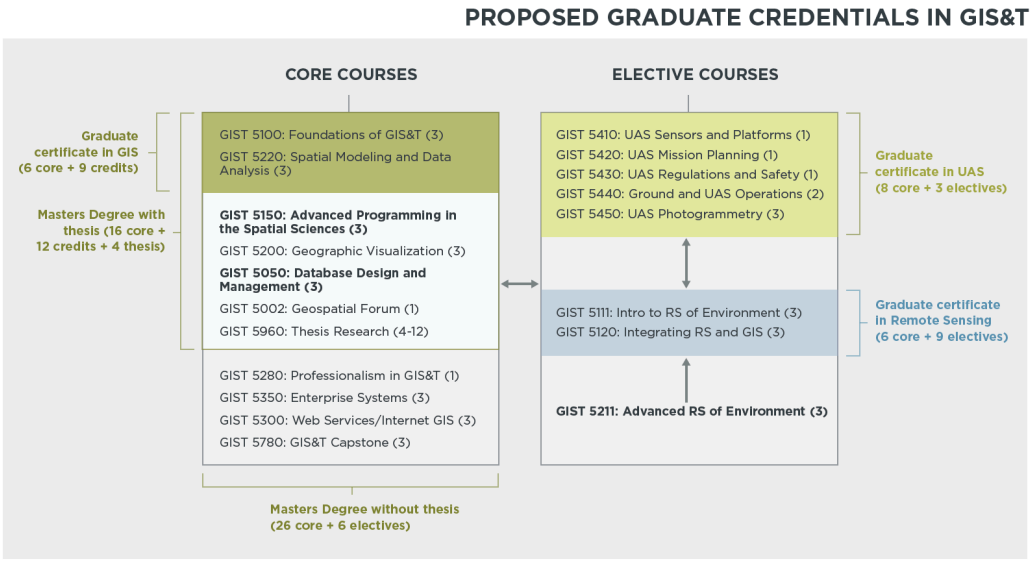


Figure 5b. Requirements for the online professional master's degree and nested on-campus master's and graduate certificates in GIS, remote sensing and UAS. Certificates are composed of courses contributing to the master's degree.

Bachelor of Science in GIS&T with two stackable certificates

The proposed 4-year Bachelor of Science Degree in GIS&T requires that students successfully complete a selection of courses aimed at building geospatial competence while also earning a

relevant minor (appropriate UW minors will be determined by GIST leadership and a faculty advisory board) in a second discipline. The minor requirement recognizes that students with multidisciplinary knowledge, including geospatial competency, are best positioned for success. A 4-year plan for this B.S. degree is included below (Fig. 6). Undergraduates will also have an opportunity to earn stackable certificates in GIS and/or remote sensing. Evidence suggests that certificates like these, earned *en route* to an undergraduate degree, increase graduation rates because students experience tangible progress upon earning each credential. These certificates add no additional cost to the overall program, and are likely to be popular with students outside of this bachelor's degree program.

Geospatial Information Science and Technology, B.S.

Requires Minor in another discipline

This sample degree plan is a guide, to be used for planning in consultation with your academic advisor. Actual course sequence may vary by student. A ▲ symbol identifies courses that must be taken and passed during the suggested semester in order for a student to stay on track toward completing the degree program within four years.

Sequence	Course Prefix	Course Number	Course Title	Credit Hours	Min Grade	Notes
Freshman Fall Semester						
			USP First-Year Seminar	3	C	FY
▲	GIST	1001	Introduction to GIST and Digital Portfolio	1	C	
▲	GIST	1100	Foundations of Spatial Thinking	3	C	
	MATH	1400	College Algebra (or MATH 1450)	3	C	Q
			USP COM1	3	C	C1
			Credit hours subtotal:	13		
Freshman Spring Semester						
			USP US & Wyoming Constitutions	3		V
▲	GIST	2100	Introduction to GIS	4	C	
	MATH	1405	Trigonometry (or MATH 1450)	3	C	Q
	STAT	2050	Fundamentals of Statistics (or STAT 2070)	4		
			Minor Core Course	3		
			Credit hours subtotal:	17		
Sophomore Fall Semester						
			USP Human Culture	3		H
▲	GIST	2200	Introduction to spatial data visualization	3		
▲	GIST	2150	Introduction to Programming in GIST&T	3		
			Minor Core Course	3		
			Elective	3		
			Credit hours subtotal:	15		
Sophomore Spring Semester						
			USP Human Culture	3		H
	GIST	2250	Digital Map Design (USP COM2)	3		C2
			Minor Core Course	3		
	GIST		GIST Electives (specify choices)	6		
			Credit hours subtotal:	15		

This sample degree plan is a guide for course work in the major. • Course sequencing may need to be altered if ACT or Math Placement scores require a student to take pre-college courses before taking required math or English courses. • Not all courses are offered every semester and some electives may have prerequisites. Students should review course descriptions in the *University Catalog* and consult with their academic advisor to plan accordingly.

University of Wyoming requirements:

Students must have a minimum cumulative GPA of 2.0 to graduate. • Students must complete 42 hours of upper division (3000-level or above) coursework, 30 of which must be from the University of Wyoming. • Courses must be taken for a letter grade unless offered only for S/U. • University Studies Program (USP) Human Culture (H) and Physical & Natural World (PN) courses must be taken outside of the major subject, but can be cross-listed with the major.

Notes continued on next page(s).

Geospatial Information Science and Technology, B.S.
Requires Minor in another discipline

Sequence	Course Prefix	Course Number	Course Title	Credit Hours	Min Grade	Notes
Junior Fall Semester						
	GIST	3111	Introduction to Remote Sensing of the Environment	3		
	GIST		GIST Electives (specify choices)	6		
			Minor Electives	6		
			Credit hours subtotal:	15		
Junior Spring Semester						
▲	GIST	3050	Spatial Database Design and Management	3		
	GIST		GIST Upper Division Electives	6		
			Upper Division Electives (specify choices)	3		
			Minor Electives	3		
			Credit hours subtotal:	15		
Senior Fall Semester						
▲	GIST	4990	Internship/Research in GIST	6		
	GIST		GIST Upper Division Electives (specify choices)	6		
			Minor Electives (upper division)	3		
			Credit hours subtotal:	15		
Senior Spring Semester						
			GIST Upper Division Electives	6		
			Upper Division Electives	6		
GIST	4780		GIST Capstone	3	C	C3
			Credit hours subtotal:	15		
			TOTAL CREDIT HOURS	120		

[Degree] Program notes:

The B.S. Degree in GIST requires that the student also choose a minor in another discipline. Student can earn certificates in GIS and Remote Sensing by completing 9 credits of courses (specified and approved by your advisor) in these disciplines. Highlighted courses (green) or approved electives can contribute to GIS certificate or (blue) with electives to the Remote Sensing certificate.

Figure 6. **Four-year plan for B.S. degree** with courses for stackable certificates highlighted and options explained in Degree Program notes.

Master's Degree without thesis (online)

The non-thesis Master of Science Degree is a professional degree that will be delivered primarily online. It provides a pathway for both traditional students and professionals to earn a graduate credential in 2 years as outlined below.

Course sequence for Master's degree without thesis (32 credits)

*New courses (GIST electives are a mixture of new and existing courses)

Semester 1
*GIST 5100 Foundations of GIS&T (3) (on campus and online)
GIST 5150 Advanced Programming in the Spatial Sciences (3) (on campus and online)
*GIST 5200 Geographic Visualization (3) (on campus and online)
*GIST 5280 Professionalism in GIS&T (1) (online)

Semester 2
GIST 5050 Database Design and Management (3) (on campus and online)

*GIST 5220 Spatial Modeling and Data Analysis (3) (on campus and online)
*GIST 5XXX Elective (3) (on campus and online)

Semester 3
*GIST 5350 Enterprise Systems (3) (online)
*GIST 5300 Web Services/Internet GIS (3) (online)
*GIST 5002 Geospatial Forum (1) (on campus and online)
*GIST 5XXX GIST Electives (3) (on campus and online)

Semester 4
*GIST 5780 Capstone (3)

The Master of Science degree with thesis will be delivered mainly on the UW campus. Requirements for this degree are a subset of requirements for the online master's degree (see below), which does not require a thesis. Students will be paired with a graduate advisor who will guide their thesis research and chair their committee. This degree will require a combination of core and elective courses that typically will follow the sequence outlined below for completion in 2 years. Students earning this traditional master's degree will contribute to WyGISC's research mission and to GIST teaching.

*New courses (GIST electives are a mixture of new and existing courses)

Master's Degree with Thesis (on-campus)

Course sequence for Master's degree with thesis (28 credits + 4 thesis credits)

Semester 1
*GIST 5100 Foundations of GIS&T (3) (on campus and online)
GIST 5150 Advanced Programming in the Spatial Sciences (3) (on campus and online)
*GIST 5200 Geographic Visualization (3) (on campus and online)

Semester 2
GIST 5050 Database Design and Management (3) (on campus and online)
*GIST 5220 Spatial Modeling and Data Analysis (3) (on campus and online)
*GIST 5XXX Elective (3) (on campus and online)

Semester 3

5XXX GIST Electives (9) (on campus and online)

Semester 4
*GIST 5002 Geospatial Forum (1) (on campus and online)
GIST 5960 Thesis Research (4-12) (on campus)

Graduate Certificates

Graduate certificates provide a means for students and professionals to earn marketable credentials in 1-2 semesters. These certificates require a combination of core and elective courses as outlined below, and they can contribute to requirements for the master's degree. These graduate certificates will be delivered primarily online. Because they are subsets of the master's degree requirements, they add little additional cost to the program.

*New courses

Graduate Certificate in GIS&T (online; 15 credits)

Core

*GIST 5100 Foundations of GIS&T (3)
*GIST 5220 Spatial Modeling and Data Analysis (3)

Electives (9 credits)

Choose from other GIST courses (see M.S. courses) or interdisciplinary courses

Graduate Certificate in Remote Sensing (online; 15 credits)

Core (6 credits)

BOT/GIST 5111 Introduction to Remote Sensing of the Environment (3)
*GIST 5120 Integrating Remote Sensing and GIS (3)

Electives (9 credits)

Choose from other remote sensing and UAS courses or interdisciplinary RS courses

Graduate Certificate in Unmanned Aerial Systems (online and on campus; 8-11 credits)

Core (8 credits)

*GIST 5410 UAS Sensors and Platforms (1)
*GIST 5420 UAS Mission Planning (1)
*GIST 5430 UAS Regulations and Safety (1)
*GIST 5440 Ground and UAS Operations (2)
*GIST 5450 UAS Photogrammetry and Digital Image Processing (3)

Electives (3 credits) (may be optional for some students)
Choose from remote sensing courses or interdisciplinary UAS applications courses

Assessment Plan

Undergraduate degree

A new B.S. Degree in GIS&T at UW provides an opportunity to assess the effectiveness of this important undergraduate program as it evolves. This will require establishment of direct and indirect assessment tools and metrics at the outset, that can be applied when the degree programs are launched and each year thereafter.

Direct assessment will include an exam covering core GIS&T concepts and competencies that will be administered when each student enters the proposed undergraduate degree program, during their program, and again in students' last semester. This exam will be anchored in the UCGIS GIS&T Body of Knowledge (link). Other direct assessments may be developed to address specific learning objectives and to track student learning as they advance through our courses and programs.

Another opportunity for direct assessment of student learning exists as part of the required capstone experience. In the capstone, evaluation based on the quality of student project proposals, project implementation, and final reports will focus not just on technical skills, but on organizational capability, critical thinking, and communication.

UW's existing internship management programs (Handshake [link] and EPIC [link]) will be leveraged in evaluating internship experience quality and accomplishment, including input from internship sponsors and partner programs on campus like the Wyoming Research Scholars Program.

Finally, we will explore the utility of the UW SOAR program [link] as an ancillary resource for assessing student experiences outside the classroom, and providing guidance for students in attaining on-campus discipline-oriented experience and off-campus career preparation

Indirect assessment of our program will include student course evaluations and exit interviews, in which each student reports on their perception of the value of the program relative to their goals and career plans. We will also monitor completion of the undergraduate certificates in relation to graduation rates.

Other assessment measures include monitoring of enrollment trends in the program and co-degrees, DFW rates, quality of internship experiences, and collection of data on student employment after graduation.

Master's Degrees

As with the undergraduate degree, the initiation of a new graduate program affords the opportunity to assess program effectiveness and student success from the beginning. This will be accomplished with direct and indirect assessment tools, including pre- and post-exams evaluating core competency in GIS&T, annual graduate student reports, assessment by graduate committees at the time of defense for thesis students, tracking of student and faculty publications, evaluation of the quality of capstone projects, student evaluations of our programs, and monitoring of student employment success after graduation. Some of these tools will be developed in concert with the undergraduate degree assessment, while others will be unique to the graduate degrees.

Graduate Certificates

If successful, graduate certificate programs will provide students with knowledge of specific geospatial disciplines and, for many, will help them reach professional or academic goals (*e.g.*, advancement in their jobs, progress in academic programs, or increased chance of admission).

Knowledge can be assessed directly by administering tests of core concepts and technological applications at the beginning and end of each certificate program. Indirect assessment of individual student experiences will include student evaluations of the certificate program and tracking of post-certificate progress in career or school. The latter will require permission by the students, but when granted will yield valuable information that can be used to ensure that our certificate programs are relevant and competitive. For example, for the UAS certificate, passing the FAA remote pilot certification exam will be one specific indirect assessment metric we will seek to track.

Degree Program Evaluation

Program evaluation will be ongoing and will be accomplished by the WyGISC Director, the GIST Program Director, participating faculty, and an advisory board made up of representatives from UW and the public and private sectors. Specifically, we plan to:

- Use the advisory board to assess our success in accomplishing the program's mission, objectives, and curriculum
- Collect and analyze enrollment data, including retention and graduation rates
- Collect and analyze exit surveys for graduate students
- Track and analyze DFW rates for undergraduate students
- Collect and employment statistics for GIST students

Substantive Change Determination

This has been investigated. This program does not represent a Substantive Change and there are no significant implications for UW's Higher Learning Commission re-accreditation.

New Resources Required

Where possible, the new program will take advantage of existing WyGISC resources, including an increase of one faculty member and a realignment of four existing WyGISC faculty, both facilitated by the reorganization of the Geography Department. Under this proposal, these faculty will continue to make GIST-related contributions to the continuing Geography Minor, and the multi-year Geography teach-out plan. Two additional faculty lines, representing a commitment of $215,606 (salary + fringe) by Academic Affairs have been granted to WyGISC for FY21 through the CPM process. These new faculty will contribute directly to teaching in the new program and to geospatial research at WyGISC.

During AY18-19 and AY19-20, WyGISC has allocated approximately $95,000 of its existing departmental budget toward developing the program. In AY18-19, these resources were used for conducting market research, budget analysis and preparation, marketing, facility upgrades, and teaching capacity expansion.

Annually, the WyGISC *in-kind* match will minimally include $25,000 in enterprise-level software licenses.

An additional form of match – specifically for to support student opportunities – will be established with the Wyoming Department of Workforce Services, in the form of DWS training dollars made available to private business to establish paid internships.[3]

Faculty and instructional staffing

Estimates of new faculty and instructional staffing support are based on new credit hours taught and standard faculty teaching loads (15 credits/year for tenure track faculty and 21 for APLs) (see *pro forma* budgets for estimated costs). The *pro forma* budgets that accompany this report take into account overlap in teaching when a single course contributes to more than one credential. Teaching by current UW faculty whose teaching has been reallocated to this program as a result of reorganization of the Geography Department are not counted as a new expense in the *pro forma* budgets. Similarly, teaching by two new tenure-track faculty to begin in Fall 2020 are not counted as new teaching expense in the *pro forma* budgets.

We estimate that by year 4, we will need teaching for new courses *equivalent to* 1 tenure track faculty line and 2 new APLs. Ideally, two of the new faculty will have expertise in aspects of

[3] Personal communication with Robin Cooley, Director, Wyoming Department of Workforce Services, Cheyenne, WY, August 30, 2019. Additional information may be found at: http://wyomingworkforce.org/businesses/wdtf/

geospatial information science (GIS) and one in remote sensing, the latter including UAS (drone) expertise. Some of these may be joint appointments that will teach GIST courses and courses for other academic departments. It is also likely that faculty hired in other academic departments will contribute GIS&T teaching (*e.g.*, data science hires). In some ways, this is analogous to teaching contributions to the Life Sciences Program (LIFE), which uses faculty from across campus to teach LIFE courses. However, for this program to be successful, UW needs to invest to strengthen the breadth and depth of its GIS&T faculty.

New course development by faculty will require funding for supplemental salary for faculty. We budgeted $5,000 per new course (see *pro forma* budgets) given that many GIST courses require development of technical lab exercises and the added challenge of distance delivery. We received a grant from the Office of Distance Education Support for FY20 that will provide $37,500 plus fringe for supplemental salary for new course development.

The Provost has provided funding for a full-time 9-month Program Coordinator for continued program development and roll-out going forward beginning August 30, 2019.

Because the credentials are nested, we break down the need for new faculty resources into those needed for the undergraduate bachelor's degree and for the graduate online master's degree.

Bachelor's Degree with Nested Certificates

During year 1 (AY20-21), new teaching for the bachelor's degree adds to less than one faculty equivalent, and much of this teaching can be handled by existing faculty. By year 4 (AY 23-24), new teaching for the proposed bachelor's degree is equivalent to full teaching loads for 4 faculty, though much of this teaching can be delivered by existing and new faculty that have already been committed to the program.

Master's Degree with Nested Certificates

New teaching for the master's degree and nested certificates is equivalent to less than a full faculty teaching load each year, but some new expertise will be required to deliver core course content. Again, some of this new teaching can be handled by existing faculty, but some new expertise will be required. New faculty hires recently allocated through CPM will provide much of this new expertise.

GA Support

Delivery of new courses and graduate recruitment will benefit from 3-10 new GAs per semester during the first four years of the program and these assistantships will also contribute to recruiting students for the on- campus master's degree. Most of these will be used for undergraduate courses contributing to the B.S. degree, but one is needed for graduate courses. The need for GA support will depend partly on enrollment, but some courses (*e.g.*, UAS ground school) require GA support regardless of the number of students due to safety requirements. Ultimately, income generated by online courses will contribute to funding GAs for recruitment

and for facilitating distance delivery of graduate courses.

Bachelor's Degree with Nested Certificates

Delivery of courses for the bachelor's degree will require 3 – 4 semesters of GA support in year 1 and 5 – 6 semesters of support in year 2. WyGISC currently has 2 semesters of GA support from dissolution of the Geography Department, and the Office of Distance Education Support has offered us support for 2 semesters during FY20 which may be ongoing while the program ramps up.

Master's Degree with Nested Certificates

The proposed graduate credentials will require one master's-level GA per semester over the first 4 years of the program for delivery of courses. Additional GAs will be needed for recruiting students into the thesis-based master's program.

Program administration and staff support

Administration of the new GIST programs will require 50% of one new FTE staff person at WyGISC, with expertise in marketing, recruitment, and academic program support. Accounting support will be provided by existing WyGISC staff.

Technology

Delivery of an interactive, hands-on Professional Master's program and graduate certificates requires that students access UW's virtual (remote) lab system to use ArcGIS, Erdas Imagine, ENVI, and other software. UW currently has 45 remote lab nodes, with 30 in UWSRMP1 and 15 in UWSRMP2 (Jesse Ballard, IT Manager of the Academic Support Unit – usage reports available).

Ballard reports that, based on historical concurrent usage reports, the remote lab system has the capacity to serve 100 additional online students (a number we used to explore the potential new load), assuming that all of them would not use the system concurrently.

A more concerning limitation of the virtual system has been that it does not have access to Graphical Processing Units (GPUs) – usually found at physical nodes in the form of discreet graphics cards. This limitation has constrained students' ability to do graphics-intensive work on the remote lab system. Information Technology is currently working with us and others to rectify this limitation, and we anticipate that this will not be a problem by the time online GIST lab courses are introduced. A test of new capability will be conducted in Fall 2019. Additionally, some course material or class projects may require longer processing times, which would accrue higher usage charges by IT, but UW IT estimates that these charges will be small.

UW license agreements allow granting of student software licenses for ArcGIS and Erdas Imagine, software that is also available on the remote lab system. WyGISC already pays for a

university-wide unlimited site license for ArcGIS products that can serve our proposed programs. Our Erdas Imagine license supports 60 concurrent users in classrooms and on the remote lab system in addition to student licenses. This should be sufficient for initiating our program, but may need to be expanded in the future, requiring funding.

ENVI is the software of choice for geologic and hyperspectral remote sensing. Our current license for ENVI, another image processing software package used in some remote sensing courses cannot be used on the remote lab system and is restricted to computers located "*on the campus of the academic institution*" to which it is licensed. The vendor offers alternate licensing to solve this; obtaining such licensing will require additional resources. ENVI is the software of choice for geological remote sensing and hyperspectral RS.

Given the proposed certificates and specializations in UAS technology, additional image processing software will be required. Proprietary software, such as Pix4D and Agisoft Metashape, are highly specialized software adept at stitching together multiple images to create a 3-dimensional point cloud of the subjects within the images. The licensing model is similar ENVI, thus resources are required. Open source software options are currently limited to Visual SfM. This software has several limitations and may inhibit its use within a course setting.

We anticipate that new GIS&T courses will also use open source software (*e.g.*, R, GRASS, QGIS, *etc.*). The subcommittee is exploring (with UWIT) technical requirements for using these in online delivery of courses, but we don't anticipate that this will require additional resources or present roadblocks.

UAS Infrastructure Development

Using Unmanned Aerial Systems (UAS or drones) to collect airborne data is an enormous growth area across disciplines, and we are collaborating with other groups on campus to explore and develop infrastructure and training opportunities for students and faculty. With key faculty in the College of Engineering and Applied Science (CAES), we have recently formed a UAS working group to survey existing campus UAS resources, make recommendations for new UAS and sensor purchases, develop plans for building a UAS practice facility near the Laramie Regional Airport, and work with off campus groups (*e.g.*, the Laramie Airport) that are exploring an expanded drone data transfer and fueling site for large drones near the airport. Separately, WyGISC and the College of Engineering sponsored two successful five-day UAS workshops in May and June 2019 to jump-start training in key skills so that students and faculty will be better prepared to take advantage of new opportunities.

Marketing

Pending BoT approval of the RfA, UW institutional Marketing will provide an in-kind match of marketing resources in the form of a GIST curricula promotional video (estimated value = $5,000.). Direct marketing of the B.S. degree will include outreach to new potential undergraduate students both in and out of state. Meetings with UW Marketing and the AVP for Enrollment Management suggest that students can be targeted for about $5K per 1000 potential

students. We hope to contact 1,000 students during each of the first 4 years of the program. To the extent that available resources allow, we will also develop printed promotional materials and advertise in relevant media and online, and will host an on-campus GIST seminar series to promote faculty participation and engage current students. When available, we will also leverage marketing opportunities available through the Office of Graduate Education and Office of Distance Education Support. The latter has provided $7,500 in marketing support for FY20. This will be used to develop pamphlets, posters, and a website. Marketing costs should drop after year 4 when the program has become established.

Support

Additional program costs include support for software for specialized courses, travel to regional (*e.g.*, GIS in the Rockies annual conference) and national meetings (ESRI Petroleum Users Group, Urban & Regional Information Systems Association) to market the program, support for visiting speakers presenting in a geospatial forum, funds to support community college participation in articulation summits, and office supplies and telecommunication costs.

Space Requirements

The GIST program will leverage existing WyGISC space including one shared PC lab and one dedicated PC lab (which underwent a $100,000 remodel in 2016). A need exists to secure additional office space on the 3rd floor of Agriculture Building C to support new faculty and graduate students identified as part of the program. (A proposal for such an expansion is currently being evaluated by the UW Space Allocation Committee.) The need for a third lab, designed specifically for active learning pedagogy, is being explored.

Executive Summary of Demand Statistics

We received an Education Advisory Board (EAB) Market Research Brief in April 2018 that evaluated the proposed programs, and we commissioned a follow-up EAB report delivered in July 2019 that was more focused on enrollment and tuition for individual credentials. We conducted undergraduate and graduate student focus groups (described earlier in this report) to get student input on demand, delivery format, and curricula. We also conducted a regional survey of potential employers to better understand post-graduation demand for GIST students. We interpreted Gray Associates Data for the relevant CIP code included in their database, but we caution that the multidisciplinary field of GISci is not well captured by the GrayData. Consequently, we surveyed other institutions in our region that offer geospatial credentials (*e.g.*, in the Colorado Front Range and Montana) to help estimate student demand and to develop competitive tuition for online graduate credentials. We also surveyed employment demand information from the U.S. Bureau of Labor Statistics (O*NET Database), online job posting sites (*e.g.*, Indeed.com and others) and from professional societies (*e.g.*, ASPRS) and journal articles. Finally, we visited other institutions (Harvard University, North Carolina State, University of Redlands) with successful program analogs, and we consulted with leaders in geospatial curricula at the University of Southern California and the University Consortium for Geographic Information Science, and at ESRI, an international GIS company. We will be visiting with a representative of the University of Denver's

online GIST program this fall to gain additional knowledge of distance learning delivery strategies.

In the summary that follows, we evaluate student and employer demand and the competitive potential of the program as a whole and of our proposed credentials individually.

Market area and primary target markets

The target market for the proposed program is primarily students from Wyoming and the Rocky Mountain region, including prospective undergraduate and graduate students and professionals The 2018 EAB study suggests that even for online courses, students tend to choose programs close to where they live, but we will also market outside the Rocky Mountain region using targeted contacts and advertising in traditional media and online. We will also market to graduate students nationally and internationally primarily through advertisements in professional publications and outreach at professional meetings and online.

Demand Data for Students Trained in Geospatial Sciences

Educational market and student demand statistics

The 2018 EAB study was strongly supportive of development of GIS&T programs at the University of Wyoming, suggesting that these programs will meet increased employer demand in the region, particularly if we offer asynchronous online credentials accessible to professionals. The study reported that GIS&T completions in our region increased from 180 to 248 from AY 2011-12 to AY 2015-16 (38%) but that these completions were not sufficient to meet employer demand. The study reported increasing demand at the graduate level regionally, with a ~9% increase in completions of graduate certificates in GIST between the 2011-12 and the 2015-16 academic years and a 55% increase in GIST master's completions in the same period. The number of undergraduate completions was less than for graduate and certificate completions but substantial nevertheless (Fig. 7). According to the EAB, job postings in GIST increased from 1,162 in 2013 to 1,437 in 2017, a 24% increase, while nationally there were over 24,000 GIST job postings seeking candidates with GIST degrees (bachelor's and master's) in the 12 months prior to the study.

The U.S. Bureau of Labor Statistics reports that employment for "cartographers and photogrammetrists" (includes GIST professionals) is expected to grow 19% from 2016-2026 (Fig. 1). This is much faster than average growth (7.5%) in other occupations. They also report that typical entry-level positions require a bachelor's degree.

A 2012 National Geographic Advisory Committee white paper[4] noted that the rapidly growing geospatial technology and research industry faced a shortage of qualified workers and that academia should work to prepare students for these new job opportunities. This remains true today.

The 2019 EAB report was less useful than we had hoped, but provided some data on enrollment

[4] O'Connell, Matt, D. McKay, J. Gabrynowicz, and U. Dinh. 2012. The administration's STEM education initiatives from a geospatial workforce development perspective. National Geospatial Advisory Committee (www.fgdc.gov/ngac). January 2012.

and tuition for analogous credentials. The EAB researchers only provided data from a few institutions, many of which were outside of our region (*e.g.*, Mary Washington University, University of Massachusetts at Amherst) and that don't necessarily have access to the same student demand in geospatial sciences that we do in Wyoming. Nevertheless, we summarize their findings in following sections of this report.

A survey[5] based on analysis of 1000 job postings from 12 commonly used job posting websites between September 2018 and January 2019 found that most job postings for GISci jobs are for GIS Technicians and Analysts, and that these typically require at least a Bachelor's Degree in GIS/Cartography or Geography.

In a 2018 white paper, The University Consortium for Geographic Information Sciences (UCGIS) emphasized the importance of incorporating geospatial courses and degree opportunities into the rapidly growing field of data science, noting that GIS&T "has key contributions to make to evolving data science curricula[6]."

Sinton (2012)[7] noted that spatial reasoning and analysis are core components of critical thinking, a key learning outcome for university students at UW and elsewhere. Sinton also observed that GIS&T education is being incorporated into schools of business, health and medicine, law enforcement, natural resources, and other disciplines and is supporting multidisciplinary research challenges with advances in spatial data visualization and analysis.

With stronger programs and more courses, we believe there is substantial potential for increased enrollment in undergraduate programs at UW. Currently, about 65-70 students per year take foundational GIS courses and over 100 take remote sensing courses. Undergraduate focus group participants expressed substantial interest in additional GIST course offerings, and students across disciplines (including business and engineering) are likely to see value in a GIST degree.

[5] Hibdon, Sarah, R. Hickey, and J. Cannon. 2019. GIS jobs: current industry expectation. Directions Magazine. URL: https://www.directionsmag.com/article/8795.
[6] UCGIS. 2018. A UCGIS Call to Action: Bringing the Geospatial Perspective to Data Science Degrees and Curricula.
[7] Sinton, D. S. 2012. "Making the case for GIS&T in higher education." In D.J. Unwin, K.E. Foote, N.J. Tate, and D. DiBase (eds), *Teaching Geographic Information Science and Technology in Higher Education*, Wiley-Blackwell, Oxford, pp. 17-36.

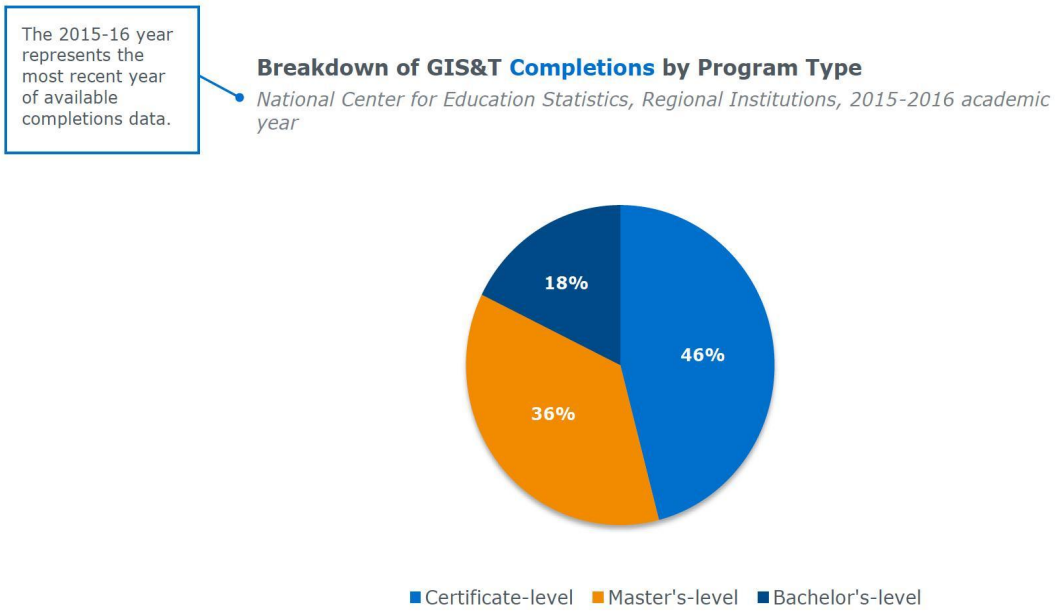


Figure 7. Proportions of completions of undergraduate, master's degrees, and certificates in 2015-16 from the EAB report.

Student and Employer Demand Data for Individual Credentials

Demand data and tuition analyses for individual credentials are discussed below, including EAB findings, GrayData analysis, and information from other sources.

Gray Associates data are widely used for academic market analysis, but are insufficient for new technologies (like UAS) and imperfect for multidisciplinary fields (like GIS&T). While geospatial science is not new, we believe that application of GrayData for our proposed credentials has limited value due to lack of specialization of the 6-digit CIP codes that are used (there is only a single CIP code for "Geographic Information Science and Cartography" and none for remote sensing or UAS). CIP codes will be revised in 2020 and will presumably expand to cover some relevant new areas (*e.g.*, UAS, geospatial data science), but for now, many relevant technologies are not targeted. Further, Gray Associates state on their website that they *do not include enrollment by program* because colleges do not report it at the level of detail captured by the 6-digit CIP codes. As an example, NC State and Penn State both have robust programs in geospatial sciences, but data on IPED completions for these programs are absent in the National Center for Education Statistics website because they are not reported at this level of programmatic detail. Additionally, Geospatial Information Science is highly multidisciplinary, contributing substantially to many fields, and consequently, a single CIP code does not adequately capture employment and student demand. GIS credentials are often delivered by academic departments (*e.g.*, Geography, Anthropology) that are not *called* GIS departments and that do not report at the level of our proposed credentials.

Missing data regarding demand for GIS&T is not unique to Gray and Associates data. A 2013

Point of Beginning article[8] notes that "geography and geospatial technologies are often missing from identified STEM degree education and programs," and that many universities offer GIS programs within Geography departments. The U.S. Dept. of Education, in another example, classifies "surveying engineering" as engineering, and "geography and cartography" as a social science. The article provides many other examples, but the point is that these inconsistent classifications of GIS&T result in under- or misreporting of demand.

Other sources of information on student demand include our own survey of regional programs, articles and demand surveys described in trade publications and professional journals, information from job posting websites, and information for students from other institutions offering GISci credentials.

Bachelor of Science Degree in GISci with stackable certificates

EAB Reports. The 2018 EAB report states that students with a bachelor's degree combining GIS&T with training in another discipline, as we propose, are popular among students at comparator institutions and valuable to employers. While the EAB report notes that only 16% of job postings from regional employers specify completion of a GIST degree as a requirement for employment, the Bureau of Labor Statistics suggests that many entry-level GIS jobs require undergraduate training in geospatial science. Students at other institutions often double major in GIST and another discipline, and we have designed our bachelor's degree to facilitate this by allowing substantial elective credit and requiring a targeted minor (which could be also be satisfied by a double major). EAB emphasized the importance of student internships for success in the employment market, and we will require an internship for all of our bachelor's students.

The 2019 EAB report reported enrollment data from only two institutions, the University of Texas at Dallas (33 undergraduates in their Bachelor of Science in GISci) and the University of Utah (5 undergraduates in a similar B.S. degree). This is a big range, and it suggests that factors other than just offering a degree affect enrollment. Based on enrollment data from the two institutions surveyed by EAB, undergraduate certificates in GIS attracted enrollment of 13 and 58 students, respectively.

Gray Associates Data (Overall score 6). GrayData for an on-campus Bachelor of Science degree suggest that in the Laramie 360 region, there were no inquiries online about such degrees and only 15 IPEDS completions from 2 campuses, a 6% decline from the previous year. Based on this and other data, the scaled student demand score was -2.

These numbers suggest that the GrayData are not capturing key data. Our survey of data from Offices of Institutional Analysis in the region along with phone calls to individual academic departments revealed that UC Boulder has 168 geography majors, the University of Denver has 47 geography majors, and Montana State University (just outside Laramie 360) has about 20 students majoring in geospatial and environmental analysis. Colorado State University has "up to" 50 undergraduate minors in spatial information management and they offer a Geography degree

[8] Point of Beginning. 2013. Words matter: how geospatial education suffers because of government classification. URL: https://www.pobonline.com/articles/96974-words-matter-how-geospatial-education-suffers-because-of-government-classification

with a GIS concentration. The Front Range Community College has recently launched a Bachelor of Applied Science degree in Geospatial Science. Other institutions, from which we were unable to get specific enrollment data, offer undergraduate degrees in Geospatial Sciences. These include the University of Montana (outside Laramie 360), CU Denver, and the University of Northern Colorado. All of this suggests that more than 15 students a year must be completing undergraduate credentials in GISci and that other institutions see these programs as valuable.

Other Data. The Bureau of Labor Statistics Occupational Outlook Handbook reports that jobs for "Cartographers and Photogrammetrists" typically require a bachelor's degree in cartography, geography, geomatics, or surveying for entry level jobs and that the growth for this category is expected to be 19% from 2016 to 2026, much faster than average job growth in all fields. The same handbook shows that jobs for "surveying and mapping technicians" will increase 11% (faster than average) from 2016-2026, but that these jobs do not typically require a bachelor's degree for entry level jobs.

The most recent (2011) 10-year industry survey by the American Society for Photogrammetry and Remote Sensing (ASPRS), the largest U.S. professional society for remote sensing scientists, found that 52% of respondents from private industry preferred that job candidates earned undergraduate degrees (master's degrees were 2nd at 21%) and that students with GIS and remote sensing skills were especially valuable to companies in the geospatial industry.

Texas A&M University (much larger than UW) reports 40 IPEDS completions for their bachelor's degree in Geographic Information Science and Cartography, considerably more than complete degrees in Geography, suggesting the GISci may eclipse Geography in terms of student interest.

Anecdotally, absent any substantial marketing, the Geography Department and WyGISC fielded 20-25 inquiries from new or existing students about the scope and/or launch of new GIST credentials, suggesting student demand for these programs.

Tuition Analysis for Undergraduates

The University of Wyoming is known for being inexpensive. Undergraduates declaring a major in GIST will pay the same tuition as other UW undergraduates, $139/credit for residents and $537/credit for non-residents. Other institutions in the region offering undergraduate degrees in geospatial sciences charge from $298 - $1372/credit for residents and $884 - $1372 for non-residents. Our proposed program is less expensive for both residents and non-residents.

Master of Science Degree in GISci (with and without thesis)

Our proposed online M.S. degree (without thesis) is our primary offering at the graduate level, with other graduate credentials comprised of bundled subsets of the requirements for the online master's. The proposed on-campus master's with a required thesis has a smaller core course requirement (a subset of the online core) to allow for thesis research, and the graduate certificates are either part of the M.S. core, a combination of core and electives, or comprised entirely of electives from the online master's degree.

EAB Reports. The 2018 EAB report recommends that online programs be launched ahead of in-person programs to attract working professionals as well as traditional students. They further noted in 2018 that only 2 of the 8 regional institutions reporting master's level completions have online programs, but that increased certificate and master's-level completions in GIS&T may indicate strong student demand for these programs. Specifically, according to the study, master's level completions increased from 58 to 90 between AY 2011-12 and AY 2015-16 (55% increase).

The 2019 EAB report looked at two institutions with online GIST master's programs (Salisbury University and the University of Wisconsin at Madison) and found enrollment of 12 students in 2018 at Salisbury and 150 at Wisconsin in 2019. Again, this is a wide range of enrollments and a small sample size, but it suggests that enrollment in online programs has potential to be large if the programs are marketed effectively. EAB survey data for on-campus master's degrees suggested enrollment from 6 to 28 students in 2019 based on information from three institutions.

Gray Associates Data (Overall score 11 for online M.S. and 8 for on campus M.S.).

For online Master's degrees, GrayData show 44 completions in the Laramie 360 region over the last 12 months, a 120% increase over the previous year with 2.3 jobs per graduate. Market analysis suggests that 7% of job postings require a master's degree, and that there are 891 GISci jobs in the Laramie 360 area and over 12,000 nationally.

For on-campus Master's degrees, the story told by Gray Associates is different, and they report no demand--no inquiries, no google searches, and no completions, and they report that 6% of job postings require master's degrees. It is unclear why they report a lower proportion of jobs requiring master's degrees for their analysis of on-campus master's vs. online master's, and it seems unrealistic that online master's generate robust interest and growth, while on campus master's generate none. Despite this, the on-campus master's degree adds little cost to the program, because it is a subset of the online master's degree.

Other Data. The University of Denver reported that 42 students were enrolled in their online master's program in GIS in Fall 2018 (OIA data) and that this number has been fairly constant since 2014, ranging from 35 – 47 students/year. CU Denver reports that they have about 10 students/year in their online master's in Geomatics Engineering and GIS, and 20 students in their on-campus master's program in Geomatics and GIS.

Tuition Analysis. Graduate students matriculating into the on-campus master's program (with thesis) will pay standard UW graduate tuition and will have opportunities like other UW graduate students to earn graduate assistantships. UW graduate tuition is very competitive with other regional institutions. Specifically, tuition for residents in other on-campus master's programs in the region ranged from $377 - $2058/credit and for non-residents from $1186 - $2,205. UW charges $271 for residents and $811 for non-residents.

We propose a tuition structure for the online graduate credentials, including the online master's degree, that is designed to attract residents and non-residents by being less expensive than most nearby in-state tuition (to attract non-residents) and much less expensive than nearby out-of-state

tuition (to attract Wyoming residents). We found only 2 online master's programs in the region, and tuition ranged from $731 - $1,029 for both residents and non-residents. Our proposed tuition of $700/credit captures these students. The 2019 EAB study reported resident tuition for online master's degrees ranging from $665 – $820/credit and for non-residents ranging from $820 - $1,008/credit. Again, UW is competitive in this market.

Table 1. Tuition for M.S. degrees in GIST sorted by in-state tuition as reported in the 2018 or 2019 EAB reports or on program websites. Online M.S. degrees are shaded blue.

Institution	Credential and Delivery Mode	In-state Tuition (per credit)	Out-of-state Tuition (per credit)	Source
University of Wyoming (graduate)	**M.S. (campus)**	**$271**	**$811**	**UW**
University of Montana	M.S. (campus)	$383	$1,186	Pearce
University of Utah	M.S. (un-specified mode)	$550 $566	$550 $2,004	EAB 2018 Driese
University of Colorado Boulder	M.S. (campus)	$564	$1,189	Pearce
Salisbury University	M.S. (online)	$665	$665	EAB 2019
University of Wyoming (proposed)	**M.S. (online)**	**$700**	**$700**	**Driese, Hamerlinck**
University of Colorado Denver	M.S. (online)	$731	$731	Driese, Pearce
Texas A&M	M.S. (online)	$800	$1,008	EAB 2019
University of Arizona	M.S. (online)	$820	$820	EAB 2019
Redlands University	M.S. (un-specified mode)	$1,103	$1,103	EAB 2018
University of Texas Dallas	M.S. un-specified mode)	$1,453	$2,205	EAB 2018

Graduate Certificate in GIS&T

The graduate certificate in GIS is designed to be a subset of the requirements for a master's degree in GIS&T, meaning that this and other certificates can be stacked to contribute towards master's requirements or earned separately from the master's degree. This certificate adds no substantial new cost to the program beyond what is required to deliver the master's degree.

EAB Reports. One of the key take-home messages from the 2018 EAB report is that UW should prioritize development of an online graduate GIS&T certificate that will provide specialized GIS&T knowledge to working professionals. They note strong demand for online certificate programs (46% of all GIS&T completions in 2015-16).

The 2019 EAB report looks more specifically at enrollment and tuition for graduate GIST certificate programs. Of three online graduate GIS certificates surveyed (University of North Dakota, University of West Florida, University of Wisconsin at Madison), enrollment ranged from 15 – 43

students.

Gray Associates Data (overall score 5). GrayData show no inquiries, no google searches, no completions, and no campuses with graduates earning a certificate in GIS in the Laramie 360 regions. GrayData also do not provide data on the number of jobs requiring or favoring students with graduate certificates, but they report a 1.7% 10-year estimated increase (CAGR) in GISci jobs (not specific to students with graduate certificates in GIS).

This indicates to us that GrayData do not adequately capture demand for this credential based on the conclusions of the EAB report and on our own contact with programs in the region. For example, the University of Denver, which is within the Laramie 360 region, reports 94 students working towards an online graduate certificate in GIS. Is it possible that none of these 94 students made inquiries or completed the degree? It seems more likely that these data are not reported in a way that is captured by Gray Associates.

Tuition analysis. Based on our own survey of regional institutions and on the 2019 EAB report, resident tuition for online graduate GIS certificates ranged from $576/credit (University of North Dakota) to $1,029/credit (University of Denver). Our proposed per credit online tuition of $700/credit, while not the least expensive, is not less expensive than many competitors.

Graduate Certificate in Remote Sensing

EAB Reports. Neither the 2018 nor 2019 EAB reports specifically address enrollment in online remote sensing certificates, though they suggest that Penn State and Northeastern University have online programs that are more expensive per credit than the proposed UW online tuition (see tuition analysis below).

Gray Associates Data. There is no relevant CIP code in the current GrayData for evaluating this certificate.

Other Data. Penn State University offers a 12 credit graduate certificate in remote sensing and earth observation. They suggest that there is a growing need for GIS professionals who can work with data from new satellites and drones.

The 2011 ASPRS industry survey reported gross revenues for the remote sensing portion of the geospatial industry of $7.039 billion, and they estimated that by 2021, this would grow to over $12 billion. The report noted that “the industry has ample room for workers to enhance their employability by improving their geospatial education level, especially with GIS applications that incorporate remote sensing.” At that time, survey respondents from industry complained that there was a need to train more students in remote sensing skills, including lidar and photogrammetry, and they suggested that understanding of spatial databases would become increasingly important.

George Mason University reports that they have had “10 or less” students enrolled in their on-campus remote sensing and image processing graduate certificate program, but they suggest (personal email) that an online program would generate more interest.

The University of Colorado College of Engineering and Applied Science offers a graduate certificate in remote sensing and they report (personal communication) that 15 students receive this certificate each semester.

Tuition Analysis. The 2019 EAB report reported online tuition data for graduate certificates in remote sensing from Penn State University and Northeastern University. Penn State charges $903/credit and Northeastern charges $13,068 for the certificate as a whole, equivalent to $726/credit for this 18-credit program. Both of these are more expensive than our proposed online tuition ($700/credit).

Graduate Certificate in UAS

EAB Reports. Neither the 2018 nor the 2019 EAB reports provided enrollment data for the proposed UAS certificate, though the 2019 report noted that an undergraduate UAS certificate at the University of North Dakota attracted 48 students in 2018.

Gray Associates Data. UAS is an emerging technology, and there is no relevant CIP code in the current GrayData.

Other Data. The Embry-Riddle Aeronautical University offers a Master of Science degree in UAS, and their website reports that more than 100,000 UAS jobs are projected by 2025. The University of Florida has a graduate certificate in UAS that enrolls 5-10 students per year. UAS remote sensing is growing very rapidly, and we feel that there is enormous potential for offering this certificate, as there are not others like it in our region.

Tuition Analysis. The 2019 EAB report quoted tuition for online graduate UAS certificates at the University of North Dakota ($821/credit) and Kansas State ($8,500 for the program, equivalent to $566/credit). The proposed UW online tuition is less expensive than UND, but more expensive than Kansas State.

Graduate salary trends and other post-completion trends

According to the Urban and Regional Information Systems Association (URISA) survey of salaries for GIS&T professionals, salaries in 2017 averaged $70,857, an increase of 15.1% over 2010 average salaries (Table 1).

Table 2. Salaries for GIS&T professionals (mean salary = $70,857) in 2017 from a survey by URISA.

Salary by Job Title	Average Salary	Median Salary	Respondents
Director of Geographic Information Systems/Geographic Information Officer (GIO)	$98,696	$96,000	111
GIS Manager	$81,029	$78,700	611
GIS Coordinator	$70,141	$68,000	400
GIS Specialist	$63,418	$61,000	363
GIS Programmer	$80,752	$80,000	149
GIS Analyst	$62,336	$61,000	649
GIS Technician	$47,225	$45,000	236
User of GIS (Heavy)	$67,137	$64,414	100
Educator/Trainer	$76,111	$72,000	67
Independent Consultant	$114,097	$107,500	24
GIS Business Development/ Sales & Marketing	$103,883	$99,000	47

Timeline for Program Initiation

Matriculation of students into the new degrees and certificates will occur in phases beginning in Spring 2020, pending program approval. We will roll-out first semester courses for the undergraduate B.S. degree and the online certificates beginning in the Fall 2019, because these courses will be valuable to students even if the program approval is delayed. The first cohort of students for the master's degrees and certificates will matriculate in Fall 2020, but some courses for graduate students will be taught earlier and can contribute to the credentials. If the full program is approved in November 2019, the first cohort of undergraduates could graduate in May 2024, Master's in May 2022, and earners of graduate certificates in May of 2021.

Appendix 1. Letter of Support from Central Wyoming College

September 10, 2019

To whom it may concern:

I am a Professor of geospatial information science and technology (GIST) at Central Wyoming College and am writing this letter in support of the proposed GIST program at the University of Wyoming. The career opportunities in this realm are numerous, and the need for trained technicians only continues to grow.

At present, our GIST program consists of two undergraduate certificates (16 and 30 credits), an Associate of Applied Science, and an Associate of Science in Expedition Science that includes an embedded 16 credit GIST certificate. The missing piece for CWC is a well thought out and fully articulated 2 + 2 program with that includes not only appropriate 1000 and 2000 level course equivalents, but advanced 3000 and 4000 level courses. The program being proposed by UW will fill that niche and – through communication, and a well-developed articulation plan – will provide a solid transfer destination to complement and enhance CWC offerings.

An additional area of interest for CWC is in respect to potential opportunities to partner in the delivery of summer GIST programs, and to work with UW as a supportive collaborator for NSF grants. CWC is currently planning to submit a GIST based proposal for an Advanced Technical Education (ATE) Grant. While this grant targets two year colleges, ATE grant requirements include an identified transfer partner for junior and senior year work, with strong evidence of legitimate communication across institutions.

It is thus with great excitement and support that I write this letter to confirm my enthusiasm for the new GIST programs at the University of Wyoming. I have already been in active communications with Ken Driese about how best to articulate the new program to compliment and support CWC's programs, and am very excited about all levels of instruction (through to the MS) being proposed for the UW program.

Please feel free to contact me with any questions.

Sincerely,

(signed letter available)

Jacki Klancher
Professor Env Science
Alpine Science Institute Director of Instruction and Research

This template is intended to be used as a basic guide to generate a projection of additional expenses and revenues at the University.

Cells in orange are variables which can be updated as needed. Please enter information in numerical tab order.

Cells in gray calculate automatically

	Fiscal Year 1	2	3	4	
Revenue					
Cummulative Total NEW Laramie campus headcount enrollment	7	19	33	47	*Cumulative enrollment over time (not 1-year enrollment)*
NEW Resident enrollment (# of new students entering the program each year)	4	7	8	8	*Based on other programs (5 to 33 from EAB; 40 UTex; 20 MSU; 168 Geog @ CU Boulder)*
NEW Non Resident Enrollment (# of new students entering the program each year)	3	5	6	6	*EAB reports 8-15 completions nationally per year per institution*
NEW Resident distance enrollment (ONLY use this field if the Program is 100% delivered online)	*0*	*0*	*0*	*0*	*No distance delivery for this degree*
NEW Non Resident distance enrollment (ONLY use this field if the Program is 100% delivered online)	*0*	*0*	*0*	*0*	*No distance delivery for this degree*
Resident (credit hours delivered outside of NEW Program)	116	263	421	583	*This is based on new courses*
Resident (credit hours delivered in NEW Program)	4	67	149	227	*This is based on new courses*
Resident Distance (credit hours delivered in NEW Program through Distance)	0	0	0	0	*No distance delivery for this degree*
Non Resident (credit hours delivered outside of NEW Program)	87	190	312	432	*This is based on new courses*
Non Resident (credit hours delivered in NEW Program)	3	50	108	168	*This is based on new courses*
Non-Resident Distance (credit hours delivered in NEW Program through Distance)	0	0	0	0	*No distance delivery for this degree*
Total Resident credit hours generated**	120	330	570	810	
Total Non Resident credit hours generated**	90	240	420	600	
Per Credit Tuition*					
Resident (Posted Tuition Rate)	$139	$145	$150	$156	*Tuition revenue caculated based on std. UW tuition rates*
Nonresident (Posted Tuition Rate)	$537	$558	$581	$604	
Prior Year's Non Resident Discount Rate (updated annually by the budget office)	30%	30%	30%	30%	
Estimated Actual Non Resident Per Credit Tuition	$376	$391	$407	$423	
Total Resident Tuition generated outside of NEW Program	$16,124	$38,019	$63,294	$91,156	
Total Resident Tuition in NEW Program	$556	$9,686	$22,401	$35,493	
Total Non Resident Tuition outside of NEW Program	$32,703	$74,278	$126,851	$182,665	
Total Non Resident Tuition in NEW Program	$1,128	$19,547	$43,910	$71,037	
Total Distance Tuition in NEW Program					
Total Tuition from NEW Enrollment	$50,511	$141,529	$256,456	$380,350	
Fees					
Program Per Credit Hour	$25	$25	$25	$25	*Fee revenue based on UW standard*
Program Fee Revenue	$5,250	$14,250	$24,750	$35,250	
Advising Fee Per Credit Hour	$6.00	$6.00	$6.00	$6.00	
Advising Fee Revenue	$1,260	$3,420	$5,940	$8,460	
Mandatory Fee (Per Full Time Student)	$705.47	$705.47	$705.47	$705.47	
Mandatory Fee Revenue	$4,938	$13,404	$23,281	$33,157	
Distance Fee	$100	$100	$100	$100	
Total New Revenue Generated Within New Program	$6,934	$43,482	$91,061	$141,779	
Total New Revenue Generated Outside of the Program	$55,026	$129,121	$219,366	$315,438	
Total Distance Revenue Generated	$0	$0	$0	$0	
Total Distance Revenue Remaining with College	$0	$0	$0	$0	
Total Distance Revenue Remaining with Provost	$0	$0	$0	$0	
Total New Revenue Generated	$61,959	$172,603	$310,427	$457,217	
New Program Expense Assumptions					
Compensation and benefits					
Faculty	$14,387	$65,222	$109,345	$109,345	*Based on 4-year teaching schedule and excluding existing faculty and currently funded faculty resources.*
Other administrative staff	$0	$7,472	$7,472	$7,472	*1/4th of 50% staff person (see graduate pro forma for other 3/4)*
Graduate Assistants	$18,375	$24,500	$24,500	$30,625	*Assume MS level GAs at $6,125/semester*
Supplies	$1,250	$1,250	$1,250	$1,250	*Office supplies*
Travel	$3,000	$3,000	$3,000	$3,000	*$12K/yr for director and instructor travel split over all credentials*
Marketing	$1,750	$1,500	$875	$875	*$20K for 4 years spread across credentials*
Software	$4,000	$4,000	$4,000	$4,000	*UAS photogrammetry software maintenance, Erdas, etc., split across pro formas*
Community College articulation	$3,000	$3,000	$1,000	$1,000	*Articulation summits first 2 years, then visits to CCs*
New course development	$1,667	$10,000	$5,000	$5,000	*Based on Nasser est. of $5000/new course supplemental pay*
Capital expense					

Other (specify)				

Projected Financial Results for New Program	**FY1**	**FY2**	**FY3**	**FY4**
Total Expenses	$47,429	$119,944	$156,442	$162,567
Total New Revenues Generated by NEW Program	$6,934	$43,482	$91,061	$141,779
New Program's Total Surplus or Deficit	**-$40,495**	**-$76,462**	**-$65,381**	**-$20,788**
Operating margin (surplus or deficit / revenues)	-5.84	-1.76	-0.72	-0.15

B.S. is revenue negative, but costs are covered by revenue positive graduate credentials

* UW's Board of Trustees' current working policy is to raise tuition by 4% each year
Last updated 4/29/19

Enter Course of Study, Credit Hours, indicate if the course is new and if the course will be offered through distance education			
Freshman Fall	13	NEW Course	Distance Option
GIST 1001 Intro. GIST and digital portfolio (Jeff)	1		
Q	3		
USP C1	3		
USP FYS	3		
GIST 1100 Foundations of spatial thinking (APL)	3		
Freshman Spring	17		
STAT 2050	4		
MATH 1405 Trig	3		
USP V	3		
GIST 2100 Intro GIS (Chen)	4		
Minor core course	3		
Sophmore Fall	15		
USP PN Elective	3		
USP H	3		
GIST 2200 Spatial Visualization (CPM2)	3		
GIST 2150 Intro Programming (Chen)	3		
Minor core course	3		
Sophmore Spring	15		
USP H	3		
GIST 2250 (C2) Digital map design (APL)	3		
Minor core course	3		
GIST elective	3		
GIST elective (PN) (APL)	3		
Junior Fall	15		
GIST 3111 Intro to RS of env.	3		
GIST elective (CPM1)	3		
GIST elective	3		
Minor elective	3		
Minor elective	3		
Junior Spring	15		
GIST 3050 Spatial database design & mngmt.	3		
GIST upper division elective (CPM 2)	3		
GIST upper division elective	3		
Upper division elective	3		
Minor elective	3		
Senior Fall	15		
GIST 4990 Internship/research in GIST	6		
GIST upper division elective (CPM 2)	3		
GIST upper division elective	3		
Minor elective	3		
Senior Spring	15		
GIST Capstone (USP C3)	3		
GIST upper division elective	3		
GIST upper division elective	3		
Upper division elective	3		
Upper division elective	3		
Total Hours	120		

NEW CREDIT HOURS OFFERED
BY ACADEMIC YEAR

			1		2		3		4	
Freshman Fall	New Course hours		Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring
GIST 1001 Intro. GIST and digital portfolio (Jeff)	TRUE	1	1		1		1		1	
Q	FALSE	3	0		0		0		0	
USP C1	FALSE	3	0		0		0		0	
USP FYS	FALSE	3	0		0		0		0	
GIST 1100 Foundations of spatial thinking (APL)	FALSE	3	0		0		0		0	
Freshman Spring										
STAT 2050	FALSE	4		0		0		0		0
MATH 1405 Trig	FALSE	3		0		0		0		0
USP V	FALSE	3		0		0		0		0
GIST 2100 Intro GIS (Chen)	FALSE	4		0		0		0		0
Minor core course	FALSE	3		0		0		0		0
		30	1	0	1	0	1	0	1	0
Sophmore Fall					0		0		0	
USP PN Elective	FALSE	3			0		0		0	
USP H	FALSE	3			0		0		0	
GIST 2200 Spatial Visualization (CPM2)	TRUE	3			3		3		3	
GIST 2150 Intro Programming (Chen)	TRUE	3			3		3		3	
Minor core course	FALSE	3			0		0		0	
Sophmore Spring						0		0		0
USP H	FALSE	3				0		0		0
GIST 2250 (C2) Digital map design (APL)	TRUE	3				3		3		3
Minor core course	FALSE	3				0		0		0
GIST elective	TRUE	3				3		3		3
GIST elective (PN) (APL)	TRUE	3				3		3		3
		30	0	0	6	9	6	9	6	9
Junior Fall										
GIST 3111 Intro to RS of env.	FALSE	3					0		0	
GIST elective (CPM1)	TRUE	3					3		3	
GIST elective	FALSE	3					0		0	
Minor elective	FALSE	3					0		0	
Minor elective	FALSE	3					0		0	
Junior Spring								0		0
GIST 3050 Spatial database design & mngmt.	TRUE	3						3		3
GIST upper division elective (CPM 2)	TRUE	3						3		3
GIST upper division elective	FALSE	3						0		0
Upper division elective	FALSE	3						0		0
Minor elective	FALSE	3						0		0
		30	0	0	0	0	3	6	3	6
Senior Fall									0	
GIST 4990 Internship/research in GIST	FALSE	6							0	
GIST upper division elective (CPM 2)	TRUE	3							3	
GIST upper division elective	FALSE	3							0	
Minor elective	FALSE	3							0	
Senior Spring										0
GIST Capstone (USP C3)	TRUE	3								3
GIST upper division elective	TRUE	3								3
GIST upper division elective	FALSE	3								0
Upper division elective	FALSE	3								0
Upper division elective	FALSE	3								0
		30	0	0	0	0	0	0	3	6
Total Hours		120	1	0	7	9	10	15	13	21

Standard faculty teaching load 15

0.39

Compensation (based on teaching hours)	Salary	Benefits	1	2	3	4	
Salary: Asst. Professor	$79,300	$31,006	-$14,708	$22,061	$66,184	$66,184	*Based on proportion of full tenure-track teaching load (15 credits) (After discussion with Alex Keane)*
Salary: APL	$72,400	$28,308	$14,387	$43,161	$43,161	$43,161	*Base on proporton of full APL teaching load (21 credits)*
Total Faculty Salary			-$321	$65,222	$109,345	$109,345	

For more specific salary and benefit data please contact the Budget Office at 766-9028

NEW CREDIT HOURS OFFERED BY ACADEMIC YEAR

			1		2		3		4	
Freshman Fall	New Course	hours	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring
GIST 1001 Intro. GIST and digital portfolio (Jeff)	FALSE	1	0		0		0		0	
Q	FALSE	3	0		0		0		0	
USP C1	FALSE	3	0		0		0		0	
USP FYS	FALSE	3	0		0		0		0	
GIST 1100 Foundations of spatial thinking (APL)	FALSE	3	0		0		0		0	
Freshman Spring										
STAT 2050	FALSE	4		0		0		0		0
MATH 1405 Trig	FALSE	3		0		0		0		0
USP V	FALSE	3		0		0		0		0
GIST 2100 Intro GIS (Chen)	FALSE	4		0		0		0		0
Minor core course	FALSE	3		0		0		0		0
		30	0	0	0	0	0	0	0	0
Sophmore Fall					0		0		0	
USP PN Elective	FALSE	3			0		0		0	
USP H	FALSE	3			0		0		0	
GIST 2200 Spatial Visualization (CPM2)	FALSE	3			0		0		0	
GIST 2150 Intro Programming (Chen)	FALSE	3			0		0		0	
Minor core course	FALSE	3			0		0		0	
Sophmore Spring						0		0		0
USP H	FALSE	3				0		0		0
GIST 2250 (C2) Digital map design (APL)	FALSE	3				0		0		0
Minor core course	FALSE	3				0		0		0
GIST elective	FALSE	3				0		0		0
GIST elective (PN) (APL)	FALSE	3				0		0		0
		30	0	0	0	0	0	0	0	0
Junior Fall										
GIST 3111 Intro to RS of env.	FALSE	3					0		0	
GIST elective (CPM1)	FALSE	3					0		0	
GIST elective	FALSE	3					0		0	
Minor elective	FALSE	3					0		0	
Minor elective	FALSE	3					0		0	
Junior Spring								0		0
GIST 3050 Spatial database design & mngmt.	FALSE	3						0		0
GIST upper division elective (CPM 2)	FALSE	3						0		0
GIST upper division elective	FALSE	3						0		0
Upper division elective	FALSE	3						0		0
Minor elective	FALSE	3						0		0
		30	0	0	0	0	0	0	0	0
Senior Fall									0	

GIST 4990 Internship/research in GIST	FALSE	6							0	
GIST upper division elective (CPM 2)	FALSE	3							0	
GIST upper division elective	FALSE	3							0	
Minor elective	FALSE	3							0	
Senior Spring										0
GIST Capstone (USP C3)	FALSE	3								0
GIST upper division elective	FALSE	3								0
GIST upper division elective	FALSE	3								0
Upper division elective	FALSE	3								0
Upper division elective	FALSE	3								
		30	0	0	0	0	0	0	0	0
Total Hours		120	0	0	0	0	0	0	0	0

Teaching load	fall	spring								
faculty line 1	9	6	0	0	0	0	0	0	0	0
faculty line 2	9	6	0	0	0	0	0	0	0	0
faculty line 3	9	6	0	0	0	0	0	0	0	0
faculty line 4	9	6	0	0	0	0	0	0	0	0

		0.39				
Compensation	Salary	Benefits	1	2	3	4
faculty line 1	$65,000	$25,415	0	$0	$0	$0
faculty line 2	$65,000	$25,415	0	$0	$0	$0
faculty line 3	$65,000	$25,415	0	$0	$0	$0
faculty line 4	$65,000	$25,415	0	$0	$0	$0
			$0.00	$0	$0	$0

For more specific salary and benefit data please contact the Budget Office at 766-9028

NON-RESIDENT

FY11 2010-11	FY12 2011-12	FY13 2012-13	FY14 2013-14	FY15 2014-15	FY16 2015-16	FY17 2016-17	FY18 2017-18	FY19 2018-19	FY20 2019-20	FY21 2020-21		
$ 376	$ 395	$ 413	$ 432	$ 454	$ 477	$ 496	$ 516	$ 537	$ 558	603	8%	**Non-Resident UG Per Student Credit Hour Tuition Increase**
	5%	5%	5%	5%	5%	4%	4%	4%	4%	8%		Non-Resident UG Per Student Credit Hr (SCH) Tuition Percent Increase over Prev. Yr.
$ 11,280	$ 11,850	$ 12,390	$ 12,960	$ 13,620	$ 14,310	$ 14,880	$ 15,480	$ 16,110	$ 16,740	$ 18,090		**30Student Credit Hours (SCHs) - Full-time**
$ 478.73	$ 502.61	$ 548.94	$ 582.19	$ 627.86	$ 660.75	$ 667.31	$ 673.73	$ 689.79	$ 705.47	$ 705.47		UG Mandatory Fees per Semester (Full-time)
	5%	9%	6%	8%	5%	1%	1%	2%	2%	0%		UG Mandatory Fees Percent Increase over Previous Year
$ 957	$ 1,005	$ 1,098	$ 1,164	$ 1,256	$ 1,322	$ 1,335	$ 1,347	$ 1,380	$ 1,411	$ 1,411		**UG Mandatory Fees Per Year (Full-time, 2 Semesters)**
$ 12,237	$ 12,855	$ 13,488	$ 14,124	$ 14,876	$ 15,632	$ 16,215	$ 16,827	$ 17,490	$ 18,151	$ 19,501		**Total Non-Resident UG Tuition & Mandatory Fees (30SCHs & 2 Semesters of Fees)**

0.0%	**Fee Increase**

RESIDENT

FY11 2010-11	FY12 2011-12	FY13 2012-13	FY14 2013-14	FY15 2014-15	FY16 2015-16	FY17 2016-17	FY18 2017-18	FY19 2018-19	FY20 2019-20	FY21 2020-21		
$ 99	$ 104	$ 106	$ 108	$ 113	$ 119	$ 124	$ 129	$ 134	$ 139	$ 139	0%	**Resident UG Per Student Credit Hour Tuition Increase**
	5%	2%	2%	5%	5%	4%	4%	4%	4%	0%		Resident UG Per Student Credit Hr (SCH) Tuition Percent Increase over Prev. Yr.
$ 2,970	$ 3,120	$ 3,180	$ 3,240	$ 3,390	$ 3,570	$ 3,720	$ 3,870	$ 4,020	$ 4,170	$ 4,170		**30Student Credit Hours (SCHs) - Full-time**
$ 478.73	$ 502.61	$ 548.94	$ 582.19	$ 627.86	$ 660.75	$ 667.31	$ 673.73	$ 689.79	$ 705.47	$ 705.47		UG Mandatory Fees per Semester (Full-time)
	5%	9%	6%	8%	5%	1%	1%	2%	2%	0%		UG Mandatory Fees Percent Increase over Previous Year
$ 957	$ 1,005	$ 1,098	$ 1,164	$ 1,256	$ 1,322	$ 1,335	$ 1,347	$ 1,380	$ 1,411	$ 1,411		**UG Mandatory Fees Per Year (Full-time, 2 Semesters)**
$ 3,927	$ 4,125	$ 4,278	$ 4,404	$ 4,646	$ 4,892	$ 5,055	$ 5,217	$ 5,400	$ 5,581	$ 5,581		Total Resident UG Tuition & Mandatory Fees (30SCHs & 2 Semesters of Fees)

AGENDA ITEM TITLE: **United States Forest Service Lease Amendment**, Mai