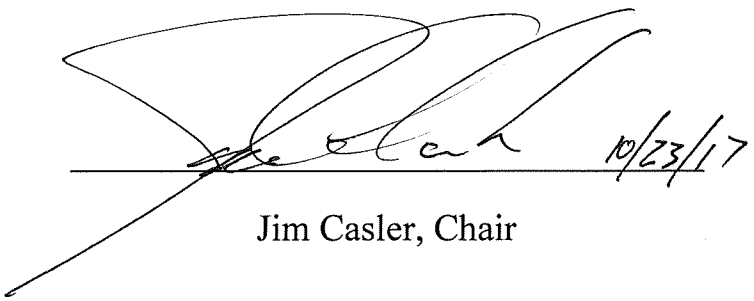
UNIVERSITY OF NORTH DAKOTA

JOHN D. ODEGARD SCHOOL OF AEROSPACE SCIENCES

DEPARTMENT OF SPACE STUDIES

PLAN FOR ASSESSMENT
OF
STUDENT LEARNING

Spring 2017



Jim Casler, Chair

SECTION 1: INTRODUCTION

The Department of Space Studies pursues the mission to provide a professional and creative learning environment that fosters development and advancement of the interdisciplinary field of space studies.

To that end, assessment of student learning in the Department of Space Studies is a continuous process that is an integral part of program assessment. Due to our focus on graduate education, there is a strong emphasis both on individual progress and on the communication and interaction of students with their advisors and committee members to ensure achievement of the desired learning outcomes.

The intent of this Assessment Plan is to outline the systematic process by which progress toward achievement and sustainment of the student learning goals (SLG) of the UND Space Studies department can be measured. Not every learning goal is met in every deliverable or course. However, achievement of these learning goals is desired across the collected learning experiences of each student.

Assessment involves the application of several measures, both direct and indirect. Direct measures are drawn from observation and scoring of attributes of student performance. Indirect measures involve eliciting student perspectives about the experience. In Space Studies, both summative and formative methods are used to inform instructors of student experiences. These measures are made via mid-semester student surveys, course assessments, post-Capstone surveys and interviews, and alumni surveys. Application of different measures enables triangulation on the strengths and weaknesses of the program, thereby allowing development of sustaining or corrective activities, as appropriate.

Sections 2 and 3 discuss the formal assessment of the quality of student learning in the graduate and undergraduate programs, respectively. Each of these sections outline the respective learning goals and identify the broad regimes, or program elements, in which these goals are expected to be demonstrated. Within each regime, measures are identified to capture and aggregate student performance relative to the identified goals.

This Plan includes a standing Assessment Committee to periodically collect data from the various sources at a mid-point in the semester and at the end of each semester. The Committee will regularly meet to compile and analyze the data. The Committee will meet at least semiannually (more frequently if required) with Space Studies faculty to report its findings and to develop alternatives for corrective actions as required. The semiannual report will combine semiannual performance with historical data to also provide a trend analysis. Recommendations for corrections to the two programs will be provided in written form to the Department Chair. A summary of Assessment Committee findings will be made available on the Space Studies website and will be disseminated to current students, alumni, appropriate faculty within UND, program donors, and other stakeholders.

SECTION 2: ASSESSMENT OF STUDENT LEARNING IN **GRADUATE** PROGRAMS

Student Deliverables

Generally, the student deliverables for the Space Studies program include:

a. Individual course papers, homework submissions, projects, presentations, and examinations
b. Comprehensive examination
c. Individual course, e.g., Capstone, peer-reviews
d. Thesis and its associated proposal and defense
e. Capstone paper and presentation
f. Colloquium reviews

Student Learning Goals

Appropriate outcomes for each student are determined individually through consultation and collaboration with the primary advisor who directs the student's program. Appropriate outcomes are determined based on student background, career goals, availability of resources, and appropriate focus.

The student learning goals of the Master of Science program are that the student:

a. Possesses both multidisciplinary and interdisciplinary knowledge of space enterprises.

   Objective 1: Demonstrates correct and effective use of the terminology and concepts of a broad range of space-related fields, to include both social sciences and technical disciplines.

   Objective 2: Demonstrates understanding of the interrelationships between the technical and social aspects of space enterprises by effectively applying this knowledge to problem-solving.

   Objective 3: Demonstrates effective critical thinking and problem-solving in space-related fields through oral and written communication.

   Objective 4: Demonstrates effective problem-solving and decision-making in an interdisciplinary team environment.

b. Possesses knowledge of one of the following space-related disciplines: management, history, policy, law, engineering, human factors, applications, or planetary science.

Objective 5: Demonstrates correct and effective use of the terminology and concepts of a selected space-related discipline.

Objective 6: Demonstrates effective participation in either independent or faculty research projects to advance the body of knowledge of space enterprise.

Assessment Elements

Assessment of student learning in the Department of Space Studies is a continuous process. There are both formal and informal aspects to the assessment program. The formal program involves faculty assessment (direct measures) of the aggregated student academic performance and student self-assessment (indirect measures).

The primary elements of **direct** measurement are those student deliverables required for graduation. These are:

a. For thesis track:

    1. Thesis proposal and defense presentations (Objectives 1, 2, 3, 5 and 6)

    2. Thesis document (Objectives 1, 2, 3, 5 and 6)

b. For non-thesis track:

    1. Comprehensive examination (Objectives 1, 2, 3)

    2. Independent study (SPST 997) document and presentation or poster session (Objectives 1, 2, 3, 5 and 6)

    3. Capstone project report and presentation (Objectives 1, 2, 3, 4, and 6)

Learning goals and objectives and direct assessment elements are related to applicable rubrics in Table 1. Five rubrics (Tables 2-6) are provided for instructor use in assessing the respective elements.

The primary elements of **indirect** measurement are qualitative and consist of student perceptions of their learning as gathered from:

a. Mid-semester formative surveys of all currently enrolled students
b. Summative surveys of all enrolled students at the end of each semester
c. Independent survey of all students enrolled in the Capstone project
d. Exit interviews with graduating students

Student learning is also continuously assessed informally as observations are made throughout a student's tenure during the following activities. This informal aspect complements the formal elements of the assessment program. These observations include:

a. Advisor-student meetings
b. Departmental on-line chats with students
c. Peer-reviews
d. Informal in-house seminars
e. Student performance in graduate research assistantships (GRA) and graduate teaching assistantships (GTA)

The formal data are gathered and analyzed by the Department Assessment Committee. These data, with the informal observations, are discussed at periodic meetings of the graduate faculty. Deficiencies in achieving student learning goals are identified and corrective actions developed and recommended to the Chair for implementation.

SECTION 3: ASSESSMENT OF STUDENT LEARNING IN **UNDERGRADUATE** PROGRAMS

Student Learning Goals

The student learning goal of the undergraduate minor is that the student:

a. Possesses both multidisciplinary and interdisciplinary knowledge of space enterprises.

   Objective 1: Demonstrates correct and effective use of the terminology and concepts of a broad range of space-related fields, to include both social sciences and technical disciplines.

   Objective 2: Demonstrates understanding of the interrelationships between the technical and social aspects of space enterprises by effectively applying this knowledge to problem solving.

Assessment Elements

In general, assessment of undergraduate outcomes is done through assessment within individual courses for multidisciplinary understanding (Objectives 1 and 2). Student deliverables include individual course papers, homework submissions, projects, presentations, and examinations.

The learning goals and assessment elements for the undergraduate program are presented in Table 7. Both formative and summative assessment methods are used to inform instructors of student performance levels and perspectives on experiences. Data is collected through mid-semester and end of semester surveys, student performance on the aforementioned deliverables, and ratings of conceptual understanding presented in Table 8 for the remaining Space Studies courses in which undergraduates are enrolled.

TABLES

Table 1: Measurement of Graduate Program Learning Goals and Objectives

Assessment Element		Graduate Program Learning Goals and Objectives					
		a. Possesses multidisciplinary & interdisciplinary knowledge of space enterprises				b. Possesses knowledge of a space-related discipline	
		1: Demonstrates correct & effective use of terminology & concepts of a broad range of space-related fields.	2: Demonstrates understanding of interrelationships between technical & social aspects of space enterprises by effectively applying this knowledge to problem-solving.	3: Demonstrates effective critical thinking & problem-solving in space-related fields through oral & written communication.	4: Demonstrates effective problem-solving & decision-making in an interdisciplinary team environment.	5: Demonstrates correct & effective use of terminology & concepts of selected space-related discipline.	6: Demonstrates effective participation in either independent or faculty research projects to advance the body of knowledge of space enterprise.
Thesis	Thesis defense presentation (Objectives 1, 2, 3, 5 and 6)	Rubric 1				Rubric 1	
	Thesis document (Objectives 1, 2, 3, 5 and 6)	Rubric 2				Rubric 2	
Non-Thesis	Comprehensive examination (Objectives 1, 2, 3)	Rubric 3					
	Independent study document & presentation or poster session (Objectives 1, 2, 3, 5 and 6)	Rubrics 4a & 4b				Rubrics 4a & 4b	
	Capstone project presentation & report (Objectives 1, 2, 3, 4, and 6)	Rubrics 5a & 5b					Rubrics 5a & 5b

Table 2: Thesis Proposal and Defense Presentations Rubric (Rubric 1)

Weight	Graded Element	Exhibited Behavior/Outcome				
		Noteworthy (4)	Good (3)	Acceptable (2)	Unacceptable (1)	Substantially Unacceptable (0)
25%	Demonstrates critical thinking and problem solving. (Objectives 2 & 3)	Demonstrates a novel solution, invoking principles from multiple perspectives and synergizing these viewpoints into a consistent, clear, unambiguous argument	Clearly lays out the problem and assumptions. Presents a systematic progression of argument leading to an unambiguous solution.	States the problem and associated assumptions, and sketches the outline of an argument which can be reasonably followed.	Simply restates arguments or positions from the literature, without providing support or demonstrating original thought.	Fails to demonstrate minimal level of performance or understanding.
25%	Demonstrates conceptual understanding of the problem and the pertinent issues. (Objectives 5 & 6)	Demonstrates thorough and deep understanding of the relevant issues and the significance of the problem.	Demonstrates an understanding of the nature of the problem and identifies the major relevant issues but does not give an appreciation of the broad political, technical, societal, and cultural effects.	Exhibits a broad but shallow understanding of the problem with some mention of underlying issues and implications.	Presents an incomplete understanding or simply restates the observations of the literature.	Fails to demonstrate minimal level of performance or understanding.
15%	Integrates knowledge from multiple disciplines. (Objective 1)	Seamlessly demonstrates how one discipline affects the others.	Effectively uses concepts and demonstrates an understanding of the terminology of each discipline.	Separately discusses from perspective of each discipline.	Fails to present multiple disciplines or fails to demonstrate concepts and terminology of multiple disciplines.	Fails to demonstrate minimal level of performance or understanding.
20%	Demonstrates accuracy and completeness. (Objectives 1 & 5)	Discussion is rich with accurate detail and relevant citations. Substantial use of mathematical representation.	Discussion contains relevant detail and supporting citations but to a lesser degree. May contain some element of subjectivity.	Discussion is primarily qualitative, with some limited weakness in coverage. Adequately supported with citations.	Sparse detail. Highly qualitative and subjective with little or no supporting citations.	Fails to demonstrate minimal level of performance or understanding.
15%	Demonstrates effective oral communication. (Objective 3)	Presence is exceptionally clear and expressive and captures and retains audience attention. Line of reasoning is exceptionally clear, logical, and well-organized. Communication aids are creative, enhance the presentation, and display original ideas. Content is exceptionally well conveyed in the time allotted.	Presence is clear and expressive, although less composure and polish may be exhibited. Organization is well organized and line of reasoning clear. Communication aids enhance the presentation and are of consistent style and free from grammatical errors. Time allocation is effectively used.	Presence lacks consistent clarity and effective expression. Nervous, with occasionally distracting mannerisms. Much of presentation is read and responses to questions, while correct, are simple and unimaginative. Presentation organization is generally clear. Transitions are occasionally abrupt or confusing. Some grammatical errors exist. Slightly over or under time allotted.	Presence is unclear, not composed, unpolished. Audience unable to follow the presentation. Haphazard flow. Communication aids distract and confuse. Frequent mechanics errors. Cannot effectively respond to questions. Fundamentally fails to articulate the arguments of the thesis. Significantly over or under the time allotted.	Fails to demonstrate minimal level of performance or understanding.

Table 3: Thesis Document Rubric (Rubric 2)

Weight	Graded Element	Exhibited Behavior/Outcome				
		Noteworthy (4)	Good (3)	Acceptable (2)	Unacceptable (1)	Substantially Unacceptable (0)
20%	Demonstrates critical thinking and problem solving. (Objectives 2 & 3)	Demonstrates a novel solution, invoking principles from multiple perspectives and synergizing these viewpoints into a consistent, clear, unambiguous argument	Clearly lays out the problem and assumptions. Presents a systematic progression of argument leading to an unambiguous solution.	States the problem and associated assumptions, and sketches the outline of an argument which can be reasonably followed.	Simply restates arguments or positions from the literature, without providing support or demonstrating original thought.	Fails to demonstrate minimal level of performance or understanding.
20%	Demonstrates conceptual understanding of the problem and the pertinent issues. (Objectives 5 & 6)	Demonstrates thorough and deep understanding of the relevant issues and the significance of the problem.	Demonstrates an understanding of the nature of the problem and identifies the major relevant issues but does not give an appreciation of the broad political, technical, societal, and cultural effects.	Exhibits a broad but shallow understanding of the problem with some mention of underlying issues and implications.	Presents an incomplete understanding or simply restates the observations of the literature.	Fails to demonstrate minimal level of performance or understanding.
20%	Integrates knowledge from multiple disciplines. (Objective 1)	Seamlessly demonstrates how one discipline affects the others.	Effectively uses concepts and demonstrates an understanding of the terminology of each discipline.	Separately discusses from perspective of each discipline.	Fails to present multiple disciplines or fails to demonstrate concepts and terminology of multiple disciplines.	Fails to demonstrate minimal level of performance or understanding.
20%	Demonstrates accuracy and completeness. (Objectives 1 & 5)	Discussion is rich with accurate detail and relevant citations. Substantial use of mathematical representation.	Discussion contains relevant detail and supporting citations but to a lesser degree. May contain some element of subjectivity.	Discussion is primarily qualitative, with some limited weakness in coverage. Adequately supported with citations.	Sparse detail. Highly qualitative and subjective with little or no supporting citations.	Fails to demonstrate minimal level of performance or understanding.
20%	Demonstrates effective written communication. (Objective 3)	Paper is laid out clearly with consistent and correct use of a recognized style (APA 6th preferred). Paragraph and sentence structure and word choices permit easy reading and comprehension. Only rare grammatical, spelling, or punctuation errors.	Organization, while not optimal, can be reasonably followed. Occasional lapses in style usage. Paragraph and sentence structure and word choices may be occasionally obtuse but generally enable comprehension. Scattered grammatical, spelling, and punctuation errors may be present.	Organization can be followed despite some difficulty for the reader. Paragraph and sentence structure and word choices are occasionally confusing, requiring considerable effort by the reader to discern meaning. Occasional grammatical, spelling, and punctuation errors may be present.	Haphazard flow. Does not follow a recognized style. Paragraph and sentence structure and word choices are frequently confusing and incomprehensible. Frequent errors in writing mechanics.	Fails to demonstrate minimal level of performance or understanding.

Table 4: Comprehensive Examination Rubric (Rubric 3)

Weight	Graded Element	Exhibited Behavior/Outcome				
		Noteworthy (4)	Good (3)	Acceptable (2)	Unacceptable (1)	Substantially Unacceptable (0)
20%	Demonstrates critical thinking and problem solving. (Objectives 2 & 3)	Demonstrates a novel solution, invoking principles from multiple perspectives and synergizing these viewpoints into a consistent, clear, unambiguous argument	Clearly lays out the problem and assumptions. Presents a systematic progression of argument leading to an unambiguous solution.	States the problem and associated assumptions, and sketches the outline of an argument which can be reasonably followed.	Simply restates arguments or positions from the literature, without providing support or demonstrating original thought.	Fails to demonstrate minimal level of performance or understanding.
20%	Demonstrates conceptual understanding of the problem and the pertinent issues. (Objectives 5 & 6)	Demonstrates thorough and deep understanding of the relevant issues and the significance of the problem.	Demonstrates an understanding of the nature of the problem and identifies the major relevant issues but does not give an appreciation of the broad political, technical, societal, and cultural effects.	Exhibits a broad but shallow understanding of the problem with some mention of underlying issues and implications.	Superficial. Presents an incomplete understanding or simply restates the observations of the literature.	Fails to demonstrate minimal level of performance or understanding.
20%	Integrates knowledge from multiple disciplines. (Objective 1)	Effectively integrates at least three disciplines and seamlessly demonstrates how one discipline affects the others.	Effectively uses concepts and demonstrates an understanding of the terminology of at least three disciplines.	Separately discusses from perspective of each of three disciplines.	Fails to present multiple disciplines or fails to demonstrate concepts and terminology of multiple disciplines.	Fails to demonstrate minimal level of performance or understanding.
20%	Demonstrates accuracy and completeness. (Objectives 1 & 5)	Discussion is rich with accurate detail and relevant citations. Substantial use of mathematical representation.	Discussion contains relevant detail and supporting citations but to a lesser degree. May contain some element of subjectivity.	Discussion is primarily qualitative, with some limited weakness in coverage. Adequately supported with citations.	Sparse detail. Highly qualitative and subjective with little or no supporting citations. Or makes unsupported claims.	Fails to demonstrate minimal level of performance or understanding.
20%	Demonstrates effective written communication. (Objective 3)	Examination is organized clearly with consistent and correct use of a recognized style (APA 6th preferred). Paragraph and sentence structure and word choices permit easy reading and comprehension. Only rare grammatical, spelling, or punctuation errors.	Organization, while not optimal, can be reasonably followed. Occasional lapses in style usage. Paragraph and sentence structure and word choices may be occasionally obtuse but generally enable comprehension. Scattered grammatical, spelling, and punctuation errors may be present.	Organization can be followed despite some difficulty for the reader. Paragraph and sentence structure and word choices are occasionally confusing, requiring considerable effort by the reader to discern meaning. Occasional grammatical, spelling, and punctuation errors may be present.	Haphazard flow. Does not follow a recognized style. Paragraph and sentence structure and word choices are frequently confusing and incomprehensible. Frequent errors in writing mechanics.	Fails to demonstrate minimal level of performance or understanding.

Table 5a: Independent Study Document Rubric (Rubric 4a)

Weight	Graded Element	Exhibited Behavior/Outcome				
		Noteworthy (4)	Good (3)	Acceptable (2)	Unacceptable (1)	Substantially Unacceptable (0)
20%	Demonstrates critical thinking and problem solving. (Objectives 2 & 3)	Demonstrates a novel solution, invoking principles from multiple perspectives and synergizing these viewpoints into a consistent, clear, unambiguous argument	Clearly lays out the problem and assumptions. Presents a systematic progression of argument leading to an unambiguous solution.	States the problem and associated assumptions, and sketches the outline of an argument which can be reasonably followed.	Simply restates arguments or positions from the literature, without providing support or demonstrating original thought.	Fails to demonstrate minimal level of performance or understanding.
25%	Demonstrates conceptual understanding of the problem and the pertinent issues. (Objectives 5 & 6)	Demonstrates thorough and deep understanding of the relevant issues and the significance of the problem.	Demonstrates an understanding of the nature of the problem and identifies the major relevant issues but does not give an appreciation of the broad political, technical, societal, and cultural effects.	Exhibits a broad but shallow understanding of the problem with some mention of underlying issues and implications.	Superficial. Presents an incomplete understanding or simply restates the observations of the literature.	Fails to demonstrate minimal level of performance or understanding.
15%	Integrates knowledge from multiple disciplines. (Objective 1)	Seamlessly demonstrates how one discipline affects the others.	Effectively uses concepts and demonstrates an understanding of the terminology of each discipline.	Separately discusses from perspective of each discipline.	Fails to present multiple disciplines or fails to demonstrate concepts and terminology of multiple disciplines.	Fails to demonstrate minimal level of performance or understanding.
20%	Demonstrates accuracy and completeness. (Objectives 1 & 5)	Discussion is rich with accurate detail and relevant citations. Substantial use of mathematical representation.	Discussion contains relevant detail and supporting citations but to a lesser degree. May contain some element of subjectivity.	Discussion is primarily qualitative, with some limited weakness in coverage. Adequately supported with citations.	Sparse detail. Highly qualitative and subjective with little or no supporting citations.	Fails to demonstrate minimal level of performance or understanding.
20%	Demonstrates effective written communication. (Objective 3)	Paper is laid out clearly with consistent and correct use of a recognized style (APA 6th preferred). Paragraph and sentence structure and word choices permit easy reading and comprehension. Only rare grammatical, spelling, or punctuation errors.	Organization, while not optimal, can be reasonably followed. Occasional lapses in style usage. Paragraph and sentence structure and word choices may be occasionally obtuse but generally enable comprehension. Scattered grammatical, spelling, and punctuation errors may be present.	Organization can be followed despite some difficulty for the reader. Paragraph and sentence structure and word choices are occasionally confusing, requiring considerable effort by the reader to discern meaning. Occasional grammatical, spelling, and punctuation errors may be present.	Haphazard flow. Does not follow a recognized style. Paragraph and sentence structure and word choices are frequently confusing and incomprehensible. Frequent errors in writing mechanics.	Fails to demonstrate minimal level of performance or understanding.

Table 5b: Independent Study Presentation or Poster Session Rubric (Rubric 4b)

Weight	Graded Element	Exhibited Behavior/Outcome				
		Noteworthy (4)	Good (3)	Acceptable (2)	Unacceptable (1)	Substantially Unacceptable (0)
25%	Demonstrates critical thinking and problem solving. (Objectives 2 & 3)	Demonstrates a novel solution, invoking principles from multiple perspectives and synergizing these viewpoints into a consistent, clear, unambiguous argument	Clearly lays out the problem and assumptions. Presents a systematic progression of argument leading to an unambiguous solution.	States the problem and associated assumptions, and sketches the outline of an argument which can be reasonably followed.	Simply restates arguments or positions from the literature, without providing support or demonstrating original thought.	Fails to demonstrate minimal level of performance or understanding.
20%	Demonstrates conceptual understanding of the problem and the pertinent issues. (Objectives 5 & 6)	Demonstrates thorough and deep understanding of the relevant issues and the significance of the problem.	Demonstrates an understanding of the nature of the problem and identifies the major relevant issues but does not give an appreciation of the broad political, technical, societal, and cultural effects.	Exhibits a broad but shallow understanding of the problem with some mention of underlying issues and implications.	Presents an incomplete understanding or simply restates the observations of the literature.	Fails to demonstrate minimal level of performance or understanding.
15%	Integrates knowledge from multiple disciplines. (Objective 1)	Seamlessly demonstrates how one discipline affects the others.	Effectively uses concepts and demonstrates an understanding of the terminology of each discipline.	Separately discusses from perspective of each discipline.	Fails to present multiple disciplines or fails to demonstrate concepts and terminology of multiple disciplines.	Fails to demonstrate minimal level of performance or understanding.
20%	Demonstrates accuracy and completeness. (Objectives 1 & 5)	Discussion is rich with accurate detail and relevant citations. Substantial use of mathematical representation.	Discussion contains relevant detail and supporting citations but to a lesser degree. May contain some element of subjectivity.	Discussion is primarily qualitative, with some limited weakness in coverage. Adequately supported with citations.	Sparse detail. Highly qualitative and subjective with little or no supporting citations.	Fails to demonstrate minimal level of performance or understanding.
20%	Demonstrates effective oral communication. (Objective 3)	Presence is exceptionally clear and expressive and captures and retains audience attention. Line of reasoning is exceptionally clear, logical, and well-organized. Communication aids are creative, enhance the presentation, and display original ideas. Content is exceptionally well conveyed in the time allotted.	Presence is clear and expressive, although less composure and polish may be exhibited. Organization is well organized and line of reasoning clear. Communication aids enhance the presentation and are of consistent style and free from grammatical errors. Time allocation is effectively used.	Presence lacks consistent clarity and effective expression. Nervous, with occasionally distracting mannerisms. Much of presentation is read and responses to questions, while correct, are simple and unimaginative. Presentation organization is generally clear. Transitions are occasionally abrupt or confusing. Some grammatical errors exist. Slightly over or under time allotted.	Presence is unclear, not composed, unpolished. Audience unable to follow the presentation. Haphazard flow. Communication aids distract and confuse. Frequent mechanics errors. Cannot effectively respond to questions. Fundamentally fails to articulate the arguments of the thesis. Significantly over or under the time allotted.	Fails to demonstrate minimal level of performance or understanding.

Table 6a: Capstone Report Rubric (Rubric 5a)

Weight	Graded Element	Exhibited Behavior/Outcome				
		Noteworthy (4)	Good (3)	Acceptable (2)	Unacceptable (1)	Substantially Unacceptable (0)
20%	Demonstrates critical thinking and problem solving. (Objectives 2 & 3)	Demonstrates a novel solution, invoking principles from multiple perspectives and synergizing these viewpoints into a consistent, clear, unambiguous argument	Clearly lays out the problem and assumptions. Presents a systematic progression of argument leading to an unambiguous solution.	States the problem and associated assumptions, and sketches the outline of an argument which can be reasonably followed.	Simply restates arguments or positions from the literature, without providing support or demonstrating original thought.	Fails to demonstrate minimal level of performance or understanding.
20%	Demonstrates conceptual understanding of the problem and the pertinent issues. (Objectives 5 & 6)	Demonstrates thorough and deep understanding of the relevant issues and the significance of the problem.	Demonstrates an understanding of the nature of the problem and identifies the major relevant issues but does not give an appreciation of the broad political, technical, societal, and cultural effects.	Exhibits a broad but shallow understanding of the problem with some mention of underlying issues and implications.	Superficial. Presents an incomplete understanding or simply restates the observations of the literature.	Fails to demonstrate minimal level of performance or understanding.
15%	Integrates knowledge from multiple disciplines. (Objective 1)	Seamlessly demonstrates how one discipline affects the others.	Effectively uses concepts and demonstrates an understanding of the terminology of each discipline.	Separately discusses from perspective of each discipline.	Fails to present multiple disciplines or fails to demonstrate concepts and terminology of multiple disciplines.	Fails to demonstrate minimal level of performance or understanding.
15%	Demonstrates effectiveness in interdisciplinary team environment (Objective 4)	Demonstrates extremely well-integrated & balanced contributions from all team members, presented as though in single voice.	Generally well-integrated & balanced contributions from all team members. Infrequent lapses in consistency may be apparent.	Contributions apparent from all team members. Occasional minor lapses in consistency may be permissible.	Gives appearance of patchwork contributions from members, inadequately integrated, often inconsistent. Not all members contribute.	Fails to demonstrate minimal level of performance or understanding.
15%	Demonstrates accuracy and completeness. (Objectives 1 & 5)	Discussion is rich with accurate detail and relevant citations. Substantial use of mathematical representation.	Discussion contains relevant detail and supporting citations but to a lesser degree. May contain some element of subjectivity.	Discussion is primarily qualitative, with some limited weakness in coverage. Adequately supported with citations.	Sparse detail. Highly qualitative and subjective with little or no supporting citations.	Fails to demonstrate minimal level of performance or understanding.
15%	Demonstrates effective written communication. (Objective 3)	Paper is laid out clearly with consistent and correct use of a recognized style (APA 6th preferred). Paragraph and sentence structure and word choices permit easy reading and comprehension. Only rare grammatical, spelling, or punctuation errors.	Organization, while not optimal, can be reasonably followed. Occasional lapses in style usage. Paragraph and sentence structure and word choices may be occasionally obtuse but generally enable comprehension. Scattered grammatical, spelling, and punctuation errors may be present.	Organization can be followed despite some difficulty for the reader. Paragraph and sentence structure and word choices are occasionally confusing, requiring considerable effort by the reader to discern meaning. Occasional grammatical, spelling, and punctuation errors may be present.	Haphazard flow. Does not follow a recognized style. Paragraph and sentence structure and word choices are frequently confusing and incomprehensible. Frequent mechanics errors.	Fails to demonstrate minimal level of performance or understanding.

Table 6: Capstone Presentation Rubric (Rubric 5)

Weight	Graded Element	Exhibited Behavior/Outcome				
		Noteworthy (4)	Good (3)	Acceptable (2)	Unacceptable (1)	Substantially Unacceptable (0)
15%	Demonstrates critical thinking & problem solving. (Objectives 2 & 3)	Demonstrates a novel solution, invoking principles from multiple perspectives & synergizing these viewpoints into a consistent, clear, unambiguous argument	Clearly lays out the problem & assumptions. Presents a systematic progression of argument leading to an unambiguous solution.	States the problem & associated assumptions, & sketches the outline of an argument which can be reasonably followed.	Simply restates arguments or positions from the literature, without providing support or demonstrating original thought.	Fails to demonstrate minimal level of performance or understanding.
20%	Demonstrates conceptual understanding of the problem & the pertinent issues. (Objectives 5 & 6)	Demonstrates thorough & deep understanding of the relevant issues & the significance of the problem.	Demonstrates an understanding of the nature of the problem & identifies the major relevant issues but does not give an appreciation of the broad political, technical, societal, & cultural effects.	Exhibits a broad but shallow understanding of the problem with some mention of underlying issues & implications.	Presents an incomplete understanding or simply restates the observations of the literature.	Fails to demonstrate minimal level of performance or understanding.
15%	Integrates knowledge from multiple disciplines. (Objective 1)	Seamlessly demonstrates how one discipline affects the others.	Effectively uses concepts & demonstrates an understanding of the terminology of each discipline.	Separately discusses from perspective of each discipline.	Fails to present multiple disciplines or fails to demonstrate concepts & terminology of multiple disciplines.	Fails to demonstrate minimal level of performance or understanding.
20%	Demonstrates effectiveness in interdisciplinary team environment (Objective 4)	Demonstrates extremely well-integrated & balanced contributions from all team members, presented as though in single voice.	Generally well-integrated & balanced contributions from all team members. Infrequent lapses in consistency. No evidence of discord.	Contributions from all team members but not always integrated or consistent. Evidence of discord.	Fails to present united appearance. Haphazard & inconsistent. Significant imbalances in contributions. Obvious discord.	Fails to demonstrate minimal level of performance or understanding.
15%	Demonstrates accuracy & completeness. (Objectives 1 & 5)	Discussion is rich with accurate detail & relevant citations. Substantial use of mathematical representation.	Discussion contains relevant detail & supporting citations but to a lesser degree. May contain some element of subjectivity.	Discussion is primarily qualitative, with some limited weakness in coverage. Adequately supported with citations.	Sparse detail. Highly qualitative & subjective with little or no supporting citations.	Fails to demonstrate minimal level of performance or understanding.
15%	Demonstrates effective oral communication. (Objective 3)	Presence is exceptionally clear & expressive & captures & retains audience attention. Line of reasoning is exceptionally clear, logical, & well-organized. Communication aids are creative, enhance the presentation, & display original ideas. Content is exceptionally well conveyed in the time allotted.	Presence is clear & expressive, although less composure & polish may be exhibited. Organization is well organized & line of reasoning clear. Communication aids enhance the presentation & are of consistent style & free from grammatical errors. Time allocation is effectively used.	Presence lacks consistent clarity & effective expression. Nervous, some distracting mannerisms. Reads much of presentation. Responses to questions are simple & unimaginative. Presentation organization is generally clear. Transitions are abrupt/ confusing. Some grammatical errors exist. Slightly over/ under time allotted.	Presence is unclear, not composed or polished. Audience unable to follow. Haphazard flow. Communication aids distract. Frequent mechanics errors. Cannot effectively respond to questions. Fundamentally fails to articulate the arguments of the thesis. Significantly over or under the time allotted.	Fails to demonstrate minimal level of performance or understanding.

Table 7: Measurement of Undergraduate Program Learning Goals and Objectives

Assessment Element	Undergraduate Program Learning Goals	
	a. Possesses multidisciplinary & interdisciplinary knowledge of space enterprises.	
	1: Demonstrates correct & effective use of terminology & concepts of broad range of space-related fields.	2: Demonstrates understanding of interrelationships between technical & social aspects of space enterprises by effectively applying this knowledge to problem solving.
Individual courses (Objectives & 1)	Combined GPA for substantially interdisciplinary course, i.e., SPST 200.	Department-wide rating for conceptual understanding in all courses, except SPST 200.

Table 8: UNDERGRADUATE COURSE ASSESSMENT WORKSHEET

Semester: _____

Course: _____

Instructor: _____

e-mail: _____

Number of students completing course: _____

Assessment of individual student mastery of undergraduate program learning goals

Student	Assessment of student mastery of: (Score: 0 – 4)*
	Conceptual understanding
Class total	
Class average	

* Qualitative Rating Scale

Rating	Description
4	Noteworthy
3	Good
2	Acceptable
1	Unacceptable
0	Substantially unacceptable