Undergraduate Capstone Course Policy Guide

For

Bachelor of Science in Aeronautics (BSA)

Bachelor of Science in Aviation Security (BSAS)

Bachelor of Science in Aviation Maintenance (BSAvM)

Bachelor of Science Safety Management (BSSM)

Bachelor of Science in Transportation (BST)

Bachelor of Science Unmanned Systems Application (BSUSA)

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(OPR- O.L. Godsey)

Keynote

The Chair of the Department of Aeronautics Undergraduate Studies is the primary authority in all aspects of the implementation of this policy guide and the administration of all undergraduate capstone courses assigned to the department. The Program Chair for the appropriate Bachelor of Science degree program and/or the Associate Program Chair are the first points of contact for any questions regarding the implementation of this policy guide and the administration of the College of Aeronautics undergraduate capstone course.

The Capstone Course (AMNT 490, ASCI 490, BSSM 490, SCTY 490, TRAN 490 & UNSY 490) must be taken as the final course in the student's degree program. Exception to this policy will require justification from the student and approval from the Chair of the Department of Aeronautics, Undergraduate Studies. Students can contact their advisor, Campus Director, or email wwaero@erau.edu for more information on exception policy and submission of requests.

Note: At the present time the BSA, BST, BSAS, BSSM, BSAvM and BSUSA degrees are included in this guide, other degree programs will be added as they come available.

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Introduction to the Capstone

Purpose

The Aeronautical Science Capstone Course is the culminating effort of the entire learning experience for undergraduate students in the College of Aeronautics. This course is an **assessment course** and not an instructional course. The student will complete a project providing significant evidence of experience within the discipline studied. Students will work with a designated faculty member to formulate, develop, and complete the aviation/aeronautical project. The completion of the Capstone Course is designed to document significant evidence the student's applicable program outcomes have been met and provide the student evidence of experience available to current and prospective employers. The Capstone Course will be taken as the last course in the student's degree program. Exception to this policy will require justification from the student and approval from the Chair of the Department of Aeronautics, Undergraduate Studies. Students can contact their advisor, Campus Director, or email wwaero@erau.edu for more information on exception policy and submission of requests.

For the purposes of the course description found in the catalog, a "project" is the culminating effort and can be any "approved" project. The qualifying criteria are the project proposal must allow the student to demonstrate each aspect of the applicable Program Outcomes and be approved by the assigned faculty member and a College of Aeronautics Department of Undergraduate Studies representative.

Goal

The goals of the College of Aeronautics Capstone Courses are to provide an opportunity for students to demonstrate achievement of the applicable Program Outcomes. The final project will capture the student's extensive research effort.

However, the Capstone is an assessment course, not an instructional course. That is why it does not include Learning Outcomes as other UG courses do. The Capstone is intended to assess the student's skills, based upon prior learning of the Program Outcomes. Instructors should guide the student toward addressing the critical elements that will further allow the student to succeed in the Capstone. If the instructor considers a proposal weak his or her purpose is not to instruct the student with the intent of helping the student earn a grade of 'A'. Rather, the instructor's purpose is to highlight critical issues/areas that could prevent student success in passing the Capstone and provide the student the guidance necessary to meet the minimum standards for the proposal established by those objectives.

Establishing Communications

Communication is the key element to success in this course. It must occur early and often. It is imperative that two-way communication is established between faculty and student as soon as possible. Close coordination between faculty and student will ensure course expectations are understood and met. Delays in communication could impact the successful completion of the course.

Many students and faculty find that utilizing multiple means of communication enables greater chance at success. Means such as phone, text, email, Eagle Vision, Skype, and Google Hangouts facilitates rapid and successful conversing as necessary.

Institutional Review Board

The University fully complies with the policy on the use of human subjects as required by the Public Health Service (PHS) (45 CFR 46 as revised). Any proposal/project involving human subjects, as defined by 45 CFR 46, requires approval by the University Institutional Review Board (IRB) for the Protection of Human Subjects (Appendix A). Any capstone student

who plans to conduct research using human subjects must contact their faculty member to obtain approval at the earliest opportunity and complete the applicable process in accordance with University policy. Faculty have the responsibility to assist students in obtaining IRB approval. Additional information can be found in APPM 2.8.5 at www.erau.edu/appm.

The Proposal

The proposal is **the most important component of the Capstone** for several reasons. First and foremost, the project cannot proceed until the proposal has been approved by the college department representative. The proposal requires a consistent effort and hard work from the student beginning on day one of the course. Students should address feedback from the assigned faculty member in a timely manner. If there are questions, students need to take the initiative to get answers and make the requisite corrections. Communications are essential in this part of the process. While the student's proposal is undergoing review the instructor should allow the student to begin gathering data and information related to the approved topic(s). The instructor should not, however, allow the student to move forward with the development and writing of the Capstone paper or presentation until the proposal receives final approval.

The Capstone review process should be focused on the following:

- The student includes the required components of the template
- The student's proposal contains the correct POs for their program
- Proposal demonstrates the student understands each of the POs
- Proposal addresses **HOW** the project will demonstrate an understanding of each PO

- Proposal contains sufficient information and data to ensure the student will successfully demonstrate each aspect of their applicable POs if conducted as proposed.
- Proposal includes the **generalized sources of information that will be used to answer the PO** (not just simply saying the internet or Hunt library). This information will provide insight into whether the student has sufficient understanding of the sourcing of information and data required for each PO in order to provide sufficient evidence that the student can successfully meet the overall Capstone requirements. An acceptable example would be "student expects to obtain the necessary information and data for demonstrating the PO from the aircraft manufacturer's certified emergency procedures, from the Federal Aviation Regulation, Parts 91, 121, or 135, or from commercial carriers' Standard Operating Procedures."
- APA style has been followed and the paper is written in the third person.

The challenge found for the student in the Capstone proposal process is in identifying and communicating how the POs will be addressed and demonstrated successfully. Remember that the proposal is the student's "research roadmap", detailing what will be done, how it will be done, and what material will be used to do it. Once this task is complete and students have developed the roadmap for conducting the Capstone that the proposal is intended to provide them, they are more adept at continuing with their work towards a successful Capstone. The Capstone paper itself is where the student actually does what he or she has previously proposed.

Capstone Project

Students register for the Capstone course the same as any other course. Students and

faculty may utilize any approved delivery modality to facilitate course completion. Students should be willing to be flexible in any means of course delivery, and many times, utilize them all. Student registrations may dictate which option for course completion is available.

Individual project. The project subject will be identified at the beginning of the term. Project size and structure will be determined by the faculty member.

The faculty member will guide the student in the development, focus, scope and methodology of the project. The project must be comprehensive, relevant, and address each aspect of the applicable degree Program Outcomes. The scope of the project must remain broad enough to clearly demonstrate achievement of each aspect of the applicable Program Outcomes. See Appendices B, E, H, K, N, & Q for the appropriate proposal template.

The project proposal must be submitted to the faculty member who will forward with recommendation to the Department of Aeronautics representative for review no later than the end of Week 2 (See Appendices B, E, H K, N, & Q for proposal template). Review and feedback of the proposal by the Department of Aeronautics representative will be accomplished within five (5) working days of receipt. The instructor should not/will not forward student work that does not meet the standards outlined in this guide to the College representative for approval.

General Focus of the Capstone Project

- The student must focus the Capstone project on the demonstration of each aspect of the applicable POs.
- The student must demonstrate mastery of knowledge of the appropriate POs through the application of the higher order learning skills of analysis, evaluation, and

synthesis, as well as the practical skill of critical thought. Appendices C, F, I, L, O & R provide templates for the appropriate Capstone Project.

Definition of Terms

First, what is meant by the term *research* in the construct of the undergraduate Capstone? Undergraduate research is:

> *The application of the three higher order learning skills of analysis, evaluation, and synthesis, and the practical skill of critical thought to gathered existing data and other information to extend that information into new uses and concept*.

The above defines the intent of the term research in the construct of the undergraduate Capstone.

Definitions:

- **Analysis:** The detailed examination of the elements of something, typically as the basis for discussion or interpretation.
- **Evaluation:** Forming an idea of the amount, number, or value of something.
- **Synthesis:** The combination of ideas or knowledge to form a theory or system by extending that knowledge beyond its current limits or understanding.
- **Critical Thought:** Directed, problem-focused, reflective thinking intended to evaluate evidence in order to test ideas, concepts, or possible solutions for errors or drawbacks for the purpose of drawing conclusions.

- ***Note: This is what differentiates an UG research paper (such as the Capstone) from a term paper.***

Program Outcome Guidance

Information Concerning POs

As a minimum for each PO, the student should meet the following objectives in his or her proposal:

1. **The student understanding of the PO.** This should be as simple as one sentence in which the student explains his or her understanding of the PO.

   This information will provide the instructor insight into whether the student's understanding of the PO aligns with the guidance contained in this document for each PO and whether additional instruction to the student regarding the meaning of each PO as needed.

2. **How the student will demonstrate his or her understanding of the PO as specifically related to the student's project topic**.

   This information will provide the instructor insight into whether the student has a sufficient plan for demonstrating each PO as well as a sufficient understanding of the selected topic(s) in order to provide a likelihood the student can successfully meet the overall Capstone requirements and pass the course, whether additional instruction to the student regarding the means for demonstrating skill at each PO is needed.

3. **What information and data the student expects he or she will require to successfully accomplish Objective No. 2 (above) for each PO.**

   This information will provide the instructor insight into whether the student has a sufficient understanding of the information and data the student will require to meet Objective No. 2 for each PO in order to provide a likelihood the student can successfully meet the overall Capstone requirements and pass

the course, and whether additional instruction to the student regarding the demonstration of skill at each PO is needed.

4. **From what sources the student expects he or she will be able to obtain the information in Objective No. 3 to successfully accomplish Objective No. 2 (above) for each PO.**

   The information will provide the instructor insight into whether the student has a sufficient understanding of the sourcing of information and data the student will require meet Objective No. 2 (above) for each PO in order to provide a likelihood the student can successfully meet the overall Capstone requirements and pass the course, and whether additional instruction to the student regarding sourcing of information and data for each PO is needed.

   Note: It is important that the instructor elicits from the student sufficient detail in the proposal regarding these four objectives to provide the instructor the intended insight. As an example, a student statement such as "The student will obtain information from credible primary sources" does not meet the necessary standard of detail. Expressing more detail as shown in the following statement "The student expects to obtain the necessary information and data for demonstrating this PO from the airplane manufacturer's certified emergency procedures, from Federal Aviation Regulations (FARs) under Section 14 of the Code of Federal Regulations (CFR) Parts 91, 121, and 135, and from available private, on-demand, and commercial carriers Standard Operating Procedures (SOPs)".

Additional General Guidance for the Proposal and Capstone Project

- The Capstone proposal and project are required to be formatted in and follow the writing rules of the current edition of the Publication Manual of the American Psychological Association (otherwise referred to as the APA manual) including being written in the third person and meeting required spacing requirements.

Program Outcome Specific Guidance (ASCI 490, AMNT 490, SCTY 490, & Tran 490 only)

General Education POs (Apply to ASCI, AMNT, SCTY, and Tran Capstone Degree Programs only)

1. ***Critical Thinking.*** *The student will show evidence of knowledge at a synthesis level to define and solve problems within professional and personal environments.*

Critical thinking is the key to a successful Capstone effort. Critical Thinking goes beyond a reciting of information researched. It involves the application of knowledge gained through research that develops a defined project in order to meet a specific outcome.

As an integral component of problem solving and decision-making, this combination of skills allows one to form contentions, conclusions, and recommendations. This skill combines analysis, evaluation, conceptualizing, application, solutions, recommendations, synthesis, decision-making, and problem solving through critical research.

The proposal should clearly identify how the Critical Thinking PO will be met through the development of the Capstone and include key words, phrases, and concepts applicable to the research objective, such as:

- Analyzing valid and reliable information and data with a specific purpose that results in the forming of conclusion or recommendations.
- Evaluating information and data as part of a decision making process (problem solving).

- Recommending courses of action (through research) to meet a specific objective.
- Evaluating potential solutions to a project.
- Comparing and contrasting critical variables of a project.
- Identifying and establishing priorities in project.

The result of Critical Thinking is the analysis of information and the development of conclusions and recommendations related to a project and is supported by valid and reliable referenced material.

2. ***Quantitative Reasoning.*** *The student will show evidence of the use of digitally-enabled technology & analysis techniques to interpret data for the purpose of drawing valid conclusions and solving associated problems.*

Quantitative Reasoning is the utilization and application of quantitative concepts and methods in solving real world problems. These concepts (which vary greatly) include basic math, algebra, statistics, geometry, and associated techniques and tools like spreadsheets, graphing, charting and the technology to construct them.

Quantitative Reasoning is the application of quantitative concepts that support and develop a defined project in order to meet a specific outcome. It is the quantitative version of Critical Thinking.

The proposal should clearly identify how the Quantitative Reasoning PO will be met through the development of the Capstone and include key words, phrases, and concepts applicable to the research object, such as:

- Analyzing data that supports a project. (This does not necessarily mean "statistical analysis").
- Applying quantitative data, such as descriptive statistics, charts, graphs, linear representations, tables, figures, databases, and spreadsheets to support a specific objective or outcome.
- Interpret and apply quantitative calculations in support of decision making and problem solving processes.
- Using quantitative concepts to "measure" variables in projects.

The result of Quantitative Reasoning is the application of quantitative concepts in the analysis of information and the development of conclusions and recommendations related to a project and supported by valid and reliable referenced material.

3. ***Information Literacy.*** *The student will show evidence of meaningful research, including gathering information from primary and secondary sources and incorporating and documenting source material in their writing.*

There must be a valid and reliable relationship established between any topic of discussion and the material used to support that discussion. This material is comprised of identifiable 'primary' sources, and supported 'secondary' sources in order to logically, effectively, and concisely qualify a position on the topic.

Key to the Information Literacy PO is the conduct and reporting of meaningful research that specifically supports the fundamental purpose of the project.

The proposal should clearly identify how the Information Literacy PO will be met by identifying how research will be conducted and reported in support of the development of the Capstone and include key words, phrases, and concepts to the research objective, such as:

- Use of peer reviewed research that is specific to an objective or outcome
- Conducting research that differentiates between primary and secondary sources.
- Information that is reliable and valid to the project.
- Reporting of research that conforms to APA guidelines.
- Information Literacy employs correct research processes that support the development of the project, including analysis and evaluation of the information gathered, not simply randomly gathering data.
- Using research that is properly cited and referenced and can be verified.
- The result of Information Literacy is the conduct of valid and reliable research that supports the analysis, conclusions, and recommendations related to a project.

4. ***Communication.*** *The student will show evidence of communicating concepts in written, digital and oral forms to present technical and non-technical information.*

In this context, communication is the application of thought into cogent written and oral presentation. Communication is the requisite expression of thought that successfully supports positions on a selected project using the standards identified in the appropriate documents (Publication manual of the

American Psychological Association [APA] and Capstone Policy Guide), and that successfully conveys those positions to the intended audience.

Key to the Communication PO is the effective and efficient communication of the Capstone as a whole, utilizing a logical flow and organization that successfully communicates the outcomes of the project to the intended audience. The student must remember that the Capstone paper and presentation are created for the audience.

Effective communication is not necessarily a singular process or tool (such as MS Word or PowerPoint), but an integration of multiple processes and tools. The proposal must be clear in explaining exactly how the project will be communicated. Communication can take on many forms, including:

- The Capstone itself, which encompasses other components:
    - Correct use of APA guidelines
    - Grammatically correct
    - In-text citations
    - Referenced
    - Logical sequence, flow, transitions

The project presentation. This can take on many forms, including:

- Development of the supporting Power Point presentation
- In-class verbal presentation
- Verbal presentation through Eagle Vision or Skype
- Verbal presentation through teleconferencing
- Individual presentations between instructor and student

Participation in the Discussion Board

- Communication between instructor and student in the development of the proposal and Capstone
- Communication between students
- Weekly status checks

The results of Communication are the presentation of valid and reliable research that supports the analysis, conclusions, and recommendations related to a project and the understanding of that information by the intended audience.

5. ***Scientific Literacy.*** *The student will show evidence of analyzing scientific evidence as it relates to the physical world and its interrelationship with human values and interests.*

Scientific Literacy is the application of critical thinking to the general scientific evidence (general physics, mechanics, weather, chemistry, biology, physiology, etc.) that is used to support a project.

The proposal should clearly identify how Scientific Literacy will be met through the development of the Capstone and include key words, phrases, and concepts applicable to the research objective, such as:

- Applying physics or physical laws to a project.
- Identifying and apply factors in aeronautical science as they relate to a project.
- Analyzing weather as a factor in developing a project.

- Evaluating operating characteristics of a system, component, or part as part of an overall project.
- Analyzing mechanical or electrical properties related to a project.
- Assessing physiological factors in human performance.

The result of Scientific Literacy is the analysis of information and the development of conclusions and recommendations related to the scientific aspects of a project and supported by valid and reliable referenced material.

6. ***Cultural Literacy.*** *The student will show evidence of the analysis of historical events, cultural artifacts, and philosophical concepts.*

Cultural Literacy is the knowledge, understanding, and application of history, contributions, and perspectives of differing cultural groups to a specific project or the impact on those cultural groups of the topic of a specific project.

Cultural Literacy is the ability to associate an individual's knowledge, understanding, and application of history, contribution, perspectives, and impacts of their own and other cultural groups. These groups are not limited to ethnic, religious or social groups, but include groups associated with industry, professional, and other work or recreationally related entities. Examples of cultures can include:

- Social cultures
- Organizational cultures
- Aviation cultures (or non-aviation cultures)
- Safety cultures
- Religious cultures

- Ethnic cultures

The proposal should clearly identify how Cultural Literacy will be met through the development of the Capstone and include key words, phrases, and concepts applicable to the research objective, such as:

- Analyzing historical events as they impact/influence a project.
- Comparing and contrasting social norms as they impact a specific objective or outcome.
- Examining the evolution of an organization as cultures change.
- Evaluating challenges in managing multi-cultures change.
- Evaluating past and current cultures for trends in aviation safety.

The result of Cultural Literacy is the application and analysis of information in the development of conclusions and recommendations related to the cultural aspects of a project and supported by valid and reliable referenced material.

7. ***Life Long Personal Growth.*** *The student will show evidence of the skills needed to enrich the quality of life through activities, which enhance and promote lifetime learning.*

Life Long Personal Growth is not about the student's personal experience, but broadly with an industry perspective how an individuals' (not the students) personal experience can be demonstrated through the project.

Life Long Personal Growth relates to a compilation of knowledge, skills, and actions taken by individuals in an industry over time to advance one's position and abilities to their benefit. The acquisition of knowledge and skill is followed by an application or action in order to change something.

A demonstration of Life Long Personal Growth skills necessitates an understanding of the Gen Ed POs themselves. These skills are an integral part of an action and planned professional development (both specific to aviation and generalized outside of aviation). The proposal should clearly identify how Life Long Personal Growth is demonstrated through the project. Examples of Life Long Personal Growth can include:

- Evaluating how diversity in professional responsibility supports a specific project.
- Critiquing increase experience through the involvement in a specific project.
- Assessing how education and training impacts performance as it applies to a specific project.
- Evaluating the value of professional development as it applies to a specific project.
- Assessing how professional development (or lack of progression) of career advancement as it applies to a specific project.

The result of Life Long Personal Growth is application of knowledge and skills through professional development that supports the analysis, conclusions, and recommendations related to the life long personal growth aspects of a project and supported by valid and reliable referenced material.

Bachelor of Science in Aeronautics (BSA)(ASCI 490) – Core Program Outcomes

8. **Aviation/Aerospace/Aeronautical Science.** *The student will show evidence of advanced concepts of aviation, aerospace, and aeronautics to solve problems commonly found in their respective industries*.

The Aeronautical Science PO is the application of critical thinking to the specific aeronautical scientific evidence (the physics of flight, flight operations, human factors, flight physiology, aircraft simulation, aviation safety and security, air traffic control, UAS, etc.) that is used to support a project.

Aeronautical Science includes concepts that can be explained by any of the aeronautical sciences and the associated concepts and properties as they relate to the project.

The proposal should clearly identify how Aeronautical Science will be met through the development of the Capstone and include key words, phrases, and concepts applicable to the research objective, such as:

- Applying aeronautical sciences and associated concepts to a project.
- Identifying and applying factors in aeronautical science as they relate to a project.
- Analyzing human factors or flight physiology as factors in developing a project.
- Evaluating flight operations principles and concepts as characteristics of an overall project.
- Analyzing flight simulation systems and procedures as they relate to a project.

- Assessing air traffic control systems, technologies, and procedures as they impact aviation safety and security.

The result of Aeronautical Science is the analysis of information and the development of conclusions and recommendations related to the aeronautical science aspects of a project and supported by valid and reliable referenced material.

9. ***Aviation Legislation and Law.*** *The student will show evidence of the basic concepts in national and international legislation and law as they pertain to the aviation, aerospace, and aeronautics industries.*

The Aviation Legislation and Law PO is the application of critical thinking to the past, present, and future local, state, federal, and international laws and regulations that are used to support a project.

Aviation Legislation and Law includes an analysis and evaluation of any and all regulatory requirement (safety, security, flight and maintenance operation, liability, local, state, federal, and international aviation regulations, environmental, aviation facility development, etc.) as they impact and relate to the project.

The proposal should clearly identify how the Aviation Legislation and Law PO will be met through the development of the Capstone and include key words, phrases, and concepts applicable to the research objective, such as:

- Analyzing and applying the impact of all laws and regulations that impact any aspects of the project.
- Capstone topic and associated concepts to a project.

- Recommending changes to or elimination of existing laws and regulations or the addition of new laws and regulations as they relate to a project.
- Analyzing and evaluating proposed or soon to be implemented laws and regulations for the impact on a project.

The results of Aviation Legislation and law is the analysis of information and the development of conclusions and recommendations related to the aviation legislation and law aspects of a project and supported by valid and reliable referenced material.

10. Aviation Safety. *The student will show evidence of basic concepts in aviation safety as they pertain to the aviation, aerospace, and aeronautics industry.*

The Aviation Safety PO is the application of critical thinking to the specific topics of aviation safety and security that are used to support a project.

Aviation Safety includes an analysis and evaluation of any and all safety and security concepts, techniques, and procedures (SMS, airfield and other aviation facility security, accident investigation, operation safety, Federal Air Marshal Program, terrorism prevention, etc.) as they impact and relate to the project.

The proposal should clearly identify how the Aviation Safety PO will be met through the development of the Capstone and include key words, phrases, and concepts applicable to the research objective, such as:

- Applying aviation safety and security programs, agencies, and concepts to a project.

- Identifying the role accident investigation techniques and procedures as they relate to a project.
- Analyzing the impacts of human factors and human error on aviation safety and security as factors in developing a project.
- Evaluating and analyzing prior aviation accidents for use in developing new regulations and methodologies for improving aviation safety and security.
- Assessing the roles private industry and federal regulators and academic research play in improving aviation safety and security.
- Developing safety and security recommendations based upon valid researched evidence from numerous sources.

The result of Aeronautical Safety PO is the analysis of information and the development of conclusions and recommendations related to the aviation safety and security aspects of a project and supported by valid and reliable referenced material.

11. Aviation Management and Operations. *The student will show evidence of sound, ethical, management principles within standard aviation, aerospace, and aeronautics operations.*

The Aviation Management and Operations PO is the application of critical thinking to the specific topics of management of aviation operations that are used to support a project.

Aviation Management and Operations includes an analysis and evaluation of any and all management concepts, techniques, and procedures (personnel, flight

operations, maintenance operations, engineering development and test, airfield, airline, etc.) as they impact and relate to the project.

The proposal should clearly identify how the Aviation Management and Operations PO will be met through the development of the Capstone and include key words, phrases, and concepts applicable to the research objectives, such as:

- Applying established aviation management techniques to the personnel and programs associated with all aviation operations to a project.
- Evaluating the impacts of failures in management on aviation operations as they relate to a project.
- Developing and recommending improvements to existing management techniques and theories or new techniques, based upon valid research, as needed to support a project.

The result of Aviation Management and Operation PO is the analysis of information and the development of conclusions and recommendations related to aviation operations management aspects of a project and supported by valid and reliable referenced material.

Bachelor of Science in Aviation Maintenance (AMNT 490 only) – Core POs

8. Aviation Maintenance. *The student will be able to demonstrate an understanding and application of the fundamentals of aviation maintenance, commonly accepted maintenance practices and global regulations applicable to the aviation maintenance industry.*

The Aviation Maintenance PO includes the study of physical mathematics, weight and balance, FAA regulations, common and special tools and measuring

devices, fluid lines, hardware, aircraft servicing, and documentation and is used to support a project.

Aviation Maintenance includes concepts that can be explained by any of the theoretical knowledge of the experienced aircraft technician in the various areas of aeronautics and the associated concepts and properties as they relate to the project.

The proposal should clearly identify how Aviation Maintenance knowledge will be met through the development of the Capstone and include key words, phrases, and concepts applicable to the research objective, such as:

- Applying Aviation Maintenance knowledge and associated concepts to a project.
- Identifying and applying factors in Aviation Maintenance knowledge in record keeping and FAA regulations as they relate to a project.
- Demonstrating how basic mathematics is used to solve problems in an aviation maintenance environment that focus on weight and balance of aircraft.
- Evaluating all the required Federal Aviation Regulations regarding aircraft maintenance and understand the certification, obligations, privileges and limitations, and career progression of the Airframe and Powerplant mechanic as they relate to a project.
- Evaluating the inspection processes for maintaining an airworthy aircraft and being able to identify inspection criteria and implement an inspection

program in accordance with aircraft manufacturer and FAA specifications as they relate to a project.

- Identifying corrosion types and analyzing and Non-destructive Inspection (NDI) techniques used in an aircraft corrosion preventative program while identifying basic materials used in aircraft structures and be able to apply the techniques as they relate to a project.
- Assessing ground handling and operating procedures, proper servicing, and safety practices used on the flight line and parking areas, and understand coordinated work efforts and interaction between agencies in an aviation environment as they impact aviation safety and security.

The result of Aviation Maintenance is the analysis of information and the development of conclusions and recommendations related knowledge of the experience aircraft technician in the various areas of aviation maintenance aspects of a project and supported by valid and reliable referenced material.

9. Aviation Maintenance Management. *The student will be able to demonstrate an understanding and application of management functions applicable to aviation maintenance operation for all types of aerial vehicles.*

The Aviation Maintenance Management PO is the application of critical thinking to the specific topics of management of aviation management operations that are used to support a project.

Aviation Maintenance Management PO includes an analysis and evaluation of any and all management concepts, techniques, policies and procedures (overhaul, repair, inspection or modification of an aircraft or aircraft component, personnel,

organizational management, maintenance operations, engineering development, planning, forecasting, cost control, reliability, flight scheduling and safety etc.) as they impact and relate to the project.

The proposal should clearly identify how the Aviation Maintenance Management PO will be met through the development of the Capstone and include key words, phrases, and concepts applicable to the research objective, such as:

- Applying established aviation management Regulations and Airworthiness Directives and techniques to the personnel, aircraft and programs associated with all aviation maintenance management to a project.
- Evaluating the requirements of an aviation maintenance and safety program to a maintenance organization, including FAA, EPA, OSHA, and other applicable federal, state, and local regulations and the impact of failures in management in these areas as they relate to a project.
- Developing and recommending improvements to existing management regulations and techniques and theories or new techniques, based upon valid research, as needed to support a project.
- Evaluating the various elements of the Maintenance Steering Group (MSG) program and how they relate to large aircraft maintenance program development as they relate to a project.
- Analyzing the nature of failure and the concept of Reliability Centered Maintenance (RCM), which is common to both civil and US military aircraft maintenance programs as they relate to a project.

- Identifying Maintenance Control by reliability methods and other performance based metrics in order to determine how they apply to the management of a particular aircraft maintenance organization and how these principles can promote cost savings.
- Analyzing aging aircraft philosophies and demonstrate how they relate to cost trade-offs as well as their effect on Operational Availability and other fleet performance metrics.

The result of Aviation Maintenance Management PO is the analysis of information and the development of conclusions and recommendations related to aviation maintenance and management aspects of a project and supported by valid and reliable referenced material.

10. Aviation Maintenance Safety. *The student will be able to demonstrate a comprehension and application of the basic concepts of ground and flight safety pertaining to the aviation maintenance industry.*

The Aviation Maintenance Safety PO is the application of critical thinking to the specific topics of aviation maintenance safety and security that are used to support the research of a specific project.

Aviation Maintenance Safety includes an analysis and evaluation of any and all aviation maintenance safety and security concepts, techniques and procedures (SMS, airfield and other aviation facility security, accident investigation, operational safety, inspection and repair of aircraft structures, coatings, and systems in hangars and on the airfield, etc.) as they impact and relate to the project.

The proposal should clearly identify how the Aviation Maintenance Safety PO will be met through the development of the Capstone and include key words, phrases, and concepts applicable to the research objective, such as:

- Analyzing inspection and repair of aircraft structures, coatings, and systems in hangars and on the airfield as factors in developing a project.
- Applying aviation maintenance safety and security program, agencies, and concepts to a project.
- Identifying the role accident investigation techniques and procedures as they relate to a project.
- Analyzing the impacts of human factors and human error on aviation maintenance safety and security as factors in developing a project.
- Evaluating and analyzing prior aviation accidents for use in developing new regulations and methodologies for improving aviation safety and security.
- Assessing the roles private industry and federal regulators and academic research play in improving aviation maintenance safety and security.
- Developing aviation maintenance safety and security recommendations based upon valid researched evidence from numerous sources.

The result of Aviation Maintenance Safety PO is the analysis of information and the development of conclusions and recommendations related to the aviation maintenance safety and security aspects of a project and supported by valid and reliable referenced material.

Bachelor of Science in Transportation (TRAN 490 only) – Core Program Outcomes

8. ***Air Transport System:*** *The student will identify and apply the fundamentals of air transportation as part of a global transportation system, including the technological, social, economical, and political aspects of the system as they apply to passenger and cargo operations and management.*

The Air Transportation System PO is the application of critical thinking to the specific topics of the air transportation system that are used to support the research of a specific project.

9. ***Highway System:*** *The student will demonstrate and discuss the characteristics of commercial, public, and private vehicles, as well as road and highway infrastructure, and the factors that lead to differences in the economics, pricing, and operations of the various forms of highway transportation and evaluate each method where used.*

The Highway Systems PO is the application of critical thinking to the specific topics of highway systems that are used to support the research of a specific project.

10. ***Rail Systems:*** *The student will apply the operational, economic, and regulatory characteristics of rail vehicles and rail right-of-ways for the movement of people and freight, to identify the advantages and the potential of rail to the transportation system as a whole.*

The Rail System PO is the application of critical thinking to the specific topics of rail systems that are used to support the research of a specific project

11. ***Marine Systems:*** *The student will apply their knowledge of the*

characteristics of marine vessels and the waterways on which they operate, as well as the economics, regulatory, considerations, maritme and international laws, to evaluate the role of marine transport systems in the efficient transport of passengers and cargo.

The Marine Systems PO is the application of critical thinking to the specific topics of marine systems that are used to support the research of a specific project

12. Pipeline Systems: *The student will demonstrate and justify the economics and regulatory aspects of pipelines, to include the movement of liquids, gases, slurries, and other bulk materials, as well as the various environmental and land use issues related to the construction and operation of pipelines.*

The Pipeline Systems PO is the application of critical thinking to the specific topics of pipeline systems that are used to support the research of a specific project.

13. Strategic Intermodal Alliance: *The student will demonstrate through comparisons and analysis, an evaluation of the physical, economic, and regulatory aspects of intermodal transportation alliances at a local, national, and international level.*

The Strategic Intermodal Alliance PO is the application of critical thinking to the specific topics of the Strategic Intermodal Alliance that are used to support the research of a specific project

14. Transportation Legislation: *The students will discuss and recall the*

evolution and development of federal transportation legislation including highway, air, railroad, maritime, transit, and pipeline, including funding mechanisms and past and present underlying problems. A critical review of applicable international treaties and conventions is included.

The Transportation Legislation PO is the application of critical thinking to the specific topics of transportation legislation that are used to support the research of a specific project.

15. ***Transportation and the Environment*:** *The student will identify and describe the challenges of developing and maintaining an effective and efficient transportation system while mitigating the negative environmental impacts, to include economic, regulatory, legal, political, and energy consumption considerations.*

The Transportation and the Environment PO is the application of critical thinking to the specific topics of transportation and the environment that are used to support the research of a specific project.

16. ***Transportation Safety and Security:*** *The student will relate and recommend improvements for safety and security issues pertaining to transportation networks, vehicles, people, and facilities, as well as the construction and design of operational and managerial criteria for the defense of people and property.*

The Transportation Safety and Security PO is the application of critical thinking to the specific topics of transportation safety and security that are used to support the research of a specific project.

17. ***Urban Transportation and City Planning:*** *The student will analyze city*

planning as it relates to meeting the needs of transporting people, goods and cargo. Evaluation will include examples of best and worst city practices and historical, technological and environmental influences. Students will assess city development, urban transportation public and private, motorized and non-motorized, as well as identifying the complex relationships between transportation and land use within the urban environment to evaluate existing and proposed designs.

The Urban Transportation and City Planning PO is the application of critical thinking to the specific topics of urban transportation and city planning that are used to support the research of a specific project.

Bachelor of Science in Aviation Security (SCTY 490 only) – Core Program Outcome

8. ***Aviation Security:*** *The student will demonstrate an understanding and application of the basic and thus advanced concepts of aviation security as they apply to the aviation/aerospace industry for solving security problems.*

The Aviation Security PO is the application of critical thinking to the specific topics of aviation security that are used to support the research of a specific project.

Aviation Security includes an analysis and evaluation of any and all security concepts, techniques, and procedures (SMS, airfield and other aviation facility security, accident investigation, operation safety, Federal Air Marshal Program, terrorism prevention, etc.) as they impact and relate to the project.

9. ***Aviation Security Management and Operations:*** *The student will present and illustrate an understanding and application of management activities as they*

apply to aviation/aerospace security management and operations.

The Aviation Security and Management and Operations PO is the application of critical thinking to the past, present, and future local, state, federal, and international laws and regulations that are used to support a project.

10. ***Aviation Legislation and Law:*** *The student will engage and discuss to present an understanding and application of basic concepts in National and International Legislation and Law as they pertain to the aviation/aerospace security industry.*

The Aviation Legislation and Law PO is the application of critical thinking to the past, present, and future local, state, federal, and international laws and regulations that are used to support a project.

Aviation Legislation and Law includes an analysis and evaluation of any and all regulatory requirement (safety, security, flight and maintenance operation, liability, local, state, federal, and international aviation regulations, environmental, aviation facility development, etc.) as they impact and relate to the project.

The proposal should clearly identify how the Aviation Legislation and Law PO will be met through the development of the Capstone and include key words, phrases, and concepts applicable to the research objective, such as:

- Analyzing and applying the impact of all laws and regulations that impact any aspects of the project.
- Capstone topic and associated concepts to a project.

- Recommending changes to or elimination of existing laws and regulations or the addition of new laws and regulations as they relate to a project.
- Analyzing and evaluating proposed or soon to be implemented laws and regulations for the impact on a project.

The results of Aviation Legislation and law is the analysis of information and the development of conclusions and recommendations related to the aviation legislation and law aspects of a project and supported by valid and reliable referenced material.

11. ***Aviation Safety:*** *The student will compare and discuss in written and spoken format an understanding and application of basic concepts in aviation safety as they pertain to the aviation/aerospace industry in conjunction with aviation security principles.*

The Aviation Safety PO is the application of critical thinking to the specific topics of aviation safety and security that are used to support a project.

Aviation Safety includes an analysis and evaluation of any and all safety and security concepts, techniques, and procedures (SMS, airfield and other aviation facility security, accident investigation, operation safety, Federal Air Marshal Program, terrorism prevention, etc.) as they impact and relate to the project.

The proposal should clearly identify how the Aviation Safety PO will be met through the development of the Capstone and include key words, phrases, and concepts applicable to the research objective, such as:

- Applying aviation safety and security programs, agencies, and concepts to a project.

- Identifying the role accident investigation techniques and procedures as they relate to a project.
- Analyzing the impacts of human factors and human error on aviation safety and security as factors in developing a project.
- Evaluating and analyzing prior aviation accidents for use in developing new regulations and methodologies for improving aviation safety and security.
- Assessing the roles private industry and federal regulators and academic research play in improving aviation safety and security.
- Developing safety and security recommendations based upon valid researched evidence from numerous sources.

The result of Aviation Safety PO is the analysis of information and the development of conclusions and recommendations related to the aviation safety and security aspects of a project and supported by valid and reliable referenced material.

Program Outcome Specific Guidance (BSSM 490 only)

General Education POs (Applies to BSSM Capstone Degree Program only)

1. ***Critical Thinking.*** *The student will apply knowledge at a synthesis level to define and solve problems within professional and personal environments.*

   Critical thinking is the key to a successful Capstone effort. Critical thinking goes beyond a reciting of information researched. It involves the application of knowledge gained through research that develops a defined project in order to meet a specific outcome.

As an integral component of problem solving and decision-making, this combination of skills allows one to form contentions, conclusions, and recommendations. This skill combines analysis, evaluation, conceptualizing, application, solutions, recommendations, synthesis, decision-making, and problem solving through critical research.

The proposal should clearly identify how the Critical Thinking PO will be met through the development of the Capstone and include key words, phrases, and concepts applicable to the research objective, such as:

- Analyzing valid and reliable information and data with a specific purpose that results in the forming of conclusion or recommendations.
- Evaluating information and data as part of a decision making process (problem solving).
- Recommending courses of action (through research) to meet a specific objective.
- Evaluating potential solutions to a project.
- Comparing and contrasting critical variables of a project.
- Identifying and establishing priorities in project.

The result of Critical Thinking is the analysis of information and the development of conclusions and recommendations related to a project and is supported by valid and reliable referenced material.

2. ***Quantitative Reasoning.*** *The student will demonstrate the use of digitally enabled technology (including concepts, techniques and tools of computing),*

mathematics proficiency & analysis techniques to interpret data for the purpose of drawing valid conclusions and solving associated problems.

Quantitative Reasoning is the utilization and application of quantitative concepts and methods in solving real world problems. These concepts (which vary greatly) include basic math, algebra, statistics, geometry, and associated techniques and tools like spreadsheets, graphing, charting and the technology to construct them.

Quantitative Reasoning is the application of quantitative concepts that support and develop a defined project in order to meet a specific outcome. It is the quantitative version of Critical Thinking.

The proposal should clearly identify how the Quantitative Reasoning PO will be met through the development of the Capstone and include key words, phrases, and concepts applicable to the research object, such as:

- Analyzing data that supports a project. (This does not necessarily mean "statistical analysis").
- Applying quantitative data, such as descriptive statistics, charts, graphs, linear representations, tables, figures, databases, and spreadsheets to support a specific objective or outcome.
- Interpret and apply quantitative calculations in support of decision making and problem solving processes.
- Using quantitative concepts to "measure" variables in projects.

The result of Quantitative Reasoning is the application of quantitative concepts in the analysis of information and the development of conclusions and

recommendations related to a project and supported by valid and reliable referenced material.

3. ***Information Literacy.*** *The student will conduct meaningful research, including gathering information from primary and secondary sources and incorporating and documenting source material in his or her writing.*

There must be a valid and reliable relationship established between any topic of discussion and the material used to support that discussion. This material is comprised of identifiable 'primary' sources, and supported 'secondary' sources in order to logically, effectively, and concisely qualify a position on the topic.

Key to the Information Literacy PO is the conduct and reporting of meaningful research that specifically supports the fundamental purpose of the project.

The proposal should clearly identify how the Information Literacy PO will be met by identifying how research will be conducted and reported in support of the development of the Capstone and include key words, phrases, and concepts to the research objective, such as:

- Use of peer reviewed research that is specific to an objective or outcome
- Conducting research that differentiates between primary and secondary sources.
- Information that is reliable and valid to the project.
- Reporting of research that conforms to APA guidelines.

- Information Literacy employs correct research processes that support the development of the project, including analysis and evaluation of the information gathered, not simply randomly gathering data.
- Using research that is properly cited and referenced and can be verified.
- The result of Information Literacy is the conduct of valid and reliable research that supports the analysis, conclusions, and recommendations related to a project.

4. ***Communication.*** *The student will communicate concepts in written, digital and oral forms to present technical and non-technical information.*

In this context, communication is the application of thought into cogent written and oral presentation. Communication is the requisite expression of thought that successfully supports positions on a selected project using the standards identified in the appropriate documents (Publication manual of the American Psychological Association [APA] and Capstone Policy Guide), and that successfully conveys those positions to the intended audience.

Key to the Communication PO is the effective and efficient communication of the Capstone as a whole, utilizing a logical flow and organization that successfully communicates the outcomes of the project to the intended audience. The student must remember that the Capstone paper and presentation are created for the audience.

Effective communication is not necessarily a singular process or tool (such as MS Word or PowerPoint), but an integration of multiple processes and tools. The

proposal must be clear in explaining exactly how the project will be communicated. Communication can take on many forms, including:

- The Capstone itself, which encompasses other components:
    - Correct use of APA guidelines
    - Grammatically correct
    - In-text citations
    - Referenced
    - Logical sequence, flow, transitions

The project presentation. This can take on many forms, including:

- Development of the supporting Power Point presentation
- In-class verbal presentation
- Verbal presentation through Eagle Vision or Skype
- Verbal presentation through teleconferencing
- Individual presentations between instructor and student
- Use of email in cases when voice communication is not reasonable

Participation in the Discussion Board

- Communication between instructor and student in the development of the proposal and Capstone
- Communication between students
- Weekly status checks

The results of Communication are the presentation of valid and reliable research that supports the analysis, conclusions, and recommendations related to a project and the understanding of that information by the intended audience.

5. ***Scientific Literacy.*** *The student will be able to analyze scientific evidence as it relates to the physical world and its interrelationship with human values and interests.*

Scientific Literacy is the application of critical thinking to the general scientific evidence (general physics, mechanics, weather, chemistry, biology, physiology, etc.) that is used to support a project.

The proposal should clearly identify how Scientific Literacy will be met through the development of the Capstone and include key words, phrases, and concepts applicable to the research objective, such as:

- Applying physics or physical laws to a project.
- Identifying and apply factors in aeronautical science as they relate to a project.
- Analyzing weather as a factor in developing a project.
- Evaluating operating characteristics of a system, component, or part as part of an overall project.
- Analyzing mechanical or electrical properties related to a project.
- Assessing physiological factors in human performance.

The result of Scientific Literacy is the analysis of information and the development of conclusions and recommendations related to the scientific aspects of a project and supported by valid and reliable referenced material.

6. ***Cultural Literacy.*** *The student will be able to analyze historical events, cultural artifacts, and philosophical concepts.*

Cultural Literacy is the knowledge, understanding, and application of history, contributions, and perspectives of differing cultural groups to a specific project or the impact on those cultural groups of the topic of a specific project.

Cultural Literacy is the ability to associate an individual's knowledge, understanding, and application of history, contribution, perspectives, and impacts of their own and other cultural groups. These groups are not limited to ethnic, religious or social groups, but include groups associated with industry, professional, and other work or recreationally related entities. Examples of cultures can include:

- Social cultures
- Organizational cultures
- Aviation cultures (or non-aviation cultures)
- Safety cultures
- Religious cultures
- Ethnic cultures

The proposal should clearly identify how Cultural Literacy will be met through the development of the Capstone and include key words, phrases, and concepts applicable to the research objective, such as:

- Analyzing historical events as they impact/influence a project.
- Comparing and contrasting social norms as they impact a specific objective or outcome.
- Examining the evolution of an organization as cultures change.
- Evaluating challenges in managing multi-cultures change.

- Evaluating past and current cultures for trends in aviation safety.

The result of Cultural Literacy is the application and analysis of information in the development of conclusions and recommendations related to the cultural aspects of a project and supported by valid and reliable referenced material.

7. ***Life Long Personal Growth.*** *The student will be able to demonstrate the skills needed to enrich the quality of life through activities, which enhance and promote lifetime learning.*

Life Long Personal Growth is not about the student's personal experience, but broadly with an industry perspective how an individuals' (not the students) personal experience can be demonstrated through the project.

Life Long Personal Growth relates to a compilation of knowledge, skills, and actions taken by individuals in an industry over time to advance one's position and abilities to their benefit. The acquisition of knowledge and skill is followed by an application or action in order to change something.

A demonstration of Life Long Personal Growth skills necessitates an understanding of the Gen Ed POs themselves. These skills are an integral part of an action and planned professional development (both specific to aviation and generalized outside of aviation). The proposal should clearly identify how Life Long Personal Growth is demonstrated through the project. Examples of Life Long Personal Growth can include:

- Evaluating how diversity in professional responsibility supports a specific project.

- Critiquing increase experience through the involvement in a specific project.
- Assessing how education and training impacts performance as it applies to a specific project.
- Evaluating the value of professional development as it applies to a specific project.
- Assessing how professional development (or lack of progression) of career advancement as it applies to a specific project.

The result of Life Long Personal Growth is application of knowledge and skills through professional development that supports the analysis, conclusions, and recommendations related to the life long personal growth aspects of a project and supported by valid and reliable referenced material.

Outcomes 8-11 are the Discipline Program Outcomes for the BSSM degree.

8. *Anticipate, recognize, evaluate and develop safety strategies for hazardous conditions and work practices.*

The Safety PO is the application of critical thinking to the specific topic of safety that is used to support a project.

Safety includes an analysis and evaluation of any and all safety concepts, techniques, and procedures as they impact and relate to a project.

The proposal should clearly identify how the Safety PO will be met through the development of the Capstone and include key words, phrases, and concepts applicable to the research objective, such as:

- Applying safety and programs, agencies, and concepts to a project.

- Identifying the role accident investigation techniques and procedures as they relate to a project.
- Analyzing the impacts of human factors and human error on safety and security as factors in developing a project.
- Evaluating and analyzing prior accidents for use in developing new regulations and methodologies for improving safety.
- Assessing the roles private industry and federal regulators and academic research play in improving safety.
- Developing safety recommendations based upon valid researched evidence from numerous sources.

The result of Safety PO is the analysis of information and the development of conclusions and recommendations related to the safety aspects of a project and supported by valid and reliable referenced material.

9. *Demonstrate the application of safety programs through the understanding of safety and risk management concepts.*
10. *Identify and apply applicable standards, regulations, and codes.*

The PO is the application of critical thinking to the past, present, and future local, state, federal, and international laws and regulations that are used to support a project.

This includes an analysis and evaluation of any and all regulatory requirement (safety, liability, local, state, federal, and international regulations, environmental, facility development, etc.) as they impact and relate to the project.

The proposal should clearly identify how the PO will be met through the

development of the Capstone and include key words, phrases, and concepts applicable to the research objective, such as:

- Analyzing and applying the impact of all laws and regulations that impact any aspects of the project.
- Capstone topic and associated concepts to a project.
- Recommending changes to or elimination of existing laws and regulations or the addition of new laws and regulations as they relate to a project.
- Analyzing and evaluating proposed or soon to be implemented laws and regulations for the impact on a project.

The result is the analysis of information and the development of conclusions and recommendations related to the legislation and law aspects of a project and supported by valid and reliable referenced material.

Outcome 11 will be completed in a non-academic setting with a Coop/Internship/supervised experience and will not be included in the Capstone Project. However, information gathered/learned from this non-academic setting can be included in the Capstone Project.

11. Apply principles of safety and health in a non-academic setting through an intern, cooperative, or supervised experience.

Program Outcome Specific Guidance (BSUSA only)

General Education POs (Apply to the BSUSA Capstone Degree Programs only)

1. Critical Thinking. *Apply knowledge at a synthesis level to define and solve problems within professional and personal environments.*

Critical thinking is the key to a successful Capstone effort. Critical Thinking goes beyond a reciting of information researched. It involves the application of

knowledge gained through research that develops a defined project in order to meet a specific outcome.

As an integral component of problem solving and decision-making, this combination of skills allows one to form contentions, conclusions, and recommendations. This skill combines analysis, evaluation, conceptualizing, application, solutions, recommendations, synthesis, decision-making, and problem solving through critical research.

The proposal should clearly identify how the Critical Thinking PO will be met through the development of the Capstone and include key words, phrases, and concepts applicable to the research objective, such as:

- Analyzing valid and reliable information and data with a specific purpose that results in the forming of conclusion or recommendations.
- Evaluating information and data as part of a decision making process (problem solving).
- Recommending courses of action (through research) to meet a specific objective.
- Evaluating potential solutions to a project.
- Comparing and contrasting critical variables of a project.
- Identifying and establishing priorities in project.

The result of Critical Thinking is the analysis of information and the development of conclusions and recommendations related to a project and is supported by valid and reliable referenced material.

2. ***Quantitative Reasoning.*** *Demonstrate the use of digitally-enabled technology, including concepts, techniques and tools of computing; mathematics proficiency, and analysis techniques to interpret data for the purpose of drawing valid conclusions and solving associated problems.*

Quantitative Reasoning is the utilization and application of quantitative concepts and methods in solving real world problems. These concepts (which vary greatly) include basic math, algebra, statistics, geometry, and associated techniques and tools like spreadsheets, graphing, charting and the technology to construct them.

Quantitative Reasoning is the application of quantitative concepts that support and develop a defined project in order to meet a specific outcome. It is the quantitative version of Critical Thinking.

The proposal should clearly identify how the Quantitative Reasoning PO will be met through the development of the Capstone and include key words, phrases, and concepts applicable to the research object, such as:

- Analyzing data that supports a project. (This does not necessarily mean "statistical analysis").
- Applying quantitative data, such as descriptive statistics, charts, graphs, linear representations, tables, figures, databases, and spreadsheets to support a specific objective or outcome.
- Interpret and apply quantitative calculations in support of decision making and problem solving processes.
- Using quantitative concepts to "measure" variables in projects.

The result of Quantitative Reasoning is the application of quantitative concepts in the analysis of information and the development of conclusions and recommendations related to a project and supported by valid and reliable referenced material.

3. ***Information Literacy.*** *Conduct appropriate research, including gathering information from primary and secondary sources and incorporating and documenting source material in their writing.*

There must be a valid and reliable relationship established between any topic of discussion and the material used to support that discussion. This material is comprised of identifiable 'primary' sources, and supported 'secondary' sources in order to logically, effectively, and concisely qualify a position on the topic.

Key to the Information Literacy PO is the conduct and reporting of meaningful research that specifically supports the fundamental purpose of the project.

The proposal should clearly identify how the Information Literacy PO will be met by identifying how research will be conducted and reported in support of the development of the Capstone and include key words, phrases, and concepts to the research objective, such as:

- Use of peer reviewed research that is specific to an objective or outcome
- Conducting research that differentiates between primary and secondary sources.
- Information that is reliable and valid to the project.
- Reporting of research that conforms to APA guidelines.

- Information Literacy employs correct research processes that support the development of the project, including analysis and evaluation of the information gathered, not simply randomly gathering data.
- Using research that is properly cited and referenced and can be verified.
- The result of Information Literacy is the conduct of valid and reliable research that supports the analysis, conclusions, and recommendations related to a project.

4. ***Communication.*** *Communicate concepts in written, digital and oral forms to present technical and non-technical information.*

In this context, communication is the application of thought into cogent written and oral presentation. Communication is the requisite expression of thought that successfully supports positions on a selected project using the standards identified in the appropriate documents (Publication manual of the American Psychological Association [APA] and Capstone Policy Guide), and that successfully conveys those positions to the intended audience.

Key to the Communication PO is the effective and efficient communication of the Capstone as a whole, utilizing a logical flow and organization that successfully communicates the outcomes of the project to the intended audience. The student must remember that the Capstone paper and presentation are created for the audience.

Effective communication is not necessarily a singular process or tool (such as MS Word or PowerPoint), but an integration of multiple processes and tools. The

proposal must be clear in explaining exactly how the project will be communicated. Communication can take on many forms, including:

- The Capstone itself, which encompasses other components:
    - Correct use of APA guidelines
    - Grammatically correct
    - In-text citations
    - Referenced
    - Logical sequence, flow, transitions

The project presentation. This can take on many forms, including:

- Development of the supporting Power Point presentation
- In-class verbal presentation
- Verbal presentation through Eagle Vision or Skype
- Verbal presentation through teleconferencing
- Individual presentations between instructor and student
- Use of email in cases when voice communication is not reasonable

Participation in the Discussion Board

- Communication between instructor and student in the development of the proposal and Capstone
- Communication between students
- Weekly status checks (online courses)

The results of Communication is the presentation of valid and reliable research that supports the analysis, conclusions, and recommendations related to a project and the understanding of that information by the intended audience.

5. ***Scientific Literacy.*** *Analyze scientific evidence as it relates to the physical world and its interrelationship with human values and interests.*

Scientific Literacy is the application of critical thinking to the general scientific evidence (general physics, mechanics, weather, chemistry, biology, physiology, etc.) that is used to support a project.

The proposal should clearly identify how Scientific Literacy will be met through the development of the Capstone and include key words, phrases, and concepts applicable to the research objective, such as:

- Applying physics or physical laws to a project.
- Identifying and apply factors in aeronautical science as they relate to a project.
- Analyzing weather as a factor in developing a project.
- Evaluating operating characteristics of a system, component, or part as part of an overall project.
- Analyzing mechanical or electrical properties related to a project.
- Assessing physiological factors in human performance.

The result of Scientific Literacy is the analysis of information and the development of conclusions and recommendations related to the scientific aspects of a project and supported by valid and reliable referenced material.

6. ***Cultural Literacy.*** *Analyze historical events, cultural artifacts, and philosophical concepts that are relevant to their selected field of study or influential to the development of humanity.*

Cultural Literacy is the knowledge, understanding, and application of history, contributions, and perspectives of differing cultural groups to a specific project or the impact on those cultural groups of the topic of a specific project.

Cultural Literacy is the ability to associate an individual's knowledge, understanding, and application of history, contribution, perspectives, and impacts of their own and other cultural groups. These groups are not limited to ethnic, religious or social groups, but include groups associated with industry, professional, and other work or recreationally related entities. Examples of cultures can include:

- Social cultures
- Organizational cultures
- Aviation cultures (or non-aviation cultures)
- Safety cultures
- Religious cultures
- Ethnic cultures

The proposal should clearly identify how Cultural Literacy will be met through the development of the Capstone and include key words, phrases, and concepts applicable to the research objective, such as:

- Analyzing historical events as they impact/influence a project.
- Comparing and contrasting social norms as they impact a specific objective or outcome.
- Examining the evolution of an organization as cultures change.
- Evaluating challenges in managing multi-cultures change.

- Evaluating past and current cultures for trends in aviation safety.

The result of Cultural Literacy is the application and analysis of information in the development of conclusions and recommendations related to the cultural aspects of a project and supported by valid and reliable referenced material.

7. ***Life Long Personal Growth.*** *Develop skills needed to enrich the quality of life through activities that enhance and promote lifetime learning.*

Life Long Personal Growth is not about the student's personal experience, but broadly with an industry perspective how an individuals' (not the students) personal experience can be demonstrated through the project.

Life Long Personal Growth relates to a compilation of knowledge, skills, and actions taken by individuals in an industry over time to advance one's position and abilities to their benefit. The acquisition of knowledge and skill is followed by an application or action in order to change something.

A demonstration of Life Long Personal Growth skills necessitates an understanding of the Gen Ed POs themselves. These skills are an integral part of an action and planned professional development (both specific to aviation and generalized outside of aviation). The proposal should clearly identify how Life Long Personal Growth is demonstrated through the project. Examples of Life Long Personal Growth can include:

- Evaluating how diversity in professional responsibility supports a specific project.
- Critiquing increase experience through the involvement in a specific project.

- Assessing how education and training impacts performance as it applies to a specific project.
- Evaluating the value of professional development as it applies to a specific project.
- Assessing how professional development (or lack of progression) of career advancement as it applies to a specific project.

The result of Life Long Personal Growth is application of knowledge and skills through professional development that supports the analysis, conclusions, and recommendations related to the life long personal growth aspects of a project and supported by valid and reliable referenced material.

Outcomes 8 through 11 are BSUSA degree program core competencies.

8. ***Unmanned Systems Fundamentals***. *Apply the fundamentals of unmanned systems, including the technological, economical, legal, social, political, and environmental aspects of unmanned systems operations.*
9. ***Unmanned Systems Applications***. *Evaluate and suggest appropriate unmanned systems elements, configurations, and operational criteria supporting different applications within various environments through analysis and comparison.*
10. ***Unmanned Systems Performance.*** *Identify and apply performance criteria to solve basic operational problems such as task oriented asset and payload selection and distinction of acquisition of design criteria.*

11. ***Research.*** *Demonstrate appropriate selection and application of research to support program objectives and solving of identified problems specific to their course subject matter.*

Outcomes 12, 13, 14 are track-specific program outcomes – a student will only have to demonstrate competencies relating to their specific track.

12. ***Administrative Track.*** *Analyze a variety of managerial aspects and examine how they apply to different unmanned systems applications. The comprehension of administrative functions within organizations and relations between entities will enable students to apply management concepts to selected unmanned systems topics.*
13. ***Operations Track.*** *Analyze different task requirements under varying operational circumstances in order to select appropriate solutions during mission planning and execution. The comprehension of systems capabilities and limitations will enable students to support successful employment of the craft, its sensors, and/or its payload.*
14. ***Development Track.*** *Apply engineering knowledge and skills towards the design, development, and validation of unmanned systems applications. The comprehension of operational, engineering and design, and test requirements will enable students to support development efforts in unmanned systems applications.*

Submission of Final Capstone Documents

Upon completion of the capstone project, faculty will complete the interactive rubrics embedded in the Canvas Course Template grade center and then provide feedback

to the student. This feedback must be provided in Crocodoc or Word. Once completed the faculty member will submit a copy of the completed rubrics and completed project to the student's imaging file (procedures can be found on the Faculty Services page of ERNIE, Capstone Resource Center, or see Appendix P). The appropriate Degree Program Chair/Associate Program Chair (specific email addresses will be provided via email to faculty members) should be included as an info addressee with the conveying email. The final project and the rubric will be reviewed by the College representative to ensure academic integrity, continuity and consistency. The review will also provide an opportunity to collect direct assessment data for applicable program assessment.

Note: As noted previously, the capstone course must be taken as the final course in the degree program. With approval from the Chair of the Department of Aeronautics Undergraduate Studies, a student may undertake the Capstone course in parallel with **ONE** other course.

Plagiarism

All projects are submitted through plagiarism detection software. Plagiarism cases are taken very seriously by the University. Please review the University policy concerning plagiarism and other types of academic misconduct. Students should avoid simply cutting and pasting materials from other course assignments. Instead they should rework, rephrase, update, change, or revise previous research to be integrated into the final capstone document. University policy does not condone plagiarism and actions in accordance with the Worldwide Catalog and POM will be taken by the faculty member.

Course Incomplete Options

Students may petition their faculty member for an incomplete grade for the capstone course if the student has not completed all requirements within the 9-week term timeframe. However, the awarding of a requested incomplete is not automatic; it is the

decision of the individual faculty member. If an incomplete grade is approved and the student has not completed the course at the end of the approved incomplete period (up to a 30 day limit) the course must be retaken by the student. All university policies concerning an incomplete grade apply.

APPENDICES

Appendix A - IRB Policy and Application

Appendix B - BSA Individual Project Proposal Template

ERNIE>Services>Capstone Resource Center>COA Capstone Resources

Appendix C - BSA Individual Project Paper Template

ERNIE>Services>Capstone Resource Center>COA Capstone Resources

Appendix D - BSA Program Outcome Rubrics

ERNIE>Services>Capstone Resource Center>COA Capstone Resources

Appendix E - BSAS Individual Project Proposal Template

ERNIE>Services>Capstone Resource Center>COA Capstone Resources

Appendix F - BSAS Individual Project Paper Template

ERNIE> Services>Capstone Resource Center>COA Capstone Resources

Appendix G - BSAS Program Outcome Rubrics

ERNIE>Services>Capstone Resource Center>COA Capstone Resources

Appendix H - BSAvM Individual Project Proposal Template

ERNIE>Services>Capstone Resource Center>COA Capstone Resources

Appendix I – BSAvM Individual Project Template

ERNIE>Services>Capstone Resource Center>COA Capstone Resources

Appendix J – BSAvM Program Outcome Rubrics

ERNIE>Services>Capstone Resource Center>COA Capstone Resources

Appendix K – BSSM Individual Project Proposal Template

ERNIE>Services>Capstone Resource Center>COA Capstone Resources

APPENDICES (Con't)

Appendix L – BSSM Individual Project Template

ERNIE>Services>Capstone Resource Center>COA Capstone Resources

Appendix M – BSSM Program Outcome Rubrics

ERNIE>Services>Capstone Resource Center>COA Capstone Resources

Appendix N - BST Individual Project Proposal Template

ERNIE>Services>Capstone Resource Center>COA Capstone Resources

Appendix O - BST Individual Project Template

ERNIE>Services>Capstone Resource Center>COA Capstone Resources

Appendix P – BST Program Outcome Rubrics

ERNIE>Services>Capstone Resource Center>COA Capstone Resources

Appendix Q - BSUSA Individual Project Proposal Template

ERNIE>Services>Capstone Resource Center>COA Capstone Resources

Appendix R - BSUSA Individual Project Template

ERNIE>Services>Capstone Resource Center>COA Capstone Resources

Appendix S – BSUSA Program Outcome Rubrics

ERNIE>Services>Capstone Resource Center>COA Capstone Resources

Appendix T - Capstone Project Imaging Submission Instructions

ERNIE>Services>Capstone Resource Center>COA Capstone Resources

Appendix U – Important Info for the Undergrad Capstone Instructor & Proposal Reviewer

ERNIE>Services>Capstone Resource Center>COA Capstone Resources

APPENDIX A

IRB Policy and Application

IRB Instructions

Embry-Riddle Aeronautical University
University Policy on Human Subjects

The University fully complies with the policy on the use of **human subjects** as required by the Public Health Service (PHS) (45 CFR 46 as revised). Any proposal/project involving **human subjects,** as defined by 45 CFR 46, requires approval by the University ***Institutional Review Board (IRB) for the Protection of Human Subjects.***

Additional information can be found in APPM 2.8.5 at www.erau.edu/appm and http://research.erau.edu/faculty-resources/institutional-review-board/forms/index.html.