The Department of Aerospace and Ocean Engineering has used the capstone design sequence, AOE 4056, 4066, as the context through which we satisfy the core curriculum’s writing intensive requirement since the inception of that requirement. This has been a very successful way to teach our students how to prepare discipline specific written communications as well as giving them experience in oral presentation of their work. While the design sequence has been a successful focus of these efforts, we have also been preparing students for this experience by giving them practice in written and oral communication in a number of earlier courses. These efforts, along with the design sequence experience will be discussed below and rolled into this larger Spoken, Visual and Written Communication Plan.

Program Goals

The goals of this program are to instruct our students in discipline appropriate communication skills. We wish to give the students the opportunity to exercise these skills throughout the curriculum with their experiences gradually building to the intensive design sequence experience. Specific student outcomes include:

1. Writing clear, concise, and coherent documents that conform to Standard Written English.
2. Speaking clearly and articulately in front of groups using appropriate organization and effective physical and vocal delivery.
3. Proficiency using common forms of engineering communication including laboratory reports, project reports, progress reports and design reports.
4. Effectively use a variety of means (e.g., charts, graphs, tables, drawings) to visually represent engineering data/information as appropriate.
5. Designing information to make it easily accessible for audiences (e.g. using meaningful headings, subheadings, lists, and related visual cues to make documents easy to skim; designing slides to help audiences easily follow presentations; providing tables
of contents, lists of figures/tables, indexes).
6. Developing documents and presentations collaboratively in a team environment.
7. Communicating ethically.

Curriculum Plan

The Communications Plan spans the sophomore, junior and senior years with each experience building on previous ones. Although the bulk of their communications experience comes in the senior design sequence, students get the opportunity to exercise their communication skills in several courses throughout the curriculum. All of these experiences are presently in place in
our curriculum and thus no phasing in is necessary. Curriculum sheets for both the Aerospace Engineering and Ocean Engineering degree are attached to assist the reader in seeing how these experiences fit into a student’s course of study.

Sophomore Year

AOE 2204 Introduction to Ocean Engineering (Fall of sophomore year) Students are assigned a 1200-1800 word research paper on a topic of their choosing pertaining to a recent development in the Ocean Engineering field. They are asked to format figures, tables and references in the style of a journal in the field. The papers are graded 60% on technical content and 40% on communication content. Approximately half of the reports are presented orally in class with the presentations critiqued by the class.

Students begin to work on writing skills. Visual expression and spoken communication skills are exercised by some whose efforts are observed and critiqued by all.

Junior Year

AOE 3014 Aero/Hydrodynamics (Fall of junior year) Students write a report on a project, structured as a report to an employer, explaining and interpreting the results. Instructions are given regarding the format of the report.

Professional writing skills are developed by all.

AOE 3054 Experimental Methods (Spring of junior year) Students are required to:

- Write and submit seven individual technical reports (one every two weeks). Reports are graded based on technical content, format and quality of writing. Reports are typically 15 to 25 pages in length, of which half is writing and half figures.
- Write and submit one group report (groups are typically 6 students).
- Develop and maintain, as a group, detailed Excel documentation (technical notes, details and results) for a total of 8 experimental tests.
- Collaborate and act as a group to overcome the instructional and technical challenges of each practical component of the course. Writing skills are further developed. Good visual organization of material in a spreadsheet is introduced. Group collaboration skills are developed.

Senior Year
AOE 3044 Boundary Layer and Heat Transfer (Fall of senior year)
Students are required to produce six written reports documenting computer projects. The format is much like a laboratory report and instructions are given on content.

In AOE 3044, students are given further opportunity to develop competency in writing professional reports.
AOE 4154 Aerospace Engineering Laboratory
AOE 4254 Ocean Engineering Laboratory (both Fall of senior year)
These are parallel laboratory courses for the Aerospace and Ocean majors respectively. Students are required to produce seven written lab reports that exercise both written and graphical communication. These reports are graded on grammar and sentence construction as well as visual presentation of results.

By this course, students are expected to produce organized written reports including effective visual content (both figures and graphs).

AOE 4065/4066 Senior Design Sequence (two courses Fall and Spring of senior year)
These capstone design courses have been used to satisfy the writing intensive requirements of the core curriculum and are the focal point of this communications plan.

These courses require the students to integrate their technical background with writing and verbal communication skills to design a system or vehicle and to communicate the value of that design to others. A progressive sequence of individual iterative technical writing assignments results in a final group report that is normally limited to 100 pages. The design projects the students are working on and writing about are different from section to section and group to group but the pedagogy of the course remains consistent.

Student-teacher interaction forms the basis of the course. The professor teaching the course meets the class during regular class periods. He provides general instruction in the design process. Students interact with the professor in the process of carrying out their design work and then write up reports that are critiqued by the professor and returned for revision, often more than once. The professor will provide guidance in writing style and suggestions for improvement of both content and presentation. Instructional material on the expected writing style and examples of technical writing are provided. Additionally, students are presented with the guidelines for authors published by a major technical journal in the field.
In reviewing students’ written work, faculty look for the quality of the technical content, proper grammar, correct referencing of outside sources, effective use of graphical information, a logical presentation of the material, overall success in communicating and consistency of style. The standards against which the students’ work is judged are representative of the expectations of the discipline.

Students work in teams to perform their design work with different areas of technical responsibility being assigned to different individuals. Each individual is responsible for writing five or six small reports per semester. The material that forms the basis for these reports is presented orally at weekly meetings to both the professor and to the other members of the student team. The student must defend his or her work using charts and figures. Revised versions of the written reports are melded into a single document to report on the work of the team at the end of each semester. This requires the students to blend their work into a document with consistent style and tone.
The interaction between students as well as the student-teacher interaction that is an inherent part of these courses provides frequent opportunity for informal writing both in e-mails and in print. This type of communication is typical of professional interaction in these fields. Students will receive strong feedback from their peers if their communication skills are less than sufficient.

Examples of the final work are available on the web: http://www.aoe.vt.edu/~mason/Mason_f/SD1SrDesRpts.html

While the students often complain strongly about the quantity of writing, revision and presentations they are asked to do, they seem to feel that they benefit from it. Surveys of the students have shown generally positive to very positive opinions on the issues explored by the survey. The students felt that both their written and oral communication skills were improved by the courses. In all cases, they felt that the writing assignments improved both their writing skills and their understanding of the subject material.

The greatest strength of the course sequence is that it exposes the students to the environment they will be working in when they graduate. They are expected to develop and exercise both their technical and communication skills.

Assessment Plan

The achievement of the outcomes listed above will be assessed in four ways:

- Student work on each communication assignment is evaluated by the faculty member teaching each course to assess individual and group performance.
- Students are surveyed at the end of the senior year to assess the extent to which they feel they have been prepared in the areas of spoken, visual and written communication.
- Selected groups of alumni are surveyed to assess the extent to which they feel they have been prepared in the areas of spoken, visual and written communication.
- The employers of those selected groups of alumni are surveyed to assess the extent to which they feel they have been prepared in the areas of spoken, visual and written communication.

The above data will be collected annually. The results of this assessment will be compiled by the departmental assessment coordinator and reviewed by the department head and assistant
department head as it becomes available. The results are presented to the faculty during our annual review of curricular assessment data and they will decide on any indicated changes to the curriculum.

Both the curricular content and the assessment process are analogous to what has been done in the past in satisfaction of the writing intensive core curriculum requirement. The difference is that we will now expand our attention to the visual and spoken components particularly in assessing student performance in the design sequence. No resources from outside the department will be necessary.