We designed a new lab science course on stratospheric ballooning (SB), titled Exploring the Edge of Space. The course, which starts in the upcoming semester, brings together two groups of students simultaneously: Mainstream liberal arts students and students in the college’s Honors program. The Honors students meet an additional hour weekly, review scientific literature extensively, and complete a capstone project. The course design is a collaboration between the physics and earth science departments at Central Lakes College, and is drawn on the five-year experience of the authors doing SB flights, many in collaboration with the Bemidji State University SB program. Unlike the past SB flights based on a semester project within pre-existing course curricula, the SB project is the kernel of this course. Therefore, it will allow students to focus on learning the knowledge, skills, and attitudes necessary for the success of a large science-technology project while also fulfilling the outcomes to assure transferability. Those students who complete the major project activities, including, but not limited to, developing experiment and revising draft reports will achieve the learning outcomes in the goal area of Natural Science of the Minnesota Transfer Curriculum as well as some of the Undergraduate Physics Laboratory Curriculum recommended by the American Association of Physics Teachers. Past experience has shown that students need to spend considerable time building competency in the areas of working in teams with diverse groups, working with technology, critical thinking, complex problem solving, written communication, applying knowledge in field situations, and science literacy in both earth science concepts and research. This course will focus on developing those skills in an entirely inquiry-based, workshop lab environment. Students will be guided through the learning of essential concepts, and supported in doing their own research, project development, and experimental design.

### Course Outcomes

**Minnesota Transfer Curriculum (MnTC) & some AAPT Undergraduate Physics Outcomes**

#### MnTC

- Demonstrate understanding of scientific theories
- Evaluate societal significance of experiments in atmospheric science
- Formulate hypotheses

#### AAPT

- Present results and ideas with reasoned arguments supported by experimental evidence and utilizing appropriate and authentic written and verbal forms
- Analyze and display data using statistical methods and critically interpret the validity and limitations of these data and their uncertainties
- Collect, analyze, and interpret real data from personal observations of the physical world to develop a physical and geoscientific worldview
- Develop, engineer, and troubleshoot experiments constructed for testing models and hypotheses while working within specific constraints such as cost, time, safety, and available equipment
- Become proficient using common test equipment in a range of standard laboratory measurements while being cognizant of device limitations
- Develop abstract representations of real systems, study them in the laboratory, seek to understand their limitations and uncertainties, and use their models to make predictions

### Honors

- Compare a summary report of their independent research of scientific literature; Critically discuss scientific topics; and Independently conduct original SB capstone project, that embodies the spirit and purpose of the Honors designation.

### Tentative course outline for Fall Semester, 2016

**Week 1**

- Intro to scientific posters and poster sessions.
- Assignment: Tethered launch on Central Lakes College campus grounds.

**Week 2**

- Team scientific poster due at end of week for printing and assembly.
- Data analysis, report writing, designing and making scientific posters.

**Week 3**

- Week 3 due: Write lab reports.
- Week 3 due: Write draft literature review.
- Week 3 due: Independent research report draft due for instructor comments.

**Week 4**

- Team scientific poster due at end of week for printing and assembly.
- Week 4 due: Independent research report and capstone project report due.

**Week 5**

- Experiment assembly and testing.

**Week 6**

- Background concept building, team building, developing and building SB experiment, learning about SB launch, flight, and recovery systems.

**Week 7**

- SB flight debrief and cleanup. Begin data analysis and report writing.

**Week 8**

- SB flight data analysis and scientific report writing continued.

**Week 9**

- Draft report due for instructor comment. Continue working on poster.

**Week 10**

- Data analysis, report writing, designing and making scientific poster.

**Week 11**

- Independent research report draft due for instructor comments.

**Week 12**

- All reports due. Scientific poster session will be on scheduled final.

### Assessment Instruments

<table>
<thead>
<tr>
<th>Whole Class</th>
<th>Honors</th>
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<tbody>
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<td>Poster presentations</td>
<td>Capstone project</td>
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<td>Reading notes</td>
<td>Extensive literature review</td>
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<tr>
<td>Research/design notes</td>
<td>Literature review</td>
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### Honors program at CLC

Courses in the Honors Program emphasize independent inquiry, informed discourse, and direct application within small, transformative, and seminar-style classes that embrace detailed examinations of the material and feature close working relationships with instructors. In addition, students learn to leverage course materials so that they can affect the world around them in positive ways. Activities may include (original) research, inquiry based investigation(s), collaboration, or other project types that the instructor deems worthy of the Honors’ designation.