Stratospheric ballooning is a tool of enormous promise to help STEM college faculty foster highly engaged student learning of science for a wide range of students at a wide range of institutions. High altitude ballooning offers a platform for investigating science and engineering across many fields. Ballooning has been used in courses and experiences for not just undergraduate science majors, but also all undergraduates—including future teachers who, in turn, are the key to improving K-12 science education. Technological advances are lowering the cost of and expertise levels required to make launches and analyze data.

Balloon offers a context within which faculty can use effective research-based educational practices. Studies document that while many faculty are aware of STEM education research findings and new instructional practices, many fewer understand the underlying pedagogical principles behind the practices and have been able to implement new practices effectively. Changing one’s instructional practice is difficult to do and educators trying to do this need appropriate supports including time to try, reflect, try again, discuss with others, etc. Given this, how faculty implement new practices can be widely variable with different levels of success in engaging students successfully in learning STEM content.

This session reviews a selection of STEM education research topics and focuses on concrete examples to help college instructors involved in ballooning. Specific facets of instructional practice are examined as are findings related to how to support faculty as they develop professionally and work to implement new practices.

We find that the emerging field of disciple-based education research (DBER) offers a productive framework within which to highlight why ballooning can very naturally inspire and support faculty in using research-based pedagogical practices to foster highly engaged student learning of science. DBER documents learning and teaching in a discipline from “a perspective that reflects the discipline’s priorities, worldview, knowledge, and practices” and the most recent research on learning and cognition (NAS, 2012).

All students deserve the opportunity to become science-literate citizens and prepared for a workforce where science, technology, engineering and mathematics skills are key to many meaningful and lucrative jobs. Educators at all levels have a responsibility to offer engaging learning opportunities in STEM topics. In particular, STEM faculty are in one of the most critical positions to impact
This was the case during our earlier two grants where student learning assessment showed marked improvement in learning as ballooning implementation was repeated 3 or more times in a specific course (practically as well as statistically significant increases occurring). There were also marked differences between instructors. Previous work trained faculty on doing balloon launches but did not focus on application to specific science disciplines and curricula. Therefore, there is a need to determine “best practices” for implementing ballooning in courses and provide a system that supports a group of faculty in a “journey” to implement effectively to obtain strong learning outcomes consistently in varied STEM fields.

Promoting and supporting ballooning as an evidence-based effective strategy for STEM educator on a large scale offers other challenges. In our prior NSF grant, we surveyed STEM deans and department heads across the US and found that most do not understand ballooning. There is a need to grab the attention, communicate, and demonstrate the capabilities of ballooning to faculty teaching STEM to undergrads. Promoting the value of ballooning as an effective instructional strategy and a way to engage in meaningful collaborative research is needed. Faculty learning how and then sustaining their use of ballooning with undergraduate students require training that is easily available, low cost, effective, and comprehensive. It needs to cover topics of:

- Launching/tracking/recovering balloon
- Course curricula and science discipline applications
- Best evidence-based instructional practices for implementation in courses to support engaged student learning

In addition to training, those new to ballooning need to be integrated into an academic ballooning community which can provide them with collaborative and synergistic project opportunities, continued training, and opportunities for professional growth and accomplishment (publications, conference presentations, leadership). They, in turn, expand the community and can help to introduce, integrate, and grow new faculty in ballooning so that more students have access to engaged STEM learning.