Abstract – One of us (LGR) has taught in the distance-learning mode for many years, and has offered a graduate level statistics course for many more. This year, we offered ‘Statistics for Scientists and Engineers’ in the distance-learning mode for the first time. With the assistance of an instructional designer (Scheer), we have redesigned this class to incorporate the advantages of the interactive video-conferencing environment. Our goal was to adapt best practices of the modern classroom to the distance-learning environment. The class was diverse including on-grounds students from a variety of disciplines, and working engineers from sites around Virginia and other states. We will review our innovations, the results we achieved, and student assessments of their experiences in this course.

Index Terms – Assessing instruction, Asynchronous learning, Distance learning, Statistics.

STATISTICS FOR SCIENTISTS AND ENGINEERS
A graduate course Statistics for Scientists and Engineers has been taught at the University of Virginia since 1985. It was originally offered as part of our Master’s Program in Manufacturing Systems Engineering. The audience for this class has expanded greatly in recent years; it is now required by several graduate programs and strongly recommended by others. This year, we decided to offer Statistics for Scientists and Engineers in the distance-learning mode, and experiment with a new classroom environment. We selected a popular text [1], and used the Minitab Software [2,3]. We also had a full time teaching graduate assistant.

THE CGEP INTERACTIVE VIDEO CLASSROOM
The Commonwealth of Virginia’s Graduate Engineering Program (CGEP) is a cooperative venture among several state universities: the University of Virginia, Virginia Tech, Old Dominion University, Virginia Commonwealth University, and George Mason University. Other schools and industries provide multiple receive sites around the Commonwealth, the Mid-Atlantic region, and now the entire nation. Through CGEP, we broadcast our regular graduate courses and each class has a local audience of full time graduate students, as well as those students enrolled through the School of Continuing and Professional Studies. This year, the CGEP classroom has been upgraded in several ways: new equipment, a new layout for the instructor’s console, and a new user-interface. The latter provides the instructor control over what the students see: a computer monitor, students in the UVa classroom, students at remote sites, the view of a document camera, or the instructor. The main innovation from the teacher’s point of view is that everything that is broadcast is now under his or her control.

COMPOSITION OF THE CLASS
We had 80 students enrolled in the Statistics class this semester- half were on-grounds and half off-grounds. The off-grounds students were distributed at sites around Virginia, and a few other states (Minnesota, Michigan). The on-grounds students represented a variety of disciplines (Mechanical and Aerospace, Civil, Systems, Electrical, Computer Science, Materials Science, and Engineering Physics) and were about evenly divided between Masters and PhD students. The off-grounds students may be in a degree program, but they do not have to be.

PRACTICES
All notes for this class were produced as PowerPoint slides, and were available to the students before each class. There were a number of start-up problems; we experimented with different slide layouts and backgrounds, and we learned to select symbols and features of the equation editor that most students would have available on their own computer. All lectures were available as streaming video on the worldwide web, and the corresponding class notes were posted on the Instructional Toolkit.

ASSESSMENTS
We assessed all aspects of this class. Several surveys were used to gather students’ reactions to the course and its pedagogy. We were especially interested in how the logistics and technology were perceived by the students. Some of the questions are shown below; the complete analysis of the data from this class will be presented at FIE 2004.
First day survey
1. Who, where, contact information, background
2. Why are you taking this class?
3. What do you hope to get from this class? What are your personal learning objectives?

Survey at end of each exam
1. Rating scales dealing with difficulty, length, fairness, representativeness, and goodness of the test
2. Comments on the class, instructor, coverage, book
3. Time needed to complete the exam

Survey on class progress and logistics
1. What do you like best about this course?
2. What do you like least about this course?
3. What can we do to improve MAE/APMA643?
4. Please assess the workload for this course
5. Please assess the pace of this class
6. Please assess the pace at which the instructor speaks
7. Please comment on the sound quality and picture quality of broadcast (televised class).
8. Class notes – do you prefer the PowerPoint format to my (hand-) writing the notes on blue paper?

Streaming Video
10. Have you watched the streaming video for this class on the Internet?
   ___ Yes I watch it regularly
   ___ I watch it occasionally
   ___ I watched it only a few times
   ___ I have never watched the streaming video
11. Has the asynchronous class mode worked for you?
   Can you access the streaming video easily, and does it provide adequate instructional value?
12. Please comment on the sound quality and picture quality of the streaming video.
13. Do you benefit from having the class notes on the homepage? Do you print them out, or study them online?
14. Are the homework assignments valuable in helping you learn the material?
15. Is the Textbook (Milton and Arnold) a good choice for this class? What do you like and dislike about this book?
16. Is this course providing what you expected?
17. Are you getting what you want from MAE643 so far?
18. Please provide any additional comments, concerns, or suggestions.

Overall Class Evaluation
1. Did you get what you wanted from this class?
2. What topic(s) did you find most valuable?
3. Which topic(s) did you find least valuable?
4. How can we improve this class? What changes would you suggest? Are there additional topics we should have covered?
5. Did you find the book useful? Enjoyable? Clear?
6. Did you find the class toolkit page useful? Is it valuable to post class notes on the web?
7. Was the distance-education mode acceptable for this class? Should we do it this way again?
8. Was the test format acceptable? Do you prefer in-class or take-home exams? Do you feel the tests helped you to learn the material?
9. Will you be able to use the material from this class in your job or research?
10. Would you recommend this class to a coworker or another student?

DATABASE AND PLANNED ANALYSIS
The database consists of responses to all these survey items and performance measures for each student (test scores, homework, final grades). We will examine a number of key items separately for on-grounds and off-grounds students, and also assess whether there were differences in overall performance.

LESSONS LEARNED (ALREADY)
Some things are already clear - mostly from the experience of teaching this class in this mode for the first time. We really tried to make this class interactive, but it was hard. There is a large amount of technical content, and Statistics involves new ways of thinking for most students. The class had a wide range of abilities and this tends to intimidate some students. Finally the off-grounds students were often away during class times, and viewed the class as streaming video on the Internet. Some on-grounds students did also.
We did manage to cover more material in this class than in the typical course. This was largely due to the fact that all notes were distributed to the students in advance.
The data analysis will explore what differences there are between on- and off-grounds students. A previous analysis [5] of an array of engineering courses found no performance differences between these two types of students.

REFERENCES