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An Evaluation of Navy Video Teletraining (VTT)

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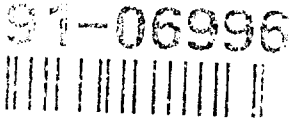

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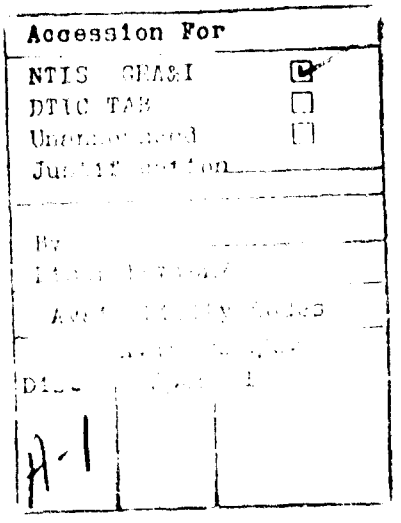

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An Evaluation of Navy Video Teletraining (VTT)

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ABSTRACT

This research memorandum evaluates the use of Video Teletraining (VTT) to deliver Navy F-school instruction to students at remote sites. Using data collected from a four-site, fully interactive audio-video network, the analysis focuses on system utilization, training effectiveness, downtime, and savings to the Navy.

EXECUTIVE SUMMARY

Video Teletraining (VTT) is a method of delivering Navy schoolhouse instruction to students at remote sites. VTT involves the use of a full duplex audio-visual network between existing schoolhouses and remote locations. The network is fully interactive in that participants at different locations can talk to and see one another in real time.

In March 1989, the Navy established a multipoint secure VTT system with sites at Charleston, Dam Neck, Mayport, and Norfolk. All sites are interconnected via commercial satellite. The Center for Naval Analyses was tasked by Commander, Naval Education and Training (CNET) to evaluate this system during its first six months of operation. Results from this analysis can be grouped into four areas:

- System utilization
- Training effectiveness
- Downtime
- Net savings to the Navy.

SYSTEM UTILIZATION

The VTT network consisted of six classrooms. Dam Neck and Charleston each had two classrooms, and Norfolk and Mayport each had one classroom. On the average weekday, 46 percent of the classrooms were being used for either training or holding conferences. The principal reason for the low overall utilization rate was that the second classrooms at both Dam Neck and Charleston were typically unused. This problem has recently been addressed by eliminating the second classrooms at both of these sites and establishing a new site at Newport.

VTT was employed to train 705 students in 25 convenings of 12 F-school courses. In addition, the system was used to support Navy training exercises, conferences, and Office of Civilian Personnel Management (OCPM) training. The total attendance from these other uses of the system was 737 persons, which was achieved using only 16 convenings. Relative to VTT course training, the other uses had much higher throughput per convening because they typically used more sites per convening and they had higher attendance per site.

TRAINING EFFECTIVENESS

Course grades of students at the remote sites were compared to those of students at the originating site to determine how effective the VTT method of instruction is relative to the traditional method of instruction. Students at the remote sites serve as the test group in the

evaluation because they could see, hear, and speak with the instructor exclusively through the VTT technology. In contrast, students in the same room as the instructor (i.e., at the originating site) serve as the control group because they interacted with the instructor without using the VTT technology. Although students at the originating site are the best available control group, they are not a perfect control group since some of their learning (e.g., graphics on television monitor) did rely on the VTT technology.

The average grade across all sites was 87.2 on a scale of 0 to 100. Controlling for a student's mental aptitude and experience in the Navy, the number of sites, and differences in grading across courses, a regression analysis found that grades at remote sites were, on average, 2.4 points lower than grades at the originating site. This suggests that the average grade under VTT would be lower than the average grade under traditional methods of instruction. The difference in grades was small enough that failure rates (i.e., percentage of students with grades less than 70) did not differ significantly between the two training methods. Since the VTT Steering Committee has selected the difference in failure rates as the relevant measure of training effectiveness, the difference in grades is not considered to be practically significant. However, it should be noted that these courses typically have very low failure rates. If VTT was used in courses with relatively high failure rates, the difference in grades could become practically significant.

In a survey of VTT students, 64.2 percent of those at remote sites preferred traditional methods of instruction to VTT. The survey also identified three main areas of deficiency in the VTT method of instruction: the quality of the video, the level of instructor-student interaction, and the quality of the audio. Improving the quality of the audio and video transmissions is primarily a technical issue. During the latter part of the evaluation period, efforts were made to improve VTT by increasing the size of the television monitors, adding additional microphones for the students, using a cordless microphone for the instructor, and incorporating new software in video compression/decompression. Since these courses were not designed for VTT, improving instructor-student interaction will require training of instructors to effectively use the medium and redesigning course materials to better fit the medium.

Based on a regression analysis, when the total number of sites increased from two to three, the average grade dropped 2.2 points at both originating and remote sites. The associated increase in the total number of students accounted for only 18 percent of this decline. Therefore, the number of sites was a more important determinant of course grades than the number of students. Whether grades would remain the same or further deteriorate with an increase from two remote sites to three or more remote sites, is an important question for further research.

DOWNTIME

When the transmission is degraded to a large degree or lost altogether in a VTT course, the course must stop and the time that students must wait for it to restart is classified as downtime. During the first six months, the VTT system was down rather infrequently, with an average of

1.4 incidents per course convening. The average downtime per incident was 29 minutes. Equipment problems were the most frequent cause of downtime; they accounted for half of the incidents. Bad weather was the second-most frequent reason; it accounted for one-third of the incidents.

The VTT instructors generally indicated that training missed due to downtime was later made up so that no training was lost. However, since students had to wait for the system to come back up, downtime may have contributed to some of the negative attitudes of students toward the VTT method of instruction.

NET SAVINGS TO THE NAVY

Net savings are defined as the difference between gross savings in travel and per diem and the cost of operating the VTT system. During the first six months, VTT generated net savings of $68,721 to the Navy as a whole. However, these savings should not be used to project the savings that would be achieved by any future system. Both the benefits and costs of the future system are likely to increase as the system expands beyond the scale of the present system. In the short run, more aggressive scheduling of courses with high throughput should yield additional savings. In the long run, changes in technology should lower costs and improve the quality of the medium. Further cost-benefit analyses will be required as additional data on the future system become available.

RECOMMENDATIONS

The cost-effectiveness of VTT will depend critically upon the extent to which the system is used. During the first six months, fewer than half of all classrooms were used on a typical weekday. To improve the cost-effectiveness of VTT, the study makes the following recommendations:

- Select short courses with high throughput per convening because they save more money per week than other types of courses.

- If there is excess capacity in the training system, expand the "other uses" of the system because they generate a greater than proportionate amount of gross savings.

- Establish an R&D program to (1) develop formal courses for the training of VTT instructors and (2) redesign course materials to more effectively use VTT (e.g., graphics on monitor).

To determine the maximum number of sites that should be used simultaneously for a single course, courses should be convened that are graded and that use three or more remote sites.

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SECTION 1

INTRODUCTION

The Navy is exploring alternative methods of delivering individual training in a cost-effective manner to remote locations. Currently, sailors who are not located near fleet training centers or other existing "schoolhouses," must either travel to these sites or have the training exported to them. Sending students to schoolhouses is very expensive. Alternatively, when training is exported, an instructor must be sent to the remote site on temporary additional duty (TAD). Given the limited number of instructors, many requests for exported training cannot be filled. In FY 1989, only 51.5 percent of the quarterly requests to COMTRALANT for exportable training courses were approved.

The exportation of training is also receiving considerable attention in the planning for strategic homeporting. The advent of establishing "strategic homeports" in areas that are even farther from existing fleet training centers, will add to the geographical disbursement of potential students and could cause a significant drain on the pool of available instructors.

This study evaluates the use of Video Teletraining (VTT) to deliver instruction to students at remote locations. VTT uses a full duplex audio-visual network between existing schoolhouses and remote locations. The network is fully interactive in that participants at different locations can talk to and see one another in real time. In principle, this provides the "intimacy" of a single integrated classroom, although students may be distributed across several locations.

The initial VTT system was established by the Navy in March 1989 with joint funding from COMTRALANT, CNET and OP-01. A multipoint secure system was designed and implemented with sites at Charleston, Dam Neck, Mayport, and Norfolk. The sites are interconnected via a commercial Ku-band satellite through a CODEC (coder/decoder), a microcomputer to compress/decompress the video signal, and a video branch exchange system (VBX). The VBX is a voice-activated switch that selects the site from which the audio-visual signal will originate. The signals are encrypted in accordance with National Security Agency (NSA) standards using KG-81s. Training up to the level of secret can be broadcast on the VTT network. Figure 1 shows the connectivity among the system's elements.

Compressing the video signal reduces its bandwidth. This results in a significant savings in satellite costs, but reduces the quality of the signal. However, software improvements have permitted reductions in bandwidth during the evaluation period without any degradation in the quality of the broadcast.

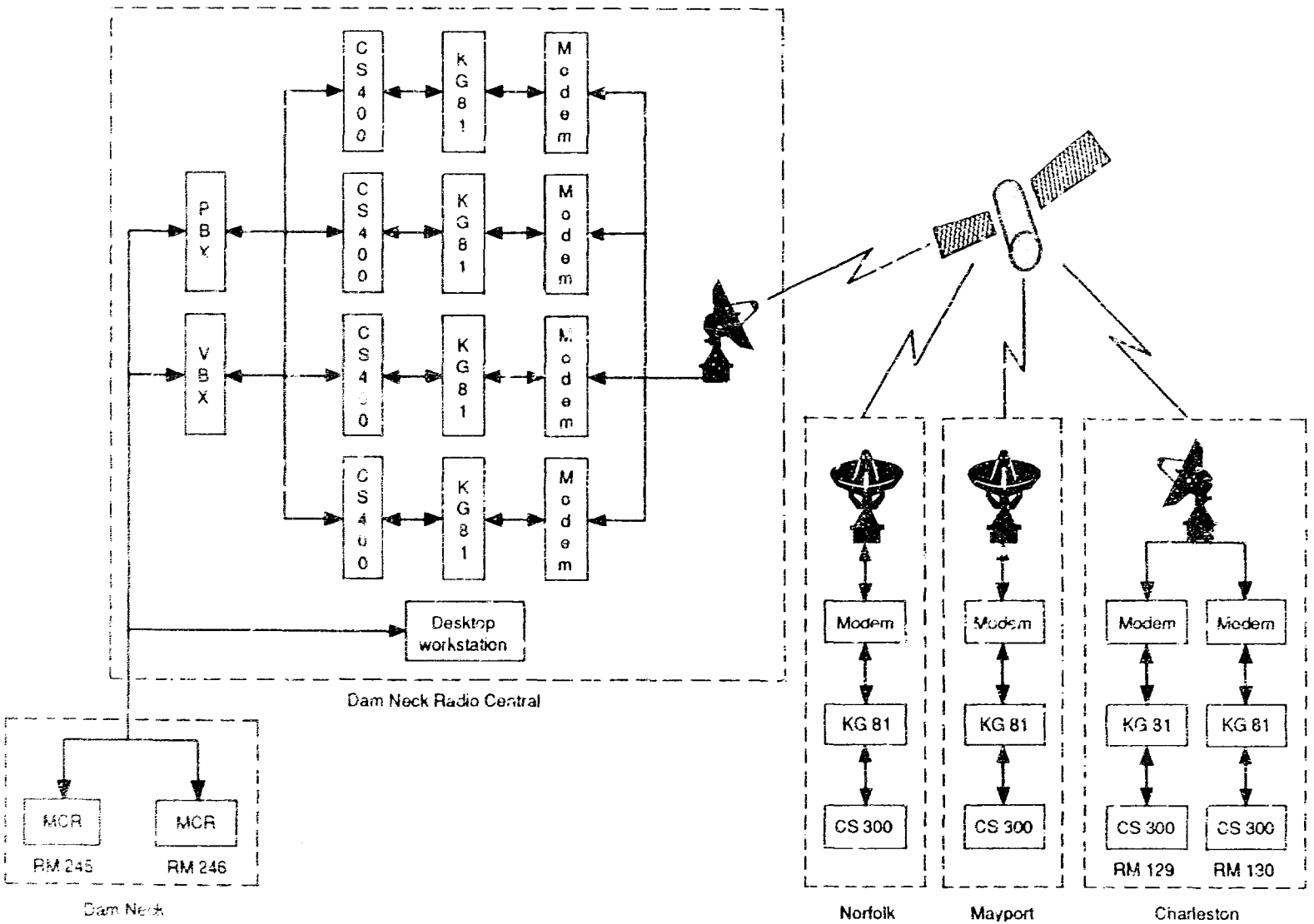

Figure 1. System configuration (SOURCE: FCTCLANT)

Television monitors, video cameras, and microphones were also installed in each classroom. A copy stand was installed at each of the originating sites to transmit images of paper copies or small equipment. Figures 2 and 3 illustrate the initial configurations of the typical VTT classrooms at the originating and remote sites, respectively. It should be noted that pre-existing lighting and acoustical conditions were used. Due to budget limitations, no special effort was made to design a classroom to accommodate the video and audio equipment.

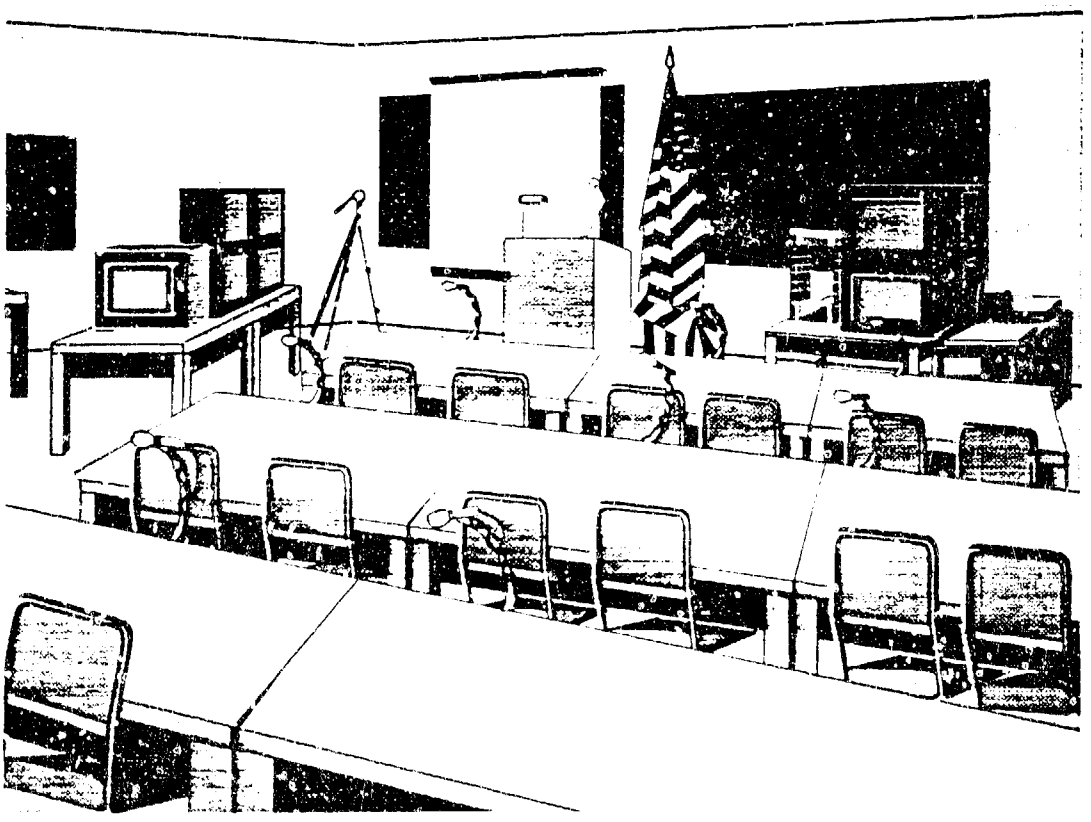

Figure 2. Typical originating classroom (Source: FCTCLANT)

The Center for Naval Analyses was tasked by Commander, Naval Education and Training (CNET) to evaluate this system during its first six months of operation (i.e., March 1989 through September 1989). Section 2 shows the extent to which the system was used over this period. The training effectiveness of VTT relative to traditional methods of instruction is examined in sections 3 and 4. Section 5 focuses on the technical problems experienced during the first six months. In section 6, the net savings from using VTT during this period are tabulated. The main conclusions from the study are summarized in section 7.

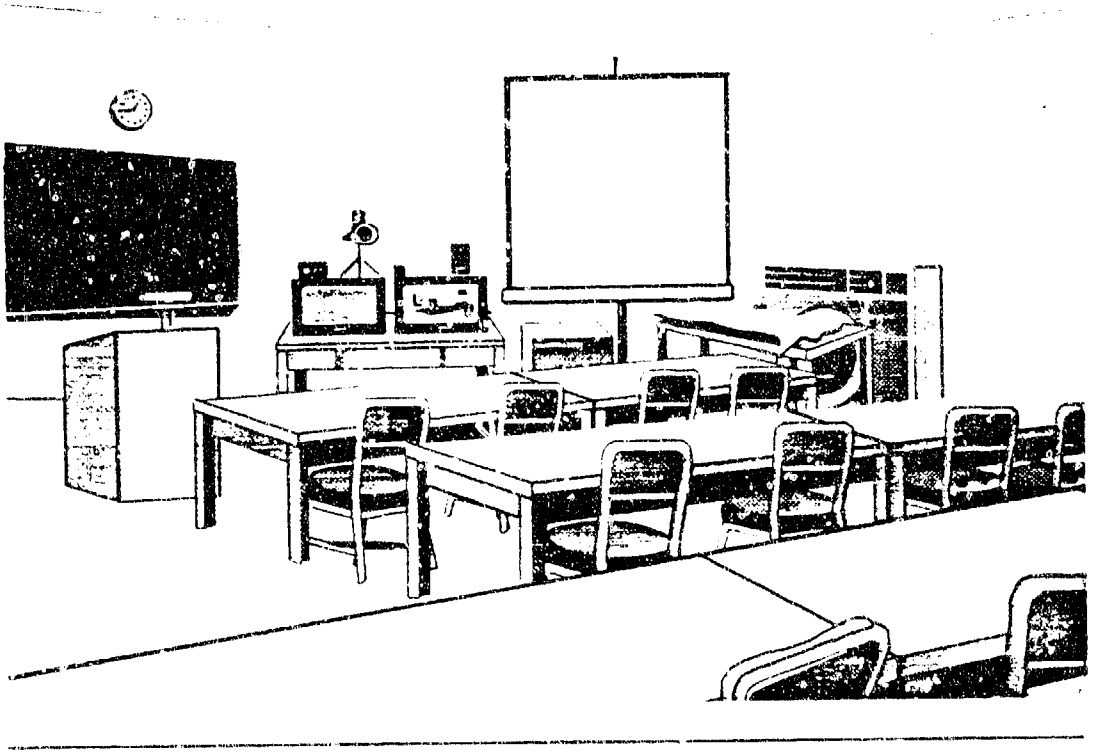

Figure 3. Typical remote classroom (Source: FCTCLANT)

SECTION 2

SYSTEM UTILIZATION

This section shows how the VTT system has been used during the six-month evaluation period. Table 1 contains a list of the first 12 courses to be taught via this medium. These F-school-type courses tend to be lecture-oriented with the instructor providing hand-outs and using slides or transparencies. The key exception was the .50-caliber Machine Gun Maintenance course that provided some hands-on instruction with the copy stand.

Table 1. VTT courses

Course	Length (in days)	Number of convenings	Originating site	Number of remote sites
Operation Security Planning	2	3	Dam Neck	1
Track Supervisor, Track Force Coordinator	5	4	Dam Neck	2
Gun Battery Alignment	5	2	Dam Neck	1
Ammunition Administration	5	3	Dam Neck	1 to 3
Advanced Signalman	10	1	Norfolk	2
Advanced Communication Procedures	5	3	Norfolk	1
Command Information and Retention Counselor/Coordinator (CCCC)	20	2	Norfolk	1
Theatre Nuclear Warfare	2	1	Dam Neck	1
SAS/EAP	3	2	Dam Neck	1
Soviet Signaling Procedures	3	2	Norfolk	1 to 2
.50-caliber Machine Gun Maintenance	3	1	Dam Neck	2
Nuclear Weapons Rad. Con.	3	1	Dam Neck	1

The courses range in length from 2 to 20 days; the typical course lasted 5 days. During the evaluation period, each course convened from 1 to 4 times for a total of 25 convenings. The originating site was either Dam Neck or Norfolk, and the remote sites were typically Charleston and/or Mayport. Only one convening of one course (i.e., Ammunition Administration) used all three of the remote sites. For this convening, Dam Neck was the originating site, and Charleston, Mayport, and Norfolk were the remote sites.

In addition to using the VTT system to conduct Navy course-training, the system also supported briefings on training exercises, civilian training, and conferences (see table 2). In contrast to the VTT courses, a typical individual used the system for only one day. An event like the OCPM conference lasted three days, but the list of participants was different on each day. As

a result, this conference was categorized as having 3 convenings lasting one day apiece. Using this definition, there were 8 convenings involving training exercises, 4 convenings of civilian training, and 4 convenings of conferencing. For these other uses, all four of the sites were employed simultaneously in 7 of 16 convenings (44 percent). For course training, four sites were used in only 1 of 25 convenings (4 percent).

Table 2. Other uses of VTT system

Use of system	Length (in days)	Number of convenings	Number of sites
BFIT exercise	1	5	2
CINTEX exercise	1	2	3
FLEETEX exercise	1	1	3
TCCT conference	1	1	2
Office of Civilian Personnel Management (OCPM) Conference	1	3	4
OCPM training	1	4	4

Table 3 indicates how intensively the network of six classrooms was used on weekdays over the evaluation period.[1] On the average weekday, 46.1 percent of the classrooms were in use. Utilization rates varied substantially across sites, ranging from 28.4 percent at Dam Neck to 72.7 percent at Mayport. The main reason for this variation was the number of classrooms at each site. The Dam Neck and Charleston sites have much lower utilization rates than Norfolk and Mayport but twice as many VTT classrooms. Thus, the second classroom at a given site was typically not used. This problem has recently been addressed by eliminating the second classrooms at Dam Neck and Charleston and establishing a new site at Newport. Because these changes took place after the first six months, one should expect higher system utilization during the next year.

Table 4 provides data on attendance for each type of use. A total of 705 students were trained in 25 convenings of the 12 VTT courses listed in table 1.[2] In contrast, the total attendance from other uses of the system was higher (737 persons), but this was achieved using only 16 convenings. The other military uses of the system consisted primarily of Navy training exercises, and the civilian uses of the system consisted primarily of OCPM training. The civilian uses had the highest attendance per convening with an average of 55.1 persons. This was accomplished by using all four sites at each of their convenings. The other military uses had the next highest attendance per convening, with an average of 39 persons. Although they used an

1. Legal holidays are excluded from the analysis.
2. Appendix A contains a detailed breakdown of attendance by convening and site.

average of only 2.3 sites per convening, the other military uses had the highest attendance per site, with an average of 16.7 persons. The VTT courses had the lowest attendance per convening, with an average of 28.2 students. The relatively low attendance for the average VTT course can be attributed to the fact that the courses used the fewest number of sites per convening (i.e., 2.4 sites) and had the lowest attendance per site (i.e., 11.8 students).

Table 3. Classroom utilization rates by site

Site	Number of classrooms	Proportion of classrooms in use per weekday (percent)
Charleston	2	41.3
Dam Neck	2	28.4
Mayport	1	72.7
Norfolk	1	64.4
All sites	6	46.1

Table 4. Attendance by type of use

	VTT courses	Other uses	
		Military	Civilian
Number of personnel (excluding instructors)	705.0	351.0	386.0
Number of convenings	25.0	9.0	7.0
Attendance per convening	28.2	39.0	55.1
Sites per convening	2.4	2.3	4.0
Attendance per site	11.8	16.7	13.8

The next two sections of this memorandum address the effectiveness of using VTT for Navy courses.[1] Training effectiveness is examined in section III using course grades as the measure of effectiveness. Section 4 reports on a survey of VTT students that was conducted to identify specific training deficiencies.

1. The Naval Training System Center (NTSC) was tasked by CNET to provide a separate analysis of VTT's effectiveness in its other military and civilian uses.

SECTION 3

EFFECT OF VTT ON COURSE GRADES

This section employs a regression model to evaluate the relative effectiveness of using VTT in conducting training for the Navy. Table 5 defines each of the variables in this model. Final course grades are the dependent variable because they provide a measure of learning effectiveness. The key independent variable, REMOTE, indicates whether a given student was at a remote or originating site. Thus, the grades of students at the remote sites are compared to those at the originating site to determine how effective the VTT method of instruction was, relative to the traditional method of instruction. Students at the remote sites serve as the test group in the evaluation because they could see, hear, and speak with the instructor exclusively through the VTT technology. In contrast, students in the same room as the instructor (i.e., the originating site) serve as the control group because they interacted with the instructor without using the VTT technology.

Table 5. Variables in regression model

Variable	Definition	Source of data
GRADE	Final course grade on scale of 100 points	Instructor grade sheets
REMOTE	1: student at remote site 0: student at originating site	VTT student background questionnaires
NSITES	1: three sites 0: two sites	VTT course schedules
SIZE	Number of students at all sites	VTT status reports
AFQT	Percentile score on Armed Forces Qualification Test	Enlisted Master Record
YOS	Years of service as of January 1989	Enlisted Master Record
COURSE1	1: Track Supervisor course 0: otherwise	VTT student background questionnaires
COURSE2	1: Advanced Signalman course 0: otherwise	VTT student background questionnaires
COURSE3	1: Advanced Communication Procedures course 0: otherwise	VTT student background questionnaires
COURSE4	1: CCCC course 0: otherwise	VTT student background questionnaires
COURSE5	1: Soviet Signaling course 0: otherwise	VTT student background questionnaires

Although students at the originating site are the best available control group, they are not a perfect control group since some of their learning did rely on the VTT technology. For example, when students were speaking at one of the remote sites, students at the originating site had to rely on the VTT technology hear and see them. As the number of sites increases, one would expect that the proportion of time spent on listening and hearing students at the other sites would increase. The model addresses this issue by controlling for the number of sites, NSITES, in the regression equation. This variable would also control for difficulties that the instructor might have in teaching to a larger number of sites and to a larger number of students. The effect of class size can be quantified separately by including the total number of students, SIZE, in the equation and observing its effect on the coefficient of NSITES.

Comparing grades of students at the originating site with those of students at remote sites will not show the relative effectiveness of using the copy stand in communicating visual information. When an instructor uses a copy stand, students at both types of sites observe the material via their television monitors. However, when the instructor focuses one of the cameras on a blackboard or slide screen, students at the originating site observe the material without relying on the VTT technology whereas students at the remote sites again rely on the technology via their monitor.

The VTT system was designed to provide actual training rather than to serve as a laboratory for manipulating variables such as the configuration of the room or type of equipment. Therefore, the variables used in the regression model were limited to those variables that differed across classrooms or individuals.

The regression model controls for differences in student mental aptitude and years of service by including the variables AFQT and YOS. In addition, differences in grading across courses are captured by the course dummy variables, COURSE1 through COURSE5. These five variables respectively correspond to Track Supervisor Track Force Coordinator, Advanced Signalman, Advanced Communication Procedures, CCCC, and Soviet Signaling. The coefficient of a given dummy variable is an estimate of the difference in grades between that particular course and the Gun Battery Alignment course.

The sample consists of 356 students from a total of 13 course convenings. The other 12 convenings cannot be used in the regression analysis because either grades were not given or no students took the course at the originating site. Furthermore, only enlisted personnel are included in the sample because of the need to control for the AFQT score.[1] Half of the students in the sample received the training at the originating site, and the other half received the training at one of the remote sites.

Table 6 presents the results from the regression analysis. Controlling for each of the variables discussed above, grades at the remote sites were 2.4 points lower than grades at the

1. Of the total population in the first 25 VTT convenings, 81.4 percent were enlisted and 18.5 percent were officers.

originating site on average. The 2.4-point difference is statistically significant at the 1 percent level and corresponds to one-third of a standard deviation in the grade measure.

Table 6. Regression results (dependent variable: GRADE)

Independent variable	Mean (standard deviation)	Coefficient (t-statistic)	
		Model without SIZE variable	Model with SIZE variable
Intercept		80.3[a]	80.9[a]
		(43.9)	(36.7)
REMOTE	0.50	−2.4[a]	−2.4[a]
	(0.50)	(−3.8)	(−3.8)
NSITES	0.44	−2.2[b]	−1.8
	(0.50)	(−1.9)	(−1.2)
SIZE	31.2		−.03
	(7.9)		(−.5)
AFQT	62.2	.15[a]	.15[a]
	(18.1)	(7.7)	(7.7)
YOS	5.9	.34[a]	.34[a]
	(4.4)	(3.5)	(3.4)
COURSE1	.33	−2.0	−1.8
	(.47)	(−1.2)	(−1.1)
COURSE2	.06	−3.1	−3.2
	(.24)	(−1.5)	(−1.6)
COURSE3	.17	−3.1[b]	−2.8[b]
	(.37)	(−2.3)	(−1.9)
COURSE4	.19	−1.7	−1.1
	(.39)	(−1.2)	(−.6)
COURSE5	.17	−3.2[a]	−3.0[b]
	(.37)	(−2.1)	(−1.9)
R-square		.33	.33
F-statistic		18.5[a]	16.7[a]
Sample size		356.0	356.0

NOTE: Mean and standard deviation of GRADE are 67.2 and 7.2, respectively.

a. Statistically significant at the 1 percent level.
b. Statistically significant at the 5 percent level.

When the total number of sites was increased from two to three, the average grade dropped 2.2 points at both originating and remote sites. In the first six months, there have not been any graded VTT courses using three or more remote sites. Whether grades would remain the same or further deteriorate with an increase from two remote sites to three or more remote sites, remains an important question for further research.

When the number of students is included as an explanatory variable, it reduces the coefficient on the number of sites variable from 2.2 to 1.8. This indicates that the increase in class size explains only 18 percent of the reduction in grades associated with an increase in the number of sites. Thus class size only partially explains the negative effect on grades of increasing the number of sites.

The effect of individual-specific variables on course grades is in the anticipated direction. An increase of one standard deviation from the mean AFQT score (i.e., from the 62nd to 80th percentile), improved the course grade by 2.7 points on average. Likewise, an increase of one standard deviation from the mean Navy experience (i.e., from 6 to 10 years of service), was associated with a 1.5-point increase in the course grade on average.

The regression results in table 6 are robust. Substituting convening-specific dummy variables for the course-specific dummy variables leaves the results intact.[1] Interacting the number of sites with whether the student is at the originating or remote sites, confirms that students at both the originating and remote sites experienced on average the same 2.2-point reduction when the total number of sites was increased from two to three.[2]

From a policy standpoint, the question arises whether the difference in grades between originating and remote sites is practically significant. The Navy's VTT Steering Committee has chosen differences in failure rates as the relevant criterion for measuring "practical significance."[3] Students who received final course grades below 70 were classified as failures based on the school's definition of failure in a typical course.

At the originating site, only 3 of 178 students (1.7 percent) received grades below 70. At the remote sites, only 4 of 178 (2.2 percent) received grades below 70. Therefore, the difference in grades during the evaluation period is not "practically significant" because the difference in failure rates between originating and remote sites is small and statistically insignificant at the 5-percent level.

1. The NSITES variable must be dropped when using this specification of the model because the number of sites is a linear combination of the convening specific dummy variables.
2. Results from these alternative specifications of the model are documented in appendix B.
3. The VTT Steering Committee consists of representatives from a wide variety of Navy organizations including CNET and the functional training commands.

Failure rates were not affected by differences in grades between sites because the mean grades at both types of sites were much higher than the minimum passing score of 70. Controlling for the other factors affecting grades, the mean student grades were 88.4 at the originating site and 86.0 at the typical remote site.[1] Figure 4 shows the cumulative distributions of grades for students at the originating and remote sites based on the grade data collected during the evaluation period. Note that most of the grade distribution lies above the minimum passing score of 70. If the shapes of these distributions and the average difference between sites are assumed to be the same for courses with different mean grades, the effects of using VTT in more difficult courses can be estimated.

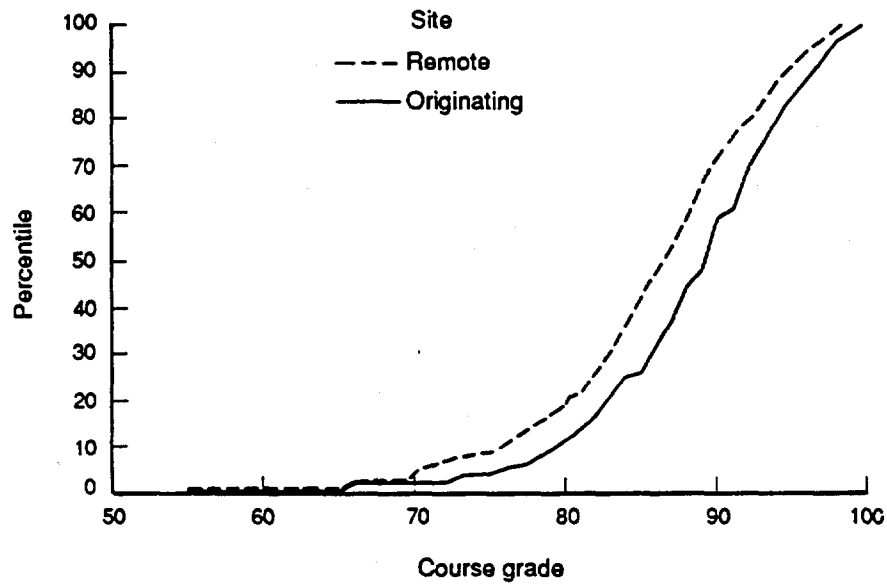

Figure 4. Course grade distributions at originating and remote VTT sites

Figure 5 provides estimates of expected failure rates at originating and remote sites for different mean grades at the typical remote site. Note that the corresponding mean grade at the originating site is 2.4 points higher than the hypothetical mean grade at the remote site. During the evaluation period, the mean grade at the remote site was 86.0. The difference in failure rates between the originating and remote sites at this point is one-half of a percentage point.

As more difficult courses are selected (i.e., courses with mean grades below 86.0), the difference in failure rates will increase. If the mean grade falls to 79.0 (i.e., approximately one standard deviation from the sample mean), the failure rates at the originating and remote sites increase to 5.1 percent and 10.7 percent, respectively. The difference in failure rates is then

1. The typical remote site is associated with a convening consisting of one originating site and 1.4 remote sites (i.e., the mean number of sites during the evaluation period).

5.6 percentage points, which is statistically significant at the 5-percent level. On the other hand, if less difficult courses are selected (i.e., courses with mean grades above 86.0), there is virtually no difference in failure rates between sites.

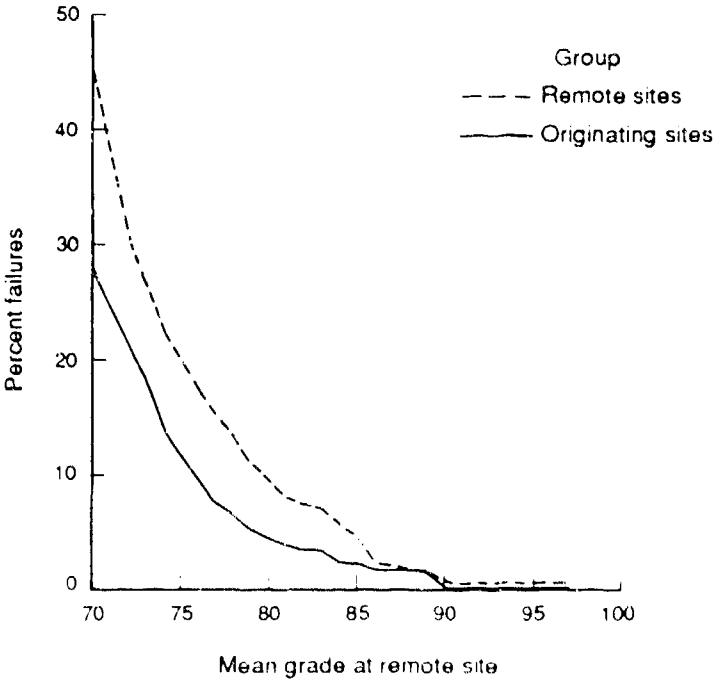

Figure 5. Predicted failure rates at originating and remote sites (failure: grade below 70)

These results suggest that the level of difficulty of a course is an important criteria in selecting those courses best suited for the VTT method of instruction. It should be noted, however, that the difference in failure rates would decrease if the grades at remote sites improve in the future relative to the grades at originating sites.

SECTION 4

STUDENT SURVEY

This section uses student survey data to identify specific areas for improving the effectiveness of VTT. On the first day of each convening, background questionnaires were administered to students at each of the sites. Student responses were used to identify the sailors who were trained, the site where they received the training, the location of their duty station, and their travel and berthing arrangements. On the last day of each convening, course questionnaires were administered to students at each of the sites. Students were asked to evaluate the instructor, audio-visual aids, tests, homework, instructor-student interaction, and remedial instruction. In addition, they were asked to indicate their preferences as to method of instruction.[1]

The questionnaires were typically administered by the facilitators at each site. Copies of the forms were mailed to the the point-of-contact at the Fleet Combat Training Center, Atlantic (FCTCLANT) and then forwarded to CNA for analysis. For each student, data from the two questionnaires were entered into a VTT data base. Of the students who took a VTT course, 95 percent of them returned their course questionnaires.[2] In cases where students did not complete a background questionnaire but did complete a course questionnaire, most of the information required for the background questionnaire was obtained from other sources.

Results from the first section of the course questionnaire are contained in tables 7 through 10. For each item, students were asked to choose a number from a scale of 1 to 5, in which 1 is unsatisfactory and 5 is outstanding. In the analysis, the mean response was calculated for each item by type of site (i.e., remote versus originating). For a given item, the difference in the mean response between remote and originating sites is then computed and a t-test is performed to determine whether the difference is statistically significant. The sample sizes for each item by type of site and the actual t-statistics are contained in appendix D.

Results from the student evaluation of the instructor are shown in table 7. On each of the items, students at the remote sites rated the instructor significantly lower than students at the originating site. The largest difference between sites is on the item "availability of the instructor for individual assistance outside of class." Although instructors were advised to set aside time after class to speak with students, the instructors indicated that students at remote sites were less likely to take advantage of these opportunities than students at the originating site.

1. Appendix C contains copies of the student questionnaires.
2. Three convenings accounted for all of the missing data: the 11th convening (Theatre Nuclear Warfare), the 17th convening (SAS/EAP), and the 24th convening (.50-caliber Machine Gun Maintenance).

Table 7. Student evaluation of instructor

Statement	Mean response (scale 1-5)		
	Remote	Originating	Difference
Instructor prepared for class.	4.6	4.9	−.3
Instructor presented lessons clearly.	4.1	4.7	−.6
Instructor answered student questions.	4.5	4.9	−.4
Instructor encouraged class participation.	4.2	4.6	−.4
Instructor was available for individual assistance outside of class.	3.1	4.7	−1.6
Instructor treated students fairly.	4.6	4.9	−.3

NOTE: For each item, the difference is statistically significant at the 1-percent level.

Table 8. Student evaluation of audio-visual aids

Statement	Mean response (scale 1-5)		
	Remote	Originating	Difference
Video screen was large enough to be seen.	4.0	4.4	−.4[a]
Video screen was close enough to be seen.	4.3	4.5	−.2[a]
Image on video screen was clear.	3.3	4.1	−.8[a]
Audio transmission was loud enough to hear instructor's voice.	3.8	4.3	−.5[a]
Audio transmission was clear enough to hear what instructor said.	3.5	4.3	−.8[a]
Graphics/slides/transparencies on TV were readable.	2.7	4.1	−1.4[a]
Television was in working order.	4.3	4.3	.0[b]
Your microphone was in working order.	4.3	4.5	−.2[b]

a. Difference is statistically significant at the 1-percent level.
b. Difference is not statistically significant at the 5-percent level.

Table 9. Student evaluation of tests and homework

Statement	Mean response (scale 1-5)		
	Remote	Originating	Difference
Test questions were clearly written.	4.4	4.6	–.2
Test questions were directly related to course.	4.7	4.9	–.2
Test answers were graded fairly.	4.7	4.9	–.2
Homework assignments were understandable.	4.5	4.7	–.2
Homework assignments were directly related to course.	4.7	4.9	–.2

NOTE: For each item, the difference is statistically significant at the 1-percent level.

Table 10. Student overall evaluation of instructor and course

Statement	Mean response (scale 1-5)		
	Remote	Originating	Difference
Comparison of this instructor to other Navy instructors that have taught you in the past	3.9	4.6	–.7
Comparison of this course to other Navy courses that you have taken in the past	3.6	4.4	–.8

NOTE: For each item, the difference is statistically significant at the 1-percent level.

Table 8 reports student mean responses to the audio-visual aids used in the course. In contrast to the previous table, it should be noted that students at the originating site spend less time using these aids and therefore have less information with which to judge their effectiveness. In particular, students were asked about their ability to hear the instructor through the audio transmission. For students at the originating site, this item was not strictly applicable. However, they might have inferred the general quality of the audio transmission from their ability to hear the students at the remote sites.

Students at the remote sites must rely on VTT's audio-visual aids for most of their instruction. With the exception of the last two items (i.e., television and microphone in working order), these students rated audio-visual aids significantly lower than students at the originating site.

Furthermore, students at the remote sites tended to rate the audio-visual aids lower than other items in the course evaluation. In table 7, the average response at the remote sites was less than 4 on only one of six items concerning the instructor (i.e., instructor availability for individual assistance outside of class). In table 8, the average response was less than 4 on four of eight items concerning the audio-visual aids. The two lowest-rated items in the evaluation are related to the quality of the video (i.e., readability of graphics/slides/transparencies on TV and clarity of image on video screen). The other two items to receive ratings of less than 4 are related to the quality of the audio (i.e., loudness and clarity of audio transmission).

Results from the students' evaluation of tests and homework are shown in table 9. Although students rated each of these five items significantly lower at the remote sites than the originating site, the magnitude of the difference between sites is very small (i.e., two-tenths of one point on a scale of 1 to 5). Indeed, the difference between sites is smaller on items concerning tests and homework than on items concerning the instructor or audio-visual aids. In addition, none of the five test/homework items is rated below 4.

Based on the results from tables 7 through 9, the main problem areas were the quality of the video transmission, the use of the instructor for individual assistance outside of class, and the quality of the audio transmission. Students' dissatisfaction with these items may have spilled over to other items and led to general dissatisfaction with the course and instructor. Table 10 demonstrates that students at the remote sites rated both the instructor and the course significantly lower than students at the originating site.

Not surprisingly, table 11 shows that students generally preferred the traditional method of instruction to VTT. The proportion of students favoring the traditional method was significantly lower at the remote sites (64.2 percent) than at the originating site (78.2 percent).[1]

Table 11. Student preferences on method of instruction (percent)

Question: Which method of instruction would you have preferred for this course?

Method	Remote	Originating
Traditional	64.2	78.2
Indifferent	27.2	19.5
VTT	8.6	2.3
	100.0	100.0

1. In appendix D, tables D-5 and D-6 provide t-statistics and sample sizes, respectively, for statements in tables 11 through 16.

Table 12. Student interaction with instructor (percent)

Question: Did you talk to the instructor or ask any questions during the regular hours of this course?

Response	Remote	Originating
Yes	75.6	92.4
No	24.4	7.6
	100.0	100.0

Table 13. Student evaluation of opportunities for interaction (percent)

Question: How did VTT affect your opportunities to talk to the instructor or ask questions, as compared to traditional methods of instruction?

Response	Remote	Originating
More opportunities	1.8	5.6
No effect on opportunities	43.2	79.3
Fewer opportunities	55.0	15.1
	100.0	100.0

Table 14. Student use of remedial instruction (percent)

Question: Did you attend any remedial instruction periods?

Response	Remote	Originating
Yes	13.4	21.8
No	86.6	78.2
	100.0	100.0

Table 15. Student evaluation of opportunities for remedial instruction (percent)

Question: Were there adequate opportunities for remedial instruction outside of the regular class hours of this course?

Response	Remote	Originating
Yes	41.6	73.2
No	23.4	2.3
Remedial instruction was not necessary for this course	35.0	24.5
	100.0	100.0

Table 16. Student evaluation of participation at other sites (percent)

Question: How did the participation of students at other site(s) affect your learning during this course?

Response	Remote	Originating
Improved learning	12.2	16.2
No effect on learning	69.6	66.3
Reduced learning	18.2	17.5
	100 0	100.0

The advantage of using two-way video/audio as opposed to one-way video/audio is that the former permits students at a remote site to interact with the instructor and students at other sites. Under the traditional method of instruction, such interaction could easily be facilitated by the fact that the instructor is in the same classroom with all of the studen . Although two-way video/audio technically permits interaction between sites, whether people will fully use this capability is an important issue. Tables 12 through 16 show the extent to which instructors and students interacted under VTT relative to traditional methods of instruction. Students at the originating site interacted with the instructor via the traditional method since the instructor was in the same room. Students at the remote sites interacted with the instructor only by means of the VTT system.

Table 12 reveals that students at the remote sites were less likely to interact with the instructor than students at the originating site. The proportion of students indicating that they did not talk to the instructor or ask any questions during the course's regular hours was 24.4 percent at the remote sites but only 7.6 percent at the originating site, for a difference of 16.8 percentage points.

Students were asked to assess how VTT affected their opportunities to interact with the instructor (see table 13). At the originating site, a majority of students (79.3 percent) believed that VTT had no effect on their opportunities to talk to the instructor or ask questions. At the remote sites, a majority of students (55.0 percent) believed that VTT reduced their opportunities to interact with the instructor. In sharp contrast, only 15.1 percent of the students at the originating site believed that VTT reduced their opportunities for interaction, for a difference of 39.9 percentage points between sites.

If students at remote sites are more reluctant than students at the originating site to interact with the instructor during regular class hours, are they more likely to interact with him outside of regular class hours when fewer students are using the system? Table 14 shows that this was not the case in the evaluation period. In fact, students at remote sites (13.4 percent) were even less likely to attend remedial instruction periods than students at the originating site (21.8 percent). Table 15 indicates that a majority of students at the originating site (73.2 percent) felt that there were adequate opportunities for remedial instruction whereas a minority of students at the remote sites (41.6 percent) expressed that view.

These results suggest that the interaction between the instructor and students at remote sites needs to be improved. It should be noted that these courses were not specifically designed for the VTT system. Moreover, there are currently no formal courses to train instructors in using VTT and no procedures for selecting instructors best suited for this medium. The Naval Training System Center (NTSC) has completed a literature review that provides valuable information the Navy could use in redesigning courses and retraining instructors for VTT.[1]

Students were asked about how the participation of other students at other sites affected their learning (see table 16). Although most students at both types of sites believed that it had no effect, a greater proportion of students at the originating site believed that this participation improved their learning.

In the previous section, it was shown that increasing the number of sites reduced course grades. However, the survey data indicates that there were no differences in attitudes between students who were trained in convenings with two versus three sites.

1. See Naval Training Systems Center, *Video Teletraining and Video Teleconferencing: A Review of the Literature*, Technical Report 89-C8901X, Draft Version, October 1989.

SECTION 5

DOWNTIME

When the transmission is degraded to a large degree or lost altogether, a VTT course must stop and the time that students must wait for the course to restart is defined as downtime. In this evaluation, if the incident occurred near the end of the class-day and the class reconvened earlier on the next day, the system is classified as down but the amount of downtime is recorded as zero.

The VTT instructors generally indicated that the training that was missed due to downtime was later made up so that no training was lost. However, because downtime disrupted training and caused students to wait for the system to come back up, it could have affected their attitudes towards the course and the VTT system.

When the system was down, the VTT project manager at the FCTCLANT was responsible for coordinating the activities required to bring the system back up. In discharging these duties, a record was maintained of such events in a weekly status report. For each incident, the amount of downtime was recorded as well as the suspected reason for the failure of the system. These data are summarized in tables 17 and 18.

Table 17. Reported downtime per class-day

Month	Downtime[a] (minutes)	Class-days	Downtime per class-day
March	250	17	14.7
April	45	15	3.0
May	100	25	4.0
June	190	18	10.6
July	214	25	8.6
August	186	26	7.2
September	0	5	0.0
Total	985	131	7.5

a. Downtime counts twice if it affected two courses simultaneously.

Table 17 shows that a total of 985 minutes of downtime (i.e., 16.4 hours) occurred during a total of 131 class-days, for an average of 7.5 minutes per class-day. The amount of downtime varied substantially by month. The greatest amount of downtime per day (14.7 minutes) occurred during the first month of operation. A NASA launch of the space shuttle accounted for

almost half of the March downtime (120 of 250 minutes). At that time, the VTT system was not considered a "regular" user of the satellite. Consequently, the VTT system was "bumped" off the satellite that it was using and was forced to find an alternative satellite for its transmission. This problem was later remedied and subsequent launches of the space shuttle have not accounted for any downtime.

Table 18. Reasons for downtime

Cause	Number of times	Minutes	Percentage of total downtime
Equipment problems	15	415	46.1
Bad weather	10	285	31.7
NASA launch	1	120	13.3
Power outage	4	80	8.9
Total	30	900	100.0

a. Downtime counts once if it affected two courses simultaneously.

The general reasons for downtime are shown in table 18.[1] Equipment problems were the most frequent cause; they accounted for half of the incidents (15 of 30) and 46.1 percent of the actual downtime. Bad weather was the second-most frequent reason for the system going down. It accounted for one-third of the incidents (10 of 30) and 31.7 percent of the downtime. In contrast to land-line cables, satellite broadcasts are affected by inclement weather. This problem can be alleviated through the use of more powerful satellite dishes at the sites, higher bandwidths, or software upgrades to the equipment. Given the high costs associated with the first two options, software upgrades by the contracter have been the principal means of addressing this problem.

In the evaluation period, downtime occurred rather infrequently, averaging about 1.4 incidents per course convening (i.e., 34 incidents/25 convenings). Furthermore, the average downtime per incident was only 29 minutes (i.e., 985 minutes/34 incidents). When the regression model discussed in section III is expanded to include downtime, downtime (however defined) has no significant effect on course grades. Not only was downtime a relatively minor problem during the first six months but it actually declined. Downtime per class-day was 27 percent lower in the second quarter of the evaluation period than in the first quarter.[2]

1. Specific reasons for each incident are shown in appendix E.
2. Downtime during the first two quarters of the evaluation period averaged 8.5 and 6.2 minutes per class-day, respectively.

SECTION 6

ANALYSIS OF NET SAVINGS

This section examines the Navy's net savings from using VTT, during the first six months. Gross savings are defined as the travel and per diem that would have been incurred in sending personnel from the remote sites to the originating site. For the VTT courses, this involved sending students from Charleston and/or Mayport to either Dam Neck or Norfolk. For the other uses of the system, the originating site was defined as the site with the most participants. Because of the close proximity of Dam Neck and Norfolk, their attendance was combined when selecting the originating site for the other uses.

Table 19 shows that the gross savings from travel and per diem was $278,721. Estimates of the cost of air travel, ground travel, and per diem were obtained from the comptroller's office at FCTCLANT. One-half of a day's travel time was used in computing the per diem. Daily per diem is higher for officers and civilians than for enlisted personnel because officers and civilians usually stay off-base and enlisted personnel generally stay on-base at the Bachelors' Enlisted Quarters (BEQ). Car rentals were assumed for those staying off-base.

Table 19. Summary of cost analysis

	Gross savings in travel and per diem (all uses):	$278,721
Minus	Cost of using VTT system:	$210,000
Equals	Net savings from VTT:	$68,721

Since the instructor's services would have been required under both the traditional method and VTT, the net cost of using instructors was assumed to be zero. If VTT were used on a much larger scale, there could be net savings from training the same number of students with fewer instructors. Alternatively, more students could be trained with the same number of instructors through the use of multiple remote sites.

The program manager and on-site facilitators performed collateral duties in addition to VTT management. Because new billets were not created during this initial six-month period, the marginal cost of using their services was assumed to be zero. If VTT were implemented on a larger scale, the analysis would need to include the cost of creating new billets or contracting for the appropriate personnel to manage the VTT system.

The cost of using VTT was estimated to be the amount budgeted for the six-month period, $210,000. Net savings were then computed as the difference between between gross savings and the cost of using VTT. The VTT system generated net savings of $68,721, which translates into $17,180 per site.

This estimate of net savings applies specifically to the six-month evaluation period.[1] It should not be used to predict the cost-effectiveness of any future system. The benefits and costs of VTT are likely to increase as the system expands. Whether the future system will save money depends largely on the rate at which the system is utilized. Most of the costs of the future system (including satellite time) will likely be fixed costs that do not vary with system utilization. Greater utilization of the system should then increase the benefits by reducing the travel and per diem of students. A more detailed analysis of the costs and benefits of the future system will be a subject for further research.

Table 20 shows the division of gross savings by type of use.[2] VTT courses used the system for 136 class-days and generated gross savings of $142,822. In contrast, the other uses employed the system for only 16 days and generated gross savings of $135,899. Gross savings per day were $1,050 for VTT courses and $8,494 for the other uses of the system. The other uses were more cost-effective than the VTT courses because their convenings were much shorter. The average length of a convening was 5.4 days for the VTT courses and 1 day for the other uses.

Table 20. Gross savings by type of use

	VTT courses	Other uses	
		Military	Civilian
Number of days in use	136	9	7
Number of convenings	25	9	7
Gross savings	$142,822	$58,313	$77,586
Gross savings per day in use	$1,050	$6,479	$11,084
Days in use per convening	5.4	1.0	1.0

1. The contractors were responsible for surveying sites, leasing most of the VTT equipment including the satellite dish, providing maintenance, and procuring satellite time.
2. Appendix F provides a breakdown of gross savings by convening.

During this period, civilian uses accounted for more savings per day than other military uses. Based on data from seven convenings, civilian uses generated gross savings of $11,084 per day. In contrast, other military uses generated $6,479 per day based on data from nine convenings. The principal reason for this difference was shown in table 2. The civilian uses averaged more sites per convening than the other military uses.

Shorter convenings are more cost-effective because they permit more personnel to use the system over any given period of time. This principle not only is illustrated in table 20 by comparing other uses to VTT courses but is also demonstrated by comparing VTT courses of different length in table 21.[1] Two-day courses averaged $1,906 per day in gross savings, and 20-day courses averaged only $525 per day in gross savings. The lower gross savings for the 10-day course relative to the 20-day courses is due to lower attendance at remote sites in the 10-day course rather than course length.

Table 21. Cost avoidance by course length

Course length in days	Number of convenings	Gross savings	Gross savings per class day
2	4	$15,248	$1,906
3	6	31,462	1,748
5	12	70,906	1,182
10	1	4,214	421
20	2	20,991	525

1. The official course length is used in this table rather than the actual course length. In most cases, they were the same. However, the actual length could have been shorter due to a holiday during the week.

SECTION 7

CONCLUSIONS AND RECOMMENDATIONS

Course grades were lower, on average, under VTT than under traditional methods of instruction. The differences in grades was small enough that failure rates were low and did not differ significantly between the two training methods. If VTT were used in courses with much lower mean grades, failure rates might become much higher under the VTT method than under the traditional method of instruction. Increasing the number of remote sites from one to two for a given course also reduced course grades. Whether failure rates would change dramatically with a further increase in the number of sites is an unresolved question. Further research on this issue requires convenings of courses that both are graded and use three or more remote sites.

A survey of students identified three main areas of deficiency in the VTT method of instruction: the quality of the video, the level of instructor-student interaction, and the quality of the audio. Improving the quality of the audio and video transmissions is primarily a technical issue. During the latter part of the evaluation period, efforts were made to improve VTT by increasing the size of the television monitors, adding additional microphones for the students, using a cordless microphone for the instructor, and incorporating new software in video compression/decompression. Data should be collected during the next year to determine the efficacy of these changes.

If instructor-student interaction is to be improved, greater attention needs to be focused on how instructors are trained in using the VTT method as well as modifying or redesigning course materials to more effectively fit the medium. The Navy's proposed research laboratory for VTT could play an important role in addressing these issues. In particular, it would be very useful to retrain instructors and change course materials for those instructors and courses that have used VTT during the first six months. Course grades and surveys of both students and instructors could then assess the relative improvement in VTT training effectiveness from applying the lessons learned in a laboratory environment to an actual teaching environment.

The cost-effectiveness of VTT will depend upon the extent to which the system is utilized. During the first six months, less than half of all classrooms were used on a typical weekday. Benefits should increase as scheduling improves. In addition, shorter courses should be selected with higher throughput at multiple remote sites. The "other uses" of the system, which generated a greater than proportionate amount of gross savings, should be expanded given the excess capacity within the system. Costs also will increase as the system expands. In the long run, advances in technology should lower costs and improve the quality of the medium. Further cost-benefit analyses will be required as additional data become available.

APPENDIX A

VTT COURSE CONVENINGS

APPENDIX A

VTT COURSE CONVENINGS

During the evaluation period of the Navy's VTT network, a total of 705 students were trained in 25 convenings of the 12 VTT courses. Tables A-1 and A-2 provide detailed breakdowns of attendance by convening and site.

Table A-1. VTT course convenings (1st quarter)

Course	Week	Number of students by site				
		Dam Neck	Charleston	Mayport	Norfolk	Total
1. Opsec. Plan.	1	0[a]	0	9	0	9
2. Track Sup.	2	0[a]	13	3	0	16
3. Gun Bat. Align.	2	8[a]	9	0	0	17
4. Ammc. Admin.	3	22[a]	14	13	12	61
5. Advanced Sig.	4	0	6	8	14[a]	28
6. Adv. Com. Proc.	6	0	4	0	14[a]	18
7. CCCC	8	0	0	17	18[a]	35
8. Ammo. Admin.	11	26[a]	28	0	0	54
9. Adv. Com. Proc.	13	0	15	0	17[a]	32
10. Track Sup.	13	16[a]	3	11	0	30
Total		72	92	61	75	300

a. Indicates originating site.

Table A-2. VTT course convenings (2nd quarter)

Course	Week	Number of students by site				
		Dam Neck	Charleston	Mayport	Norfolk	Total
11. Th. Nuc. War	14	0[a]	0	3	0	3
12. SAS/EAP	14	0[a]	8	0	0	8
13. Sov. Sig. Proc.	15	0	11	9	14[a]	34
14. Gun Bat. Align.	17	11[a]	0	8	0	19
15. Opsec. Plan.	18	20[a]	8	0	0	28
16. CCCC	19	0	17	0	20[a]	37
17. SAS/EAP	19	0[a]	0	12	0	12
18. Track Sup.	20	19[a]	12	3	0	34
19. Opsec. Plan.	21	22[a]	6	10	0	38
20. Ammo. Admin.	22	25[a]	13	18	0	56
21. Track Sup.	23	17[a]	15	13	0	45
22. Sov. Sig. Proc.	24	0	9	0	20[a]	29
23. Adv. Com. Proc.	25	0	9	0	18[a]	27
24. 50 Cal. MG Maint.	25	0[a]	8	12	0	20
25. NW Rad. Con.	27	0[a]	15	0	0	15
Total		114	131	88	72	405

a. Indicates originating site.

APPENDIX B

REGRESSION RESULTS FROM ALTERNATIVE SPECIFICATIONS

APPENDIX B

REGRESSION RESULTS FROM ALTERNATIVE SPECIFICATIONS

A regression model was used to evaluate the relative effectiveness of using VTT in Navy training courses. Tables B-1 through B-3 document the results from alternative specifications of the model.

Table B-1. Additional variables in alternative specifications[a]

Variable	Definition	Control group
CONV(*i*)	1: student in *i*th course convening 0: otherwise	Students in third course convening
ORIG(*j*)	1: student at originating site and convening has total of *j* sites 0: otherwise	Students at originating site when convening has a total of two sites
REMOTE(*k*)	1: student at remote site and convening has total of *k* sites 0: otherwise	Students at originating site when convening has total of two sites

a. Table 5 contains definitions for those variables that were also used in the main regression model.

Table B-2. Regression results with 12 convening-specific dummy variables (dependent variable: GRADE)

Independant variable	Mean (standard deviation)	Coefficient (t-statistic)
Intercept		81.1[a]
		(38.2)
REMOTE	.48	−2.3[a]
	(.50)	(−3.5)
AFQT	62.1	.15[a]
	(18.3)	(7.6)
YOS	6.0	.33[a]
	(4.4)	(3.3)
CONV(5)	.06	−6.3[a]
	(.24)	(−3.1)
CONV(6)	.04	−1.7
	(.20)	(−.8)
CONV(7)	.09	−3.1
	(.29)	(−1.6)
CONV(9)	.07	−5.4[a]
	(.26)	(−2.7)
CONV(10)	.08	−6.1[a]
	(.27)	(−3.2)
CONV(12)	.10	−6.3[a]
	(.30)	(−3.4)
CONV(14)	.05	−1.9
	(.21)	(−.9)
CONV(16)	.10	−2.1
	(.30)	(−1.1)
CONV(18)	.10	−4.5[b]
	(.30)	(−2.4)
CONV(21)	.12	−5.0[a]
	(.32)	(−2.8)
CONV(22)	.08	−4.1[b]
	(.27)	(−2.1)
CONV(23)	.06	−3.9[b]
	(.25)	(−1.9)
R-square		.34
F-statistic		11.2[a]
Sample size		341.0

NOTE: Mean and standard deviation of GRADE are 87.2 and 7.3, respectively.

a. Statistically significant at the 1-percent level.
b. Statistically significant at the 5-percent level.

Table B-3. Regression results with interaction of site type by number of sites (dependent variable: GRADE)

Independent variable	Mean (standard deviation)	Coefficient (t-statistic)
Intercept		80.3[a]
		(43.4)
ORIG(3)	.21	–2.2
	(.40)	(–1.6)
REMOTE(2)	.27	–2.4[a]
	(.44)	(–2.8)
REMOTE(3)	.23	–4.6[a]
	(.42)	(–3.5)
AFQT	62.2	.15[a]
	(18.1)	(7.7)
YOS	5.9	.34[a]
	(4.4)	(3.4)
COURSE1	.33	–2.0
	(.47)	(–1.2)
COURSE2	.06	–3.1
	(.24)	(–1.5)
COURSE3	.17	–3.1[b]
	(.37)	(–2.3)
COURSE4	.19	–1.7
	(.39)	(–1.2)
COURSE5	.17	–3.2[b]
	(.37)	(–2.1)
R-square		.33
F-statistic		16.6[a]
Sample size		356.0

NOTE: Mean and standard deviation of GRADE are 87.2 and 7.2, respectively.

a. Statistically significant at the 1-percent level.
b. Statistically significant at the 5-percent level.

APPENDIX C

STUDENT QUESTIONNAIRES

APPENDIX C

STUDENT QUESTIONNAIRES

This appendix contains copies of the student questionnaires used in evaluating the Navy's VTT courses. The questionnaires were developed by CNA based on input from the fleet and other organizations represented on the Steering Committee.

BACKGROUND QUESTIONNAIRE FOR VTC STUDENTS

INSTRUCTOR:	Administer this questionnaire on the first day of class and send all questionnaires to Dam Neck P.O.C.
FACILITATOR:	Collect questionnaires and send to instructor, who will forward them.

1. Name _____ _____ _____ 2. SSN _____ - _____ - _____
First MI Last

3. Gender ☐ a. Male ☐ b. Female 4. Paygrade _____-_____ 5. Rating _____ 6. Today's date___/___/___

7. Course title

☐ a. Ammo Admin
☐ b. Gun Batt Align
☐ c. TADIL-A FORTRCOO
☐ d. OPSEC Planning
☐ e. Advanced SM
☐ f. Soviet Signaling
☐ g. Comm Procedures
☐ h. CCCC
☐ i. Intro to HWS
☐ j. Sub Off Minewar
☐ k. Other (specify) _____

8. Type of classroom

☐ a. Originating where instructor is physically present
☐ b. Remote where instructor is seen on television

9. Location of your classroom

☐ a. FCTCLANT, Dam Neck, VA
☐ b. FTC, Norfolk, VA
☐ c. FTC, Mayport, FL
☐ d. FMWTC, Charleston, SC
☐ e. Other (specify) _____

10. City and state of your duty station _____, _____

11. Name of your command (example: FFG 36) _____

12. Are you receiving per diem while taking this course?

☐ a. Yes
☐ b. No

ANSWER QUESTIONS 13 THROUGH 15 ONLY IF YOU ANSWERED YES TO QUESTION 12.

13. Type of berthing when taking course

☐ a. BEQ or BOQ
☐ b. Commercial hotel or motel
☐ c. Other (specify) _____

14. Mode of transportation (from city of duty station to course)

☐ a. Air
☐ b. Bus
☐ c. Train
☐ d. Auto
☐ e. Other (specify) _____

15. One-way travel time in hours (from city of duty station to course) _____

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COURSE QUESTIONNAIRE FOR VTC STUDENTS

INSTRUCTOR:	Administer to students at the end of last class and send to Dam Neck P.O.C.
FACILITATOR:	Collect questionnaires and send to instructor, who will forward them.

1. Name _____ _____ _____ 2. SSN _____ - _____ - _____
First MI Last

3. Today's date___/___/___

4. Course title

- ☐ a. Ammo Admin
- ☐ b. Gun Batt Align
- ☐ c. TADIL-A FORTRCOO
- ☐ d. OPSEC Planning
- ☐ e. Advanced SM
- ☐ f. Soviet Signaling
- ☐ g. Comm Procedures
- ☐ h. CCCC
- ☐ i. Intro to HWS
- ☐ j. Sub Off Minewar
- ☐ k. Other (specify) _____

SECTION 1: COURSE EVALUATION

For each of the following statements (1 through 21), check the appropriate box corresponding to a scale of 1 (unsatisfactory) through 5 (outstanding). Leave any statements that do not apply to this course blank.

	UNSATISFACTORY				OUTSTANDING
INSTRUCTOR	0-50% OF TIME	51-60% OF TIME	61-80% OF TIME	81-90% OF TIME	91-100% OF TIME
1. Instructor prepared for class	☐	☐	☐	☐	☐
2. Instructor presented lessons clearly	☐	☐	☐	☐	☐
3. Instructor answered student questions	☐	☐	☐	☐	☐
4. Instructor encouraged class participation	☐	☐	☐	☐	☐
5. Instructor was available for individual assistance outside of class	☐	☐	☐	☐	☐
6. Instructor treated students fairly	☐	☐	☐	☐	☐
AUDIO-VISUAL AIDS					
7. Video screen was large enough to be seen	☐	☐	☐	☐	☐
8. Video screen was close enough to be seen	☐	☐	☐	☐	☐
9. Image on video screen was clear	☐	☐	☐	☐	☐
10. Audio transmission was loud enough to hear instructor's voice	☐	☐	☐	☐	☐
11. Audio transmission was clear enough to hear what instructor said	☐	☐	☐	☐	☐
12. Graphics/Slides/Transparencies on TV were readable	☐	☐	☐	☐	☐
13. Television was in working order	☐	☐	☐	☐	☐
14. Your microphone was in working order	☐	☐	☐	☐	☐

(OVER)

TESTS/HOMEWORK	UNSATISFACTORY 0-50% OF TIME	51-60% OF TIME	61-80% OF TIME	81-90% OF TIME	OUTSTANDING 91-100% OF TIME
15. Test questions were clearly written	☐	☐	☐	☐	☐
16. Test questions were directly related to course	☐	☐	☐	☐	☐
17. Test answers were graded fairly	☐	☐	☐	☐	☐
18. Homework assignments were understandable	☐	☐	☐	☐	☐
19. Homework assignments were directly related to course	☐	☐	☐	☐	☐

OVERALL	UNSATISFACTORY				OUTSTANDING
20. Comparison of this instructor to other Navy instructors that have taught you in the past	☐	☐	☐	☐	☐
21. Comparison of this course to other Navy courses that you have taken in the past	☐	☐	☐	☐	☐

SECTION 2: INSTRUCTOR-STUDENT INTERACTION

22. Did you talk to the instructor or ask any questions during the regular hours of this course?

☐ a. Yes
☐ b. No

23. How did the video tele-training method of instruction affect your opportunities to talk to the instructor or ask questions, as compared to traditional methods of instruction?

☐ a. More opportunities
☐ b. No effect on opportunities
☐ c. Fewer opportunities

24. Were there adequate opportunities for remedial instruction outside of the regular hours of this course?

☐ a. Yes
☐ b. No
☐ c. Remedial instruction was not necessary for this course.

25. Did you attend any remedial instruction periods?

☐ a. Yes
☐ b. No

ANSWER QUESTIONS 26 AND 27 ONLY IF YOU ANSWERED YES TO QUESTION 25.

26. From whom did you obtain the remedial instruction?

☐ a. Instructor via video tele-training
☐ b. Instructor who was physically present in same room
☐ c. Other (specify) _____

27. How many hours of remedial instruction did you receive? _____

SECTION 3: STUDENT COMMENTS

28. Which method of instruction would you have preferred for this course?

- ☐ a. Video tele-training where instructor is on TV
- ☐ b. Traditional methods of instruction where instructor is physically present in the classroom
- ☐ c. Indifferent between video tele-training and traditional methods of instruction

29. How did the participation of students at other site(s) affect your learning during this course?

- ☐ a. Improved learning
- ☐ b. No effect on learning
- ☐ c. Reduced learning

30. What did you like most about this course?

31. What did you like least about this course?

32. Discuss any suggestions that you have for improving how video tele-training is used in this course.

APPENDIX D

ADDITIONAL STATISTICS FROM STUDENT COURSE EVALUATIONS

APPENDIX D

ADDITIONAL STATISTICS FROM STUDENT COURSE EVALUATIONS

Tables D-1 through D-6 support section 4's discussion of the student evaluation of Navy VTT. The tables show sample sizes by type of site and actual t-statistics for each item and for the overall evaluation.

Table D-1. Student evaluation of instructor

Statement	Sample size		t-statistic for difference in means
	Remote	Originating	
Instructor prepared for class.	332	316	−6.5
Instructor presented lessons clearly.	332	315	−10.4
Instructor answered student questions.	331	314	−6.5
Instructor encouraged class participation.	332	314	−6.8
Instructor was available for individual assistance outside of class.	282	312	−15.9
Instructor treated students fairly.	321	315	−6.3

Table D-2. Student evaluation of audio-visual aids

Statement	Sample size		t-statistic for difference in means
	Remote	Originating	
Video screen was large enough to be seen.	331	255	-4.0
Video screen was close enough to be seen.	328	257	-3.3
Image on video screen was clear.	331	257	-8.5
Audio transmission was loud enough to hear instructor's voice.	331	222	-5.9
Audio transmission was clear enough to hear what instructor said.	330	219	-8.6
Graphics/slides/transparencies on TV were readable.	327	249	-14.0
Television was in working order.	330	257	-1.1
Your microphone was in working order.	329	236	-1.5

Table D-3. Student evaluation of tests and homework

Statement	Sample size		t-statistic for difference in means
	Remote	Originating	
Test questions were clearly written.	290	264	-4.5
Test questions were directly related to course.	289	264	-5.7
Test answers were graded fairly.	269	259	-4.3
Homework assignments were understandable	248	224	-3.1
Homework assignments were directly related to course.	246	227	-2.8

Table D-4. Student overall evaluation of VTT course

Statement	Sample size		t-statistic for difference in percent
	Remote	Originating	
Comparison of this instructor to other Navy instructors that have taught you in the past.	328	307	−9.8
Comparison of this course to other Navy courses that you have taken in the past	329	307	−11.3

Table D-5. Student responses to other items on course questionnaire

Statement	Remote (percent)	Originating (percent)	t-statistic for difference in percent
Preferred traditional method of instruction	64.2	78.2	−3.9
Interacted with instructor during regular hours of course	75.6	92.4	−6.0
Perceived fewer opportunities to interact with instructor using VTT relative to traditional methods of instruction	55.0	15.1	11.5
Attended any remedial instruction periods	13.4	21.8	−2.8
Perceived that opportunities for remedial instruction were adequate	41.6	73.2	−8.5
Perceived that participation of students at other sites reduced own learning	18.2	17.5	0.2

Table D-6. Sample size for other items on course questionnaire

Item	Remote	Originating
Prefsrence as to method of instruction	327	304
Interaction with instructor during regular hours of course	332	218
Opportunities to interact with instructor using VTT relative to traditional methods of instruction	331	235
Attendance at remedial instruction periods	326	307
Adequacy of opportunities for remedial instruction	329	310
Impact of participation of students at other sites on own learning	319	309

APPENDIX E

SPECIFIC REASONS FOR DOWNTIME BY INCIDENT

APPENDIX E

SPECIFIC REASONS FOR DOWNTIME BY INCIDENT

Tables E-1 and E-2 show the amounts of, and specific reasons for, downtime in each convening of the Navy's VTT courses during the first six months.

Table E-1. Reasons for downtime (1st quarter)

Convening number	Downtime (minutes)	Source of problem
1	120	NASA launch delays start
2	30	Bad weather at Dam Neck
2	0[a]	Modem at Mayport
3	40	Satellite dish
4	45	Disk interfacing with CODEC
4	15	Bad weather at Dam Neck
5	30	Charleston audio
6	15	Loose cable in CODEC link
7	10	Microphone at Norfolk and switching problems at Dam Neck
7	10	Power outage at Norfolk
7	60	Bad weather at Mayport
7 & 8	10	Satellite carrier
9 & 10	15	Brown-out
9 & 10	30	Bad weather at Charleston
10	0[a]	Power outage at Mayport due to weather
10	10	Bad weather at Mayport
10	90	Bad weather at Mayport

a. Students were dismissed early.

Table E-2. Reasons for downtime (2nd quarter)

Convening number	Downtime (minutes)	Source of problem
13	0	Modem at Charleston 1; switched classrooms
14	4	Bad weather at Mayport
15	90	Resister in power supply at Charleston
16	15	Bad weather
16	45	Technical difficulties
16 & 18	30	Bad weather at Charleston
16	45	Power outage at Norfolk
20	16	Bad weather
21	40	Torn plastic cover on earth station
21	25	Audio problems at Charleston and Mayport
21	15	Audio problems at Charleston
22	15	Technical difficulties
23	30	Loose cable on modem at Charleston

APPENDIX F

COST AVOIDANCE BY SPECIFIC USE

APPENDIX F

COST AVOIDANCE BY SPECIFIC USE

Tables F-1 through F-4 support section 6's discussion of the Navy's savings from using VTT, during the first six months. Tables F-1 and F-2 show the gross savings from using VTT for Navy course training. Tables F-3 and F-4 show the gross savings from using VTT for other uses, such as briefings on training exercises, civilian training, and conferences.

Table F-1. Cost avoidance by course convening (1st quarter)

Convening number	Number who would have traveled	Travel savings (round-trip)	Per diem savings	Gross savings
1	9	$2,537	$1,444	$3,981
2	16	4,101	466	4,567
3	9	2,349	262	2,611
4	27	7,842	4,118	11,959
5	14	3,286	928	4,214
6	4	996	117	1,113
7	17	3,808	2,388	6,196
8	28	7,728	2,065	9,793
9	15	3,735	437	4,172
10	14	3,379	408	3,787
Total	153	$39,761	$12,633	$52,393

Table F-2. Cost avoidance by course convening (2nd quarter)

Convening number	Number who would have traveled	Travel savings (round-trip)	Per diem savings	Gross savings
11	3	$757	$206	$963
12	8	2,604	1,738	4,342
13	20	4,755	371	5,126
14	8	2,001	531	2,532
15	8	2,324	863	3,187
16	17	6,390	8,406	14,796
17	12	3,027	824	3,851
18	15	3,840	437	4,277
19	16	4,634	2,483	7,117
20	31	9,181	5,484	14,665
21	28	7,123	1,233	8,356
22	9	2,339	432	2,771
23	9	2,393	679	3,072
24	20	5,245	1,373	6,618
25	15	5,033	3,723	8,756
Total	203	$61,646	$28,783	$90,429

Table F-3. Cost avoidance by other use (1st quarter)

Other use	Number who would have traveled	Travel savings (round-trip)	Per diem savings	Gross savings
CINTEX	27	$7,561	$3,281	$10,842
FLEETEX	25	5,836	3,038	8,874
OCPM conf.	37	10,441	4,496	14,937
OCPM conf.	22	6,196	2,673	8,869
OCPM conf.	40	11,370	4,860	16,230
OCPM training	17	4,781	2,066	6,847
OCPM training	25	7,000	3,038	10,038
OCPM training	16	4,563	1,944	6,507
OCPM training	35	9,905	4,253	14,158
TCCT conf.	14	3,752	1,701	5,453
Total	258	$71,405	$31,350	$102,755

Table F-4. Cost avoidance by other use (2nd quarter)

Other use	Number who would have traveled	Travel savings (round-trip)	Per diem savings	Gross savings
BFIT	5	$1,340	$608	$1,948
BFIT	13	3,484	1,580	5,064
BFIT	20	5,360	2,430	7,790
BFIT	10	2,680	1,215	3,895
BFIT	12	3,216	1,458	4,674
CINTEX	24	6,857	2,916	9,773
Total	84	$22,937	$10,207	$33,144