

1. Report No. FAA-AM-72-33		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle ATTRITION-RETENTION RATES OF AIR TRAFFIC CONTROL TRAINEES RECRUITED DURING 1960-1963 AND 1968-1970				5. Report Date November 1972	
				6. Performing Organization Code	
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9. Performing Organization Name and Address FAA Civil Aeromedical Institute P. O. Box 25082 Oklahoma City, Oklahoma 73125				10. Work Unit No.	
				11. Contract or Grant No.	
12. Sponsoring Agency Name and Address Office of Aviation Medicine Federal Aviation Administration 800 Independence Avenue, S.W. Washington, D. C. 20591				13. Type of Report and Period Covered OAM Report	
				14. Sponsoring Agency Code	
15. Supplementary Notes This research was conducted under Tasks No. AM-B-69-PSY-5, AM-A-70-PSY-5, AM-B-71-PSY-5, and AM-B-72-PSY-5.					
16. Abstract This study involved a total of 6,367 subjects in three ATCS options. Of these, 2,000 entered FAA Academy training during 1960 to 1963, before an ATC-Aptitude Test Battery became operational in the screening of most applicants. The remaining 4,367 subjects, the vast majority of whom were selected from among aptitude-screened applicants, entered the Academy's basic training courses during October 1968 through March 1970. Percentages reflecting Academy elimination rates for entrants of the earlier and later time periods, respectively, were: 20.9 and 19.3 for Terminal Area Traffic Control (TATC) personnel, 32.0 and 17.9 for Air Route Traffic Control Center (ARTCC) trainees, and 18.5 and 12.8 for the Flight Service Station (FSS) option. Irrespective of training option, the Academy eliminees represented 26.2% of the 2,000 pre-1964 recruits and 17.9% of the 4,367 entrants of the more recent time period. Using 1 December 1971 as a common date for follow-up purposes, it was determined that the <u>post-Academy attrition rates</u> for the TATC, ARTCC, and FSS entrants of 1960-1963 were 16.0, 22.8, and 18.1%, respectively (averaging 19.6), whereas corresponding rates for those recruited only 20 to 38 months prior to the follow-up date were 10.1, 20.3, and 5.9 (averaging 17.2%). The study also revealed that personnel who were exempted from the aptitude-screening requirement and entered training at the GS-9 level or higher (on the basis of specialized pre-FAA experience) had appreciably higher Academy graduation rates but lower <u>post-Academy retention</u> rates at high-traffic-density TATC and ARTCC facilities than did the conventionally recruited trainees.					
17. Key Words Air Traffic Controller Training Attrition Personnel Selection Career Success			18. Distribution Statement Availability is unlimited. Document may be released to the National Technical Information Service, Springfield, Virginia 22151, for sale to the public.		
19. Security Classif. (of this report) Unclassified		20. Security Classif. (of this page) Unclassified		21. No. of Pages 31	22. Price \$3.00

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ATTRITION-RETENTION RATES OF AIR TRAFFIC CONTROL TRAINEES RECRUITED DURING 1960-1963 AND 1968-1970

I. Introduction.

During the past 12 years, the Federal Aviation Administration's Civil Aeromedical Institute (CAMI) has conducted extensive research bearing upon the usefulness of various aptitude test measures, evaluations of pre-FAA experience, assessments of educational background, chronological age, and other variables for selection of personnel for training as Air Traffic Control Specialists (ATCSs). The ultimate objective of such research has been the identification of factors having validity for prediction of success at the journeyman-level controller position.

In most instances, predictor variables were first validated against criterion measures which were more readily available. For example, grades reflecting performance in the academic and laboratory phases of the Academy's basic training courses and "pass-fail status" for Academy training were the only criteria utilized in some of the studies.^{2 3 5 6 7 8 9 22} In a number of other studies,^{18 19 20 21 23} the predictor variables were validated against Academy training performance measures and also against indices of post-Academy training progress and/or "attrition-retention status" of personnel for periods of one to eight years after entry into training. Moreover, experimental performance-rating procedures were developed and employed in several follow-up studies^{4 15 18 20 21 23} because the officially derived ratings (e.g., those based on the "Employee Appraisal Record," and others which were rendered primarily for remedial or diagnostic purposes) offered little potential for individual differentiation. The experimental ratings submitted by supervisors, crew chiefs, and peers of the subjects were somewhat less "haloed" than those rendered for official purposes but, like

The assistance of Dana Hauserman and Barbara Mallett in the collection, processing, and/or analysis of the data is gratefully acknowledged.

the latter, they did not possess a very high degree of reliability.

It is not at all uncommon in personnel selection research to experience great difficulty in obtaining criterion measures which are considered fully satisfactory. According to Thorndike and Hagen,¹⁷ two of the best known authorities in the field, "the most troublesome part of personnel selection is to get reliable, unbiased, and relevant measures of success on the job." In most situations, measures with such characteristics either do not exist or they are apt to be very few in number. Moreover, their development is particularly difficult if the man-machine system is an extremely complex one which is undergoing continual evolution. This is much the type of situation with which CAMI and other FAA investigators have been confronted in research on ATCS personnel; there has generally been little recourse other than to deal with the criterion data set forth in the official records.

Although none of the wide variety of variables used as criteria in CAMI's ATC selection research may be deemed entirely satisfactory, there are two which have been consistently regarded as more important than all others. Both relate to the attrition-retention status of personnel, with the first reflecting graduation or elimination from Academy basic training, and the other denoting post-Academy attrition-retention status at specified points in time.

The present report pertains to a follow-up study in which updated records of 1 December 1971 were used to ascertain the long-range attrition-retention status of each ATCS subject who entered Academy basic training as a member of any of the classes for which CAMI collected data in connection with its ATC selection research of the past 12 years. Inasmuch as a large proportion of the subjects were enrollees of the period September 1960 through August 1963 while others entered under different qualification-

and-selection standards during October 1968 through March 1970, one objective of the study was to determine and compare both the Academy elimination rates and post-Academy attrition rates of personnel recruited during the different time periods for each of the training options. A second, and perhaps the most important, purpose of the study was to ascertain the degree to which variance in the Academy elimination rate of each group and subgroup (i.e., training option) might be associated with that of the post-Academy attrition rate. A third major objective was to compare the retention rates of *Academy ATCS graduates* at En Route and Terminal facilities of different air-traffic-density levels.

II. Method.

The study involved a total of 6,367 former students of the Academy's basic training courses in En Route, Terminal, and Flight Service Station procedures. The vast majority of the 6,367 had been appointed to ATC training less than three weeks before entry into the Academy. All were members of classes, or groups, which entered the Academy during specific time periods in which CAMI was engaged in extensive experimental testing programs. Inasmuch as the procedures and results relating to the different phases of that research have been summarized in a number of earlier publications,^{2 5 7 8 9 18 21} they will not be reviewed in detail in this report. However, it should be emphasized that this follow-up study pertains *only* to those former classes of each training course for which CAMI collected a variety of data in connection with the earlier studies.

A. *1960-1963 Groups.* Exactly 2,000 of the 6,367 subjects entered Academy basic training during September 1960 through August 1963. When CAMI initiated its ATCS selection research in September 1960, the Academy was conducting three basic ATC training courses. Personnel recruited for work at Terminal, or Tower, facilities were assigned to the T-303 course in which the instruction and training focused upon Terminal Area Traffic Control (TATC) procedures. En Route, or Center, trainees attended the T-302 course, in which Air Route Traffic Control Center (ARTCC) procedures were emphasized. Similarly, Flight Service Station recruits received specialized training

in the FSS T-304 course. Each of the three courses was of eight weeks duration.

Due to research priorities, no data were collected on groups which entered the FSS course prior to 7 September 1962. It was announced in August of that year that the ARTCC course was to be discontinued and that the last En Route class would enter training on 21 September. Arrangements were then made to extend the research to include all FSS trainees who entered during September 1962 and thereafter. The aptitude testing program and the collection of other data for the FSS and TATC trainees continued until 23 August 1963, on which date the last class entered the TATC course before that course was abolished and subsequent classes for the FSS course (which was eliminated some time later) were so small that they were excluded from all CAMI studies.

The groups of subjects, by training option, for which data were collected prior to September 1963 and which were included in the present study were as follows:

(1) 733 students of the Terminal TATC T-303 training course who entered the Academy during September 1960 through August 1963.

(2) 1,008 En Route trainees who entered the Academy's ARTCC T-302 course during September 1960 through September 1962.

(3) 259 FSS trainees who enrolled in the Academy's T-304 course during September 1962 through August 1963.

B. *1968-1970 Groups.* From 1964 until the latter part of 1968, budgetary limitations severely restricted the recruitment of personnel for ATCS training; no basic training courses were conducted at the Academy, and CAMI engaged in no detailed studies involving the few hundred trainees who were recruited during that period and who received basic training at their respective facilities of assignment. In 1968, however, a rapid expansion of the air traffic management system was undertaken. Funding was substantially increased, the FAA implemented a new program for accelerating the recruitment of ATCS trainees, and the Academy was again designated to provide basic training to newly hired control personnel.

Inasmuch as the basic training courses for En Route, Terminal, and FSS personnel had been discontinued almost five years earlier, the scope

of the revised ATC recruiting program and the need for its rapid implementation created a number of challenging problems for Academy training officials. Most importantly, they needed time (at least several weeks) in which to revise and update the respective training courses, to prepare instructional materials, assemble various types of equipment, and to recruit many additional instructors.

As a tentative solution, an abbreviated course of only six weeks duration and covering the general aspects of the air traffic management system was developed and instituted as the "T-305 Interim Course." All trainees, regardless of the training option for which recruited, who arrived at the Academy during the month of October and the first half of November 1968, took the T-305 course only.

On 20 November 1968, the T-203 TATC course, which was of 8½ weeks duration, was implemented for Terminal ATCS trainees and the T-204 course, which provided 13 weeks of training for newly recruited FSS personnel, became operational on the same date. En Route trainees continued to be assigned to the T-305 Interim Course until 8 January 1969, at which time the 8½ week T-202 ARTCC course was instituted.

A matter bearing upon the results obtained in this study is that standards for evaluation of training performance were virtually non-existent for the T-305 Interim Course. Moreover, Academy officials informed CAMI researchers that two to three months were required following implementation of each specialized training course before performance evaluation standards became stabilized and that trainees who entered after April 1969 were probably evaluated "more rigidly and in a more consistent manner" than those who entered during the earlier months.

Some 4,367 of the 6,367 subjects involved in the present study entered basic ATCS training at the Academy during the period 8 October 1968 through 27 March 1970. The groups, by training option, were:

(1) 935 Terminal trainees. Fifty-five, all of whom entered the Academy prior to 20 November 1968, took the T-305 Interim Course; the remaining 880 were students of the T-203 course.

(2) 3,159 En Route trainees. Only 437, who arrived at the Academy prior to 8 January 1969, were enrollees of the T-305 Interim Course. The remaining 2,722 took the T-202 basic training course.

(3) 273 FSS trainees. Nine entered the T-305 course on or before 5 November 1968 whereas the remaining 264 comprised the classes for the T-204 course.

C. Considerations in Comparing the 1960-1963 Groups With Those of 1968-1970. As a basis for evaluating the comparative analyses to be presented later, all differences between the attrition rates of the two major groups and also between and within the subgroups (i.e., En Routes, Terminals, and FSSs) must be presumed as being attributable to a variety of changing circumstances and factors. While we have chosen to omit discussion of the potential or speculated influence of most such factors, there are two which, in our opinion, warrant special elaboration.

First, it is essential to bear in mind that the post-Academy attrition-retention statuses of all subjects were determined relative to a specific date (i.e., 1 December 1971). Differences between dates of graduation from the Academy therefore resulted in different lengths of time during which the subjects were vulnerable to attrition in the post-Academy phases and/or possibly in the journeyman positions if recruited prior to 1964. A matter of relatively minor importance when comparing post-Academy attrition rates, and which should not be completely disregarded when considering Academy eliminations, is that the FSS T-204 course was of 13 weeks duration in 1968-1970, whereas the FSS T-304 course was eight weeks in length during 1960-1963. (The TATC and ARTCC basic training courses of both the earlier and later time periods were approximately eight weeks in length.)

The second factor which warrants special consideration concerns differences between the 1960-1963 and 1968-1970 groups with respect to cognitive, or intellectual, abilities. The procedures by which the pre-1964 trainees were selected from among ATCS applicants involved no formal assessment of mental abilities. Upon arrival at the Academy, however, they participated in a CAMI research project which included experimental examination with a wide variety of aptitude tests. It was subsequently deter-

mined, through analysis of the intercorrelations of 27 different tests and their validities for prediction of training performance, that a composite score based on only six of the instruments could be used to improve appreciably the ATCS selection process.

Beginning in January 1964 and continuing through September 1968, a qualifying aptitude index, based on the six tests recommended by CAMI, constituted a major eligibility requirement of every applicant, irrespective of his pre-FAA experience and other qualifications. The group of tests is generally referred to as the CSC (Civil Service Commission) ATC-Aptitude Test Battery.

However, when the FAA's program for rapid expansion of the ATC system was implemented in 1968, the selection standards were further modified. The change having a potential bearing upon the results obtained in this study pertained to those applicants having exceptional amounts or types of pre-FAA experience (and particularly radar control experience such as attained by many military controllers). Under the revised procedures, the latter could be granted exemptions of the aptitude qualification requirement *and* also be hired at pay grades, or General Service levels, of GS-8 and above, whereas the vast majority of trainees selected from among the less experienced applicants continued to be hired at the normal-entry pay grade of GS-7. The change was predicated on the assumption that most individuals having highly specialized experience would probably have little difficulty in successfully completing a basic training course in FAA TATC or ARTCC procedures and regulations and that they would master subsequent phases of training and advance to journeyman ATCS status more quickly than the less experienced personnel.

It was determined that 959 (or 22%) of the 4,367 entrants into Academy basic training during October 1968 through March 1970 possessed ratings above the GS-7 level. The 959 included two GS-12's, 20 GS-11's, 31 GS-10's, 745 GS-9's, and 161 GS-8's. All 161 GS-8's arrived at the Academy within three months after the new recruiting standards were implemented and most of them were shortly thereafter redesignated as GS-9's on the basis of re-evaluations of prior experience. Some 3,408 of the total group of 4,367 possessed ratings lower than GS-8; 2,955

were GS-7's, 404 were GS-6's, and 49 entered as GS-5's. All but 23 of the 404 GS-6's entered the Academy within the first 12 weeks following the new recruiting program's implementation. Over 95% of the 3,408 lower-rated and moderate-to-low experienced trainees indicated, on a CAMI-administered questionnaire, that they were required to qualify (with scores of 210 or higher) on the CSC ATC-Aptitude Test Battery before being appointed to ATCS training. In no analysis of the present study was a distinction made with respect to the trainees' specific GS levels. In the latter phases of the investigation, however, several analyses were accomplished in which, after *deletion* of the subjects who entered the Academy prior to 1 January 1969, the attrition and retention rates of the combined subgroups of GS-7's, GS-6's, and GS-5's were compared with those of all trainees who qualified for appointment to ATCS training (at the GS-9 level and higher) on the basis of specialized experience.

Numerous CAMI studies,^{e.g., 7 8 9} have consistently shown that the Academy trainees of October 1968 through March 1970 were generally very superior to the pre-1964 recruits in terms of performance scores on a wide variety of aptitude tests. For example, studies^{8 22} in which the CSC Test Battery was validated on 893 Academy trainees of 1962 and 1963 revealed that their mean raw score was 191 and that scores of 210 and above were attained by less than 36% (N=317) of the experimentally examined group. It was further determined that 271, or 30.3%, of the 893 failed to successfully complete Academy basic training and that over 80% (N=219) of the 271 eliminees were among the 576 who scored less than 210. In contrast, studies^{7 8 9} dealing with samples of aptitude-screened trainees who entered the Academy after September 1968 have shown that they generally averaged about 245 on the CSC Battery. Scores of 245 or better were attained by only 3.2% of the 893 pre-1964 trainees who were experimentally assessed with the battery. Moreover, we estimate (through interpolative procedures developed during research with the California Test of Mental Maturity¹⁶ and the CSC Battery) that a CSC score of 245 is roughly equivalent to a so-called "I.Q." of 130 to 135.

The study in which the CSC Battery was validated with 893 pre-1964 recruits revealed that

only 16.4% of the 317 with CSC scores of 210 and higher were subsequently attrited from Academy basic training. Therefore, a somewhat similar Academy elimination rate would be *expected* for the aptitude-screened trainees of the 1968-1970 groups if all other selection standards (i.e., exclusive of aptitude standards) and the Academy training courses and training-performance evaluation standards had remained unchanged across the contrasting time periods.

D. *Criterion Variables.* Academy training officials provided CAMI with an "Evaluation of Performance Record" for each trainee shortly after the graduation date of each class. For purposes of this study, each subject who failed to successfully complete his respective training course, regardless of reason, was designated as an "Academy attrition." (A previous study⁹ had shown that over 82% of the Academy non-graduates possessed failing grades at the time they were attrited.)

"Post-Academy retention-attrition status" reflected whether the subject was or was not with the FAA in ATCS work as of 1 December 1971. This was determined by collating the names and social security numbers of all subjects with those set forth in FAA magnetic tape records for all personnel who, on 1 December 1971, possessed an occupational code of 2152 (denoting the ATCS specialty). Those subjects who were still within the air traffic management system on that date were categorized as "post-Academy retentions." The listing of all remaining and attrited cases of the CAMI samples was then compared against the listing of Academy eliminees and each subject who was attrited subsequent to Academy graduation was designated as a "post-Academy attrition."

III. Results and Discussion.

ATTRITION AND RETENTION RATES OF THE 1960-1963 GROUPS

A. *Personnel of the Combined Training Options.* Figure 1 shows the numbers and proportions of the 2,000 entrants into the Academy's ARTCC, TATC, and FSS training courses during September 1960 through August 1963 who were: (a) Academy attritions, (b) post-Academy attritions, or (c) post-Academy retentions (as of 1 December 1971). Of the 2,000 students in the combined training options, 524, or 26.2%,

were attrited while at the Academy, and 393, or 19.6%, were attrited subsequent to Academy graduation. The remaining 1,083, representing 54.2% of the total group, were still with the FAA in ATC work on 1 December 1971, which was at least eight years and one month subsequent to the *graduation date* of the last class of which any of the group had been members. A point of probable interest, but not presented in Figure 1, is that the 1,083 retentions represented 73.4% of the 1,476 who successfully completed their respective training courses at the Academy.

The attrition and retention rates were also computed for subgroups, each of which represented the combined inputs for the Academy's TATC, ARTCC, and FSS training programs during one of nine 4-month intervals. The results are plotted in Figure 1.

An examination of Figure 1 will reveal that both types of attrition rates and the percentages reflecting the "retentions" were highly variable across the nine temporally-ordered subgroups. For example, the post-Academy retentions represented 58.7% of the personnel who entered Academy ATCS training during September-December 1960, 53.5% of those who entered during the first four months of 1961, and only 47% of the "May-August 1961" input. The retention rates of groups entering training thereafter were highly variable, ranging from 42.5% to 63.8%—for the inputs of May-August 1962 and May-August 1963, respectively.

Inasmuch as the post-Academy retention rate of each subgroup was dependent upon both the Academy-elimination and post-Academy-attrition rates, the fluctuations in the latter two are of particular interest. As may be noted, the Academy eliminees represented only slightly more than 17% of the recruits of "September-December 1960" and "January-April 1961," whereas the post-Academy attritions accounted for 23.9% and 29.3% of the respective inputs. During the ensuing 15 months, there was a general upward trend in the Academy elimination rate, to 42.8% for the entrants of May-August 1962, while the post-Academy attrition rate progressively declined from 26.9 to 14.7%. Thereafter, the trend in the Academy elimination rate was downward, to 20.1% for the May-August 1963 subgroup, whereas the post-Academy attrition rate progressed from a low of 10.3% for entrants of

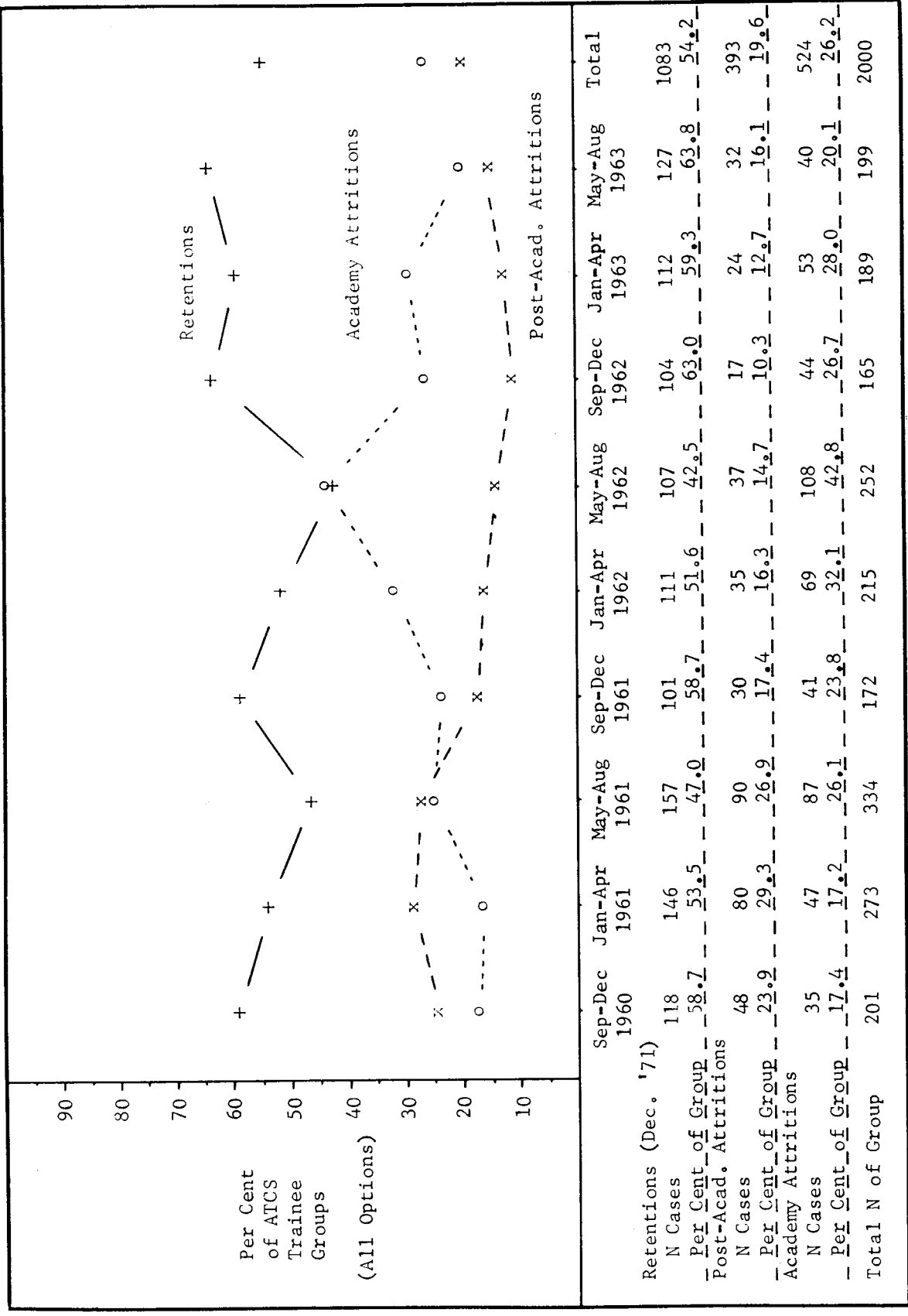


FIGURE 1. Percentages of entrants into the Academy's basic ARTOC, TAIC, and FSS courses during September 1960 through August 1968 who were Academy attritions, facility-training attritions, or were still in FAA ATC work in December 1971.

September-December 1962 to 16.1% for personnel recruited during the last four months of the time period.

A most obvious finding is that the post-Academy attrition rates, such as those depicted in Figure 1, tended to vary inversely with the Academy elimination rates. This finding was not particularly surprising, however, because both rates for each of the subgroups represented percentages based on the total number of *entrants* into training. In other words, the post-Academy attrition rate depended to some extent upon the Academy elimination rate. For example, had 80% of the trainees entering during one of the four-month intervals been eliminated during Academy training, the post-Academy attrition rate (as based on the number of entrants) would have been necessarily low and could not have exceeded 20%.

Consequently, an analysis was undertaken wherein the post-Academy attrition rates were determined for the *Academy graduates only* and techniques were then employed to assess the relationship between the latter and the Academy elimination rates. The two arrays of percentages are presented in Table 1. (In order to assess more reliably the relationship between the two rates, the group of 2,000 pre-1964 trainees was divided into 18 subgroups, rather than the nine for which data were depicted in Figure 1.)

The lowest of the Academy elimination rates pertained to those ATCS personnel who entered training during January-February 1961; only 13.4% of them were eliminated at the Academy but 33.6% of those who graduated were eventually attrited at their facilities of assignment. Similarly, only 16.4% of the entrants of September-October 1960 failed to complete Academy

Table 1

Rates of elimination from Academy training for 1960-1963 ATCS personnel of all options and attrition rates for GRADUATES of Academy training after returning to field facilities.

Academy Training Entry Periods	Entrants Into Academy Training N	Per Cent of ENTRANTS Eliminated During Academy Training	Per Cent of GRADUATES of Academy Training Attrited at Facilities
1960			
September-October	116	16.4	34.0
November-December	85	18.8	21.7
1961			
January-February	127	13.4	33.6
March-April	146	20.6	37.1
May-June	205	29.8	38.2
July-August	129	20.2	34.0
September-October	113	23.9	24.4
November-December	59	23.7	20.0
1962			
January-February	86	27.9	30.6
March-April	129	34.9	19.1
May-June	178	40.4	28.3
July-August	74	48.2	18.4
September-October	85	28.2	19.7
November-December	80	25.0	8.3
1963			
January-February	89	20.2	25.4
March-April	100	35.0	9.2
May-June	111	18.9	22.2
July-August	88	21.6	17.4
Total	2000	26.2	26.6

Correlation between Academy elimination rates and post-Academy attrition rates (rho coefficient): -.40*

* Statistically significant at the .05 level.

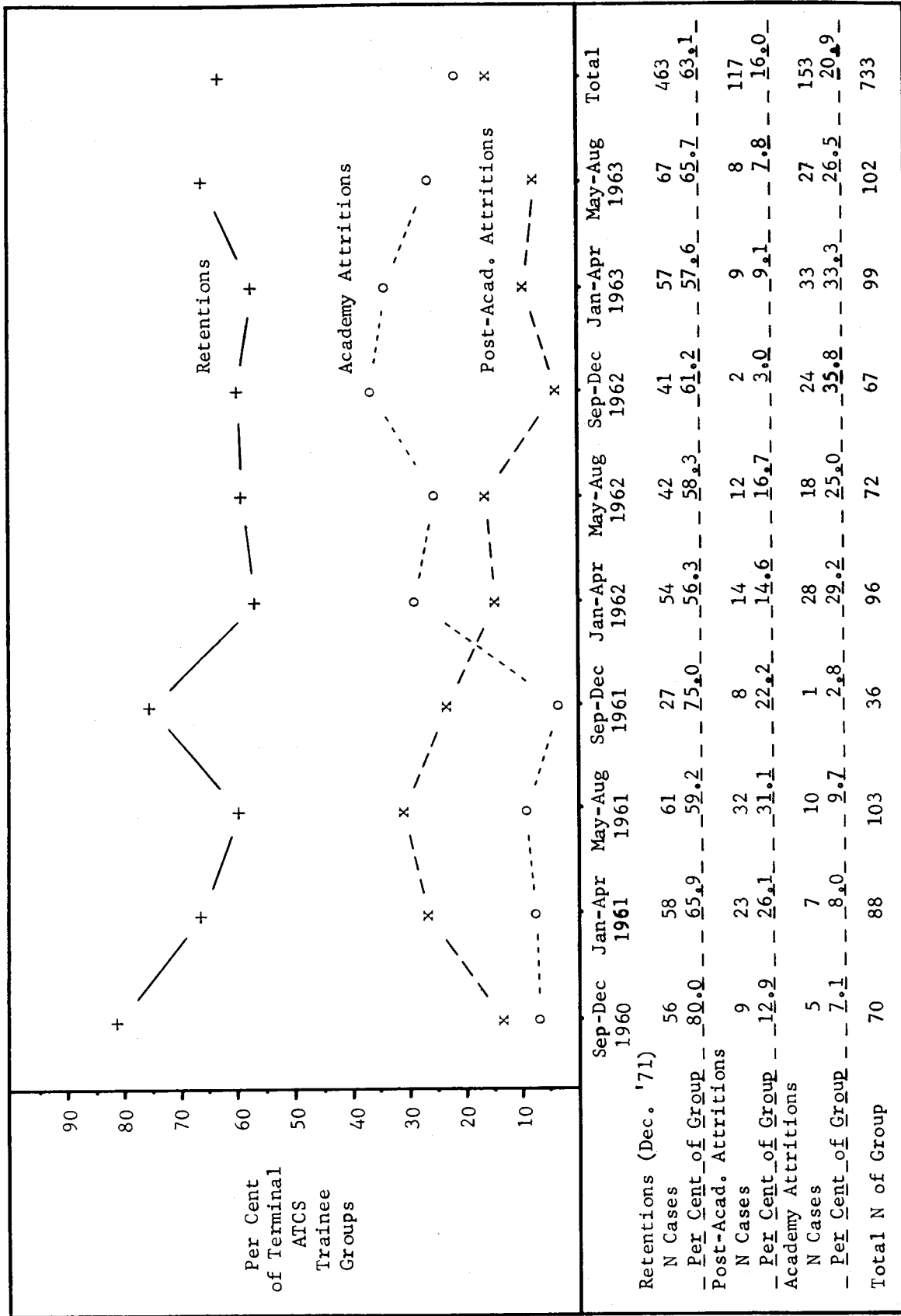


Figure 2. Percentages of entrants into Academy basic TATC training during September 1960 through August 1963 who were attrited at the Academy, were attrited at their facility, or were still in FAA ATC work in December 1971.

training whereas the post-Academy attrition rate of those who survived basic training was 34%. Conversely, the lowest of the post-Academy attrition rates was 8.3% for the graduates of the November-December 1962 classes from which 25% were eliminated at the Academy. Although there were exceptions, the rates tended to vary inversely with each other. Spearman's rank-difference correlation method was employed to assess their relationship. The resulting rho coefficient was -0.40 , indicating a moderate and statistically significant ($p < .05$) inverse relationship. The finding of a significant negative correlation between the two variables provides empirical support for the philosophy of the 1960-1963 period, i.e., that the Academy's basic

training courses should serve to further screen, as well as initially train, newly hired ATCS personnel.

B. *Comparison of Terminal, En Route, and FSS Trainees of 1960-1963.* Figures 2, 3, and 4 follow the same format as Figure 1, but present attrition and retention rates separately for the 733 entrants into the Academy's TATC course (Figure 2), the 1,008 who entered the ARTCC course (Figure 3), and the 259 FSS enrollees (Figure 4).

As of December 1971, 63.1% (N=463) of the former TATC students and 63.3% (N=164) of the FSSs were still in the air traffic management system compared to a significantly lower ($p < .01$) proportion of 45.2% (N=456) of the En Routes.

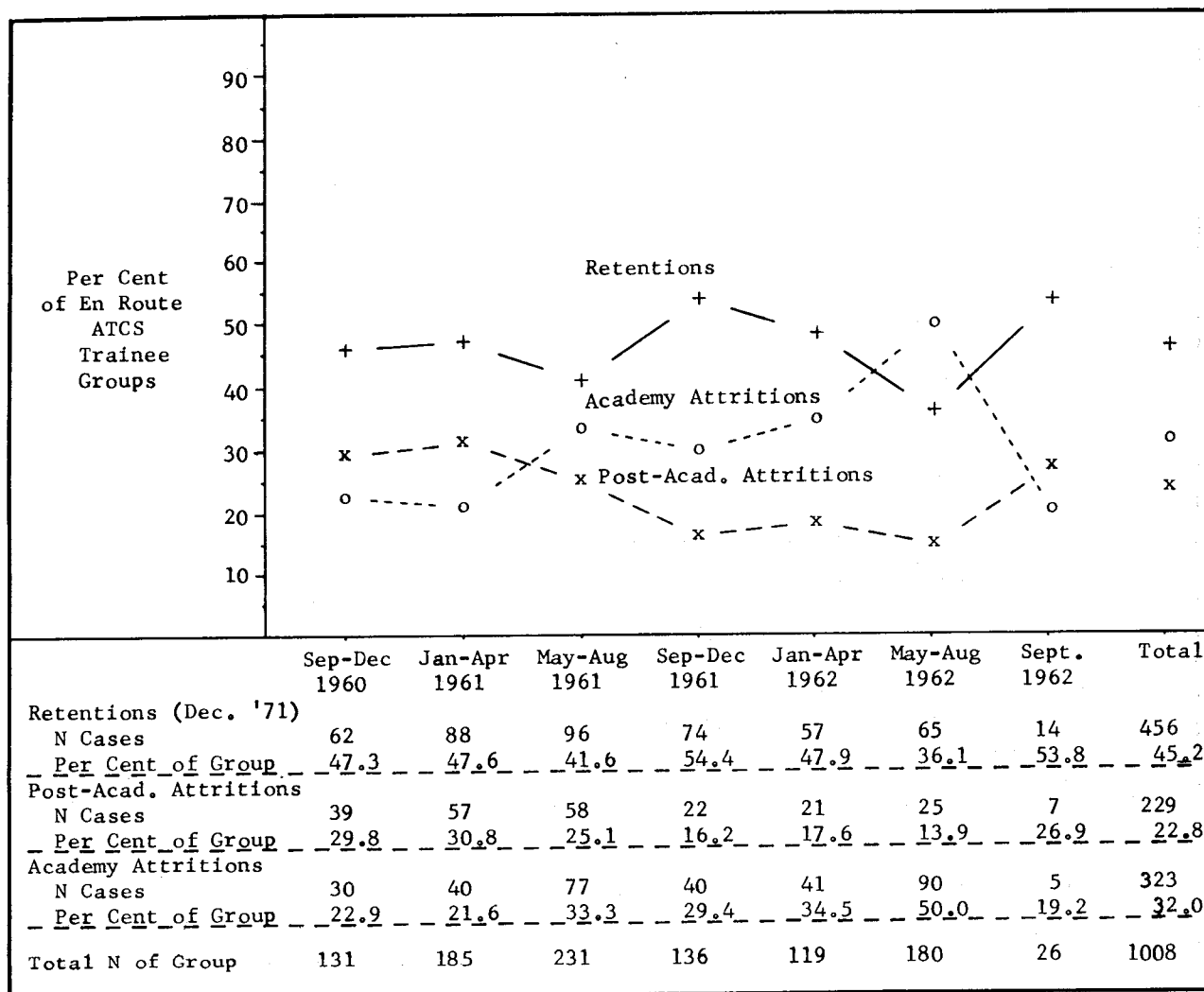


FIGURE 3. Percentages of entrants into Academy basic ARTCC training during September 1960 through September 1962 who were attrited at the Academy, were attrited at their facility, or were still in FAA ATC work in December 1971.

(Except where otherwise noted, differences between corresponding rates and proportions presented in this report were tested for statistical significance through use of the \bar{z} ratio method.)

Exactly 32% of the En Routes were eliminated from training while at the Academy; this was significantly higher ($p < .01$) than the Academy attrition rates of 20.9% and 18.5% obtained for the Terminals and FSSs, respectively. Post-Academy attrition rates (as based on each total input) were 16.0% for the Terminals, 22.8% for the En Routes, and 18.1% for the FSSs; only the

difference between the ARTCC and TATC rates was statistically significant ($p < .01$).

Although not shown, percentages were also computed reflecting the post-Academy attrition rates of only those who successfully completed Academy training. The percentages were 20.2, 33.4, and 22.3 for the TATC, ARTCC, and FSS graduates, respectively. The difference between the TATC and FSS rates was not statistically significant, but both were significantly lower ($p < .01$) than the 33.4% obtained for the ARTCC subjects. These findings illustrate that the En

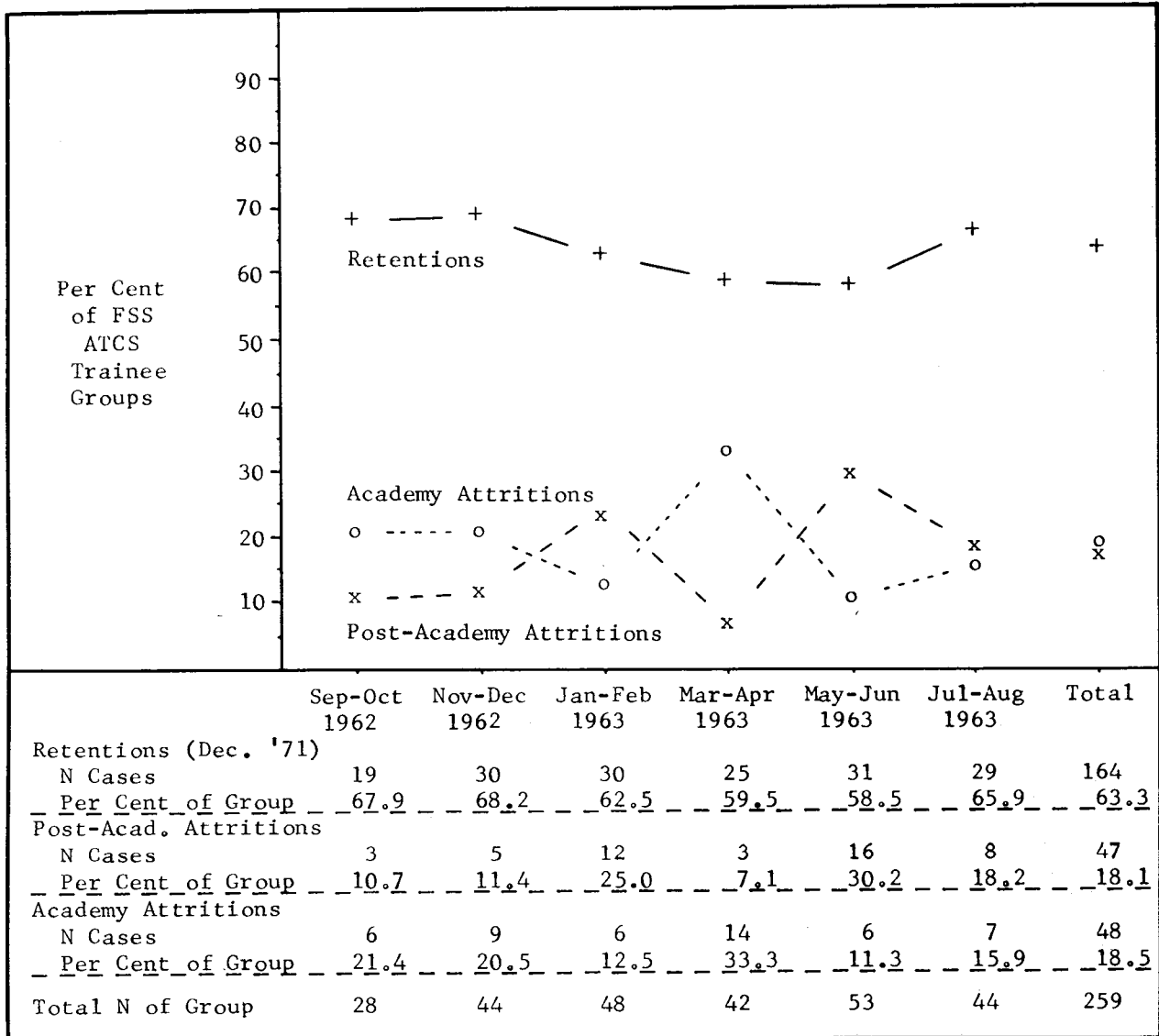


FIGURE 4. Percentages of entrants into Academy basic FSS training during September 1962 through August 1963 who were attrited at the Academy, were attrited at their facility, or were still in FAA ATC work in December 1971.

Route personnel experienced appreciably greater difficulty than personnel of the other two options both in completing Academy training and in post-Academy career advancement phases. A matter of possible relevance is that most trainees in the En Route and Terminal options possessed prior military experience as tower controllers; this being so, the ARTCC (or En Route) course may have presented certain "transitional difficulties" which the TATC course did not.

The group of Terminal subjects was divided into nine subgroups, with the subgroups representing entrants into the TATC course during each of *nine 4-month intervals*. The mean attrition rates were then computed and plotted (Figure 2) for the successive intervals. Data of the En Route trainees were also grouped in terms of *four-month intervals* but all subjects of the last, or *seventh*, subgroup entered during one month, September 1962. As may be recalled, no data were collected for the FSS trainees who arrived at the Academy prior to 7 September 1962 and only 259 entered the T-304 course after that date. For these reasons, the group of 259 FSSs was divided into only six subgroups, representing the inputs of *six 2-month intervals*.

The three figures illustrate that both types of attrition rates for personnel of every training option were quite variable across the temporally arranged subgroups. Moreover, the plotted rates for the TATC personnel (see Figure 2), supplemented by those of the En Route ATCSs (see Figure 3), suggest that the changes in the rates were not random fluctuations. Instead, they appear to have been associated with time of entry into training. For example, Figure 2 indicates that the Academy elimination rates were less than 10% for the four TATC subgroups which began training prior to January 1962, whereas the post-Academy rates of the same subgroups were 12.9, 26.1, 31.1, and 22.2%. The Academy elimination rates for the TATC inputs of the next five 4-month intervals were 29.2, 25.0, 35.8, 33.3, and 26.5%; in contrast, the post-Academy attrition rates of the five subgroups dropped to 14.6, 16.7, 3.0, 9.1, and 7.8%. For En Route personnel recruited prior to May 1961, the Academy elimination rates were no higher than 23% while the post-Academy attrition rates were around 30%. Academy elimination rates of the ARTCC personnel who entered thereafter tended to be appreciably higher, reaching 50% for the

inputs of May-August 1962, whereas the post-Academy attrition rates were generally much lower than obtained for the earlier recruited personnel.

Although the results are not presented in any table or figure, analyses were also accomplished wherein the post-Academy attrition rates were computed, by training option, for the *Academy graduates only*. The pre-1964 TATC subjects were divided into 18 subgroups, each of which represented the combined incoming classes for the TATC course during a two-month interval. Similar procedures resulted in the establishment of 13 subgroups of ARTCC subjects. Inasmuch as all 259 FSS subjects entered training within a period of only one year, and none entered during December of 1962, they were divided into 11 subgroups, with each representing a one-month input.

The post-Academy attrition rates of the TATC *Academy graduates* averaged 20.2% and ranged from 0.0% for classes of November-December 1962 (from which 30.6% had been attrited at the Academy) to 40.5% for TATC inputs of July-August 1961 (for which the Academy elimination rate had been only 6.7%). ARTCC personnel who survived Academy basic training had an overall facility-of-assignment attrition rate of 33.4%; the lowest was 13.0% for subjects who entered as members of the July-August 1962 classes for which the Academy attrition rate was 56.6%; the highest was 47.2% for graduates of En Route classes of January-February 1961 for which the Academy elimination rate was 22.1%. The mean post-Academy attrition rate of all pre-1964 FSS training course graduates was 22.3%. There were no post-Academy attritions among the graduates of the FSS class of September 1962 who had seen 28.6% of their classmates eliminated while at the Academy. In contrast, the highest of the post-Academy attrition rates for personnel who had successfully completed the FSS course was 40%; it pertained to former members of a June 1963 class in which less than 12% of all who initially enrolled failed to be awarded ATCS certificates.

The Spearman rank-difference correlation method was employed to assess the relationship of the Academy elimination rates of the subgroups (or classes) to the post-Academy attrition rates of the Academy graduates represented in the various subgroups. Each of the resulting

correlations reflected an inverse relationship. The correlations for the TATC, ARTCC, and FSS subjects were $-.47$, $-.45$, and $-.77$, respectively. As mentioned earlier, a correlation of $-.40$ was obtained between the two variables for the combined subjects of all training options. Only one coefficient, the $-.45$ for the 13 subgroups of ARTCC subjects, failed to reach statistical significance at the .05 level. (However, had the number of subgroups of ARTCC subjects been 15 or more, rather than 13, the coefficient of $-.45$ would also have been significant.)

ATTRITION AND RETENTION RATES OF THE 1968-1970 GROUPS

A. *Personnel of the Combined Training Options.* Figure 5 indicates that there were 780 Academy attritions (17.9%) among the 4,367 recruits of 1968-1970. Although not shown in Figure 5, the Academy elimination rate for the 959 *higher-rated trainees* (i.e., above the GS-7 level) was 12.8%; this was a significantly lower ($p < .01$) Academy elimination rate than the 19.3% obtained for the remaining 3,408 trainees of the combined options. Neither the 12.8 nor the 19.3 differed significantly from the 16.4% rate established in the 1964 validation study for the 317 subjects who scored 210 or higher on the experimentally administered CSC Battery. However, the Academy elimination rates of both the 3,408 lower-rated trainees (most of whom presumably met the aptitude screening requirement) and the 959 who entered under the specialized experience standard were significantly ($p < .01$) below the 26.2% Academy elimination rate (shown in Figure 1) for the 2,000 pre-1964 trainees. Had the Academy's training courses and performance evaluation standards been identical for the two time periods, these findings would imply that the selection of ATCS personnel had been improved since 1963—either as a result of (a) revised selection techniques and qualification standards, and/or (b) changes in the ratio of the number of applicants to trainee positions such that recruitment of proportionately greater numbers of trainees having moderate-to-high pre-FAA ATC-related experience was possible.

The 4,367 recruits of the 1968-1970 time period also had a slightly lower post-Academy attrition rate than did the 2,000 pre-1964 trainees (com-

pare Figures 1 and 5). The difference between the two rates (17.2 and 19.6%) was small, yet statistically significant ($p < .05$) due to the large number of cases involved.

Although (a) many of the 4,367 trainees recruited during the more recent time period had graduated from the Academy only 19 months prior to the date (1 December 1971) used in determining their facility attrition-retention status (none had facility tenures greater than 37 months), and (b) all non-attrited subjects of the pre-1964 group had FAA careers of no less than eight years, the 17.2% post-Academy attrition rate of the 1968-1970 group would not be expected to increase very much if a future study covering an eight year follow-up period were accomplished on this group. Such an expectation is based upon data supplied by the FAA's Office of Manpower.¹⁰ These data relate to 2,163 "separations" among ATCS hirees of the fiscal years 1967 through 1971 and indicate that 91.8% of the 2,163 were attrited within 12 months after being hired and that an additional 5.7% were attrited within 13 to 18 months after entry; only 2.5% of the 2,163 attritions had FAA tenures of 19 to 30 months.

The post-Academy attrition rate of the *Academy graduates only* (rather than the total trainee input) was 20.9% for the 1968-1970 group, whereas the corresponding rate for the recruits of 1960-1963 was 26.6%; the difference between the two percentages was statistically significant at the .01 level.

The 1968-1970 group of 4,367 cases (of the combined training options) was divided into ten temporally arranged subgroups in order to determine variances in the attrition and retention rates. The results are plotted in Figure 5. In examining these data, it should first be noted that only 1.3% of the 151 entrants of October 1968 and less than 1% of the 437 who entered during November-December 1968 failed to complete Academy training.

However, Academy records indicated that 501 of the 588 trainees noted above took the T-305 Interim Course which, as mentioned, was a short course in which virtually no screening standards were employed. Included in the 501 were 56 TATC recruits and eight FSS trainees who arrived at the Academy prior to 20 November 1968, on which date the specialized T-203 and T-204

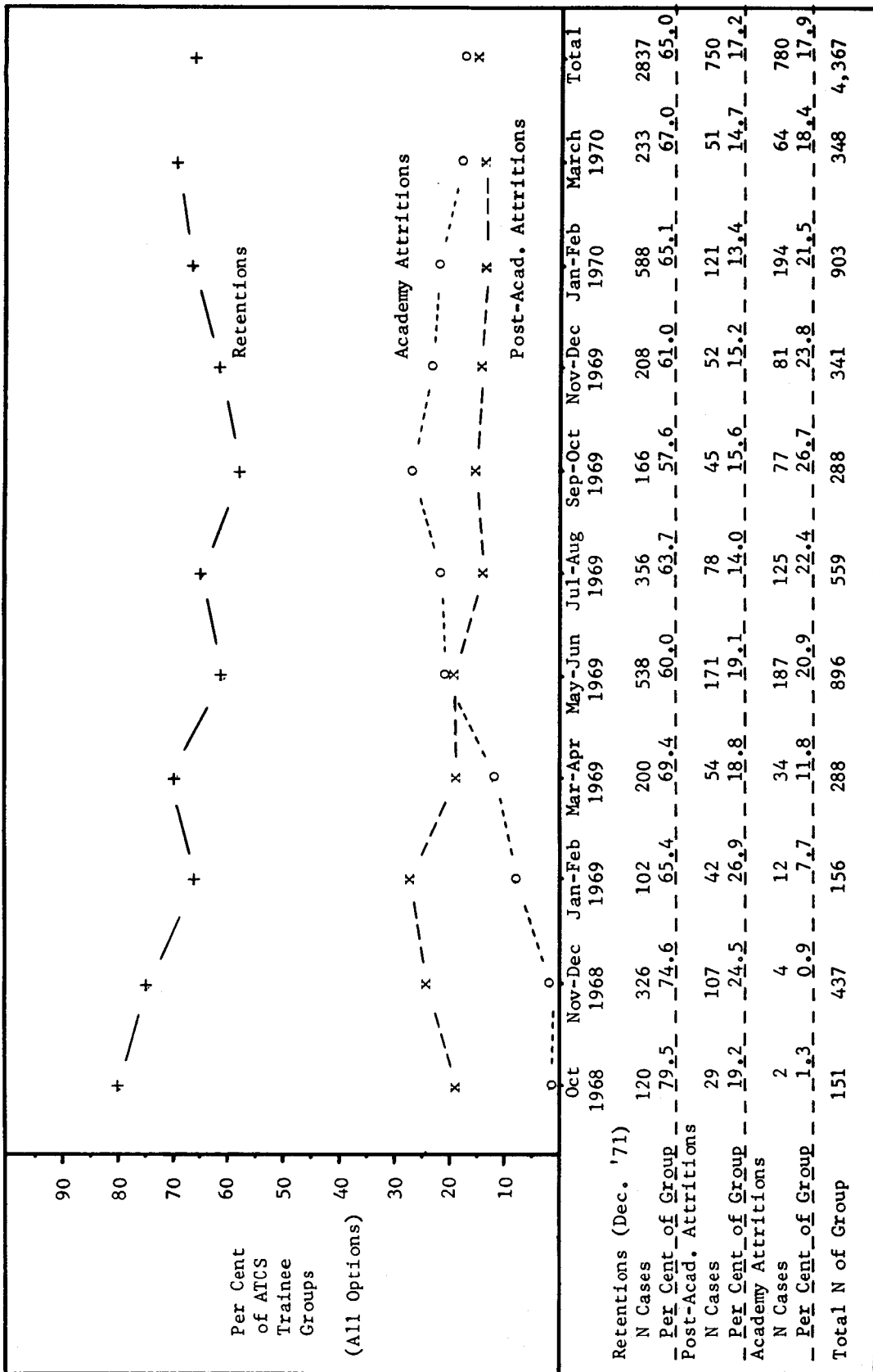


Figure 5. Percentages of entrants into the Academy's basic ARTOC, TATC, and FSS courses during October 1968 through March 1970 who were Academy attritions, facility-training attritions, or were still in FAA AIC work in December 1971.

training courses were implemented. The remaining 437 T-305 students were En Route personnel; the ARTCC Course did not become operational until 8 January 1969. The overall Academy attrition rate for the combined inputs of the three special courses was only 7.7% for the "January-February 1969" interval but rose to 11.8% for the ensuing two months. Thereafter, the Academy eliminees generally represented 20 to 25% of the inputs. The trend reflected by the plotted data tends to support the contention, alluded to earlier, that the training courses and performance evaluation standards did not become fully stabilized until April 1969.

Figure 5 also reveals considerable variability in the post-Academy attrition rate for the 1968-1970 recruits. Slightly over 19% of those who entered the Academy in October 1968 were attrited subsequent to training school graduation. The post-Academy attrition rate then rose to

24.5% for personnel who entered training during the interval "November-December 1968" and to 26.9% for the "January-February 1969" entrants. Thereafter, the post-Academy rate dropped to substantially lower levels, reaching a low of 13.4% for the "January-February 1970" entrants.

In determining the post-Academy attrition rates of the *Academy graduates only*, the 1968-1970 total group of 4,367 subjects was divided into 17 temporally arranged subgroups, each of which represented the input of a one-month period. Table 2 presents the Academy elimination rates of the various subgroups and the subsequent (i.e., field-facility level) attrition rates of those who successfully completed Academy basic training. The Academy elimination rates ranged from 0.4 to 35.9% and averaged 17.9, and the post-Academy attrition rates of the graduates ranged from 13.8 to 32.6% and averaged 20.9. The Academy elimination rates of the four

Table 2

Rates of elimination from Academy training for 1968-1970 ATCS personnel of all options and attrition rates for GRADUATES of Academy training after returning to field facilities.

Academy Training Entry Periods	Entrants Into Academy Training N	Per Cent of ENTRANTS Eliminated During Academy Training	Per Cent of GRADUATES of Academy Training Attrited at Facilities
1968			
October	151	1.3	19.5
November	253	0.4	25.8
December	184	1.6	23.2
1969			
January	106	4.7	27.7
February	50	14.0	32.6
March	86	11.6	27.6
April	202	11.9	18.5
May	548	16.8	27.6
June	348	27.3	17.8
July	402	19.7	17.6
August	157	29.3	18.9
September	117	35.9	21.3
October	171	20.5	21.3
November	119	19.3	24.0
December	222	26.1	17.7
1970			
January	585	22.1	18.9
February	318	20.4	13.8
March	348	18.4	18.0
Total	4367	17.9	20.9
Correlation between Academy elimination rates and post-Academy attrition rates (rho coefficient): -.51*			

* Statistically significant at the .05 level.

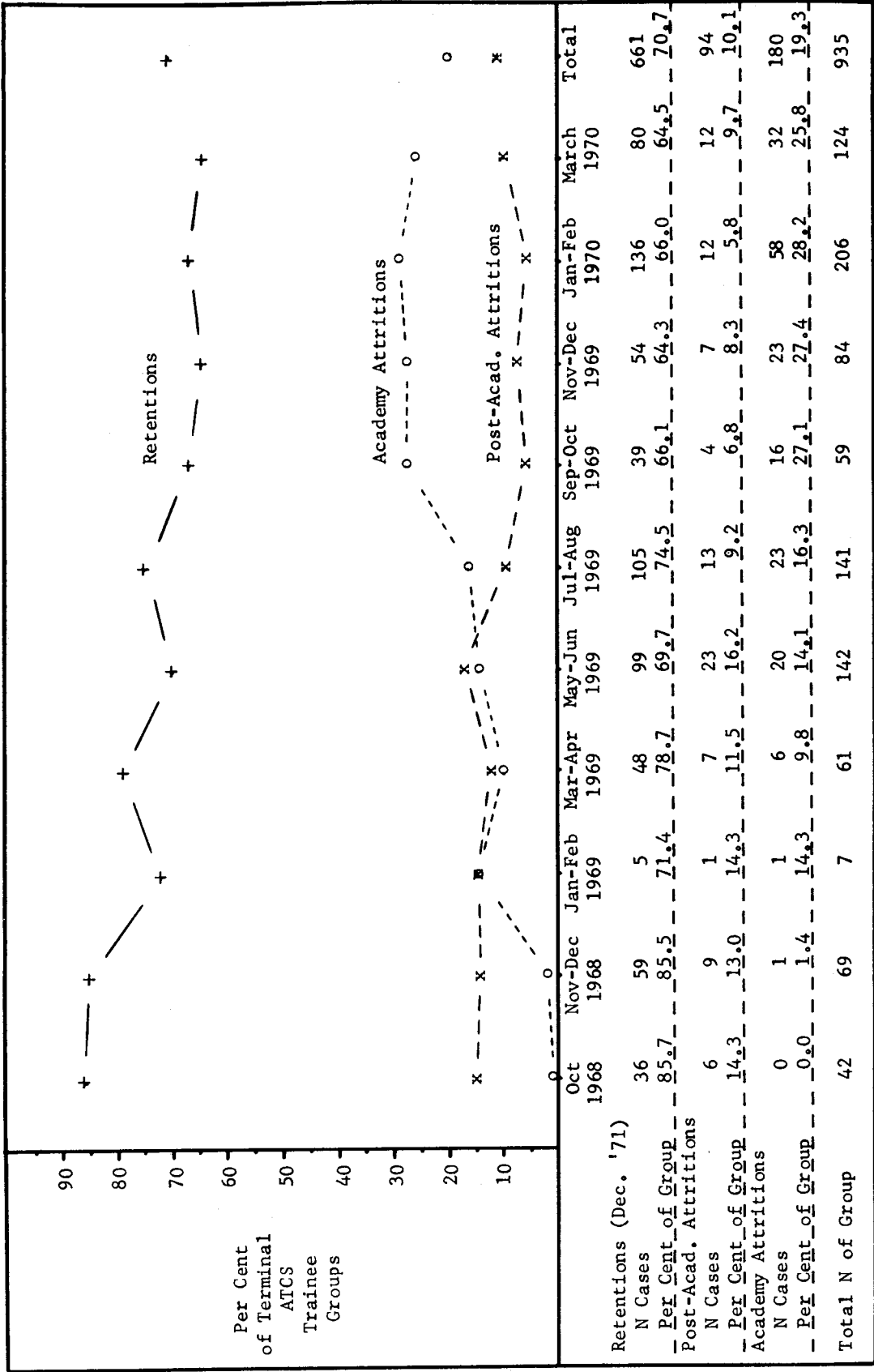


Figure 6. Percentages of entrants into Academy basic TATC training during October 1968 through March 1970 who were attrited at the Academy, were attrited at their facility, or were still in FAA ATC work in December 1971.

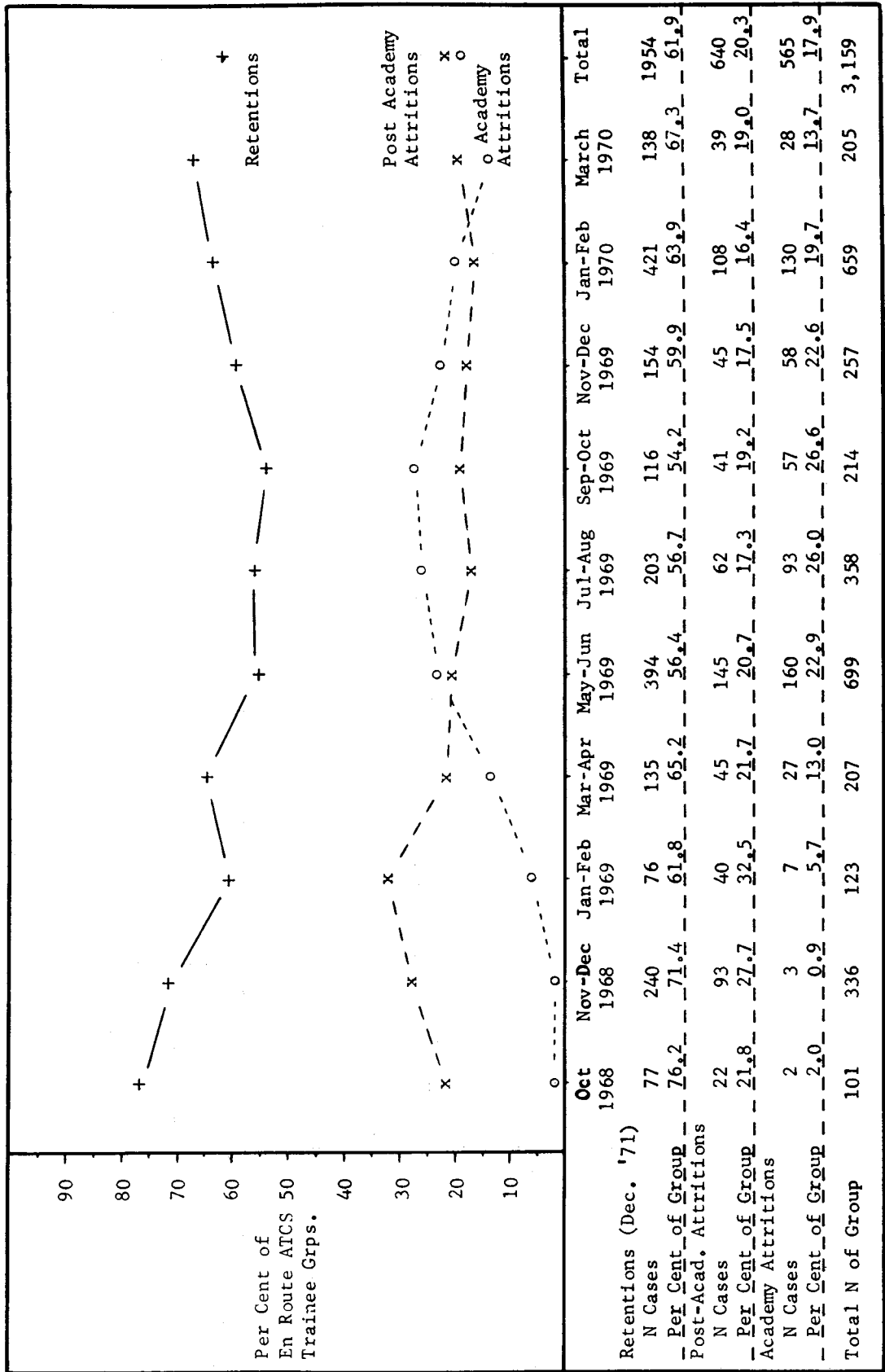


Figure 7. Percentages of entrants into Academy basic ARIIC training during October 1968 through March 1970 who were attrited at the Academy, were attrited at their facility, or were still in FAA ATC work in December 1971.

earliest recruited subgroups ranged from 0.4% to 4.7%, whereas the post-Academy attrition rates of the graduates within those subgroups ranged from 19.5 to 27.7%. Only 14% of the entrants of February 1969 failed Academy training but 32.6% who successfully completed basic training were subsequently attrited. Data for a number of other subgroups also indicated that the two variables were inversely related. An assessment of the relationship by the Spearman rank-order correlation technique produced a rho coefficient of $-.51$, which was statistically significant at the .05 level of probability. As may be recalled, the corresponding correlation for the pre-1964 subgroups of the combined options was $-.40$.

Such findings illustrate the potential with which standardized training courses, conducted on a centralized basis, can be used for secondary screening purposes. While it is theoretically possible to accomplish all necessary screening at the field-facility level, it would likely be much less economical than the former. In other words, since the average training cost per individual is contingent (at least in part) upon the average length of time after entry into the FAA, men not having potential to advance to journeyman status can be identified early; elimination at the training-program level generally represents cost savings.

B. Comparison of Terminal, En Route, and FSS Trainees of 1968-1970. Attrition and retention rates for the 935 Terminal, 3,159 En Route, and 273 FSS trainees of 1968-1970 are presented in Figures 6, 7, and 8, respectively. Beginning with a comparison of the summary data for the total number of subjects in each training option, it was determined that the Academy attrition rate of 19.3 for the TATC trainees was not significantly different from the 17.9% obtained for the En Route personnel, whereas each of the latter percentages was significantly higher than the FSS failure rate of 12.8%.

The post-Academy attrition rates, based on the number of *entrants into training*, were 10.1% for the Terminal trainees, 20.3 for the En Routes, and only 5.9% for the FSS personnel. All differences between the three percentages were statistically significant (.05-.01 levels), with two of the three, both of which involved the En Routes, being significant at the .01 level. The post-

Academy *retention* rate of 70.7% for the TATC subjects was significantly *higher* ($p < .01$) than the ARTCC retention rate of 61.9 but both percentages proved to be significantly *lower* ($p < .01$) than the 81.3% established for the FSS trainees.

These and other related findings of the study were discussed with five Academy instructors on an individual basis. Some of them opined that the pace of training in the 13-week FSS T-204 course was somewhat more moderate than in the Terminal or En Route courses (of eight weeks duration each). Two instructors contended that the training provided in the T-204 course was sufficient to enable most FSS personnel to readily adapt, and assume a role, as a working team member soon after return to their facility of assignment, whereas "graduates of the more difficult T-202 and T-203 courses were considered as having completed only the first of many complex training phases." However, there was practically no agreement among the consultants as to why the TATC and En Route personnel, after having highly similar Academy elimination rates, differed so much with respect to post-Academy attrition rates (i.e., 10.1% for the TATC trainees versus 20.3% for the En Routes). Some of the instructors also stated that a large proportion of the entrants into FSS training possessed pre-FAA experience comparable to many of the TATC and ARTCC recruits and claimed that such individuals, if also of comparable mental calibre, should have been expected to experience less difficulty in training for FSS work than if selected for Terminal or En Route training.

Since most of the instructors contacted either stated or implied that FSS training was not as difficult as TATC or ARTCC training, some analyses relevant to the assumptions regarding comparability of experience backgrounds and mental calibre of the trainees were undertaken. This was done by analyzing the records of 798 ATCS trainees who entered the Academy at the GS-7 level or lower during 1 May through 30 July 1969—a period roughly midway between 8 October 1968 and 27 March 1969. It was ascertained that prior ATC experience was possessed by: (a) slightly over 16% of the 80 trainees who comprised the FSS classes of the selected period, (b) about 45% of the 119 TATC students, and (c) slightly less than 20% of the remaining 599 ARTCC enrollees. An analysis of the CSC ATC-Aptitude Test Screening Bat-

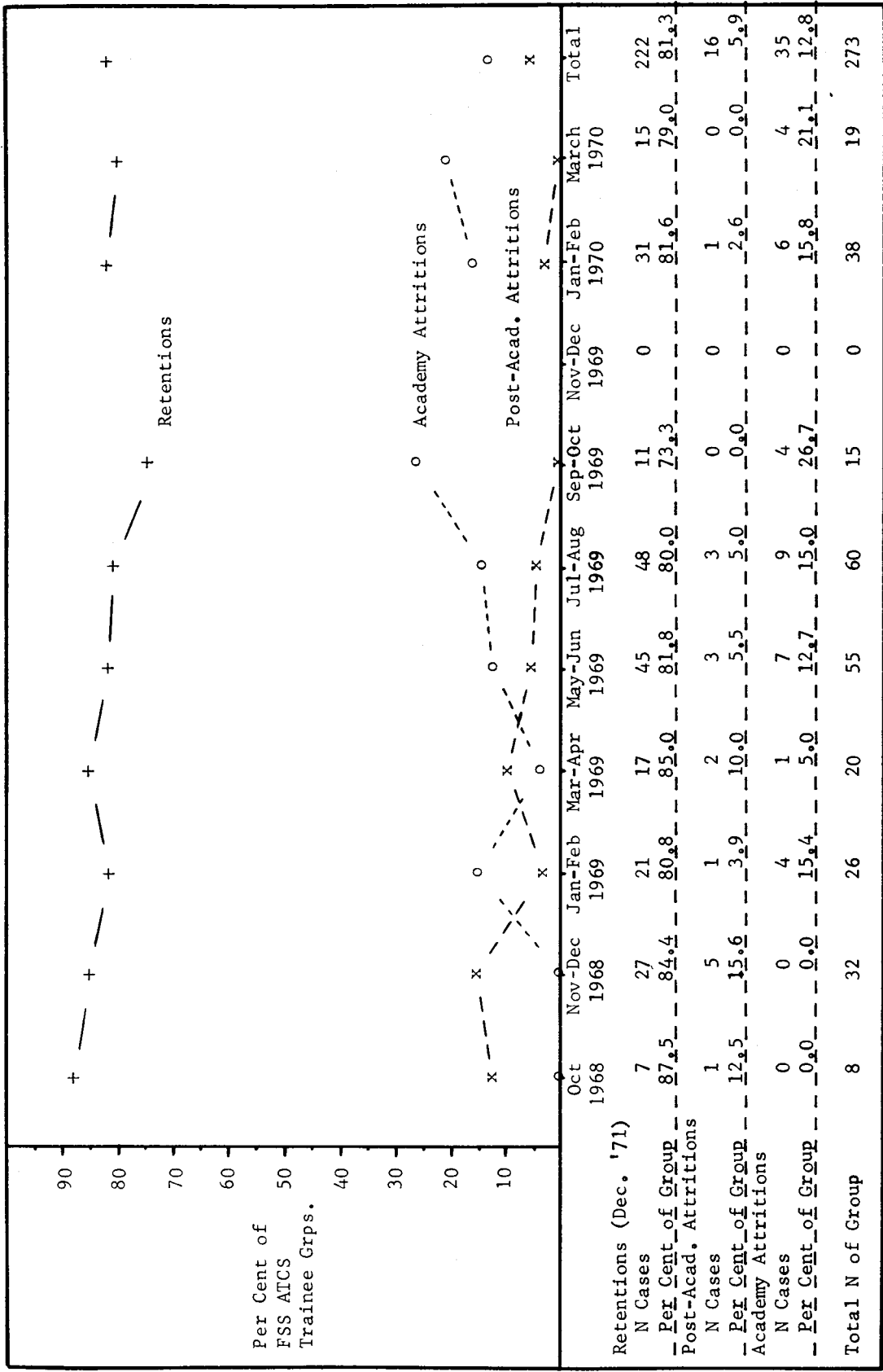


FIGURE 8. Percentages of entrants into Academy basic FSS training during October 1968 through March 1970 who were attrited at the Academy, were attrited at their facility, or were still in FSS ATCS work in December 1971.

tery Scores, which the Regions provided for about half of the 798 Academy entrants of May through July 1969, revealed no statistically significant differences between the group means (the CSC composite score means were 244.9 for the FSSs, 242.7 for the TATCs, and 247.7 for the En Routes).

As may be recalled from Figures 2, 3, and 4, the Academy attritions among the 1960-1963 group represented 20.9% of the TATC recruits, 32.0% of the ARTCC personnel, and 18.5% of the FSSs. The Academy elimination rate of 19.3% for the TATC entrants of 1968-1970 (see Figure 6) was not significantly different from that established for the TATC trainees of the earlier time period. In contrast, the difference between the Academy attrition rate of 17.9% for the ARTCC trainees of 1968-1970 (shown in Figure 7) and the corresponding percentage of 32.0 (depicted in Figure 3) for the En Route entrants of 1960 to 1963 was highly significant ($p < .01$). The lower of the two FSS failure rates (of 12.8% shown in Figure 8 and 18.5% presented in Figure 4) also pertained to the entrants of the more recent time period; the resulting difference was not statistically significant (but would have been had 315 or more cases constituted each group).

The Academy attrition rates of 17.9% for the ARTCC trainees and 12.8% for the FSSs of the 1968-1970 group are about what we would have anticipated had the training courses and training performance evaluation standards, and also all selection factors other than those involving aptitudes, remained essentially the same as in 1960 through 1963. However, it is difficult to explain why the Academy elimination rate of 19.3% for the TATC trainees of the more recent time period (Figure 6) is almost as great as the 20.9% obtained for the TATC entrants of 1960 through 1963 (Figure 2). The pre-1964 TATC trainees were not aptitude-screened and previous research²¹ had shown that they averaged slightly less than three years each in air traffic control experience before joining the FAA.

As a group, the 935 TATC subjects of 1968-1970 possessed more experience and/or higher aptitudes than the 1960-1963 subjects. About 36% of these ($N=336$) entered under the specialized experience standard and the remaining 599 averaged 34.8 months of pre-FAA experience—about the same as the pre-1964 TATC

trainees. The operational CSC Test Scores forwarded for 352 of the 599 who entered at the GS-7 level or lower, averaged 242.1, whereas an unpublished study had shown that the scores of 142 TATC trainees of the earlier time period, who were administered the CSC Battery on an experimental basis, averaged 202.1; the mean difference (according to the Fisher "t" test between uncorrelated means) was significant at the .01 level.

The post-Academy attrition rate (shown in Figure 2) for personnel who entered TATC training during 1960-1963 was 16.0%. This was significantly higher than the rate of 10.1% (presented in Figure 6) for the 935 TATC subjects who began their training after September 1968. Corresponding rates for the entrants into ARTCC training during the 1960-1963 and 1968-1970 periods were 22.8 and 20.3%, respectively (see Figures 3 and 7). However, the difference between the latter two was not statistically significant. In contrast, the difference between the post-Academy attrition rates of personnel who entered FSS training during the widely separated time periods was highly significant ($p < .01$); the two rates were 18.0 (pre-1964) and 5.9 (1968-1970) per cent (see Figures 4 and 8).

The post-Academy retention rates of the pre-1964 personnel for the TATC, ARTCC, and FSS options were 63.1, 45.2, and 63.3%, respectively; the ARTCC rate was significantly below those of the TATC and FSS subjects ($p < .01$). The retentions among the 1968-1970 group represented 70.7% of the TATC input, 61.9% of the En Route entrants, and 81.3% of those who chose the FSS option; all differences between the latter three were statistically significant at the .01 level. It is of more than incidental interest to note that the ARTCC personnel had a significantly lower retention rate ($p < .01$) than did the Terminals or FSSs of each entry period. Also, for each of the training options, the retention rate of the pre-1964 personnel proved to be significantly lower ($p < .01$) than the rate of those who entered during 1968-1970.

Procedures corresponding to those employed with the 1960-1963 groups were used to subdivide the TATC, ARTCC, and FSS subjects of 1968-1970 into subgroups, with each subgroup (except the first and last) representing the input of a specific two-month period. The attrition and

retention rates were then determined for the entrants into each training option during each of the successive two-month intervals (see Figures 6, 7, and 8).

For reasons explained earlier, the Academy elimination rates of trainees of all options who entered the training school during the latter part of 1968 were exceptionally low. As may be noted, however, the Academy failure rates rose to appreciably higher levels in 1969. For example, the TATC failure rate was 14.3% for the input of January-February 1969 and, although it dropped to 9.8 for the next two-month interval, it then rose progressively to a high of 28.2% for the entrants of January-February 1970 (see Figure 6). The TATC post-Academy attrition rate, which was no lower than 11.5% until March-April 1969, rose to 16.2 for the input of May-June 1969 and then decreased rather sharply while the Academy elimination rate increased to levels exceeding 25%.

The ARTCC Academy elimination rate (see Figure 7) rose from 5.7% at the beginning of 1969 to a high of 26.6% for the input of September-October 1969 and then gradually declined to 13.7% for the entrants of March 1970. The post-Academy attrition rate for the En Routes (based on number of entrants) ranged from 21.8 to 32.5% until March 1969 and, after dropping to 21.7 for the input of March-April 1969, thereafter ranged no higher than 20.7 and no lower than 16.4%.

Both the Academy and post-Academy attrition rates of personnel who entered FSS training were generally lower, yet proportionately more variable, than those obtained for the Terminal and En Route recruits of 1968-1970. Moreover, an examination of the data presented in Figure 8 will reveal that the total number of FSS cases comprising the input of each two-month interval was usually rather small. Consequently, the attrition rates of both types for the successive subgroups should not be considered as having good reliability. Nevertheless, it is of interest to note that the inputs of "October 1968" and "November-December 1968" had Academy elimination rates of zero and post-Academy attrition rates of 12.5 and 15.6%, respectively—with each of the latter being higher than obtained for other subgroups. The FSS entrants of September-October 1969 had an Academy failure rate of 26.7%, which was nearly twice as great as that

of any other subgroup; they also represented the only FSS input for which the post-Academy attrition rate was zero.

In accomplishing the analyses wherein the post-Academy attrition rates of the *Academy graduates only* were computed and compared against the Academy elimination rates of the entrants, grouping procedures resulted in the establishment of 17 TATC subgroups, 18 ARTCC subgroups, and 15 FSS subgroups. Each subgroup represented the input of a one-month period. Although the results obtained in these analyses are not presented in any table or figure, some of the more important findings will be discussed below.

The Academy failure rates for the 17 temporally arranged subgroups of TATC entrants ranged from 0.0 to 45.5% and averaged 19.3%. The post-Academy attrition rates of the Academy graduates in the 17 subgroups ranged from 0.0 to 25% and averaged 12.5%. The class of September 1969, for which the Academy elimination rate was 45.5%, included no individuals who, after successful completion of basic training, were attrited at their facilities of assignment. The two subgroups having the next highest Academy failure rates (of 33.3% each) also had post-Academy attrition rates of 0.0%. On the other hand, the three TATC subgroups for which the Academy elimination rates were 0.0% had post-Academy attrition rates of 9.5, 14.0, and 25.0%. With the exception of certain subgroups, each type of attrition rate generally varied inversely with the other. This was verified by a Spearman rank correlation coefficient of $-.76$, which was significant at the .01 level.

The attrition rates of the ARTCC training course graduates at their facilities ranged from 17.3 to 43.3% and averaged 24.7. However, the graduates in only three of the 18 temporally arranged subgroups had attrition rates exceeding 30%, and the Academy failure rates of the classes of which they were former members were 4.4, 9.1, and 15.5%. The lowest of the post-Academy attrition rates (i.e., 17.3%) pertained to the ARTCC class of February 1970, for which the Academy elimination rate was 16.8%. The next lowest attrition rate was 21.4% for graduates of a class in which 25.4% of the entrants failed to pass the T-202 course. Although relatively restricted in range, the post-Academy attrition rates correlated negatively with the

Academy failure rates. The resulting rho coefficient was $-.31$; though sizable, it was not statistically significant.

As mentioned earlier, a total of only 273 FSSs entered the Academy during October 1968 through March 1970. Some 12.8% failed the T-204 course and only 6.7% of the 238 who passed were subsequently attrited at their facilities. None of the Academy graduates in six of the 15 FSS classes were facility attritions and the overall Academy elimination rate for the combined classes of which these graduates had been members was 20.0%. The two subgroups of graduates having the highest post-Academy attrition rates (of 21.7 and 12.5%) constituted former classes in which none of the entrants were eliminated. The rank correlation between the Academy elimination rates of the FSS entrants and the post-Academy attrition rates of the FSS graduates was $-.44$, a coefficient of moderate size which was statistically significant at the .05 level.

The inverse relationships, most of which were statistically significant, between the Academy elimination rates of entrants into training and the post-Academy attrition rates of Academy graduates of the three training options are important in two respects. First, they attest to the *potential* with which the Academy training courses might be used to further screen, as well as provide initial training for, newly hired ATCS personnel. However, logic would indicate that the correlations obtained in this study would likely have been much smaller had substantially less variability occurred in the two attrition rates throughout each of the time periods. Thus, the findings imply that the training courses could probably have been used with even greater effectiveness (i.e., with more consistency than that which actually prevailed) in precluding the advancement of many other ATCS trainees to subsequent training phases in which they were eventually eliminated.

RETENTION RATES OF ACADEMY ATCS GRADUATES AT FACILITIES OF DIFFERENT TYPES AND LEVELS

As may be recalled, the "retention rates" discussed in the preceding sections of this report usually referred to the proportions of *entrants* into Academy training who were still in FAA

ATC work on 1 December 1971. However, percentages reflecting the retention rates of Academy ATCS *graduates only* were deemed more appropriate data than the former for analyses involving comparisons of retention rates for personnel assigned to control facilities of different types and levels. Analyses in this regard were accomplished for those subjects who entered the Academy during January 1969 through March 1970. Such analyses were facilitated by the availability of information set forth in the magnetic-tape records provided by FAA Headquarters for all ATCS personnel. Aside from other information, each subject's record also included coded data designating the type of facility (i.e., TATC, ARTCC, or FSS) and the level (or relative traffic-density rating) of the facility in which the ATCS was working.

In the FAA's facility-level classification systems, there are four different levels of TATC facilities, two levels of Centers (or ARTCCs), and three categories of Flight Service Stations. Only those TATC facilities having 300,000 or more instrument operations per year warrant a Level-IV designation, whereas other Terminal facilities are of Level III, II, or I, depending upon the amounts and/or types of air traffic dealt with annually. Each Center is either a Level-II or Level-I facility, with one million operations per year constituting the criterion for designation as Level-II. However, there is no direct comparability between the corresponding levels of ARTCC and TATC facilities. Inasmuch as the FSS subjects in the present study were so few in number, no distinction was made with respect to their facility levels in any of the analyses and thus, no description of the levels will be presented.

A. *Retention Rates at TATC Facilities of Different Levels.* Table 3 presents the retention rates of Academy ATCS graduates at Terminal facilities of different levels. (The levels shown are based on FAA records dated 1 December 1971.)

The largest number of cases for any of the individual TATC facilities was 20 (for O'Hare International); the Ns for the other facilities ranged from one to 12. Consequently, plans to compute and compare the retention rates of personnel at several selected high-traffic-density airports were abandoned.

Table 3

Facility-training retention rates of Academy Basic-TATC-Training-Course graduates at Terminal facilities of different levels.

Terminal Facility and/or Level of Facility to Which Assigned	Number of Basic TATC Training Course Graduates Among Academy Entrants of Jan. 1969 - March 1970	Facility Training Retentions (still in FAA ATC work as of December 1971)	
		N	Per Cent
All Level-IV's			
N. Y. Common IFR	12	12	
Chicago O'Hare	20	17	
Atlanta Mun.	1	1	
Los Angeles	9	9	
Oakland	13	9	
Washington Nat'l	1	1	
Miami	1	1	
Gr. S. W. Int'l			
Phoenix	2	1	
Boston	4	4	
Detroit Wayne	9	9	
San Antonio Int'l	2	2	
Total for all IV's:	74	66	89.2

Top Ten Level-III's			
J. F. K.	10	9	
San Francisco	9	6	
Philadelphia	7	7	
La Guardia	9	9	
Pittsburgh Gr.	4	4	
Dallas Love Fld.			
Houston Intercont'l	10	10	
Denver			
St. Louis	8	6	
Cleveland Hopkins	5	5	
Total for ten III's:	62	56	90.3

Total for all other Level-III facilities:	154	132	85.7

Total for all Level-II and Level-I facilities:	355	312	87.9

Total for all TATC facilities:	645	566	87.8

Table 4

Facility-training retention rates of Academy Basic-ARTCC-Training-

Course graduates at thirteen Level-II Centers.

Air Route Traffic Control Center to Which Assigned	Academy Training Entry Periods	Academy Graduates N	Facility Training Retentions (still in FAA ATC work as of December 1971)		
			N Per Group	Per Cent of Academy Graduates All Groups	
Chicago	Jan-June '69	81	42	51.9	
(Aurora)	July-Dec '69	70	28	40.0	
<u>Illinois</u>	<u>Jan-Mar '70</u>	<u>82</u>	<u>58</u>	<u>70.7</u>	<u>54.9</u>
Cleveland	Jan-June '69	31	28	90.3	
(Oberlin)	July-Dec '69	37	33	89.2	
<u>Ohio</u>	<u>Jan-Mar '70</u>	<u>34</u>	<u>34</u>	<u>100.0</u>	<u>93.1</u>
New York	Jan-June '69	33	30	90.9	
(Islip)	July-Dec '69	44	42	95.5	
<u>New York</u>	<u>Jan-Mar '70</u>	<u>32</u>	<u>31</u>	<u>96.9</u>	<u>94.5</u>
Washington	Jan-June '69	14	14	100.0	
(Leesburg, Va.)	July-Dec '69	42	41	97.6	
<u>D. C.</u>	<u>Jan-Mar '70</u>	<u>28</u>	<u>28</u>	<u>100.0</u>	<u>98.8</u>
Atlanta	Jan-June '69	57	52	91.2	
(Hampton)	July-Dec '69	55	38	69.1	
<u>Georgia</u>	<u>Jan-Mar '70</u>	<u>26</u>	<u>20</u>	<u>76.9</u>	<u>79.7</u>
Fort Worth	Jan-June '69	19	13	68.4	
(Eules)	July-Dec '69	12	9	75.0	
<u>Texas</u>	<u>Jan-Mar '70</u>	<u>36</u>	<u>30</u>	<u>83.3</u>	<u>77.6</u>
Indianapolis	Jan-June '69	62	37	59.7	
Indiana	July-Dec '69	50	34	68.0	
	<u>Jan-Mar '70</u>	<u>62</u>	<u>46</u>	<u>74.2</u>	<u>67.2</u>
Houston	Jan-June '69	47	36	76.6	
Texas	July-Dec '69	23	21	91.3	
	<u>Jan-Mar '70</u>	<u>19</u>	<u>18</u>	<u>94.7</u>	<u>84.3</u>
Los Angeles	Jan-June '69	62	47	75.8	
(Palmdale)	July-Dec '69	27	23	85.2	
<u>California</u>	<u>Jan-Mar '70</u>	<u>32</u>	<u>27</u>	<u>84.4</u>	<u>80.2</u>
Kansas City	Jan-June '69	85	47	55.3	
(Olathe)	July-Dec '69	59	35	59.3	
<u>Kansas</u>	<u>Jan-Mar '70</u>	<u>59</u>	<u>33</u>	<u>55.9</u>	<u>56.7</u>
Oakland	Jan-June '69	39	34	87.2	
(Fremont)	July-Dec '69	24	22	91.7	
<u>California</u>	<u>Jan-Mar '70</u>	<u>40</u>	<u>28</u>	<u>70.0</u>	<u>81.6</u>
Boston	Jan-June '69	12	12	100.0	
(Nashua, N. H.)	July-Dec '69	16	16	100.0	
<u>Massachusetts</u>	<u>Jan-Mar '70</u>	<u>37</u>	<u>36</u>	<u>97.3</u>	<u>98.5</u>
Jacksonville	Jan-June '69	49	38	77.6	
(Hilliard)	July-Dec '69	23	21	91.3	
<u>Florida</u>	<u>Jan-Mar '70</u>	<u>24</u>	<u>19</u>	<u>79.2</u>	<u>81.3</u>
Total of Top 13 ARTCCs	Jan. '69-Mar. '70	1584	1201	75.8	

Table 5

Facility-training retention rates of Academy-Basic-ARTCC-Training-
Course graduates at fourteen Level-I Centers.

Air Route Traffic Control Center to Which Assigned	Academy Training Entry Periods	Academy Graduates N	Facility Training Retentions (still in FAA ATC work as of December 1971)	
			N Per Group	Per Cent of Academy Graduates All Groups
Miami	Jan-June '69	47	34	72.3
Florida	July-Dec '69	15	12	80.0
	Jan-Mar '70	37	30	81.1
-----	-----	-----	-----	-----
Memphis	Jan-June '69	47	38	80.9
Tennessee	July-Dec '69	27	26	96.3
	Jan-Mar '70	16	15	93.8
-----	-----	-----	-----	-----
Albuquerque	Jan-June '69	34	25	73.5
New Mexico	July-Dec '69	14	10	71.4
	Jan-Mar '70	27	15	55.6
-----	-----	-----	-----	-----
Denver	Jan-June '69	25	17	68.0
(Longmont)	July-Dec '69	15	13	86.7
Colorado	Jan-Mar '70	33	30	90.9
-----	-----	-----	-----	-----
Seattle	Jan-June '69	43	23	53.5
(Auburn)	July-Dec '69	14	8	57.1
Washington	Jan-Mar '70	17	8	47.1
-----	-----	-----	-----	-----
Minneapolis	Jan-June '69	18	15	83.3
(Farmington)	July-Dec '69	25	19	76.0
Minnesota	Jan-Mar '70	32	28	87.5
-----	-----	-----	-----	-----
Salt Lake City	Jan-June '69	16	14	87.5
Utah	July-Dec '69	15	14	93.3
	Jan-Mar '70	23	18	78.3
-----	-----	-----	-----	-----
Honolulu	Jan-June '69	6	4	66.7
Hawaii	July-Dec '69	6	3	50.0
	Jan-Mar '70	8	5	62.5
-----	-----	-----	-----	-----
San Juan	Jan-June '69	1	1	100.0
Puerto Rico	July-Dec '69	4	3	75.0
	Jan-Mar '70			
-----	-----	-----	-----	-----
Anchorage	Jan-June '69	4	2	50.0
Alaska	July-Dec '69	3	1	33.3
	Jan-Mar '70	2	2	100.0
-----	-----	-----	-----	-----
Great Falls	Jan-June '69	1	1	100.0
Montana	July-Dec '69	1	1	100.0
	Jan-Mar '70			
-----	-----	-----	-----	-----
Guam, M. I. and Balboa, C. Z. and Fairbanks, Al. Total	Jan-June '69 July-Dec '69 Jan-Mar '70	2	1	50.0
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Total for fourteen Level-I ARTCCs	Jan. '69-Mar. '70	578	436	75.4

The average retention rate for the subjects assigned to the 12 Level-IV TATC installations was 89.2%, whereas a 90.3% rate was obtained for those at the 10 highest-ranked of the Level-III facilities. The mean retention rate for personnel assigned to the remaining Level-III facilities was 87.5%, while the corresponding rate for the combined groups of the Level-II and Level-I TATC installations was 87.9%. No differences between any of the four percentages nor between any of the latter and the overall TATC retention rate of 87.8% were statistically significant.

B. *Retention Rates of Trainees at Level-II and Level-I ARTCC Facilities.* Results of an analysis similar to that accomplished on the TATC subjects are shown in Tables 4 and 5 for trainees of the Level-II and Level-I ARTCCs, respectively. As may be noted, 1,584 of these ARTCC graduates were assigned to Level-II Centers and had a mean retention rate of 75.8%. The trainees assigned to Level-I ARTCC facilities numbered only 578; their overall retention rate was 75.4%. These highly comparable rates differed significantly ($p < .01$) from the retention rates of the trainees at TATC facilities of four different levels and each was also significantly lower ($p < .01$) than the overall TATC retention rate of 87.8% (see Table 1). Although the difference between the previously established mean *Academy elimination* rates (of 19.3% and 17.9%, respectively) for the Terminal and En Route personnel was not statistically significant, the results pertaining to post-Academy training clearly demonstrate that the probability of progressing toward full journeyman status was somewhat greater in TATC training than in ARTCC training—regardless of the level of the facility for which recruited.

The retention rates (shown in Table 4) for the Academy ATCS graduates at the Level-II ARTCC facilities ranged from 54.9% for the Center at Aurora, Illinois, which ranked first in terms of total operations, to 98.8% for the fourth-ranked facility at Leesburg, Virginia. However, the Kansas City Center, which ranked tenth operationally, had a retention rate of 56.7%, only slightly higher than that at the Aurora Center. Further examination of the data presented in Table 4 indicated that the rates tended to vary independently of the operations rankings. This was also true with regard to the rates at the

various Level-I ARTCCs. As may be noted in Table 5, the latter ranged from 52.7% at the fourth-ranked Seattle Center to 100% for the Great Falls, Montana Center, which recruited only two trainees. Also, over 85% of the 46 trainees at Salt Lake City, which ranked seventh, were "retentions."

In all but a few instances, the total number of trainees at each En Route facility was rather substantial, thus permitting a reliable assessment and comparison of retention rates within and between the facilities for trainees recruited during each of two 6-month intervals of 1969 and the first quarter of 1970. The FAA's need for ATCS trainees was presumably at its peak at the beginning of 1969 and we therefore postulated that the retention rates at most facilities would probably be highest for the recruits of the first six months and progressively lower for the entrants of subsequent time intervals. A cursory review of the results shown in Tables 4 and 5 revealed no consistent upward or downward trend in the rates at the various facilities with respect to the time factor. However, arithmetical averages (which are not shown) were computed for the trainees of the combined Centers of each level and the results contradicted our hypothesis. The mean rates for the Level-II facility trainees, proceeding from the earliest to the last of the subgroups recruited, were 72.8, 75.3, and 79.7. Differences between the retention rates of trainees recruited during the adjacent time intervals were not statistically significant, whereas the remaining difference (between the percentages of 72.8 and 79.7) was significant at the .01 level. The mean rates for trainees of the Level-I ARTCCs followed a different pattern. Again, however, the lowest of the three rates, rather than the highest, pertained to the subgroup which entered the Academy during the first half of 1969. The "retentions" represented 71.7% of the first subgroup, 79.1% of the next, and 77.4% of those Academy graduates who had begun their Academy training during the first three months of 1970. (None of the differences between the latter percentages was statistically significant.)

C. *Comparison of Retention Rates of Trainees of GS-9 and GS-7 Levels.* As pointed out earlier, the selection standards which became operational in October 1968 permitted applicants having exceptional amounts and/or types of experience to be appointed to training at the GS-8

Table 6

Percentage of trainees by training option, facility level, and GS-level who successfully completed Academy basic training and were still in FAA ATC work in December 1971. (Data pertain to only those personnel who entered Academy basic training during January 1969 through March 1970.)

Training Option	Facility Level	G.S. Level	Academy Training		Facility Training	
			Entrants During 1969 and Jan.-Mar. 1970	Graduates Per Cent of Entrants		
				N		Per Cent of Academy Graduates Still in FAA ATC Work in Dec. '71
Terminal	IV	9 & >	35	33	94.3	84.9
		7 & <	49	41	83.7	92.7
		Total	84	74	88.1	89.2
	III	9 & >	91	79	86.8	81.0
		7 & <	167	137	82.0	90.5
		Total	258	216	83.7	87.0
	II & I	9 & >	112	86	76.8	88.4
		7 & <	370	269	72.7	87.7
		Total	482	355	73.7	87.9
All Levels	9 & >	238	198	83.2	84.9	
	7 & <	586	447	76.3	89.0	
	Total	824	645	78.3	87.8	
En Route	II	9 & >	333	272	81.7	71.5
		7 & <	1705	1312	77.0	76.3
		Total	2038	1584	77.7	75.8
	I	9 & >	117	105	89.7	76.2
		7 & <	567	473	83.4	75.3
		Total	684	578	84.5	75.4
Both Levels	9 & >	450	377	83.8	74.3	
	7 & <	2272	1785	78.6	76.0	
	Total	2722	2162	79.4	75.7	
F. S. S.	9 & >	48	40	83.3	97.5	
	7 & <	185	158	85.4	94.3	
	Total	233	198	85.0	94.9	
All Options	All Levels	9 & >	736	615	83.6	79.2
		7 & <	3043	2390	78.5	79.7
		Total	3779	3005	79.5	79.6

level or higher. Moreover, they were not required to qualify on the CSC ATC-Aptitude Screening Battery. Most trainees, however, failed to qualify under the specialized-experience standard; they usually possessed ATC experience but not enough to warrant exemption of the aptitude-screening requirement nor appointment to pay grades higher than GS-7.

Table 6 presents the Academy graduation rates and post-Academy retention rates of 736 trainees of the GS-9 level and higher, and corresponding data for 3,043 trainees who entered at the GS-7 level or lower during January 1969 through March 1970. (No trainees entered at the GS-8 level after 1 January 1969.) Looking first at the summary data shown in the lower portion of Table 6, it should be noted that 83.6% (N=615) of the 736 higher-rated trainees and 78.5% (N=2,390) of the remaining trainees successfully completed Academy training. Although not of great magnitude, the difference between the Academy graduation rates of the two groups was statistically significant ($p < .01$) due to the large numbers of cases involved. However, the overall *facility-training retention rate* of the *Academy graduates* among the higher GS-rated trainees was slightly lower, though not significantly lower, than that of the graduates having pay grades lower than GS-9.

Table 6 also presents, by training option, the Academy graduation rates and post-Academy retention rates for the different GS-rated groups and, with the exception of FSS trainees, for subgroups recruited for the different levels of facilities. For FSS personnel, where no distinction was made with respect to level of facility for which recruited, the nonsignificant difference between the Academy graduation rates (of 83.3 and 85.4) favored the aptitude-screened trainees of the lower GS levels, while the nonsignificant difference between the post-Academy retention rates (i.e., 97.5 and 94.3) favored the more experienced and higher-rated trainees. Regardless of the level of facility for which recruited, the Terminal and En Route trainees who qualified for the higher-than-normal pay grades had slightly *higher Academy graduation rates* than those hired at the GS-7 level and lower.

However, a comparison of the *post-Academy retention rates* of the dichotomized groups of Academy graduates (see Table 6) indicated that

those of the GS-9 level and higher tended to experience more difficulty than the lower GS-rated personnel at TATC facilities of both the Level-IV and Level-III categories. In other words, the retention rates of the "GS-9's and higher" were substantially below those of the "GS-7's and lower" at the busiest TATC facilities. At the lower-ranked TATC facilities, their mean retention rate of 88.4% was less than one percentage point above that established for the combined groups of GS-7's, GS-6's, and GS-5's. At the Level-II ARTCC facilities, the retentions represented 73.5% of the "GS-9's and higher" and 76.3% of the "GS-7's and lower." The retention rates of the different GS-groupings were also quite comparable at the Level-I Centers; the percentages were 76.2 and 75.3, with the negligibly higher rate pertaining to the higher paid group.

The Terminal and En Route personnel who were recruited at the GS-9 level and higher generally possessed appreciably greater amounts of pre-FAA ATC experience than recruits of the lower pay grades. A reasonable assumption is that their greater experience enabled them to learn more easily the materials and procedures presented in the TATC and ARTCC basic training courses—thus explaining why their Academy graduation rates were higher than those of the less experienced personnel.

However, the reasons are unclear as to why the post-Academy retention rates of the higher-rated and more experienced trainees were *lower* than those of the less experienced trainees at Level-II Centers and at TATC facilities of Levels IV and III (and were barely higher at ARTCC and TATC facilities of lower levels). Such findings do not necessarily imply that pre-FAA experience is of little or no value to a trainee after Academy graduation; instead, they may have been due, at least in part, to the effects of age upon performance. Previous studies^{4 7 9 19 20} have consistently shown chronological age to be inversely related (at highly significant levels) to numerous aptitude test measures, various indices of training progress, and ratings of job performance.

One study,⁷ involving 710 aptitude-exempted trainees of the advanced GS levels (all of whom are included in the groups referred to in Table 6), revealed that the mean age of the 710 was 33.1 years and that almost 23% were 35 years of

age or older. In contrast, a mean age of 28.4 years was established in another study⁹ with 798 GS-7's of whom less than 14% were over 34 years old. Unpublished research pertaining to 301 of the 710 higher-rated subjects of the study mentioned above revealed that 273 of the 301 successfully completed Academy training, and that the subsequent attrition rate was 42% for the 45 Academy graduates of age 35 and older and only 17.5% for the 228 younger trainees. A similar analysis relating to 613 Academy graduates of the GS-7 level and lower indicated that 25% of those over 34 years old were subsequently attrited, compared to 18% of the younger trainees. Extension of the analyses to include consideration of operational and/or experimentally derived CSC ATC Aptitude Test Scores yielded results indicating that trainees recruited under the specialized experience standard were generally not of the exceptional mental calibre which characterized most of the GS-7's, GS-6's, and GS-5's. For example, the previously discussed study of 301 trainees who were recruited at the GS-9 level and higher showed that 135 of them (about 45%) scored so low on the operationally administered test battery that they would have been declared ineligible for appointment to training had their experience not warranted exemption of the aptitude screening hurdle. (Thirty-two per cent of the 135 were attrited, either in Academy training or subsequent to it.)

Such studies have conclusively illustrated that the major factors bearing upon success or failure of personnel in ATCS training programs of the past were chronological age, types and/or amounts of prior ATC experience, and mental aptitudes. They have also demonstrated that measures pertaining to the three areas are inter-related. Unfortunately, a valid assessment of the interaction effects of the three variables upon post-Academy training performance has been virtually impossible because: (1) the entrants into Academy ATCS training qualified for appointment under *different* sets of standards, (2) they generally represented *highly selected groups* in terms of measures reflecting ATC experience and/or aptitudes, and (3) the "restriction-of-range effects" became even more pronounced because many of the trainees in the upper age categories or in the lower experience and aptitude categories were eliminated while at the Academy.

On the basis of research findings obtained to date, however, we are inclined to believe that the age factor is far more important than experience as a determinant of post-Academy training performance and, if no selectees were older than 35, that the positive influence of pre-FAA ATC experience would be greater than that of aptitudes upon performance in both the Academy and post-Academy training stages. Aptitude test measures are primarily useful for *screening* purposes, to preclude the selection of personnel who are not apt to succeed in FAA ATC work *solely* because they fail to possess sufficient mental abilities. Should the composite-aptitude score level chosen for screening purposes not be unrealistically high, scores exceeding the prescribed minimum may correlate substantially with indices of performance in the early stages of training (and particularly with groups possessing little or no prior ATC experience) but they should not be expected to have great potential for forecasting subsequent success or failure in the profession.

OCCUPATIONAL PERSPECTIVES FOR EVALUATING ATCS ATTRITIONS

To complete a discussion of the attrition rates of ATC trainees and of ATC personnel in general, some frames of reference are worth considering. Although other types of occupations which make use of one or more sets of initial screening tests as well as formal centralized training are not directly comparable to air traffic control work (nor to each other), their attrition rates provide at least some perspective from which ATC Academy attritions may be viewed. For example, published reports of several occupational groups which are carefully pre-screened prior to entry-into-training revealed training-attrition rates ranging from 22-43%. Included among these were attrition rates of 35.6% during U.S. training of Peace Corps volunteers¹¹; 22% of nursing students in their first year of training¹² (a different study¹⁴ of nursing turnover in a teaching hospital showed that 38% of the nurses stayed on the job less than one year); 43% of Army Officer Candidates during 23 weeks of training¹³; and 35% (excluding those who failed to complete training due to medical or disciplinary problems) for a sample of naval aviation students who, in addition to pre-screening, were typically recent college graduates.¹

Since ATCSs make up about one-half of the FAA work force, some comparisons of their annual attrition rates with rates of non-ATCS FAA personnel provide another occupational perspective. The same caveat noted above with regard to differences in the types of occupations (as well as average GS-grade levels and other characteristics), of course, applies to these comparisons. However, based on FAA personnel tapes, we have calculated the average attrition rate for all FAA employees *not* in the air traffic control occupational specialty to have been approximately 13.5, 9.3, and 9.1% for calendar years 1969, 1970, and 1971, respectively (averaging 10.6% for the three years). The rates during the same time periods for all ATCSs were 5.7, 7.8, and 5.0% (averaging 6.3%). If the assumption is made that those who were attrited from the FAA Academy would have been later ATCS attritions anyway, then, following selection and Academy screening, the attrition rates of ATCSs would drop to approximately 3.3, 5.6, and 4.9%, respectively, for the 1969 through 1971 periods (a three-year attrition rate averaging 4.6%).

Addendum. Another way to look at these three-year attrition rates is to make longitudinal comparisons between ATCSs and non-controller FAA personnel. Subsequent to the completion of this report, data were made available by FAA's Office of Manpower (AMN-23) regarding all full-time GS employees (i.e., excluding temporary or part-time help) hired during the six-month period between October 1968 through March 1969. During that period, 949 ATCSs (including many who entered the Academy during April or later) were hired at the GS-5 through GS-9 levels; a total of 217 non-ATC FAA employees were also hired at those same levels. The overall attrition rate (as of December 1971) for the 217 non-controllers was 32.7%; for the 949 ATCSs, the rate was 24.6% (including Academy failures).

IV. Summary.

This study involved comparison of Academy basic training elimination rates and post-Academy attrition and retention rates of FAA Air Traffic Control Specialist (ATCS) personnel who were recruited during each of two widely separated time periods for each of three different types of ATCS training. Data were obtained for a total of 6,367 former trainees. Exactly

2,000 of the 6,367 entered the Academy during September 1960 through August 1963, before the Civil Service Commission (CSC) ATC-Aptitude Test Screening Battery became operational in the screening of most applicants. The 2,000 included 733 entrants into Terminal Area Traffic Control (TATC) training, 1,008 Air Route Traffic Control Center (ARTCC) trainees, and 259 Flight Service Station (FSS) personnel. The remaining 4,367 subjects, the vast majority of whom were required to qualify on the CSC Test, entered the Academy during October 1968 through March 1970; 935 of the 4,367 were TATC trainees, 3,159 were ARTCC personnel, and 273 were FSSs.

Percentages reflecting the Academy elimination rates for the earlier versus the later time periods, respectively, were: 20.9 and 19.3 for the TATC personnel, 32.0 and 17.9 for the ARTCC trainees (this difference was statistically significant at the .01 level), and 18.5 and 12.8 for the FSSs. The mean Academy elimination rate of 26.2% for the 2,000 total pre-1964 trainees was significantly higher ($p < .01$) than the 17.0% rate obtained for the 4,367 recruits of the more recent time period. Moreover, the 17.9% rate was only slightly higher than a rate of 16.4% which we had projected on the basis of results obtained in an earlier study wherein 893 pre-1964 trainees were experimentally examined with the CSC Test Battery (before it was adopted for operational use).

Follow-up procedures were employed whereby those subjects who were still in ATC work on 1 December 1971 were designated as "retentions" while those eliminated after completion of Academy training were designated as "post-Academy attritions." The post-Academy attrition rates for the TATC, ARTCC, and FSS entrants of 1960-1963 were 16.0, 22.8, and 18.1%, respectively, whereas the corresponding rates for the recruits of 1968-1970 were 10.1, 20.3, and 5.9%. The ARTCC option was the only one for which the difference between the rates was not statistically significant.

Analyses pertaining to subgroups, each comprised of one to four former incoming classes of the Academy's TATC, ARTCC, or FSS training courses, yielded significant *inverse* relationships between the Academy elimination rates and post-Academy attrition rates of the trainees.
