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16. Abstract

An overview of research findings on air traffic controllers is presented. Results of personality, aptitude, motivation, interest, and attitude studies are considered in terms of the general pattern of characteristics found to be associated with success in the air traffic profession. The implications of these findings for managerial programs is discussed.

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A REALISTIC VIEW OF THE PEOPLE IN AIR TRAFFIC CONTROL

Over the past few years, there have been many research studies concerned with the air traffic controller side of the air traffic control (ATC) system. Included among these investigations have been studies of the personality, aptitude, interest, motivation, and attitude characteristics of controllers. This paper is an attempt to draw together the main points of these research findings in order to come to a more comprehensive understanding of the people involved in air traffic control. Such an understanding is essential to the development of effective motivational and managerial programs for the ATC work force.

First, let us consider the personality traits of air traffic controllers. The FAA Office of Aviation Medicine has conducted an extensive assessment of controllers and controller applicants by use of the 16PF questionnaire. As can be seen in Figure 1, which presents a distillation of data collected by Karson and O'Dell[6] (and kindly shared with this author), a wide range of personality characteristics are considered across the 16 factors included in the questionnaire. Two profiles are presented in the figure; the circles connected by the solid lines compose the average profile of approximately 11,000 controllers at centers and towers. It is immediately apparent from an examination of the average scores of controllers on each of these factors that controllers differ little from men in general. With only four exceptions, the mean scores for the scales are within the "average" range of scores denoted by the shaded area. Furthermore, the scores on only three of these scales actually fall outside the range of scores that could be reasonably expected by chance in the general population;[a] this normal range is denoted by the two vertical marks on each scale. These three scales are intelligence (B), to which we shall return in a moment; the scale that measures conformity (G); and the scale reflecting a tough-minded, no-nonsense, self-reliant approach to life (I). Another scale on which controllers also tend to have a slightly higher-than-average score is the measure of self-control and decisiveness (Q_3). Taken together, these findings indicate that controllers tend to be a quite normal group, differing from the general male population only in that they are brighter than average and have a tendency to respond in a somewhat more exclusively masculine manner to most situations than is typical of men in general (See Figure 1).

The second profile on Figure 1 represents the average for airline pilots[2] and is presented for comparison purposes. It can be seen that the pilots differ distinctly from men in general on 11 of the 16 factors, as contrasted with only 4 factors on which controllers and men in general differ. There is, however, some similarity between the shape of the profiles for the two occupational groups. This similarity suggests certain common response tendencies; however, on almost every scale, the controllers were closer to the average of men in general than were the pilots.

The 16 PF finding on intelligence is consistent with the results of the extensive assessment of controller aptitudes conducted at the FAA Civil Aeromedical Institute.[e.g., 3] It has been found, for example, that the *California Test of Mental Maturity*, a general measure of intelligence, yields an estimate of controller intelligence that is about at the level indicated by the 16PF.[10] Controllers usually obtain scores on this measure that fall in the upper 20 percent of the general population. They also tend, as a group, to do especially well on measures of spatial orientation, spatial visualization, memory, numerical ability, and abstract reasoning. This means that controllers have considerable intellectual power and educational potential, although it has been noted that relatively few controllers have directed their attentions to pursuing extensive higher education

[a] Technically, this range is described as plus or minus one standard error of measurement and is the range of scores about the mean that could be considered "average" because of chance variability in the test scores.

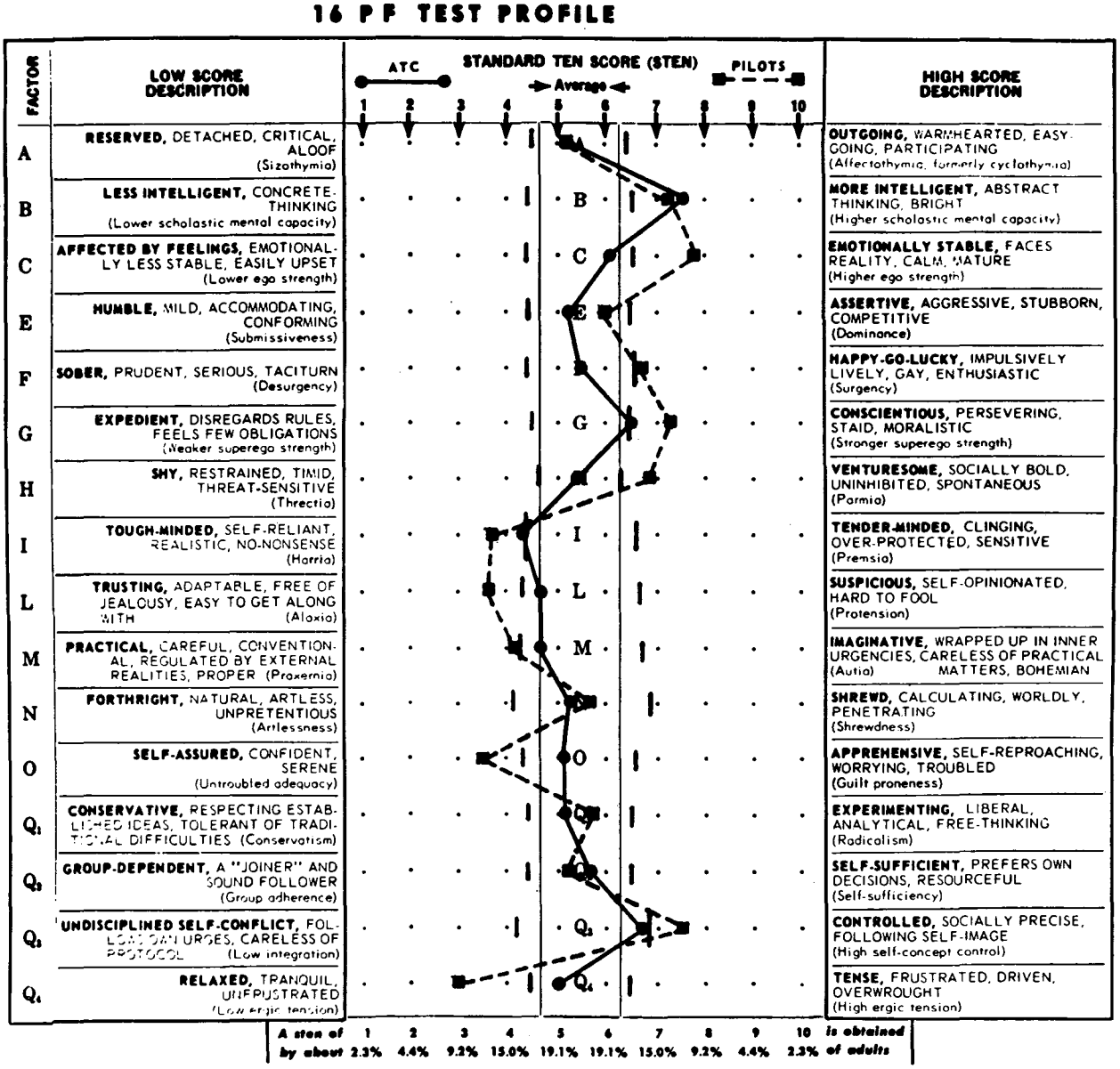

FIGURE. 1. Average 16PF profiles for journeyman air traffic controllers (solid line) and airline pilots (broken line). The two vertical marks on each scale indicate the range of scores that may be considered typical for the general adult male population.

programs.[4] It should be added that the lifestyle area in which controllers showed most divergence from men in general, the tough-mindedness dimension, is one that would suggest a lack of concern with purely intellectual pursuits in favor of more practical interests.

The same pattern of overall similarity to men in general was also obtained in the recently completed survey of interest patterns of journeyman controllers,[8] in which the *Strong Vocational Interest Blank* (SVIB)[1] was completed by more than 700 controllers at various facilities across the country. Looking first at the general scales (Table 1), we can see that controllers appear to score considerably below the typical college graduate on the Academic Achievement Scale, a measure of interest patterns that are conducive to good scholarly performance. By the same token, controllers score relatively low on the Specialization Level Scale, a measure of the willingness to focus one's interests and activities into a fairly narrow field of endeavor. Persons who

score high on this scale tend to be interested in some particular facet of science or liberal arts, while persons in technical and skilled trades tend to have scores similar to those of controllers. The score on the Masculinity-Feminity Scale was about average for men, an indication that controllers have a typically masculine interest pattern. The score on the Occupational Introversion-Extroversion Scale was also typical for men and suggests a balance between an orientation that is highly "people" centered (as would be typical of social or teaching occupations) and one that is highly "thing" directed (as would be typical of engineers, technicians, etc.) (See Table 1).

TABLE 1. Mean scores for air traffic controllers on five general scales from the Strong Vocational Interest Blank

Scale	Mean *
Academic Achievement	41.9
Specialization Level	38.4
Masculinity–Femininity	51.2
Occupational Introversion–Extroversion	46.7

* For each scale, the mean score for men in general is 50.0.

As for the findings on the various occupational scales, it can be seen in Figure 2 that, as in the case of the 16PF, controllers differ relatively little from men in general with respect to vocational interests. None of the patterns of interests for other occupations clearly fit the interest patterns of air traffic controllers. Such matches would be indicated by scores on the occupational scales in the A or B+ range. The only occupational group for which controllers show a discernible trend to score more highly than men in general is group III, the "technical supervision" group. Here the primary correspondence is to the Army and Air Force Officer Scales. This is especially significant because officer and controller career patterns tend to be rather similar, especially with the advent of early retirement programs for controllers. Military officers generally have a relatively short career of approximately 20 years. When they retire, they then pursue a variety of second careers not necessarily associated with their military experience. This may also be increasingly the case with controllers (See Figure 2).

Even though controllers are similar to men in general, it is possible to derive an air traffic controller scale for the SVIB. The items that compose this scale tend to be weighted toward the "masculinity" dimension. For example, controllers frequently designated the following occupations as those in which they might like to be engaged: athletic director, auto racer, airplane pilot, professional baseball player, rancher, and computer operator. They would not like to be university professors (although many are certainly capable of this type of endeavor), teachers, or librarians. For amusement, they tend to prefer playing poker, visiting nightclubs, and reading popular mechanics magazines somewhat more than most men. For activities, working on cars, operating machinery, and engaging in competitive activities were endorsed substantially more often by controllers than by the general male population. Interestingly, one item in particular that was checked an unusually large number of times was "pursuing bandits in a sheriff's posse." Responses such as this clearly fit a "masculine" orientation that may be characteristic of controllers.

To complete the consideration of the controller, it is appropriate to consider the controller attitudes that emerged from the survey of 792 journeyman controllers conducted in early 1972.[7] One purpose of that survey was to determine what controllers liked best and what they liked least about ATC work (Figure 3). As you can see, most of the positive statements about ATC work concerned the work itself; most of the negative statements concerned agency policy and administration or working conditions. Now the question is, how unique is this distribution? According to Dr. Frederick Herzberg,[5] who devised the classification scheme, satisfaction in work should arise from factors related to what the individual does, or what Dr. Herzberg calls "motivators." He theorizes that most dissatisfaction should arise from so-called "hygiene factors," which describe the context or environment in which one works. With air traffic controllers, as with most other occupations, this is clearly borne out. The only substantial discrepancy between what is expected from the theory and the responses of controllers is on the salary factor, which many researchers feel is not properly included as a hygiene factor. It should also be

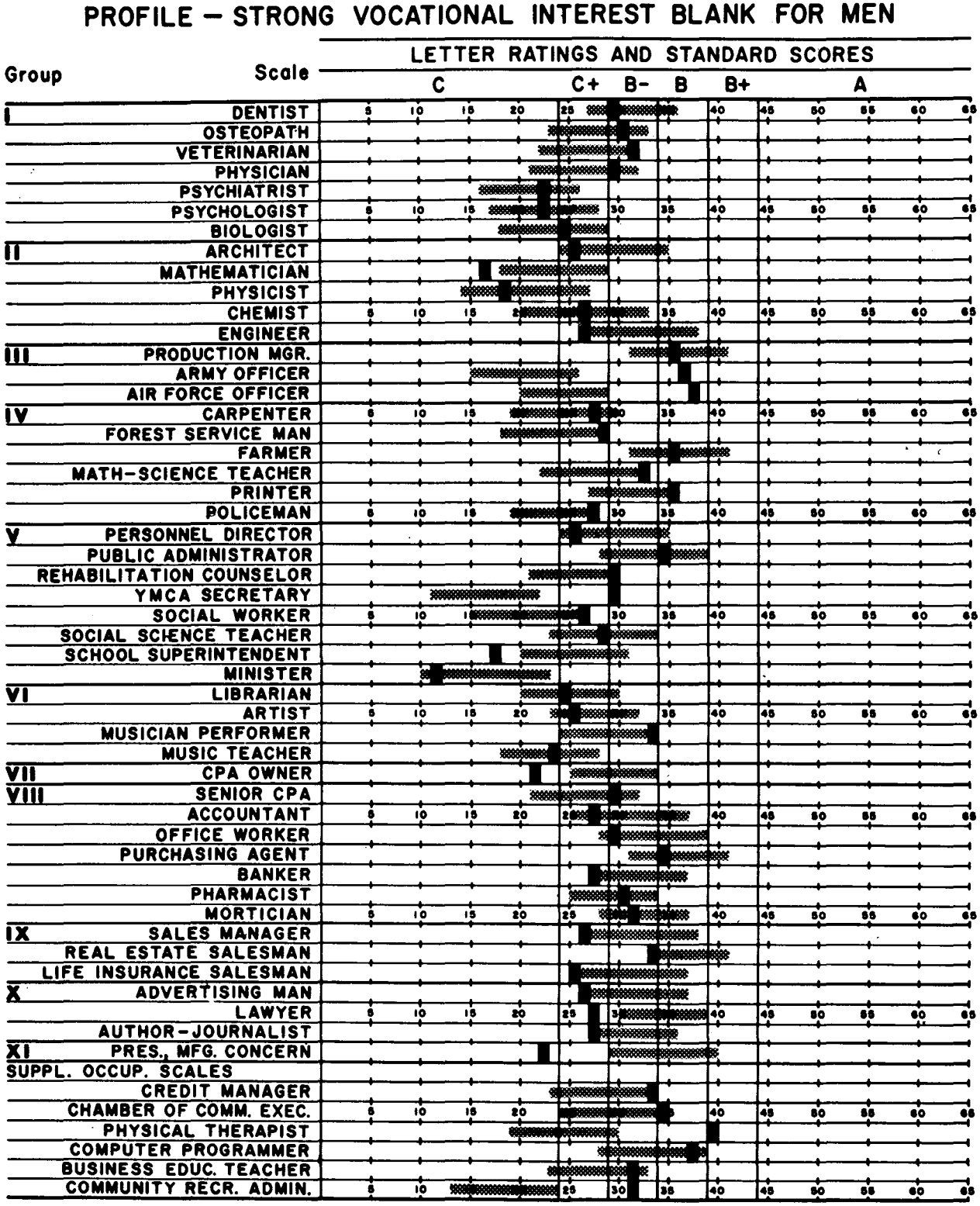

FIGURE 2. Average Strong Vocational Interest Blank pattern for journeyman air traffic controllers. The mark on each scale indicates the degree of correspondence between controller interest patterns and interest patterns of persons successful in the various occupations listed. Average scores in the A and B+ range indicate relatively close correspondence, scores in the B range indicate general correspondence, scores in B− or C+ range indicate slight correspondence, and scores in the C range indicate no correspondence to specific interest pattrens.

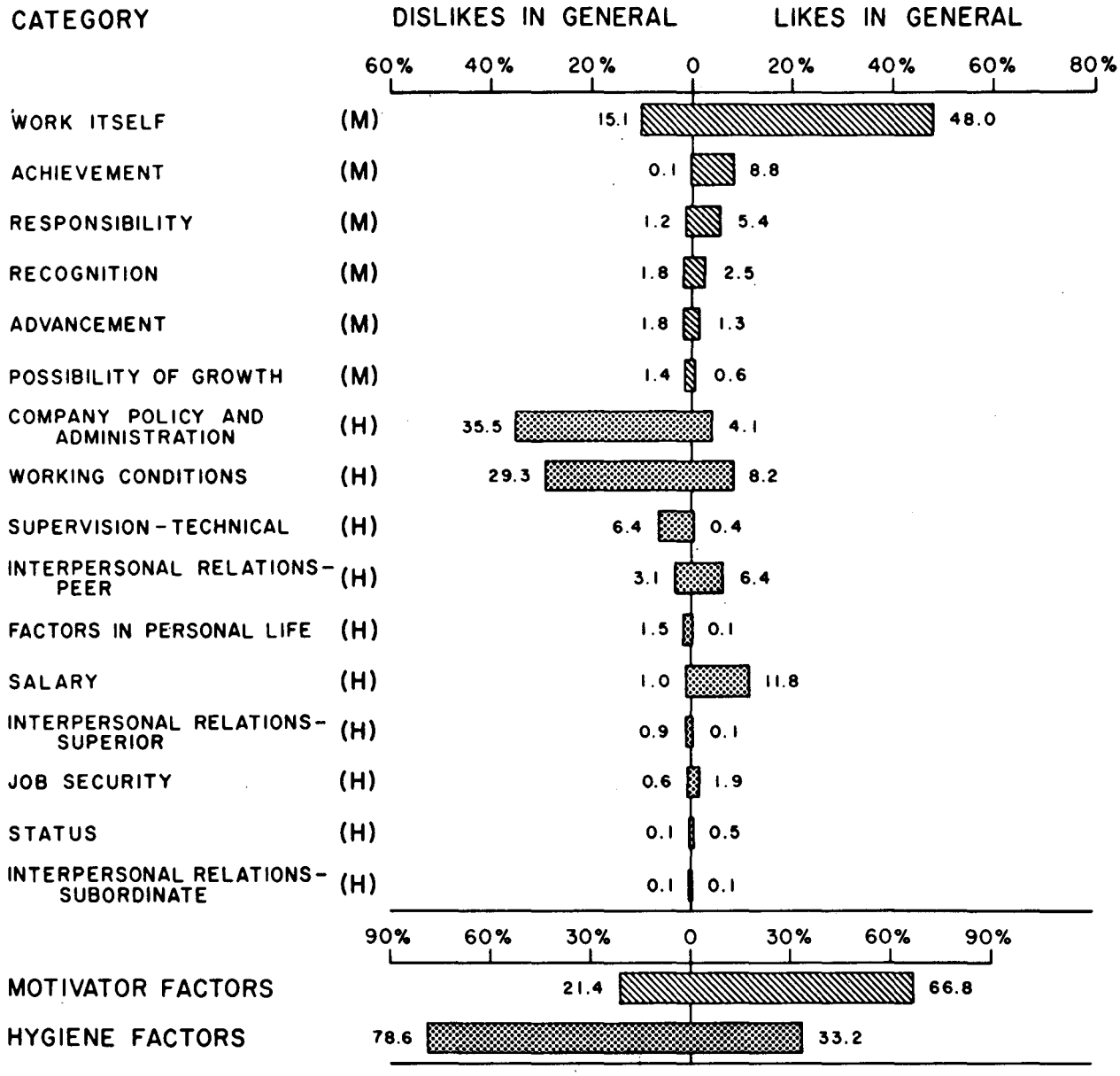

FIGURE 3. Percentages of statements concerning likes and dislikes about air traffic control work classified in each of Herzberg's six motivator (M) and hygiene (H) factors.

noted, inasmuch as controllers are sometimes accused of being especially negative toward management, that approximately 35 percent of the dislike responses concerned the policy and administration factor, a figure that compares very closely with the average of 31 percent obtained from studies of various occupations reported by Herzberg. In other words, controllers appear to be no more negative toward management than are most other occupational groups (See Figure 3).

Finally, with respect to job satisfaction, more than 91 percent of the controllers indicated that they were satisfied or very satisfied with being in the ATC profession. This is an extremely high percentage from an employee group; more typically, about 80 percent of an occupational group will report overall job satisfaction.[9]

In sum, what do these data mean for management and motivation in the ATC system? Taken together, they suggest that the controller, being more like than unlike employees in other occupa-

tions, should respond favorably to motivational programs that have been successfully applied to other work settings. For one thing, such programs are *not* hygiene oriented. Although improving working conditions, salary, and managerial effectiveness will reduce job dissatisfaction, employee morale and productivity are more effectively and permanently influenced by motivation-oriented job-enrichment programs. These programs emphasize the personal responsibility and self-direction of the employee as well as the employee's participation in the decision-making process on those matters relevant to his work situation. In fact, the very characteristics of air traffic controllers that differ from those of men in general are likely to enhance the effectiveness of such programs as well as make them imperative for long-term improvement of controller morale. Controllers, because they are bright and action oriented, tend to be intolerant of routine, demanding of opportunities to actively participate in decision-making processes, and capable of providing sophisticated input concerning the structure and management of the ATC system. Such job-enrichment opportunities would therefore appear to hold the greatest promise for improvement of the "people" side of the ATC system.

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