

1. PURPOSE:

To provide a guide to the airframe manufacturers and their customers in arriving at an acceptable transition training program for operational personnel.

This AIR (Aerospace Information Report), although designed to be used independently of associated reports if so desired, actually represents but one of what the training committee expects will be a family of reports relative to programs and equipment required to train aerospace vehicle operating and maintenance personnel. In this connection the reader is referred to the following additional committee reports dealing with other aspects of the same subject: "Guide for Training Equipment Design"; and, "Handbook of Training Media."

2. INTRODUCTION:

Variations in size and complexity of aircraft, as well as the somewhat differing requirements of operators, necessitate that any guidelines be of a general nature. Nonetheless, the airframe manufacturer has an inherent obligation to adequately transfer operational knowledge and skills to the buyer --- and these can be defined with fair precision in a qualitative sense.

Quantitatively, the extent of such training, the details encompassed, and the levels of proficiency required may vary rather widely with (1) the nature of the buyer's operations, (2) intended use of the aircraft, (3) the dictates of regulatory agencies concerned with aircraft operation and, (4) the capabilities of the trainees. Nevertheless, it is important that both manufacturers and operators of aircraft come to some basic agreement as to the nature and extent of the manufacturer's training obligation, if only because this will in turn determine the amounts and kinds of additional training that the operator must undertake due to the nature of his operation and/or the requirements imposed upon him by regulatory agencies.

The items discussed below constitute a general guide to the manufacturer who is interested in maximum and safe utilization of his product through an adequate program of customer training. Maintenance training --- as distinguished from the operational type training herein considered --- is recognized as of equal importance but will be given the separate treatment it deserves.

3. GROUND TRAINING:

The tendency to minimize the manufacturer's ground training program in favor of the flight check-out should be avoided. Both are necessary; both are important. However, the growing complexity of modern aircraft --- coupled with higher speeds, greater air traffic density and a corresponding emphasis on flight safety awareness --- make it absolutely necessary that aircraft crewmen have a detailed knowledge of all aircraft operational systems, including normal and emergency operation.

Section 8.3 of the SAE Technical Board rules provides that: "All technical reports, including standards approved and practices recommended, are advisory only. Their use by anyone engaged in industry or trade is entirely voluntary. There is no agreement to adhere to any SAE standard or recommended practice, and no commitment to conform to or be guided by any technical report. In formulating and approving technical reports, the Board and its Committees will not investigate or consider patents which may apply to the subject matter. Prospective users of the report are responsible for protecting themselves against infringement of patents."

The old concept that a pilot need know nothing of the inner workings of aircraft systems that can't be adjusted in flight no longer is tenable. In the first place, many times something can be done to correct malfunctions in flight; often a thorough understanding of the operational systems and their interrelationships will enable flight crew members to take an action that may avoid an unscheduled landing, a landing accident, or an in-flight emergency. Avoidance of costly down-time is a direct benefit of flight item discrepancy reports written by crewmen able to make a clear and accurate appraisal of the nature of any difficulty, and its probable cause, because of their thorough familiarity with systems operations.

Another fact that should be borne in mind is that the manufacturer's ground school is intended primarily for the aircraft systems instructor, rather than the line crewman. The course is, therefore, designed to teach teachers. This fact alone requires that the course be thorough, more thorough certainly than the average operator's course, for those who train the flight crews must themselves be fully qualified for this highly responsible task.

Finally, operational and maintenance duties must be segregated, and this makes it highly desirable to differentiate carefully between the two for training purposes. Thus, a ground school program intended for flight crew instructors should avoid all possible discussion of maintenance problems, ground troubleshooting and repairs. Instead, trainees having a special need for such information should be encouraged to attend a maintenance course in addition to the operations course.

- 3.1 Curriculum: For immediate benefit to operational people, the ground school course should be confined to those aspects of aircraft systems operation of direct interest to them plus, of course, essential information on aircraft performance, use of charts, cruise control, flight planning, and flight limitations. Subject treatment should be slanted toward flight crews; maintenance problems, as such should be avoided. Exceptions will be in some gray areas between operation and maintenance; these will be subject to individual assessment and decision.

All concerned must recognize the relationship between the manufacturer's training obligations and those of the operator. Job requirements and FAA regulations require that flight crewmen be trained in several areas: High altitude indoctrination, including the physiology of high altitude flying, use of oxygen equipment, high altitude weather, etc.; jet aircraft performance, including a consideration of the aerodynamic aspects of swept-wing aircraft; theory of jet engine operation; and aircraft systems operations.

Of these, the only ground training responsibility that operators normally should expect to transfer to the manufacturer --- or which the airframe manufacturer should expect to assume --- is that of imparting to the operator's ground and/or flight instructors a thorough understanding of all aircraft systems operation, flight characteristics and performance capabilities.¹

¹Even here there are aspects of certain subjects that normally do not constitute a part of the airframe manufacturer's ground school curriculum. One of these, for example, is alternating current electricity. Since this is a subject new to most crew members, the primary responsibility for giving the operator's training personnel a basic understanding of the theory and practical application of a-c electricity in airplane systems ordinarily would devolve upon the operators themselves, with the manufacturer expected only to cover the a-c system installation as it exists in his particular airplane. Generally, this is likewise true of such areas as power plants.

In general, the manufacturer's training obligation is limited to provision of instruction which adapts and/or applies generalized theory to content related to a specific airplane, engine, instrument, and systems configuration of a new aircraft.

Small operators lacking the in-house capability to provide their crews with adequate training in some of the basic subjects cited above, probably will have to rely in the future, as they often have in the past, on assistance from the training departments of the major airlines. Or they may, by making separate arrangement, receive similar help from airframe manufacturers having the capability and willingness to provide such training. This entire matter of providing crews with an adequate grounding in the theoretical aspects of such subjects as aerodynamics, alternating current electricity and jet engine operation - as distinguished from the application of these concepts to specific airplane components and systems - is one that should be reviewed carefully by the operator. Only by doing so, and by making realistic provision for giving his flight crews an adequate background on which to base the specialized training they will receive from the manufacturer, can the operator be assured of getting the maximum benefit from factory training. The manufacturer, in turn, needs to have this assurance that the personnel sent him for transition training will be fully prepared to receive it.

The manufacturer's flight transition training responsibility to operators of his equipment resolves itself down primarily to providing thorough ground and flight training in the normal and emergency operation of specific aircraft from a functional rather than a maintenance point of view. Normally, the following basic subjects should be covered: airplane general (consisting of a broad look at aircraft structure, landing gear, design limitations, load capacity, etc.), power plant (installation), fuel systems, hydraulic system, pneumatic system, air conditioning and pressurization system, adverse weather systems, electrical system, electronics (communication and navigation), instruments, autopilot, flight controls, emergency equipment, fire detection and extinguishing systems, aircraft performance, use of charts, cruise control and at least some flight planning.

- 3.2 Training Aids: Adequate training equipment is of constantly increasing importance in aircraft transition programs; its design merits the same thorough study given the course outline and context. Indeed, to complement one another, the text and aids should be developed simultaneously. And since he has a prior need for and interest in such training equipment anyway, the manufacturer can perform a service of considerable value to the operators as well as himself by making a detailed analysis of the types of training equipment best suited for a clear and orderly presentation of this aircraft's systems.

However, both manufacturer and operator should bear in mind that there is inclined to be a fundamental difference between the kind of training program given by the manufacturer and that utilized by the operator, and this may affect the choice of training aids.