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ABSTRACT

Flight simulators are built as realistically as possible, presumably to enhance their training value. Yet, their training value is determined by the way they are used. Traditionally, simulators have been less important for training than have aircraft, but they are currently emerging as primary pilot training vehicles. This new emphasis is an outgrowth of systems engineering of flight training programs, and a characteristic of the resultant training is the employment of techniques developed through applied research in a variety of training settings. These techniques include functional context training, minimizing over-training, effective utilization of personnel, use of incentive awards, peer training, and objective performance measurement. Programs employing these and other techniques, with training equipment ranging from highly-realistic simulators to reduced-scale paper mockups, have resulted in impressive transfer of training. The conclusion is drawn that a proper training program is essential to realizing the potential training value of a device, regardless of its realism. (Author)

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Prefatory Note

This paper is based upon research performed at the Human Resources Research Organization, Division No. 6 (Aviation), Fort Rucker, Alabama, where Dr. Caro is a Senior Staff Scientist. The work was performed for the Department of the Army under Work Unit SYNTRAIN, Modernization of Synthetic Training in Army Aviation, and related Work Units, and for the U.S. Coast Guard.

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Aircraft Simulators and Pilot Training

PAUL W. CARO, *Human Resources Research Organization, Fort Rucker, Alabama*

Flight simulators are built as realistically as possible, presumably to enhance their training value. Yet, their training value is determined by the way they are used. Traditionally, simulators have been less important for training than have aircraft, but they are currently emerging as primary pilot training vehicles. This new emphasis is an outgrowth of systems engineering of flight training programs, and a characteristic of the resultant training is the employment of techniques developed through applied research in a variety of training settings. These techniques include functional context training, minimizing over-training, effective utilization of personnel, use of incentive awards, peer training, and objective performance measurement. Programs employing these and other techniques, with training equipment ranging from highly-realistic simulators to reduced-scale paper mockups, have resulted in impressive transfer of training. The conclusion is drawn that a proper training program is essential to realizing the potential training value of a device, regardless of its realism.

INTRODUCTION

I would not consider the money being spent on flight simulators as staggering if we knew much about their training value, which we do not. We build flight simulators as realistic as possible, which is consistent with the identical elements theory of transfer of Thorndike, but the approach is also a cover-up for our ignorance about transfer because in our doubts we have made costly devices as realistic as we can in the hopes of gaining as much transfer as we can. In these affluent times, the users have been willing to pay the price, but the result has been an avoidance of the more challenging questions of how the transfer might be accomplished in other ways, or whether all that complexity is really necessary (Adams, 1972, pp. 616-617).

Personnel responsible for the design of flight simulators are almost exclusively engineers. Sometimes they are assisted by psychologists, but, as may be inferred from the above quotation, the influence of this latter group is minimal. In view of the identical elements orientation of most simulator designers and the large amounts of money available to satisfy their strivings for system identity and engineering excellence, the results are as might well be expected: most aircraft simulators are land-locked duplicates of their flying counterparts.

THE ROLE OF SIMULATORS IN PILOT TRAINING

It is not at all surprising that flight simulators are built as realistically as possible. It is not surprising, either, that pilot-training program designers and administrators have tended to rely upon such realism to assure adequate pilot training. Too often many of these individuals appear to forget that the simulator does not train. *It is the manner in which the simulator is used that yields its benefit.*

Gagne (1962) pointed out that transfer of training is a function of factors such as training objectives and instructional quality as well as of the fidelity characteristics of synthetic training equipment, and Muckler, Nygaard, O'Kelly, and Williams (1959) identified instructional

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techniques and instructor ability as important variables involved in transfer of training in flight simulators. Prophet (1966) stated that the flight simulator is only the vehicle for the training program and is often less important than are the synthetic training instructor and the organization and content of the synthetic training program.

There probably has never been a serious challenge to the suggested importance of the manner in which simulators are used. Gagne, Muckler, Prophet, their associates, and many others who could be cited, have stated no more than that which is obvious to all. In spite of this apparent consensus, however, it is my observation that very little attention is devoted to simulator training programs in many pilot training organizations, certainly much less attention than is devoted to the design of the simulators themselves.

The Traditional Role

In many pilot training programs, simulators are used as an adjunct to training conducted in flight. Their use is intended principally to effect a reduction in the overall cost of flight training, but in many instances (in fact, in almost all military training programs) there is little evidence that simulators have led to reduced training costs. In one such program, synthetic training was shown to add to the cost of pilot training without demonstrable transfer of training benefits (Isley, Caro, and Jolley, 1968; Jolley and Caro, 1970).

In these traditional or adjunct programs, there is often a division of responsibility between aircraft and simulator instructors. The former are the *real* instructors, while the latter are second-class citizens and are sometimes known as "device operators" rather than instructors. Because of their lower status, communication between the device operators and the pilots who *really* teach flying is infrequent, and students soon learn to revere the real instructors and tolerate the operators and the simulators they use.

Training tasks are also divided between the aircraft and the simulator in such programs along status lines. In spite of the sophisticated engineering features and dynamic realism of many modern simulators, they seldom are used to their full capabilities. A survey of simulator utilization in the Air Force (Hall, Parker, and Meyer, 1967) found that device instructors, probably because of their limited ability and a lack of command emphasis upon their jobs, tend to concentrate upon procedural tasks in simulator training and deemphasize or ignore completely the training value of simulators with respect to dynamic flight tasks. It appears that if a task can be taught in both a simulator and an aircraft, it will be taught in a simulator only if the flight instructor finds it boring to teach in the aircraft.

The Emerging Role

Fortunately, instances of the traditional role of simulator utilization are being encountered less frequently as economic pressures upon pilot training organizations are forcing management to be concerned over the relatively high costs of conducting training in aircraft that can be conducted in simulators. The airline industry has been a pace-setter for much of the new emphasis upon simulator training, possibly because of the high cost and adverse publicity associated with accidents during in-flight training activities. But, for whatever reasons, a new role is emerging for simulators in pilot training programs.

The new role is characterized by emphasis upon simulators as primary vehicles for pilot training and is a natural outgrowth of the application of systems engineering concepts to the design of total training systems (Hall and Caro, 1971; Prophet, Caro, and Hall, 1972). To an increasing extent, pilot training is being condu..ed in simulators with the exception of a few maneuvers that, because of engineering state-of-the-art limitations, cannot be performed in present-day simulators (American Airlines, 1969) and for the flying necessary to confidence-building or equipment-familiarization purposes (Caro, 1972).

The shift of training from the aircraft to the simulator, while in itself a major break with traditional pilot training programs, is not the most important aspect of the emerging role of simulators. It is the manner in which these devices are being used that makes the biggest difference. Training program content has begun to become more responsive to mission requirements; the instructor has become a training resource manager; and the goals of training are beginning to be viewed in objectively measurable performance terms, rather than primarily in terms of flight hours logged. It is becoming evident in these programs that the training vehicles—the simulators principally, but also the training aircraft—are less important in many respects than are the instructors and the organization and content of the training programs.

SIMULATOR TRAINING PROGRAMS

Some of the newer flight simulators have hardware features that are intended solely to enhance the training value of the equipment rather than to duplicate aircraft features (Caro and ophet, 1971). In some instances, these devices incorporate deliberate deviations from realism in attempts to improve, from the transfer-of-training standpoint, upon the relatively poor learning environment of the design-basis aircraft. But, with or without such advanced design-for-training features, it is still necessary to have an appropriately designed training program for use with these simulators if we expect to make significant gains in pilot training efficiency and effectiveness.

Most readers are already familiar with such terms as "systems engineering of training", "task analysis", "specific behavioral objectives", and "commonality analysis". Military and commercial pilot training programs have made much use in recent years of concepts underlying such terms in defining more objectively the required content of training. Because of the resulting critical training program content reviews, many programs now are devoted largely to "need to know" skills, rather than the mass of miscellaneous "nice to know" and curiosity information that still clutters up many traditional training programs.

Along with better training simulators and more clearly defined training program content has come new status for the simulator instructors. They no longer are viewed as second class citizens who use make-do equipment to accomplish uninteresting aspects of training. Instead, they are *the* instructor, often the best qualified personnel available, and they conduct or oversee all training received by their students. The resources these instructors need to attain their training objectives, *e.g.*, an aircraft, a simulator, programmed learning material, and personnel to assist as might be required, are all under their control.

These features of modern simulator training programs—better simulators, clearly defined content, and well-qualified instructors—provide the essential ingredients for effective and efficient training, but they are nothing more than that. They still do not constitute a training program. A training program is the manner in which the well-qualified instructor uses the appropriately designed simulator to establish the clearly defined course content within the skills repertoire of the trainee.

In our work in Army and Coast Guard aviation during the past decade, we at the HumRRO Aviation Division have devoted considerable effort to the methodology involved in the use of simulators and other synthetic flight training equipment in modern training programs. We have been involved in the full range of activities associated with pilot training, including definition of the training requirement itself (*e.g.*, Hall, Caro, Jolley, and Brown, 1969), design of aircraft simulators (*e.g.*, Caro, Hall, and Brown, 1969), development of simulator training programs (*e.g.*, Caro, 1971), evaluation of simulator training program transfer of training (*e.g.*, Caro, 1972), evaluation of off-the-shelf training devices and simulators (*e.g.*, Caro, Isley, and Jolley, 1968), and investigation of costs associated with simulator training programs operation (Jolley and Caro, 1970).

During these activities, our purpose has been to bring into pilot training programs the advances made through applied training research in a wide range of training settings. We believe we have been reasonably successful in our early efforts in this regard, and we believe our success has been largely due to our orientation that training is a technology which can be engaged in, after appropriate training, by reasonably bright and adaptable people, not an art which is an inherent characteristic of the "good instructor". We note also that our view of training is not unique. Training programs of several other pilot training agencies are employing many of the same techniques we are using.

Some of the training techniques currently being employed are described in the paragraphs below.

Functional context training. Pilot training programs have been organized around a functional context, *i.e.*, around sets of meaningful, purposeful, mission modules. Course content is taught within the context of the mission-oriented purpose it supports. For example, aircraft maneuvers such as descending turns are taught to undergraduate level instrument flight trainees within the functional context of a simulated instrument approach, rather than as an exercise, *per se*, as is done during early stages of some traditional instrument training programs.

Individualization of training. The pace and redundancy of training—all aspects of training, including supporting "academic" activities—are adapted to the rate of learning of each student. An individually-paced student, thus, is advanced to the next set of instructional content only after he has demonstrated to his instructor a specified level of mastery of an earlier set.

Sequencing of instruction. The order of instructional content is arranged so as to assure that students have been taught (and have mastered) prerequisite knowledges and skills before training in a new set is undertaken.

Minimizing over-training. Steps are taken to assure that training time is restricted to that time needed to bring a trainee to the required level of training and no more. In some cases, this means overriding an instructor who feels that a particular trainee can achieve higher skill levels even though his performance at the time has already reached the specified requirements for that phase of training.

Efficient utilization of personnel. Each instructor is optimally qualified for his task, is provided the tools he may require for efficient use of his time and talents, and is trained to administer the particular course of instruction in a standardized manner. In this regard, it should be noted that an optimally-qualified instructor in the aircraft is very likely to be optimally qualified to instruct in the simulator as well. Our most productive approach has been to assign both jobs to the same individual.

Use of incentive awards. Motivation to achieve in-flight training is largely a manipulable, rather than an inherited, characteristic. The behavior control techniques of "behavior modification" or "contingency management" have been found useful in flight training, as well as in other training situations. We have found, for example, that incentive awards such as free time for both the trainee and his instructor are effective "motivators" for the achievement of stated performance goals in less training time.

Crew training. Simulators lend themselves to simultaneous pilot and copilot training much more readily than do the aircraft they simulate because of the need for the instructor to occupy a pilot seat in the latter for safety reasons. By deviating from this real-world model and moving the instructor to another seat position, we have found that effective training can be given in both pilot and copilot tasks simultaneously, thus effectively increasing the availability of simulator seats for training.

Peer training. Trainees, themselves, are used to assist fellow trainees in many simulator training activities. This technique has been found particularly useful with respect to cognitive problem-solving activities such as those which occur during navigation problems. Simulators are particularly well suited for peer instruction because the instructor can be removed from the cockpit area without creating flight safety problems with relatively unskilled trainees.

Minimizing equipment costs. To the extent that it is efficient, medium- to low-fidelity training devices, or other less expensive equipment, can be substituted for the much more expensive training in simulators. Training tasks should be allocated among the various training vehicles principally on the basis of cost effectiveness.

Objective performance measurement. All training goals are stated in objective, measurable terms which relate to the performance of the trainee or the simulator (or aircraft) he controls. With objective data, the usefulness of observations does not depend upon who is doing the observing, and there can be assurance that the proficiency data obtained are a dependable measure of the performance in question rather than a reflection of personal or other factors in the evaluation situation. Reliable data obtained through objective performance measurement can provide a basis for the standardization of the products of training. In our pilot training programs, objective performance measurement is a technique employed throughout training, not just for checkrides.

The techniques described above can be employed with almost any training equipment from simple paper mockups to operational aircraft themselves. They are not limited in their applicability to simulators, *per se*. In contrast, there are other training techniques which can be used only in those cases where specific provision is made for them in simulator design. Such training techniques include automated instruction and performance monitoring, feedback augmentation through video and simulator performance recording techniques, modeling through simulator programing, and trainee-initiated and trainee-paced instruction. For a more systematic discussion of such design features, see Caro and Prophet (1971).

TRANSFER OF TRAINING EVIDENCE

The various pilot training programs in which we have employed the training techniques described above have been quite successful. For example, in an Army undergraduate helicopter instrument-pilot training program, in which a new and quite realistic simulator was used, all of the described training techniques were incorporated into training program design at the time the simulator was introduced. The result was a 90% reduction in the amount of aircraft time required to attain the course objectives (Caro, 1972).

In that particular instrument-training program, prior to introduction of the new simulator training program, 60 hours aircraft time and 26 hours training-device time, using a modified 1-CA-1 trainer, were devoted to instructing aviators in instrument flight techniques and procedures. Graduates of the course were awarded an Army Standard Instrument Card. When the new simulator, the 2-B-24, and its specially-designed training program were introduced, the same training goals were achieved after only 6½ hours aircraft time and just under 43 hours simulator time, on the average. In addition, the total calendar time required to accomplish the training was reduced from 12 to 8 weeks.

The introduction of new training equipment often provides an opportunity to introduce new training program concepts, as is illustrated by the above instance. A similar opportunity was provided when new trainers were obtained for a fixed-wing instrument course. The training device in that instance was a commercially-available instrument trainer, the GAT-2, which was modeled after a "generalized" light twin-engine aircraft, *i.e.*, it clearly was not a "simulator" and many training activities could not be conducted in it. Nevertheless, impressive transfer of training benefits were shown when the trainer was used in conjunction with a training program incorporating the training features described above (Caro, 1971).

The training goals of the fixed-wing course included transition to a twin-engine aircraft as well as qualification for a Standard Instrument Card. The programmed allocation of aircraft time between these two goals was 10 hours for twin-engine transition and 50 hours for instrument training. Additionally, 21 hours of training in a 1-CA-1 trainer were included in the course prior to the introduction of the new commercially-available trainer. Using the new trainer with the training program we developed for it, a total of 25 hours of instruction resulted in a reduction of the 60 hours training time in the aircraft to only 35 hours—approximately 5 hours for twin-engine transition and 30 hours for instrument training. In spite of the fact that substantial savings were realized with respect to the VFR transition training goals in this course, it should be noted that there was no synthetic visual display associated with the new trainer.

In another study where device realism might be considered exceptionally low, five instructional periods in a cockpit mockup made of plywood and photographs by unskilled labor (psychologists) at a cost of about $30 were found to be about as effective as five hours of instruction in the aircraft itself (Prophet and Boyd, 1970). The training task in that study consisted of aircraft pre-start, start, runup, and shutdown procedures for the OV-1 Mohawk aircraft. The training consisted of a highly-structured program which incorporated most of the techniques described above. The same training program was used in the mockup and in the aircraft. For the tasks involved, pilots trained in the mockup were found to be as proficient in the aircraft as were pilots who received comparable training in the aircraft itself.

In another course, where a slightly more realistic mockup built by the Army at a cost of about $4,300 was introduced, again with a training program incorporating many of the techniques described above (Caro, Isley, Jolley, and Wright, 1972), the instructors reported impressive transfer-of-training results. The course was a transition course for the Army's U-21 aircraft, and it consisted of 25 hours instruction in the aircraft. When the mockup and its training program were added, without any change in the 25 flight hours, there was about a 10% increase in the amount of that time each trainee spent in learning to fly instead of sitting on the ramp learning procedures. Although no attempt was made to measure the increased pilot proficiency which presumably resulted, it is evident that they at least had 2½ hours more actual flight experience upon graduation with no increase in programmed flight hours.

To complete the description of instances of training device utilization, I shall mention one more item. We also have obtained substantial, demonstrable transfer of training using reduced-scale paper mockups when an appropriately-designed training program is used with them. Admittedly, the amount of training which can be undertaken with such simple devices is limited. On a cost-effectiveness basis, however, simple devices can often be much more efficient training vehicles for the tasks for which they were designed than more realistic simulators.

CONCLUSIONS

At this point it is appropriate to return to the quotation which introduced this paper. I am of the opinion that we know more about the training value of simulators than the quotation implies, although I do not suggest that we know very much. Perhaps we build simulators as realistically as possible because people who design them do not know much about training. Or, perhaps it is because those who design them know that those who use them do not know much about training, and the safest thing to do is to build simulators like aircraft. In that way, at least, instructor pilots will be able to get some training value out of them by using simulators just like they would aircraft.

It is true that the users have been willing to pay the price for simulator realism, although in some instances realism was bought for the sake of realism, not to meet known training goals. In spite of such affluence, the question of how transfer might be accomplished in less expensive ways is not being avoided altogether. It is receiving attention in research centers such as that which I represent. Even now, there is substantial applied research evidence that much of the training being conducted in expensive simulators could be accomplished in less expensive devices *if* the training programs used with them were properly designed and conducted.

Finally, let me acknowledge that the present state-of-the-training art is relatively primitive, and I do not suggest we should cancel all orders for realistic simulators. I do believe that in many cases we are paying for realism where it cannot be justified from a transfer-of-training standpoint. A proper training program can compensate for lack of physical similarity between the training device and the aircraft, but a realistic simulator is a poor substitute for competent training. Obviously, transfer of training from a device to an aircraft is limited to the tasks which can be performed in the device. But, whether that limit is reached is a function of the way in which the device is used. There probably would have been zero transfer, or even a great deal of negative transfer, in all the instances of device utilization I described above had they been used with inappropriate training programs. The key is the program, not the hardware.

REFERENCES

Adams, J. A. Research and the future of engineering psychology. *American Psychologist*, 1972, 27(7), 615-622.

American Airlines, Inc. Flight Training Academy. Optimized flight crew training, a step toward safer operations. American Airlines, Inc., Fort Worth, Texas, 1969.

Caro, P. W. An innovative instrument flight training program. Paper No. 710480, Society of Automotive Engineers, New York, N. Y., 1971.

Caro, P. W. Transfer of instrument training and the synthetic flight training system. Proceedings of Fifth Naval Training Device Center and Industry Conference, Orlando, Florida, 1972.

Caro, P. W., Hall, E. R., and Brown, G. E., Jr. Design and procurement bases for Coast Guard aircraft simulators. Technical Report 69-103, Human Resources Research Organization, Alexandria, Virginia, 1969.

Caro, P. W., Jr., Isley, R. N., and Jolley, O. B. The captive helicopter as a training device: experimental evaluation of a concept. Technical Report 68-9, Human Resources Research Organization, Alexandria, Virginia, 1968.

Caro, P. W., Jolley, O. B., Isley, R. N., and Wright, R. H. Determining training device requirements in fixed wing aviator training. Technical Report 72-11, Human Resources Research Organization, Alexandria, Virginia, 1972.

Caro, P. W. and Prophet, W. W. Some considerations for the design of aircraft simulators for training. Proceedings of Second Annual Psychology in the Air Force Symposium, U. S. Air Force Academy, Colorado Springs, Colorado, 1971.

Gagne, R. M. (Ed.). *Psychological principles in system development.* New York: Holt, Rinehart and Winston, 1962.

Hall, E. R. and Caro, P. W. Systems engineering of Coast Guard aviator training. Proceedings of Second Annual Psychology in the Air Force Symposium, U. S. Air Force Academy, Colorado Springs, Colorado, 1971.

Hall, E. R., Caro, P. W., Jolley, O. B., and Brown, G. E., Jr. A study of U. S. Coast Guard aviator training requirements. Technical Report 69-102, Human Resources Research Organization, Alexandria, Virginia, 1969.

Hall, E. R., Parker, J. F., Jr., and Meyer, D. E. A study of Air Force flight simulator programs. USAF: AMRL-TR-67-111, Aerospace Medical Research Laboratories, Wright-Patterson AFB, Ohio, 1967.

Isley, R. N., Caro, P. W., and Jolley, O. B. Evaluation of synthetic instrument flight training in the officer/warrant officer rotary wing aviator course. Technical Report 68-14, Human Resources Research Organization, Alexandria, Virginia, 1968.

Jolley, O. B. and Caro, P. W., Jr. A determination of selected costs of flight and synthetic flight training. Technical Report 70-6, Human Resources Research Organization, Alexandria, Virginia, 1970.

Muckler, F. A., Nygaard, J. E., O'Kelly, L. I., and Williams, A. C., Jr. Psychological variables in the design of flight simulators for training. USAF: WADC-TR-56-369, Wright-Patterson AFB, Ohio, 1959.

Prophet, W. W. The importance of training requirements information in the design and use of aviation training devices. Paper presented at 16th Annual International Air Safety Seminar, Athens, Greece, 1963.

Prophet, W. W. and Boyd, H. A. Device-task fidelity and transfer of training: aircraft cockpit procedures training. Technical Report 70-10, Human Resources Research Organization, Alexandria, Virginia, 1970.

Prophet, W. W., Caro, P. W., and Hall, E. R. Some current issues in the design of flight training devices. *25th Anniversary Commemorative Technical Journal*, U. S. Naval Training Device Center, Orlando, Florida, 1971.

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