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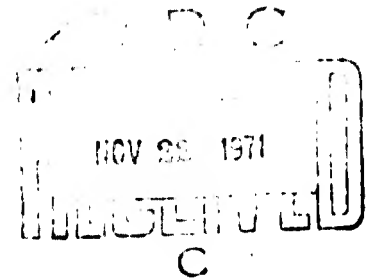
MULTI-MEDIA IN USAF PILOT TRAINING

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Flying Training Division  
Air Force Human Resources Laboratory

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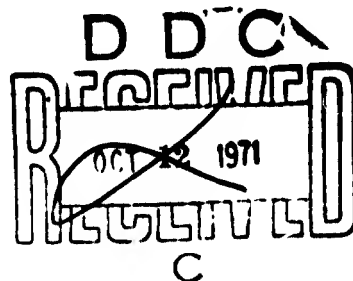
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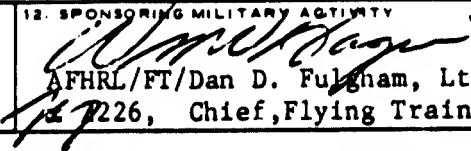
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13. ABSTRACT  The flight-line portion of flying training has traditionally required large amounts of airborne practice under an apprenticeship form of instruction. New developments in Educational Technology, from both a philosophical and device point of view, provide new opportunities to train airborne skills in a ground environment. Through the use of multi-media instructional techniques, within the context of a systematic approach to training, much can be done to improve the overall efficiency of actual airborne practice.			

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## MULTI-MEDIA IN USAF PILOT TRAINING

Milton E. Wood

Traditionally, one associates the wild blue yonder with much of the pilot training process. As even the novice might guess, however, the classroom of the sky is far from an ideal learning situation. Aside from the overall expense of aircraft operation, and the increasing dangers of crowded airspace, the trainee finds the "windswept heights" noisy, stressful and demanding of more skill than he often has to offer. Placed in more theoretical terms, the problems of high task-load, impaired attention, concealed knowledge-of-results, reduction of memory, and rapid accumulation of fatigue often reduce overall in-flight training efficiency.

In addition to what might be characterized as trainee variables, instructor problems also arise from the need to train in the natural environment. Because of the very private nature of flying where student and instructor are isolated in space, it has only been natural for flying training to become largely an apprenticeship type experience. As is often the case in this situation, the quality of instruction is primarily dependent upon the flying and instructional skills of the instructor pilot. It is also dependent upon the "mood" of the instructor, the "mood" of the student, and the overall compatibility of the apprentice-tutor team. Although the apprenticeship form of instruction is fully capable of producing highly skilled pilots, it can be

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inefficient and often is through the natural fact that everyone cannot be an ideal instructor.

Looking at flying training from the perspective of the last 40 years, it is tempting to observe that learning-to-fly is better described as flying-to-learn. This is not entirely fair in that both military and civilian student pilots do first learn, then fly by: (1) attending formal academic courses which provide instruction in flying related topics; and (2) practicing various procedural and basic flight tasks in ground trainers before and after actual in-flight practice. It has become apparent, however, that even more of what is normally learned in the air can be effectively learned on the ground in what might be called a "second flying environment."

In the future, part of this second environment will consist of sophisticated flight simulators which will provide a complete synthetic air space in terms of motion, vision and appropriate aircraft dynamics. Part task trainers will contribute to the second environment by allowing ground practice of selected airborne tasks, eg., formation, landings, etc., (existing ground trainers now fall into this "part task" category.) A third portion of the second environment will be realized through the application of multi-media techniques to those topics normally addressed only on the flight line and/or in the air.

The beginning of a multi-media attack to bring about improved training efficiency is already underway within the Air Force, and does provide a remarkable potential for effectively teaching many airborne tasks.

### POTENTIAL OF MULTI-MEDIA TO FLYING TRAINING:

Having already listed some negative aspects of "flying to learn", it is apparent that the educational technology of today can offer conditions more favorable to learning if what is to be learned can be effectively moved from sky to ground.

In the past, at least two problems have severely limited the extent to which this transition could be made. One problem can be characterized strictly in terms of the limitation of available training equipments. Another is described by an overall philosophy of training which, as already mentioned, was primarily apprenticeship in nature.

During the last few years, tremendous advances have been made in both these areas. The technology of equipment design has provided specialized educational equipments which offer the flexibility and reliability needed to exercise many of the principles of instruction long defined by learning and training research. Philosophies of instruction have given increasing emphasis to a systems approach to training (SAT) which, through the definition of specific behavioral objectives, makes it possible to systematically isolate and train various task components in the most efficient manner. There is no doubt concerning the need for further training research in both these areas; but, significant progress is being made, and great improvements in training efficiency can be realized using available educational technologies. (Wood, 1970a)

In light of the promising potential of new equipments, the effective application of principles of learning, and the guiding philosophy of a systematic approach to training, consider the potential impact of this new educational technology on flying training through the fol-

lowing applications.

<sup>Reducing</sup>  
Stress: Some level of psychological and physiological stress always accompanies the task of piloting an aircraft. For the student pilot, stress often reaches high levels. Although the student must eventually learn to cope with all the stresses of flight, it is generally inefficient to crowd the information processing potential of the new student with the tremendous array of external and internal cues available from actual flight. To the extent that various individual flight tasks can be practiced on the ground under controlled conditions and subsequently "transferred" to the sky (1) more efficient learning of that task will occur, and (2) subsequent in-flight learning will be enhanced through a reduction in overall taskload. In a circular manner, the reduction in airborne taskload will contribute to an incremental reduction in psychological (and perhaps even physiological) stress. This allows a more efficient operation of the student's attention mechanisms, provides greater information processing potential for relevant cues, and because information is processed and organized, memory is enhanced.

Allowing Self Study: Inherent in the multi-media approach are many qualities which can be conveniently grouped about the basic notion of self-study. Even though most self-study advantages are easily recited, they must not be forgotten by the training specialist.

The power of individualized instruction, self-pacing, and the application of individual prescriptive study is certainly an important part of the total concept. In flying training, is often expedient to think not only in terms of individual study, but also in terms two,

three or four person study. This comes about because four students are often assigned to one instructor, and each student remains relatively close in the acquisition of skill throughout training.

Knowledge-of-results (KR) is cardinal principle in the self-study approach, and can be manipulated through at least three major dimensions: (1) immediate KR; (2) rapid KR; and (3) delayed KR.

Immediate KR is easily obtained through electronic response circuitry or through careful programming of still or dynamic media. In manipulating KR, covert as well as overt forms of KR can be used to great advantage.

The effectiveness of rapid KR has been demonstrated in USAF pilot training (Schumacher, Rudov and Valverde, 1970) by video taping selected portions of student in-flight practice and allowing the student to view his own performance immediately after landing. This "self-confrontation" technique is also effective in other training situations.

Delayed KR is receiving some attention relative to its ability to enhance retention.

Student involvement can easily be achieved through multi-media techniques, and is conveniently instrumented through the "pause" features of even the least expensive cassette tape recorders.

Vicarious student experience, or "dry flying" is easily obtained by using the several dynamic media available to the learning center. Cassette-loaded super-8 films is one technique for providing dry flight. A USAF study (Wood, 1970b) showed savings of up to 16 hours flying time per class of 60 undergraduate pilot training (UPT) students through use of only three, nine minute films in T-37 training. Extended use of this media in UPT promises much greater savings.

Self-study also suggests many other areas beyond the scope of this limited article. Of particular importance, however, is the fact that requirements to design self study material within the context of flying training, forces the flying training software specialist to pull together - for the first time - words and pictures which reify instructions formerly available only on a ~~mouth to mouth~~ person to person basis.

Applying Instructional Flexibility: In addition to the direct application of basic principles of learning through the techniques of multi-media, it is important not to lose sight of what is really the magic of modern educational technology. This magic, though identifiable in other more scientific terms, does represent capabilities which can only be achieved through use of the media approach. As one author put it so well (Palmer, 1947) media can substitute for both the physical eye and the mind's eye. Taken in this context the physical eye shows how things look, while the mind's eye shows what things mean.

By applying the magic of media much can be achieved. Time can be slowed down, speeded up, or dissected into many parts. One can return to past or visit the future. Because so much of learning to fly requires an intimate feel for the time dimension, this touch of magic is of great importance.

It is also possible, through techniques of illustration and animation, to deal effectively with most parameters of complexity. Only a little effort is required to simplify or abstract an idea, to exaggerate a detail for increased relevance, or to distill and depict a process which though extremely important may be clouded due to its complex nature.

The magic of media can be effectively used to promote the affective or "liking" aspects of that which is to be learned. With only a little skill, instructional programs can be made interesting through careful control of presentation techniques which (1) personalize the material to be learned, (2) vary the pace or difficulty level of subject matter, or (3) provide feelings of accomplishment generated by the instructional program itself.

Other touches of magic involve the use of multiple images where one image provides a standard and the other is varied to demonstrate some state of error or difference. Stereo vision or audition provide interesting avenues of possible application. Polarization techniques give illusions of motion even though a static slide is being used. On and on the list extends, providing training potential which has yet to be described or evaluated.

#### THE WILLIAMS LEARNING CENTER

Based upon the success of various individual media in aiding pilot instruction, the United States Air Force has procured a full scale multi-media learning center to augment undergraduate pilot training at Williams Air Force Base, Arizona. The system was procured for Air Training Command by the Flying Training Division of the Air Force Human Resources Laboratory and was officially opened on March 4, 1971.

The Williams Learning Center provides multi-media support to both the T-37 and T-38 phases of training. The devices and carrels associated with the T-37 aircraft, (the first of two jet aircraft used during UPT), was placed in a relocatable building located within a few feet of the flight line squadron area. A similar building housed those equipments and carrels designed for T-38 instruction. Of the 35 two-

man carrels designed specifically for T-37 support, five were configured to look like the cockpit of the T-37 aircraft. Although the cockpit interface is primarily photographic in nature, movable stick and throttle controls are included to enhance the realism and practicality of the cockpit carrels. Each of the five cockpit carrels provide 64 channels of audio available on a touch-tone access basis. The prime purpose of the cockpit carrel is to allow guided or unguided practice in the many normal and emergency cockpit procedures related to flight. These carrels can also be used with any audio program which would be enhanced through the availability of a cockpit reference, eg, viewing single-concept films.

Fifteen of the T-37 carrels are audio-visual in nature, and contain 35mm projector, cassette-load tape recorder, plus programming/synchronizing circuitry which allows combinations of soundslide presentation with student response and/or knowledge-or-results. These carrels take advantage of the low cost and convenience of 35mm color photography, as well as the instructional flexibility of sound-slide programming. The audio-visual carrels feature programs such as: (1) night and formation phase briefings, (2) ground cues which define local flying areas; (3) the computation of fuel quantities, takeoff run, data and mission planning; (4) basics of instrument flight and in-flight procedures, etc.

The 15 remaining T-37 carrels utilize audio-video tape recordings, and are referred to as audio-video carrels. Seven of these carrels contain color monitors, while the remaining are equipped with monochrome

monitors. Through the use of touch-tone selectors, students may call up color or monochrome material from four video tape recorders, a 16mm film projector or a 35mm sound-slide projector which, with the 16mm projector, is accessible to the closed circuit system through uniplex film trains. The 64 channels of audio may also be accessed from the video carrels. In addition to the equipments contained in the 35 carrels just described, students may also check out (1) cartridge-load, super-8, sound projectors to view cartridge loaded films or (2) cassette load tape recorders for use on a take-home basis.

The 16 T-38 carrels which make up the T-38 Learning Center essentially replicate the T-37 media equipments. Eight of the T-38 carrels are cockpit carrels which include a programmable, four response with feedback sound slide capability. The eight remaining carrels are two-man sound slide carrels which employ cassette recorders with synchronizing and pause circuits. Super-8 self contained projectors are again available for checkout, as well as take-home cassette tape recorders. No audio-video carrels are available in the T-38 center.

In addition to the several types of carrels just mentioned, each relocatable building contains a storage/equipment/library area with an attendant in charge. Attendants will provide the students with those sound-slide materials required for the operation of the audio-visual carrels as well as load the audio and video tapes which will be available to the dial-access systems during any given day. Duties will also involve: minor maintenance on the materials and devices; check-out of the self-contained single-concept projectors, and tape recorders, films and tapes; and, record keeping as required.

The Williams system is an ambitious attempt to enlarge upon the training potential of the flight line environment. Not only does the center provide an immediate opportunity to operationally exercise the utility of the multi-media approach, it also provides a research base which will make possible the further definition of how best to employ multi-media techniques in the flying training environment. Because of the universal nature of most multi-media applications, it is expected that much of the research to be conducted at Williams will be of general value to the educational community.

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### BIOGRAPHY

Milton E. Wood, (BA, University of Louisville; MS, University of Dayton; Doctoral Program, Arizona State University) is currently the senior staff member of the Flying Training Division, Air Force Human Resources Laboratory, Williams AFB, Arizona. Mr Wood previously served as a B-47 pilot with Strategic Air Command and then as a training research psychologist at Wright-Patterson AFB, Ohio. Mr Wood's recent activities in flying training research have centered on pioneering the application of multi-media instruction to Undergraduate Pilot Training (UPT). This application involves the integration of single-concept films, sound-slide presentations, airborne video recordings, and other media in an Information Retrieval System (IRS) to be installed at Williams AFB as a model for UPT.