METEOROLOGICAL INPUT TO GENERAL AVIATION PILOT TRAINING

John R. Colomy

St. Cloud State University

Analyzing meteorological input to general aviation pilot training programs requires an examination of the present effectiveness of the meteorological education process and the examination of the instructor's preparation, the "symbol set" utilized in the communication, and the student's experience in meteorology. Specific recommendations may then be presented based upon the analysis.

In order to be a safe and proficient pilot one must develop effective, cognitive, and psychomotor data in the "human computer" through education. Persons may be very knowledgeable about the factors that affect flight operation, but without experience in the skills involved this author would seriously doubt their ability to operate the system. On the other hand, an individual may be "God's gift to aviation" in skill, but without a knowledge of procedures, meteorology, systems design, and performance parameters, this author would doubt if they would be safe pilots. Knowledge and skill are equal requirements for safe and proficient pilot operation.

One may evaluate, to some extent, our present educational effectiveness by examining the statistics of those individuals who have not been successful in avoiding difficulties (i.e., weather-related accidents). One must realize that these statistics do not reflect those individuals who have survived a "close encounter of the terrifying kind" with a resolve to never again attempt a flight in that type of meteorological phenomena.

The Annual Review of *Aircraft Accident Data* for the general aviation calendar year 1977, published by the National Transportation Safety Board, indicates a total accident count for 1976 of 4,793 and a total accident count for 1977 of 4,286. Of 1,490 accidents involving injury, 239 occurred in weather that was below minimums. There was a total of 317 accidents in IFR weather and 27 in weather that was below minimums. The total accidents involving small fixed-wing aircraft were 3,842 with 875 involving weather as a cause or factor in the accident. Weather was involved in 22.7% of the reported small fixed-wing accidents. The latest specific information available on weather-related accidents is for 1976 in *Brief* of *Fatal Accidents Involving Weather as a Cause/Factor*, published by the National Transportation Safety Board. The report indicates a decrease in the weather-related accidents per hours flown since 1967, but also indicates 908 accidents involving

weather in 1976. The briefs presented on weather-related accidents indicate that many pilots had failed to maintain aircraft control. Weather did not directly cause these accidents; pilot disorientation was the cause. The disorientation was induced by lack of visual reference and not necessarily by the severity of the weather. The lack of pilot understanding of the effects of meteorological phenomena on pilot operation is evident.

The indications are that the meteorological input into general aviation pilot training programs should, indeed must, be improved. In order to arrive at a practical set of recommendations, the present "system" must be evaluated.

The "FAA approved" definition of learning is a "change in behavior brought about through experience." This author would add to this definition that the experience may be real or imagined. Most educators mix the real and imagined experiences for their students. Some disciplines do not lend themselves to the use of real experience in the educational process and there may be other restrictions (staff, facilities, budgets) that prohibit the educator from involving the student in a real experience during the educational process. This does not indicate, however, that the learning experience was not a valuable one for the student if the imagined experience was a well-contrived one. I think that one would agree that the emotional experience one had during the viewing of Alfred Hitchcock's *Psycho* was indeed a very "real" one. In recent years the industry has utilized aircraft simulators as a means of substituting imagined experience for real experience and this has proved to be most effective.

Education has many objectives to include: the discovery of new knowledge, the dissemination of existing knowledge, and the translation of facts and knowledge into action on the part of the student. Meteorological research involves the utilization of technology to expand our knowledge of the ongoing process. The specifics of the meteorological education system that this paper examines involve the dissemination and translation phases of the process.

Meteorological education is a communications system involving a sender (educator), a set of symbols (vehicle), and a receiver (student). It is vital to the effectiveness of the individual's education that the system maintains its integrity. Each "block" is vital to the structure of the system. Education is a lifelong process and, therefore, one must not restrict the examination of meteorological education to the initial "precertification" classroom phases of pilot training.

Professionalism is a must for the educator to be effective. This applies to all meteorological instructors, be they classroom teachers, flight or ground instructors, or pilot briefers. Professionalism requires extended training and preparation; study and research; logical and accurate thinking; good judgment; and, perhaps most important, individual commitment to become the best that one is capable of becoming while operating within the system.

The general aviation industry is confronted with several problem areas concerning flight and ground instruction in general and in meteorological education specifically. Historically the training and preparation of a pilot to become an instructor has been minimal, Very few flight and ground instructors have received an education in the teaching process similar to that which is required for teacher certification of elementary or secondary educators. The recertification requirements are minimal compared with the ongoing education that is required of an instructor in a school system. The typical exposure to the theory of education involves a memorization of the *Flight* Instructor's *Handbook* in order to pass the FAA *Fundamentals of Instruction* written examination. The applicant may receive some classroom or individualized instruction in the educational process, but this is usually conducted by another instructor who was trained using the same approach. The result has been a minimal knowledge of the educational process among the majority of flight and ground instructors.

The problem is compounded by the specific background in various disciplines that is required for competent instruction. The meteorological background of most instructors is limited to the exposure during initial pilot certification (i.e., the meteorological sections of the private and instrument courses). This background varies from "reading the chapter" to instruction received from another pilot who is a product of the same system. Few pilots are fortunate enough to have received instruction, in depth, from professional meteorologists or individuals with extensive education in this area. Continuing education in meteorology is not a requirement for the typical flight or ground instructor.

Another area of concern is the transitory nature of the majority of general aviation instructors. Many individuals who seek certification are utilizing the instructor position as a bridge to a career in corporate or airline operation. This is not to say that these individuals are inadequate instructors, but to indicate that the cadre does not have an average experience level that is found in the secondary school system, for example. Unfortunately, many of these individuals are more interested in building time than they are in teaching technique or study and research in the required disciplines. They, in many cases, are not interested in becoming the best instructors that they are capable of becoming while they are involved in flight instruction.

The recent increase in airline flight crew positions has depleted the military, corporate, and general aviation pool of pilots. There is currently a shortage of flight instructors in many parts of the country. More individuals are leaving the profession than are entering it, primarily because of economics (i.e., income). The positive aspect of this shortage will be an increase in the average income of a general aviation instructor, which, most individuals feel, is long overdue.

There is also a problem area in instructor education that relates to quality control. School teachers must complete a period of time in a practice teaching situation for certification before graduation. There is no such provision for the general aviation instructor. The practice teaching experience involved in instructor training is usually limited to the student instructor practicing presentations to the instructing instructor. The student instructor usually has no opportunity for a real experience of teaching students under supervision. Evaluation of an applicant's instructing ability is limited to the certification practical examination, which is a minimal look at the applicant at best.

Those individuals that educate the general aviation pilot in the present and future trends of the meteorological system (i.e., meteorologists and Flight Service Station briefers) are critical to general aviation operations. These educators must also have extensive preparation, training, and continuing education. The fact that it is possible to obtain two different briefings from two different briefers at the same Flight Service Station within a short time frame is an indication that the briefer's education should be examined.

The sender of communications must be knowledgeable of the receiver's background in order to establish a set of symbols to be utilized in the process. It is obvious that there is a necessity to utilize a set of symbols in this communication that have the same meaning to the receiver as they do to the sender. This "symbol set" is critical to the educator (teacher and briefer) if he is going to be effective while painting a weather picture for the student or pilot. The term "bumper" may be received as meaning a thunderstorm or as meaning the device found on the front and back of an automobile, for example.

An examination of the present symbol set reveals a mixing of meanings and symbols that are difficult to learn, easily forgotten and easily misunderstood. The sequence report utilizes some numbers to represent statute miles (visibility), some numbers to represent nautical miles (wind velocity), and some numbers to represent feet (RVR values). The terminal forecast will omit a visibility number if the forecast is for visibility greater than six miles and will omit a wind group if the forecast winds are less than 10 knots. The area forecast does not utilize the same format as the terminal forecast, but is prepared in a "notehand" presentation utilizing contractions.

The weather charts utilize different presentations depending upon the type of chart or the level it represents. The lines utilized on a surface analysis chart represent isobars, the lines on a weather depiction chart represent restrictions to visibility or ceiling, and the lines on a radar summary chart represent areas of radar echo return. The lines on a lsw level significant weather prognostic chart are utilized to represent ceiling and visibility restrictions, freezing levels, turbulence areas, and isobars. The high level significant weather prognostic charts illustrate surface locations of pressure centers and

fronts, but present cloud cover only above 24,000 feet MSL (400 millibars). The cloud cover is described with numbers representing eighths of coverage instead of the surface chart symbol which represents tenths of coverage. The constant pressure charts may or may not present temperature-dew point spread, or isotachs, depending upon the level represented. The contour levels vary and the height is presented in meters.

The term "VFR" (Visual Flight Rules) may indicate visibility is greater than five miles and ceiling is greater than 3,000 feet when used in a forecast. VFR may also indicate a visibility range of one to five miles depending upon altitude and type of airspace when used in reference to the Federal Aviation Regulations.

The difficulties encountered by educators and students alike in mastering the symbol set are compounded by the dissemination of the communications. Recent budget reductions have eliminated some offices of the National Weather Service and curtailed staffing at others. Flight Service Stations have also received budget cutbacks. The pilot, in many locations, does not have ready access to the meteorological communications system, much less the opportunity for an in-person briefing.

There are several facets to the receiver's (student's) perception of a communication: physical organism, basic need, goals and values, self concept, time and opportunity, and recognition of the element of threat. One of the most important factors is motivation. Does the meteorological communication system positively motivate the student to learn? Does the system create the desire to learn about meteorology or does it force the student to learn only what is necessary to pass a written examination?

This author questions the effectiveness of the experience in meteorology that is currently available in general aviation pilot training programs. It is possible for a pilot to be certificated without any experience in low ceiling or low visibility operations. The regulations, however, then allow that individual to carry passengers in as low a visibility as one mile while only remaining clear of clouds. Pilots may receive the instrument rating without ever making a flight into a cloud or storm system. How does one understand the effects of structural ice accumulation and other conditions without experience? Simulator technology is providing the student with the opportunity to experience a "real" contrived situation, but is not currently available to the general aviation pilot.

Is there a need to change the meteorological communication system? This author belives that change for improvement is feasible and necessary.

Historically, most flight and ground instructors in general aviation came from the pilot ranks. They were pilots first and through a

minimal amount of training became instructors. Perhaps the industry should encourage universities to develop a professional aviation instructor curriculum that would parallel those curricula currently used to educate secondary school teachers. This would take those individuals that are by nature teachers and educate them in aviation. This would provide the industry with a stable cadre of professional educators that are well educated in teaching techniques as well as in the disciplines of aviation. Advanced coursework in meteorology could be a graduation requirement. In addition, a practice teaching experience requirement would provide the student instructors with "real" teaching experiences and an evaluation of their knowledge and teaching technique.

An FAA regulatory change requiring newly certified instructors to teach under the supervision of selected chief flight instructors for the first year might also be appropriate. The senior instructor would assist the new teachers in their flight and ground instruction, evaluate the new instructor's students, and make recommendations for permanent certification.

The symbol set utilized in meteorological communication should be reevaluated by NOAA and educators to improve the consistency of meaning of the symbols utilized. The objective is to communicate and not to confuse. A consistent set of symbols would assist the educator (teacher and briefer) and replace confusion with understanding on the part of the student.

New methods of communication dispersal utilizing today's technology must be developed. The use of computer-stored cathode ray tube displayed data should be expanded. The development of higher resolution pictures and an improved dispersal system for them should be pursued.

Educators must develop a meteorological presentation that positively motivates a student to learn. Instead of presenting the material in such a way that implies memorization to pass a test, the "senders" should attempt to develop a desire to learn on the part of the "receivers."

This author believes that much can be done to improve the meteorological experience the current system provides. The use of CRT displays incorporating computer-generated visual references on general aviation simulators should be developed. These displays have the capability of depicting various visibility and ceiling conditions and would provide the student with the experience in operation during marginal weather.

Video tape programs depicting in-flight meteorological encounters would be valuable in teaching what flight under various situations is like. It is difficult to teach what a flight in or around a well-developed thunderstorm is like. It is difficult to teach the "pilot

terror" developed when encountering moderate ice in an aircraft not equipped with deice systems. Well-structured video programs incorporating pilot comments could be very effective.

Flight instructors should also attempt to provide real experience in flight operation during low ceilings or visibilities. One does not have to operate in a thunderstorm to receive an impression of the energy involved. Certainly every pi'lot who receives an instrument rating should have some experience in real instrument flight.

Can the system be improved? Yes. Will improvement in the meteorological education system improve flying safety? Yes. It is the responsibi1ity of the system managers to seek the necessary improvements. It will benefit all.