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FEATURES

DEPARTMENTS

FRONT COVER: A Piper Chieftain's scenic right turn. BACK COVER: An Aerostar 600A arrives in time for the sunset. (Photos courtesy of the aircraft manufacturers)

Communications-Related Incidents in General Aviation Dual Flight Training

by Kamil Etem and Marcia Patten

A recent survey of the Aviation Safety Reporting System (ASRS) database on incidents involving general aviation (GA) aircraft revealed that one third of the GA incidents were associated with communications difficulties. These problems included failure to comply with ATC clearances, communications equipment malfunctions, and poor radio technique. The results of this survey suggested to our research team that GA communications issues were an appropriate topic for further ASRS research. We were also aware that past ASRS research on general aviation issues has not focused on this subject. It largely has been confined to weather-related topics, such as single-pilot IFR; pilot judgment issues; and flight phase-specific problems such as landing incidents. --ASRS Editor

The 1996 Nall Report, published by the Aircraft Owners and Pilots Association (AOPA) Air Safety Foundation, further focused our attention on dual instruction. [For the purposes of this study, dual instruction is considered primary or advanced flight training that involves a student or rated pilot who actively handles the aircraft controls (usually from the left seat of the aircraft, except in tandem configurations) and a certified flight instructor who observes the trainee's actions (usually from the right seat of the aircraft) and has the capability of intervening in control and communications actions.] Although flight instruction overall is one of the safest operations in general aviation, according to the accident statistics from the 1996 Nall Report: Accident Trends and Factors for 1995, there was a notable concentration of fatalities and accidents during dual instruction: the only fatal go-around accident, four of the five fatal maneuvering accidents, and five out of seven non-fatal maneuvering accidents occurred during dual instruction. This cluster of accidents and fatalities in dual flight instruction raised the question of whether problematic communications, both inside and outside the aircraft, might have played a role.

A final motivation for this study was research by NASA and others which has shown that in shared decision-making situations similar to those that occur in GA dual flight instruction, there is often a failure of individuals to take responsibility for actions, including communications. At the 1995 Ohio State University (OSU) Symposium, Carolyn Prince and Renee Stout presented the results of interviews with professional aviators from the military, air carriers, and GA. They reported that 30 percent of the GA instructors surveyed stated that they trained students to perform independently, as single pilots, and believed their task as flight instructor was to encourage independence, not team awareness. An exaggerated emphasis on pilot independence during training arguably may exclude development of sound cross-cockpit communications procedures and impair communications awareness and effectiveness.

Defining the Task

Our research goal was to examine a representative set of ASRS reports referencing communications-related incidents that occurred during GA dual instruction with the following specific objectives:

- To identify the airspace, location, and operational context in which GA dual instruction communications incidents occurred (external factors);
- To determine the nature of problematic communications interactions that occurred (or did not occur) in the cockpit between instructor and trainee (internal factors);
- To identify contributing communications equipment and operational factors;
- To suggest strategies for improving communications management during GA dual flight instruction.

This research effort was limited to ASRS incidents involving powered aircraft with a maximum gross takeoff weight less than or equal to 14,500 pounds. Incident reports selected for the study had to directly reference the presence of a flight instructor on-board who was actively conducting dual flight instruction or a flight review.

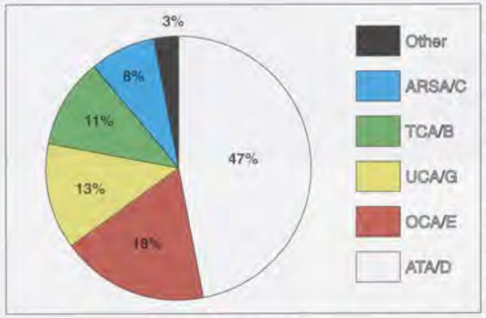

Figure 1 - Airspace Involved

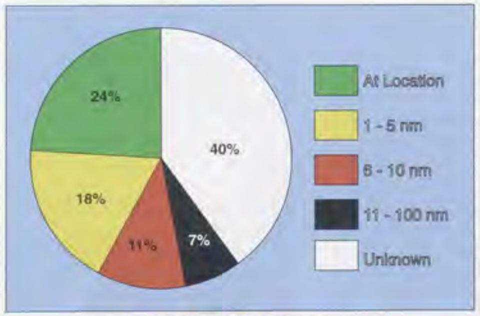

Figure 2 - Distance from Airport (miles)

Although we had no means of identifying database reports in which communications (or the lack thereof) between instructor and trainee contributed to an incident, but were not reported, it was possible to retrieve reports in which communications factors were explicitly referenced as a contributing factor. Therefore a further requirement was that reports selected for the study contain specific references to verbal interactions between the flight instructor and trainee which contributed to the incident. Examples included directives or instructions; questions, recognition, or announcements of a problem; predictions or warnings; status reports; information acquisition; statements referring to planning or goals; explanations; and non-pertinent conversations. (See the sidebar on the Properties of ASRS Data on page 5.)

Initial query of the ASRS database revealed 582 incident occurrences from January 1988 through December 1996 which had the potential to meet the scoping criteria for this study. We screened a random sampling of these reports to aid in hypothesis generation and the development and refinement of a coding instrument.

A final data set of 200 incidents were selected that met the scoping criteria for the study. Eighty-four percent of these reports were submitted by instructors; sixteen percent were submitted by trainees. This reporter distribution is almost identical to the that of the ASRS database for all GA dual instruction incidents.

FINDINGS AND DISCUSSION

External Factors

1. Environment For GA Communications Incident Occurrences

A strong pattern emerged from our analysis of the environment in which dual instruction communications-related incidents occurred: Half or more of the incidents occurred within the airport environs and airspace, within 10 nautical miles of the airport at altitudes less than 1,000 feet. [There were a total of 300 airspace citations for the 200 incident reports in the data set.]

As depicted in Figure 1, almost half of the dual instruction events occurred in Class D airspace, with Class E airspace next in the number of occurrences. This concentration of incidents within Class D airspace was not surprising, as both primary and more advanced types of instruction are airport-centered: primary instruction involves recurrent landing practice and

pattern work, while more advanced flight instruction often involves approaches to an airport or related navigational aid and takeoff/landing practice. In slightly over half of all events, the incident also occurred within a 10-nautical mile range of the airport (Figure 2) and at altitudes less than 1,000 feet AGL (Figure 3).

Consistent with the number of incidents in the study set that occurred on or near airports and at low altitudes, communications-related incidents were most prevalent during the approach/descent phases (167 citations, 47 percent) and landing phase (103 citations, 29 percent) of flight. [There were a total of 356 flight phase citations for the 200 incident reports in the data set.] The concentration of incidents in these flight phases is doubtless due to the fact that more approaches and landings are performed in dual instruction than in other types of GA operations.

2. Surface Versus Airborne Communications Incidents

One third of our data set (66 reports) described incidents involving aircraft operating on an airport surface and conducting external radio communications. In our extensive experience as flight instructors, the amount of time spent on the airport surface in any type of dual instruction is generally small-usually 15 percent (or less) of an instructional period, even in primary instruction. The occurrence of more GA dual instruction incidents on the airport surface than expected suggests that airports may be a problematic environment for communications-related incidents. [To provide a context for this study finding, we searched for statistics on the numbers of total GA ground operations that occur daily and/or annually in the U.S. We discovered that the Boeing Company has done a study for insurance purposes of the amount of time an air carrier aircraft spends on the ground in maintenance. However, we were unable to find comparable data on the numbers of GA ground operations for any time period.]

For both surface and airborne incidents that involved external radio communications, control tower communications were reported the most frequently. Of the 66 surface-based incidents, 47 (71 percent) cited communications with a control tower. Another 117 reports that involved airborne operations cited ongoing ATC communications. Of these, 52 incidents (44 percent) cited communication with towers, 39 incidents (33 percent) referenced communication with TRACONs, and 21 incidents (18 percent) cited communications with UNICOM or Centers. The prevalence of tower-communication reports in our study set reinforces the notion that effective management of instructional communications while monitoring Tower frequencies is crucial to the effective and safe conduct of dual training operations, both while on the surface and airborne.

Internal Factors

All reports included in our study set were classified into broad groupings of verbal communication anomalies that occurred within the cockpit. Drawing on explicit references from the study reports, we classified the types of instructor/trainee statements, determined whether these statements were heard by the intended recipient, and evaluated the timeliness and appropriateness of these responses these statements elicited. Additionally we sought to identify the equipment, and task or workload-related (operational) factors which played material roles in the events.

1. Cockpit Communications Anomalies

Figure 4 (below) lists the three most frequently occurring combinations of instructor/trainee verbal interaction problems. [192 out of 200 reports (96 percent) described one or more communications anomalies that occurred within the cockpit during flight (as opposed to preflight, or post-tiedown, communications anomalies).]

Confusing, erroneous, or misleading statements were the leading type of instructor communications anomaly (30 percent of citations). Delayed or withheld communications by instructors were the next most frequent instructor anomaly (16 percent of citations), and a leading cause of delayed or inappropriate actions on the part of trainees. It is a common technique of flight instructors to allow the trainee to

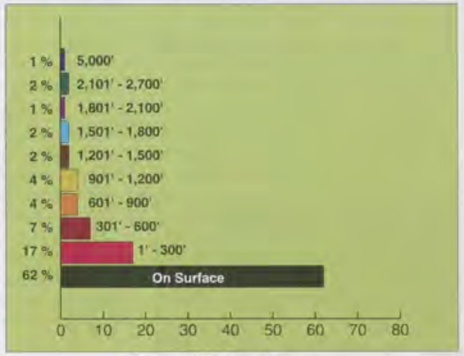

Figure 3 - AGL Altitude Range
(113 of 200 Total Reports)

Figure 4 -- Cockpit Communications Anomalies

Top 3 Combinations of Communications Anomalies

- Instructor made confusing or misleading statements and trainee delayed action or acted inappropriately
- Instructor heard but misinterpreted intra-cockpit communications and trainee delayed action or acted inappropriately
- Instructor withheld or delayed comment and trainee delayed action or acted inappropriately

make mistakes in an attempt to develop independent actions and observe the trainee's level of awareness. However, especially during IFR operations or when compliance with an ATC directive is doubtful, corrective verbal comments by the instructor have a significant impact on flight safety.

Regardless of the type of communications anomaly displayed by instructors, the effect on trainees most often was a delayed or inappropriate verbal or control response (39 percent of citations). Several reports indicated a lack of assertiveness on the trainee's part and a failure to challenge the instructor, even when the trainee believed the instruction was wrong. The following study report excerpt exemplifies how confusing and vague communication by both instructor and trainee can result in a safety incident:

- "Instructor said...'Uh, you can have control if you, uh, want it.' I probably replied 'OK' rather than the usual 'I have control.' I began to pull the nose up slowly when I thought I felt my instructor push forward on the wheel [and] relaxed...Nosewheel touched down first and we bounced...Fortunately we walked away...with an undamaged aircraft. 'Wishy washy' coms played a major role in this." (ASRS Report # 240165)

2. Communications Equipment Factors

We expected that a number of reports in the study set would describe problems with onboard communications equipment that contributed to incidents. One in five reports (21 percent) did identify such problems. The most frequently reported problems involved malfunctioning or improperly operated headsets, microphones, and installed radios. The following instructor's report illustrates both a pilot-induced headset problem, and a preoccupation with training that led to complete lack of situational awareness:

- "We had started flying using headsets, with the radios being monitored through the headsets. After the first landing the student stated he would prefer to continue without the headsets as he didn't feel comfortable wearing them. I said OK. We got involved in doing touch and goes (5) and I failed to notice that we had not heard from Tower during this time. When I did notice that the speaker button was not in the proper position, I made contact with the Tower. They (Tower) terminated the flight and I was instructed to call the Tower." (ASRS Report # 290210)

3. Operational Factors

In addition to our analysis of cockpit communications anomalies, we examined the types of operational factors that were present during dual flight training and identified the leading combinations of factors associated with incident occurrence. We found that instructor critiques during ongoing maneuvers were the most frequent operational pattern (27 percent of citations), closely followed by maneuvers during ongoing communications with Tower (26 percent), and instructor critiques during ongoing Tower communications (20 percent of citations). The following description of a wrong-runway takeoff illustrates how an instructor's perception of task priority may have been distorted by the desire to critique the student:

- "We took off on [Runway] 24 instead of 30, as the Tower subsequently informed us. As I reviewed the event later, with my student and in my own mind, I realized how I may have added to the uncertainty. I was busy pointing out airport markings and critiquing the flight to this point. The priority should have been communications with the Tower and standard procedure." (ASRS Report # 137322)

4. Event Consequences

More than three-fourths of all the GA communications incident citations involved some ATC-related infraction or violation of FAR. Most often this was non-compliance with a clearance (51 percent of citations), but more than a third of all citations also involved clearance-related ground hazards, such as runway incursions (22 percent) and ground conflicts (10 percent). Aircraft damage was reported in 13 percent of citations.

Although the study's report selection criteria had required that there be direct reference to verbal communications between instructor and trainee, no such requirement existed regarding ATC communications. The large number of ATC-related consequences was therefore unexpected. We believe that the high incidence of missed ATC clearances in the study set and reporters' failure to comply with various clearance requirements directly relate to several other patterns observed in the data: (1) the concentration of dual instruction incidents on or near airports, especially tower-controlled airports with their demanding communications requirements; and (2) the operational context in which dual instruction often occurs, specifically, the simultaneous occurrence of internal verbal or external radio communications with aircraft maneuvers and demonstrations.

It is clear that dual instruction places heavy demands on the attention management and communications skills of both instructor and trainee, and that lapses in concentration may result in reduced situational awareness and safety consequences.

Summary and Conclusions

General aviation flight instruction presents an environment with unique external and intracockpit communications requirements. This research identified key communications factors that contributed to incidents in the study set. The research team also developed some possible approaches to resolving the communications problems identified.

Situation 1:

Almost half of all communications-related dual instruction incidents occurred within, or near, an airport environs at an altitude less than 1,000 feet AGL. Ongoing communications with tower were a prominent element of both ground and airborne incidents.

Suggestion:

In preflight briefings and ground instruction, instructors may wish to raise trainees' awareness that airport surface operations are vulnerable to safety incidents during dual instruction. They should also consider emphasizing the importance of standard phraseology in communications with ATC and the active monitoring of ATC frequencies--especially tower frequencies.

Situation 2:

Trainees often delayed actions or acted inappropriately because instructors made confusing or misleading comments, misinterpreted trainees' comments, or delayed or withheld feedback on maneuvers.

Suggestion:

Our study data suggest the need for additional curriculum and training to improve the clarity, economy, and judgment of priority of verbal communications in dual training, especially for flight instructors. Trainees need to be able to express doubt or uncertainty and also to admit mistakes. But it is also helpful for instructors to remember that every word counts—as well as the timing of training-related critiques. For example, it is more effective for an instructor to say "turn left 90 degrees," than to ask, "where are you going?" as the aircraft enters controlled airspace without a required clearance.

Instructors should consider delaying critiques until after tiedown, whenever possible. This will allow maximum attention to be given to other aircraft operations, compliance with taxi clearances, runway and taxiway markings and signs, pedestrian activity (at non-tower fields), and aircraft equipment operating procedures. Instructors may make summary notes in-flight for use in post-flight debriefings. These notes may be reviewed before the next lesson's flight to reinforce instructional focus.

Situation 3:

One in five study reports noted problems with communications equipment that contributed to the incident.

Suggestion:

The detection during preflight of aircraft equipment problems, especially with "renter installed" communications equipment such as intercoms and push-to-talk switches, can serve as a caution to delay the flight until qualified assistance can be found to ensure normal operation.

Instructors may want to establish specific radio usage procedures to ensure that volume levels for ATC communications are louder than intercom volume levels, and that radio equipment is operating normally with periodic equipment tests (i.e., "radio checks").

To enable quick recognition of external communications problems (i.e., stuck mike or volume level misset), an instructor may minimize intra-cockpit communications, especially at controlled airports during pattern operations.

Situation 4:

A large majority of all incidents involved non-compliance with ATC clearances or other ATC-related infractions and violations.

Suggestion:

In order to advise ATC and other aircraft of the instructional nature of a flight, the word "trainer" (e.g., Cessna trainer 54321) may be added to flight plans and radio broadcasts. The use of "trainer" can also serve as an attention cue that helps guard against missed clearances and readbacks. ATC already employs enhanced callsigns with suffixes such as /R (RNAV) and /H (Heavy).

This article originally appeared in the December 1998 issue of NASA's ASRS Directline.

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Properties of ASRS Data

ASRS data have certain limitations. Reporters to ASRS may introduce biases that result from a greater tendency to report serious events than minor ones; from organizational and geographic influences; and from many other factors. All of these potential influences reduce the confidence that can be attached to statistical findings based on ASRS data. However, the proportions of consistently reported incidents to ASRS, such as altitude deviations, have been remarkably stable over many years. Therefore, users of ASRS data may presume that incident reports drawn from a time interval of several or more years will reflect patterns that are broadly representative of the total universe of aviation safety incidents of that type.

The Good Copilot

by John Sheehan

The pilot flying, who was also acting as the pilot-in-command, had performed flawlessly during the flight. Flight planning, crew briefing, passenger boarding, takeoff, cruise, descent, and approach to low IFR minimums with a squeaker landing to top off a boffo performance—what more could a fella ask? Before we heap praise and accolades on this super-pilot, let's see what happens next.

The next leg was flown by the very experienced pilot who occupied the right seat on the previous leg. Mr. Super, now relegated to the right seat, soon showed signs of slowing down. The passengers beat him to the aircraft at boarding time, he was behind in setting up the Flight Management System (FMS), flubbed the clearance readback, failed to have the silent checklist items completed before the pilot asking for the challenge-and-reply items, mis-computed takeoff weights and speeds, and misdirected the pilot in finding the proper taxi route. And this was all prior to takeoff! Maybe he's just a bit behind the demands of the right seat after having performed so well on the other side—we'll see....

Things went from bad to worse as the flight progressed; more flubbed clearances, mis-set radios, inability to find charted intersections, poor fuel balance control, and general lack of support for the pilot flying marked the remainder of the flight. What happened to Super Pilot? Sadly, super pilots sometimes make poor copilots.

The pilot flying is preoccupied with the need to act, to plan for action and to be directly involved with the immediate concerns of where the aircraft will be in the next 30 seconds or so. While longer range planning and foresight are necessary, most of the pilot's actions are rooted in the present and near future. Action and the next few minutes are his real concerns.

Conversely, the copilot is charged with a more reflective, supporting role. His life should be concerned with what will happen in 10 miles, 15 minutes, the next altitude assignment, or after the next frequency change. A principal mission of the copilot is to think ahead and sort out the options available to the aircraft and the pilot flying. The copilot forms the supporting cast to the pilot flying's lead; at their best copilots observe, evaluate, advise, anticipate, direct, assist, and counsel. The phrase, "at their best" is key here.

At their worst copilots create high amounts of induced drag on cockpit operations. A poor or behind-the-curve copilot can prove to be a distraction, hindrance, source of frustration, and a bona fide safety hazard.

There must be a willingness to serve within the copilot, a predisposition to helping another (the pilot) toward a common goal. Without this key ingredient the copilot may as well stay at home or be replaced by an automated checklist.

While all of us started in the right seat, we used it as a vehicle from which to learn more about either the aircraft itself or aviation in general. We learned that we served the person in the left seat. When we got good enough we were allowed to graduate to the left seat, first under supervision, and then permanently as pilot-in-command. But what happens when both pilots are well or equally qualified? What happens to the quality of work performed from the right seat?

Ideally, the work should be of equal or better quality to that performed from the left seat. This is especially true for well-qualified copilots since much of the more introspective and background work emanates from the right side. But many consider sitting in the right seat more of a holding pattern or necessary evil to be endured while waiting to return to the driver's seat.

Much of this impatience to return to the left seat has been ameliorated by cockpit resource management training. The recognition of a near-equal partnership between front-end crew members has lessened the rigid hierarchical relationship that once predominated in cockpits. The concept of teamwork and collective problem-solving has served to elevate the role and status of the copilot. While personalities still intervene in the process of shared duties and mutual respect, the copilot's job has gained increased importance within the past twenty years.

Back to our Super Pilot; what's wrong with his right seat performance? Since we are dealing with human beings, it is difficult to say with certainty what is wrong. Personality conflict, personal problems, or just a "bad hair day" may be interfering with the close link that should exist between him and his pilot. Whatever the problem, he should be called to task on his substandard performance, since there are potential safety implications involved. Allowing this performance to go unchecked gives tacit approval to it and will tend to perpetuate it.

Such discussions may prove confrontational. However, the chances of them becoming so are lessened if CRM principles are used. The pilot should state his/her concern over specific items of performance and invite discussion from the other party. If done in a professional and caring manner, conflict can often be avoided. Regardless of whether conflict is encountered, deficiencies of performance should not be allowed to hover between cockpit crew members.

Few people have attempted to define the qualities of a good copilot. Most of us concentrate on those of the pilot to the exclusion of the copilot. See if you agree that the following attributes mark the good copilot.

Anticipation. The ability to look ahead and have information ready, communicate a need to ATC, or insert information into the FMS in a timely manner saves much grief and turmoil. Without this quality the copilot is either chronically behind the aircraft or must be prompted by the pilot.

Preparedness. Closely aligned with anticipation, preparation for what comes next is a highly desired quality. Even though one anticipates correctly, without preparation for the required action, the gesture is lost.

Vigilance. A heavy term, but essential. Too much happens during high workload situations for one pilot to cope safely. The demands of staying ahead of the aircraft may not allow him/her to be on the lookout for traffic outside and for anomalies within the cockpit. The second set of eyes and ears and, most importantly, a second brain, concentrating on the tasks at hand are invaluable.

Expertise. Does the copilot know the aircraft, the ATC system, company policy, standard operating procedures, and the needs of the passengers? Without an in-depth knowledge of these features the right-seater may be more liability than asset.

Willingness to help. This feature may be the most important of all. If the copilot embodies all the other desirable qualities and has a poor attitude or is poorly motivated, he/she may be better considered as ballast than as a crew member. When the going gets fast and rough both pilots must be willing to assist the other in performing their duties; without this quality the crew may as well be flying two single-pilot aircraft in tight formation, not one dual-piloted.

The best flight crews seem to talk little, yet they communicate well through mutual respect, professionalism, and good standard operating procedures. Copilots may have to contribute more than their half of this effort. The best copilots are those who stay ahead of both the aircraft and the pilot flying not an easy task.

John Sheehan is the Secretary General of the International Council of Aircraft Owners and Pilots Association (IAOPA).

Cockpit Interruptions and Distractions

H. Dean Chamberlain photo

Effective Management Requires a Careful Balancing Act

by Key Dismukes, Ph.D.; Grant Young, Ph.D.; and Captain Robert Sumwalt

This article is primarily about air carrier pilots, but the lesson taught can also be of value to general aviation pilots. A distraction is a distraction—no matter who you are. --Editor

Managing several tasks concurrently is an everyday part of cockpit operations. For the most part, crews handle concurrent task demands efficiently, yet crew preoccupation with one task to the detriment of other tasks is one of the more common forms of error in the cockpit. Most pilots are familiar with the December 1972 L-1011 crash that occurred when the crew became preoccupied with a landing gear light malfunction and failed to notice that someone had inadvertently bumped off the autopilot. More recently, a DC-9 landed gear-up...when the crew, preoccupied with an unstabilized approach, failed to recognize that the gear was not down because they had not switched the hydraulic pumps to high.

NASA has recently begun a research project to study why crews are vulnerable to these sorts of errors. As part of this project we reviewed NTSB reports of accidents attributed to crew error. We concluded that nearly half of these accidents involved lapses of attention associated with interruptions, distractions, or preoccupation with one task to the exclusion of another task. We have also analyzed 107 ASRS reports involving competing tasks; we present here some of our conclusions from this review. The 107 ASRS reports involved 21 different types of routine tasks crews neglected at a critical moment while attending to another task. Sixty-nine percent of the neglected tasks involved either failure to monitor the current status or position of the aircraft or failure to monitor the actions of the pilot who was flying or taxiing.

Thirty-four different types of competing activities distracted or preoccupied the pilots. Ninety percent of these activities fell into one of four broad categories:

1. Communication (e.g., discussion among crew or radio communication),
2. Head-down work (e.g., programming the flight management system (FMS) or reviewing approach plates),
3. Searching for VMC traffic, or
4. Responding to abnormal situations.

We will discuss examples from each category and suggest preventive actions crews can take to reduce their vulnerability to these and similar situations. Our suggestions are not perfect fixes, but we hope they will be useful. It is likely that research will ultimately provide more powerful solutions.

Category 1: Communication

"Copilot was a new hire and new in type... Copilot was hand-flying the aircraft on CIVET arrival to LAX. I was talking to him about the arrival and overloaded him. As we approached 12,000 feet (our next assigned altitude) he did not level off even under direction from me. We descended 400 feet low before he could recover. I did not realize that the speed brakes were extended, which contributed to the slow altitude recovery." (# 360761)

In this example, the Captain was attempting to help the new First Officer, but the combination of flying the airplane and listening to the Captain was too much for the new pilot. Tellingly, the act of talking distracted the Captain himself from adequately monitoring the status of the aircraft.

Thirty-one of these incidents involved altitude deviations or failure to make a crossing restriction. [Note: The relative frequencies of different types of neglected activity reported probably do not reflect the relative frequencies actually occurring in line operations. Pilots may be more likely to report incidents observable to ATC--for example, altitude deviations--than to report incidents not observable outside the cockpit--for example, omitting a checklist item.] In 17 of these 31 incidents (and 68 of the total 107 incidents) the crews reported being distracted by some form of communication, most commonly discussion between the pilots or between a pilot and a flight attendant. Most, although not all, of these discussions were pertinent to the flight. However, in many cases the discussion could have been deferred. We later discuss how crews can schedule activities to reduce their vulnerability to distraction.

Research studies have shown that crews who communicate well tend to perform better overall than those who do not. But conversation has a potential downside because it demands a substantial amount of attention to interpret what the other person is saying, to generate appropriate responses, to hold those responses in memory until it is one's own time to speak, and then to utter those responses. One might assume that it is easy to suspend conversation whenever other tasks must be performed. However, the danger is that the crew may become preoccupied with the conversation and may not notice cues that should alert them to perform other tasks. (The accompanying sidebar explores the nature of interference between competing tasks.) Special care is required to avoid distraction when others enter the cockpit, because they may not recognize when the pilots are silently involved in monitoring, visual search, or problem-solving.

Category 2: Head-Down Work

"...Snowing at YYZ. Taxiing to Runway 6R for departure. Instructions were taxi to Taxiway B, to Taxiway D, to Runway 6R....as First Officer I was busy with checklists [and] new takeoff data. When I looked up, we were not on Taxiway D but Taxiway W...ATC said stop...." (# 397607)

In a 1994 NTSB review of airline accidents attributed primarily to crew error over a 12-year period [Safety Study NTSB/SS-94-01], the NTSB concluded that failure to monitor and/or challenge the pilot flying contributed to 31 of the 37 accidents. In 35 of the ASRS incidents we studied, the pilot not flying reported that preoccupation with other duties prevented monitoring the other pilot closely enough to catch in time an error being made in flying or taxiing. In 13 of these 35 incidents (and 22 of the total 107 incidents), the pilot not flying was preoccupied with some form of head-down work, most commonly paperwork or programming the FMS.

Monitoring the pilot who is flying or taxiing is a particularly challenging responsibility for several reasons. Much of the time the monitoring pilot has other tasks to perform. Monitoring the other pilot is much more complex than monitoring altitude capture because the other pilot is performing a range of

activities that vary in content and time course. Thus, it is sometimes difficult for the monitoring pilot to integrate other activities with monitoring because he or she cannot entirely anticipate the actions of the other pilot. Furthermore, serious errors by the pilot who is flying or taxiing do not happen frequently, so it is very tempting for the pilot who is not flying to let monitoring wane in periods of high workload.

Periods of head-down activity, such as programming the FMS, are especially vulnerable because the monitoring pilot's eyes are diverted from other tasks. Also, activities such as programming, doing paperwork, or reviewing approach plates, demand such high levels of attention that attempting to perform these tasks simultaneously with other tasks substantially increases the risk of error in one task or the other (see sidebar). Some FMS entries involving one or two keystrokes can be performed quickly and may be interweaved with other cockpit tasks. However, attempting to perform longer programming tasks, such as adding waypoints or inserting approaches during busy segments of flight, can be problematic. It is not possible for the pilot not flying to reliably monitor the pilot flying or the aircraft status during longer programming tasks, and it is difficult to suspend the programming in midstream without losing one's place.

Category 3: Searching for VMC Traffic

"PRADO 5 Departure. Cleared to climb (and) received TCASII TA (which) upgraded to an RA, monitor vertical speed. While searching for the traffic we went past the NIKKL intersection...for the turn to the TRM transition. We had discussed the departure before takeoff; special procedures, combined with many step climb altitudes in a short/time/distance, made this a more demanding departure than most. Next time on difficult departures I will use autopilot sooner...will try to be more vigilant in dense traffic areas." (# 403598)

In 16 incidents crews failed to turn as directed by ATC on the SID or STAR they were following. The crews reported various activities competing for their attention; in three cases the activity was searching for traffic called out by ATC or TCAS. Altogether, crews reported searching for traffic as a competing activity in 11 of the 107 incidents. Searching for traffic takes the pilot's eyes away from monitoring aircraft position and status, and also demands substantial mental attention. If the conflict is close the urgency may further narrow the focus of attention.

One of the insidious traps of interruptions is that their effects sometimes linger after the interruption. For example, descending through 4,500 feet, a crew might be instructed to report passing through 3,000 feet. They might then respond to and quickly resolve a traffic alert, but forget the instruction to report by the time they reach 3,000 feet. In this hypothetical example, searching for traffic preempts the reporting instruction from the crew's conscious awareness. The instruction presumably is still stored in memory in an inactive form, and if reminded, the crew probably will recognize that they were given the instruction. However, lacking such a reminder and being preoccupied with other activities, they do not remember to contact ATC as they pass through 3,000 feet.

Category 4: Responding to Abnormal Situations

"Large areas of thunderstorms; we had to deviate considerably. Several (equipment malfunctions) in short period...then cabin pressure started climbing slowly in cruise (FL290). Troubleshooting...to no avail. Requested immediate descent. Descending through FL180, both crew members forgot to reset altimeters, putting us 300 feet low at FL130. To prevent this from occurring again during any abnormal [situation], I will: 1) delegate tasks; have one person focus on flying the airplane while the other troubleshoots and state clearly who will do what, 2) strictly adhere to company procedures." (# 404306)

In 13 incidents crews failed to reset their altimeters when passing through the transition altitude (18,000 feet MSL in the United States and Canada). It is especially easy to forget to reset altimeters if this action is not linked in pilots' minds to other actions. (For this reason some pilots make resetting altimeters part of a cluster of action items they routinely perform together, e.g., making a passenger announcement and turning on the seat belt sign. Some companies make resetting altimeters part of the descent checklist.) In principle, the problem is similar to that of monitoring for altitude level-off, except more vulnerable to error. In air carrier operations the crew is normally aided with altitude level-off by altitude alerting devices and by the formal procedure of making a thousand-foot call, confirmed by both pilots, before reaching the assigned altitude.

Two of the crews reporting to ASRS thought that they forgot to reset their altimeters stated they were preoccupied with an abnormal situation. Altogether, abnormals were a factor in 19 of the 107 incidents. Ironically, it seems that one of the biggest hazards of abnormals is becoming distracted from other cockpit duties. Abnormals easily preempt crews' attention for several reasons. Recognizing the cockpit warning indicators, identifying the nature of the problem, and choosing the correct procedure require considerable attention. Crews have much less opportunity to practice abnormal procedures than normal procedures, so choosing and running the appropriate checklists requires more effort and greater concentration of mental resources than running normal checklists. Also, in situations perceived to be urgent or threatening, the normal human response is to narrow the focus of attention, which unfortunately tends to diminish mental flexibility and reduce ability to analyze and resolve non-routine situations.

Strategies for Reducing Vulnerability to Interruptions and Distractions

We suggest several lines of defense

against the types of crew errors described above. These are not perfect, but in combination they should, in our opinion, help reduce crews' vulnerability to error.

1. Recognize that conversation is a powerful distracter.

Unless a conversation is extremely urgent, it should be suspended momentarily as the aircraft approaches an altitude or route transition, such as altitude level-off or a SID turn. In high workload situations, conversation should be kept brief and to the point. Even in low workload situations, crew should suspend discussion frequently to scan the status of the aircraft and their situation. This requires considerable discipline because it goes against the natural flow of conversation, which usually is fluid and continuous.

2. Recognize that head-down tasks greatly reduce one's ability to monitor the other pilot and the status of the aircraft.

If possible, reschedule head-down tasks to low workload periods. Announce that you are going head-down. In some situations it may be useful to go to a lower level of automation to avoid having one crew member remain head-down too long. For example, if ATC requests a speed change when cockpit workload is high, the crew may set the speed in the Mode Control Panel instead of the FMS. An FMS entry might be made later, when workload permits. Also, some airlines have a policy that FMS entries should be commanded by the pilot flying and implemented by the pilot not flying. This approach minimizes the amount of attention the pilot flying must divert from monitoring the aircraft.

3. Schedule/reschedule activities to minimize conflicts, especially during critical junctures.

When approaching or crossing an active runway, both pilots should suspend all activities that are not related to taxiing, such as FMS programming and company radio calls, until the aircraft has either stopped short of the runway or safely crossed it. Crews can reduce their workload during descent by performing some tasks while still at cruise, for example, obtaining ATIS, briefing the anticipated instrument approach, and inserting the approach into the FMS (for aircraft so equipped). Also, it may be useful for companies to review their operating practices for optimal placement of procedural items. For instance, could some items on the Before Takeoff Checklist be moved to the Before Start Checklist, since the latter is performed during a period that usually has lower workload?

4. When two tasks must be performed concurrently, set up a scan and avoid letting attention linger too long on either task.

In some situations pilots must perform two tasks concurrently, for example, searching for traffic while flying the airplane. With practice, pilots can develop the habit of not letting their attention linger too long on one task, but rather switch attention back and forth every few seconds between tasks. This is somewhat analogous to an instrument scan and, like an instrument scan, it requires discipline and practice. Our natural tendency is to fixate on one task until it is complete. Pilots should be aware that some tasks, such as building an approach in the FMS, do not lend themselves to time-sharing with other tasks without an increased chance of error.

5. Interruptions should be treated as red flags.

Knowing that we are all vulnerable to preoccupation with interruptive tasks can help reduce that vulnerability. Many pilots, when interrupted

while running a checklist, place a thumb on the last item performed to remind them that the checklist was suspended; it may be possible to use similar techniques for other interrupted cockpit tasks. One of us has developed a personal technique using the mnemonic "Interruptions Always Distract" for a three-step process:

1) Identify the interruption when it occurs,
2) Ask, "What was I doing before I was interrupted" immediately after the interruption,
3) Decide what action to take to get back on track.

Perhaps another mnemonic for this could be Identify-Ask-Decide.

6. Explicitly assign pilot flying and pilot not flying responsibilities, especially in abnormal situations.

The pilot flying should be dedicated to monitoring and controlling the aircraft. The pilot flying must firmly fix in mind that he or she must concentrate on the primary responsibility of flying the airplane. This approach does not prevent each pilot from having to perform concurrent tasks at times, but it does insure that someone is flying the airplane and it guards against both pilots getting pulled into trying to solve problems.

This article appeared in the December 1998 issue of ASRS Directline and was written by Key Dismukes, Ph.D, NASA Ames Research Center; Grant Young, Ph.D.; New Mexico State University; and Captain Robert Sumwalt, Battelle. Other ASRS staff members who assisted in this study: Dr. Rowena Morrison and Mr. Vince Mellone helped design the search strategy for reports; Mr. Bob Wright screened reports; Capt. Bill Richards made callbacks to reporters and consulted with NASA on selected incidents; Capt. Charles Drew reviewed the paper; Dr. Rowena Morrison reviewed and edited the paper; and the FAA Office of the Chief Scientific and Technical Advisor for Human Factors provided support for this research.

Task Management

Why do activities as routine as conversation sometimes interfere with monitoring or controlling the aircraft? Cognitive research indicates that people are able to perform two tasks concurrently only in limited circumstances, even if they are skillful in performing each task separately.

Broadly speaking, humans have two cognitive systems with which they perform tasks; one involves conscious control, the other is an automatic system that operates largely outside of conscious control. The conscious system is slow and effortful, and it basically performs one operation at a time, in sequence. Learning a new task typically requires conscious processing, which is why learning to drive a car or fly an airplane at first seems overwhelming: the multiple demands of the task exceed conscious capacity. Automated cognitive processes develop as we acquire skill; these processes are specific to each task, they operate rapidly and fluidly, and they require little effort or attention.

Many real-world tasks require a mixture of automatic and conscious processing. A skillful driver in a familiar car on a familiar road can perform largely on automatic, leaving enough conscious capacity to carry on a conversation. However, if the automatic system is allowed to operate without any conscious supervision, it is vulnerable to certain types of error, especially a type of error called habit capture. For example, if we intend to take a different route home from work, we are prone to miss our turnoff and continue our habitual route if we do not consciously supervise our driving. Also, if we encounter a section of road that is difficult to navigate, we find that we cannot continue the conversation without risking errors in the driving, the conversation, or both. This is because the automatic processes are not adequate to handle the unpredictable aspects of the driving task.

Conscious control is required in four situations:

1) when the task is novel,
2) when the task is perceived to be critical, difficult, or dangerous,
3) when an automatic process must be overridden to prevent habit capture, or
4) to choose among competing activities.

The required mixture of automatic and conscious processing varies among tasks, and the mixture may vary with the moment to moment demands of a given task. Conversation, for example, generally requires a substantial amount of conscious processing because it involves novelty; we do not know what the other person is going to say and we have to formulate unique responses appropriate to the discussion. In contrast, an experienced pilot can manually fly a familiar aircraft in a largely automatic fashion. However, certain subtasks embedded in the act of flying manually require conscious attention. For example, leveling off at an assigned altitude requires consciously monitoring the altimeter to read the numbers and to match the current altitude with the assigned altitude the pilot is holding in memory.

The framework outlined above allows some general conclusions about the circumstances under which two tasks may be performed concurrently. A task requiring a high degree of conscious processing--FMS programming, for example--cannot be performed concurrently with other tasks without risking error. Two tasks that are largely automated can be performed together reliably, if they are regularly practiced in conjunction--for example, flying the aircraft manually and intercepting the localizer. We are less certain how well individuals can combine two tasks, each of which involves a mixture of conscious and automatic processing--for example, searching for traffic while monitoring for altitude capture. We suspect that pilots can learn to integrate two tasks of this sort and achieve reliable performance, but only if they regularly practice the two tasks in conjunction. This, however, is speculation, and requires experimental research for validation.

Tackling the Tailwheel

by Robert C. Hill

Perhaps the single most substantial contribution a pilot can reward him or herself with is the skill and proficiency that is acquired by learning to fly a tailwheel airplane or, more precisely, to maneuver a taildragger during taxi, takeoff, and landing. As you will see, it is the ground maneuvering operations that become the impediment of the novice tailwheel pilot. Once in the air, the taildragger is just like any other airplane.

For many years the conventional type landing gear (tailwheel) was essentially the only style manufactured. Aircraft manufacturers discovered that it was simple to make and easy to assemble. A tailwheel also contributes significantly less weight and drag to the airframe, which allows the airplane to have an increased useful load and greater cruise speed than a comparable nosewheel version. Moreover, the maintenance associated with a tailwheel assembly is less than that of the nosewheel. One significant advantage of the taildragger is that it provides greater propeller clearance, and this lessens the chance of damaging the propeller. These characteristics help to explain why pilots, who regularly operate from remote areas and unimproved surfaces, utilize tailwheel aircraft. Others simply enjoy the classic image associated with conventional gear airplanes.

Bush pilots are quick to point out that the taildragger provides better short field and soft field performance than tricycle gear versions. They are correct. As Figure 1 illustrates, when the pilot of a tricycle gear airplane effects rotation, the horizontal tail sur-

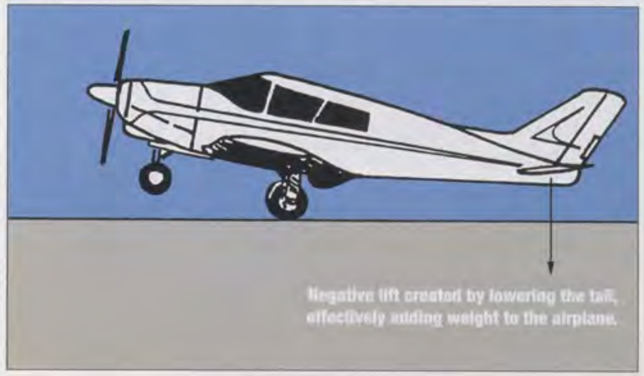

Figure 1 • Negative lift, created by lowering the tail, effectively adds weight to the airplane requiring the wing to produce greater lift to enable flight.

faces must produce a downward force to raise the nose. This negative lift (expressed in pounds) effectively adds additional weight to the airplane, requiring the wing to produce greater lift to enable flight. For a given angle of attack, this may only be accomplished by accelerating more air over the upper curvature of the wing to further reduce pressure. This requires a longer takeoff roll. Also, unless the nosewheel can be immediately raised off the ground by the application of power, its tendency will be to traverse the contours of the runway surface, varying the angle of attack of the wing and retarding its effectiveness. This can only serve to increase the departure roll. Conversely, Figure 2 depicts a taildragger accelerating on the departure roll. The pilot must now raise the tail to position the wing at the maximum lifting angle. As Figure 1 clearly illustrates, this generates positive lift on the horizontal tail surfaces. The upward force produced effectively reduces the weight of the airplane by contributing to the overall vertical lift component. Consequently, less forward speed is required (read less ground roll) to become airborne.

Initially, the novice tailwheel pilot struggles greatly to master this new art. The two villains attempting to foil the unsuspecting pilot are the wind and the location of the airplane's center of gravity with respect to main landing gear.

One soon discovers that the tailwheel airplane, not unlike a floatplane in the displacement mode, makes an excellent weathervane while taxiing. Depending upon wind direction and velocity, the airplane always wishes to "weathercock" into the wind. For this reason, upwind turns are accomplished quite easily. Downwind turns, on the other hand, can prove extremely difficult, if not impossible. Moreover, a downwind turn may require a substantial application of power to aid with rudder effectiveness, combined with hefty differential braking. Attempting a downwind turn while taxiing could prove impossible, forcing the pilot to exit the cockpit and physically move the airplane to the desired heading.

A sharp pilot is "wind conscious" and seeks to take advantage of the upwind turning tendencies by planning turns toward the upward direction. This same airman is the individual who knows to "ramp" the airplane facing into the wind as opposed to haphazardly placing it on the apron.

A tailwheel pilot also needs to be cognizant of wind direction and velocity at the start of the takeoff roll. (These concepts pertain to all pilots.)

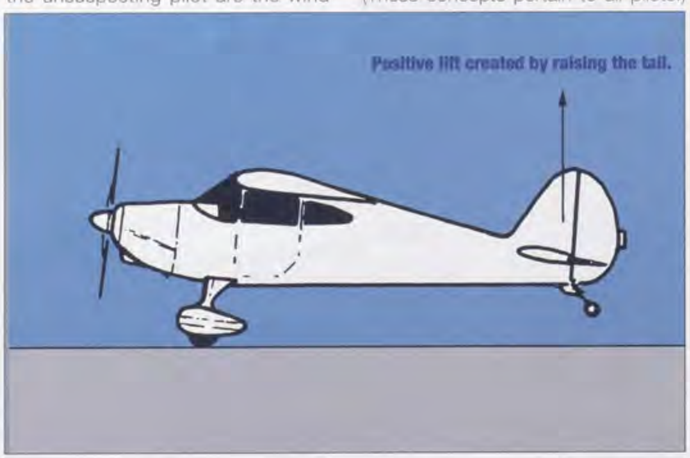

Figure 2 • Positive lift created by raising the tail for accelerating on departure roll.

A left crosswind will serve to compound the "left turning tendencies" already inherent in airplane design and will require additional right rudder application. A right crosswind may minimize or potentially eliminate the "left turning tendencies" requiring less right rudder input. The "left turning tendencies" inherent with a clockwise rotating crankshaft includes torque, asymmetric thrust (P-factor), slipstream spiral, and gyroscopic precession. Expect the taildragger to have a more pronounced left yaw tendency when power is applied. P-factor exists because rotational velocity of the propeller is more significant when placed at a greater angle of attack by virtue of the airplane's three point attitude as the airplane moves forward. Moreover, when the tail is raised as the airplane accelerates down the runway, gyroscopic precession will induce an additional left yawing moment. Be sure to "trap" the nose with the application of right rudder to preserve directional control.

The weathervaning propensity so apparent with tailwheel airplanes exists due to the greater amount of surface area and longer moment arm (upon which the winds act) that is present between the main wheels (pivot point) and the tailwheel. Also, a swiveling type tailwheel, as opposed to the locking style, will contribute to the ease in which the tail will move. The tricycle gear airplane has less surface area and a relatively short moment arm existing between the main wheels and the nose wheel. Certainly, the proximate location of the center of gravity and the weight of the engine and its accessories placed nearly on top of the nosewheel strut contributes greatly to eliminating nosewheel displacement during gusty wind conditions. However, the wind is only one reason the tailwheel pilot struggles to preserve directional control. The second reason involves the location of the center of gravity with respect to the main landing gear. Interestingly, if the CG was located ahead of the main landing gear our taildragger would require a nose wheel conversion, because the airplane would now

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Recall from earlier studies that the center of gravity of an airplane is the point at which all weight is assumed to be concentrated. Also, recall that an object in motion has momentum and its inertia will continue to move along its original path should the object become displaced. Momentum acts through the center of gravity. Figure 3 portrays a tailwheel airplane in motion, traveling along a straight line. Momentum is depicted moving through the center of gravity. Figure 4 shows the aircraft losing directional control to the left. Due to inertia, the momentum of the CG continues to move along its original path which is straight down the runway. It can be seen that momentum is now applying a force to the outside wheel of the turn. This force will begin to decrease the airplane's turn radius, and, as the radius of the turn decreases, its moment of inertia will begin to increase the rate at which the airplane turns. In other words, as directional control is lost, momentum acting through the CG will apply a force to the outside wheel of the turn and cause the airplane to turn tighter and faster. This helps explain why the tailwheel airplane is intolerant of poor technique. A successful outcome demands that an attentive pilot properly use rudder and aileron inputs to preserve directional control and be able to touchdown with zero drift when landing. Figures 5 and 6 help explain why tricycle gear airplanes are so forgiving of inferior technique. When the "trike" begins to lose directional control, momentum acting through the center of gravity has a tendency to realign the airplane with the runway by pulling on the inside wheel. This explains why the tricycle gear airplane is so inherently stable. It also proves that operating a taildragger can be more challenging and demanding, requiring the strict attention of the pilot at all times.

When starting a taildragger, particularly the lighter weight models, it is a good idea to apply aft stick to prevent the tail from rising. For heavier aircraft, such as the Cessna 180 or Maule M-6, this is not as critical.

After minimum "temps" are real-

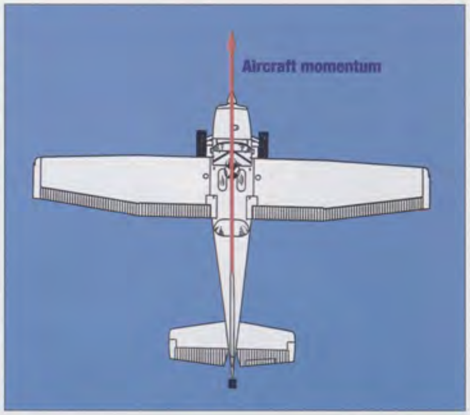

Figure 3 • Tailwheel airplane in motion traveling along a straight line. Momentum is depicted moving through the center of gravity.

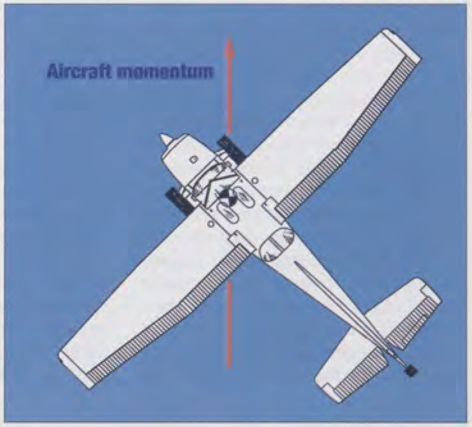

Figure 4 • Shows the tailwheel airplane losing directional control and rotating to the left.

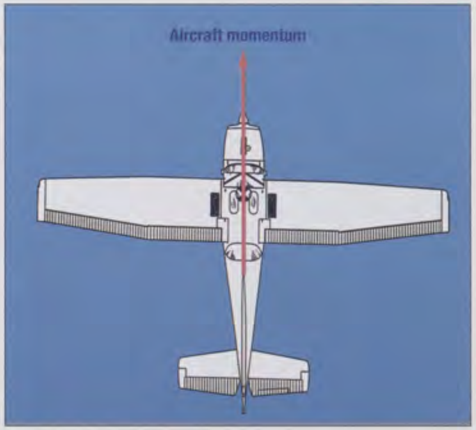

Figure 5 • Tricycle gear airplane in motion traveling a straight line. Momentum is depicted moving through the center of gravity.

ized, throttle is applied to begin taxiing the airplane. Place the stick in the aft position and only apply enough power to allow the airplane to begin to creep forward. Use of excessive RPM on a relatively cold engine is poor technique and can easily damage a powerplant as the pistons are forced into a cylinder choke that has not yet reached a normal operating cylinder head temperature. Additionally, the majority of conventional gear airplanes suffer from poor over the nose visibility, and require a cautious "eyes out of the cockpit" slow taxiing procedure. Learn to taxi while executing gentle S-turns to enhance your scan and to hopefully avoid an incursion.

Remember to position the flight controls properly with respect to headwind and tailwind components. An excellent initial wind awareness exercise is to find a large unobstructed area on the apron and to taxi in left and right 360 degree circles. As the pilot circles, the relative direction of the wind to the aircraft is constantly changing, requiring the pilot be able to reposition the ailerons and elevator appropriately.

After completing the pre-takeoff checklist, taxi onto the runway centerline. Pay particular attention to the attitude of the airplane with respect to a point on the horizon. This is the same attitude the pilot needs to visually acquire to be able to execute a three point landing. With aileron placed into the wind and the stick placed in the full aft position, begin to smoothly apply maximum allowable power. Attributable to slipstream spiral and P-factor, the aircraft will begin to yaw to the left. Torque further compounds the left yaw as its "rolling moment" applies a downward force to the left main landing gear, increasing the frictional resistance of the left tire. Remember that surface wind may serve to increase or reduce the yaw tendency. Apply appropriate rudder as necessary to preserve directional control. As the airplane accelerates, decrease upwind aileron, release the elevator back pressure, and begin to apply slight forward stick pressure to raise the tail and poise the wing for lift off. As the tail rises, be sure to "trap" the airplane in the lift off attitude by reapplying slight back pressure on the stick. Too much forward stick pressure will create a negative angle of attack forcing the main wheels into the runway, which lengthens the take off distance. Also, as the tail begins to rise, the effect of gyroscopic precession will make itself known and the aircraft will wish to yaw left. Apply right rudder as necessary to maintain directional control. With the wing poised for lift off simply allow the aircraft to fly itself off the runway. Accelerate to best rate or best angle of climb, as necessary.

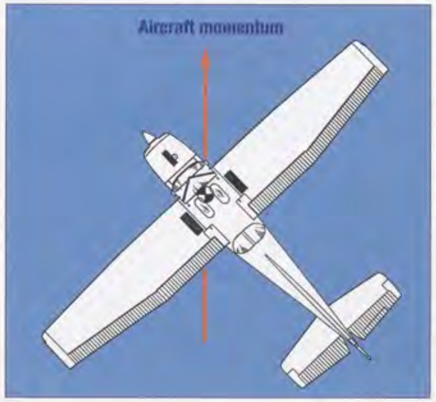

Figure 6 • Shows tricycle gear airplane losing directional control and yawing to the left.

Fundamentally, there are two types of landings to be mastered when operating a taildragger: the three point landing and the "wheel" landing. The latter type is not meant to imply that a three point landing is not on the wheels. I would hope all landings (in a land plane) are on the wheels. It's just that a wheel landing touches down on the main landing gear first, and the pilot then transitions to the three point attitude as forward speed dissipates. The concept of the three point landing requires the pilot to touch down on all three wheels simultaneously, or the tailwheel touching slightly before the main landing gear. This is historically referred to as the "full stall" landing. It is simply the attitude at which the aircraft normally rests when on the ground. Visually, it is precisely the attitude (as viewed from cockpit) revealed before the start of the takeoff roll. The three point attitude nearly approaches the critical angle of attack and consequently allows the airplane to touch down at near minimum speed.

The key to successful three point landings is to touch down without excessive speed and with zero drift on all three wheels concurrently or tailwheel slightly first. Of course, proper crosswind technique must always be strictly adhered to. Recall that the CG is located aft of the main landing gear. If, when attempting a three point landing, the pilot impacts the runway with the main landing gear first, the CG will cause the tail to become lower, which increases the wings' angle to attack. The result is increased lift and the airplane once again becomes airborne. It is important to develop visual cues through practice to learn the proper three point attitude. When the pilot perceives the aircraft is about to make contact with the runway, continue to apply aft stick in an effort to prevent the aircraft from touching down. "Hold it off as long as possible" is the appropriate phrase. When the aircraft touches down in the proper three point attitude, gracefully apply full aft stick to enhance controllability. Continue to preserve directional control with the rudder pedals. Maintain aileron into the wind as necessary.

Remember that tricycle gear airplanes have the CG positioned ahead of the main landing gear. Upon touchdown, when the main landing gear impacts the runway, the nose is forced to become lower, decreasing the wings angle of attack. Consequently, tricycle gear airplanes don't exhibit the same tendency to bounce, unless it is pilot induced.

It is said the wheel landing is generally utilized during gusty wind conditions to gain more controllability from the primary control surfaces. The slightly greater approach speed used for wheel landings does indeed allow for a more "crisp" control effectiveness. However, controllability is usually compromised by wind gusts constantly displacing the aircraft. Successful wheel landings demand a touchdown that occurs with a near zero sink rate, and performing them when turbulent can be most challenging. One method of decreasing the form drag (upon which the wind gusts will act) to better enhance controllability is the use zero or minimal flap settings. Wheel landings can be more difficult to perform than the three point landing. The wheel landing is accomplished by literally flying down the runway and rolling the main wheels onto the surface. This faster touchdown speed results in a longer landing rollout and requires a greater usable runway distance. Remembering the taildragger's tendency to bounce because of CG location when landing main wheels first, it is important to touchdown with minimum or zero sink rate and then to smoothly apply slight forward stick pressure to ensure the wheels remain on the runway. As forward speed dissipates, fly the tail down by gently applying back pressure. Once the tailwheel is on the runway, apply full aft stick, use aileron into wind as necessary to aid in holding the upwind wing down, and rudder pedals to maintain directional control. One key to successful wheel landings is to carry a small amount of power until touchdown occurs, then apply the slight forward stick pressure, and smoothly reduce the throttle to idle. When easing the tail down to the runway, be watchful of gyroscopic precession now wishing to cause a slight right yawing tendency.

Additionally, when executing a wheel landing, as the touchdown occurs, there may be a slight nose down pitching moment. This is caused by the frictional resistance of the tires as they "spool up" from zero to touch down speed. The pilot must delicately balance this nose down moment with that of the CG induced tail low moment.

A common fear of new tailwheel pilots executing wheel landings is that too much forward stick pressure will result in a propeller strike. This is highly unlikely and would probably require inappropriate use of brakes to force the aircraft onto its nose.

Throughout tailwheel transition training, should the pilot perceive the aircraft may be losing directional control, it is important to understand that simply stopping the yawing moment with appropriate opposite rudder will serve to stop the ensuing loss of directional control. Many loss of directional control problems are compounded by pilots attempting to not only stop the yaw, but by applying additional correction in an attempt to return the aircraft to its original position. This usually results in over controlling. Simply stop the yaw movement and resist the temptation to apply additional correction. In time, with experience, you will acquire the skill to expertly replace the aircraft to its pre-displaced position.

Maximum performance takeoffs and landings, such as short field and soft field, are procedurally no different than those executed in a tricycle gear airplane. When flying a taildragger, one common technique for soft field situations is to initially raise the tail slightly to minimize the frictional resistance of the tail wheel. Another acceptable method is to allow the aircraft to become airborne in the three point attitude. Short field departures may be executed in the same manner. The pilot then accelerates to V_Y or V_X, a appropriate. Generally, most short and soft field arrivals are accomplished with three point landings, allowing for touchdown at the slowest possible speed.

Lastly, if one wishes to tackle the tailwheel and place themselves on the road to becoming a more accomplished airman, then finding a competent instructor to aid you in developing the art of taildragging will place you on the proper path. Certainly, if one wishes to fly some of the most fun airplanes ever manufactured, you need to give it a try. The skills acquired during training may open the door to a plethora of available tailwheel airplanes, such as antiques, classics, homebuilts, warbirds, and biplanes. Chances are your training would most likely be accomplished in an antique or classic. That alone is worth the price of admission!

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Bob Hill is an Aviation Safety Inspector at the Nashville (TN) Flight Standards District Office.

SAFETY FIRST:
Balancing the Scales

by Patricia Mattison

Weight and balance is a subject that is of great interest to pilots. It also should be understood by their passengers. Many people take trips with a pilot friend or hire a plane and pilot to take them to their favorite vacation spot. When a person packs to travel, the normal tendency is to pack more than is really needed for the trip. Nonpilots may not realize that airplanes can carry only so much weight, and, unless each item is weighed, it is easy to underestimate the amount of weight being put in the airplane.

Let's take an average aircraft, a Cessna 207. The basic empty weight of that aircraft is 2,128 pounds, and the maximum gross weight is 3,800 pounds. At first glance it appears to the layperson that you could put 1,672 pounds of passengers and baggage--useful load--into the plane, and it would fly. Not so. In fact, a lot of variables need to be considered before making that determination.

How much fuel do you need to fly to the destination and return with a safe margin in case of an emergency? The Cessna 207 carries 61 gallons of fuel and, at six pounds a gallon, that's 366 pounds to deduct from 1,672 pounds--with 1,306 pounds remaining. How much do the pilot and passengers weigh? Airlines use an average weight of 170 pounds per passenger to estimate an individual's weight and balance. The Cessna 207 holds a pilot and five passengers of average weight, for a total of 1,020 pounds. Now, 286 pounds of useful load remain. Is baggage being brought along, and what is its weight? All of these items must be totaled to see if the weight is within tolerance.

While an overloaded aircraft may fly off the runway depending on the amount it is overweight, it may be unable to climb once in the air. Grossly overweight, the airplane might lift off, get a few feet off the ground, and settle back on the runway, usually too far down the runway to stop safely.

Once the weight is totaled, placement of that weight within the aircraft is calculated, and that's where balance comes in. Picture the airplane as a teeter totter for a minute. As children we all got a kick out of having a friend teeter totter with us. Leaning back securely while on terra firma, we could suspend our pal in the air on the other end of the teeter totter. He or she would holler, "Let me down, let me down right now!" How ornery we felt at the time, watching our friend bouncing, flailing about, and screaming to be let down. It was great fun.

Airplane weight and balance works the same way as that teeter totter, except that the consequences are greater. If a load is placed too far forward, the pilot may have a difficult time lifting off the runway because the aircraft is nose heavy. Too far aft and the aircraft becomes less controllable because of lack of stability at all airspeeds.

As a pilot you have a responsibility to your passengers to assure that you have checked all of the performance data for the flight. Unfortunately, there are those who often guess at weight and balance instead of working it out properly. Occasionally a pilot will be tempted to take off overweight regardless of the consequences, but careful computations of weight and balance are a must for safe flight.

Passengers should never insist that a pilot attempt to carry more than the recommended useful load. Overloading is dangerous. If necessary, extra baggage can be shipped ahead in another plane.

Spend a few minutes planning weight and balance.

Ms. Mattison is the Safety Program Manager at FAA Juneau (AK) Flight Standards District Office.

The *Aircraft Weight and Balance Handbook* (FAA-H-8083-1) was updated in 1999 and is available for sale from the Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7954 or from a U.S. Government Printing Office bookstores or their website <http:\\www.gpo.gov>. The stock number is 050-007-01272-1 and the cost is $12 ($15 foreign).

The Code
Part 1

by Bill O'Brien

Early on in my aviation career, as a young mechanic with hair, I kept hearing about and just as quickly forgetting about--"The Code." "The Code," I found out later, stood for the Code of Federal Regulations. Fully armed with that dollop of information, but not seeing what it meant to me, I naturally assigned it to the mental equivalent of ram dump and went happily on my way. Like me, I bet the majority of mechanics working the line figure "The Code" is a lot like the electoral college—it works okay, if you don't think a lot about it.

It was only after I matriculated into the bureaucracy and found myself as an instructor in the FAA Academy in Oklahoma City that I learned how big "The Code" is and how it affects us all.

What follows is a general description of "The Code" in a term paper format, so aspiring, but lazy, students of the Federal Aviation Regulations can plagiarize it with little mental effort expended. Here we go.

The Code of Federal Regulations is a codification of general and permanent rules that were first published in the *Federal Register* by agencies and departments that, for the most part, belong to the Executive Branch of the Federal Government.

The code is divided into 50 huge "titles," which represent broad areas subject to federal regulations. The various titles list regulations that set the standards that affect all of us from air transportation, to processing meat, to establishing mutual funds, to paving a road, and--everyone's favorite--establishing the income tax tables.

Each of the 50 titles is divided into chapters, and the chapters usually bear the name of the issuing agency. For example, the title that we mechanics must pay attention to is Title 14 Aeronautics and Space. Title 14, Chapter 1, is entitled Federal Aviation Administration, Department of Transportation.

Although there are four chapters in Title 14, Chapter 1 is the only one that talks to the Federal Aviation Regulations (FAR). The rest of the chapters deal with Department of Transportation rules, NASA regulations, etc.

Now here's the part you are not going to believe. Compared to most of the other executive agencies, the FAA has only a handful of regulations that do not quite fill up a chapter's worth of paper. For example, compared to the Department of the Treasury's Title 12 Banks and Banking, which has 28 chapters, and the Department of Agriculture's Title 7, which has 34 chapters, the FAA with one chapter is considered among its peer agencies as a neophyte in the rule-making business.

So far in the code we have looked at titles and chapters. Moving on we find that each chapter is further divided into subchapters. For example, in Title 14 Subchapter A contains only one part, Part 1: Definitions, while Subchapter B, Procedural Rules, contains about five parts. Subchapter C, Aircraft, has 11 parts in the subchapter.

The entire 199 parts that make up the Federal Aviation Regulations are initially divided this way. Yes, that was not a typo. In Chapter 1, there are 199 parts assigned to the Federal Aviation Regulations. Sounds like an awful lot of rules! However, in the real world it's not so! Most of the 199 parts do not affect mechanics--such as parts dealing with airport security, air traffic control internal regulations, or (my personal favorite) Subchapter N, War Risk Insurance--do not apply to aircraft mechanics.

Okay, so far we have titles, chapters, and subchapters--next are the parts. Parts are what most mechanics are familiar with. Parts contain regula-

tions dealing with a particular subject, such as Part 39: Airworthiness Directives or Part 145: Repair Stations. Parts are further divided into subparts and sections. Subparts make up a specific group within the part, such as Subpart B in Part 21 that deals with type certificates.

Sections are what the legal folks call individual rules. For example, FAR § 43.13 Performance Rules is a section of a subpart, which is part of a part, which is found in a chapter, which is a subdivision of a title. So once again we have titles, chapters, subchapters, parts, subparts, and sections. The government has a unique way or code on how each part, subpart, and section is identified. The code works like this. Title 14, Chapter 1, Part 39, Subpart A, Section 39.1. Have you noticed the code starting with parts is numerical, then Subpart A is alphabetical, then Section 43.13 is numerical. Why you almost think they planned it that way!

In addition, have you noticed that the FAA fills up odd number parts first, such as Parts 1, 11, 21, 43, 91, 121, 145, etc. With a few exceptions, only slightly more than half (106) of the 199 parts assigned to the Federal Aviation Regulations are being used. With that much empty space available, I like to think that the designers of the code built in bureaucratic job security for people like me.

The same identification scheme that is used to identify FAR parts from one another is also used within each part. Each original individual section or rule is identified with an odd number, for example § 21.95 or § 43.1. You can tell a new rule (Part 66) or section (§ 43.12), if it has an even number.

By this time you are probably wondering, why am I subjecting you to this tome on "The Code?" My intent is to go over some little known **facts** about the regulations that set the standards that you, the mechanic, earn your living by.

Part 1: Definitions and Abbreviations.

Part 1 is your aviation dictionary. If you ever get a bureaucratic valentine from the local FSDO that may impact your certificate make sure you double check the aviation dictionary (Part 1) for the proper, legal definition of the words used in the letter of investigation. Words like maintenance, total time, appliance, airframe, most likely have a totally different legal meaning than what you have been taught to believe.

Also, take a look in a little heard of Section 1.3, Rules of Construction. This section defines the way "words" are used in the rest of the Federal Aviation Regulations. For example, words importing (referring to) the singular include the plural and vice a versa. Words importing the masculine gender include the feminine. The word "shall" is used in an imperative sense. The word "may" is used in a permissive sense--such as a person may or may not be authorized or permitted to do the act prescribed. Finally, the word "includes" means "includes, but is not limited to."

Part 11: General Rulemaking Procedures

I have written several articles on this part, but it bears repeating because in Subpart C of this part is where the average person has regulatory authority to change the way the FAA does business by requesting a rulemaking action.

The average citizen has the power, as written in Title 14, Chapter 1, Part 11 to petition the FAA to make a rule, change an existing one, or delete a rule altogether. Especially handy to the student of the FAR is Section 11.25, which explains not only the rulemaking process, but also explains how to obtain an exemption from one or more rules.

Part 13: Investigative and Enforcement Procedures:

In numerous safety seminars I have given on FAA regulations, by far the majority of mechanics agree on this one statement of mine. "Mechanics look at the regulations only three times in their lives: 1) When they study for the A&P test, 2) when they want something from the FAA, such as an IA or a repair station, and 3) when they are in trouble."

Part 13 is where mechanics should go first when they get a letter of investigation from the FAA. More importantly, if you have to get an attorney to defend you, make sure the guy you are paying $200 an hour has read Part 13. If the lawyer says he knows it, test him on it. You might embarrass him in private, but better him than you in front of an administrative law judge.

If you could sit with me a week or two in my cubicle of power, you would be surprised at the number of lawyers who called me in a week. After I successfully make them identify themselves as a lawyer (they are easy to spot), the conversation quickly turns into a question and answer session that focuses on what to do next for their client.

Recently, in a telephone conversation, I gave a counselor the two minute rote answer to what is the fee scale for a witness in the proceedings. The answer is found in Part 13, Section 13.121. Imagine my surprise when I found out that he turned around and charged his client a 1/2 hour ($100) for "consulting" with the FAA.

Part 21: Certification Procedures for Products and Parts

A rule in Part 21 that is worth your time to read is Section 21.181. It talks to the duration of airworthiness certificates. If you read into the rule, it says this airworthiness certificate is effective as long as the maintenance, preventive maintenance, and alterations are performed in accordance with Parts 43 and 91 of this chapter and the aircraft is registered in the United States.

This statement is duplicated on the standard (white) airworthiness certificate which is found in most seat pockets or back of cockpit doors. But the real message is this. The registration certificate, not the airworthiness certificate, is the most important document in the aircraft because the airworthiness certificate is worthless without it.

If you have a problem with the above statement, as I did when I first found it staring up at me, take a look at an airworthiness certificate. The validity of my statement is found in Block 1 of the airworthiness certificate. Block 1 identifies the "N" number of the aircraft, which is found on the registration certificate.

Section 21.197, Special Flight Permits, is another rule worth reading. The rule allows an aircraft that does not meet all the applicable airworthiness requirements, but is flyable, to make a flight. There are five reasons or purposes that a special flight permit is issued:

1. Flying the aircraft to a base where repairs, alterations, or maintenance are to be performed or to a point of storage.
2. Delivering or exporting the aircraft.
3. Production flight testing new production aircraft.
4. Evacuating aircraft from areas of impending danger.
5. Conducting customer demonstration flights in new production aircraft that have satisfactorily completed production flight tests.

If you need one of the above special flight permits, please contact your local FSDO. An FAA airworthiness inspector will help you process the paperwork in accordance with Section 21.199.

Another important rule in Part 21 is Section 21.303, Replacement and Modification of Parts. The rule states that no person may produce a modification or a replacement part for sale for installation on a type certificated product, unless it has a Parts Manufacturer Approval (PMA). However, there are four exceptions:

1. Parts produced under a type or production certificate.
2. Parts produced by an owner or operator for their own product.
3. Parts produced under a Technical Standard Order (TSO).
4. Standard parts conforming to an established U.S. or industry standard.

Without getting into an article length explanation of owner produced parts, here are some things you must remember. The part is for the owner's aircraft only. The owner or his agent must use approved data to produce the part(s). No reverse engineering like tracing out a damaged spar on the garage floor and then whittling a spar blank to size is permitted! FAA figures if Boeing has to have approved data to make a part, so does the owner.

Now if the owner has only acceptable data, it is time to contact the local FSDO and see if the acceptable data can be field approved. Also, don't forget that the owner must sign his or her name on the maintenance record to affirm that the part is owner produced and is airworthy. The mechanic who installs the part will still follow Section 43.9, Maintenance Record Entry Requirements.

Another area not really taught to mechanics in A&P schools is export airworthiness approvals found in Subpart 1 of Part 21.

Exports are broken down into three groups or "classes." A Class I product is a complete type certificated (TC) aircraft, or TC aircraft engine, or TC propeller.

Class II product is a major component of a Class I product, such as a wing or a fuel control or a control surfaces.

A Class III product is anything that is not a Class I or II. Now one of the obscure things found in this rule is the definition of "newly overhauled." The term "newly overhauled" is used to describe a product that has not been operated or placed in service, except for testing, since having been overhauled, inspected, and approved for return to service in accordance with the applicable FAR.

The paperwork required for a Class I product is called an Export Certificate of Airworthiness, FAA Form 8130-4. You must make application for the certificate at the local FSDO. The export certificate does not authorize the operation of the aircraft. It only states that the aircraft meets its type design and is in an airworthy condition.

Section 21.329 requires that used aircraft being exported must have an annual type inspection completed no less than 30 days before the date of application is made for the Export Certificate of Airworthiness.

Used engines and propellers being exported must be "newly overhauled." In addition, the importing state may have additional requirements that the exporter must meet. See the local FSDO for additional requirements of other countries.

For Class II and Class III products, Sections 21.231 and 21.333 both say that the export certificate of airworthiness for both classes is in the form of an 8130-3 tag. The tag identifies the part by manufacturer, make, model, or serial number. The tag declares the part is new or newly overhauled and that the part is in an airworthy condition. The tag also will show that the part meets the special requirements of the importing country. However, Section 21.331 allows the exporter some wiggle room by stating that the product does not have to meet all the requirements of the rule **if** the importing country gives its okay.

In closing, I offer my apology to those who, for the last few minutes or so, had to wade through this ton of information to glean some useful dollop of wisdom that might prove helpful on the hangar floor someday.

I tried to be witty in explaining the regulations, but only got half way to my goal. But in my defense trying to make the regulations easy to understand is in itself a contradiction. I give you fair warning to steel yourselves for some more bureaucratic insights with all the clarity of an astrologers predictions. As you read this, "The Code, Part 2" has already been mailed to the editor.

Bill O'Brien is a National Resource Specialist in Flight Standards' Continuous Airworthiness Maintenance Division.

The Ice Cometh

The following reports from NASA's Aviation Safety Reporting System (ASRS) appeared in the December 1998 issue of Callback. --Editor

This is the time of year when many pilots are gearing up for the increased likelihood of encountering in-flight icing. Our first reporter believed that an airplane "certified for flight into known icing" could handle a routine IFR flight.

[On arrival], prior to cloud penetration, all [anti-ice] systems engaged. I continued checking the leading edges of wings and spinners--no significant accumulation noted. Level at 3,000 feet at about 140 knots, the airplane began to buffet, elevator response became mushy, and it appeared the plane was ready to stall. When I reached to add more power, the airplane nosed over and began to turn. I went with the turn, trading altitude for airspeed, and cycled the deicing boots.

I declared an emergency with Approach Control. With the increased power and resultant airspeed and continuous cycling of the boots, I got the plane stabilized. Approach Control provided vectors for the ILS approach at XYZ. We experienced no further difficulty flying the approach.

[On post-flight], there was about one-quarter inch of ice remaining on the nose, spinners, upper portion of the tail, and other unprotected areas. I assume significant ice was shed while descending. I have become an even more cautious flight planner. I now know first-hand that icing conditions are unpredictable and how severe localized icing can be--it can quickly overpower a "known icing" aircraft.

Ice-Bound

Loss of aircraft control due to the weight of ice and the disruption of airflow over the wings and elevator surfaces is only one part of the icing story. Ice accumulation can also cause jamming or malfunction of controls and components, as an air carrier First Officer reports:

I was flying the aircraft on autopilot. The flight had been normal and uneventful. During approach, ATC gave us a descent, a turn, and a speed reduction. After establishing the descent and turn, I extended the speed brakes to start slowing. The speed brakes felt stiff going past one-third extension, so I retracted and re-extended, and they felt normal the second time. The autopilot did not appear to roll out. I watched it closely and by five degrees prior to heading, I was sure it was not going to roll out. I disconnected and attempted to manually roll out. It took considerable force to move the yoke. With more force and about two-thirds deflection (considerably more than normal), the controls appeared to break free. After this, the aircraft responded and flew normally. We landed uneventfully.

Maintenance inspected, detected, and removed ice from the control cables and pulleys.

The reporter surmised that the previous night's rain and wind had blown water into the control unit housings, where the water froze, causing the controls to jam.

"Get-There-Itis"

A general aviation pilot debated filing an IFR flight plan for a pleasure flight in mixed VMC/IMC. The reporter even considered canceling the flight because of the weather, but admits that "my judgment was clouded by 'get-there-itis,' combined with beckoning patches of blue sky."

After considering the options, I decided that flying VFR would allow me the freedom to find a hole in the clouds and get on top in clear air. As we climbed toward the blue patches, it seemed harder and harder to find a hole large enough to climb through. Since it looked like we only needed to climb about another 100 feet to clear the tops, I decided that I would plow on through. Things got worse.

At first the sun poked through occasionally, beckoning us on. Then it started getting darker, and we picked up a trace of rime ice. Just as I was deciding that we would have to turn back, the engine started surging. I thought carb ice, but carb heat didn't help. As I was trouble-shooting the engine, another aviation demon was sneaking up on us. It turned out that the pitot heat was inoperative, and the pitot tube had frozen over.

As we were climbing, the airspeed indicator was falsely reading a higher and higher airspeed, and I was gradually compensating (unaware) to stay at V_x indicated airspeed. The plane then began to porpoise, indicating an imminent stall. Just as the stall broke hard, the scenario came together in my mind. We banked at least 90 degrees, and I pushed the yoke forward... I pulled the throttle back to idle, and recovered from the stall in solid IMC. I did a 180 turn and headed for VMC. We broke out in a few minutes and landed VFR.

The pitot tube didn't thaw out until we got below the freezing level... I am convinced that the surging engine was due to the high pitch attitude.

The reporter points out several lessons to be learned from this incident: Check the pitot heat before any flight which has the potential to be in IMC, and carefully monitor weight and balance for aft-of-limit conditions that may hamper stall recovery. Finally, avoid the beckoning lure of those "blue patches" between clouds. ✈

Anger:

How to control a killer emotion by Glenn R. Stoutt, Jr., MD

Anger is a perfectly normal human emotion. It is an adaptive survival response to threats and danger that helps us defend ourselves. It becomes a problem when it becomes inappropriate, prolonged, excessive, or out of control.

Prehistoric man needed to develop a storm of anger to fight fiercely with a cave bear or sabertooth tiger. But, he calmed down a few minutes after the fight ended (either calm or dead). His anger released a surge of adrenaline, preparing him for fight-or-flight. His blood pressure went up, blood was diverted to his muscles, blood clotted easier. The Neanderthal became a formidable fighting machine--but for an appropriate time only.

Contrast this with present day man--not unlike *Homo sapiens aeronauticus*--who may get road rage and then stay angry for hours after the traffic incident (perceived as a personal insult) has long passed. He or she may stay mad at a boss, spouse, or even a frustrating situation for days, even weeks. Some people stay in an almost perpetual state of anger, with simmering irritation just waiting to explode.

Anger arises from the frustration we experience when our interactions with people and things do not go according to our expectations. For example, difficulties encountered in assembling an "easy-to-assemble" appliance or waiting in line or struggling to loosen a rusted nut or bolt. One thing is certain: Angry people have a low tolerance for frustration.

The natural response to frustration is anger. Here's the problem though: How much of it is normal or appropriate? Do we stay mad all morning because our car keys are lost? Does a rude sales person merit ruining an hour or so of your time? You can't lash out at everyone who irritates or inconveniences you. Throwing a lamp through the front window is extreme; being sarcastic or sulking is a milder form of the same thing.

We are each born with certain largely unchangeable personalities. Some of us are laid-back and calm; others bristle easily and have a "short fuse." Our undesirable traits--such as proneness to anger—can, and must, be controlled to a degree. Do you express the same degree of anger to the president of your company as you do to a subordinate? So, you really have some degree of control. You don't scream at the boss.

Here's an almost fatal example of the toll anger can take: An airline captain, who was known for his violent temper, was making a tricky approach in marginal weather and was off on his heading and altitude. The first officer was afraid to say anything until just before the situation became dangerous. In other words, he was not as fearful of a controlled flight into terrain as he was of incurring the fury and explosive tongue of his captain.

An angry pilot--even a mildly irritated one--is prone to make procedural errors. After several maddening delays at home one morning, a corporate pilot made four "procedural errors" driving to the airport. He overshot his regular turn, pulled in front of another motorist, was driving way too fast, and spilled hot coffee in his lap. Luckily, he calmed down before climbing into a *Citation*.

Life is full of natural frustrations. Life is not easy. There will always be pain, loss, injustice, and disagreements. If this frustration load leads to excessive or prolonged anger, two things can occur: The anger can be directed outward in the form of irritability or aggression; or it can be directed inward, resulting in fatigue and depression. In fact, long-standing unresolved anger is the main cause of being tired and depressed. It raises havoc with our general health.

In July 1997, the Beth Israel Deaconess Medical Center at Harvard Medical School reported that "anger is the affective state associated with myocardial ischemia [lack of blood flow to the heart muscle] and life-threatening arrhythmias [irregular heart rhythms], with at least 36,000 (2.4% of 1.5 million) heart attacks precipitated by anger in the United States [yearly]." Blowing up over

something minor could put you in the hospital--or the morgue.

If you think you feel steamed most of the time, or if your anger is often out of control and you don't know why, make an appointment with a competent psychotherapist who deals in anger management. The cost may be the same as a new set of tires for your car plus a new transmission. But, it may be the most important thing you will ever do for your marriage, job, health—or your life.

More than 90 percent of success in life is getting along with people (find what they like and do more of it; find what they don't like and do less of it). No one enjoys being around someone who is--much of the time--cynical, demanding, suspicious, defensive, and hostile qualities often seen in the chronically angry person.

Understanding what triggers your anger will take a lot of time and motivation. Controlling your anger is as important as controlling your aircraft. After all, you didn't get to be a hot-shot pilot overnight. Be cool.

Yours for good health and safe flying.

Dr. Stoutt is Senior FAA Aviation Medical Examiner a partner in the Springs Pediatrics and Aviation Medicine Clinic, Louisville, Ky., and he has been an active AME since 1960. No longer an active pilot, he once held a commercial pilot's license with instrument, multiengine, and CFI ratings.

This article originally appeared in the Summer 1999 The Federal Air Surgeon's Medical Bulletin.

Note: The views and recommendations made in this article are those of the author and not necessarily those of the Federal Aviation Administration.

Tips from a psychotherapist who specializes in anger control

- First, what doesn't help? "Letting it all blow" is a myth. It is like throwing gasoline on a fire. Conversely, holding lots of anger in (suppressing it) for a long time does lots of havoc with your mood—and blood pressure.
- Of course, meditation, counting to ten, deep breathing, exercise, visualizing happy scenes and experiences, or yoga all may help some. But these recommendations are in all anger-management articles--things to do when you are already mad, but hardly able to think rationally. Use them, but remember what you really want to know is how to keep from letting crippling anger get started in the first place.
- The bottom line is learning how to prevent excessive and unreasonable anger, dangerous anger. Learn your own anger pattern so that you can prevent smoldering anger or blow-ups. What gets you angry? How do you handle it? Is anger a big problem in your life?
- Anger-prone people often feel they deserve special consideration from others and become highly irritated when they don't get it.
- Respect yourself, be assertive--but not aggressive. Talk to an offending person when you are both calm and in a reasonably good mood. Say something like, "Chris, I like you and think you really can teach me a lot, but every day you seem to put me down, and I don't hear anything positive about what I am doing. I go home tired and discouraged. What can we do to work things out?" Go on from here. (One woman did and then got fired, but her next job was sheer pleasure and she got $11,000 more a year.) Nothing works all the time.
- Healthful anger is OK. Just try to be objective and say how you feel about things. Calmly let others know what your needs are.
- Realize that no one ever wins a power struggle.
- You can't always help being around obnoxious people, but you can control how you react to them. You are the boss of your emotions and responses.
- In a social situation, be willing to change the expectations you have for other people. Don't expect others to be perfect or to treat you fairly—it doesn't always happen.
- Absolutely best of all: Try to avoid things that get you steamed. Try to identify, when you are calm and rational, the things that make you angry, and plan what you can do to avoid or control them. For instance, leave earlier for your job, and go home later if traffic drives you nuts. Better to spend the time at work than on the expressway. Devise strategies to avoid nasty people and frustrating situations as much as you reasonably can.
- Ask yourself, "Is this frustration enough to ruin my whole day, even an hour?"

• Safety Improvement

I believe that the air safety program can be greatly improved in the following manner. The only time pilots are required have a review of their pilot skills is at a flight review every two years (BFR). These BFR sessions have not been updated in many years.

I feel that these BFR reviews are the one time to assure getting the pilot's attention. Though some diligent pilots are constantly reviewing various safety materials, most pilots do not.

The BFR should also include a handout, with some discussion, of the most commonly occurring accidents in aviation. Unlike the NASA or NTSB publications, the CFI should have a condensed and targeted publication with accidents common to the particular type or class of aircraft the pilot flies. For instance, a Cessna 150 pilot is not interested in the causes of "a flame out in engine #4 of a B747."

I feel an accident safety data handout would be very beneficial for the average pilot (probably 85% of pilots) who do not perform any other safety refresher courses other than the BFR every two years.

Paul D. Adler
Based at MVY

Thanks for the ideas Paul. You have made some good points.

FAR § 61.56, Flight Review, outlines the requirements for a flight review. The rule spells out the minimum ground and flight times required for meeting the regulatory requirement, including a review of the current general operating and flight rules of Part 91. However, the rule leaves it up to the person giving the review to determine the maneuvers and procedures that person believes necessary to determine that the pilot can safely exercise the privileges of the pilot certificate. Since it is up to the person giving the flight review to determine the content of the review, that person could very easily do as you suggest. (Also see Advisory Circular 61-98A.)

FAA AVIATION NEWS welcomes comments. We may edit letters for style and/or length. If we have more than one letter on the same topic, we will select one representative letter to publish. Because of our publishing schedules, responses may not appear for several issues. We do not print anonymous letters, but we do withhold names or send personal replies upon request. Readers are reminded that questions dealing with immediate FAA operational issues should be referred to their local Flight Standards District Office or Air Traffic facility. Send letters to H. Dean Chamberlain, FORUM Editor, FAA AVIATION NEWS, AFS-805, 800 Independence Ave., SW, Washington, DC 20591, or FAX them to (202) 267-9463; e-mail address:

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• Class C Airspace

Could you settle a discussion for me, or at least point me towards an appropriate advisory circular that interprets the rule.

We operate from a tower controlled airport (RHV) that is outside of the SJC Class C airspace. If you depart straight out from Runway 31 at RHV, you will clip a corner of the SJC Class C airspace. You are usually instructed by the RHV tower to "remain clear of the SJC Class C airspace." I contend, however, that if you are NOT given specific instructions by ATC (RHV Tower, in this case) to remain clear of the SJC Class C airspace, then you have met the communications requirement of FAR § 91.130 for entry into the Class C airspace by virtue of being in radio contact with the SJC tower.

FAR §91.130 says that you only need to "...establish two-way radio communications with the ATC facility" "providing air traffic services prior to entering that airspace...."

It does NOT specify the ATC facility responsible for the Class C airspace, only that you are communicating with ATC prior to entry. Your opinion would be greatly appreciated.

Steve Mann
San Jose, CA
Via the Internet

Sorry, Steve. Good try, but you are talking to the wrong ATC facility. The appropriate ATC facility is the one that controls the airspace in question. In this case, you said it is SJC that controls the Class C airspace. For more information you can review the information in the Aeronautical Information Manual (AIM) under paragraph 3-2-4, Class C Airspace.

• Glider Operations and the Safety Zone

I read with interest the article on "Runway Incursions" in the latest issue of *FAA Aviation News* on the Internet. Very good job.

I was wondering how glider operations can fit into the safety zone. We have operated in the past at uncontrolled airports where the approach is visual and pilots have the option of landing long or going around if there is any apprehension.

We usually monitor the common traffic advisory frequency (CTAF) or UNICOM to be apprised of actions, but the tow vehicles do not have radios. We do, however, have the yellow flashing beacons.

I'm planning to propose at many small airports that the "taxiway incursion" line be used on parallel taxiways which are on the same side as the pre-

vailing pattern. This would work well at airports where the prevailing traffic is high-wing.

By doing the runup on the parallel taxiway, it allows the pilots to easily see the last of the downwind, base, as well as final. If the runup is done on the perpendicular taxiway, downwind and base are almost impossible to see without a 360-degree taxi being executed. Even low-wing aircraft cannot see downwind.

One other small point. Many small airports do not have anything like the possible combinations of yellow lines seen at the control tower airports.

Guess where most of the basic training is done!

Better marking of these small airports might prove an inexpensive "teacher." Everybody will be asking "What are those lines?" before they get to the big airports.

Bob Davis,
CFIA, CFIG
via Internet

We are glad you liked the article. Thanks for the kind words.

Gliders are exposed to some potential problems if they have to share a runway with other aircraft. I am a glider pilot so I understand your concern. I think one way to work gliders into the local pattern is to first publicize to as many pilots in the area as possible that glider operations are being conducted at that airport. NOTAMS and the Airport Facility/Directory are two means. If there are enough glider operations to justify a glider symbol on the sectional chart, that may be an option.

I just think it is important for everyone to realize that glider operations are taking place and to remember the operating limitations a glider has once a decision to land has been made. I especially worry about student power pilots who may not recognize a glider and who may then fail to yield right of way.

Another option is to have a radio in the glider so that the pilot can communicate with other pilots.

Regarding your tow vehicles, you may want to buy a cheap aircraft frequency radio monitor for use in the vehicles. If someone is monitoring the CTAF or UNICOM, then one of the new family frequency radios could be used to communicate with the tow vehicles.

I don't understand your comment about using the parallel taxiways. The problem, as I see it, is that the aircraft holding on the parallel taxiway would block other aircraft prepared for departure.

I think your idea about better marking of small airports is a good one. Now if only local airports had the money or resources to do the work.

• Professionalism

I would like to comment on the article in the April 1999 issue "The Mystic Art of Being a Low-Time Pilot." There are not many articles that speak of proficiency instead of legal currency. As a low-time professional pilot, I appreciate the recognition of skills and knowledge that cannot be measured in flight hours.

My primary and advance flight training is "task rich" as opposed to "hour rich," meaning that I have had the good fortune of being trained well on tasks, and not just flying until I met the legal flight hour minimum. For example, my instructors did not have to demonstrate and teach spins, but they did. My crosscountry flights were truly exercises in pilotage and navigation, and not just a flight following a highway.

A logbook does not tell the whole story. The emphasis should be proficiency and attitude. Is the pilot proficient, and even more important, does the pilot want to be proficient?

My recommendation to all pilots and flight instructors is to set and maintain high standards of training. Use the standards set for airline transport pilots. Consider all flying professional, from student through ATP, and balloons through jet aircraft.

In my service to general aviation through my employment as a flight service specialist with the FAA, I set and maintain high standards using the ATP practical and knowledge test standards. I maintain proficiency as a pilot using the FAA "Wings" Program, and I maintain the currency required of an aircraft dispatcher stated in FAR §121.463. My observation of airline operations always improves my motivation to be more professional in areas of my aviation life.

I applaud this article, and I hope to see more on this topic in the future. The focus on flight hours needs to be balanced with proficiency. This article has been very encouraging.

Dennis Zimmerman
FAA Flight Service Specialist

We want to thank you for your kind comments. Your comments about being a professional are the foundation of aviation. As you say, everyone should strive for and work towards those high standards. However, as in sports, aviation is and has always been a numbers game in the United States. The key to success for a pilot is having the required numbers while developing and maintaining the high standards you discussed. As you pointed out, proficiency and attitude are important. They represent professionalism and help build one's professional reputation.

121.5 MHZ ELT SIGNAL PROCESSING PHASE OUT

The National Oceanic and Atmospheric Administration (NOAA) has announced the approval of an international initiative to phase out satellite processing of distress signals from 121.5 MHz emergency beacons. This includes the satellite processing of 121.5 MHz emergency locator transmitters (ELT's) installed in most U.S. aircraft required to carry ELT's.

NOAA is the U.S. representative to the Cospas-Sarsat Program. According to the November 10, 1999, NOAA press release, "The International Cospas-Sarsat Program, a program that uses a satellite constellation that relays distress alerts to search and rescue authorities, has announced it will terminate satellite processing of distress signals from 121.5/243 MHz emergency beacons. Mariners, aviators, and individuals using emergency beacons will need to switch to those operating at 406 MHz if they want to be detected by satellites.

"The termination of the 121.5/243 processing will happen over a period of time. It is expected to take place far enough into the future to avoid a crisis for persons now using these beacons. The Cospas-Sarsat Program is currently working on the details of the transition, including the time frame. Although no effective date has been set, the Cospas-Sarsat Program has decided that the 121.5/243 MHz instruments will not be carried on the next generation of satellites--starting in 2006 for Russian satellites and 2009 for the U.S. satellites, operated by the Commerce Department's National Oceanic and Atmospheric Administration."

According to the NOAA news release, the phase out is part of an international plan to increase the effectiveness of search and rescue efforts by only processing the more effective 406 MHz alert beacons. The Cospas-Sarsat Program made this decision in response to guidance from the International Maritime Organization (IMO) and the International Civil Aviation Organization (ICAO). More than 180 nations are members of IMO and ICAO.

The Federal Aviation Administration (FAA) had agreed with ICAO's recommendations that 121.5/243 MHz satellite processing could be terminated in the year 2008. That date was not approved at the annual Cospas-Sarsat Council meeting. Hence the current Cospas-Sarsat plan to terminate future launches of satellites capable of monitoring 121.5/243 MHz signals.

The FAA believes a definite processing termination date allows aviation users to better plan their transition to 406 MHz ELT's if they wanted the continued space-based monitoring of their ELT's. A definite termination date or a "hard termination date" would also let everyone know exactly when the space-based monitoring of the 121.5 MHz frequency was no longer available. Under the current plan, the Cospas-Sarsat Program will now have to determine at what point in the future, the current 121.5/243 MHz portion of the satellite based-monitoring system is no longer capable of providing a specified level of service.

Currently, FAA has no plans to require aircraft owners or operators who have 121.5 MHz ELT's installed in their aircraft to convert to the more capable 406 MHz ELT with its digitally encoded owner identification capability. However, when the Cospas-Sarsat Program terminates space-based monitoring of the 121.5/243 MHz frequency, pilots with the older ELT's onboard their aircraft or in their survival kits will have to rely on other over-flying aircraft or nearby air traffic facilities capable of monitoring 121.5/243 MHz to detect an activated ELT in the event of a crash or the more frequent problem of the inadvertent activation of an ELT.

FAA will continue to monitor the work of the Cospas-Sarsat Program as it decides how to establish a termination date for its space-based 121.5/243 MHz signal monitoring. An initial Cospas-Sarsat meeting is planned for March 2000 in Australia. FAA will keep the aviation community informed of the process.

GENERAL AVIATION REVITALIZATION ACT PLUS FIVE

Five years ago President Clinton signed into law the General Aviation Revitalization Act (GARA) on August 17, 1994. At that time according to the General Aviation Manufacturers Association (GAMA) the industry had, "...experienced a 95 percent decline in production and a loss of over 100,000 jobs in the preceding decade. Today, five years after its enactment, the General Aviation Revitalization Act has proven to be an unqualifed success."

According to GAMA's report to the President and Congress, 25,000 new manufacturing jobs have been created as a result of GARA. This number does not include those jobs created within the industry to support the production demands of the 25,000 new manufacturing jobs created. The report also states that general aviation aircraft production is up "100 Percent" since 1994. General aviation exports have more than doubled, student pilot starts are up, and new products are being developed are up by more than 150%.

In addition, since GARA, the industry has started the "BE A PILOT" advertising and promotional campaign to attract new student pilots to take up flying. According to GAMA's report to the President and Congress, the BE A PILOT campaign is "...the largest 'learn to fly' program in civil aviation history." According to the report, new student starts are up.

For more information about GAMA's report to the President and Congress, readers can contact GAMA at 202-393-1500 or by downloading the report from the GAMA website at www.generalaviation.org.

AvNEWS

QUESTIONS ABOUT PART 61?

In case you didn't know it, the FAA Website for the most frequently asked questions (FAQ) about FAR Part 61 is also frequently updated. This is an excellent site to find answers to questions you may have about pilot certification or pilot schools and is a good site to "bookmark" or add to your "favorites" folder on your browser. The URL is<http://www.mmac.jccbi.gov/afs/afs600/pefaq.html#faq>.

The FAQ's are also downloadable to your hard drive and could be printed, but the file is now over 300 printed pages long. K. Allan Pinkston, who manages the site, suggests that you save the file to your hard drive and work with it in a word processing program. If you have e-mail and would like a MicroSoft Word file of the FAQ's, please e-mail k.allen.pinkston@faa.gov and he will send the file to you.

NEW DIRECTOR OF THE NATIONAL AIR AND SPACE MUSEUM NAMED

General John R. Dailey (USMC, Ret.) is named the new director of the Smithsonian's National Air and Space Museum. Smithsonian Secretary I. Michael Heyman announced Dailey's selection on November 24, 1999.

Dailey is scheduled to assume his new duties in January. Before his selection to succeed Vice Adm. Donald Engen who was killed in a glider accident last July, Dailey was Associate Deputy Administrator at NASA. Dailey served as the Assistant Commandant of the Marine Corps before his retirement.

Dailey is pilot with more than 6,000 flight hours. During two tours of duty in Vietnam, Dailey flew 450 combat missions.

According to the Smithsonian Institution, the National Air and Space Museum is its busiest museum and the most-visited museum in the world. Nearly 10 million people visit it annually.

ALBUQUERQUE'S INTERNATIONAL BALLOON FIESTA '99

The 1999 Kodak Albuquerque International Balloon Fiesta, held last October in New Mexico, had an estimated 1,090,621 spectators during the one-week event. Fiesta 1999 registered 903 balloons from 42 States and 21 Countries.

The large international event had 803 regular shape balloons, 80 special shape, and registered 20 gas balloons that participated at public scheduled events and races. More than one thousand media representatives from 275 worldwide media outlets attended this year's colorful event.

Twenty teams representing 12 countries flew the 43rd Coupe Gordon Bennett gas balloon distance competition, that ended with the victory of the Belgian team of Philippe DeCok and Ronny Van Havere who flew a distance of 910 miles. Missouri pilot George Thomas was the overall winner in the hot air ballooning competitive events. Fiesta 2000 is scheduled to take place October 7-15, 2000.

EAA HALLS OF FAME WELCOME 15 NEW INDUCTEES

On October 22, the Experimental Aircraft Association (EAA) welcomed 15 new members to its affiliated Halls of Fame at a program in Oshkosh, WI. The new inductees are:

International Aerobatic Club Hall of Fame (founded 1987): Henry Haigh

EAA Homebuilders' Hall of Fame (founded 1993): Chris Heintz, Richard Van Grunsven, and the late Henri Mignet

Vintage Aircraft Association Hall of Fame (formerly Antique/Classic and founded in 1993): Gene Chase, Tom Flock, and Edward C. Wegner

Warbirds' Hall of Fame (founded 1995): Richard Ervin and the late William Dodds

Flight Instructors' Hall of Fame (founded 1997): Anders Christenson, Dale DeRemer, and Verne Jobst

Ultralights Hall of Fame (founded 1999): John Moody, Homer Kolb, and Chuck Slusarczyk

"All of these men have contributed much to the world of flight," said EAA President Tom Poberezny. "Each has carved a unique niche in aviation history. They represent the best that recreational aviation has to offer and serve as an example for everyone involved in flying. We are honored to welcome them as our newest inductees to the EAA Halls of Fame."

The inductees were nominated by members of EAA, EAA Divisions, or the National Association of Flight Instructors (NAFI) for their contributions to the history, development, and growth of a particular facet of sport aviation. The final selection was made by Board of Directors of each group.

SUN 'N FUN FLY-IN 2000 DATES

The 26th Annual Sun'n Fun Fly-In will be held April 9-15, 2000 at the Lakeland Linder Airport in Lakeland, FL. The theme for the 2000 event is "Flying Into Our Future." For more information on the Fly-In, computer users can check the Sun'n Fun website at www.sun-n-fun.org. *FAA Aviation News* will once again feature the event in its March issue.

According to Sun'n Fun EAA Fly-In, Inc., 684,200 people attended the 1999 fly-in. All 50 states were represented in that attendance figure as well as 74 countries. A total of 2,035 show planes were registered during the event.

Editor's Runway

from the pen of Phyllis-Anne Duncan

A World Turned Upside Down

If you're reading this some time in the month of January, then the world turned upside down has been righted again. Actually, that's a bit self-indulgent. The only world inverted was that of the members of the Aviation News Staff. What subscribers or readers have experienced is an inconvenience. As a public servant, I consider your inconvenience far more important than the magazine's recent internal crisis.

Those of you who are regular subscribers or readers have likely noticed (a little humor here) that there have been no copies of *FAA Aviation News* since late September. If you are a subscriber, then you're likely receiving three issues at once—October 1999, November-December 1999, and January-February 2000. It would be tempting to attribute this to typical government foul-ups, and suffice it to say it's difficult not to allude the delay to that. After 38 years of being untouched by changes of administration, budget battles between opposing political parties, internecine office politics, the FAA's only regular safety magazine recently got caught up in all of those. (Now is the time to roll one's eyes and remark on the inefficiency of bureaucracy. Go ahead. It's okay. I've nearly rolled my eyes out of my head.)

I used to wonder why all the editors I knew ended up looking like Ed Asner from the television programs "The Mary Tyler Moore Show" and "Lou Grant." Now I know. I haven't quite made it to Asner status yet, but the gray hair definitely took hold over the past four months when my staff prepared three issues of this magazine which had to sit on a desk because printing was prohibited. The why I'll avoid the details of, lest I be guilty of spreading sour grapes about, but sometimes even the bureaucrats get bitten in the you-know-what by bureaucracy.

The FAA's budget has been the subject of industry concern for the past two years, and areas of the agency involving services, i.e., printing, are usually the first to be cut back. I don't really quibble with that because air traffic control, certification, and surveillance are the backbone of this agency's safety mission. But communicating safety information is an important duty as well, especially from a public agency to an industry it regulates. To sum up, printing at the FAA came to a halt unless special requests were made to the appropriate offices. Initially, we were stymied at the end of fiscal year 1999 by a printing budget that was exhausted by August 18. Next, came the budget squabbles that left us operating on a continuing resolution, and printing was held back. We have printed during continuing resolutions before, but this time, because of the depth of the budget cuts in FAA, we were only going to do "essential" tasks until the final Federal budget was signed. Of course, I and my staff think this publication is essential, as do the people who have paid their money to receive it, but the magazine is a small part of a large organization. Very humbling. Extremely frustrating—as a public servant and as a taxpayer. (The two are not mutually exclusive.)

All of this is a build-up to an apology and an assurance that the Aviation News Staff did the best it could to ensure that this publication was prepared to be received by the reader on time. For four months, we proceeded business as usual, writing articles, designing the layouts, preparing the inevitable paperwork involved in getting a government printing job to the printing plant. For all that work and diligence, we came up empty-handed, which meant you came up empty-handed, and for that all I can offer is my sincere and earnest apology. And that, in itself, is woefully inadequate. I could tell from the tone of those who have called and complained that I failed to deliver the goods. I am the Editor. The responsibility is mine. However, I did my best, as insufficient as that was. I know we've lost some of you forever. I know we've lost the trust of others who are new to this publication. I'm sorry for that, too, and can only say that we will do better. We may encounter the brick wall again, but it won't be for lack of trying to serve our customers. Of that, you may always be assured.

Other than that, Mrs. Lincoln, I really liked the play, though I don't think I want to sit through it again.

I hope the New Year is a prosperous and safe one for everyone in aviation and a little less trying than the end of the Old Year for *FAA Aviation News*.

'Til next time-we hope...

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