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ADVISORY CIRCULAR

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

SUBJECT: ACROBATICS - PRECISION FLYING WITH A PURPOSE

1. PURPOSE. This advisory circular provides information to persons who are interested in acrobatics to improve their piloting skills as recreation, sport, or as a competitive activity. It also discusses Federal Aviation Regulations (FAR) pertaining to acrobatic aircraft airworthiness considerations, acrobatic instruction, operations, and acrobatic flight safety.

2. BACKGROUND.

a. The Federal Aviation Administration (FAA), in cooperation with various industry groups, has written this advisory circular in response to the growing national interest in acrobatic flight activities. This increasing interest is attributable to several factors, not the least of which are the promotion of this sport by various industry organizations, the availability of more aircraft built for this purpose, and the recognized value of acrobatics in pilot training.

b. Presently, there are no airmen certificates which require the performance of "pure" acrobatic maneuvers during the flight test other than the spin requirement for airplane flight instructor applicants. Therefore, the FAA has not been involved in establishing criteria for the performance of acrobatic maneuvers or the certification of flight instructors to teach acrobatics. In addition, the FAA does not contemplate the development of such requirements in the near future.

3. DEFINITION.

a. FAR Section 91.71 defines "acrobatic flight" as "an intentional maneuver involving an abrupt change in an aircraft's attitude, an abnormal attitude, or abnormal acceleration, not necessary for normal flight." In addition, Section 91.15(c) indirectly refers to acrobatic

flight in which it specifies that "Unless each occupant of the aircraft is wearing an approved parachute, no pilot of a civil aircraft, carrying any person (other than a crewmember) may execute any intentional maneuver that exceeds:

(1) A bank of 60 degrees relative to the horizon; or

(2) A nose-up or nose-down attitude of 30 degrees relative to the horizon."

b. The above bank and pitch tolerances further define the differences between an acrobatic and nonacrobatic maneuver.

4. REFERENCES. In addition to the sections of the FAR quoted above, there are other sections of which a pilot should be knowledgeable:

a. Section 91.9 - Careless or Reckless Operation. "No person may operate an aircraft in a careless or reckless manner so as to endanger the life or property of another."

b. Section 91.15 - Parachutes and Parachuting. Pilots should familiarize themselves with the requirements of Section 91.15 which contain certain parachute wearing and packing requirements.

c. Section 91.71 - Acrobatic Flight. "No person may operate an aircraft in acrobatic flight:

(a) Over any congested area of a city, town or settlement;

(b) Over an open air assembly of persons;

(c) Within a control zone or Federal airway;

(d) Below an altitude of 1,500 feet above the surface; or

(e) When flight visibility is less than three miles."

5. WHY ACROBATICS?

a. Pilot Training. To this date, all U.S. military pilot training courses include acrobatic flight. The purpose of this training is to instill confidence in the student pilot's ability to handle the aircraft and perform precision maneuvers in all flight attitude regimes. The ability to recover from extreme attitudes is also recognized.

b. Acrobatics as recreation. Many pilots pursue acrobatics as a recreation or hobby. Acrobatics, once learned, is an important part of sport and recreational flying.

c. Acrobatic competition. Many pilots who pursue acrobatics as a sport also participate in competitive events. These events provide an

opportunity for pilots to match their skills against an established criteria or standard of grading. Acrobatic competitions are held in most areas of the country and are sponsored by various aviation organizations. The events are conducted according to rules and regulations established by the various organizations and are usually monitored by the FAA.

6. INSTRUCTION AND TRAINING.

a. One of the most common questions asked is, "Where do I find an acrobatic flight school and instructor?" Unfortunately, such schools and instructors cannot be found on every airport. Acrobatic instruction is a skill unto itself and not all flight instructors have been exposed to it. The unavailability of acrobatic aircraft has been a problem to pilots interested in learning acrobatics. Long gone are the barnstorming days when pilots performed "stunts" to thrill crowds at county fairs and carnivals. Today's acrobatic flight is an advanced form of precision flying. To develop these skills, pilots require expert training, good sound aircraft, and frequent practice. To locate a qualified acrobatic instructor, it may be wise to contact one of the acrobatic organizations specializing in acrobatic flight. (Two such organizations are listed in paragraph 11.) If it is not possible to do this, you may contact your local General Aviation/Flight Standards District Office for a listing of approved flight schools and available flight courses.

b. Also, various aviation trade publications accept advertising from persons and schools who offer instruction. Regardless of what method you use, be sure to ask the instructor some of the following questions:

(1) What is the instructor's background? Where did he/she receive acrobatic instruction?

(2) How many hours of acrobatics and acrobatic instruction does he/she have?

(3) Has he/she ever flown in competition?

(4) What types of courses are offered? What types of aircraft are used?

(5) Does he/she have any references?

(6) What does the syllabus consist of?

c. Ask yourself, would you like to learn instrument flying from a person who has little or no experience in actual instrument conditions? The same applies to acrobatics.

d. If you are interested in eventually competing, it is helpful to fly with someone who has a "competition" background. Such a person can show you what the judges are looking for in competition and can tailor a course to meet your individual needs.

e. The syllabus of instruction is also important and should be reviewed with you. Generally, a school with an established curriculum or flight syllabus is the mark of a good organization and the likelihood of their providing good instruction is much greater.

f. Remember that even in a flight school approved under Part 141, acrobatic instruction is seldom covered. The contents of any approved acrobatic course would be determined by that school and approved by the FAA. The FAA has no regulation concerning required course content of acrobatic schools nor is such a regulation proposed in the foreseeable future.

g. A number of schools offer a basic "safety" course of about five hours, and others offer ten-hour "primary" acrobatic courses. Cost varies considerably depending on type aircraft used and the instructor's background.

h. In summary, check out the school, the equipment, and the instructor thoroughly to assure they fit your needs.

7. AIRCRAFT.

a. FAR Part 23 prescribes airworthiness standards for normal, utility, and acrobatic aircraft. If acrobatics are planned, be sure your aircraft is certificated in the "acrobatic" category. Section 23.3(c) states, "The acrobatic category is limited to airplanes intended for use without restrictions other than those shown to be necessary as a result of required flight tests." This does not mean that all acrobatic maneuvers can be flown. Operating limitations must be observed.

b. The difference between "acrobatic" category aircraft and "normal" or "utility" is basically the limit-load factors, or "G forces" the structure can withstand.

c. Naturally, "acrobatic" aircraft must be built stronger. For example, the following are the positive limit maneuvering load factors for "utility" and "acrobatic" aircraft:

	Utility	Acrobatic
Positive	+4.4 G's	+6.0 G's
Negative *	-1.76 G's	** -3.0 G's

*0.4 times of the positive limit.

**0.5 times of the positive limit.

d. It can be seen that aircraft certificated in the "acrobatic" category by the FAA are designed to be significantly stronger than "utility" or "normal" category airplanes.

e. Many aircraft still remain on the market today that are designed to standards prescribed by the old Civil Air Regulations that existed before and immediately after World War II. In many cases, operating limitations did not preclude the performance of certain acrobatic maneuvers. These aircraft, however, do not necessarily meet the newer certification requirements of Part 23 and the pilot must be cautious as to what he/she does with these aircraft. Some are only suitable for mild acrobatic maneuvers. The operator must also take into account the effects of age, weather, metal fatigue, and other factors which would have a deleterious effect on the aircraft's structural integrity. Some research on the aircraft's design limits would be well worth the time.

f. In regard to the aforementioned "operating limitations," these are determined at the time of manufacture and are in accordance with pertinent FAR. In acrobatic aircraft, maneuvers that can be performed safely are listed either in the approved aircraft flight manual or on placards located in the cockpit. Safe entry speeds are also listed. These limitations must be closely observed. All of the other limitations should be followed as well, such as airspeed, RPM, temperature, and other maximums. Be sure to study the airplane's flight manual and know it well.

g. Any discussion of acrobatic aircraft would not be complete without touching on amateur-built aircraft. Many of these aircraft are used for sport acrobatics, competition, and airshow work. It is difficult, however, for a person not knowledgeable of aircraft structures to determine which are acrobatic and which are not. The FAA does not specify structural standards for amateur-built aircraft. Therefore, whether or not the amateur-built aircraft is suitable for acrobatics is largely determined by the builder and the individual FAA inspector who prescribes its operating limitations. Acrobatic maneuvers listed as acceptable for these aircraft are determined during the time the aircraft is undergoing flight testing in a prescribed flight test area. If none are listed, the aircraft is restricted from acrobatic flight. The operator should examine the service history of the aircraft and consult the designer before attempting any acrobatics.

h. Be cautious of any claim that the aircraft is "fully acrobatic." It may never have been designed for that purpose. Acrobatics in amateur built aircraft should only be conducted in airplanes with service records in that type of operation or which have been designed and built for that purpose.

8. OPERATIONS.

a. Preflight. The preflight inspection of acrobatic airplanes is the same as any other type. Special attention should be given, however, to those areas unique to acrobatic airplanes. This may include:

(1) Structure. Check for visual evidence of damage or failure. Wrinkles in the metal or fabric covering or looseness in any structural part are indicators. Aircraft used extensively for training would require particularly close scrutiny.

(2) Cabin Door Release. In cabin-type airplanes, an emergency door release is provided. Make sure the release is not corroded or damaged.

(3) Seatbelts & Shoulder Harness. These are particularly important in the acrobatic airplane and have much more stress placed on them than in nonacrobatic aircraft. It is highly recommended that dual seatbelts and crotch strap, each with individual attach points, also be installed. Make sure they are in good condition and undamaged. Check latching mechanisms as well.

(4) Parachute. Have someone who is qualified check you out on preflighting the parachute. Items such as proper fit, adjustment, unobstructed ripcord pins (make sure the riggers seal is intact), general condition, and repack currency should be thoroughly checked.

(5) Loose Objects. Be sure everything is properly secured as they often become missiles in flight. Additionally, jammed controls could result from a dislodged object.

b. Airspace. When performing acrobatic flight, those portions of Section 91.71 previously quoted must be kept in mind at all times. The airspace utilized for acrobatics should be carefully selected. Remember that Section 91.71 is only the minimum. You should also avoid known student training areas, military low-level routes, approach paths, nearby airports (unless specifically authorized), and any other areas known to be congested with itinerant traffic. When performing acrobatics, do not allow your concentration on flying maneuvers to override your responsibility to clear for other traffic. Before performing any acrobatic maneuver or group of maneuvers, clear the area well.

c. Noise. Consider the fact that your aircraft will be operating at high-power settings during many acrobatic maneuvers. Be a "good neighbor" and minimize the noise effect on the surrounding countryside by flying higher and over sparsely populated areas where possible.

d. Postflight Inspections. If at any time during a flight the aircraft limitations are exceeded, the aircraft should be returned to the airport for an inspection by a qualified mechanic. If something doesn't feel right during the flight, the same advice applies. Even after a normal flight, many pilots feel it is a good idea to "postflight" the aircraft to check for any problems. This is a favor to the next person who may miss something on the preflight.

9. MAINTENANCE. Any general aviation aircraft used to give flight instruction for hire may not be operated unless, within the preceding 100 hours of time in service, it has received an annual or 100-hour inspection and has been approved for return to service in accordance with Part 43 of the Federal Aviation Regulations. Additionally, an aircraft used to give instruction for hire may be inspected in accordance with a progressive inspection under Section 91.171 or an approved aircraft inspection program

under Part 135 of this chapter. However, aircraft in which no PASSENGERS or STUDENTS are carried for compensation or hire need only have annual inspections. Operators should consider more frequent inspections due to the structural strain imposed on these aircraft.

10. MINIMUM ALTITUDES. Section 91.71 requires a minimum of 1,500 feet above ground level for acrobatic flight. This is only a minimum. There is a saying that there is "nothing more useless than altitude above you and runway behind you." The more altitude, the more margin for safety. Pilots should take into account any altitude loss that normally occurs in maneuvers plus any "fudge factor" that should be built in for safety. Airplane flight characteristics should also be weighed. For example, some aircraft lose more altitude in spin recoveries than others. Flight instructors should be familiar with individual aircraft characteristics. The airplane flight manual should also be consulted.

11. INDUSTRY ORGANIZATIONS

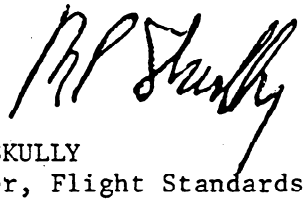
a. It is useful for pilots and others interested in various phases of aviation to join industry organizations devoted to their particular interest. For acrobatics, the following organizations are listed for your information:

International Aerobatic Club, Inc. (IAC)
P.O. Box 229
Hales Corners, Wisconsin 53130
(Division of Experimental Aircraft Association)

Aerobatic Club of America
P.O. Box 3032
Kenesaw, Georgia 30144
(Division of National Aeronautics Association)

b. The IAC has a nationwide network of chapters that can be of help to acrobatic enthusiasts in exchanging information, by participation in acrobatic events, and by providing educational seminars and presentations.

12. CONCLUSION. Acrobatics are good for aviation. We need to do them properly and safely. The educational results will pay off in a safer operating community.



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