Introduction

Welcome to the world of soaring. Whether it has been a lifelong dream or a new interest, the pleasure of flying is truly addictive and exhilarating. The intellectual challenge combined with the quiet and beauty of flying high above the earth are two of the many reasons that people both young and old get hooked on flying gliders. If contemplating learning more about the sport, an introductory flight absolutely helps make the decision. Soaring gracefully through the air, along with the meditative silence that surrounds you, is refreshing and exciting. Organizations such as the Soaring Society of America (SSA) have developed excellent programs not only to track a pilot’s learning progression, but also issue badges for flight and knowledge accomplishments. Glider clubs are located all over the country and offer great flight training schools and pilot camaraderie.
The Glider Flying Handbook is designed to aid pilots in achieving their goals in aviation and to provide the knowledge and practical information needed to attain private, commercial, and flight instructor category ratings for gliders. This handbook, in conjunction with the Pilot’s Handbook of Aeronautical Knowledge, FAA-H-8083-25 (as revised), is a source of basic knowledge for certification as a glider pilot and instructor. There are numerous other commercial sources available to the pilot for reference that should be obtained for additional information.

Gliders—The Early Years

The fantasy of flight led people to dream up intricate designs in an attempt to imitate the flight of birds. Leonardo da Vinci sketched a vision of flying machines in his 15th century manuscripts. His work consisted of a number of wing designs including a human-powered ornithopter, the name derived from the Greek word for bird. Centuries later, when others began to experiment with his designs, it became apparent that the human body could not sustain flight by flapping wings like birds. [Figure 1-1] The dream of human flight continued to capture the imagination of many, but it was not until 1799 when Sir George Cayley, a Baronet in Yorkshire, England, conceived a craft with stationary wings to provide lift, flappers to provide thrust, and a movable tail to provide control.

Otto Lilienthal was a German pioneer of human flight who became known as the Glider King. [Figure 1-2] He was the first person to make well-documented, repeated, successful gliding flights beginning in 1891. [Figure 1-3] He followed an experimental approach established earlier by Sir George Cayley. Newspapers and magazines published photographs of Lilienthal gliding, favorably influencing public and scientific opinion about the possibility of flying machines becoming practical.

By the early 1900s, the famed Wright Brothers were experimenting with gliders and gliding flight in the hills.
Wolfgang Klemperer broke the Wright Brothers 1911 soaring duration record with a flight of 13 minutes using ridge lift. In 1928, Austrian Robert Kronfeld proved that thermal lift could be used by a sailplane to gain altitude by making a short out and return flight. In 1929, the National Glider Association was founded in Detroit, Michigan; by 1930, the first USA National Glider Contest was held in Elmira, New York. In 1937, the first World Championships were held at the Wasserkuppe in Germany.

By the 1950s, soaring was developing rapidly with the first American, Dr. Paul MacCready, Jr., taking part in a World Soaring Championships held in Sweden. Subsequently, Dr. MacCready went on to become the first American to win a World Soaring Championship in 1956 in France.

The period of the 1960s and 1980s found soaring growing rapidly. During this period, there was also a revival of hang gliders and ultralight aircraft as new materials and a better understanding of low-speed aerodynamics made new designs possible.

By the late 1990s, aviation had become commonplace with jet travel becoming critical to the world economy. Soaring had grown into a diverse and interesting sport. Modern high performance gliders are made from composite materials and take advantage of highly refined aerodynamics and control systems. Today, soaring pilots use sophisticated instrumentation, including global positioning system (GPS) and altitude information (variometer) integrated into electronic glide computers to go farther, faster, and higher than ever before.

**Glider or Sailplane?**

The Federal Aviation Administration (FAA) defines a glider as a heavier-than-air aircraft that is supported in flight by the dynamic reaction of the air against its lifting surfaces, and whose free flight does not depend principally on an engine. [Figure 1-5] The term “glider” is used to designate the rating...
that can be placed on a pilot certificate once a person successfully completes required glider knowledge and practical tests.

Another widely accepted term used in the industry is sailplane. A sailplane is a glider (heavier-than-air fixed-wing aircraft) designed to fly efficiently and gain altitude solely from natural forces, such as thermals and ridge waves. [Figure 1-6] Older gliders and those used by the military were not generally designed to gain altitude in lifting conditions, whereas modern day sailplanes are designed to gain altitude in various conditions of lift. Some sailplanes are equipped with sustaining engines to enable level flight even in light sink, or areas of descending air flow. More sophisticated sailplanes may have engines powerful enough to allow takeoffs and climbs to soaring altitudes. In both cases, the powerplants and propellers are designed to be stopped in flight and retracted into the body of the sailplane to retain the high efficiency necessary for nonpowered flight.

Self-launching gliders are equipped with engines; with the engine shut down, they display the same flight characteristics as nonpowered gliders. [Figure 1-7] The engine allows them to be launched under their own power. Once aloft, pilots of self-launching gliders can shut down the engine and fly with the power off. The additional training and procedures required to earn a self-launch endorsement are covered later in this handbook.

Glider Pilot Schools

Most airports or glider bases have some type of pilot training available, either through FAA-approved pilot schools or individual FAA-certificated flight instructors. FAA-approved glider schools usually provide a wide variety of training aids, special facilities, and greater flexibility in scheduling. A number of colleges and universities also provide glider pilot training as a part of their overall pilot training curricula. However, most glider training is conducted by individual flight instructors through a membership in a glider club. Also, there are several commercial glider companies located around the United States offering flight training, sightseeing glider rides, and glider towing services.

Choosing the right facility or instructor for your glider training should be both exciting and educational. Many factors need to be considered when choosing the right school, such as location, type of certification, part- or full-time training, and cost. The quality of training received should be the most important factor. Before interviewing schools, potential student pilots should be educated on the types of training curriculums that are available. Pilot training is conducted in accordance with one of two regulatory categories: Title 14 of the Code of Federal Regulations (14 CFR) part 141 or 14 CFR part 61. Students can receive exceptional flight training under either part 141 or 61 training programs, as both have the same teaching and testing requirements. What differs is the way you are taught in order to meet those same requirements.
Glider Certificate Eligibility Requirements

To be eligible for a commercial or flight instructor glider certificate, an individual must be 18 years of age, complete the specific training requirements described in 14 CFR part 61, pass the required knowledge tests, and pass another practical test. If currently a pilot for a powered aircraft is adding a glider category rating on that certificate, the pilot is exempt from the knowledge test but must satisfactorily complete the practical test. Certified glider pilots are not required to hold an airman medical certificate to operate a glider. However, they must not have any medical deficiencies.

The FAA Practical Test Standards (PTS) establish the standards for the knowledge and skills necessary for the issuance of a pilot certificate. It is important to reference the PTS, FAA Advisory Circular (AC) 60-22, Aeronautical Decision Making, Pilots Handbook of Aeronautical Knowledge (FAA-H-8083-25), and the Risk Management Handbook (FAA-H-8083-2) to understand the knowledge, skills, and experience required to obtain a pilot certificate to
fly a glider. For more information on the certification of the gliders themselves, refer to 14 CFR part 21, the European Aviation Safety Agency (EASA) Certification Specifications (CS) 22.221, and the Weight and Balance Handbook (FAA-H-8083-1).

Common Glider Concepts

Terminology
There are a number of terms used in gliding that all glider pilots should be familiar with. The list is not comprehensive, but includes the following:

- **Knot**—one nautical mile per hour (NMPH). A nautical mile is 6,076.115 feet as opposed to 5,280 feet in a statute mile. Rounded that is 6,000 feet, which divided by 60 minutes equals 100 feet per minute (fpm). Hence, this gives 1 on a variometer, which means one knot per hour or approximately 100 fpm. A 4-knot thermal lifts the glider at 400 fpm.

- **Lift**—measured in knots, rising air lifting the glider higher.

- **Sink**—falling air that forces the glider to lose height and is measured in knots.

- **Attitude**—the orientation of an aircraft in the air with respect to the horizon. If the aircraft is diving, then it is said to have a “nose-down attitude about its lateral axes.” Attitude can also be a roll or bank as referenced to the longitudinal axis and pitch up or down as referenced to lateral axis.

- **Pitch**—the up and down movement around the lateral axis for pitch. Increasing the pitch lifts the nose and drops the tail. Decreasing the pitch drops the nose and lifts the tail.

- **Roll**—movement around a line between the nose and tail longitudinal axes. Rolling right drops the right wing while lifting the left wing.

- **Yaw**—a turning motion in which the nose of the aircraft moves to the right or left about its vertical axis.

- **Cable**—steel wire used to connect the glider to the winch. It is approximately 5mm wide and should be avoided at all times until after the correct training for safe handling. There are some winch operations using composite fiber cable that is stronger and lighter than steel.

- **Strop**—a special part of the winch cable that is designed to be handled. The strop has the tost rings that are attached to the glider.

- **Weak link**—a safety device in the winch cable or tow line. They come in various strengths (indicated by their color) and the correct one must be used with a given glider.

- **Elevator**—a moveable section in the tailplane (the small wing at the back of the glider) that effectively controls whether the glider climbs or dives in flight.

- **Thermal**—a bubble or column of warm rising air. Pilots try to find these columns of rising air and stay within them to gain altitude.

Converting Metric Distance to Feet

A glider pilot must also be able to convert distance in meters to distance in feet, using the following conversion:

\[
1 \text{ meter} = 3.2808 \text{ feet}
\]

Multiply the number of meters by 3.2808

To convert kilometers to nautical miles and nautical miles to kilometers or statute miles, use the following:

\[
1 \text{ nautical mile (NM)} = 1.852 \text{ kilometers (km)}
\]
\[
1 \text{ nautical mile (NM)} = 1.151 \text{ statute miles (SM)}
\]
\[
1 \text{ km} = 0.53996 \text{ NM}
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