Understanding Performance Flight Testing

Kitplanes and Production Aircraft

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Contents

CHAPTER 2

General Flight Test Procedures

As with any flight operations, the flight tests described in this book must be conducted within the confines of the Federal Aviation Regulations and the operating limitations of the airplane. None of the tests require exceeding either of these restrictions. However, it is essential that the pilot observe all of the rules. The airspeed calibration test, for example, demands a low altitude, but FAR 91.79 regarding minimum safe altitudes should be followed. Likewise, a safe terrain clearance altitude should be attained before performing tests such as stall speed. It would be wise to observe FAR 91.71 dealing with aerobatic flight for all altitude flight tests, even though many do not necessarily involve abrupt altitude change maneuvers.

All test flying should be performed in good VFR weather; that is, not just marginally VFR. The tests should be conducted in non-congested airspace. Even so, it is particularly important to be alert for other traffic. The nature of test flying requires a pilot's concentration on the instrument panel in order to hold exact conditions, much like IFR flight. The observer(s) will also be concentrating on reading instruments, recording data, or spotting landmarks. It is a very good idea to also carry one more crew member than necessary for carrying out the tests, if space permits. This person can serve as a traffic spotter and should be someone familiar with this sort of activity.

If some crewmembers are not pilots or not accustomed to flying in light aircraft, they should be thoroughly briefed on safety and emergency procedures. Make sure that they understand how and when to use seatbelts. It is also wise to brief them on the meaning of warning horns, such as stall and gear warnings which may sound, or other unusual situations that may occur during the course of conducting some tests. This helps to relieve much anxiety in such situations and makes the testing easier and more pleasant. A calm data-taker also records much more accurate information than a nervous one.

Methods of Obtaining Data

More than one crewmember is required for most tests. Make sure that the duties of each are understood prior to takeoff (Fig. 2-1). The pilot needs to concentrate on accurately flying the airplane. A second crewmember may need to continually observe instrument indications. A

Fig. 2-1. Planning and coordinating duties among crewmembers prior to flight test.

third person is often desirable to record data read out by the observer. In other tests, landmark spotting is required by one person. Another may serve as both instrument observer and data recorder in such situations. Usually, three people are required to comfortably perform the tests. Most tests could possibly be performed, however, by two and would have to be in the case of a two-place airplane.

Data are obtained, in most cases, from the standard instruments installed in the panel. If the observer is not a pilot, make sure that he or she is familiar with the instrument indications. Also, make sure that everyone in the crew understands what data will be taken and in what order. It would be wise to rule off columns on a sheet of paper to be used as a data sheet. Label the column headings for the data to be taken in the order in which it will be read. A well-coordinated effort among pilot, observer, and recorder will make testing much easier and avoid confusion later when the data are reduced and plotted. Appendix A contains a typical data sheet (Figs. 2-2 and A-2).

Practically all tests will require an airspeed value. Usually, the true airspeed is ultimately required. However, the value as read from the air speed indicator is the indicated airspeed (IAS). It is the value that you must start with in order to calculate a true airspeed. Methods for correcting to calibrated and true airspeed are discussed in Chap. 3. Some airspeed indicators are calibrated in knots and some in miles per hour (Fig. 2-3). Other indicators have both scales. It doesn't really matter which scale is used as long as you are consistent. If both scales are indicated, it is probably best to read the outer scale, usually in statute miles per hour, simply because the graduations are larger and, hence, the reading will be more accurate. If airspeed information is desired in knots, miles per hour readings could be converted later.

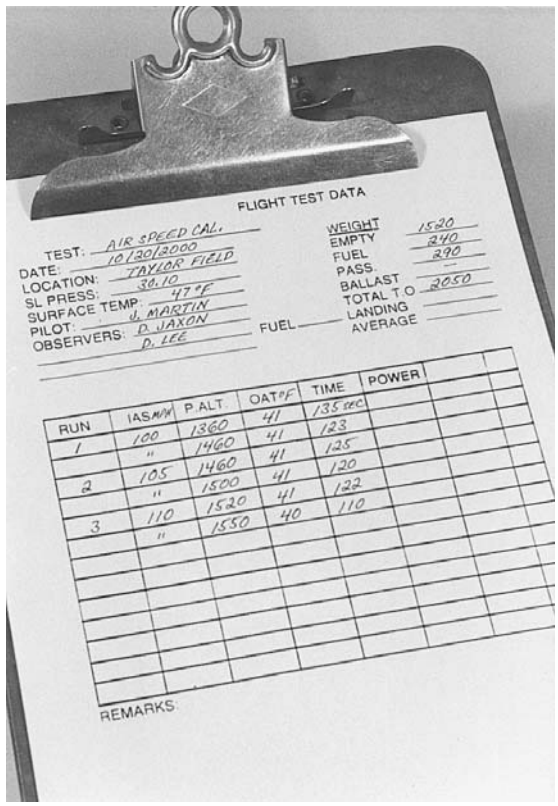

Fig. 2-2. Data should be recorded on a formal data sheet, as provided in App. A.

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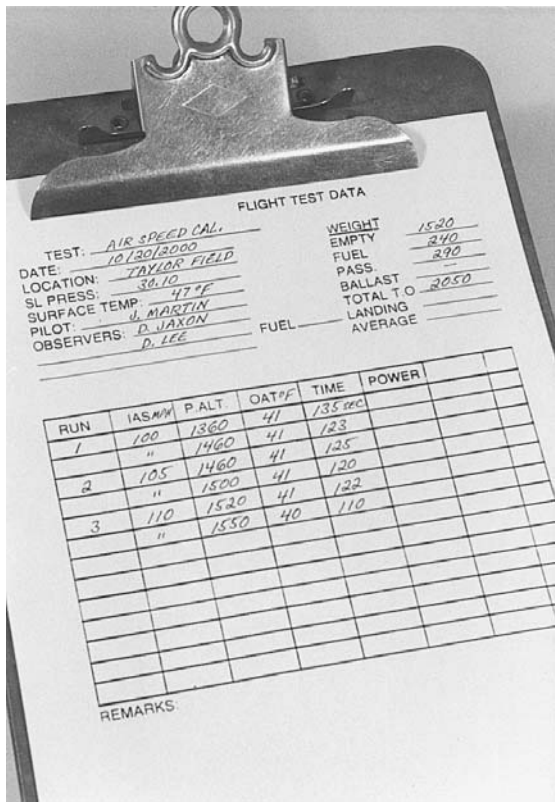

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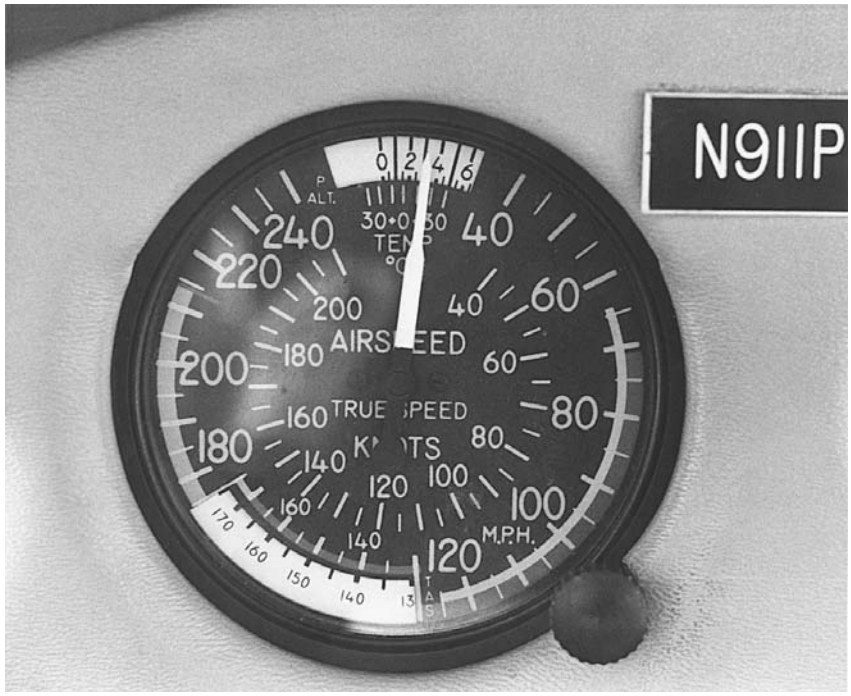

Fig. 2-3. Typical airspeed indicator. When two scales are given, the outer scale (mph here) should be used, since it is easier to read accurately.

Performance of the airplane is also highly dependent on the density of the atmosphere as discussed in Chap. 1. Since density can't be measured directly, we depend on measuring temperature and pressure in order to calculate density. Pressure is actually measured in terms of pressure altitude. The altimeter is used for this purpose and indicates in *pressure* altitude whenever the barometric pressure in the altimeter window is set to 29.92 in Hg. Since pressure altitude (not true altitude) is what is required in all fight tests, the altimeter should always be set at 29.92 during the testing (Fig. 2-4). Takeoff, landing, and other flight operations in getting to and from the test area, however, require a knowledge of *true* altitude. Therefore, it is best to set the altimeter to the proper barometric pressure at the time and location (or field elevation) prior to takeoff. After takeoff and climb to the test location, the altimeter can be reset to 29.92. It is, also, a good practice to record the true pressure so that the altimeter can be reset