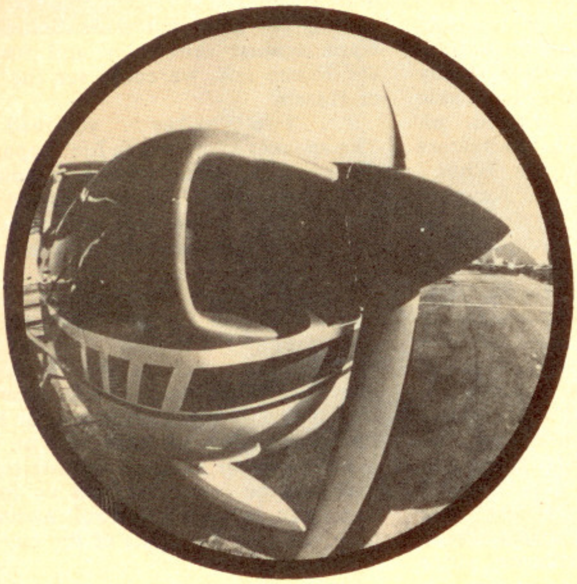
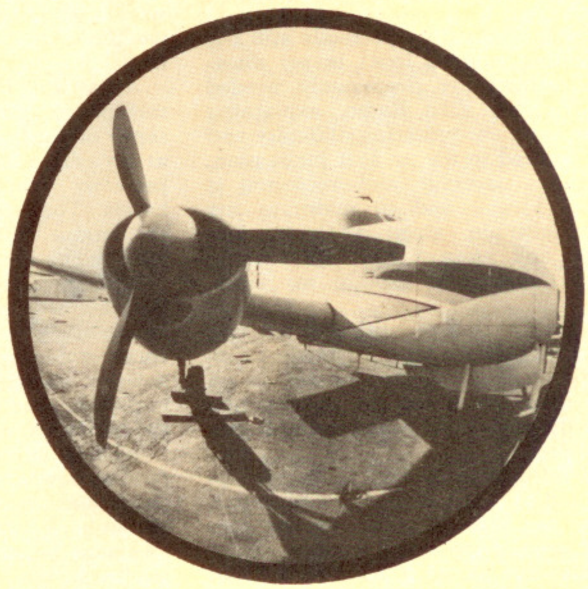
ARE 'SINGLES' SAFER THAN 'TWINS'?





Photos by the author

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■■ Some few years after the Brothers Wright did their notable thing at Kitty Hawk, somebody took a notion to hang an extra engine on an airplane—the idea being, presumably, that, among other supposed advantages, if one engine should quit, the other would see you safely to the nearest airport or facsimile thereof.

History may be a bit vague as to just who deserves credit for this notion, but time has done the idea itself proud. It finds more support today than its originator probably ever dreamed of. Insurance companies, for example, will ask a lot less premium money if your airplane sports two fans. Some FBOs will refuse to rent you anything but a "twin" if your aim is to fly IFR, or in the dark, or over any sizable stretch of mountains or water. And even the FAA seems to endorse the idea, since, under FAR Part 135, it holds a much tighter rein on air-taxi IFR-ing in "singles."

There can be no question that having an extra engine on a plane is a factor clearly favoring safety, at least in principle. Yet much of what is said about twin-engine safety today is little more than old wives' tales and wishful thinking.

Somehow, the twin's potential for staying aloft on only one engine has been translated over the years into the idea that the all-around safety of any lightplane is directly related to the number of engines it has. Certainly, a large segment of the general public believes this, and, disturbingly enough, so do a lot of high-time pilots.

Unfortunately, it simply isn't true.

According to a recently released study by the National Transportation Safety Board (NTSB), twins crashed only about half as frequently as singles. The study, which concerned itself with some 22,355 non-airline accidents over the period 1965 through 1969, disclosed that, for every 100,000 hours flown in a single, there were 4.6 accidents resulting from engine failure, while the rate for twins was only 2.3 per 100,000 hours. All well and good—except that 22.9 percent of twin accidents were fatal, while only 5.4 percent of single accidents ended in fatalities. Or, if you will, the single-engine aircraft was more than four times as safe when it came to preserving the whole skins of its occupants.

Working from three other sources —FAA's 1969 *Statistical Handbook of Aviation* and *Census of U.S. Civil Aviation* and NTSB's 1969 *Annual Review of Aircraft Accident Data, U.S. General Aviation*—one finds some equally interesting data.

In this case, our focus is on accidents to singles and twins occurring in a single year, 1969. No so-called ground incidents are included, and no emergency landings from which both planes and occupants emerged unscathed.

Since our concern is strictly with the relative virtues of singles and twins, the figures derived from these sources do *not* (as did the NTSB study cited above) include accidents that resulted from pilot error—only those that resulted from "losing an engine" as a consequence of failure of the engine itself or one of its components. Multi-engine training accidents are also excluded; while they may sometimes result from actual loss of an engine, too often it is impossible to pinpoint the cause. The airplanes involved in these calculations are restricted to modern planes used for fairly conventional purposes—i.e., no "dusters," no weather or other research planes, no "experimental" birds.

In this frame of reference, where total accidents in 1969 are concerned —those that damaged only planes, *plus* those that damaged both planes and their occupants—the twin comes out well, paralleling the accident-rate picture shown by the five-year NTSB study. Specifically, the figures derived from our three sources show one accident in twins, resulting from a lost engine, every 146,000 flying hours—as compared with one in singles every 105,000 hours.

But when only *serious* accidents are counted—those in which people as well as planes were crunched—the picture reverses somewhat dramatically. In twins, we find one such bad one, following a lost engine, every 443,800 hours; in singles, only one every 1,011,250 hours. In other words, your chances of being hurt or being put away for good seem to be about 2.27 times greater in twins.

Both these calculations and those derived from NTSB's five-year study are based on dated figures, and the situation may have changed for the better since 1969. However, preliminary studies for 1970 and 1971, according to NTSB, show an average decrease in all accidents, from all causes, of only 177. It seems unlikely, then, that the twins-versus-singles picture has changed significantly, even now.

The most curious thing in the statistical picture at hand—whether that picture is derived from the three sources just cited or from the earlier mentioned five-year study—is that singles get crumpled anywhere from 40 percent to 100 percent more often than twins, yet do far less damage to their pilots and passengers. The five-year study, taking pilot error in relation to engine and fuel management into account, comes up with the higher percentage. But even when this type of pilot error is eliminated from our calculations—even when the cause of a crash is engine failure, pure and simple (which the five-year study found to be the case in over 44 percent of the accidents examined)—there remains a striking implication that somehow singles are safer when and where it really counts.

The long-accepted idea of twin-engine safety stands in contradiction to that implication and, at the very least, seems to demand some sort of explanation.

The first possibility that comes to mind is that perhaps twins, on the average, carry more people per flight; thus, while they "go in" less often than singles, more people are exposed to death and injury when they are involved in an accident. If so, then the statistics might be giving a false picture, and twins would still be safer on a per-passenger-mile basis.

Well, while there are no reliable statistics on passenger-miles flown in general aviation, FAA estimates set the number of people per flight, for both twins and singles, at two-and-a-fraction. It would seem, then, that on the average not more than three people are involved when a plane, either single or twin, gets bent following an engine failure.

What about the possibility that twins are all heavy, high-performing planes and hence get crumpled more seriously in crash-landings than do lighter, slower singles?

While there is some merit in this idea, a good many singles are heavy high-performers, too. Some, in fact, perhaps outweigh and outperform some twins. Yet even compared with other singles, they do a superior job of preserving the whole skins of their occupants—based on certain of our same sources and calculations, in fact, about 1.5 times better for singles over 200 hp than for those with less.

Still, if there is any substance to the statistical implication that singles are safer than twins when it comes to preserving life and limb, singles must have virtues unpossessed by twins, and conversely twins must have vices unknown to singles. And such, indeed, seems to be the case.

When a single loses an engine, it still has a lot going for it, even if it's a big single. Compare, for example, a high-performance single with a light twin. While the single comes within 20 percent to 25 percent of the twin's speed, range, ceiling and useful load, it has a slightly better glide-ratio (assuming "both out" for the twin. Thus, if the single quits in flight, its pilot has a bit more time and reach to use in finding a suitable spot. (A smaller single has, of course, a *lot* more time and reach, but let's stick to our comparison.) On the way down, the high-performance single can approach that spot at 95 mph IAS, compared with 108 mph for the light twin *with one still turning*. The single driver, therefore, has more time to plan his approach. And if the spot turns out to be rock-strewn, potholed, or plowed, the single will touch down almost 10 mph slower. Finally, if the spot is a "tight squeak," the single can get in nearly 200 feet shorter.

There's much to be said, then, for the idea that singles, especially lighter singles, fare better physically in forced landings. Still one could argue that the above comparison is a bit like matching apples and bananas, so perhaps the real virtue of the single lies elsewhere than in the laws of aerodynamics—perhaps, say, in human psychology.

Aware that he has only one set of jugs, the average single driver, even if he also flies twins, seems more inclined toward caution, opting for higher altitudes at night and over mountains or water, circumnavigating really bad terrain altogether, and generally acting as if his single fan might indeed quit at any moment. Conversely, the average twin driver, even if he also flies singles, seems inclined to put his faith in his extra engine. Hence, when it gets suddenly quiet in a single, its pilot is more likely to be prepared. The twin driver, though—even with one engine still churning—can easily find himself on the way into a night-darkened mountainside (thanks to having compromised on altitude), or in for a swim, or in a panic to find a suitable spot ("just in case") down among all those crags and boulders and trees. Even if he gets to an airport, he may be in for a new experience, since nothing in the "regs" calls for training in landing with one engine actually dead and its propeller feathered. And if *both* engines quit on him, he's really in a bind, for in all likelihood he has never landed before with *two* out.

So much for the virtues, both aerodynamic and psychological, of singles. What about the vices of twins?

As reliable as they are, modern airplane engines still quit, as witness our statistics. The twin, having a "spare," remains airborne in most instances—which may explain why twins get crumpled less often than singles, but fails to explain why they seem to damage more people. It's fairly common knowledge, though, that most accidents happen when aircraft are approaching or departing from airports, and that many of these mishaps are caused by power loss.

If such fate befalls a single, the bird may get dented, but, thanks to its aforementioned virtues, its occupants stand an excellent chance of walking away. If such fate befalls a twin, no doubt it most often completes its landing satisfactorily—or, on departure, hobbles around the patch, or makes a one-eighty, and gets back in all right. But when it *doesn't* . . . ? Sudden adverse yaw, pitch and roll—all the unsavory traits of a twin that's just "lost one"—combine with low speed and low altitude to create a situation that too often ends with the plane "going in" nose first, or topside under, with generally catastrophic results.

Approach-departure accidents, then, may account for much of the statistical disparity between twins and singles when it comes to keeping people intact. Significantly, the NTSB's five-year study concludes, in this respect, that upon engine failure pilots should concentrate on avoiding, among other things, "a stall spin, stall spiral, [or] stall."

But regardless of when and where it happens, losing one of two engines still contributes to that disparity because of yet another vice of the twin. Beyond the unsavory engine-out traits mentioned above, a twin reduced to flying on one set of jugs is, in effect, actually flying on *less* than one. At a recent West Coast safety seminar, an FAA spokesman pointed out that, at sea-level density-altitude, a twin losing one engine loses 50 percent of its power—and 78 percent of its performance, relative to rate of climb. And at a density-altitude of 5,000 feet, that loss of performance becomes 88.5 percent.

In short, the twin's "spare" engine is not a spare at all; rather it's a vital component of the aircraft's total power system, the loss of which is in many ways more critical than simple engine failure in a single, owing to sharply decreased overall performance. True, the twin can still stay aloft, but only by dint of skillful handling. Add to this the potentially treacherous effects of sudden asymmetric thrust and the vices of the twin become all too apparent—as does the probable reason for the statistical disparity between singles and twins in the matter of deaths and injuries.

"The trouble with twins," an old cliché has it, "is that there's twice as much to go wrong." Actually, there is twice as much, if not more, to cope with if things do indeed go wrong. Which is why twins demand more in the way of training, pilot proficiency, "backup" devices, and anything else conducive to better behavior when an engine quits. It's why, too, the pilot who takes his multi-engine training lightly, or later neglects periodic reviews of engine-out procedures (especially "under the hood," if he flies multi-engine IFR)—and the buyer who stints on having two alternators and two hydraulic pumps—are both asking for trouble.

And, old wives' tales and wishful thinking aside, it is also why there's a lot more to safety in flying than the question of how many engines an airplane has. □