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The  
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pilots and  
aircraft  
owners

# The Aviation Consumer®

## LEGACY LSAs

You don't have to spend north of \$100,000 for an LSA-compliant two-placer. Cubs, Champs and Luscombes cost a fraction of that...page 4



Oxygen gadgets...page 13



Altitude encoders...page 9



Batteries compared...page 16

**3 LETTERS:** *WxWorx* winds; *JPI's* non-response; *CamGuard* and deposits

**12 WHAT'S NEW IN O2?** *Upgrading those old flowmeters for a start*

**21 PAINT JOB GONE BAD** *Doing paint and interior at the same time is a bad idea*

**9 ALTITUDE ENCODERS** *Why proactive replacement makes sense*

**16 AIRCRAFT BATTERY FLYOFF** *Concorde sealed models win in a walk*

**24 USED AIRCRAFT GUIDE** *Why the Piper Arrow is a popular starter retrac*



- + Concorde's sealed RG25 is the slam dunk top aviation battery.
- + Concorde's flooded and sealed products have higher capacity than Gill's.
- + Gill has a longer warranty on its 12-volt batteries than does Concorde.
- Tests and owner surveys show that Gill sealed models have poor longevity. We can't recommend them.

# Aircraft Battery Trials: Concorde Sealed Wins

*In flooded designs, Gill and Concorde are close. But owners complain—and our tests show—that Gill sealed models aren't as long-lived as the Concordes.*

by Kim Santerre

To hear some owners tell it, buying an aircraft battery is like playing the lottery: You buy your ticket, cross your fingers and wait around to see what happens. Some owners—those lucky enough

*Testing setup, below, included multiple capacity and load testing trials.*



to get five years out of a battery—ask what's the big deal? But the poor sap who buys two batteries in as many years has a more cynical view. Is this any way to run an industry? We're not sure, but our tests and owner surveys reveal a wide disparity—not to mention a vein of customer ire—in battery performance and longevity. In this article, we'll examine aircraft battery options to make sense of it all. Upfront, we'll say that the smart money rides on sealed battery designs from Concorde, with flooded models from Concorde as second choice and Gill flooded products a close third.

The quintessential old-fashioned battery with its need for cleaning, maintenance and periodic addition



of distilled water, is called a flooded cell. This battery type has the potential to leak corrosive acid or vent corrosive fumes, hence the battery box should be carefully maintained. A flooded battery is also more prone to vibration damage than a sealed battery. A flooded battery loses 1 to 1.5 percent of its charge per day sitting in your airplane when not on a trickle charger.

## FLOODED OR NOT?

A flooded battery's main strength is that it has slightly greater resistance to excess charging abuse compared to a sealed battery. Liquid electrolyte driven off by excessive charging can be replaced, within limits. A flooded cell is also less sensitive to cheap battery chargers, as long as they don't output more than 4 amps or so.

If a flooded battery is put into initial service without bench charging, allowing the airplane's charging system to bring it up, it will suffer reduced capacity and shortened life. A sealed battery arrives charged, but should be fully charged on the bench, too. In fact, Gill sealed batteries have a "charge-before-use" sticker on them.

Current state of the art for aircraft batteries is the so-called sealed battery, also known as a valve-regulated lead acid battery (VRLA) or an absorbed glass mat (AGM) battery. This refers to the design of the internal active and plate insulating materials. Since there's no liquid inside, these batteries can be installed on their sides or upside down, which they may very well be in a home-built. Some aircraft are authorized to

## BATTERY TEST SUMMARY

BRAND	MODEL	TYPE	VOLTS	PUBLISHED AMP/HR	CAPACITY TEST %	FULL WEIGHT	CCA	LOAD TIME**		REMARK	CATALOG PRICE
								11 Amp	20 Amp		
CONCORDE	RG-25	SEALED	12	22 AMPS	102	22.7	225	N/A	59 MIN	STANDARD	\$134
CONCORDE	RG-25XC	SEALED	12	24 AMPS	103	23.5	350	N/A	65 MIN	PREMIUM	\$150
GILL	G-25S	SEALED	12	18 AMPS	98	25	300	N/A	51 MIN	STANDARD	\$134
CONCORDE	RG24-11	SEALED	24	11 AMPS	102	26.5	160	57 MIN	N/A	STANDARD	\$308
CONCORDE	RG24-16	SEALED	24	13.6 AMPS	101	29.5	200	66 MIN	N/A	PREMIUM	\$380
CONCORDE	CB24-11	FLOODED	24	10 AMPS	103	28	140	53 MIN	N/A	STANDARD	\$255
GILL	G-242	FLOODED	24	10 AMPS	102	25.7	150	51 MIN	N/A	STANDARD	\$260

## LONG-TERM TEST ON 28-MONTH OLD BATTERIES

CONCORDE	CB35	FLOODED	12	29 AMPS	72	28.5	325				
CONCORDE	RG35S	SEALED	12	29 AMPS	87/96*	29.5	390				

- \* The long-term capacity test indicates before and after deep anti-sulfation treatment by HiTec heavy duty prototype desulfator.
- The two long-term test Concorde's are 28 months old and abused intentionally. The two comparable Gill's died at 12 and 18 months.
- The FAA capacity test standard is 80 percent of rated capacity to pass. International standard is 85 percent.
- A 24-volt battery uses one half the amps to produce the same power (watts) as a 12-volt battery.
- Batteries selected for testing are comparable for old and new Cessna 150/172/some 182s, and similar engines in other brand aircraft.
- Premium Concorde brands are called "Platinum" line and have more lead and greater capacity than standard version.
- The \*\* indicates a fixed load to either an 11 or 22 volt cutoff was done. Avionics work more reliably in this range. The capacity test cuts at 10 or 20 volts.



use only a sealed battery because of location in the airframe. Some dual battery installations use both a sealed and a flooded battery, capitalizing on the benefits of each. Check the airplane's documentation for battery requirements—they may vary considerably. Some sealed batteries aren't AGMs, but not in certified aviation batteries. Such batteries are



sometimes called dry cells, a term that Odyssey battery seems to fancy. Odyssey is a brand popular among homebuilders, but approved only for a few certified airplanes. The term "dry cell" is a misnomer, in that these batteries are saturated with liquid electrolyte, but not enough to spill if the top was forced open. The electrolyte is absorbed into the internal matrix—sort of the way a sponge holds water, but tighter.

### TOP PERFORMANCE

Sealed batteries perform best when a proper bench charger is initially and periodically used, such as the aviation models from VDC Electronics, which have a multistage charging profile that's voltage optimized for aviation AGMs or flooded cells.

Periodic bench charging is not a requirement with

either flooded or sealed batteries, but it has been empirically

*Both Concorde and Gill flooded models performed well, but Concorde delivers more amp-hours for equivalent size and price.*

shown that such charging is beneficial to maintaining a battery in peak condition for any battery in an airplane that's not flown frequently. An AGM will out-gas if charged excessively, say over 14.9 volts and several amps for an extended period in a 12-volt system. That means your charging system must be up to par and properly controlled to get reasonable life from these batteries. Once they out-gas, they're permanently damaged. (In recent torture testing of batteries, we used 15.2 volts for several hours and damaged a Gill sealed battery, reducing its capacity. However, a Concorde similarly treated suffered no ill effects.)

Concorde recommends a charging system of at least 35 amps for use with their sealed batteries because an AGM can cause a smaller charging system to run hot by accepting a charge faster than the alternator can deliver it.

The big upside to an AGM battery is faster recharge. There's almost no limit to recharge current from any charging system, so they fully recharge shortly after the airplane is in cruise as long as it has a healthy charging system. An AGM also provides more starting current on a size-for-size basis for better starts. That's because it has less internal resistance than a flooded battery of similar capacity. Further, AGM batteries perform significantly better than flooded models in cold temperatures and are much more resistant to loss of charge. Again, this is primarily due to low





*One way to test a battery's mettle is to charge it with a range of chargers, including automotive types that simulate a charging system running at overvoltage.*

irical method as long as the numerical parameters are met.

internal resistance. Before discussing our specific tests, a word about battery capacity tests. These are required periodically to assure that an aircraft battery is airworthy which, as defined by the FAA, means the battery must last at least 30 minutes in an emergency avionics configuration with the charging system inoperative. This is one of the most ignored requirements in general aviation because many shops don't have, nor do they want to invest in, the equipment for capacity testing.

The test parameters are found in the instructions for continuing airworthiness (ICA) the FAA requires the battery makers to provide. These ICAs have been included with new batteries for the past seven years. For simplicity, Kelly Aerospace and now Hitec have developed dedicated, automatic capacity testers. Concorde and Gill sell the Kelly-made model under their own brand names for about \$950. (Concorde loaned us one for our testing.)

The capacity test can use any em-

The dedicated tester is a push-button, walkaway design with the capacity percentage displayed after the tester automatically shuts down at the proper cutoff voltage.

## OUR TESTS

Worth noting here is that for us, battery testing is not a one-shot deal. We maintain a battery of batteries for long-term tests of various kinds, including overcharge abuse testing. For this round of trials, the models we tested are described in the chart. We obtained through normal supply channels four Concorde models (two 12-volt and two 24-volt) and one each 12- and 24-volt Gills. We bought the Gill batteries while Concorde allowed us to obtain their products through suppliers for credit. Concorde also loaned us a capacity tester.

We test verified the manufacturer's amp-hour ratings after they were conditioned with several charge/discharge cycles. We then conducted the FAA charge/discharge capacity tests four times and averaged the results.

A new battery should have a capacity of about 100 percent. The Gills started over 100 percent, but gravitated to 100 percent or a little less with each discharge cycle. (The Concordes actually got better each time and the Gills just a little worse.) By the third test cycle, results were at 95 to 102 percent for all. The Concordes had less variation and incrementally improved, which is desirable. The Concordes we tested had greater amp-hour capacity than the equivalent Gills. The Gill G25S, for instance, is 18 amp-hours while at the same price and for the same application, the Concorde RG25 has 22 amp-hours. The more amp-hours the better, since it means greater starting and emergency capacity.

## LONG TERM TESTS

We put an overzealous charger to good use to intentionally abuse each of the 12-volt Concorde and Gill sealed batteries. The Black and Decker multi-stage charger has a cutoff voltage that's too high (15.2 volts) and a float that's also too high, at 13.5 volts.

This high charge voltage is OK for a rare equalization session to shock a weak flooded deep-cycle battery back to its previous capacity, but if used on a regular basis, it does the opposite by causing plate damage. It will diminish capacity each time it's used depending on the duration of charge, current and condition of the battery. If it's used on a sealed battery, the damage is permanent. Outgassing from excess voltage is not reversible in a sealed battery.

We tortured a Gill G25S sealed battery with two recharges from deep discharge tests up to 15.2 volts. The two sessions took about 6 percent in capacity loss over the baseline average from the three previous capacity tests. The Concorde RG25 got the same treatment, but only continued to improve. It was obviously more tolerant of this abuse.

We also tested our two 28-month-old Concordes' capacities following a regimen of benign neglect of charging them only every six months. (The two Gills we had obtained at the same time had died at 12 and 24 months.) The Concorde RG35 made 72 percent on the first try and an astounding 96 percent after one 24-hour desulfation with a prototype industrial desulfator made by Hitec and sold through Wilco (316-943-9379) for about \$950.

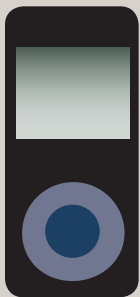
We tried a cheaper desulfation approach on the old Concorde CB35 using the unique "equalization" mode of the Black and Decker charger. It actually reduced capacity 5 percent and made a mess of expelled electrolyte in the process. Not recommended except as a desperation measure for your lawn tractor battery. Chargers equipped with built-in desulfators have yet to prove themselves to us.

## RECOMMENDATIONS

If you want to stick with a flooded battery, have a Gill as the original equipment and if you're satisfied, stay with it, especially if it's a 12-volt. These batteries perform well and the warranty is longer than Concorde's. If you retain the original battery,

## HEAR MORE HERE

Why don't aviation batteries last longer? We posed this question and others to Concorde's Skip Koss. Hear his answers in this podcast, which you can find on our online



publication, [www.avweb.com](http://www.avweb.com). Click on the podcast button, then "more podcasts" and scroll down the index to the Concorde battery podcast.

technically, no capacity test is required. But we recommend doing one anyway; it's cheap insurance against a failure.

Both our long- and short-term tests have shown the Concorde to be a better battery, flooded or sealed. They have greater amp-hour ratings than the equivalent Gill and at competitive prices. Concorde's sealed technology is superior, according to our testing. And even our long-term test CB35 flooded battery had off-the-shelf performance of 87 percent capacity after 28 months of neglect.

One obvious workaround to the annual capacity test is the sealed Concorde, which is so robust that the manufacturer allows it to go two full years initially with no capacity test needed. Then test once a year thereafter, so you can go at least three years with only one test. In our view, this puts the Concorde sealed battery into the slam-dunk category as the best choice and the best value.

We attempted to contact Gill via fax and e-mail with technical questions several times during our testing program, but the company was unresponsive on the specific issues we raised, replying that it doesn't discuss technical details. We did point out some shortcomings in their technical documentation, however, which Gill did respond to and said they would correct. But overall, we wish Gill were as responsive as Concorde, which buried us in technical data.

For more detailed information on battery capacity, maintenance and technology, see our sister magazine, *Light Plane Maintenance*, which has extensive coverage in its January 2008 issue, including a 60-second ramp capacity check anyone can perform.

*Kim Santerre is editor of Aviation Consumer's sister publication, Light Plane Maintenance.*

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Gill Batteries  
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Odyssey Batteries  
888-379-2555  
www.odysseybatteries.com

## REPORTS FROM THE FIELD

# SURVEY: OWNERS UNHAPPY WITH LONGEVITY, WARRANTY

To leaven our test bench findings, we asked owners—662 to be exact—to tell us about their operational experiences with aircraft batteries. In general, survey respondents seemed to bear out our empirical testing, which is to say Gill sealed batteries did poorly against the Concorde.

The survey was published on our online publication, [www.avweb.com](http://www.avweb.com). We asked pilots and owners what types of batteries they had, how long they'd been in service and how they've performed. Of the 662 who completed the survey, 92.3 percent chose either Gill or Concorde. Other brands were used by homebuilders, who have more choices with non-PMA or OE batteries. The most frequent minority choice was the Odyssey brand, which is approved only for a few certified airplanes, including the Piper PA-18 Super Cub. It's a popular, well-regarded battery in Alaska and among homebuilders.

Our survey population split 37.5 percent for Concorde and 54.8 percent for Gill, which has been in the aircraft battery business for decades and still dominates sales. Gill is also OE on many older aircraft, while Concorde has an STC available for most aircraft and has thus made market inroads against Gill.

The inertia of staying with what you have tends to be human nature until you're unhappy, as many Gill owners told us they were. What influences owners to pick one battery over another? More than a quarter (26.3 percent) said they just stayed with what they had, 14 percent were influenced by press reports and/or advertising while 25.4 percent

followed the recommendation of a friend or mechanic.

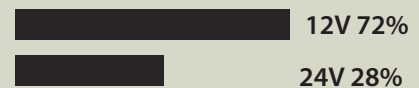
Sealed batteries are gaining a greater foothold in the market, which we think is good, given how they've improved during the past 10 years. Sealed batteries account for 46 percent of the market, according to our survey.

*'report' continued on following page*

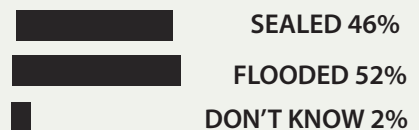
### What brand battery do you own?



### Is it a 12 or 24-volt system?



### Is it a sealed or flooded cell?



### If the battery failed in under 24 months, what brand was it?\*



*\*These percentages based on 273 owners who said their batteries failed in under 24 months.*

### If the battery failed in under 24 months, what type was it?\*



### If applicable, was the warranty service satisfactory?



*\*These percentages based on 175 owners who said their batteries qualified for warranty.*

## REPORTS FROM THE FIELD, continued from previous page

How long do batteries last? Some 12 percent of owners had batteries in service over 36 months and 18.8 percent have had them for over 48 months. Some claim up to seven years, which is astonishing and too long to safely keep a battery in service. Our previous research shows that most aircraft batteries have an average life of 36 months, after which they won't pass a capacity check, meaning that many owners are flying batteries with little or no emergency capacity—a bad thing.

We asked how many batteries had failed in under 24 months. We were stunned to learn that 44 percent experienced a failure in under 24 months, which we think is shameful for the battery makers. Concorde was the clear winner here, but still had a 21.8 percent failure rate. Gill was far worse, at 58.7 percent.

This means that if you buy a Gill battery the chances of it seeing its second birthday are not especially good, at least according to our respondents' experience. And some were vocal about their ire: "I will never purchase a wet cell battery again," a Piper Comanche owner told us. "Three Gill batteries in five years and the last one leaked, removing the paint from the fuselage vent area—

—this was the breaking point. The new Concorde has more cranking amps will hold a charge for a longer time," he added. We heard many such complaints about Gill batteries. But Concorde didn't escape unscathed: "I have had three Concordes fail in less than five years," wrote another owner.

The failure rate in this group for 12-volt versus 24-volt batteries was 45.5 and 38.8 percent, respectively. At a glance, that doesn't make sense because 24-volt batteries have twice as many cells and double the connections. However, 12-volt airplanes represent the older segment of the fleet, which may mean they fly less often and are more likely to have substandard charging systems. Such factors can contribute to early battery failure, particularly the low flying hours.

The sealed battery was clearly the winner in that it failed 40 percent less often than conventional flooded cell designs. That's probably because sealed batteries are less subject to sulfation when they sit for long periods without being flown or charged. (A sealed Concorde self discharges at about one-tenth the rate of the flooded version.) With respect to warranty service on the 24-month failure batteries, twice as many



expressed an unsatisfactory warranty service experience as satisfactory. We weren't able to determine which manufacturer had better or worse warranty response.

Thirty two percent told us they use a battery charger at least occasionally. The frequency of flying—or lack thereof—may reflect the impact of high of fuel prices or factors unknown, but many aircraft aren't flown much. Of 662 pilots, more than a third—38 percent—said they flew fewer than 100 hours a year and 21 percent fly fewer than 50 hours. Disuse is hard on a battery and harder on flooded designs than on sealed, something our survey bore out.

If you don't fly as often as you'd like—and most of us don't—an investment in a tender-type charger will pay off. For more on that topic, see the June 2007 issue of *Aviation Consumer*.



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