Light Sport Eligible Aircraft
Where the Numbers Come From

March 14, 2019

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Light Sport Eligible Aircraft – Where the Numbers Come From

The website – and this document – were created by Steve Beste working with Dan Johnson.

1. Background

1.1 Purpose

The website analyzes the FAA’s1 aircraft registration database with two goals: to highlight the growth in light sport and similar aircraft registrations since the Light Sport Aircraft (LSA) program began in 2005, and to spot the current industry leaders. This information will be useful to manufacturers, dealers, buyers, owners, and the government.

1.2 What Aircraft Do I Count?

I count only these aircraft:

1. **Light Sport Aircraft (LSAs)** regardless of how they are registered (SLSA, ELSA…).
2. **Kit-built aircraft** that are similar to the LSA models. Thus, the Sonex is here even though it has never been an LSA.
3. **Modern-style gyroplanes.** The FAA does not currently allow gyroplanes to be LSAs, but I include certain models here that I think *might* become LSAs in the future. To do that, I first limited the list to "modern-style" models, by which I mean the design that has proven so popular in Europe. The hallmark of this design is the large horizontal stabilizer well aft as well as – to be honest – a certain look. Second, I wanted models that are participating in the current boom in gyroplane registrations in the U.S.

1.3 What Do I Not Count?

1. Any aircraft built before 2005, when the first LSA model appeared.
2. Any aircraft that doesn’t fit the LSA rules – typically by being too heavy or too fast.
3. Two-seat ultralights grandfathered-in before 2008 as part of the launch of the LSA program – technically, those in the FAA database where Certification = “48A”. However, I *do* include 48As for models that I know were never sold as ultralights. In these cases, the 48A has to be a miscode in the database.
4. Standard-category aircraft that can be flown as LSAs, such as early-model Ercoupes.
5. Earlier-design gyroplanes.

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1 FAA = The Federal Aviation Administration, the United States government agency that regulates civil aviation in the U.S.
Examples of the Aircraft Being Counted

**LSA Airplane**
Flight Design CTLS

**LSA Airplane**
M-Squared Breese LSA

**LSA Trike**
Evolution RevoLT

**Modern-style Gyroplane**
DTA J-Ro

**LSA Powered Parachute**
Powrachute Airwolf

**LSA Powered Parachute**
Six Chuter Legend
2. Where the Data Comes From

2.1 Step One – Get Data

My analysis begins by getting four data sources:

2.1.1 The FAA Aircraft Registry
The main data source is the FAA’s registry of all N-numbered aircraft, almost 300,000 of them.

FAA processing times. New aircraft like experimental and light-sport that have not been assigned a registration number are generally worked within 3 workdays because they cannot obtain an airworthiness certificate or be operated until the aircraft is registered. Imported aircraft are worked within one day. For ownership transfers, expect a 36 workday cycle time before the transfer shows up here.

The FAA publishes the registry online at:

https://www.faa.gov/licenses_certificates/aircraft_certification/aircraft_registry/releasable_aircraft_download/
Inside the downloaded zipfile are two comma-separated text files that I load into my database software, Microsoft Access:

1. **MASTER** – This contains one row for every aircraft in the registry. The key is the N-number.

2. **ACFTREF** – This contains one row for every aircraft make and model in the registry, each with a unique “CODE”. For example, 05617ML is the Pipistrel Virus 912:

   ![ACFTREF Table](image)

   The CODE field links back to the MASTER table (where the CODE value shows up in the field MFR MDL CODE). Following that link gives us the seven Pipistrel Virus 912s in the MASTER table:

   ![MASTER Table](image)

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### 2.1.2 The FAA’s Current List of Approved LSAs

As manufacturers get approved to build certain models as Light Sport Aircraft, the FAA adds those models to a spreadsheet which it publishes online at [https://www.faa.gov/aircraft/gen_av/light_sport/](https://www.faa.gov/aircraft/gen_av/light_sport/). As of this writing, the spreadsheet lists 189 makes and models.

This list is my driver. At the end of the day, I filter the MASTER table looking for the aircraft in this list.

First, though, I have two problems to solve.

1. The FAA list omits some LSAs that used to be approved but no longer are. Yet the aircraft are still out there and should be counted for my purposes. This means that:
   - I need to keep my own list of LSA makes and models and never delete an entry.
   - I need to start with an older list that includes the discontinued models. That came from Dan Johnson.

2. I want to add modern-style gyroplanes to my list. But the FAA does not include these as LSAs. Hence, I need to make my own list of those.

Therefore, I need two more sources.
2.1.3 Dan Johnson’s List of Approved LSAs

Dan Johnson is a longtime chronicler of light sport aviation. He has closely tracked the emergence of LSA makes and models. Using data from his website gave me these models that were no longer in the FAA’s list as of November, 2018. I include them.

2.1.4 The List of Gyroplane Makes and Models

From vendors at Sun ‘n Fun 2018, from discussions with two gyroplane instructors, and from web searches, I produced this list of modern-style gyroplane makes and models. I will expand this when more enter the market.

2
See https://www.bydanjohnson.com/
2.2 Step Two – Update The List of Makes & Models

1. Whenever I update the data, I add any new LSAs that have appeared in the FAA’s latest spreadsheet.
2. The Dan Johnson feed was a one-time thing.
3. I ask around to see if any new modern-style gyroplane models have come on the market. If so, I add them to my list.
Policy – Shorten Names. I want to keep the make and model names short. When publishing online, screen real estate will be scarce, so I want short names. Here’s an example:

Policy – Combine Models. I combine similar models into one. For example, American Legend Aircraft has three models in the FAA’s list of SLSAs. I combine them all into just one – the “Legend Cub”.

There are two reasons for combining models, both having to do with the reports:

1. **Trend line.** For measuring the popularity of the Legend Cub, the distinctions between the various models don’t matter. My approach highlights the overall statistics for all Legend Cubs.

2. **Usability.** At 213, the list of makes and models is already long enough that it will be difficult to work with using the pick lists in Tableau Public when I publish online. By combining the models, I ease that problem.

Policy – List Models Under their Current Manufacturers

Many models have been produced by different companies over the years. For example, the Cygnet amphibious trike was first produced by Krucker in Ontario, then by Sea & Sky, and now by Airtime.

In these cases, I cite all the aircraft, but credit them all to the current manufacturer. Thus, the website shows all Cygnets but labels them all “Airtime Cygnet” even though Airtime did not build them all. This lets users see the overall trend in Cygnet registrations. By contrast, if I were to list “Sea & Sky Cygnet” separately from “Airtime Cygnet”, the overall Cygnet picture would be chopped up and obscure. It’s a tradeoff.

*                           *                           *

At the end of Step Two, I have an updated list of “our” makes and models. Next, I go looking for them in the FAA data.
2.3 Step Three – Find Our Makes and Models in the FAA Data

The FAA Registry has a table of aircraft makes and models. It’s called ACFTREF, and if you can identify a make and model there, you can follow a link into the MASTER table to count all the actual aircraft of that make and model. My task is to find my makes and models in ACFTREF and connect to them, as shown by the red double line in the diagram.

The problem is that the makes and models in ACFTREF don’t exactly match the makes and models in the FAA’s LSA spreadsheet – much less the makes and models in my list. For example, here’s what ACFTREF says about the Pipistrel Virus: 14 different entries, all for essentially one model, the Virus.

Here’s what my list says about the Virus:
Notice the field [LSA Num] that’s in both tables. (I added it to ACTREF.)

I manually find all the Viruses in ACTREF and set the value of [LSA Num] in each row to whatever is appropriate from my list. Here’s the result:

![ACFTREF Table](image)

Mind you, [LSA Num] means nothing in the outside world. It’s purely internal to this project.

With the [LSA Num] values in place in ACFTREF, all three tables are linked. I can now write a query that:

- Starts with “Pipistrel Virus” in my table,
- Then brings in all the above 14 corresponding rows in the ACFTREF table, based on the [LSA Num] values that are now in both tables.
- Then brings in all the 42 actual Pipistrel Virus aircraft in the MASTER table via the CODE field in ACFTREF.

The diagram on the next page shows how these linkages work.
Follow the links to ACFTREF
Start here with “Pipistrel Virus”
then from there to the MASTER table
and see all 42 Pipistrel Viruses
At the end of Step Three, I have linked our list of makes and models with the actual aircraft in the FAA registry. Next, I use these links to extract a table of just the actual aircraft that interest us.

### Why not use the FAA's own LSA codes?

Why go to all this trouble spotting the LSAs based on make and model names when the FAA’s registry already codes all the LSAs as such in its `CERTIFICATION` field?

1. **Accuracy.** 9% of the aircraft listed in the MASTER table have no certification listed. That is, the `CERTIFICATION` field is blank. This includes 600 aircraft that, on inspection, really are LSAs. If I identified the LSAs based on this field, we would lose those 600. Going the other way, the MASTER table does code 298 aircraft as being SLSAs or ELSAs of the kind that interest us – but on inspection they are neither, like the Quad City Challenger and the Buckeye Dream Machine. Together, these amount to 15% of the 6,305 aircraft we found. Thus, I get more accurate results by spotting the LSAs based on make and model name rather than by using the `CERTIFICATION` field in the database.

2. **Normalization of the Names.** To make the reports useful, I have to normalize the make and model names anyway. Looking at the `MODEL` field in the ACFTREF table, the computer thinks that these are all different models:
   - Virus
   - Virus 912
   - Virus 912 LSA
   - Virus 912 SW
   - Virus SW
   - Virus SW 914
   - Virus SWIS
   - SW Virus
   - SW Virus 100

But they’re really all the same model. There’s no value in reporting statistics separately for each of these. Therefore, at some point, I have to manually “normalize” these names, which means linking them all to one entry – “Virus” – in our master list of makes and models. So, there’s just no avoiding the exercise. Step Three above described how I do it.
2.4 Step Four – Build a Table of Just Our Aircraft

With a query that uses the links described above, I create a table of aircraft that interest us. As of December 28, 2018, it had 6,305 aircraft.

**OUR AIRCRAFT**

(the first 12 rows on December 28, 2018)

<table>
<thead>
<tr>
<th>N-Number</th>
<th>Make</th>
<th>Model</th>
<th>Aircraft Type</th>
<th>Amphibian?</th>
<th>Certification</th>
<th>Mfr Yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>1001K</td>
<td>Flight Design</td>
<td>CT</td>
<td>Airplane</td>
<td>No</td>
<td>SLSA</td>
<td>2017</td>
</tr>
<tr>
<td>1005A</td>
<td>LSA America</td>
<td>Allegro</td>
<td>Airplane</td>
<td>No</td>
<td>SLSA</td>
<td>2015</td>
</tr>
<tr>
<td>100GH</td>
<td>Just</td>
<td>Highlander</td>
<td>Airplane</td>
<td>No</td>
<td>E-AB</td>
<td>2010</td>
</tr>
<tr>
<td>101MG</td>
<td>Rans</td>
<td>S-7LS Courier</td>
<td>Airplane</td>
<td>No</td>
<td>E-AB</td>
<td>2011</td>
</tr>
<tr>
<td>100NH</td>
<td>Pipistrel</td>
<td>S-LS</td>
<td>Airplane</td>
<td>No</td>
<td>SLSA</td>
<td>2014</td>
</tr>
<tr>
<td>1010Z</td>
<td>Just</td>
<td>Highlander</td>
<td>Airplane</td>
<td>No</td>
<td>E-AB</td>
<td>2006</td>
</tr>
<tr>
<td>10120</td>
<td>Rans</td>
<td>S-LS Coyote</td>
<td>Airplane</td>
<td>No</td>
<td>E-AB</td>
<td>2006</td>
</tr>
<tr>
<td>1014C</td>
<td>Atec</td>
<td>Faeta</td>
<td>Airplane</td>
<td>No</td>
<td>SLSA</td>
<td>2005</td>
</tr>
<tr>
<td>1017Q</td>
<td>Rans</td>
<td>S-LS Coyote</td>
<td>Airplane</td>
<td>No</td>
<td>E-AB</td>
<td>2006</td>
</tr>
<tr>
<td>1019X</td>
<td>Remos</td>
<td>Gx</td>
<td>Airplane</td>
<td>No</td>
<td>SLSA</td>
<td>2008</td>
</tr>
<tr>
<td>101LW</td>
<td>BRM</td>
<td>Bristell</td>
<td>Airplane</td>
<td>No</td>
<td>SLSA</td>
<td>2016</td>
</tr>
<tr>
<td>101PF</td>
<td>Kitfox</td>
<td>Light Sport</td>
<td>Airplane</td>
<td>No</td>
<td>E-AB</td>
<td>2012</td>
</tr>
</tbody>
</table>

OK – where did I get the Aircraft Type, Certification, Manufacture Year, and so on? For that story, read section 3 below, **Breakouts**.
2.5 Step Five – Publish to Tableau Public

But first, I need to publish to Tableau Public so everyone can see the numbers.

Tableau Public

Tableau is the industry leader among products that let people explore data visually and interactively over the web. Their visualizations are famous.

Tableau Public is their free version that lets anyone publish visualizations interactively on the web. Of course, the data is then visible to anyone in the world, which is why most organizations prefer the paid version. The free version also has some limitations as to size and data sources, but it’s perfect for my purposes.

See their [one-minute introductory video](#).

This step is easy. I export the OUR AIRCRAFT table to Excel and upload it to Tableau Public. That updates everything on the website.
3. **Breakouts**

In Tableau Public, you can filter the data by any of these breakout dimensions:

- Aircraft Type
- Make & Model
- Certification
- Certification Group

Those breakouts come straight from the OUR AIRCRAFT table, where every aircraft has them as attributes, as you see here.

![OUR AIRCRAFT Table](image)

Here’s where I get those values.

### 3.1 Aircraft Type

#### 3.1.1 Possible Values

![AIRCRAFT TYPE Table](image)

#### 3.1.2 Derivation

I set these manually in my table of makes and models based on my knowledge of the market, augmented by internet searches.
3.2 Year
This attribute is critical to showing the trend in registrations over time.

3.2.1 Derivation
The year of manufacture comes from the FAA registry. In preferential order, I take:

<table>
<thead>
<tr>
<th>Source</th>
<th>MASTER-table Field</th>
<th>% of Aircraft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year of manufacture</td>
<td>[YEAR MFR]</td>
<td>86.5% of our aircraft. The other entries are blank in this field so for them I use…</td>
</tr>
<tr>
<td>Year of Airworthiness Certificate</td>
<td>[AIR WORTH DATE]</td>
<td>3% of our aircraft. The rest are blank in this field, too, so for them I use…</td>
</tr>
<tr>
<td>Year of certification</td>
<td>[CERT ISSUE DATE]</td>
<td>10% of our aircraft. The rest are blank in this field, too, so for them I use…</td>
</tr>
<tr>
<td>Year of last action in the registry</td>
<td>[LAST ACTION DATE]</td>
<td>0.5% of our aircraft.</td>
</tr>
</tbody>
</table>

However, if the Year of Manufacture is prior to 2005 when the first LSAs were approved, I exclude the aircraft altogether.

3.3 Make & Model
Section 2 above shows where make and model come from.
3.4 Certification

About Certifications

When the FAA issues an Airworthiness Certificate for an individual aircraft, it does so in one of several categories. Each category puts certain restrictions on both the manufacturer and the owner.

About 40% of the aircraft here are certified as Special Light Sport Aircraft. The rest are in other categories.

I’ve had to remedy some gaps and mistakes in the data. That story is told below.

3.4.1 Possible Values

The FAA has dozens of certification codes. I summarize them into just these six, which I then summarize into two groups:

- SLSA
- Kit/Other

<table>
<thead>
<tr>
<th>Certification Category</th>
<th>Certification Desc</th>
<th>Cert Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-AB</td>
<td>Experimental - Amateur-Built</td>
<td>Kit/Other</td>
</tr>
<tr>
<td>ELSA</td>
<td>Experimental - Light Sport Aircraft, excluding those grandfathered in before 2008.</td>
<td>Kit/Other</td>
</tr>
<tr>
<td>Exhibition</td>
<td>Experimental - Exhibition</td>
<td>Kit/Other</td>
</tr>
<tr>
<td>Other</td>
<td>Other, such as Crew Training, R&amp;D, and Market Survey</td>
<td>Kit/Other</td>
</tr>
<tr>
<td>Primary</td>
<td>Primary Category</td>
<td>Kit/Other</td>
</tr>
<tr>
<td>SLSA</td>
<td>Special Light Sport Aircraft</td>
<td>SLSA</td>
</tr>
</tbody>
</table>
### Derivation

The certification categories I publish mostly come straight from the FAA registry’s CERTIFICATION field. However, I do make the adjustments in the table below. Numbers come from the December 28, 2018 edition of the registry. I include them to give you a sense of which categories have lots of aircraft and which not so many.

<table>
<thead>
<tr>
<th>FAA Cd&lt;sup&gt;3&lt;/sup&gt;</th>
<th>Definition</th>
<th>#&lt;sup&gt;4&lt;/sup&gt;</th>
<th>Comment</th>
<th>My Cat&lt;sup&gt;5&lt;/sup&gt;</th>
</tr>
</thead>
</table>
| <blank>           |            | 852          | Taking each model in turn, I set the blanks to the certification that’s used the most among the aircraft that DO have codes. For example, looking at the Zenair/Zenith CH601:  
* 35 are SLSA  
* 13 are ELSA  
* 270 are E-AB  
* 12 are blank  
Therefore, I assigned “E-AB” to the 12 aircraft where the certification was blank since that’s the most-used code. | Various |
| 1                 | Standard category | 14 | On inspection, these are all SLSAs, miscoded. | SLSA |
| 2                 | Limited category  | 2  | Aerial surveying. A miscode. Should have been “42”. | Other |
| 32                | Restricted category | 1  | Experimental – R&D. | E-AB |
| 41                | R&D            | 11 | Experimental – R&D. | Other |
| 42                | E-AB           | 3,285 | Experimental – Amateur-Built. Gyroplanes plus LSAs that the owner chose to build from a kit and certify as an E-AB. That would let the builder make more modifications than would be possible for an ELSA. | E-AB |
| 43                | Exhibition     | 50 | Experimental – Exhibition | Exhibition |
| 44                | Racing         | 19 | No LSAs are racers, so these are miscodes. 18 Pipistrels and one Lambada. A friend has one of the Pipistrels, and his registration says EXPERIMENTAL – EXHIBITION – RACING. So I code these all as EXHIBITION. | Exhibition |
| 45                | Crew Training  | 2  | Experimental – Crew Training. | Other |
| 46                | Market Survey  | 2  | Experimental – Market Survey. | Other |
| 47                | Operating Kit-Built | 4  | Experimental – Operating Kit-Built aircraft. | Other |

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<sup>3</sup> FAA Cd = How this category is coded in the FAA’s aircraft registry in the CERTIFICATION field of the MASTER table. Find the definitions of the codes in the FAA’s guide to the downloadable aircraft registry.

<sup>4</sup> In data taken from the FAA registry on December 28, 2018, I found 6,613 of our aircraft. The table shows the number of our aircraft that the FAA had coded each way.

<sup>5</sup> The certification category I assigned to aircraft that the FAA coded this way.
### Certifications

<table>
<thead>
<tr>
<th>FAA Cd</th>
<th>Definition</th>
<th>#</th>
<th>Comment</th>
<th>My Cat</th>
</tr>
</thead>
<tbody>
<tr>
<td>48A</td>
<td>Grandfathered-in ELSAs</td>
<td>817</td>
<td>Experimental – Light Sport Aircraft (ELSA). These are former two-seat ultralights from before the LSA rule that were grandfathered in as ELSAs before 2008. I exclude them except for 43 that were miscodes because they could never have been ultralights.</td>
<td>Excluded</td>
</tr>
<tr>
<td>48B</td>
<td>ELSAs from kits</td>
<td>599</td>
<td>Experimental – Light Sport Aircraft. LSA manufacturers have the option of selling their aircraft as kits which the builder must complete exactly.</td>
<td>ELSA</td>
</tr>
<tr>
<td>48C</td>
<td>Factory-built SLSAs downgraded</td>
<td>382</td>
<td>Experimental – Light Sport Aircraft. SLSA aircraft are all factory-built. But the owners can elect to change their certification to the less-restrictive ELSA category.</td>
<td>ELSA</td>
</tr>
<tr>
<td>49</td>
<td>Unmanned aircraft</td>
<td>4</td>
<td>3 RV-12s and a Kitfox, probably miscoded.</td>
<td>ELSA</td>
</tr>
<tr>
<td>7</td>
<td>Primary category</td>
<td>7</td>
<td>Some AutoGyro models can be certified in this category and thus be purchased factory-made.</td>
<td>Primary</td>
</tr>
<tr>
<td>8</td>
<td>Production flight testing &amp; export</td>
<td>36</td>
<td>These are all recent SLSAs.</td>
<td>SLSA</td>
</tr>
<tr>
<td>9</td>
<td>SLSA</td>
<td>2,881</td>
<td>Special Light Sport Aircraft.</td>
<td>SLSA</td>
</tr>
</tbody>
</table>

8,968 aircraft of our makes and models.
- 355 excluded 48As – the grandfathered ultralights
- 639 excluded because built prior to 2005
7,974 The number reported on the website

#### 3.5 Certification Group

This distinguishes between factory-built aircraft that are strictly-speaking Special Light Sport Aircraft (SLSAs) and all others (Kit/Other). The breakout simply summarizes by Certification as derived above.

- **SLSA**
  - Certification = SLSA
- **Kit / Other**
  - Certification = E-AB
  - Certification = ELSA
  - Certification = Exhibition
  - Certification = Other
  - Certification = Primary
4. **About Deletions**

What happens when aircraft disappear from the FAA registry? Do they disappear from this website? Yes, they do, but not in the way you expect. Consider this example.

From 2014 to 2020, 25 Blitzwing 600s were registered. They show up in this website as below.

Let’s say that in 2020, five of these aircraft disappear from the FAA database. Perhaps they were destroyed or exported. As it happens, these five were all manufactured in 2016. You’d expect the result to look like this:

That is, all 25 were on the rolls in 2019, and now there are only 20.
Instead, what this site shows is this:

![Graph: After Deletion - Actual Result](image)

In other words, the five are removed not only from 2020, but also from the historical data going back to their year of manufacture, 2016 in this example.

This result is not what I would prefer. But it’s the best possible given that all the data on the site comes from the latest FAA download. I create these trend lines using the year of manufacture of each aircraft. But it all comes from the latest download. Thus, if airplane N-42AT is not in the latest download, then it’s gone from every year. I have no way to tell that it used to be on the rolls in 2016, 2017, and so on.

I tried to get around this problem. That would entail keeping historical copies of the database. If I worked from historical databases, I could see that N-42AT was indeed there in 2016 and 2017. The FAA publishes historical copies online, so getting the data would be easy. But I couldn’t solve the identity problem. N-numbers are re-used. Serial numbers are duplicated, especially on experimental aircraft. I could find no way to be sure that N-42AT I today’s database is the same aircraft as the N-42AT that appears in an old copy of the database. To my surprise, the FAA itself has no unique and perpetual identifier for aircraft like the VIN number on your car.

So, even though today’s website says there were only 15 Blitzwing 600s in 2016, there might have been more at that time.
5. About This Project

I’m Steve Beste, a retired software developer, data lover, and trike pilot in Springfield, VA. I’m also president of Flying Club 1, the center for light flying in Northern Virginia. I created the site to support Dan Johnson’s work.

Reach me at Stephen.Beste@gmail.com.

The website is hosted by Tableau Public, the superb tool for presenting – interactively and online – the stories that lurk in data.