ALASKAN AVIATION SAFETY FOUNDATION

July 2016

Anchorage pilot Sam Adams enjoys the view of his family's aircraft while visiting in Minnesota.

photo courtesy Samuel Adams

Weight & Balance is a fundamental part of flight safety

By Harry Kieling, Chairman

Summer is upon us and so far it has been incredible. I hope you have been getting out and flying and enjoying our great state.

Just please remember in whatever you do, put Safety First. There are no mysteries here. We know what causes aircraft accidents and we have not invented any new causes lately. In fact, recently I have had the opportunity to discuss the "Twelve Deadly Sins in Aviation" to two different Civil Air Patrol audiences. I appreciated the opportunity to speak to their safety meetings and enjoyed the dialogue. If you or a group you belong to would like to have me or one of the AASF Board members speak to you about this or a related flying safety topic let me know and we will see if we can provide a speaker.

Our feature article this quarter is about weight and balance (one of the Twelve Sins when not done correctly or at all). The article is written by Jim Robinson, a very experienced and professional pilot and Foundation Board Member dedicated to flight safety. Adding to Jim's very thoughtful article I would say ask yourself these questions: Do you have a weight and balance for every flight? Do you even remember how to do one? Do you realize the very bad things that can happen if you violate weight and balance guidelines?

Useful load is pretty straight forward but do you know what that bag going in the back really weighs? Do you have a scale available, (even the bathroom variety), to find out exactly what something weighs (even yourself with waders and survival vest)? Every year we have accidents in which weight and balance are a factor if not the leading cause. Many of these accidents cause injury and death. Weight and Balance accidents are pretty easy to fix if you just simply become more professional in your approach. Remember, real pros don't do this stuff by the seat of their pants, they are exacting and conscientious.

Fly Safe!

Harry

News from AASF membership

Congratulations to Safety Foundation member Ross Nixon, on the release of his first book, *Finding Carla: The Story That Forever Changed Aviation Search and Rescue*.

Ross is an accomplished author and has written many articles that feature Alaska and, in particular, life and events in the state's rural areas. He recently sat down with us to film Hangar Flying and talk about his new book.

Finding Carla is the heartbreaking but compelling story of Carla Corbus and the plane crash that lead to the legislation requiring Emergency Locator Transmitters (ELTs) to be installed in aircraft. Ross shares the parallels between the Oien family and his own and highlights the good that came from this tragic crash.

The lessons to be learned from this story are many— from the obvious importance of ELTs and appropriate survival gear, we see firsthand why it is critical to dress for the weather along the route of flight, and know our aircraft's limitations, as well as our own.

Please look for Ross on Hangar Flying on July 1st, 4th and 8th, or find previous Hangar Flying episodes on our YouTube channel. We wish Ross the best of luck with his book and thank him for being an aviation safety advocate.

Finding Carla is available at amazon.com. Learn more at *General Aviation News*.

Annual Fall Safety Seminar

Saturday, November 5, 2016

Registration will start at 8 a.m. for this all-day event, which is being offered as a joint effort with the NTSB.
Details to follow on location, lunch options and the seminar schedule.

There is no cost to attend!

For more information, contact the AASF at (907) 243-7237 or aasfonline@gmail.com

The danger of not calculating weight & balance

by Jim Robinson

Ceteris Paribus (Latin adds heft to my otherwise anemic writing), means "all else being equal." Of all the variables that affect aircraft performance, the pilot only has direct control over two: weight and balance (W&B). Simply stated, other than changing the weight and/or balance you have to play the hand you're dealt (continuing this analogy, it might be best to "fold" i.e. not takeoff). Without going to extremes the runway can't be made longer, density altitude can't be lowered, engine performance increased, lift coefficient improved, runway sloped downward, or obstacles moved. But what you do with weight and balance can enhance or negatively impact the performance of the aircraft.

Part 91 of the Federal Aviation Regulations (FAR) does not explicitly require a pilot to calculate a weight and balance for every flight. In particular FAR 91.103 states "…preflight action relating to aircraft performance 'aircraft gross weight' must be considered". So is it saying I don't have to calculate a W&B? No, rather the FAA is using a bit of circular logic to imply that you *must calculate W&B*.

When an aircraft is certified it must comply with both FAR 23.23 lateral range and FAR 23.25 maximum weight. The aforementioned FARs establish an aircraft's limitations which are included in the aircraft type certificate. FAR 91.9 states you must comply with operating limitations of the aircraft. Therefore the only way to ensure compliance with the aircraft limitations is via a W&B calculation. That being said there are numerous safe shortcuts pilots can use to comply with FAR 91 such as a "canned" W&B.

During a Part 91 ramp inspection you are not required to produce a W&B per se. If the inspector ramp checks a Cessna 150 that contains a reasonably sized pilot, a small passenger, and a sandwich in the bag compartment, the inspector can reasonably assume the aircraft is within limits. On the other hand, if the inspector sees me and several passengers with a bunch of gear loaded in a Cessna 185, he or she might elect to do a more extensive ramp check. The inspector might ask me to prove compliance with aircraft limitations to which I would reply, "Well, you'll note the gear and people are weighed and according to my W&B calculation we are within Type Certificate limitations." In my dreams! Most likely I'd be flustered and stammer before remembering I have a smart phone (more on this later).

Weight is one of two factors pilots can control. It can't be emphasized enough how much weight affects the performance of the aircraft. Physics tells us that more weight means more lift required. If you need more lift than the conditions allow, you have two choices: either reduce weight or don't takeoff (I suppose there is a third choice—attempt takeoff and crash).

FAR 91.323 allows some operators in Alaska to operate 15% over gross weight. FAR 91.323 generally does not apply to general aviation aircraft however. If the takeoff performance variables (wind for instance) change, the pilot may, or in some cases must, change the weight to account for the new conditions.

The often overlooked other half of the W&B equation is "balance" or Center-of-Gravity (CG). It's interesting to note that in FAR 91.103 preflight consideration, the reg does not specifically state "balance". As mentioned earlier, you must keep the CG within aircraft limitations. Balance greatly affects performance. What about moving the CG forward or aft within the legal range? A forward CG generally increases stall speed and decreases cruise speed. An aft CG decreases

continued from page 3

stall speed and increases cruise speed. For instance, in the Cessna 182Q, moving the CG from the forward to the aft range of the CG envelope decreases stall speed 7 knots! However, an aft CG decreases your margin over stall and potential spin. Something to think about: some aircraft (certified for spins) will not spin unless the CG is moved aft.

With CG forward, such as the aforementioned Cessna 182, if you let the airspeed get very low you can lose elevator authority and subsequently land hard on the nose wheel. Even within the legal CG range the aircraft performance is affected.

Generally speaking the forward seat(s) and fuel are aligned with the aircraft empty weight CG. The aft seat(s), as the name implies, tend to be aft of the CG. After the seats are filled the only place left for gear, cargo, and baggage is aft of the CG. For this reason the tendency is to load an aircraft with aft CG. (As an aside, I believe the most important and overlooked—as in not practiced—maneuver is the go-around. During a go-around, full power application in combination with an aft CG produces a significant nose up pitching tendency. The pitch-up must be immediately recognized and corrected; if the pitch-up tendency is not corrected it can lead to a fatal stall spin.)

Smart phones and associated apps (some are even free) take paperwork or "guesswork" out of W&B calculations. After initial set up, an extensive W&B calculation takes less than a minute. For example, I wanted to load several people, some gear, and of course my dog, into a Cessna 180 on floats. I pulled my new smart phone out and less than a minute later, presto, W&B done. You guessed it though, glaringly obvious, with pixilated coldness, I was over gross. Quickly tried several loading iterations, reluctantly off loaded dog, departed within limits.

From takeoff to landing there are hundreds of variables that effect aircraft performance. Weight and balance is the only performance variable directly controlled by the pilot. Being "out" of W&B range does not automatically make the aircraft uncontrollable, however you might be left without a needed safety margin. After a perfect CG is calculated make sure the CG stays where you calculated it and secure your load!

Jim Robinson is a retired military aviator who has also flown corporate, airline and general aviation. He currently flies and maintains a Cessna and lives in Anchorage.

Send us your news!

If you have something exciting to announce - a new aircraft, rating, license, promotion, birth in the family, etc. Let us know so we can share it with the membership.

Contact editor Colleen Mondor at colleen@chasingray.com.

Considering some weight & balance related accidents

By John Mahany

There have been several accidents involving weight and balance and weight shift in recent years. Some involve large air carrier aircraft. (Yes, it can even happen at the airline level.) You will likely recall the Boeing 747-400 operated by National Airlines that crashed right as a result of cargo that shifted on takeoff from Bagram Airfield, Afghanistan on April 29, 2013. The pilots did not have a chance.

On January 8, 2003, a Beechcraft 1900D crashed shortly after takeoff from Charlotte, North Carolina. There were no survivors, and the aircraft was destroyed. The NTSB determined that the probable cause was the aircraft's loss of control during the takeoff and initial climb out. This contributed to the loss of pitch control, resulting from the incorrect rigging of the elevator control system, the result of shoddy maintenance.

But the aircraft's C.G., which was found to be substantially aft of the certified aft limit, compounded the situation. The pilots were literally not able to control the Beechcraft 1900D due to complications arising from aircraft rigging problems and controllability issues as well as the aft C.G. The FAA was also found to be at fault for their lack of oversight of the airlines' maintenance program as well as its weight and balance program. These pilots did not have a chance.

In October 2007, we have a Cessna 172 in which a private pilot lost control of the aircraft right after takeoff from Oxford, Mississippi. Runway 9 is 5,600' by 100', more than adequate for a Skyhawk. The pilot stated in the accident report that the aircraft "felt a little wobbly" and seemed "a little slow in accelerating", and he 'considered aborting', but continued the takeoff. One has to wonder why he continued? Aborting would have been the wiser choice.

According to the report, airspeed was slow in the climb, and the aircraft stalled when the pilot started a climbing left turn to avoid trees. Naturally, he was not able to out climb the trees and impacted them, but the pilot and his passengers survived! They were lucky. A weight and balance was calculated after the flight, and the 172 was found to be 132 pounds overweight, which, while not 'excessively' overweight, was certainly enough to adversely affect the meager climb performance of this aircraft, on a particularly warm (28˚C) October day.

Of course, we don't know anything about the age of this 172, or the time on the engine. A tired old 172 will not climb well. This pilot thus had a few strikes going against him: as a result of being slightly overweight, the aircraft was just heavy enough that perhaps a high-time Lycoming engine, with sluggish acceleration, presented a red flag warning that the pilot chose to ignore, to his detriment.

In this case, the weather, while VFR, was warmer than standard for the location. The airport elevation at Oxford is 452'. Close enough to sea level, but for a low time (483 hour) pilot, and no idea how 'current' or proficient he was, in this case the combination was enough that he did not make it. The density altitude in this case is about 1,000' higher, so it was the equivalent of about 1,452'. While not significantly higher, it might have been just enough to make a difference.

How many pilots, after earning their private pilot license, if they do not go on to add any other ratings, perform a weight and balance before they fly? Probably not many, unless you are suddenly going to have a full airplane with every seat occupied along with bags, and then you might think about it. But how often does that happen? If you fly the same airplane, you know the airplane and what you carry. If you fly different airplanes, you should get out the AFM/P.O.H. for that aircraft and do a weight and balance. Do this for every airplane that you fly. Get to know the airplane. Do you let passengers put their own bags onboard, or do you supervise the loading? Don't be surprised—remember, you are the P.I.C.!

If you think you know your aircraft, consider how well you really know it. Here are some

questions for you. How does the airplane you fly handle with a forward or aft C.G.? What happens to your C.G. as you burn fuel on a longer flight? Does it move forward or aft? Have you ever intentionally loaded your airplane with either a forward or aft C.G., within the limits (envelope), to see how it handles? How does the stability change as the C.G. changes? You might consider this, with a competent CFI, or another *experienced* pilot onboard. Discuss this thoroughly beforehand. Avoid surprises.

You should also try/review both slow flight and stalls (straight and turning) with both a forward and an aft C.G., as well as with different flap settings on two flights and see the differences in handling and performance. How much do the stall speeds change, in different configurations, flaps vs. no flaps? What does your P.O.H. say about this? Compare the book with what you find. Have your CFI or pilot friend make note of these speeds and create your own aircraft performance data card (speeds/power settings/ stall horn/stall buffet) so you know what to expect. How is the stall recovery different with both a forward and an aft C.G., at different flap settings? And how much stick force is required?

Now with Apps for weight and balance on devices, like ForeFlight, it's even easier to do a weight and balance. But it still is probably one of the more neglected items. I know when I have conducted flight reviews over the years, many pilots have not done a weight and balance since their last flight review. (Disclaimer; if you participate in the FAA's Wings Pilot Proficiency Program, then you are no longer required to do flight reviews. *Active participation* in the FAA's Wings Program waives this requirement.)

Complacency sets in, and gradually pilots start neglecting little things, which over time leads to bigger things, and then an accident may happen as a result. Don't get lax. Make it a point to stay proficient. The key is to spot the little things that can lead to big problems, as it did in the accidents discussed above.

Fly Safely -

John

John Mahany has been flying for 30+ years. He is an ATP/CE-500 and an MCFI in southern California, with corporate, airline and charter experience. He spent 4 ½ years flying in Alaska. He is currently a King Air and Citation Instructor at FlightSafety International in Long Beach, CA. He flies a 1953 CE 180 for fun!

Alaskan Aviation Safety Foundation

C/O Aviation Technology Division UAA
2811 Merrill Field Dr.
Anchorage, AK 99501

Phone: (907) 243-7237
Email: aasfonline@gmail.com