MacAir Aviation

The MacAir Flyer

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INSIDE THIS ISSUE:

Chief Instructor Notes—Summer Flying

Tom Bell, MacAir Chief IP

With the approach of summer the flying season kicks into high gear at Greene County. This brings both new challenges and opportunities. In the first category is the effect warm weather has on performance, especially for the pilot. Therefore, this newsletter starts off with an article on the physiological effects on hot weather and what you can do to mitigate these effects.

In the last newsletter I discussed setting personal goals in order to continue to challenge yourself to be the best aviator you can be. One goal you may want to consider is obtaining your tail wheel certification. MacAir's Decathlon is a great way to learn more about "what those rudders are for" and develop a better understanding of coordinated flight. Chris Shearer, our primary tail wheel IP, has an article that spells out some of the benefits of obtaining your tailwheel certification.

In addition to these articles are several more for all pilots with techniques on judging when to flare, the relationship between pitch/power and energy, and a thought provoking article on the use of COM2 to enhance SA.

Summer also brings increased thunderstorm threats so a review of the thunderstorm briefing on the Pilots' Resource page of the website is also a good idea.

Finally, summer ops also includes increased transient traffic and the annual ramp-up for the AF Flight Surgeon Training program. As always, use your eyes and ears (radios) to clear and be patient since we all share the same airspace.

Fly Safe and Often!

Hot Weather Ops?

Nick Burch

As pilots, we are fully aware of the effects of heat and humidity on aircraft performance. But what about these effects on pilots? Do we include thermal effects considerations into our aircrew Operational Risk Management (ORM) as we approach the summer flying season? If not, we should, and let us explore why.

At times, aircrew members may have thought that the temperature inside their aircraft resembled that of a flying oven. Private aviation, especially flight training, usually takes place at the relatively low altitudes that are associated with extremely high temperatures and humidity. These conditions come about to a great degree as a result of solar radiant heat as the large expanses of glass or Plexiglas™ produce the greenhouse effect as thermal energy can become trapped within the cockpit. The temperatures in cockpits of aircraft parked on airfield ramps may be 50 to 60 degrees Fahrenheit higher than those in hangars because of the radiation of solar heating through transparent surfaces. This radiation, in turn, heats the interior objects of the cockpit. These heated objects then reradiate the waves at frequencies that cannot penetrate the glass or Plexiglas™ outward. Therefore, heat accumulates within the cockpit and becomes a significant stress factor at

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Tailwheel Aircraft - You Too Can Fly Them

Chris Shearer

You've had your license for anywhere from one to fifty years now or maybe you are just learning to fly and you see that pretty little yellow aircraft with a tailwheel in the hangar, the Decathlon. And as you walk by it you think, "That would be cool to fly, but I hear they are hard to fly." Well I am here to tell you that is nonsense. I've been teaching in tailwheel aircraft for fifteen years now and flying tailwheel aircraft for twenty-five, and I have yet to have a student that I couldn't teach. My students have ranged from age twelve to seventy-seven. My most recent student was my father who just got his private pilot's license (PPL) at age seventy-six in our maroon 1947 Stinson 108-1. So if you are interested, than read ahead.

The reality is when all three gear are a quarter of an inch off the ground, tailwheel aircraft fly just like most every other aircraft out there. The biggest difference airborne between your standard Piper product and a tailwheel aircraft is that adverse yaw thing you learned about in ground school has been designed out of most tricycle gear aircraft. Not so in most tailwheel aircraft. You will actually learn how to use your feet both on the ground and in the air.

Tailwheel pilots like to walk with a swagger because they feel they are part of the origins of flying and because they enjoy learning how to really feel the aircraft as they fly…I should know because I've been accused of it more than once. Tailwheel aircraft are more correctly identified as "Conventional Gear" aircraft because the original convention when gear started going on aircraft was to have the tail wheel or tail skid in the back of the aircraft. By putting the tail wheel on the back of the aircraft, the majority of the landing loads on the tail wheel aircraft are roughly in-line with the fuselage. What this does is take advantage of the inherent strength of the fuselage. In contrast, a tricycle gear nose wheel is always trying to be torqued off the firewall when you land. That's the reason on those soft field landings in a tricycle gear aircraft you must hold the stick/yoke aft when you are landing. The overall advantage then to the tailwheel aircraft is a stronger arrangement of the gear, less weight for the landing gear, and the ability to land on unimproved surfaces without the fear of doing damage to the nose gear.

What makes the tailwheel aircraft more of a challenge to take-off and land then? Well it is simply a matter of physics and if you are so inclined dynamic instability. It all comes down to the location of the center of gravity and its relationship to the main gear. On tricycle gear aircraft if the aircraft gets moving sideways to the direction you are landing, the drag, referred to as scrubbing drag, on the main tires tends to create a moment that causes the nose of the aircraft to be pointed in the direction you are landing. This restoring moment creates dynamic stability. With a tailwheel aircraft, if the aircraft gets moving sideways to the direction you are landing, the scrubbing drag on the main tires creates a destabilizing moment, and will try and turn you around 180 degrees from the direction you are trying to land. The pilot in a tailwheel aircraft then becomes a true part of the aircraft by controlling that destabilizing moment through the use of the rudder pedals moving both the rudder and tailwheel. If you want to experience this stability/instability first hand just note the difference between driving your car forward versus backwards.

What does it take to learn to fly a tailwheel aircraft then? We start with the Federal Aviation Administration (FAA) requirements to receive a tailwheel endorsement, specifically 14 Code of Federal Regulations Part 61.31 or more commonly referred to as the Federal Aviation Regulations

(i) *Additional training required for operating tailwheel airplanes.* (1) Except as provided in paragraph (i)(2) of this section, no person may act as pilot in command of a tailwheel airplane unless that person has received and logged flight training from an authorized instructor in a tailwheel airplane and received an endorsement in the person's logbook from an authorized instructor who found the person proficient in the operation of a tailwheel airplane. The flight training must include at least the following maneuvers and procedures:

(i) Normal and crosswind takeoffs and landings;

(ii) Wheel landings (unless the manufacturer has recommended against such landings); and

(iii) Go-around procedures.

The most common question asked before starting training involves, "How long will it take?" Well the

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Tailwheel Aircraft - You Too Can Fly Them (Cont)

the FAA does not require any specific number of hours, but some insurance companies do require around 10 hrs. But depending upon the skills of the pilot, it is typically about 2-10 hours to transition. This number of hours is based upon the pilot already knowing the basics of flying and specifically landings. The most difficult thing to overcome when transitioning from flying a tricycle gear aircraft is to learn how to use your feet and what to do with the rudder pedals. To be honest most tricycle gear aircraft pilots (military and civilian) have no idea how to properly use the rudder pedals. For tailwheel aircraft, you will learn how to use them.

In the training you will learn how to apply just the right amount of rudder for the given circumstances. What I care about in tailwheel aircraft is the rate at which the nose is moving, not as much where it is pointed. I still care about where the nose is pointed, but I care more about how I get the nose to that location, i.e. the rate at which the nose is moving left/right. This is the key difference in a tailwheel versus tricycle gear aircraft. The rudder inputs become control rate devices, not position devices like they are typically used on a tricycle aircraft. On a tailwheel aircraft we control the rate of the nose movement to control the direction of the aircraft while on the ground. For example, if I need to make a 90 deg right turn while taxing, than I will input some right rudder to get the turn started, and then reduce the right rudder or even use left rudder to control the rate of turn. When your skills are finely honed, you will turn onto your 90 deg heading change just as the rate of the nose movement stops.

For take-offs and landings, what is critical is the controlling the alignment of the momentum vector with the runway, i.e. the direction you are going, and the fuselage. For example, if I have a left cross wind on landing and my fuselage is parallel to the runway, but I don't stop the drift across the runway, than the momentum vector is pointed to the right of the runway but the fuselage is aligned with the runway. This sets up a situation that the instant the main gear touch the runway, there is scrubbing drag that will move the main gear to the left, creating a destabilizing moment. If not corrected the aircraft turns more to the left, creating more scrubbing drag, compounding the problem. The solution then is simply to learn to properly use the left wing down on landing to control the drift across the runway and opposite rudder to align the fuselage. Now in practice the cross wind, runway imperfections, tire inflation, shock absorber response, and a host of other factors will mean that your aileron and rudder inputs are always changing. So in addition to learning how to use your feet, you will finally start to understand the concept of a slip, both forward and sideslip and why they are important.

In the next articles to come I will speak more to the specifics of take-offs, three-point landings, wheel landings, and slips. In the meantime, I hope you consider obtaining the transition training and flying tailwheel aircraft. They truly are a lot of fun and create a unique opportunity to reconnect with the aircraft in this age of increasing reliance upon electronics in the cockpit. And you too will walk a little taller when you get out of the aircraft.

Rating Accolades

The following members achieved the following aeronautical ratings in the past quarter. Congratulations!

Instrument: Derek Pristas

Commercial Multi-Engine Add On: Ben Bular

Pitch Versus Power, Total Energy, and the Roller Coaster

Eric Puschmann

Whenever someone asks me about my technique for using pitch versus power to control airspeed and altitude, I always respond by saying "it depends!" What is my stage of flight? Do I have excess/insufficient total energy available? If I am in a full-power climb, obviously pitch controls the airspeed. However if I am in level, cruising flight, then power controls the airspeed. If I am descending on final approach, deviations between actual vs. desired airspeed and altitude will impact airplane control movements.

Let's take a quick, un-mathematical, look at the airplane's total energy.

The airplane has four basic types of energy that add together to make total energy available at any time during flight.

1. Kinetic, or speed, energy. (Elevator, yoke, stick)
2. Potential, or altitude, energy. (Elevator, yoke, stick)

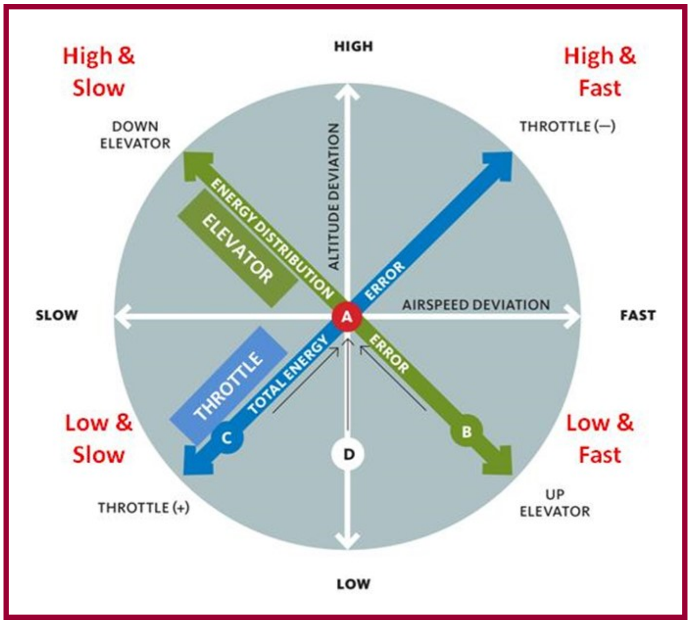
   Kinetic and potential energy are typically combined and called the "mechanical energy." We use the elevator/yoke/stick to convert between kinetic and potential (speed/altitude) energy during flight. While converting energy between airspeed and altitude, the total mechanical energy remains relatively constant (note: there may be minimal energy losses due to air mass, but for understanding flying, the theory is still relevant).
3. Chemical, or engine/power, energy. (Throttle)

   The throttle allows us to increase the amount of total energy that we have on the airplane at any given time. The airplane uses the engine/propeller to convert gasoline into mechanical energy.
4. Airmass, or drag, energy. (Speed brake, flaps, slips)

   Using drag devices (or retarding the throttle) allows us to decrease the amount of total energy on the airplane by decreasing either speed, altitude, or both.

Therefore, the throttle and drag devices change total energy in the airplane, while the elevator merely distributes the existing mechanical energy between airspeed and altitude.

As Wolfgang Langewiesche explains in his 1944 book *"Stick and Rudder,"* the interaction between kinetic and potential energy is called the "**roller coaster**" affect. Based on physics, the roller coaster is just the inverse of acceleration due to gravity, (1/a, or the inverse of 32.2 feet per second squared, if you want to do the math). Converting that into useful flying terms (1 kt = 1.69 ft/sec), at 100 knots, you



can trade one knot of airspeed for almost 8.9 feet of altitude (since I can't do math while flying, I round up to 10 feet). Therefore (when flying at 100 kts), if I am 10 knots fast but 100 feet low, I can use the elevator to convert 10 knots of excess speed energy into almost 100 feet of altitude energy, without any throttle movement.

How can we teach energy management in a simple, non-mathematical manner to students, especially in the landing pattern? Since there is a big difference between being low and slow vs. low and fast (or high/slow vs high/fast), I ask trainees to evaluate both altitude and airspeed before moving the controls. Are they too high (or low), too fast (or slow)? As the diagram below shows, high and fast means too much total energy--throttle/drag input is required. Low and slow means too little total energy--add power. High and slow (or low and fast) may require just using the elevator to trade kinetic for potential energy. If the airplane is on speed, but slightly high or low, adjusting the throttle may be enough to get back on glidepath, realizing that once on glidepath, the throttle will need to be readjusted. Often, however, the trainee will need a combination of throttle and elevator (and perhaps flaps & slips) to get back to their target speed and glidepath (point "A"). The trick is understanding how elevator and throttle work in concert to control total energy, altitude, and airspeed.

Com2...Not Just for AWOS

Kevin Price

A few years ago I was getting a mountain checkout in Alaska, flying up some gloriously beautiful glacier fields to the base of Mt McKinley. Along the way, we came upon a rescue operation in progress for someone who had just crashed onto a glacier. Everyone was fine, and they were air dropping sleeping bags and other supplies down to them. How were they found so quickly? In short, they were able to call for help with their radio…and…*someone was listening*.

Typically pilots use COM 1 as their transmit/receive radio and, when AWOS or ATIS is needed, they'll push the COM 2 button to retrieve that information. If only used for that purpose, I think COM 2 is being underutilized. I would like to suggest that you actively monitor the 121.5 emergency frequency at all times on COM 2. In a case like this accident in Alaska, you might be the only one that hears a call for help. Line of sight limitations, antenna orientation, and perhaps a failed ELT may mean that a call for help is not received by ground stations or even satellites. You could be the one to save the day just by actively monitoring 121.5.

There is also another reason. I recently flew VFR into the Washington DC SFRA/FRZ. There is zero tolerance there for deviations from the prescribed procedures. The good news is that prior to an F-16 showing up on your wing, a call will likely be made on 121.5 to advise, warn, and direct you away from entering an area that would result in an intercept and likely a violation. But…you've got to be listening to 121.5 to hear that! (On the day I flew to DC there were multiple calls made on 121.5 by defense authorities to an aircraft that approached and ultimately violated the SFRA. My bet: that aircraft never heard the radio calls because they were not monitoring 121.5. Maybe, just maybe, the pilot will get to keep their pilot's license.) While you may never fly into Washington DC, you will have to deal with controlled airspace and the associated communications from time to time. Making it easy for ATC to get a hold of you on 121.5 in case you get off frequency, have the volume down on COM 1, etc., is probably a good idea.

And oh, there is yet one more reason to set 121.5 on COM 2. If you, yes you, have an emergency, you can quickly broadcast on 121.5 by just selecting COM 2 for transmission if you have set it up ahead of time. We have different audio panel control systems in our aircraft, so how to setup the radios to accomplish that varies accordingly. (David Gracia-Rodriguez is putting together a friendly user guide that thoroughly explains how to use each one.) As an example though, here is how I setup the KMA 24 system when I fly or instruct:

Hopefully the above will prove useful to you. As a minimum, it explains why the next time you get into one of our aircraft you may see 121.5 set on COM 2…and give you an idea of who may have flown the aircraft last time …;-)

For <u>monitoring</u> 121.5:

For quickly <u>broadcasting</u> on 121.5:

Judging When to Flare **Nick Burch**

Having trouble judging when to flare? Relax, you are not alone. It is one of the hardest things to learn, because it happens so fast, for a fleeting moment, and depends on one's ability to judge height above the runway. I have found that it is easier to judge my height, and therefore how and when to flare the airplane, by focusing my vision toward the horizon at the far end of the runway as I cross the runway threshold and bring the airplane into a "level flight" attitude. Doing so makes the runway's end appear to merge with the horizon line. When it does, begin easing back on the elevator to keep it that way. If the end of the runway appears to be getting wider, add some back pressure gradually to keep it looking about the same. If the runway appears to narrow, release some back pressure because the airplane is ballooning, i.e. getting too high. In a perfect world, this gradual increase of elevator back pressure will lead to the mains touching down in a nose-high attitude in a tricycle-gear airplane, or the airplane touching down in a three-point stance in a tail-dragger.

I have found that the following exercise helps if you have trouble getting the "sight picture" of your height above the runway. With an instructor to help

you avoid mistakes, as you begin your flare by bringing the airplane into a "level flight" attitude, add sufficient power to fly the length of the runway at minimum controllable airspeed a few feet above the runway. Power up and execute a go around when about 2/3 of the way down the runway to ensure the aircraft clears any obstacles. Do this two or three times and you will have a much better idea of what height above the runway it looks like during the fleeting moments of your flare.

Hot Weather Ops? *(Cont)*

altitudes below 10,000 feet.

Comfortable limits in the work environment, including the cockpit, are 68 to 72 degrees Fahrenheit and 25 to 50 percent relative humidity. To maintain these temperatures and this humidity range, aircraft must have extra heating and cooling equipment, which, due to cost and performance limitations, is typically not found in our training aircraft. Thus our bodies must maintain their heat balance through their radiation, conduction, convection, and evaporation heat transfer mechanisms. Unfortunately, radiation, convection, and conduction all suffer one major disadvantage in cooling the body; they become less effective as temperature increases. When the temperature of the air and nearby objects exceeds skin temperature, the body actually gains heat. This gain may be dangerous to aircrew. When the ambient temperature increases to about 82 to 84 degrees Fahrenheit, sweat production increases abruptly to offset the loss of body cooling through radiation, convection, and conduction. By the time the temperature reaches 95 degrees Fahrenheit, sweat evaporation, and potential dehydration, accounts for nearly all heat loss.

Relative humidity is the factor that most limits evaporation. At a relative humidity of 100 percent, no heat is lost by this mechanism. Although the body continues to sweat, it loses only a tiny amount of heat. For example, a person can function all day at a temperature of 115 degrees Fahrenheit and a relative humidity of 10 percent if given enough water and salt. If the relative humidity rises to 80 percent at the same temperature, that same person may be incapacitated within 30 minutes.

The body will undergo certain physiological changes to counteract heat stress. To get heat from the inner body core to the surface where it can be lost to the surroundings, blood flow to the skin (cutaneous circulation) increases tremendously. Blood flow to other organs, such as the kidneys and liver, is reduced, and the heart rate is increased so that the body can maintain an adequate *(Cont on next page)*

Hot Weather Ops? *(Cont)*

blood pressure. As the heat builds up, receptors in the skin, brain, and neuromuscular system are stimulated to increase sweat production. Normal heavy sweating produces one pint to one quart of sweat per hour. Heat-stress conditions, however, can result in 3 to 4 quarts being produced. If a person does not replace this sweat loss by drinking liquids, the body rapidly dehydrates, the rate of sweat production drops, and the body temperature increases, causing further heat injury.

Dehydration and associated heat stress not only cause general physiological changes, but also result in performance impairment. Even a slight increase in body temperature impairs an individual's ability to perform complex tasks such as those required to fly an aircraft safely. A study by Gopinthan et al focused on mental performance and the effects of dehydration on the decision-making process and could be related to an increase in work-related accidents. The study concluded that with 2 percent of body weight loss, visual motor tracking, short term memory, attention and arithmetic efficiency, all important functions for safe flight operation, were impaired. In the extreme, the study notes that a 23 percent reduction in reaction time occurred with a 4 percent body fluid loss.

To illustrate the seriousness of the effects of temperature and associated dehydration on performance, a thermal stress index was developed in the late 1970's specifically for flyers of fighter aircraft, which is equally applicable to our training aircraft. The index applies to summer like conditions and uses an equation involving ambient air temperature and dew point temperature to provide pilots with one of three helpful advisory categories. This index is called the Fighter Index of Thermal Stress (FITS) and is illustrated in the figure below. As the ambient air temperature increases, the adverse effects of the dew point temperature, i.e. humidity, increase rapidly, yielding "feels like temperatures" and associated health and performance issues shown in the color coded matrix.

To help prevent dehydration, one should drink two to four quarts of water every 24 hours. Since each person is physiologically different, this is only a guide. The key is that one should be continually aware of one's condition. Most individuals will become thirsty with a 1.5-quart deficit, or a loss of 2% of total body weight. This level of dehydration triggers the "thirst mechanism." The problem, though, is that the thirst mechanism arrives too late and is turned off too easily. A small amount of fluid in the mouth will turn this mechanism off- and the replacement of needed body fluid is delayed. Remember, the amount of water one drinks will depend

(Concluded next page)

Stages of Dehydration

1. **Heat stress (body temp, 99.5-100° F) reduces**
   - Performance, dexterity, and coordination
   - Ability to make quick decisions
   - Alertness
   - Visual capabilities
   - Caution and caring
2. **Heat exhaustion (101-105 F) symptoms:**
   - Fatigue
   - Nausea/vomiting
   - Giddiness
   - Cramps
   - Rapid breathing
   - Fainting
3. **Heat stroke (>105° F) symptoms**
   - Body's heat control mechanism stops working
   - Mental confusion
   - Disorientation
   - Bizarre behavior
   - Coma

Air Temperature	Zone	Dew Point Temperature								
(F)		30	40	50	60	70	80	90	100	>110
70		70	73	76	81	86	X	X	X	X
75		74	77	80	84	89	X	X	X	X
80	Normal	77	80	83	87	92	98	X	X	X
85		81	83	86	90	95	101	X	X	X
90		84	87	90	93	98	104	110	X	X
95		88	90	93	96	101	108	112	X	X
100		91	93	96	99	104	109	115	122	X
105	Caution	94	96	99	102	107	112	118	124	X
110		97	99	102	105	109	114	120	126	133
115		100	102	105	109	112	117	123	129	136
120	Danger	104	105	108	111	115	120	125	131	138

Fighter Index of Stress (FITS) Reference Values and Flag Colors

Hot Weather Ops? *(Cont)*

on work level, temperature, humidity, personal life-style, and individual physiology.

If one does not stay aware of the environmental conditions and one's personal physiological status, one can progress to heat exhaustion, even if one maintains the above re-hydration water intake. This is because under certain conditions external fluid intake cannot keep up with the loss of fluid by the body. Here are some suggestions how to be aware of and prevent heat exhaustion.

- Drink cool (40° F) water (forget the old "sports day" theory that lukewarm water is absorbed faster into the system).
- Carry a container so you can measure daily water intake.
- Don't rely on the thirst sensation as an alarm...stay ahead. If plain water is offensive, add some sport drink flavoring to make it more acceptable.
- Limit your daily intake of caffeine and alcohol (both are diuretics and stimulate increased production of urine)
- Exercise can cause a large amount of body fluid loss that is difficult to replace quickly.
- Acclimation to a major change in weather takes one to two weeks.
- Monitor personal effects of aging, recent illness, fever, diarrhea, or vomiting.
- Monitor your work and recreational activity; if you feel light-headed or dizzy, call it a day.
- In extreme heat and exercise conditions, salt and electrolyte loss is a factor but not for the average person with a moderate exercise program. The American diet takes care of the loss.

Fly safe and never pass up an opportunity to have a fresh glass of water.

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MacAir Aero Cub

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Have comments or an idea for the next issue? Let Tom (tbell@macair.us), David (dgraciarod@macair.us) or Mike (mjcsnowak@yahoo.com) know!

Upcoming Club Events:

- 18 May: MacAir Open House
- 21 May: Private Pilot Ground School*
- 21 August: Movie Night
- 8 October: Private Pilot Ground School*

*Contact Tom, David or Ann for info / to register