CA18/2/3/8792

SOUTH AFRICAN CIVIL AVIATION AUTHORITY

ACCIDENT REPORT – EXECUTIVE SUMMARY

Aircraft Registration	**ZS-OTA**	**Date of Accident**	03 June 2010	**Time of Accident**	07:00Z
Type of Aircraft	AYRES S2R-T15		**Type of Operation**	Agricultural	
Pilot-in-command Licence Type	Commercial Pilot	**Age**	60	**Licence Valid**	Yes
Pilot-in-command Flying Experience	Total Flying Hours	8384,1		Hours on Type	4771,55
Last point of departure	Greefdale Private Aerodrome near Hartswater in the North-West Province				
Next point of intended landing	Taung in the North-West Province.				

Location of the accident site with reference to easily defined geographical points (GPS readings if possible)

On a private runway at Greefdale Aerodrome, Hartswater. GPS position determined as S27° 48.43.99 E024° 44.00.13

Meteorological Information	**Wind**: Calm; **Temperature**: 7 °C; **Visibility**: Good				
Number of people on board	1 + 0	**No. of people injured**	1	**No. of people killed**	None

Synopsis

It was reported by the pilot that he was to perform a crop spraying detail. During the takeoff roll he lost directional control and the aircraft's left wing clipped a tree next to the runway, which caused the aircraft to ground loop through 180 degrees, leaving the aircraft entangled in trees next to the runway.

The pilot sustained minor injuries to his hand. The aircraft suffered substantial damage to the wings, airframe, engine and propeller.

Probable cause

The pilot lost directional control of the aircraft during the take-off roll and hit trees next to the runway.

AIRCRAFT ACCIDENT REPORT

Name of Owner/Operator : Arctic Rose Aviation (Pty) LTD
Manufacturer : Ayres Corporation
Model : S2R-T15
Nationality : South African
Registration Marks : ZS-OTA
Place : On the runway at Greefdale Aerodrome, Hartswater
Date : 3 June 2010
Time : 0700Z

All times given in this report is Co-ordinated Universal Time (UTC) and will be denoted by (Z). South African Standard Time is UTC plus 2 hours.

Purpose of the investigation:

In terms of Regulation 12.03.1 of the Civil Aviation Regulations (1997) this report was compiled in the interest of the promotion of aviation safety and the reduction of the risk of aviation accidents or incidents and ***not to establish legal liability****.*

Disclaimer:

1. FACTUAL INFORMATION

1.1 History of flight

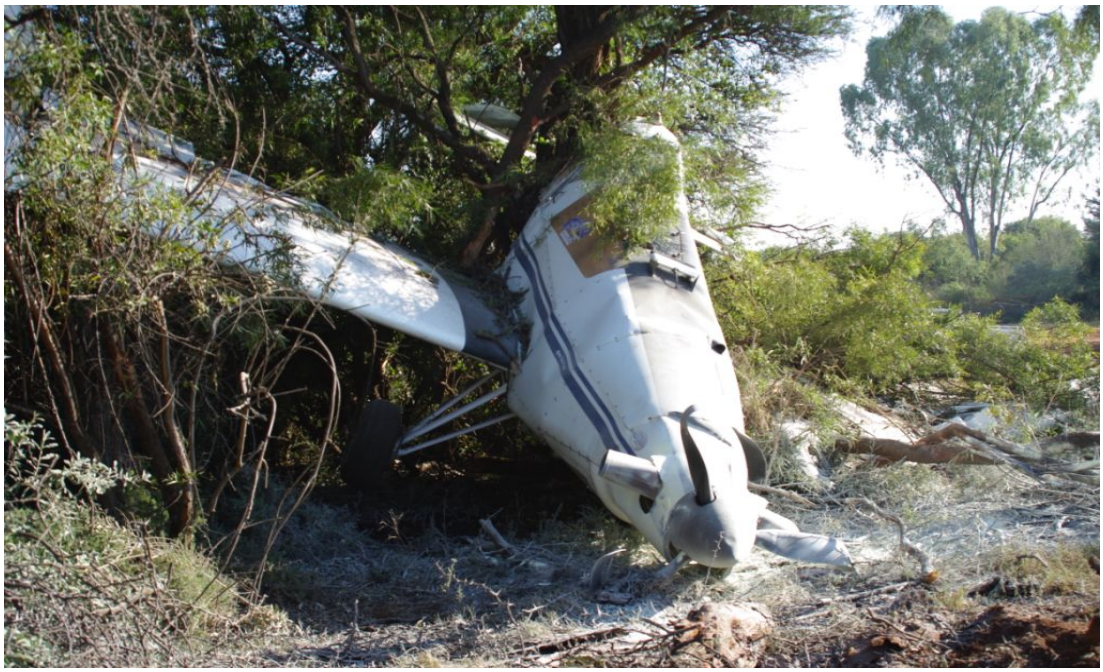
1.1.1 It was reported by the pilot that he was to perform a crop spraying detail. During the take-off roll he lost directional control and the aircraft's left wing clipped a tree next to the runway, which caused the aircraft to ground loop through 180 degrees, leaving the aircraft entangled in trees next to the runway.

1.2 Injuries to persons

Injuries	Pilot	Crew	Pass.	Other
Fatal	-	-	-	-
Serious	-	-	-	-
Minor	1	-	-	-
None	-	-	-	-

1.3 Damage to aircraft

1.3.1 The aircraft sustained substantial damage to the wings, airframe, engine and propeller.



Picture 1 Accident site.

1.4 Other damage

1.4.1 Some trees next to the runway were damaged.

1.5 Personnel information

Nationality		South African			
Licence no.	**********	Gender	Male	Age	60
Licence valid		Yes	Type endorsed	Yes	
Ratings		Night rating, Agricultural rating			
Medical expiry date		28 February 2011			
Restrictions		Medical - To wear corrective lenses			
Previous accidents		Yes – 1988: The aircraft ran off the runway and collided with an embankment.			

Flying experience:

Total hours	8384,1
Total past 90 days	19
Total on type past 90 days	19
Total on type	4771,55

1.6 Aircraft information

Airframe:

Type	S2R-T15	
Manufacturer	Ayres Corporation	
Year of manufacture	2000	
Total airframe hours (at time of accident)	1897,1	
Last mandatory periodic inspection (hours & date)	1841,1	4 February 2010
Hours since last MPI	56	
C of A (issue date)	14 June 2001	
C of A (expiry date)	13 June 2010	
C of R (issue date) (present owner)	20 May 2003	
Operating categories	Standard	

Engine:

Type	Walter –M601E Engine
Serial number	913012
Hours since new	1897,1
Hours since overhaul	TBO not yet reached

Propeller:

Type	Avia-V508E-AG/106/A
Serial number	93065549
Hours since new	680
Hours since overhaul	TBO not yet reached

1.7 Meteorological information

1.7.1 Weather information was obtained from the pilot's questionnaire.

Wind direction	Calm	Wind speed	Nil	Visibility	Good
Temperature	7°C	Cloud cover	Nil	Cloud base	None
Dew point	Unknown				

1.8 Aids to navigation

1.8.1 The aircraft was equipped with the standard navigation equipment and no defects were recorded before the flight.

1.9 Communications

1.9.1 The aircraft was equipped with the standard communication equipment and no defects were recorded before the flight.

1.10 Aerodrome information

1.10.1 The accident occurred at Greefdale private aerodrome near Hartswater with the geographical position determined as S27° 48.43.99 E024° 44.00.13; elevation 3581 feet AMSL.

1.10.2 According to the pilot, the length of the grass runway was approximately 800 m (2650 ft).

2

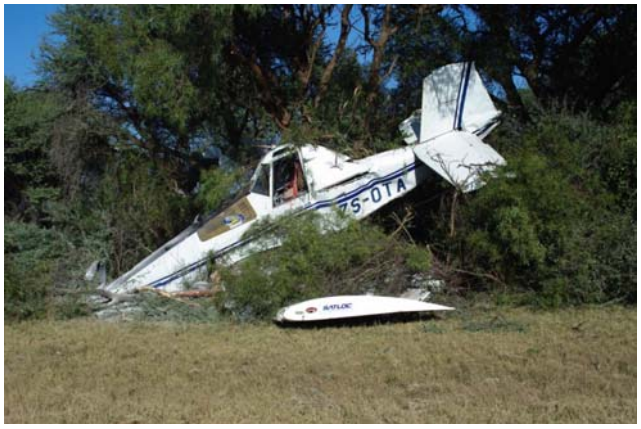
Aerodrome location	Greefdale private aerodrome near Hartswater	
Aerodrome co-ordinates	S27° 48.43.99 E024° 44.00.13;	
Aerodrome elevation	3581 ft AMSL	
Runway designations	32/14	
Runway dimensions	800 m	
Runway used	32	
Runway surface	Grass	
Approach facilities	None	

1.11 Flight recorders

1.11.1 The aircraft was not equipped with a flight data recorder (FDR) or a cockpit voice recorder (CVR), nor was it required in terms of the regulations to be fitted to this type of aircraft.

1.12 Wreckage and impact information

1.12.1 The pilot was about to commence with a crop spraying detail. During the takeoff roll in a northerly direction, the pilot lost directional control of the aircraft and hit trees 700 metres down the runway, next to the runway.



Picture 2 Damage to the aircraft

1.13 Medical and pathological information

1.13.1 The pilot sustained a cut to his hand. He was taken to a hospital for a CAT scan as a precaution on recommendation of the doctor who treated his hand.

1.14 Fire

1.14.1 There was no pre- or post impact fire.

1.15 Survival aspects

1.15.1 The accident was considered survivable. The pilot onboard the aircraft was properly restrained at the time by making use of the aircraft's safety harness.

1.16 Tests and research

1.16.1 None.

1.17 Organisational and management information

1.17.1 This was an agricultural crop spraying detail flight.

1.17.2 The operator under which the crop spraying detail was conducted was in possession of a valid operating license in accordance with the domestic and international air services licensing legislation.

1.17.3 According to available records the aircraft maintenance organization (AMO) that certified the last MPI on the aircraft prior to the accident was in possession of a valid AMO approval.

1.18 Additional information

1.18.1 Information on taking off with tail draggers. See Appendix A.

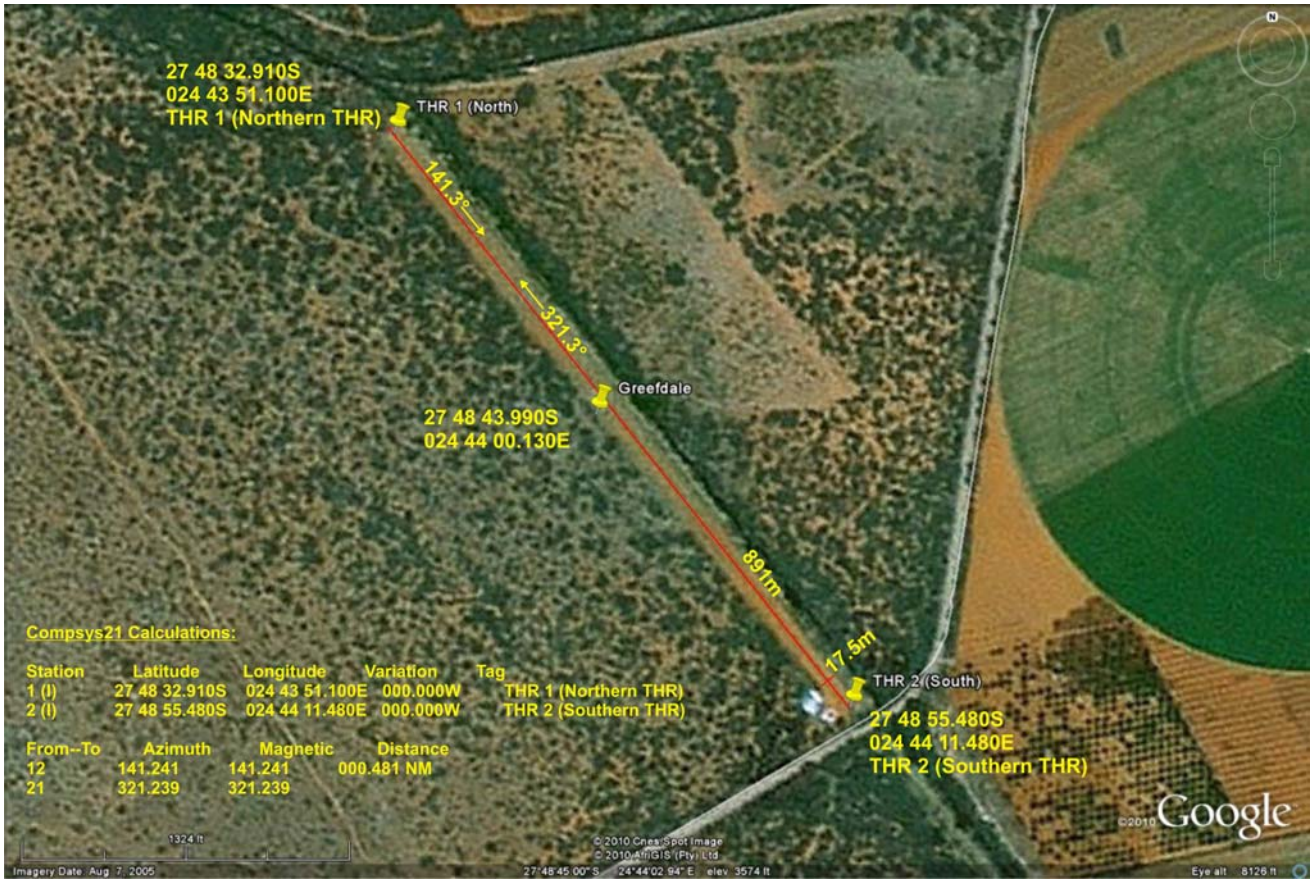
1.18.2 According to available information the pilot flew the aircraft prior to the accident on 12 April 2010, which was 2 months prior to the accident.

1.18.3 The Thrush Aircraft Inc. Model S2R-T34 TURBO THRUSH aircraft maintenance manual states that the wingspan of the aircraft is 47,5 feet.

1.18.4 The private aerodrome is located at S27°48.43.99 E024°44.00.13 from the Google Earth image below. The width of the runway was determined to be approximately 17,5m.

1.18.5 The Google Earth calculations to determine the runway dimensions were done with the Digital Aeronautical Database System (DADS) (Version 2.8/06) software. The results of the calculations can be seen on photo 2 attached below.

1.18.6 The width of the runway was determined by the trees bordering the runway. The distance between the rows of trees bordering the runway and parallel to the runway was determined to be 17.5m.



Picture 3 Google Earth image

1.19 Useful or effective investigation techniques

1.19.1 None.

2. ANALYSIS

2.1 The aircraft was serviceable prior to the accident and no record of any malfunction or defect was recorded that could have contributed to the accident.

2.2 The pilot was properly licensed and medically fit to operate the aircraft. According to available information the pilot last flew for 0,6 hours 2 months prior to the accident.

2.3 Available information indicated that fine weather prevailed in the area at the time of the accident. Therefore, the prevailing weather conditions were not considered to have had any bearing on the accident.

2.4 The aircraft is a tail dragger, and taking off with a tail dragger requires more skill, as explained in Appendix A. This pilot, however, has a total of 4771, 55 hours on type, and it is very unlikely that a pilot with such an amount of hours on type will lose directional control of the aircraft on take-off.

2.5 According to calculations performed on the Google Earth image, the width of the runway was approximately 17, 5 meters. The wingspan of the aircraft, according to its maintenance manual, is 47, 5 feet (14,478 metres). This would have left the aircraft with a total clearance of approximately 3, 02 metres or 1, 5 meters on either side of the wingtips.

The investigation determined that the clearance between the aircraft and the trees on the edge of the runway, as seen from the Google Earth image, posed a potential hazard to the pilot.

The space left between the aircraft wingtip and the trees left the pilot with a very small margin for error in case of a loss of directional control.

2.6 The pilot elected to rely on his extensive flying experience on this type of aircraft to mitigate the risk of taking off from a runway that left very little room for error.

2.7 The pilot did not have the required space and/or time to correct the loss of directional control.

3. CONCLUSION

3.1 Findings

3.1.1 The pilot was the holder of a valid commercial pilot's licence and had the aircraft type endorsed in his licence.

3.1.2 The pilot was the holder of a valid medical certificate that was issued by an approved CAA medical examiner.

3.1.3 The aircraft was maintained in accordance with the approved maintenance schedule and was in possession of a valid airworthiness certificate at the time of the accident.

3.1.4 The aircraft had flown 56 hours since the last maintenance inspection was done.

3.1.5 The crop spraying detail was conducted in terms of class 3 G8 Air Services licence with associated Aircraft Operator Certificate.

3.1.6 Weather did not contribute to the accident.

3.2 Probable cause/s

3.2.1 The pilot lost directional control of the aircraft during the take-off roll and hit trees next to the runway.

4. SAFETY RECOMMENDATIONS

4.1 None.

5. APPENDICES

5.1 Appendix A - Information on taking-off with tail dragger aircraft. (*www.taildraggers.com)*

Compiled by:

Ahmed Motala Date: ……..

For: Director of Civil Aviation

Investigator-in-charge: ……. Date: ……..

Co-Investigator: ……..……. Date: …….

Appendix A

Takeoff in a Taildragger

Your first takeoff in a taildragger might seem like some kind of exercise is s-turns on the runway, but with a little understanding of what is happening, getting a few techniques down, and a little practice, you'll soon be able to make nice, straight, and clean takeoffs in the taildragger.

Overview

In this overview section, we will explain the basic takeoff procedure in a taildragger. The next section will break down the forces acting on the taildragger in more detail.

Takeoff in a taildragger starts about like a takeoff in any airplane. You taxi out onto the runway, get the airplane lined up with the center line, get the tailwheel straightened out, and begin applying power. You will see that right rudder is immediately required to keep the airplane rolling straight down the runway. You must look straight down the runway throughout the entire takeoff roll with full attention and use the rudder to keep the airplane going straight. Don't let anything distract you from paying full attention to maintaining directional control. Do not underestimate the taildragger's ability to quickly get you in trouble if you fail to heed this advice.

Taildraggers are essentially designed to sit at their stall angle of attack on the ground for landing purposes. This is not the ideal situation for takeoff. You need to raise the tail a little during the takeoff roll to achieve something closer to the airplane's normal climb angle of attack. You accomplish this by applying forward stick/yoke fairly early in the takeoff roll. Be prepared for an extra dose of right rudder when the tail comes up. Hold this attitude and allow the airplane to fly off the runway.

You don't worry about the airspeed indicator during takeoff in a taildragger. You're not waiting to achieve "V_1" at which point you pull back on the stick/yoke to rotate and lift off as you do in a nose wheel airplane. Just the opposite is true in a taildragger. As discussed above, you actually push *forward* on the stick/yoke to lower the nose as it's too high when sitting on the tailwheel. Some folks raise the tail too high, then do pull back on the stick/yoke to "rotate" and lift off. This is not the correct way to make a takeoff in a taildragger. You want to raise the tail just a little to a normal climb attitude and let the airplane fly itself off. Airspeed is irrelevant during the takeoff roll in a taildragger. You're flying the airplane by pitch attitude, not airspeed numbers. In climb, the airspeed indicator is just used as a reference to make sure you have the correct pitch attitude. You tweak the pitch attitude to maintain the desired airspeed. Once the taildragger lifts off, you certainly use the airspeed indicator in this manner, but when rolling down the runway, you are highly concerned with marinating directional control, not waiting for any desired airspeed. The airplane will fly off when it's ready. Then you can start using the airspeed indicator as you normally would in climb.

It cannot be emphasized enough that you need to have all eyes looking straight down the runway on takeoff. You're actually flying a taildragger off the runway from the moment you started your takeoff roll. You need to pay full attention to controlling the airplane, especially keeping it going straight down the runway. You should have a feel for a good pitch attitude that allows the airplane to just fly itself off the runway.

The ideal situation is to raise the tail to attain a normal climb attitude, the airplane flies itself off the ground in that attitude, and you continue to hold that exact attitude for climb as it is the normal climb attitude. That makes a pretty takeoff and climb out in a taildragger.
Next we'll look at the forces at work acting on the taildragger during takeoff that require you to use all that right rudder to keep the airplane going straight down the runway.

Forces at Work

Torque

Torque is a major factor acting on the airplane at all times when the engine is running. It's there when you're sitting on the ramp with the engine idling. It's there when you're doing your run-up. It's there when you're in cruise. It's there during takeoff too, and in a taildragger, this is one of the times its most noticeable. In the average taildragger most of us fly, it is most noticeable early in the takeoff roll. Essentially, torque is the tendency for the propeller to stop and the airplane to turn. The more horsepower an airplane has, the stronger the effect of torque on that airplane. A 65 HP J-3 Cub does not have a lot of torque, but it is (barely) noticeable and cannot be ignored. A 300 HP Cessna 195 has very noticeable torque and must be countered properly during takeoff or you'll end up in the weeds for sure. Imagine what torque must be like in a P-51 Mustang! In these really powerful airplanes, you have to bring in the power incrementally as you pick up speed so you don't introduce more torque than you have available rudder with which to counteract the torque. The bottom line is that when you add power for takeoff, you must get on the right rudder to counteract torque. Torque is trying to turn the airplane to the left.

P-Factor

P-Factor is caused when the plane of the propeller is moving through the air at an angle. With the airplane in a nose-high attitude in relation to the path of the airplane, as is the case in a taildragger starting its takeoff roll, the plane of the propeller is not moving perpendicular through the air. The air is coming at the propeller at an angle from below. This means that the propeller blade moving downward has a higher angle of attack than the blade moving upward. Since the blade on the airplane's right hand side is moving downward it is realizing a higher angle of attack, therefore producing a little more "lift". Since the blade on the airplane's left hand side is moving up, it realizes the slightly lower angle of attack and produces a little less "lift". So, the right hand side of the propeller is pulling a little harder than the left hand side. This tends to turn the airplane to the left. If the airplane is not moving, there is no P-Factor at all. As the airplane begins to roll down the runway, P-Factor increases.
The bottom line is that this force also requires right rudder to counteract. This force gets stronger as the airplane picks up speed, but the rudder also becomes more effective as you pick up speed. This force is reduced once you have the tail raised, but is still there because you do not raise the tail high enough to completely eliminate this force.

Gyroscope Effect

This force only acts on the airplane during the moment the tail is moving up. The propeller is a pretty good gyro. When you apply a force to a gyro, it reacts 90 degrees in the direction of rotation. When you are raising the tail, you are essentially changing the plane of the propeller "gyro" as if you were pushing on the top of the propeller arc from behind. Since the propeller is turning clockwise when viewed from behind, and since a "gyro" reacts with a force 90 degrees in the direction of rotation, the reaction comes as if you were pushing from behind on the right side of the

propeller arc. This tends to turn the airplane to the left. The more horsepower the engine has, the stronger this gyroscope reaction will be. In airplanes with a lot of power, you will need to be careful not to bring the tail up too soon, before you have enough speed and therefore rudder effectiveness to counteract this force.
The bottom line is that while the tail is coming up, an extra dose of right rudder is required to keep the airplane straight. A good taildragger pilot will anticipate the tail coming up and be there an instant before with the right rudder so the nose never moves, rather than waiting to see the nose to start to the left and then kicking it back with the right rudder. Once the tail stops coming up, you let off the right rudder a little because the gyroscope effect stops, and at this time, you have reduced the angle at which the plane of the propeller is moving through the air, so P-Factor has also been reduced. Also, when the tail comes up, you lose the traction provided by the tailwheel, so this too causes a little more rudder to be required.
Once the tail is up, the airplane is picking up speed, so the rudder is becoming more effective. As the rudder becomes more effective, less rudder is required to do the same job. The typical taildragger takeoff may require a lot of right rudder during the initial moments of takeoff, maybe even sustained doses of full right rudder. During the end of the takeoff, you have pretty much reduced right rudder usage to that normal during a climb. When the airplane flies off the runway, you are essentially in a normal climb, and we all know that a little right rudder is required in the climb, whether in a taildragger or a nose wheel airplane, to counteract torque and P-Factor.

Techniques to Learn and Use

Look straight down the runway
During a taildragger takeoff, you should look straight down the runway at all times and keep on the rudders to keep the airplane going straight. Don't concern yourself with the airspeed, waiting for V_1 so you can rotate. That's not how it works in a taildragger. There is no rotation in a normal taildragger takeoff. Your first and foremost attention should be paid to keeping the airplane straight and getting the tail up to attain the proper angle of attack so the airplane flies itself off. You're flying the airplane off the runway like they did in the old days, not like they do in today's modern aircraft. Hopefully you're flying a taildragger in the first place because you like to fly, not watch gauges and push buttons on fancy radios and other equipment. You're a pilot when you fly a taildragger, not a cockpit resource manager!
Anticipate
Learn to anticipate right rudder when needed. When you start applying takeoff power, apply right rudder at the same time. Don't wait for the nose to move to the left, then come in with rudder and move it back. Keep ahead of the airplane. The same holds true when the tail comes up, as mentioned above in the gyroscope discussion. Anticipate that tail coming up. Be ready to lead that with right rudder so that when the tail comes up the nose doesn't move, rather than waiting for the nose to move to the left, then pushing in right rudder to bring it back straight. You may be a moment too late and full right rudder won't be enough to get the nose back straight.
Use your feet
Use you feet aggressively at first. The taildragger wants to do everything but go straight down the runway. Work your feet like crazy and stay ahead of the airplane. You're better off to use a little too much rudder a little too quickly than to let the airplane get ahead of you and heading off towards the weeds on either side of the runway because you can definitely get too far behind in a hurry and not be able to get the airplane straight again. You will probably pull the power off at that point, but you're probably going to end up in the weeds or the ditch alongside the runway, and

that's if you're lucky. If you're not lucky, you may end up plowing through other airplanes on a taxiway or parked on the ramp.

Takeoff Summary Outline

- Line the airplane up with the runway center line
- Get the tailwheel straight
- Look straight down the runway
- Apply power gently
- Keep looking straight down the runway and keep the airplane straight with the rudder
- Apply a little forward stick to raise the tail as necessary