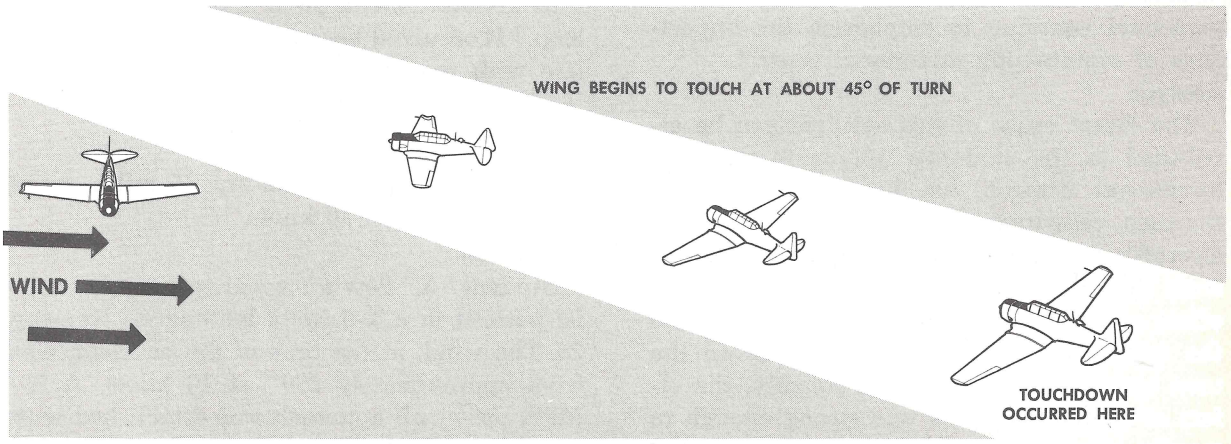
analysis of landing accidents

appendix III

In the foregoing chapters of this manual, the factors that affect an aircraft during a landing and the after-landing roll have been explained thoroughly. The pilot technique employed, both proper and improper, has been explained. The effect of different wind conditions and the use of flaps have also been discussed. From your study of these, you should be able to analyze any landing situation and make the appropriate correction. But to give you an insight into how landing accidents actually occur and the expense they entail, several actual accident reports are provided for your study.

These accident reports were taken from the files of the Directorate of Flying Safety, Headquarters, Flying Training Air Force. They were selected because they portray the types of accidents that are most typical. All names, dates, times, aircraft numbers, and stations have been deleted purposely for obvious reasons. These types of accidents occur all too frequently because of improper control technique, lack of knowledge, and just plain lack of judgment. Study them, discuss them with your fellow-students and instructors, and ask yourself what you would do in similar situations.

At the bottom of each report a section titled "Analysis" has been added to summarize the probable cause of the accident and what should have been done to prevent it. In almost all cases the analysis boils down to that time-worn



Accident No. 1

adage. "An ounce of prevention is worth a pound of cure."

ACCIDENT NUMBER ONE

Weather

Ceiling unlimited, visibility 10 miles, wind South-Southwest at 10 knots.

Description

Student "X" was returning to the home base in a T-6 after a contact proficiency flight. He flew a normal traffic pattern and executed a good three-point touch-down. There was nothing unusual about the approach or touch-down.

After the touch-down the aircraft started a slow turn to the left. The student failed to apply corrective action to maintain directional control and, as a result, the aircraft started turning to the left very rapidly. During the turn the right wing tip struck the ground. After approximately 180° of turn the aircraft was brought to a stop.

The Investigation Revealed

That damage was inflicted to the right wing tip and ailerons and that total estimated cost of the accident was $76.92.

Conclusions

From the above evidence it is concluded that the primary cause factor in this accident was the failure to use the flight controls and power to maintain directional control.

Recommendations

It is recommended that all students be briefed on this accident and that supervisory personnel continue to emphasize the importance of maintaining directional control.

Analysis

The direct cause of this accident can be attributed to the student's failure to maintain directional control. As the aircraft entered the turn, centrifugal force began acting on the aircraft's center of gravity outward and away from the direction of turn. As you know, the effect of centrifugal force is proportionate to the speed of the turning moment. Since the turn was allowed to increase steadily, the effect of centrifugal force was strong enough to tip the aircraft to such an extent that the right wing tip struck the ground.

Although this accident report does not indicate why the aircraft was allowed to turn, there are two very probable reasons. The student might have executed the landing while looking out of only the right side of the aircraft, and thus would not have noticed the turn until too late. Since the report does not indicate the runway on which the landing was made or the degree of flaps used, it is possible that a slight cross-wind was blowing from the left. Under these conditions the aircraft would have tended to weather vane into the wind, unless right rudder or brake was used to keep it rolling straight.

This accident could have been averted if the student had used right rudder and/or brake in the early part of the turn. A power application would also have been very helpful. He could have very easily applied full power and executed a go-around. Even after the aircraft had lost most of its flying speed and the swerve had become very sharp, the judicious use of right brake (low wing-tip side) and throttle would have stopped the turn. Rudder is not very effective in stopping a very sharp turn at low speeds because the airflow around the vertical stabilizer is not very effective.

If this student had stopped the turn even though the aircraft ran off the runway, there would not have been an accident. Regardless of circumstances, any landing accident can be averted up to the point that it actually occurs. This accident was a plain and simple "ground loop." It occurred because the student was "too late with too little."

ACCIDENT NUMBER TWO

Weather

Ceiling unlimited, visibility 15 miles, wind west-northwest at 16 knots.

Description

Student "X" flew a normal rectangular traffic pattern in a T-6 for a landing on Runway 25. The wind, at the time of the accident, was from approximately 290° at 16 knots. A 90-MPH power-off approach was established with 30° degrees of flaps. Although a normal round-out to a three-point landing was initiated, it

was not completed properly and the aircraft touched down slightly main wheels first. A bounce resulted.

When the aircraft struck the runway, the student pulled the stick back, and thus aggravated the bounce condition. He continued to hold the stick back and established an extremely nose-high attitude even though the aircraft was undergoing a severe bounce. The aircraft stalled and the left wing dropped. Power, right rudder, and right aileron were applied as corrective action. This corrective action was inadequate and the left wing tip struck the ground at approximately the same time as did the left landing gear.

After the accident the aircraft was righted and brought to a stop on the runway.

The Investigation Revealed

That damage was inflicted to the left wing tip and aileron and that the total estimated cost of the accident was $62.18.

Conclusions

It is concluded from the above evidence that the primary cause factor in this accident was an improper recovery from a bounce, coupled with the student's slowness in applying corrective action once the wing started to drop.

Recommendations

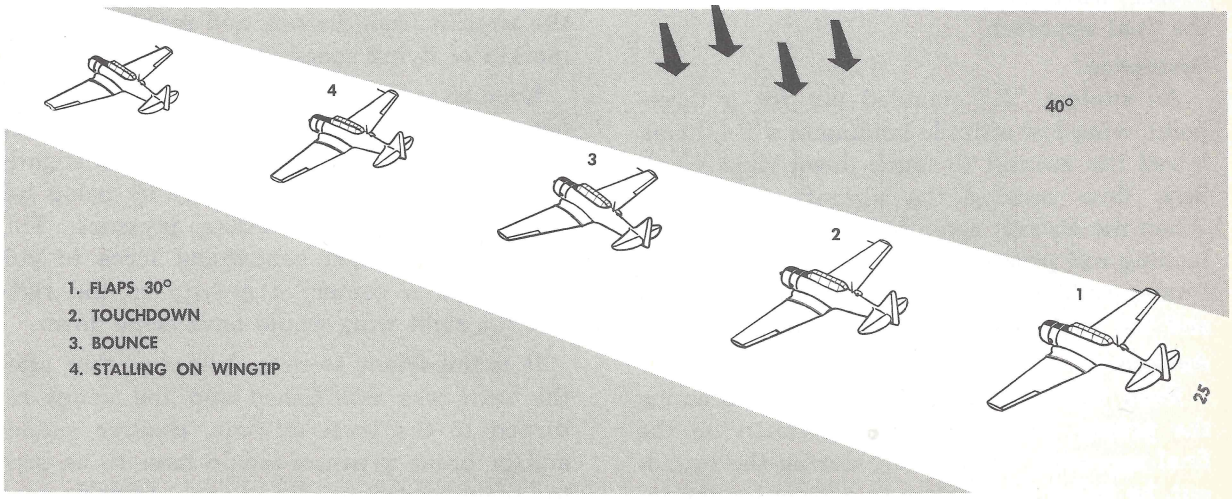
It is recommended that all pilots be again reminded that a *go-around is the only safe and positive recovery from a bad bounce.*

Analysis

This student exercised poor judgment and improper bounce recovery technique, probably as a result of being tense. The student allowed the aircraft to touch down before a three-point attitude was attained. When the aircraft landed main gear first, he pulled the stick back for no apparent reason, other than perhaps a mechanical response. This, of course, only aggravated the bounce condition and caused it to be much more severe than it otherwise would have been.

After the aircraft bounced, the student continued to hold the stick back. Since the aircraft still had flying speed, the pitch was increased to an excessively nose-high attitude. In this attitude the drag increased rapidly, the critical angle of attack was exceeded, and the aircraft stalled.

Although the student may have used the proper amount of wing-low drift correction on the final approach, he obviously failed to increase it as the airspeed dissipated during the round-out. Thus, the aircraft started drifting to the left very slightly. When the aircraft touched down on the right wheel, it was still drifting to the left. This caused the weight to be shifted to the left thus rolling the aircraft



Accident No. 2

in that direction. As the aircraft rolled, the left wheel also struck the ground and helped cause a bounce condition.

When the aircraft bounced back into the air, it was still undergoing a slight roll to the left; consequently, as the aircraft approached a stall condition, the left wing stalled first because it was moving downward and thus had a higher critical angle of attack.

After the aircraft stalled, the student applied power, right rudder, and right aileron but continued to hold the stick back. (What is the procedure for recovering from a stall?) He should have released some of the back-stick pressure with his other corrective action. This would have caused the aircraft to land wheels first and bounce again; but, by this time, the power application would have been effective enough to execute the go-around that should have been executed much earlier. Any time that you encounter a severe bounce, execute a go-around.

Similar Accident

Now let's suppose that this same accident occurred but that the student did not pull the stick back and that the aircraft did not stall. Remember, he had a 40° cross-wind from he right at 16 knots and was using 30 degrees of flaps. Let us also assume that he maintained a normal 90-MPH gliding attitude and the proper wing-low drift correction throughout the final approach.

Description

As student "X" rounded out for a three-point, wing-low attitude landing in a T-6, he allowed the aircraft to touch down right wheel first, thus causing the aircraft to bounce. When the aircraft again touched down and the landing roll progressed, the left wing dropped. Power, rudder, and aileron were used too late and the left wing tip struck the runway.

Analysis

Even though the student was maintaining the proper wing-low drift correction on the final approach, and initially during the round-out, he failed to continue to correct for the increase in drift as the airspeed dissipated. Therefore, when the right wheel struck the runway, the aircraft bounced and tipped to the left slightly. This not only removed all the wind-drift correction but actually exposed the under side of the right wing and flap to the full force of the cross-wind.

As the landing roll progressed the resultant cross-wind force increased and the relative wind decreased. Accordingly, the lift component of the right wing became so much greater than the left one that full right aileron could not equalize them. Obviously, the power was used too late. After the aircraft landed in a left wing-low condition, it was too late to be effective in supplying sufficient lift to the wings and resultant control effectiveness before the wing tip struck the ground.

What could have been done to avert an accident under these conditions? In the first place, he should not have used flaps in such a strong cross-wind and should have executed a go-around immediately after encountering a bad bounce. But assuming that he disregarded these two important safety factors, he still would not have had an accident if the proper flying technique were used.

As the aircraft bounced into the air the student should have immediately re-established the wing-low drift correction and applied power as necessary to cushion the aircraft back onto the runway. This would have prevented the aircraft from drifting and provided a safer margin of flying speed above a stall.

Even after the aircraft landed in a left wing-low condition, the student could have avoided the accident by turning the aircraft slightly to the left (into the low wing) by using left rudder and/or slight brake pressure. This would have caused centrifugal force to pull the aircraft's center of gravity to the right and the right wing would have come down.

It is important to note, however, that after the turn was established and the wings returned to the level attitude, positive rudder and/or brake pressure would have to be used to again maintain directional control even though the aircraft ran off the runway.

As a final note, if you encounter an abnormally high bounce on a landing, apply power immediately and execute a go-around. This is especially important in a strong cross-wind. Don't wait until your aircraft is "mushing" to use the power or re-establish the drift correction.

ACCIDENT NUMBER THREE

Weather

Ceiling 4000 feet scattered, visibility 15 miles, wind south at 10 knots with gusts up to 13 knots.

Description

Student "X" flew a rectangular traffic pattern in a T-6 for a landing on Runway 21. On the final approach he lowered full flaps and established the proper wing-low, cross-wind correction. During the round-out and before the aircraft touched down, he brought the left wing up and leveled the wings, instead of carrying the correction throughout the landing. The aircraft then started drifting to the right.

A landing was effected in a three-point attitude. The right wing tip scraped the runway after the aircraft had rolled approximately 75 feet down the runway. The aircraft was brought to a stop just off the right edge of the runway approximately 100 yards from the point where the accident occurred.

The Investigation Revealed

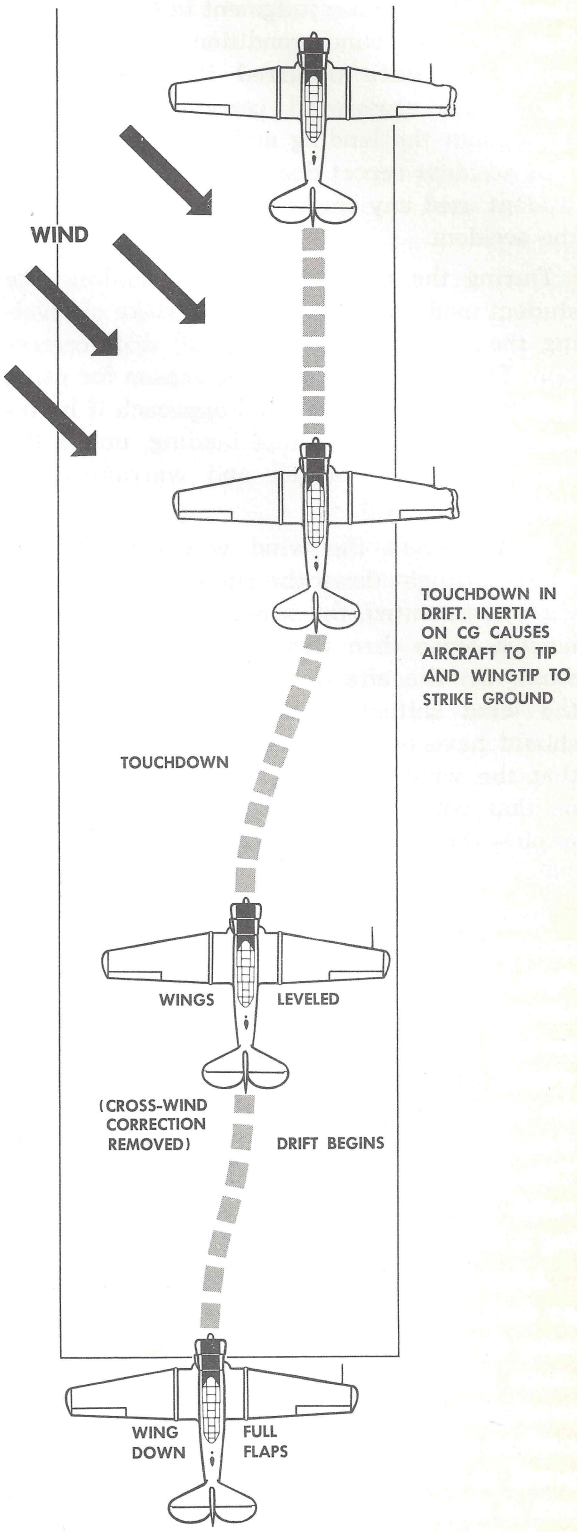
That the right wing tip, aileron, and wing section were extensively damaged and that the total estimated cost of the accident was $432.12.

Conclusions

It is concluded from the above evidence that the primary cause factor in this accident was the failure of the student to maintain a cross-wind correction throughout the touch-down and landing roll. This was aggravated by the use of full flaps in a gusty cross-wind landing.

Analysis

There are two keys to the cause of this accident — the use of full flaps in a gusty 30° cross-wind and the removal of all cross-wind correction prior to the landing. Even



Accident No. 3

though he used poor judgment in lowering full flaps for this wind condition, the accident would not have occurred if he had used the proper cross-wind correction technique throughout the landing and after-landing roll. This accident report does not indicate that the student used any corrective measures to avoid the accident.

During the round-out for the landing, the student made the inexcusable mistake of leveling the wings and removing all drift correction. There was absolutely no reason for using drift correction on the final approach if he intended removing it before landing, unless the wind condition changed and warranted the wings being level.

In the event the wind was variable and shifted straight down the runway as the landing was executed, the wings should have been leveled since then there would be no cross-wind. On the after-landing roll, however, as the wind shifted back to one side, aileron should have been applied in that direction so that the wind could not exert a lifting force on that wing. This accident report, however, implies that the wind was fairly constant from 180° at 10 to 13 knots.

As the wings were leveled, removing all drift correction, the aircraft started drifting to the right even though the longitudinal axis of the aircraft was parallel to the runway. Since the aircraft was still drifting when the three wheels simultaneously contacted the runway, the center of gravity was thrown to the right, thus causing the aircraft to tip in that direction. This rolling tendency was then further aggravated by the cross-wind from the left exerting a lifting force on the left wing and flap.

After the wing started down, it continued to go down at an even-increasing rate until the wing tip struck the runway. This occurred because the forward speed of the aircraft was constantly dissipating, and progressively more surface of the wing and flap were being exposed to the effect of the cross-wind as a result of the tipping. The wing started down immediately after touch-down but did not strike the runway until the aircraft had traveled approximately 75 feet. This indicates that the student had ample time to make the appropriate corrections before the accident occurred.

As had been stated previously in this analysis, a normal landing would have been effected if the student had not used full flaps, and he had maintained the proper cross-wind correction throughout the landing and after-landing roll.

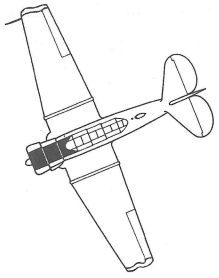
If he had not used full flaps, he would have subjected himself to a less dangerous situation. Since the aircraft would have landed at a higher flying speed in a no-flap condition, the forward speed of the aircraft would have resisted the effect of the cross-wind for a longer period and there would not have been as much aircraft surface exposed to the wind; consequently, he would have had more time to realize the effect of the cross-wind and establish the proper corrective action. Even though he failed to maintain proper drift correction during the landing, he would have had more effective control of the aircraft in preventing a wing tip from scraping the runway.

If he had maintained the proper cross-wind correction, the aircraft would not have landed while drifting and there would not have been the initial tipping or rolling force present. The aileron would automatically have been into the wind, thus decreasing some of the effective lifting force of the wind on the left wing. Even sharp gusts of wind would not have caused alarm.

What could have been done to avert an accident under these conditions? In the first place, the drift correction should never have been removed. It should have been maintained throughout the round-out and touch-down.

However, after the aircraft had landed and the right wing started down, the student could have maintained directional control and applied aileron into the wind. If the wing continued to go down, he should have applied power in addition to the aileron. As a last resort when the wing tip was extremely low, he could have executed a slight turn to the right. This

Accident No. 4



would have caused centrifugal force to pull the center of gravity to the left and thus level the wings. After such a turn is executed and the wings are leveled, it is extremely important that directional control again be maintained to prevent centrifugal force from tipping the aircraft in the other direction.

ACCIDENT NUMBER FOUR

Weather

Ceiling 3500 feet scattered, visibility 10 miles, wind east-northeast at 6 knots with light gusts on the surface.

Description

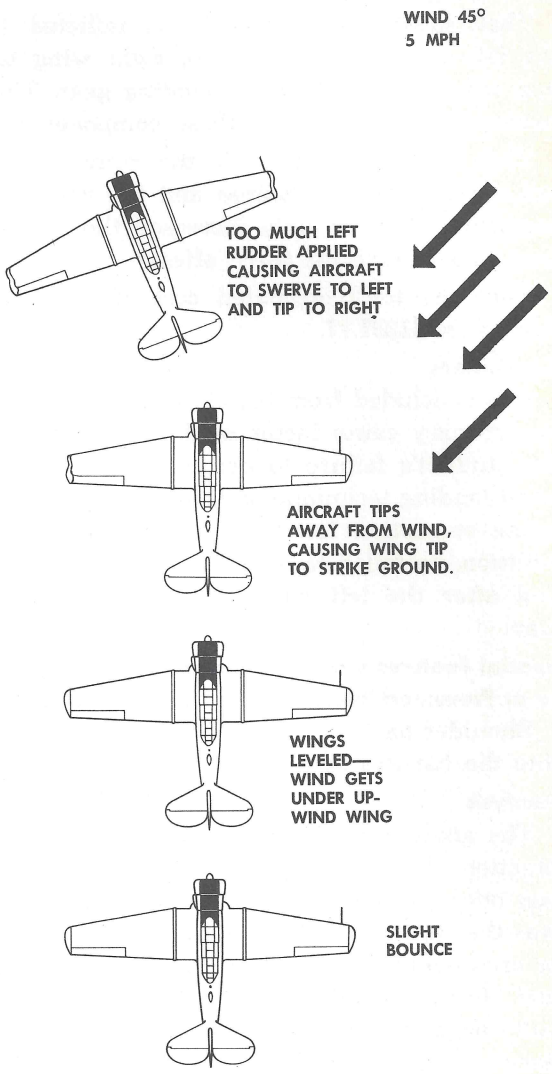
Student "X" was returning to his home base after a routine student formation training mission in a T-6 aircraft. He was number three in a four-aircraft formation led by his instructor.

Everything appeared normal as students in the formation made their pitch-outs preparatory to landing on Runway 35. As the landing pattern was continued, student "X" realized that he was too close to the aircraft ahead of him for a safe landing and effected a go-around. (NOTE: Excellent judgment.)

On his second attempt to land, his approach looked normal from the mobile control *except that he had no correction for a slight cross-wind from the right at* 6 *knots.* Touch-down was made slightly wheels first and a *skip* resulted. As the aircraft again settled onto the runway, the left wing started down, allowing the wind to get under the right wing and accelerating its movement upward. Shortly afterward the left wing tip struck the runway.

Student "X" then applied *full* left rudder and right aileron and the aircraft started a turn to the left and off the runway, dragging the right wing tip and aileron. The right wing was thrown down by centrifugal force and contacted the runway, inflicting damage to the right wing tip, aileron, and right main gear.

The aircraft came to rest approximately 160° from the runway heading at a distance of 225 feet from the runway in a three-point attitude. Student "X" immediately cut the switches and abandoned the aircraft.



The Investigation Revealed

That substantial damage was inflicted to the left wing tip and aileron, right wing tip and aileron, and the main landing gear. This necessitated a change of these components.

That as the aircraft left the runway, the tail wheel lock-pin sheared and the resultant castoring effect possibly increased the rate of turn and centrifugal force effect.

That the total estimated cost of the accident was $1231.77.

Conclusions

It is concluded from the above evidence that the primary cause factor in this accident was the student's failure to use the proper cross-wind landing technique and failure to use adequate correction for a wing-low attitude. In addition, he failed to maintain directional control after the left wing tip struck the runway.

Special Features which Contributed to or Prevented Injury

Shoulder harness was used. Leaning forward into the harness helped prevent bodily injury.

Analysis

The analysis of this accident reveals a combination of the elements found in three previous ones. Although the primary cause factor was the student's failure to maintain the proper cross-wind correction on the final approach and throughout the landing, his initial difficulty began with a bounce similar to the secondary analysis of accident report number 2. The first part of the accident, when the left wing tip scraped the runway, occurred under similar conditions as those in accident report number 3. The latter part, when the right wing tip struck the runway, was similar to accident report number 1.

Unless the proper technique is used for an intended wheel landing, an aircraft will invariably bounce when it touches down wheels first. The wings will be leveled almost every time a bounce occurs because the inertia of the aircraft settling to the ground will cause both wheels to touch down. The wings, of course, will be leveled when both main wheels are on the ground. So when a bounce occurs in a cross-wind condition, any drift correction that was used during the round-out will necessarily have to be re-established immediately during the bounce.

This student had not corrected for drift before the bounce occurred nor did he correct afterwards. Since the aircraft originally settled onto the runway while it was still drifting, it was given a tipping or rolling tendency to the left as it bounced into the air. When it returned to the runway, it was given another tipping force more prominent than the first because the flying speed was considerably reduced, and thus did not resist the effect of the cross-wind as much. This, coupled with the more broadside effect of the cross-wind, caused the right wing to be lifted sufficiently to drag the left wing tip.

Although the accident report does not mention the effect of weather-vaning, it is quite possible that the aircraft was also being weather vaned to the right. If so, centrifugal force was helping to bring the left wing down.

Up until the accident occurred, the student had made no special effort to prevent it. After the left wing tip struck the runway, however, he took the corrective action that should have been taken as a last resort before the accident occurred. He applied *full* left rudder into the low wing and full right aileron to prevent the wind from raising the right wing. Applying full right aileron that late apparently had no effect. If he had used it before the left wing tip touched, it probably would have prevented the accident altogether.

The application of *full* left rudder, at that time, was mechanical and unnecessary. The left wing tip's scraping the runway caused enough drag on the aircraft to start a turn to the left, even without the use of rudder. The application of full rudder, coupled with the turning effect of the dragging wing tip, caused the aircraft to turn very sharply and abruptly to the left. Centrifugal force caused by such a sharp turn not only leveled the wings but also brought the right wing down sufficiently to

scrape the runway. The accident report also states that the tail wheel locking-pin was sheared.

If the proper application of aileron into the wind and throttle (to increase the forward speed of the aircraft and the lift of the wings) had not been effective in preventing the accident, the student could have executed a slight turn to the left (into the low wing). But he certainly should not have made such a sharp turn. Left rudder and/or brake should have been used to initiate a turn *only to keep the left wing tip from touching the runway.* After the wings had approached approximately the level position, he should have maintained directional control and brought the aircraft to a stop. Even though the turn had been initiated too late to prevent the left wing from touching the runway, it would have minimized the damage to that wing, provided it was executed properly.

In summary, it is apparent that the student exercised good judgment until the approach for the landing was initiated. He used excellent judgment in executing a go-around when he was too close to another aircraft in the traffic pattern. After he established the final approach, however, his judgment was defective. He failed to use proper technique for a cross-wind approach. After the aircraft bounced he continued with the landing, thus demanding of himself a much higher and keener degree of judgment and flying technique.

It is also apparent from this report that the student had a very limited knowledge of the aerodynamics of a landing. He knew that a turn into the low wing would cause that wing to be raised but he obviously did not know, or at least did not consider, how effective such a turn could be. As a result, he inflicted severe damage to the right wing tip, right aileron, and main landing gear, causing about one thousand dollars damage more than if he had disregarded the corrective turn.

You should be a better and more informed pilot than this student because you have had the benefit of his mistakes. If you get into such a situation, use your own judgment and discretion. Don't wait until you are told what to do by your instructor or the mobile control officer. If you have studied Chapter Seven of this manual and these accident reports thoroughly, you will not approach such a situation; but even if you do, your good judgment should determine the appropriate action to be taken.

ACCIDENT NUMBER FIVE

Weather

Ceiling 6500 feet overcast with breaks in the overcast, visibility 10 miles, and wind from the east-northeast at 6 knots.

Description

A C-47 aircraft was returning to its home base from a local instrument training flight to terminate its mission. Landing was made on Runway 35 with a reported east-northeast wind at 7 knots. Touch-down was made in a three-point attitude using full flaps. After a roll of approximately 300 yards, the left wing dropped slowly and dragged along the runway. The pilot stated that the aircraft was not turning during this time. Investigation of the left wing tip and the runway surface confirmed the fact that the tail wheel was on the ground during the time the wing tip and aileron contacted the runway and were damaged.

The pilot stated that when the left wing dropped, he applied *right* aileron. When this had no apparent effect he applied *full right rudder,* immediately followed by full power on both engines for a go-around. The aircraft became airborne shortly after the wing tip scraped the runway, and an uneventful go-around and subsequent landing was made.

Further questioning revealed that the pilot believed that the use of the rudder on the high wing side would pick up a wing that had dropped. It must be noted that "rudder excercise stalls" were once used to teach a pilot to pick up a low wing by using opposite rudder. By employing this method a pilot landing in a cross-wind condition would insure, rather than prevent, the dragging of a wing tip during the after-landing roll.

The pilot further stated that he would be reluctant to use brakes on the low wing side of an aircraft under this condition. It is believed that an accumulation of circumstances and control techniques caused this minor accident in the following order of occurence:

1. A cross-wind from the right tended to lift the right wing and drop the left one.

2. The weather-vaning of the aircraft turned it to the right (into the wind), thus causing centrifugal force to shift the center of gravity to the left (aircraft tilt to the left).

3. The pilot's instinctive reaction to pick up the low left wing by the use of right rudder as developed by the old "rudder exercise stall" technique. Such use of the right rudder on the ground would only cause the center of gravity to shift further to the left and the left wing to be further forced down.

The Investigation Revealed

That damage was inflicted to the left wing tip and aileron, and that the total estimated cost of the accident was $732.50.

Conclusions

From the above evidence it is concluded that the primary cause factor in this accident was the failure to compensate for the wind condition and the misused brakes and/or flight controls on the ground.

It is the opinion of the board that the instruction given this pilot in his early flying career through the practice of "rudder exercise stalls" had misled him into believing and practicing the technique of trying, while on the ground, to bring a low wing up with the opposite rudder in a cross-wind condition.

Recommendations

1. That the value of "rudder exercise stalls" as practiced at some Air Force Pilot Training Schools be re-evaluated in the light of this and similar accidents.

2. That a program be established, or a film made, to re-educate pilots concerning the non-relation and danger of the "rudder exercise stall" technique when applied to a normal or cross-wind landing condition.

That the use of ailerons on a landing roll before and after an aircraft is in a stalled condition is safe and very effective in preventing a wing from rising during a cross-wind landing condition.

That all pilots be educated in an understanding of the aerodynamics and mechanics of aircraft control in cross-wind landings essentially as follows:

a. The wing-low drift correction should be used throughout the final approach, landing, and after-landing roll. The actual touch-down will be made on the up-wind main wheel first.

b. The aileron should be held into the wind throughout the entire landing roll.

c. When necessary use down-wind rudder and/or brake (cross-control in relation to the aileron usage) to keep the aircraft rolling straight.

Analysis

The accident reporting officer did such an excellent job of reporting this accident that it requires little analyzing. It is easy to understand what happened. The pilot simply used an improper cross-wind landing technique and had an erroneous understanding of the aerodynamics and mechanics of correcting for a cross-wind. He was a seasoned military pilot with approximately two thousand flying hours, mostly in heavy cargo and bombardment-type aircraft. Up until this time he had primarily used power on only one engine to combat cross-winds and to keep his aircraft aligned with the runway. When he was flying tricycle landing gear aircraft, he had very little trouble maintaining directional control because the center of gravity, instead of being back of the main landing gear as in the T-6 aircraft, was between the nose wheel and the main landing gear; consequently, when centrifugal force acted on the aircraft in a turn, it tended to resist the turn, thus helping to keep the aircraft traveling along a straight path.

During his primary pilot training, his instructor had erroneously taught him through the practice of "rudder exercise stalls" that any time a wing dropped it could be raised by skidding the aircraft in

the opposite direction. He was taught that this would increase the lift component of that wing sufficiently to raise the wing. This is true to a minor extent *when an aircraft is airborne,* but it is no value on the ground. Any lift that may be gained will be greatly overcome by the effect of centrifugal force acting on the center of gravity.

The "rudder exercise stall" is an excellent maneuver to demonstrate the effectiveness of the rudders to maintain directional control during a stalled condition. It is not practiced to teach you to change the lift components of the wings. If you attempt to use it as such, you can cause one wing to stall completely as you try to increase the lift component of the other. Whether you are airborne or on the ground, maintain directional control by using smooth rudder pressure necessary to keep the nose of the aircraft traveling straight ahead. Of course, when you are on the ground, brake and throttle also are available to help maintain directional control. Use them in any proportion that is necessary.

This accident occurred because the pilot actually forced the left wing down by turning the aircraft to the right. Although there was a cross-wind from the right and no aileron was being used to prevent the wind from lifting the wing, the accident might not have occurred if the pilot had maintained directional control and used aileron into the wind. The cross-wind was not strong enough to lift a C-47 wing high enough to cause the other wing to touch the runway. There is quite a difference between the distance of a wing tip from the ground on a C-47 and a T-6 aircraft. Also, the distance between the main landing gear is very wide on the C-47, whereas it is narrow on the T-6.

The pilot allowed the aircraft to weather vane to the right, consequently permitting centrifugal force to shift the center of gravity to the left and causing the left wing to come down. Although the rate of turning moment was not particularly dangerous, when coupled with a slight lifting effect of the cross-wind, it had caused the left wing to come down. The pilot interpreted this as being the result of a strong cross-wind and correctly applied right aileron. Of course, this did not raise the left wing since the main cause of trouble, centrifugal force, was still present. Then, thinking he would increase the lift of the left wing, he erroneously applied *full* right rudder. This greatly increased the centrifugal force and actually caused the left wing tip to strike the runway.

If he had maintained directional control by applying left rudder and/or brake, this accident would not have occurred. Remember, the pilot stated that he would be reluctant to use brake on the low wing side. There is absolutely nothing wrong with using brakes. As a matter of fact, their use is highly desirable any time they can help maintain control of the aircraft, especially in situations such as the foregoing.

Since the aircraft traveled three hundred yards down the runway before the accident occurred, the pilot had plenty of time to analyze the situation and take the appropriate action. He analyzed the situation, but because of his lack of knowledge of aerodynamic principles and of correct control techniques, his analysis was wrong and cost the Air Force $732.50.

Although this accident occurred in a C-47, it is identical to the type of accidents that occur in the T-6 aircraft and also many other types. Since the pilot was a seasoned military pilot, this accident report is proof that what you learn in primary flight training will be retained throughout your military career. Apply yourself diligently and make each flight worthwhile.

ACCIDENT NUMBER SIX

Weather

Ceiling 4000 scattered, visibility 15 miles, wind Southeast at 12 knots.

Description

After completing a solo contact proficiency flight in a T-6, Student "X" flew a normal left-hand traffic pattern for a landing on marked Runway 17 in a sodded field. The wind at the

time of the accident was from the southeast at approximately 12 knots. The traffic pattern was normal in every respect. The landing was a normal power-off, three-point attitude.

After rolling between 100 and 200 feet, the aircraft began a slow turn to the left. The student applied right rudder but the aircraft continued to turn. He then applied full right rudder with no apparent effect. At approximately 90° from the landing direction, the student applied a small amount of power but the aircraft ground looped to the left and major damage was inflicted on the aircraft.

The Investigation Revealed

That major damage was inflicted to the right wing, right aileron, and right main landing gear and that the total estimated cost of the accident was $1252.49.

Conclusions

The Aircraft Investigation Board determined that the primary cause factor was a delayed use of flight controls on the landing roll. The secondary cause factor was the failure to properly compensate for the wind conditions.

It was the opinion of the board that the student did not recognize the need for corrective action soon enough and that his application of rudder and power were too late to be effective. In addition, the proper use of brake could have been very effective in stopping the turn and preventing centrifugal force from acting on the aircraft.

This accident is to be analyzed by you and the analysis checked by your instructor.

NOTE: Could a weather-vaning tendency of the aircraft have contributed to the accident? What could have been done to prevent it?

ACCIDENT NUMBER SEVEN

Weather

Ceiling 8000 feet broken sky condition, visibility 12 miles, wind from the North at 20 knots with variable and shifting gusts.

Description

Student "X" made an approach for a three-point landing using full flaps and a combination wing-low and crab method of drift correction for a cross-wind from the right. The wind velocity at the time of the accident was reported from the north at 20 knots, variable with gusts to 23 knots.

The student removed the drift correction during the round-out and landed in a three-point attitude with the wings level. A gust of wind lifted the right wing, causing the left wing tip to strike the runway and the aircraft to veer to the left.

In making correction for directional control, the student applied power and righted the aircraft to a three-point attitude on the sod shoulder of the runway approximately 30° from the landing direction. The aircraft was brought to a stop approximately 300 feet to the left of the runway.

The Investigation Revealed

That damage was inflicted to the left wing tip and aileron, and that the total estimated cost of the accident was $250.00.

Conclusions

From the above evidence it is concluded that the primary cause factor in this accident was the improper cross-wind correction employed on the final approach and throughout the landing. Faulty judgment was exercised in using full flaps in such a landing condition. It was also concluded from other evidence that the flight instructor improperly supervised the flight.

Recommendations

It is recommended that all students and instructors use *only the wing-low* method of drift correction.

It is further recommended that all flying personnel be instructed to use a minimum No. of degrees of flaps during cross-wind landings.

Analysis

This accident is to be analyzed by you and the analysis checked by your instructor. What did the student do wrong in this accident? What could he have done to prevent the accident? What is meant by "crab" on the final approach?

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