—Overview and analysis of accident investigation cases—

Japan Transport Safety Board DIGESTS

JTSB (Japan Transport Safety Board) DIGESTS

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Aviation Accident Analysis Report

Preventing accidents caused by runway contact —Complying with rules and adhering to the basics—

Chapter 1 Introduction

The Japan Transport Safety Board (JTSB) classifies investigated accidents and serious incidents into 36 categories (Occurrence Category) based on internationally standardized criteria. These occurrence categories are published on the website of the JTSB together with the aircraft accident investigation reports and aircraft serious incident reports (hereinafter referred to as "reports") and provided as keywords for searching reports.

When looking at the breakdown of occurrence categories in reports published through November 2024, categories classified as "any landing or takeoff involving abnormal runway or landing surface contact" (ARC: Abnormal Runway Contact; see Figures 1 and 2) are the most frequent.

Additionally, in documents from the International Civil Aviation Organization (ICAO) and the National Transportation Safety Board (NTSB), a U.S. investigative agency, ARC also consistently ranks among the top occurrence categories and has long been recognized as a risk to safety during takeoff and landing.

As characteristics of ARC, the large number of occurrences is notable, and in some cases it can lead to collisions with ground objects such as the terrain or other aircraft that may result in serious damage.

Figure 1: ARC accident photo

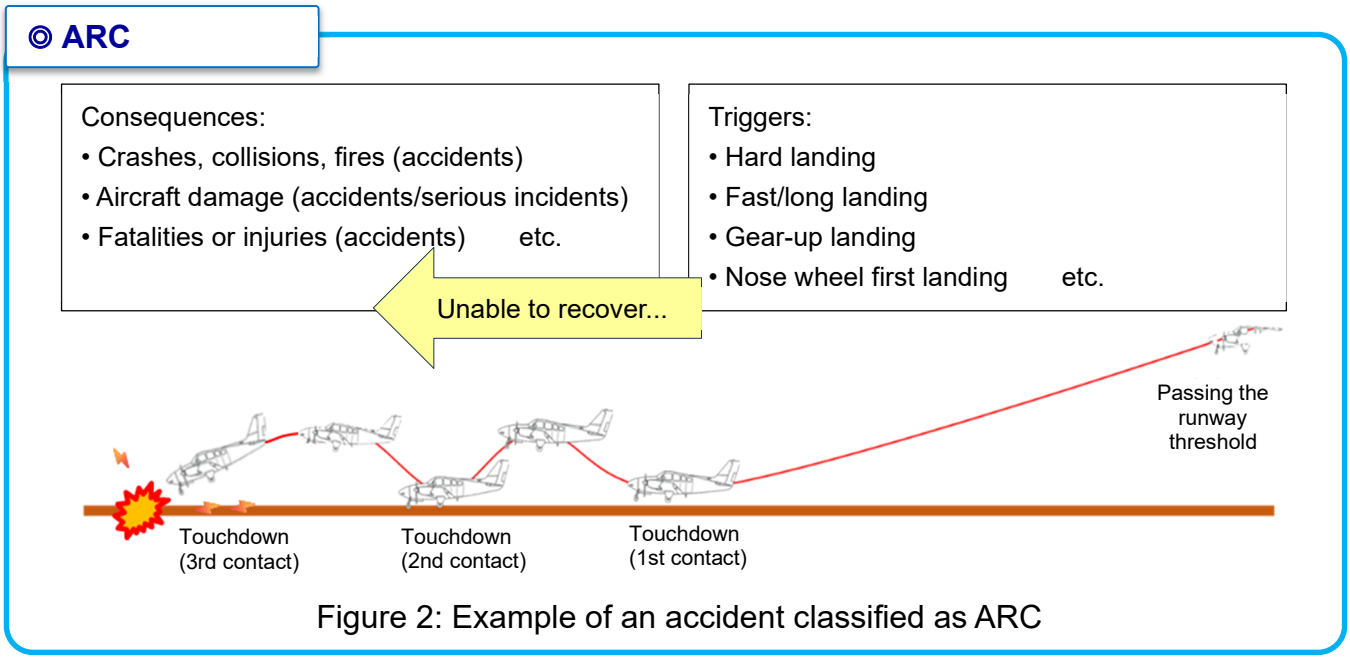


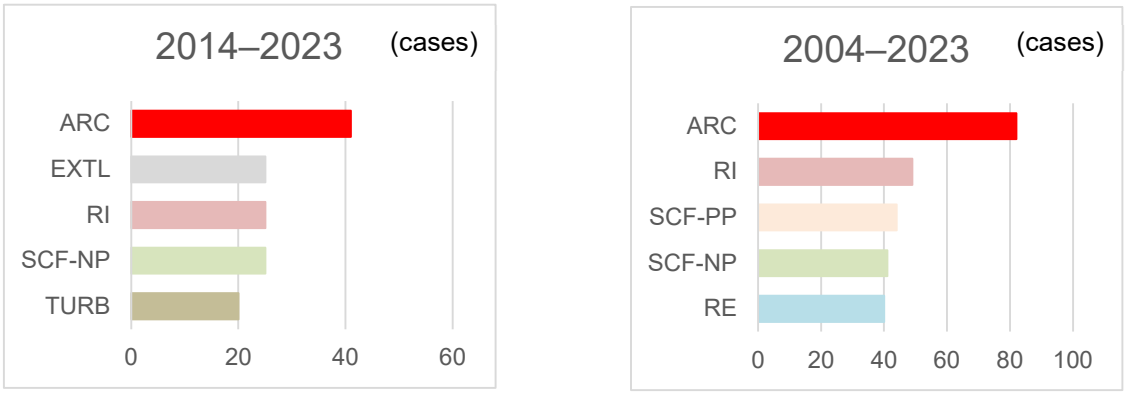
Figure 2: Example of an accident classified as ARC

In this JTSB Digest, we will focus on 41 cases of accidents and serious incidents that are classified as ARC, which occurred during the 10 years from 2014 to 2023 and whose reports were published by November 2024, (excluding those involving ultralight powered aircraft and homebuilt aircraft; hereinafter referred to as "ARC accidents") to introduce their occurrence, measures to prevent ARC accidents, and some case studies.

Chapter 2 Occurrence of ARC accidents

1. Occurrence of accidents

When looking at the occurrence categories of accidents that occurred during the 10- and 20-year periods up to 2023 (limited to accidents whose reports were published) by tabulating them, ARC accidents numbered 41 in the 10-year period and 82 in the 20-year period, making them the most frequent in both periods, and therefore, measures to prevent recurrence of accidents of this category are necessary. (See Figure 3.)



ARC: Any landing or takeoff involving abnormal runway or landing surface contact
EXTL: Occurrences during or as a result of external load or external cargo operations
SCF-PP: Failure or malfunction of an aircraft system or component related to the powerplant
SCF-NP: Failure or malfunction of an aircraft system or component other than the powerplant
RI: Any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle, or person on the protected area of a surface designated for the landing and takeoff of aircraft
RE: A veer off or overrun off the runway surface
TURB: In-flight turbulence encounter

Figure 3: Number of occurrences by occurrence category (top five categories only)

Of these, looking at the breakdown of ARC accidents over the 10-year period, as for accidents, there were three crash cases, two collision cases, two cases of injuries to persons, and 24 cases of aircraft damage (which required major repair; including 7 gear-up landing cases, 3 tail strikes, and 14 other types of damage). As for serious incidents, there were seven airframe contact cases (including 3 with fuselages, 3 with propellers, and 1 with a wingtip), and three cases where the aircraft became unable to continue flight.

Next, looking at the number of occurrence by kind of aircraft, of the 41 ARC accidents, small aircraft accounted for 22 cases (about 54%), more than half, followed by gliders, with 11 cases (about 27%). By operator, private aircraft accounted for 18 cases (about 44%), nearly half, aircraft operated by organizations such as university flying clubs accounted for 12 cases (about 29%), and commercial aircraft, including those of airlines, accounted for 11 cases (27%). (See Figure 4.)

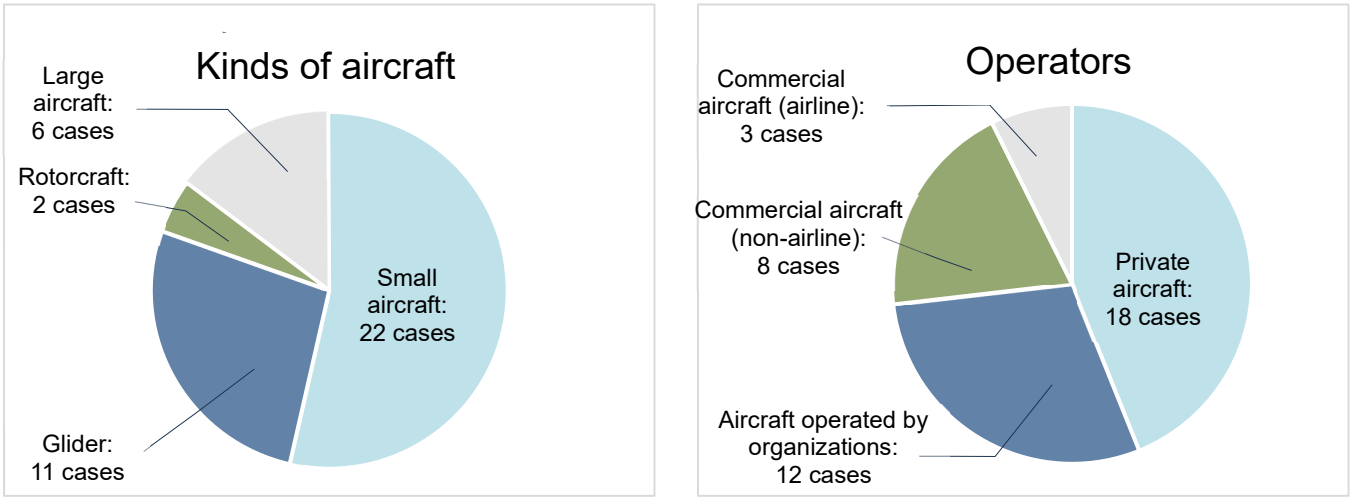


Figure 4: Number of ARC accidents by kind of aircraft and by operator

2. Occurrence of damage

As for casualties, there were two fatal accidents, four accidents with serious injuries, and three accidents with minor injuries. As there was a case where, after an aircraft bounced on the runway, inappropriate operations by the pilot led to a crash that killed all four occupants; ARC accidents do not necessarily result in only minor consequences.

Meanwhile, regarding aircraft damage, cases where aircraft were destroyed beyond practical repair and where aircraft were substantially damaged requiring major repairs totaled 30 cases (about 73%), accounting for roughly three quarters. (See Figure 5.)

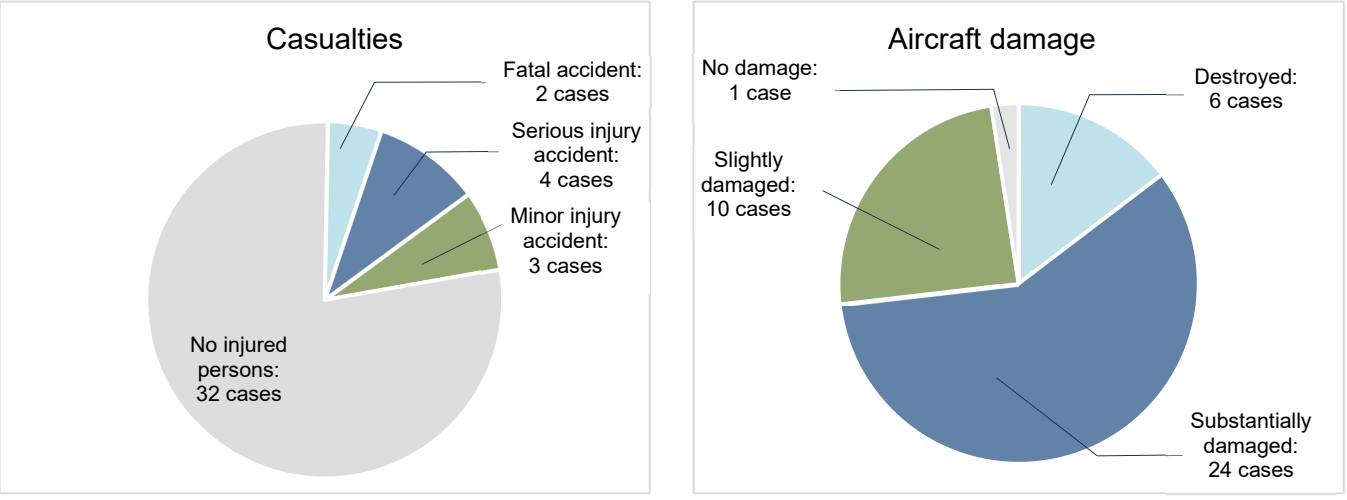


Figure 5: Number of ARC accidents by casualties and by aircraft damage

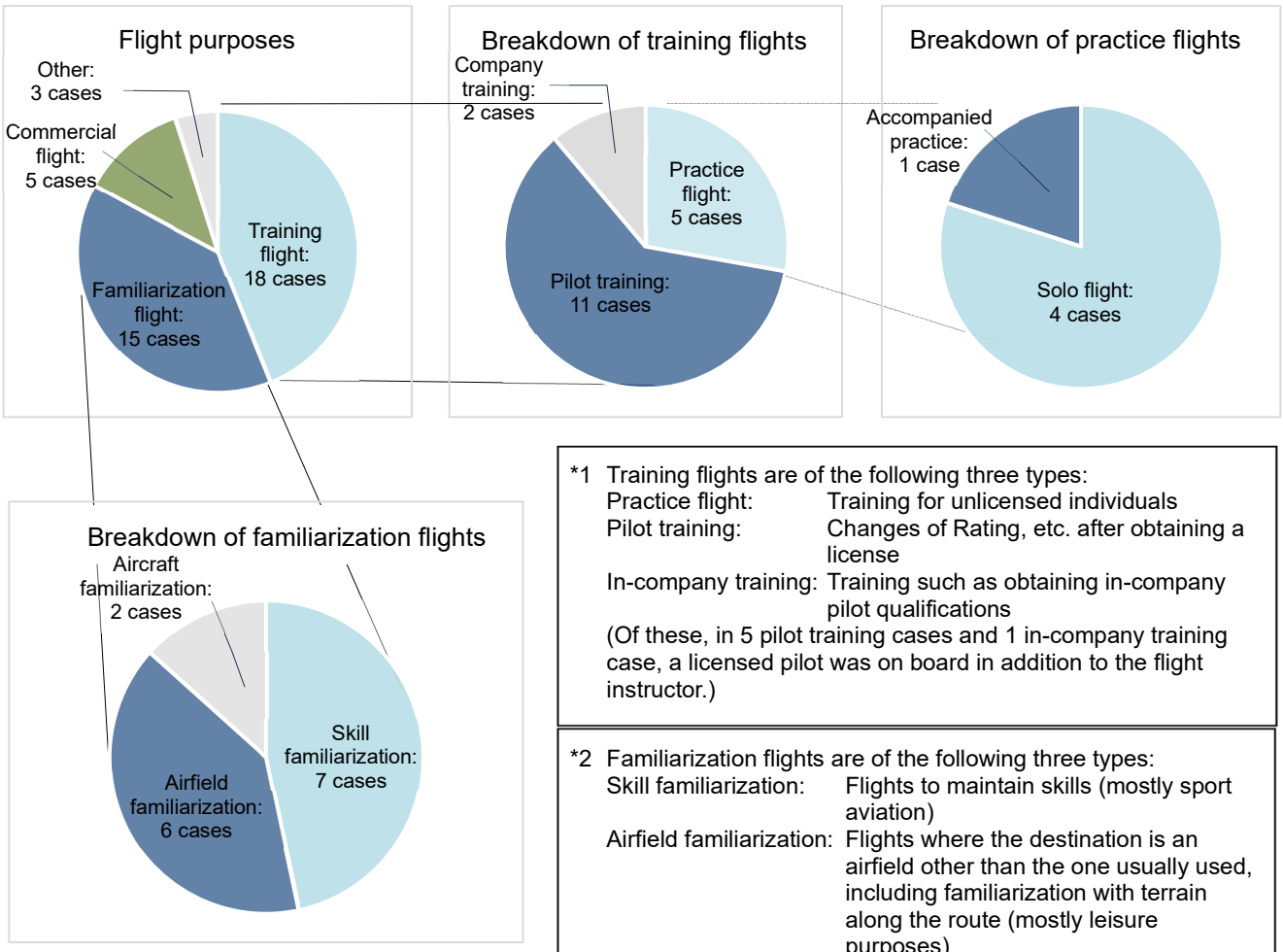
3. Occurrence by flight purpose

By flight purpose, training flights[*1] accounted for 18 cases, followed by familiarization flights[*2] with 15 cases.

In training flights, those for pilot training after obtaining a license were the most common, and among unlicensed individuals there were four cases of flight practice without a flight instructor or other supervisor on board (solo flights), notably more than for accompanied practice.

In familiarization flights, skill familiarization, which is to maintain skills after obtaining a license (including sport aviation with gliders), was the most common with seven cases, followed by airfield familiarization (including leisure flights), such as when traveling to an airfield other than the one usually used, with six cases, and aircraft familiarization for becoming accustomed to aircraft with little piloting experience with two cases.

Commercial flights other than training (including airline passenger services) were relatively few at five cases, and other activities accounted for three cases (company flights, search and rescue flights, and air transport flights). (See Figure 6.)



*1 Training flights are of the following three types:
Practice flight: Training for unlicensed individuals
Pilot training: Changes of Rating, etc. after obtaining a license
In-company training: Training such as obtaining in-company pilot qualifications
(Of these, in 5 pilot training cases and 1 in-company training case, a licensed pilot was on board in addition to the flight instructor.)

*2 Familiarization flights are of the following three types:
Skill familiarization: Flights to maintain skills (mostly sport aviation)
Airfield familiarization: Flights where the destination is an airfield other than the one usually used, including familiarization with terrain along the route (mostly leisure purposes)
Aircraft familiarization: Familiarization with aircraft for which the pilot has little experience
(Of these, in 1 skill familiarization case and 2 airfield familiarization cases, a licensed pilot was on board in addition to the captain.)

Figure 6: Number of ARC accidents by flight purpose

4. Occurrence by flight time

The pilots' flight experience showed that while there were five cases with less than 100 hours of flight time, including trainees who had just begun flight training, there were also six cases with 10,000 hours, including airline pilots, and no marked difference in accident occurrence trends was observed regarding total flight time. However, focusing on the pilots' flight time on the aircraft types in question at the time an accident occurred, 27 cases (about 65%) had 100 hours or less, accounting for more than half, and there were also three cases with 0 hours (first time operating), indicating a high proportion of accidents involving aircraft with which pilots were not familiar. (See Figure 7.) As shown in Figure 6, there were also cases where a licensed person was on board as a passenger.

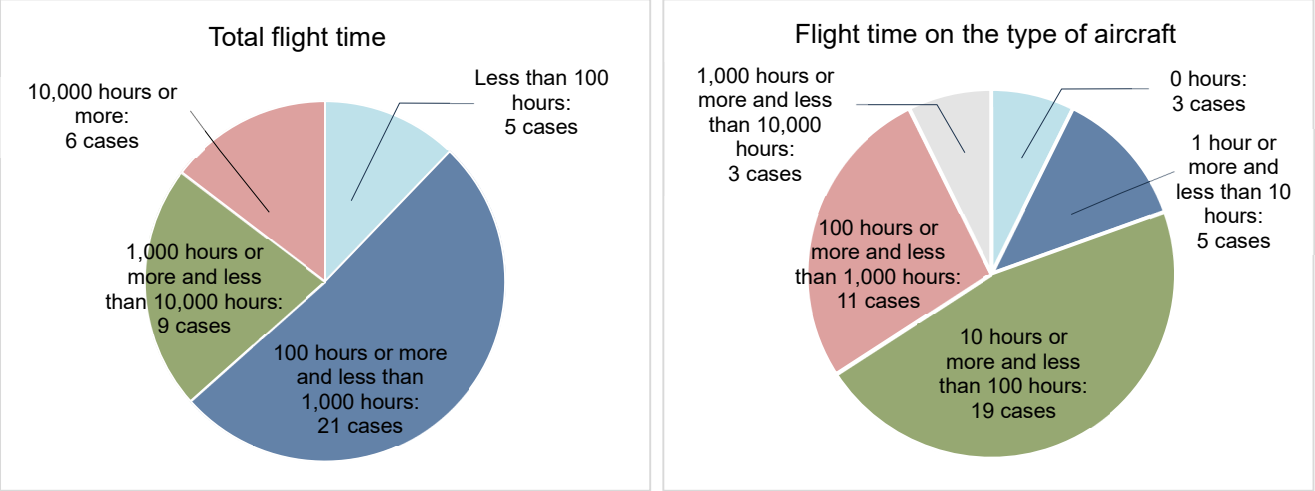


Figure 7: Pilots' total flight time and flight time on the type of aircraft in question

5. Summary of occurrence

- ARC occurs most often among the categories of accidents.
- By the kind of aircraft, small aircraft account for about half of all cases, followed by gliders.
- By operator, private aircraft account for nearly half, followed by aircraft operated by organizations.
- While "no injured persons" is the most common outcome for human casualties, fatal accidents have also occurred.
- By flight purpose, training flights and familiarization flights each account for about 40%.
- A large number of accidents occur with aircraft types with which pilots have limited experience.

In the next and subsequent chapters, we will further deepen considerations on prevention of accidents; we hope that individuals and organizations, particularly, involved in training and familiarization flights of small aircraft and gliders will find this helpful as a reference for safe operations.

Chapter 3 Measures to prevent ARC accidents

To prevent ARC accidents, it is important to understand the contributing factors and carry out flights with appropriate risk management to avoid falling into such situations.

Therefore, the 41 reports focused on in this digest have been analyzed for five contributing factors: pilot's operations, safety management, weather, manuals, and aircraft maintenance.

Among the factors involved in the occurrence of ARC accidents, the most common relate to pilot's operations, involved in 36 of the 41 cases (about 88%). Next most frequent are those related to safety management (including CRM[1]), such as managing trainees' skills in flight training and instructors' instruction methods, with 19 cases (46%); those related to meteorological conditions, 18 cases (about 44%); those related to manuals, such as deviations from operating limitations in flight manuals, eight cases (20%); and those related to aircraft, such as aircraft maintenance and component damage, seven cases (17%), each being involved. (See Figure 8.)

In this chapter, we analyze these contributing factors and consider what needs attention for safe operation.

Furthermore, since "safety actions" are included in each of the reports, we have extracted items we would particularly like to convey to all operators as "measures to prevent accidents" (pp. 8–12, etc.).

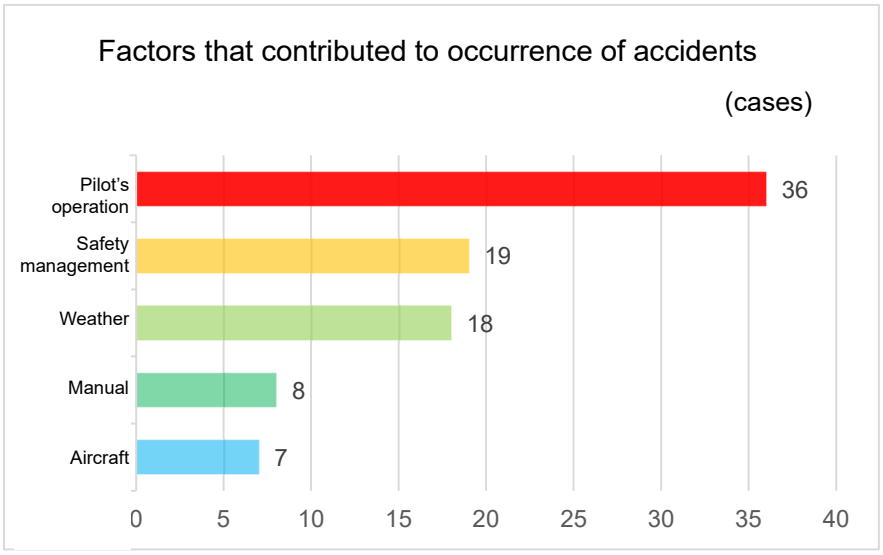


Figure 8: Factors that contributed to occurrence of accidents

Pilot's operations

Regarding pilot's operations, pilot involvement was divided into i) operational factors, ii) decision factors, iii) communication factors, iv) technical factors, and v) psychological factors, and was further classified by the kind of aircraft.

In particular, for pilot's operations, there are many cases in which multiple factors are involved, for example, "because the flare operation was insufficient, which is an operational factor i), the aircraft bounced on the runway, and because the landing was continued without performing a go-around, which is a decision factor ii), the aircraft sustained damage," and therefore, the total number of factors exceeds the number of accidents.

[1] CRM (Crew Resource Management): Concept of effectively utilizing all available resources (such as human resources and information) for safe operations

Table 1: Pilot involvement factors (by kind of aircraft) (cases)

Pilot involvement	Details	Large aircraft	Small aircraft	Rotor-craft	Glider	Total
i) Operational factors	Insufficient operation (delays, excesses/deficiencies, etc.)	6	10	1	10	27
	Incorrect operation (operations different from procedures)	1	1			2
ii) Decision factors	Decisions not appropriate to the situation	2	7		2	11
	Decisions based on erroneous situational assessment	1	9	2	9	21
iii) Communication factors	Lack of communication	1	1			2
iv) Technical factors	Insufficient verification of settings		4	1		5
	Insufficient understanding of operations		3		1	4
v) Psychological factors	Tension/stress		2	1		3
	Forgetting/overconfidence		11	3		14

i) Operational factors (common to each aircraft category)

For each aircraft category, there are, for example:

- Delayed or excessive nose-up operation during flare operations
- Confusion between the flap lever and the landing gear lever

many cases where operations themselves are the factor.

Of the 27 cases of insufficient operations, 13 involved the flare operations prior to touchdown, and nine involved excessive nose-down operations, etc., after touchdown.

In addition to thoroughly performing basic operations, meticulous pre-flight preparation, such as mental rehearsal of responses to sudden crosswinds, is required.

ii) Decision factors (mainly small aircraft and gliders)

- Errors or delays in decision after inappropriate operations
- Delays in corrective inputs due to erroneous situational assessment

and many other cases resulted in accidents.

Particularly noteworthy is the decision to perform a go-around.

Of the 41 reports, 18 involved a bounce; of these, three became porpoising (a repeated bouncing condition), and one involved a bounce that developed from floating (a temporary level flight condition). There was also one case in which, after floating, the aircraft contacted the runway surface and came to a stop.

Of these 19 cases, go-arounds were performed in seven, and there were several instances in which an earlier decision to perform a go-around might have prevented an accident.

iii) Communication factors (large aircraft and small aircraft)

Many cases involved insufficient CRM between the captain and other crew members, and this should be given particular consideration in operations of large aircraft that rely on multi-crew arrangements, such as operations in airlines, and in rescue flights where ground support is essential.

iv) Technical factors (mainly small aircraft)

- Emergency operating procedures were not executed, because of insufficient understanding of flight manuals, and the landing gear did not extend, resulting in a gear-up landing
- Because an engine restart was performed in violation of the manual, there was a large loss of altitude, and the aircraft was unable to reach the destination

are the example cases.

In any case, flights had to be undertaken only after fully understanding the aircraft' performance, operating methods, and so forth prior to departure.

v) Psychological factors (small aircraft and rotorcraft)

These are typified by lapses such as forgetting operations or checks, and

- Gear-up landings caused by forgetting to extend landing gear because of distraction or other reasons

accounted for seven cases.

Of these, six resulted in accidents because the landing gear extension was forgotten because of excessive tension, etc., and confirmation of gear extension using checklists was not carried out.

Furthermore, in three of these cases, although a warning sound indicating that the landing gear had not been extended was sounding, none of the occupants on board, including the captain, recognized it.

In situations where tasks are concentrated or when operating a type with limited experience, pilots may be subject to excessive tension. Therefore, it is advisable to agree on the confirmation using a checklist and the performance of a go-around when there is insufficient margin.

◎ Measures to prevent accidents

Large aircraft

- Reconfirm the conditions for continuing an approach below the minimum descent altitude, for example, an approach by visually identifying visual references.
- Comply with provisions of AOMs[2] such as stabilized approach and go-around procedures.

Small aircraft

- Regularly train yourself in go-around maneuvers and reconfirm response methods, etc., for appropriate decisions and responses when a bounce occurs.
- Perform necessary operations correctly by confirming them using checklists, and confirm the aircraft's proper conditions for each phase of flight.
- If you are flying an aircraft type for the first time, make sure you fully understand the operation of the equipment, etc., before flight.
- When familiarizing yourself with a new aircraft type, as with landing training, train yourself in go-around maneuvers thoroughly to fully familiarize yourself with operating procedures and flight characteristics.
- During landing rolls, perform only the necessary operations and vacate the runway after the aircraft has sufficiently slowed and stabilized.

[2] AOM (Aircraft Operating Manual): Manual concerning performance, operation, and crew procedures of the aircraft

◎ Measures to prevent accidents

Glider

- Thoroughly perform basic operations, such as flare operations and airbrake deployment appropriate to the aircraft's sink rate.
- Be prepared for situations that differ from initial assumptions, by envisioning responses in advance.
- Ensure safety margins according, for example, to the surrounding environment, aircraft performance, and pilot experience.
- Take towline-break countermeasures appropriate to the aircraft's flight characteristics, including selection of emergency landing sites.

Safety management

Following pilot involvement, many accidents were found to have resulted from insufficient organizational safety management systems.

As shown in Chapter 2, about 40% of accidents occur during training flights.

When looking at the causes of these accidents in detail, cases, for example,

i) Instructors' monitoring of trainees was insufficient

ii) Because decision criteria were unclear, accurate instructions and advice could not be provided, and appropriate takeovers could not be carried out

iii) The assessment of a trainee's skill before solo flight did not follow established procedures, or the judgment itself deviated from standards

were observed.

Outside training flights (familiarization flights and commercial flights), cases, for example,

i) Actions appropriate to the responsibilities of the pilot in command, co-pilot, etc., were not taken

ii) Because division of duties was unclear, mutual support was insufficient

related to CRM, and cases, for example,

iii) When flying an aircraft type for which they had no or little experience, they flew without fully understanding its handling characteristics

where pre-flight preparation and measures to properly maintain skills were inappropriate were observed.

Even if an aircraft is one you are qualified to fly, if it is unfamiliar, you must undertake the flight only after fully understanding differences in control operation methods and so on.

Table 2: Number of cases in which safety management systems were insufficient (cases)

Training flights	Inappropriate assessment of skill for solo flights	4
	Insufficient detail in training implementation procedures, etc.	3
	Insufficient accuracy of instructions and advice, and inadequate control interventions for trainees	8
	Unclear division of roles among instructors and others during training and tests	5
Familiarization flights, commercial flights, etc.	Unclear division of duties and insufficient mutual support	6
	Insufficient understanding of differences in handling characteristics, etc., and others	5
	Failure to make a decision to discontinue the flight	2
	Failure to perform pre-flight checks	1

◎ Measures to prevent accidents

Training flights

General:

- Clarify training procedures and provide an environment that enables trainees to undertake training after preparing sufficiently in advance.
- Provide explanations and instructions to trainees at a time when they do not interfere with standard operations.
- Trainees should maintain sound communication with instructors and share awareness.

Safety first:

- If a condition meets any of the go-around criteria of the training, perform a go-around maneuver without hesitation.
- If there is any doubt about continuing the flight due to the trainee's operations, changes in weather, etc., make ensuring flight safety the top priority.

Operating procedures:

- Instructors should closely monitor trainees' operating procedures and, on a regular basis, instruct them to thoroughly confirm the procedures using checklists.

Assistance:

- Clearly explain the purpose and implementation procedures of instructor assistance to trainees before flight.

Assessment:

- To ascertain trainees' skill, make an objective evaluation by multiple instructors from a unified viewpoint.
- Conduct skill confirmation according to prescribed procedures, including the method of skill assessment for solo flights.

Familiarization flights, commercial flights, etc.

- Clarify the division of roles between pilots and among occupants so that the team's capabilities can be maximized.
- Provide education and training so that CRM functions properly, for example, to enable the captain and the first officer to properly make assertions to each other.

Weather

Table 3: Number of cases in which meteorological conditions were involved in accidents (cases)

	Large aircraft	Small aircraft	Rotorcraft	Glider	Total
Strong wind		3		1	4
Crosswind	2	1			3
Headwind				1	1
Tailwind				1	1
Downdraft			1	3	4
Turbulence		3		1	4
Low visibility	1				1

A total of 18 cases where meteorological conditions were involved in the occurrence of accidents were identified. (See Table 3.)

By kind of aircraft, compared with large aircraft, small aircraft tend to be more susceptible to wind influence, and in particular gliders have experienced accidents because they could not cope with airflow patterns sufficiently.

As for large aircraft, cases where:

i) The aircraft was damaged because of insufficient response to strong crosswinds
ii) A forced landing was attempted in low visibility, and the aircraft collided with an air navigation facility before the runway

were observed.

As for small aircraft, cases where:

i) Because of strong winds or airflow disturbances caused by terrain, etc., the aircraft was shaken during final approach or landing roll, contacted the ground, and was damaged.

were often observed.

As for gliders, cases where:

i) Insufficient response to strong winds or tailwinds caused a sudden loss of lift, resulting in hard landings.
ii) The aircraft was affected by, for example, a strong headwind and a drop in altitude due to downdraft.

were observed.

◎ Measures to prevent accidents

Large aircraft

- Consider responses to airflow disturbances such as crosswinds and tailwinds, and other matters, in advance, and share the responses, etc., among crew members.

Small aircraft and gliders

- When changes in wind direction and wind speed are expected, pilots should actively gather information by, for example, asking the control tower or airport operations support staff about the expected range of variation, carefully decide whether to attempt an approach, and acquire information as necessary even during an approach.
- At airports that are susceptible, for example, to turbulence due to terrain and airflow disturbance due to buildings, such as hangars, try to check their typical conditions before flight and obtain wind conditions at multiple locations from the control tower, etc.
- Be prepared for sudden airflow disturbances by considering responses to crosswinds, etc., in advance.
- When the aircraft behaves differently from its expected behavior because of airflow disturbances, actively perform a go-around maneuver.
- If weather information is not available, be aware of the risk and carefully decide whether to land.

Manuals

Deviations from safety standards such as manuals directly affect flight safety.

There were several cases where failure to comply with go-around criteria and continuing the landing led to accidents. (See Table 4.)

Table 4: Number of cases of deviations from manuals (cases)

Deviation from go-around criteria	3
Exceeding of crosswind limits	1
Deviation from the permissible range for weight and the center of gravity	1
Insufficient fuel on board	1
Descent below decision height	1
Deviation from operating procedures	3

◎ Measures to prevent accidents

Large aircraft

- Ensure that the manuals (FOM, POM, SOP,[3] etc.) established by each company are complied with through education and training.

Small aircraft

- Understand that manuals and standards have been established to ensure flight safety, and deviating from them increases the risk of accidents, and comply with them thoroughly.
- As for emergency operating procedures too, perform the procedures described in flight manuals properly.
- Perform aircraft pre-departure checks, including checks on weight and the center of gravity, thoroughly.

Aircraft

As for cases involving aircraft failures, etc., there were several cases where failures in landing gear components rendered the aircraft unable to taxi, and where failures in warning systems prevented crew members from noticing that the landing gears were not extended, resulting in gear-up landings. (See Table 5.)

Table 5: Number of aircraft failure cases (cases)

Landing gear structural failure	5
Engine failure	1
Landing gear warning system inoperative	4
Towing fuse mix-up	1
Generator failure	1

◎ Measures to prevent accidents

- Comply with manuals of the aircraft, etc., and carry out maintenance and checks properly.

[3] FOM (Flight Operation Manual), POM (Pilot Operating Manual), SOP (Standard Operating Procedures): Manuals on operations prepared by each operating company

Chapter 4 Case studies

In this chapter, we look at specific accident cases based on the content of the preceding chapters.

As described in Chapter 3, most ARC accidents are attributable to pilot's operations. Therefore, by particularly focusing on:

(1) The case where problems with an assessment for solo flights, etc., were found
(2) The case caused by inappropriate response to strong wind (turbulence) during training flight
(3) The case caused by lack of knowledge about aircraft in general during flight

we will review their contributing factors, causes, and measures to prevent recurrence.

1. Case: Pilot seriously injured because of a hard landing

Date and time of occurrence:	At about 9:58 on March 21, 2022
Type:	Alexander Schleicher ASK13
Summary of the accident:	The glider was launched from Kisogawa Gliding Field, Kaizu City, Gifu Prefecture, with only a pilot trainee on board for solo flight training, and when landing at the gliding field, it made a hard landing, and the solo trainee was seriously injured.

First flight (flight instructor on board)

Flight status of the glider	Pilot trainee's operation	Flight instructor's instructions and decisions
Flight with a flight instructor on board	Flight skills were stable.	Granted solo flight permission.
		Skill confirmation standards for granting solo flight permission The skills including the stability shall be confirmed in each flight with multiple instructors or in multiple flights with a single instructor. However, in this case one instructor granted permission after a single assessment. (The provision was forgotten.)
	Proceeded to the 2nd flight.	

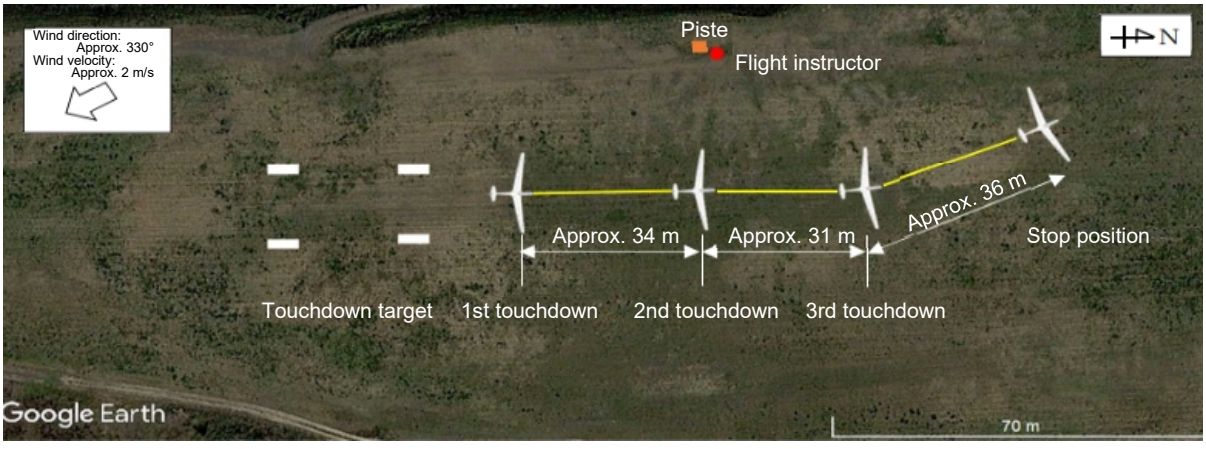
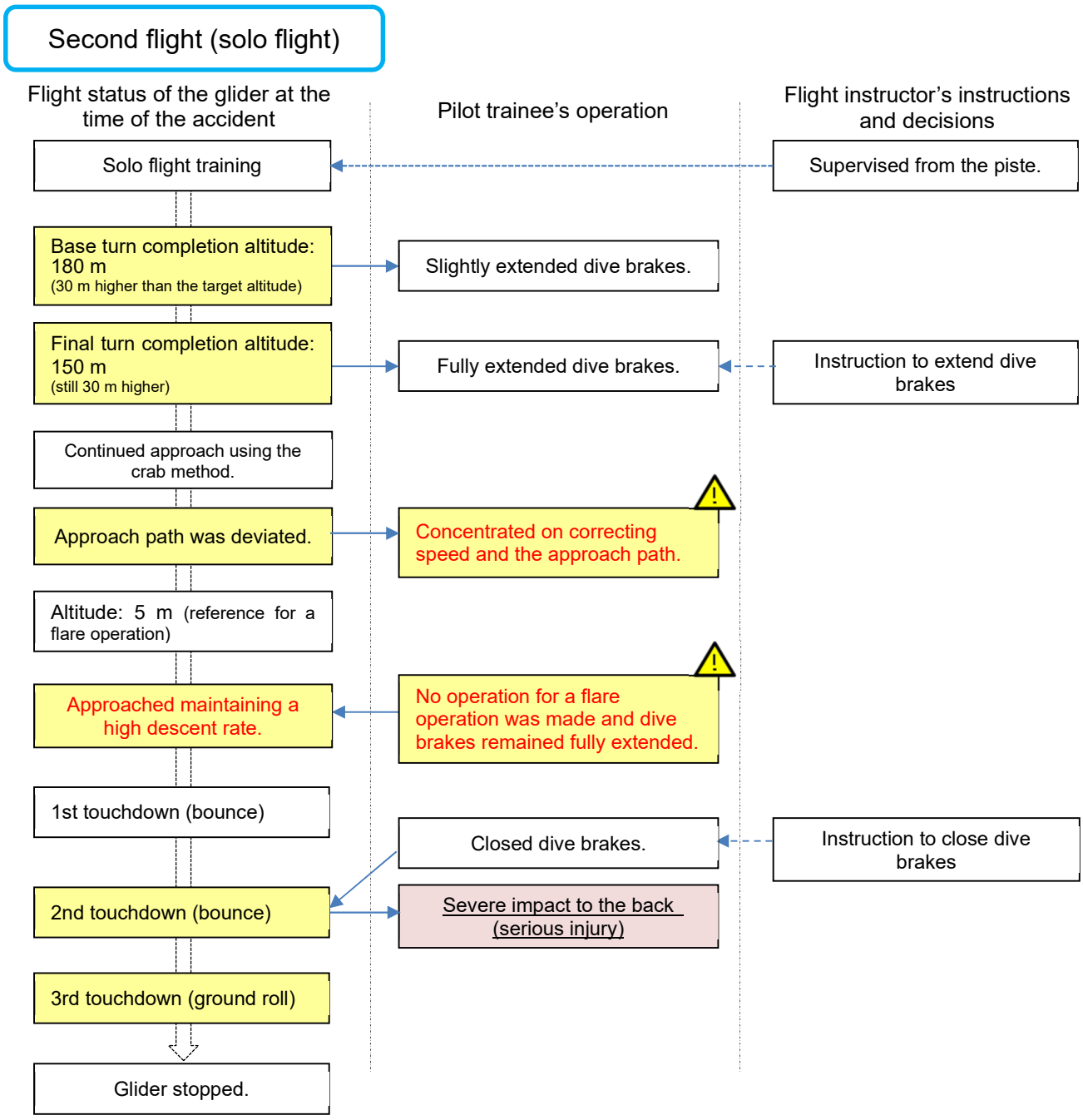


Figure 9: Estimated flight route for the 2nd flight



Probable causes:

The JTSB concludes that the probable cause of the accident was that the trainee made a landing approach on a path higher than usual with the dive brakes fully extended, thus the descent rate became higher than usual, and the flare operation was delayed because the trainee was concentrating on correcting the speed and approach path, which caused the glider to make a hard landing and bounce, and the trainee to be seriously injured because of the impact at the second touchdown.

For the prevention of recurrence

- It is necessary to make all concerned aware of the rules regarding skill confirmation for granting solo flight permission to trainees so that skill confirmation is carried out according to the procedures.
- It is desirable to consider the methods for flight instructors to give appropriate instructions depending on the situation.

The investigation report of this case is published on the website of the JTSB. (Published on January 27, 2023.)
https://jtsb.mlit.go.jp/aircraft/rep-acci/AA2023-1-2-JA2151.pdf

2. Case: Lower part of aft fuselage contacted the runway surface because of turbulence

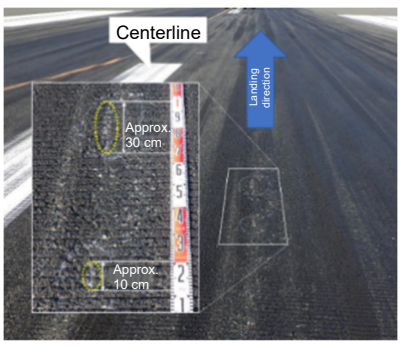
Date and time of occurrence: At about 11:30 on February 3, 2021
Type: Textron Aviation 172S
Summary of the serious incident: The aircraft executed a go-around maneuver because of unstable attitude when landing at Kitakyushu Airport during solo flight training, and the lower part of its aft fuselage contacted the runway surface.

Pilot trainee
- Student pilot permit
  - Total flight time: 50 hours 10 minutes
  - Total flight time on the type of aircraft: 50 hours 10 minutes
  - Flight time in the last 30 days: 8 hours 15 minutes

Flight instructor (onboard the instructor aircraft)

Flight status (weather conditions)	Pilot trainee's operation	Flight instructor's response
At the start of the approach (Limitation for the crosswind component of the runway exceeded.)		The instructor was on board the instructor aircraft and was flying behind the trainee so as to land following the trainee after supervising the flight of the trainee in the air.
	Continued approach judging that landing was practicable from the experience of landings with an instructor on board.	Interdependency
		Judged that landing at Kitakyushu Airport, where the trainee had experienced the same level of crosswind landing, was more appropriate than diverting to another airport, etc.
When passing the airport island end (Airflow disturbance (aircraft unstable))	Passed runway threshold with flaps extended to full down and at a specified approach speed and approach angle according to the landing procedures.	
Approximately 30 ft above ground level	Took the landing attitude with power set at idle position.	
Approximately 10 ft above ground level (The aircraft was shaken by the winds and sunk.)	Performed a nose-up operation by pulling the control column.	
	The aircraft did not stop sinking, and the trainee performed further nose-up	
	Decided to perform a go-around maneuver and set the throttle to maximum.	
	An abnormal noise and impact as if the main landing gears and the tail section contacted the ground simultaneously	

- In the post-flight inspection, scratch marks, etc., were found on the aft fuselage.
- Scratch marks were found on the runway surface.



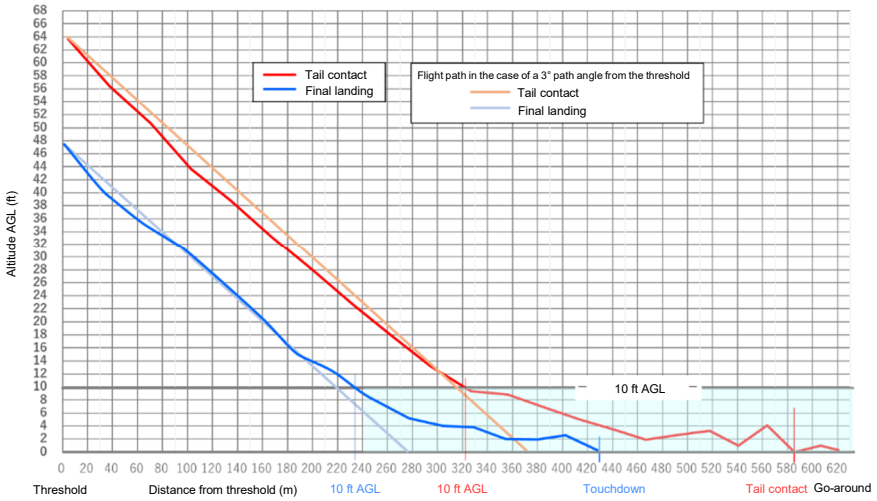


Figure 10: Comparison of flight paths from the threshold to contact (touchdown)

Probable causes:

The JTSB concludes that the highly probable cause of the serious incident was that the aircraft executed a go-around maneuver because of unstable attitude at a low altitude when performing a landing approach, and the lower part of its aft fuselage contacted the runway surface before turning to climb. As for the unstable attitude of the aircraft at the low altitude, it is probable that the following factors were involved: the aircraft encountered turbulence immediately before touchdown; and a significant nose-up operation was performed under such an influence.

For the prevention of recurrence (measures taken by the operator)

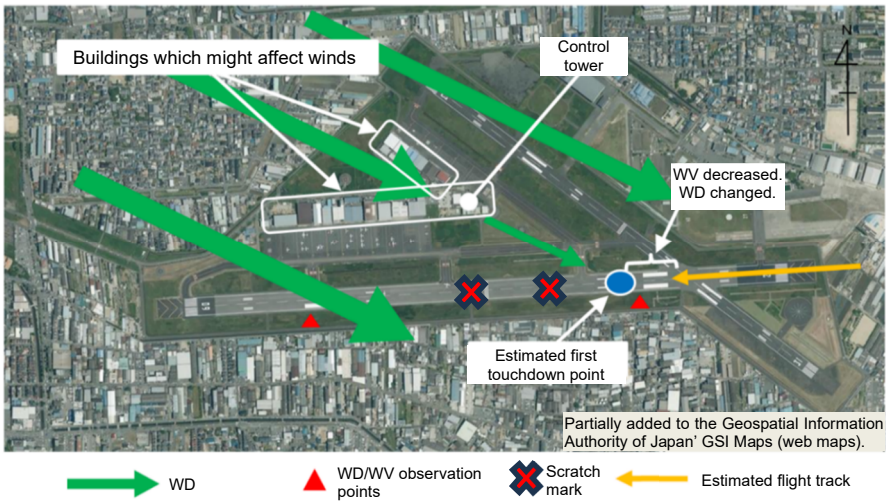
- It was decided, when crosswinds are expected during a solo flight, to calculate the crosswind component by using a virtual wind velocity that takes into account a safety margin, and to carry out a prior weather conditions survey by a monitoring aircraft (with an instructor other than the supervisor on board), as needed, to decide whether to conduct the solo flight.
- The response was clarified so that, when the crosswind component exceeds the safety standard and a landing approach is judged to be impracticable, the monitoring aircraft instructs the solo flight aircraft to hold in the air or divert to an alternate aerodrome for landing.

The investigation report of this case is published on the website of the JTSB. (Published on January 20, 2022.)
https://jtsb.mlit.go.jp/aircraft/rep-inci/AI2022-1-2-JA393A.pdf

3. Case: Propeller blade tips contacted the runway surface when the aircraft touched down again after bouncing

Date and time of occurrence:	At about 18:06 on March 6, 2022
Type:	SOCATA TBM700
Summary of the serious incident:	While the aircraft repeated bouncing on Runway A at Yao Airport, its propeller blade tips contacted the runway.

Flight status	Captain's operation	Related matters
Encountered airflow disturbances at an altitude of around 500 ft when approaching the runway. (Continued until landing.)	Indicated airspeed: 85 kt PAPI: 4.5° Approached using the aiming point marking as the aiming point.	Flight experience on the type of aircraft: • It was the first solo flight on the aircraft type after completing the education and training for those who intend to fly the aircraft for which they have no flight experience, specified in the guideline of the Civil Aviation Bureau of the Ministry of Land, Infrastructure, Transport and Tourism. • The captain had engaged in Airbus A320 scheduled flights as a pilot for about one month from the day following completion of the training to the day prior to the occurrence of the serious incident.
The descent rate was not reduced, and the aircraft touched down with a large impact and lifted off again.	Reduced the engine thrust to idle and performed a flare operation.	
Repeated bouncing three times at an interval of two to three seconds, and its attitude became unstable when it lifted off the last time. (Touched down from its nose gear while it was bouncing.)	The captain judged that it was possible to land without performing a go-around maneuver and proceeded with the landing with idle engine thrust maintained.	
	The captain judged that it would be dangerous to continue landing, and commenced a go-around maneuver in the vicinity of Taxiway A2.	
In the post-landing check, damage to the propeller blade tips was found. Scratch marks were also found on the runway surface.		



Characteristics of Yao Airport:
- The approach angle indicated by PAPIs installed at Yao Airport is 4.5° for Runway 27, which is steeper than that of typical airports.
- When a strong wind blows from the northwest, a phenomenon where an aircraft sinks significantly sometimes occurs after passing the threshold of Runway 27 until touching down.

Figure 11: Wind conditions at the airport and scratch marks

Probable causes:

The JTSB concludes that it is probable that the serious incident occurred as the aircraft, which had not been able to reduce its descent rate in the strong wind blowing from northwest, touched down with an impact larger than usual and bounced, and touched down again in a nose-low attitude because it could not maintain proper attitude. As for the aircraft's second touchdown in a nose-low attitude, it is probable that the change in the aircraft's attitude after bouncing was not properly recognized.

For the prevention of recurrence

- It is necessary to perform a go-around maneuver without hesitation when a bounce occurs after touching down with an impact larger than usual while the descent rate has not been reduced.

The investigation report of this case is published on the website of the JTSB. (Published on February 16, 2023.)
https://jtsb.mlit.go.jp/aircraft/rep-inci/AI2023-2-2-JA007Z.pdf

Chapter 5 Summary

Points to prevent accidents

—Complying with rules and adhering to the basics—

Based on the content of Chapters 3 and 4, the points to prevent accidents have been summarized below. We hope this will be useful as a reference for safe flight operations.

◎ Pilot's operations

- Compliance with manuals and standards that have been established to ensure safety
- Go-around training for appropriate decisions and responses when a bounce occurs and re-confirmation of response methods, etc.
- Correct operations using checklists and confirmation of the aircraft's proper conditions for each phase of flight
- Sufficient understanding of control operation methods, etc., before flying an aircraft that is unfamiliar
- Ensuring of safety margins according, for example, to the surrounding environment, aircraft performance, and pilot experience

◎ Safety management

- Maintenance of sound communication between trainees and instructors
- Clarification of training procedures and the provision of training environment
- Clear explanation to trainees about the purpose and implementation procedures of instructor assistance
- Compliance with prescribed procedures in conducting skill confirmation for solo flights
- Clarification of the division of roles between pilots and among occupants

◎ Weather

- Advance consideration of responses to weather conditions and sharing among crew members
- Active acquisition of weather information and careful decision
- Active performance of a go-around maneuver when the aircraft behaves differently from its expected behavior

◎ Manuals

- Understanding of and compliance with operation manuals and standards

◎ Aircraft

- Compliance with manuals on maintenance and proper performance of maintenance and checks

Comment from the Director of the Analysis, Recommendation and Opinion Office

Accidents and incidents related to ARC often involve less severe aircraft damage and occupant injuries compared with other accidents, and their causes are largely attributable to pilots' skills, and therefore, especially for private aircraft, preventive measures are rarely considered as an organizational issue, and in some cases, the primary accident-prevention measure is considered to be pilots' repeated training to improve their skills. However, since these accidents occur at a low altitude near the runway, there is little room for avoidance in terms of time, and they could lead directly to a serious accident due to a collision with the ground surface if one wrong step is taken, which is extremely dangerous.

As we have seen in this digest, there are many cases that could have been prevented if supervisors and others had properly monitored and assisted in flight training, and if checks and preparations before flights had been carried out without fail in normal operations. Therefore, systematic safety measures and risk management that are not left to individuals are required. On top of this, it is important for individual pilots to improve their skills in a safe and secure manner in an environment where systematic safety management is conducted.

With reference to this digest, we hope that all aircraft operators will recognize once again the importance of implementing basic operating procedures in accordance with the manuals for normal flights, and make efforts to acquire knowledge and experience in safe operations that can flexibly respond to unusual changes in the surrounding environment, such as weather conditions and air traffic conditions, in addition to improving pilots' flying skills.

References

The reports related to the ARC accidents covered in this digest can be viewed at the URLs below:

ARC accidents that occurred during the 10 years from 2014 to 2023

ARC serious incidents that occurred during the 10 years from 2014 to 2023

In addition, there have been many accidents since then. Recent reports are as follows:

Recent ARC accidents (published in 2024)

For prevention of aircraft accidents

Other than the Digests, please refer to investigation reports on accidents and serious incidents announced by the JTSB for your case study. Moreover, the Civil Aviation Bureau uploads information on the safety of small aircraft. For more details, please see the following information.

Safety information of small aircraft, Ministry of Land, Infrastructure, Transport and Tourism

https://www.mlit.go.jp/koku/15_bf_000061.html

JTSB Secretariat, MLIT
15F Yotsuya Tower,
1-6-1, Yotsuya, Shinjuku-ku,
Tokyo 160-0004, Japan
Attention: Analysis, Recommendation and Opinion Office, General Affairs Division

TEL: 03-5367-5026
URL: https://jtsb.mlit.go.jp/index.html
e-mail: hqt-jtsb_bunseki@gxb.mlit.go.jp

We welcome your comments on "JTSB Digests" and requests for outreach lecturers.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