AA2018-10

AIRCRAFT ACCIDENT
INVESTIGATION REPORT

WASEDA UNIVERSITY
J A 2 2 W P

December 20, 2018

JTSB Japan Transport Safety Board

The objective of the investigation conducted by the Japan Transport Safety Board in accordance with the Act for Establishment of the Japan Transport Safety Board and with Annex 13 to the Convention on International Civil Aviation is to determine the causes of an accident and damage incidental to such an accident, thereby preventing future accidents and reducing damage. It is not the purpose of the investigation to apportion blame or liability.

Kazuhiro Nakahashi
Chairman
Japan Transport Safety Board

Note:

This report is a translation of the Japanese original investigation report. The text in Japanese shall prevail in the interpretation of the report.

AIRCRAFT ACCIDENT INVESTIGATION REPORT

CRASH DUE TO STALL
OIZUMI TOWN, OURA-GUN, GUNMA PREFECTURE
AT AROUND 15:14 JST, OCTOBER 10, 2016

WASEDA UNIVERSITY
ROLLADEN-SCHNEIDER LS4-B
(GLIDER, SINGLE SEATER), JA22WP

December 7, 2018
Adopted by the Japan Transport Safety Board

Chairman	Kazuhiro Nakahashi
Member	Toru Miyashita
Member	Toshiyuki Ishikawa
Member	Yuichi Marui
Member	Keiji Tanaka
Member	Miwa Nakanishi

1. PROCESS AND PROGRESS OF INVESTIGATION

1.1 Summary of the Accident	On October 10 (Monday), 2016, the glider, Rolladen-Schneider LS4-b, registered JA22WP, owned by Waseda University was winch-launched from the Menuma Gliding Field at Kumagaya City in Saitama Prefecture for the gliding competition and crashed along the airfield traffic pattern while trying to land. The Pilot died and the glider was destroyed.
1.2. Outline of the Accident Investigation	On October 10, 2016, the Japan Transport Safety Board (JTSB) designated an investigator-in-charge and two other investigators to investigate this accident. An accredited representative of the Federal Republic of Germany, as the State of Design and Manufacture of the aircraft involved in the Accident, participated in the investigation. Comments were invited from parties relevant to the cause of the Accident and the Relevant State.

2. FACTUAL INFORMATION

2.1 History of the Flight	According to the statements of those who were involved in the competition, the record of the GPS receiver that the pilot carried on the glider, the voice of the Pilot's communication recorded in the video by other glider, the history of the flight can be summarized as follows: The Rolladen-Schneider LS4-b, registered JA22WP, owned by Waseda

University (hereinafter referred to as "the University") was winch-launched from the Runway 14 of Gliding Field No.1 of Menuma Gliding Field (hereinafter referred to as "the Gliding Field") at 14:30 Japan Standard Time (JST: UTC + 9hrs, unless otherwise stated all times are indicated in JST on a 24-hour clock) on October 10, 2016 in order to compete for the competition sponsored by the Japan Students Aviation League (hereinafter referred to as "the League") that is a public interest incorporated foundation. The Rolladen-Schneider LS4-b

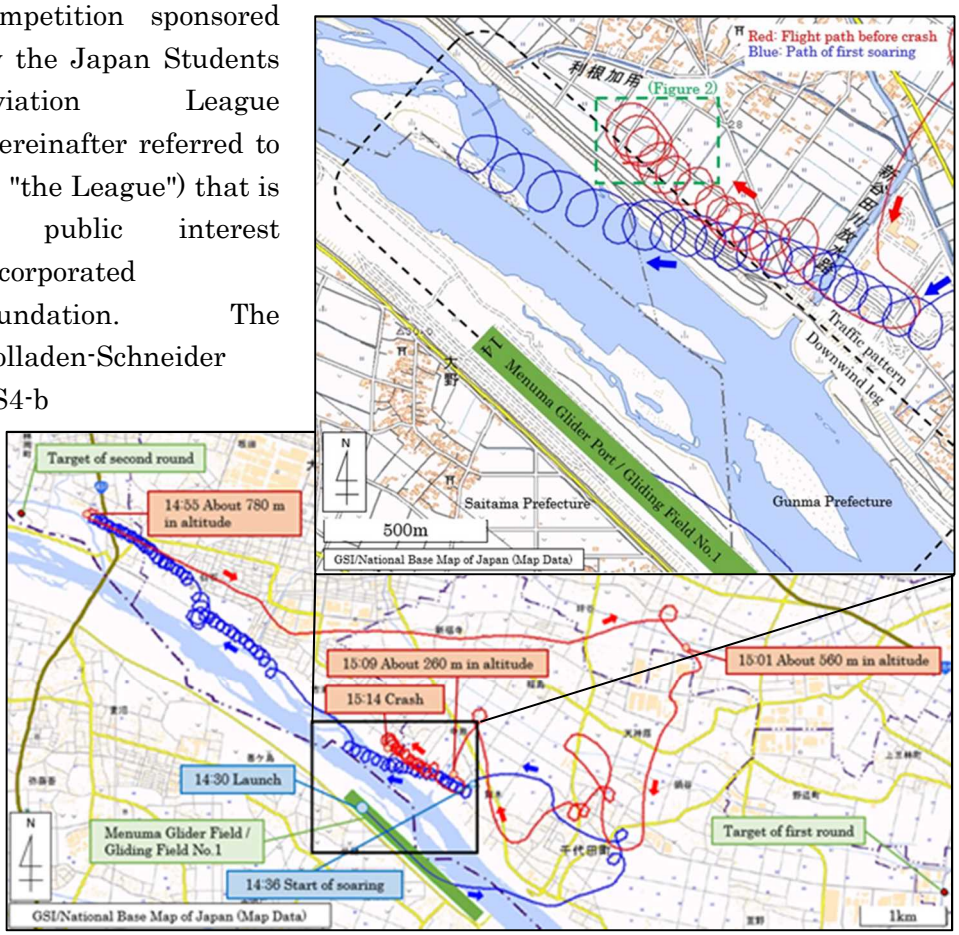
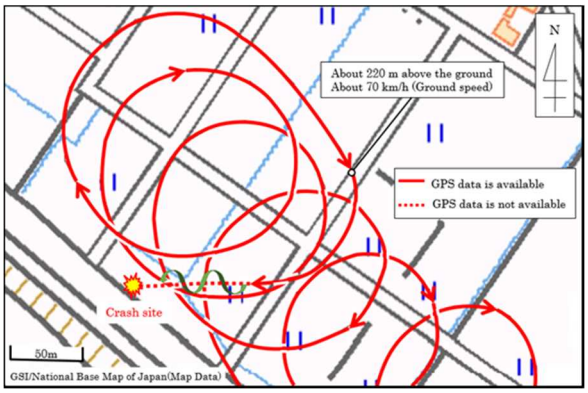


Figure 1: Estimated Flight Route

(hereinafter referred to as "the Glider") controlled by the Pilot released the towline at the pressure altitude of about 500m. In the competition, a pilot had to control his/her glider along the airfield traffic pattern to compete for the flight distance and time. At 14:36, the Glider started soaring at around 1km northeast of the Gliding Field and flying northwestward while climbing by riding the thermal (See blue line in Figure 1).

AT 14:55, the Glider reached the pressure altitude of about 780m, and kept flying toward the target point of the first round. However at 15:01, the Glider aborted the flight toward the first round target point at around 4 km northeast of the Gliding Field at the pressure altitude of about 560m, and returned near the Gliding Field. At 15:09, the Glider started flying in circles at the pressure altitude of about 260m in the neighborhood of the north-side down wind leg of the Runway 14 (Red line in enlarged view of Figure 1). The ascending wind currents have been often observed around the north-side down wind leg. At that time, five gliders including the Glider were flying and any one of them could not climb. They were flying in circles waiting for

	the weather conditions to turn for the better. Two of the gliders landed earlier than the Glider. The Pilot reported the Field Flight Operations over the radio that he was going to land next to these two gliders and made the right circle at about 220m above the ground and at the ground speed of about 70km/h in order to enter the downwind leg. The bank angle of the right turn was steep; the nose of the Glider dropped; and the Glider went into a nosedive. At the end of the right circling, the Glider nose was lifted up a little and it seemed that the Glider recovered its normal attitude. However the Glider nose dropped heavily, and went into a nosedive again. The Glider went into the left spin and crashed after spinning about 2.5 times.  Figure 2: Enlarged View of Figure 1 The Accident occurred at Oizumi Town (Latitude 36°13'21"N and Longitude 139°24'57"E), Oura-Gun, Gunma Prefecture at around 15:14 on October 10, 2016.
2.2 Injuries to Persons	The pilot died.
2.3 Damage to the Aircraft	Extent of damage to the Aircraft Substantially damaged - Nose Destroyed - Right main wing Fractured at dive brake section and damaged at connection part to main spar. - Fuselage Aft fuselage was fractured.
2.4 Personnel Information	Pilot: Male, Age 22 Private pilot certificate (High-class glider) April 24, 2015 Pilot competency assessment Expiry of practicable period for flight April 24, 2017 Class 2 aviation medical certificate Validity: May 7, 2020 Total flight time (Number of launches) 109 hours. 36 minutes. (328 launches) Flight time in the last 30 days 3 hours. 17 minutes. (6 launches) Total flight time on the type of the Aircraft 8 hours. 09 minutes. (18 launches) Flight time in the last 30 days 1 hours. 01 minutes. (4 launches)
2.5 Aircraft Information	(1) Type: Rolladen-Schneider LS4-b Serial number: 41048; Date of manufacture: March 12, 2002 Certificate of airworthiness No. 2016-62-03 Validity July 18, 2017 Category of airworthiness Glider Utility U Total flight time 2,534 hours. 05 minutes. (4,700 launches)

	(2) When the Accident occurred, the weight of the Glider was estimated to be about 351kg (including one trim weight) and the position of the Center of Gravity (CG) was estimated to be 392mm aft of the datum point (leading edge of the wing at the wing root rib), both of which was estimated to be within the allowable range (Maximum takeoff weight of 525kg, and CG range 225 to 400mm). At the time of the Accident, the position of the CG was estimated to be at about 4.5% position forward from the aft limit (400mm).
2.6 Meteorological Information	The weather observed right after the Accident at the Field Flight Operations in the Gliding Field was as follows: Cloudy, Wind speed of 2.0 m/s from south, and Visibility of 10km or more. Metrological data observed at the observational station of the Automated Meteorological Data Acquisition System located at Tatebayashi, Gunma Prefecture (about 10km east of the Accident site) was: (Tatebayashi) Wind direction/speed Maximum momentary wind speed Temperature 15:00 East-southeast / 2.4m/s 4.5m/s 20.2°C 15:10 East-southeast / 2.1m/s 5.0m/s 20.0°C 15:20 Southeast / 2.4m/s 4.3m/s 20.0°C
2.7 Additional Information	(1) Scene of the Accident The Glider crashed onto the construction waste soil heaped about 3m in height and neighboring on the river bank of Tone River that is flowing along the northeast side of the Gliding Field, and its nose was pointing to the direction of about 160°.  Photo 1: The Glider at the Accident site (2) Detailed description of damage The tip of the nose collapsed into the soil as deep as about 40cm; the aft fuselage was broken; and the tail wing was fallen toward the right side of the Glider. The cockpit was deformed as it was compressed along the longitudinal axis and the canopy was cracked. The landing gear lever was in its down position, and the elevator trim was at its end position (nose up position). The aft fuselage was bent downward at around the cockpit, and was broken at around the tail wing mounting section. The scratch mark was observed on the area around the blue registration number painted on the right side of the fuselage, and the blue paint was found on the leading edge on the horizontal stabilizer. The right and left main wings were remained to be connected each other but they were shifted to the right at the connection section with the fuselage. The skin of the root section of the left main wing trailing edge

was deformed and compressed into the fuselage, and the right main wing was broken at around the outside of the air brake.

(3) CG of the Glider

The Glider can accommodate up to three trim weights (fixed weight ballast) on the rod in front of the rudder pedal. The trim weight is used to shift the CG forward of the Glider in order to increase the stability during the flight.

According to the statements of members of the Aviation Club (hereinafter referred to as "the Club") of the University, the Pilot had been flying the Glider with two trim weights before the competition, at this time the weight of the Glider is about 353.5kg and the CG position is 378mm aft from the datum line (about 12.5% position forward from the aft limit).

A day before the competition, the Pilot made one skill check flight of 13 minutes dismounting with one trim weight, and said that he was conformable in controlling the Glider. On the day of the Accident he was controlling the Glider with one trim weight.

The following description is given in "Aeronautical Engineering Course I: Propeller Aircraft" (Japan Aeronautical Engineers' Association, 2010 (p.194), Nobuo Watari) regarding the influence of the CG on the flight when its position is near the aft limit position.

When the CG position is near the aft limit position, the stability and maneuverability can be assured as long as a pilot is carefully controlling the airplane. However, the following adverse influences will be observed and (Some parts of descriptions are omitted) *flying the airplane whose CG position is near the aft limit position is unfavorable; susceptible to degradation in stability at low speed, susceptible to stall and spin, and difficult to recover from the spin because the nose pitches up.*

(4) C/G of glider

The following descriptions are found in the home page (https://www.dg-flugzeugbau.de/en/library/optimum-cg-sailplanes) of DG Flugzeugbau GmbH that has been merged with the manufacture of the Glider:

The Optimum C/G of Sailplanes

Flight Characteristics and Safety (Excerpt of descriptions)

The C/G definitely influences the flight performance and efficiency. A position in the forward half of the C/G envelope produces negative results and should be avoided.

A good compromise is a C/G position about 30 to 40% forward of the aftmost position.

The following description is also given in "ADVISORY CIRCULAR AC 3-18 GLIDER WEIGHT AND BALANCE" issued by "GLIDING NEW ZEALAND INCORPORATED":

6.0 Weighing the Glider with Pilot

6.2 (Some parts of descriptions are omitted) *For pleasant and*

sensitive handling a position 25-35% forward of the aft limit position is a good starting point, although different gliders have their own sweet spots.

(5) Flight records of the Pilot

According to the statements of the coaches of the Club of the University, the Pilot had been flying the Alexander Schleicher ASK23b (single seater, hereinafter referred to the "ASK23") for a long period of time until May of the year when he has transferred to the Glider (Rolladen-Schneider LS4-b). The total flight time of the Pilot was relatively longer than other university student pilots, and he met the qualification of the total flight time for the competition (more than 30 hours total flight time by high-class glider, 5 hours or more on glider that is used in the competition).

The Pilot participated in the competition with the Glider for the first time.

(6) Characteristics of the Glider the Pilot was onboard

In Section 1-4 Outline of Aircraft of Chapter 1 Summary of Flight Manual, the followings are described:

This aircraft is not for the flight practice but this is the high performance glider. It features superior design, structure, manufacturing, and maneuverability but the flight of this glider has to be controlled by the skillful pilot who can observe the limitations and recommendations set forth in the Flight Manual.

In Section 3-4 Recovery from Stall in Chapter 3 Emergency Procedure of the above Flight Manual, it is stated that:

Aileron: The efficacy is degraded by 50%.

(Some parts of descriptions are omitted)

If a pilot pulls up the control stick further when the aircraft is stalling, the angle of attack increases significantly. And, depending on the CG position, the aircraft could enter the unsymmetrical stall resulting in the spin.

It is described in the Flight Manual that the stall speed of the horizontal straight line flight is 68.0km/h (Indicated Air Speed) when takeoff weight is 350kg.

According to the statement of several members of the Club who have flown in the Glider, the stall speed of the ASK23 was 64.5km/h (Indicated Air Speed) when its maximum takeoff weight is 360kg, and the ASK23 could respond the flight control as they were expected even in the vicinity of the stall speed. The Glider could respond the flight control better and quicker than the ASK23, but it was slow to respond when it was flying in low speed region.

(7) The Pilot's recent flight predisposition

According to a member of the Club who confirmed the flight data of the pilot recorded in the GPS, recent flight in the Glider tended to fly near the traffic pattern, keeping down the speed. The pilot told to some

	of members and coaches that the speed control of the aircraft could not be done well compared with ASK23. According to the coach and members, he was a watchful pilot that kept carefully monitoring the other surrounding gliders in order to keep proper distance when he was going to land. The Pilot was a captain of the Club since he was a senior. The recent pilot was stagnant in progress of maneuvering skill because he was busy in managing the Club, but on the day of the Accident he had solid breakfast and seemed to be in full of motivation. (8) Coaching in the Club In the Club, there were about 30 coaches who had been members of the Club, and they took turns in training. Some of them provided the instruction on the Pilot's speed control but they did not share awareness of his concern over the speed control. Members of the Club have been trained with the training syllabus and flight check sheet prepared by the Club and have to take the dual flight training on a two-seater glider with a coach on board in the first stage. Then they proceed with the solo-flight and fly a primary two-seater glider step by step. Student pilot who wishes to have the Private pilot certificate, after passing the paper examination, has to enter a Designated Airman Training School by the League in order to acquire the competence certification after completing the training and assessment. (9) Medical information The Pilot died of a traumatic shock and there was no trace of alcohol or illegal drug in his blood.

3. ANALYSIS

3.1 Involvement of Weather	No
3.2 Involvement of Pilot	Yes
3.3 Involvement of Aircraft	No
3.4 Analysis of Findings	(1) History of the flight up to spin It is probable that when entering the downwind leg for landing, the aircraft made a steep right turn at a ground speed of about 70km/h close to the stall speed, so the aircraft was stalled and the nose fell down and suddenly descended. It is probable that the Glider was veered into the right turn at this moment of the time because the Pilot pushed the right rudder pedal harder or he tilted the control stick to right making the bank angle steep or he did both of the above control. It is somewhat likely that in spite of the recovery maneuver the Glider stalled again while pitch-up. It is somewhat likely that the Glider was put into the left spin after the stall because the Pilot tried to pull up

	the nose inappropriately when he pushed the left rudder pedal trying to recover from the stall during the hard right turn. It is probable that the Glider hardly recovered from the left spin because it could not recover from the first stall, stalled again at low altitude and entered into the left spin. (2) Center of Gravity of the Glider The Pilot had been usually flying with two trim weights. It is highly probable that in this case the CG of the Glider was at about 12.5% forward from the aft limit position, which was near the aft limit position. In addition, the Pilot participated in the competition by removing one trim weight from the Glider just the day before the competition (the CG position is about 4.5% forward from the aft limit position) because he could fly with good feeling. It is somewhat likely that because the Pilot tended to fly at a suppressing speed, he set the CG position closer to the rear side in order to lighten the Glider nose. Even if the CG position of any aircraft or glider is within the allowable range, the stability of the aircraft decreases as approaching the aft limit, it tends to stall and spin, and recovery tends to become difficult. It is probable that the Glider was put into the situations as above at the time of the Accident. It is probable that the Pilot should have participated in the competition after having sufficiently accustomed to the Glider that changed the CG position toward the rear, because the change in the CG position has significant influence on the flight characteristics. (3) Speed control after transferring from ASK23 to Rolladen-Schneider In the recent flight of the Glider, the captain had a tendency to fly near the traffic pattern with suppressing the speed. Also, the Pilot told some of the members and the coach that the speed control of the Glider could not be done well and received guidance from some coaches. It is somewhat likely that the Pilot had not been sufficiently accustomed to the Glider who emphasized high speed performance. It is somewhat likely that these factors may have contributed to the steep turning of the Glider at low speed. The leaders such as a coach or the instructor utilize possession equipment by need effectively and give technical guidance, and it is necessary to perform the instruction about the safety at the same time. In addition, it is desirable for the leaders to check the competency of the student pilot at appropriate timing and to include the assessment of the competency of the student as a pilot in their instructions. (4) Operations at landing approach The Pilot was flying in circles at the traffic pattern where the thermal have been often occurred, but decided to land. It is somewhat likely that he veered into the right steep turn to enter the downwind leg quickly because he was going to land following the foregoing two gliders

	while taking the distance from other gliders in mind. However, it was not possible to determine what he was trying to do because of his death.

4. PROBABLE CAUSES

It is highly probable that in spite of the control to recover from the stall at low altitude, the Glider stalled again; started spinning and crashed.

It is somewhat likely that the Glider stalled at low altitude because of the steep turn at low speed and that the stall was attributable to the Pilot who did not fully familiarize himself with the flight characteristics of the Glider whose CG position was set to near the aft limit position.

5. SAFETY ACTIONS

Following this Accident, the following actions are taken:

(1) Japan Students Aviation League (Excerpt)

① The classroom and practical lessons for the actions against emergency and recovery from the abnormal attitude that have been provided to the leaders are extended to include the student pilot.

② The soaring will not be carried out when the ground altitude is less than 250m in the vicinity of the traffic pattern.

③ The recommended minimum approach speed after passing the checkpoint on the traffic pattern is increased by 5km/h or more in order to prevent the deceleration on the traffic pattern.

④ It is enforced to adjust the CG at around the center of the allowable range when flying the single seater glider.

⑤ During the competition, the physical condition and mental health of the competitors are checked with the check sheet before and after the flight.

(2) Waseda University Aviation Club (Excerpt)

① The syllabus of the classroom training of the Club has been reviewed to include the lessons by the coach for such critical flights as a stall and spin and to check the student pilot's level of understanding at the end of the lesson.

② After the flight onboard the single seater glider, the pilot is required to fill out the "Self-check Sheet of the Flight" in order to make the pilot reconfirm his/her flight performances and to share the performances with the coach. The system to utilize the GPS records and videos is set up in order to understand the student pilot's control characteristics and details of the flight when necessary.

③ In order to make it possible for coaches to share, update, and access the training information of every student pilot, the information sharing system is established by making use of application software and mobile terminals in addition to the present system in which the paper documents are used.

④ Flight Skill Enhancement Program has been set up for those who have acquired the Private pilot certificate and the competency and knowledge of the certificated pilots are checked periodically by flying the dual seater glider.

⑤ The Policy Manual is prepared in order to encourage the members to share the same sense of value and frame of mind and to promote and foster the excellent safety culture and organizational culture based on the fundamental philosophy of the Club in terms of glider operation and student sports.

⑥ We hold a workshop that incorporates elements of active learning about past accident cases, and everyone examines the cause of the accident, studies measures to prevent recurrence, and confirms the degree of understanding for each holding.

⑦ In order to build an organization that has good communication channels running between top and bottom of the organization, and to invigorate communications within the Club, the training system has been modified to introduce the "Mentor System", which is to re-build the trustworthy relationship between student pilots and coaches, and to sufficiently secure the time for briefing and debriefing between a student pilot and coach.

⑧ In order to assess the effectiveness of these actions, the Club convenes the annual Safety Meeting.