Norwegian Safety Investigation Authority

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REPORT AVIATION 2024/06

Aviation accident on 28 April 2023 at Rønneld airfield for model aircraft near Skjeberg, Norway, involving a 1:2 scale remotely piloted ASG-29 glider

The Norwegian Safety Investigation Authority (NSIA) has compiled this report for the sole purpose of improving flight safety.

The purpose of the NSIA's investigations is to clarify the sequence of events and causal factors, elucidate matters deemed to be important to the prevention of accidents and serious incidents, and to issue safety recommendations if relevant. It is not NSIA's task to apportion blame or liability under criminal or civil law.

This report should not be used for purposes other than preventive aviation safety work.

This report has been translated into English and published by the NSIA to facilitate access by international readers. As accurate as the translation might be, the original Norwegian text takes precedence as the report of reference.

Table of contents

Aviation accident report

Table 1: Data

Type of aircraft:	1:2 scale ASG-29 glider
Nationality and registration:	Norwegian
Owner:	Private
Operator:	Private
Model aircraft pilot:	1
Accident site:	Rønneld airfield for model aircraft near Skjeberg, Østfold
Accident time:	Friday 28 April 2023, at approx. 1430 hours

All times given in this report are local times (UTC + 2) unless otherwise stated.

Notification

The Norwegian Safety Investigation Authority (NSIA) received notification from the Model Aircraft Section of the Norwegian Air Sports Federation (NLF) of a model aircraft accident resulting in personnel injuries on Friday 28 April 2023 at 1748 hours. In connection with an aerotow of a large scale model glider, the glider veered off course during takeoff and hit a person standing at the side of the runway. The person lost consciousness for about 5–7 minutes. He was later taken to hospital by ambulance.

Since the injured person is a German national, the German Federal Bureau of Aircraft Accident Investigation (Bundesstelle für Flugunfalluntersuchung – BFU) was informed.

Summary

IGG (Interessengemeinschaft Großsegler) Norway planned a large scale model glider meet at Lunde airfield in Telemark county, Norway, from Thursday 27 to Saturday 29 April 2023. However, due to poor runway conditions at Lunde the event ended up being relocated to Rønneld airfield for model aircraft close to Skjeberg in Østfold county. The agreement with the local club meant that the participants registered for the original event at Lunde would fly as guest pilots at Rønneld alongside the members of the local club.

The local safety regulations were briefed for the guest pilots on Thursday 27 April. The brief was continuously translated to German to accommodate two German guest pilots.

The accident occurred on Friday when a 1:2 scale ASG-29 glider veered off course during takeoff and hit one of the German guest pilots standing at the side of the runway in the back of the head. He was seriously injured and remained in hospital for 11 days.

Model aircraft will occasionally veer off course during takeoff. Reducing the risk associated with these types of incidents is therefore more a question of reducing the consequences than reducing the likelihood. The easiest way to reduce the consequences is by ensuring that no one is in the area where a model aircraft may depart the runway during takeoff.

The guest pilot that was injured does not remember anything from the accident, and the Norwegian Safety Investigation Authority cannot conclude as to why he moved forward along the runway edge while aerotow operations were ongoing. Misunderstandings related to the local safety regulations appear to have been a factor. Language problems may have contributed.

Inadequate clearance of the area immediately surrounding the runway before the aerotow started resulted in the German guest pilot not being spotted.

As a result of the investigation, the NSIA makes one safety recommendation to the NLF/Model Aircraft Section.

About the investigation

Purpose and method

The NSIA has classified the incident as an aviation accident. The purpose of this investigation has been to clarify what caused a person to be hit by a glider during takeoff from Rønneld airfield. The NSIA has also looked at what can be done to improve safety and prevent the ocurrence of similar accidents in the future.

The accident and the circumstances surrounding it have been investigated and analysed in line with the NSIA's framework and analysis process for systematic safety investigations (the NSIA method[1]).

Focus and delimitation of the investigation

The investigation has focused on two questions:

- Why was a pilot standing at the edge of the runway, in front of the area where the tow plane and the glider were lined up to start takeoff? According to the local rules, no one was allowed in this area during aerotows.
- Why did no one spot the person and abort the takeoff?

Sources of information

- Report form NF-2007 'Occurrence reporting in civil aviation' submitted by the model glider section of the Norwegian Air Sports Federation.
- Report from the head of Sarpsborg model aircraft club, the glider pilot and the tow pilot.
- Case documents from Sarpsborg police station regarding the accident.
- The NSIA's own investigation.

The investigation report

The first part of the report, 'Factual information', describes the sequence of events, related data and information gathered in connection with the accident, what the NSIA has investigated and related findings.

The second part, 'Analysis', contains the NSIA's assessment of the sequence of events and contributory factors based on factual information and completed investigations/examinations. Circumstances and factors found to be of less relevance to explaining and understanding the accident will not be discussed in any detail.

The final part of the report contains the NSIA's conclusions and safety recommendation.

[1] *See https://www.nsia.no/About-us/Methodology*

1. Factual information

1. Factual information

1.1 History of the flight

1.1.1 BACKGROUND

The IGG (Interessengemeinschaft Großsegler)[2] Norway was planning the first meet of the year for large scale model gliders, from Thursday 27 to Saturday 29 April 2023. About 14 pilots were registered for the event at Lunde airfield in Telemark. At the start of the week, however, the person responsible at Lunde contacted IGG Norway and informed them that the event could not take place due to the runway conditions. To avoid having to cancel, IGG Norway contacted several other locations in Southern Norway to look into the possibility of moving the event. During the course of Tuesday 25 April, it was agreed with Sarpsborg model aircraft club (SMFK) to use Rønneld airfield for model aircraft near Skjeberg in Østfold. The agreement meant that they would be flying as guest pilots, and that the event was no longer a meet organised by IGG Norway. It also meant that flying would take place in accordance with SMFK's rules and procedures, and that the club's members would be able to fly as normal. The relocation of the event resulted in half of the registered IGG pilots cancelling, and the reduced attendance was part of the reason why it was considered acceptable to fly as guest pilots.

1.1.2 SAFETY BRIEFING

On Thursday 27 April, the seven remaining glider pilots from IGG convened at Rønneld airfield and received a safety briefing from the head of SMFK. The briefing included information about local procedures with regard to flying zones, no-fly zones and safety instructions. As part of the briefing, specific reference was made to section 8 of the local rules, which explained that all pilots had to stand together at the end of the runway during aerotow operations (see Appendix A for local guidelines as of 28 April 2023). The briefing was conducted in Norwegian. The IGG guest pilots included two German pilots. The information in the briefing was translated simultaneously by one of the Norwegian pilots who spoke German. There were no questions after the briefing, and the local rules appeared to be understood. The rest of the day was spent assembling the aircraft and flying the large gliders.

Before starting flying at Rønneld the guest pilots from IGG conducted a threat evaluation. As they normally operated from airfields that included manned aircraft, they were used to a different layout of the airfield. A pilot stand[3] protected by a net approximately 1 meter high was located on the western side of the runway at Rønneld, in addition to a wind socket. This was identified as an obstacle in case the model airplane should veer off course during takeoff or landing, and was considered acceptable.

1.1.3 THE DAY OF THE ACCIDENT

On Friday morning, all the glider pilots, as well as a number of SMFK's own members, convened at the airfield to fly. In total, there were between 20 and 25 people present. The weather was nice with light westerly winds, and runway 04 was used for launching the gliders. Both glider pilots who were involved in the accident later in the day flew in the morning.

[2] IGG Norway is a special interest organisation for large scale gliders in Norway. Similar organisations have been established in several other European countries.
[3] The pilot stand – often referred to as the 'pilot box' – is a defined area in which glider pilots are required to stand during flying. See Figure 2 for where the pilot stand was at Rønneld airfield.

The accident occured at approximately 1430 hours. A few minutes earlier the glider of one of the German pilots, hereafter called Pilot B, had been towed up. One of the club's members has explained to the NSIA that he had contacted Pilot B before the flight and told him that he was also going to fly. Since the club member had a motor-powered aircraft, the local rules dictated that he had to fly from the pilot stand. It was also a requirement for the pilots to be able to communicate during flying, and the German pilot therefore had to position himself so that this was possible. At one point after the takeoff, Pilot B moved forward along the runway. He ended up standing near the pilot stand, just outside the runway, while flying his glider. Exactly when he moved forward is unclear since no one has reported seeing it and he himself does not remember anything from the accident or the time just before and after.

After the tow plane that had pulled up Pilot B's glider had landed, it was made ready to tow Pilot A's aircraft. Since the thermal conditions appeared to be favourable, Pilot A had chosen to use the longest wings with a wingspan of 9 metres. After some minor problems, he managed to connect the tow line to the glider, checked the control surfaces and gave the go-ahead signal to the tow pilot. The tow pilot, who until then had been standing between the tow plane and the glider, moved out towards the left side of the runway and started the tow.

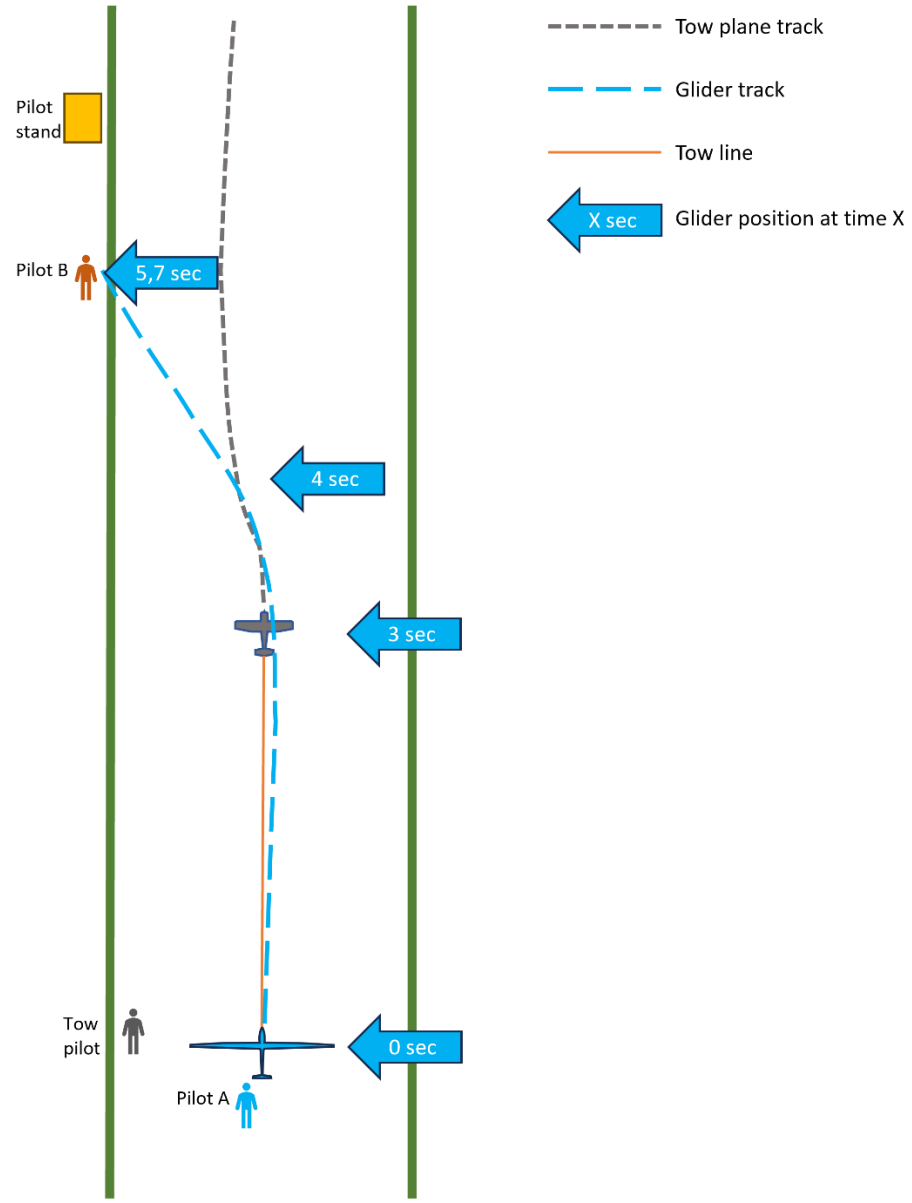

Figure 1: Illustration of the glider and tow plane tracks during takeoff. Illustration: NSIA

The tracks of the tow plane and glider during takeoff are illustrated in Figure 1, based on a video filmed with a mobile phone. At the start of the tow, the glider was lined up behind the tow plane. The tow plane had an initial vector to the left at the start of the takeoff run before correcting with a slight angle back towards the centre of the runway. The glider started the takeoff with the right wing resting on the ground, neutral ailerons and left rudder. As the aircraft began gliding forward, the pilot applied aileron to lift the right wing. It is not possible to determine from the video when this input was neutralised or reversed. As the right wing was lifted off the ground, the glider continued a smooth roll until the left wing touched the ground. At this point, the tow plane was about 2–3 metres left of the glider. With the left wing on the ground, the glider turned sharply to the left at the same time as the tow line was released and the fuselage lifted from the runway. Pilot A has explained to the NSIA that it was not until this point that he noticed Pilot B standing on the left edge of the runway, and that he attempted to lift the glider over him. A review of the video of the incident shows that, during the final seconds before the glider hit Pilot B, the gliders left wing was lifted towards wings level while the aircraft climbed slowly.

The left wing hit Pilot B in the back of the head and knocked him to the ground. Those present estimated that he was unconscious for about 5–7 minutes. Several ran across to help stabilise the injured person, and an ambulance was immediately called.

1.2 Injuries

As the accident involved a remotely controlled aircraft, there were no crewmembers or passengers on board. A German citizen standing on the edge of the runway while flying another model glider was seriously injured in the accident.

Table 2: Injuries

Injuries	Crew	Passengers	Other
Fatal			
Serious			1
Minor/none			

1.3 Damage to aircraft

The glider sustained significant damage in connection with the accident. See section 1.12 for details.

1.4 Other damage

None.

1.5 Personnel information

1.5.1 PILOT A

The glider pilot had more than 25 years' experience of flying large scale model gliders. He also had extensive experience of flying model tow planes, and estimated that he had completed more than 4,000 aerotows. Pilot A had owned the model glider he was flying in connection with the accident for about 10 years, and had an estimated 150 flights with it. The pilot had flown the glider in question earlier in the day, and the accident flight was the second flight of the day. The last flight with the glider prior to this was just over six months earlier.

NLF has confirmed that the pilot held the following valid proofs of competence issued by NLF (see Appendix B for a description of proofs of competence):

- Remote pilot licence A
- Remote pilot licence B – large scale model
- Display
- Instructor 1
- FAI Sporting Licence

1.5.2 PILOT B

Pilot B is a German national with more than 30 years' experience of large scale model aircraft. He had a valid proof of competence ('Kenntnisnachweis') issued by the German Model Aviation Association ('Deutschen Modellflieger Verband' – DMFV), which granted him permission to operate model aircraft with a takeoff mass of more than 2 kg. According to the DMFV website[4], the proof of competence was valid in Germany and certified that the holder had basic knowledge about the use and navigation of model aircraft, and of relevant laws and local airspace rules.

Pilot B spoke little English, and, over and above the use of standard phrases and terminology to coordinate with other glider pilots during flying, he was largely dependent on information being translated into German.

1.6 Aircraft information

The glider was a 1:2 scale model of an ASG-29 glider, weighing approximately 31 kg. The model was manufactured by Rosethal Models and built by Muller Modellbau in Germany. The fuselage was constructed of fibreglass with 2 mm core material of polystyrene. The wings had a polystyrene core reinforced with carbon, abachi veneer and fibreglass cloth.

The aircraft could be operated with two different sets of outer wings of different lengths. The shortest outer wings gave a wingspan of 7.5 metres and had been used in connection with the first flight on the day of the accident. At the time of the accident, the longest wings with a wingspan of 9 metres were fitted.

1.7 Meteorological information

The weather at the time of the incident was reported by SMFK to have been 'sunny, nice weather, low winds'. A review of the video of the accident, which also shows the windsock, confirms this.

The following weather forecast was valid for Rygge Airport at the time of the accident:

METAR ENRY 281220Z VRB08KT CAVOK 10/M05 Q1016 NOSIG

METAR ENRY 281250Z 26008KT 220V300 CAVOK 10/M06 Q1016 NOSIG

1.8 Aids to navigation

Not applicable.

[4] *https://kenntnisnachweisonline.dmfv.aero/en/*

1.9 Communications

Not applicable.

1.10 Aerodrome information

Rønneld airfield for model aircraft is located at Skjeberg in Sarpsborg municipality. The land belongs to Østre Rønneld farm, which had given permission for Sarpsborg model aircraft club to establish a grass field from which to operate model aircraft. See Figure 2 for an outline of the airfield area.

The runway is approximately 240 metres long and 18 metres wide. The direction of the track is 04/22. The runway is relatively flat and surrounded by cultivated land and forests.

At the south end of the runway, a depot area has been established for the preparation of model aircraft. The area is partially separated from the runway by a high safety net.

About 80 metres from the threshold of runway 04, on the west side of the runway there is a pilot stand with a low safety net (about 1 m) and a windsock.

The area surrounding the runway is divided into flying zones and no-fly zones. These zones are primarily established to reduce nuisance noise.

Figure 2: Outline of Rønneld airfield and the surrounding areas. Photo: Google Earth. Illustration: NSIA

1.11 Flight recorders

The model aircraft was not equipped with any kind of flight recorder, nor is it required to be.

1.12 Accident site and wreckage information

After striking Pilot B, Pilot A's glider hit the ground and was left lying in a field next to the runway.

A review of the video of the accident shows that the left wing broke off as it struck Pilot B. The rest of the damage to the glider most likely occurred when the aircraft hit the ground, and includes a broken tail section and a canopy that detached (see Figure 3).

NSIA was not able to examine the wreckage at the accident site, but it was given access to it afterwards.

The glider Pilot B had flown was found in one of the fields near the airfield and transported to the depot immediately after the accident. The incident report described the glider as completely destroyed. The NSIA has not seen the wreckage.

Figure 3: Damaged model glider. Photo: The police / NSIA

1.13 Medical and pathological information

Medical and pathological conditions have not been investigated in connection with the accident.

1.14 Fire

Not applicable.

1.15 Survival aspects

Not applicable.

1.16 Tests and research

No special tests or research were conducted.

1.17 Organisational and management information

1.17.1 MODEL AIRCRAFT SECTION OF THE NORWEGIAN AIR SPORTS FEDERATION (NLF)

NLF organises around 80 model aircraft clubs in Norway and has published a manual called *Modellflyhåndboken* that regulates model flying under the auspices of the clubs. The manual has been approved as a safety management system by the Civil Aviation Authority Norway in accordance with Regulations No 2460 of 25 November 2020 on aviation with unmanned aircraft in open and in specific categories *(BSL A 7-2)*, and forms the basis for operating model aircraft in specific categories. As a safety management system, the manual is intended to provide an overall description of the requirements and procedures for conducting air sport activities in a sufficiently safe manner (cf. section 3.1.4 of the manual). The safety provisions are primarily intended to ensure the safety of third parties.

According to the manual, model aircraft clubs are responsible for the operational aspects of model flying. Among other things, this means that each club must draw up local regulations and appoint a safety officer tasked with ensuring that the club's activities take place in accordance with these regulations. Furthermore, the clubs are required to inform their members about local regulations and other relevant safety information by email (cf. section 2.4 of the manual).

The manual sets out some general recommendations for the design of airfields for model aircraft, including the establishment of flying zones and the use of safety nets to separate the flying zone from the depot area and the spectator area. The manual does not say anything about where the pilots should stand in relation to where the model aircraft take off and land. Nor does it contain any recommendations for how the pilots should coordinate flights between themselves. The fact this is nevertheless perceived as important is evident from the requirements established in connection with the practical test for remote pilot licence class A (cf. Appendix B section 6.1 of the manual):

> *Before commencing a flight, the candidate must:*
> *Inform other pilots of the planned takeoff*
> *Ensure that no one has any objections to the candidate flying*
> *Ensure that the number of aircraft in the air does not exceed the maximum*
> *Stand together with the other pilots to facilitate communication*
> *Ensure that spectators are at a safe distance from the model aircraft*

Procedures for towing model gliders are not mentioned in the manual.

1.17.1.1 Model aircraft displays

Modellflyhåndboken has laid down certain requirements for model flying displays[5] (cf. section 3.4.2), an excerpt of which is reproduced below:

> *A designated event organiser must be appointed to ensure safety in connection with displays and competitions for model aircraft. The event organiser shall establish a flying zone with a safety line separating spectators and the flight zone. [...]*
>
> *Before flying commences, the event organiser shall hold a safety briefing for the participating pilots and inform them about the safety line, the location for starting the engine, flying zone/safety line and local regulations, and routines for reporting unwanted incidents. The event organiser shall ensure that each model pilot holds a valid proof of competence for the type of model in question, and has valid membership of an NLF-affiliated club or equivalent foreign organisation. If there is doubt about the model, equipment or skills, the event organiser may refuse the pilot to fly.*

1.17.1.2 Foreign participants

Modellflyhåndboken sets out competence requirements for foreign participants at events. For guest flying with a model aircraft club affiliated to NLF, the following requirements apply (cf. section 4.6 of the manual):

> *To fly at events organised by a model aircraft club affiliated to NLF/Model Aircraft Section, or as a guest at the club's airfield for model aircraft, the event organiser or the club's safety officer shall ensure that the model pilots have the necessary competence to fly the model under the prevailing conditions, and that they are familiar with the safety regulations for the airfield in question.*

1.17.1.3 Training

Appendix B to *Modellflyhåndboken* sets outs requirements for training and the issuing of a remote pilot licence class A. The training consists of a theoretical and a practical component. The theory component includes a review of laws and regulations for model flying, as well as safety rules (general and specific rules for the club). The requirement for theoretical training may be waived if the candidate has previous experience of the construction and operation of model aircraft. A theory test is not required, but, in connection with the practical test, the evaluator may choose to ask up to five questions about safety regulations and/or the local airfield regulations if parts of the practical test deviate from approved conduct. The possibility of asking questions about safety regulations and local airfield regulations is also set out in the guidelines for instructors class I1 and I2 (cf. Appendix C and Appendix E to the manual).

1.17.2 SARPSBORG MODEL AIRCRAFT CLUB (SMFK)

Sarpsborg model aircraft club has just under 70 members of all ages flying model aircraft at different levels, from recreational to competitive flying. The club's members fly a range of different

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[5] *NLF uses the word "stevne" in Norwegian, which means a large gathering of people with a certain purpose (in this case model flying). NSIA has elected to translate "stevne" with "display". "Stevne" does not necessarily have to imply a public display of an activity. It could also be a closed event. However, the way NLF uses the word in the model flying handbook indicates that they imply an event open to spectators. IGG Norway uses the word "treff" in their procedures. "Treff"* could *mean the same as "stevne", although there are some nuances. "Treff" can also mean a smaller gathering which is not open to the public. NSIA has elected to translate "treff" with "meet" in an attempt to maintain the nuances between "stevne" (display) as used by NLF, and "treff" (meet) as used by IGG Norway.*

types of model aircraft, including gliders and tow planes. At the time of the accident, there were no members flying large scale model gliders, but occasional guest pilots flew such aircraft.

SMFK is affiliated to NLF, and the club's management consists of the head of the club, the deputy head/treasurer, secretary and safety officer. Communication from the board and the head of the club to the members primarily takes place by email. There is also a bulletin board at Rønneld airfield that includes guidelines for use of the airfield, overview of the airfield and flying zones, contact information, action plan in the event of accidents, and an aerotow checklist.

The guidelines (including safety instructions) that the club had established and that were in force at the time of the accident are available in Appendix A (the guidelines have been updated after the accident). The following sections are particularly relevant in connection with this case:

6. *All flying shall take place from the pilot stand, including helicopters, and in the applicable flying zones. For aerotows of gliders, see paragraph 8.*
7. *Safety instructions:*
   […]
   7.4 Takeoff shall take place from the pilot stand.
   […]
   7.6 The pilots must communicate with each other and make agreements during flying.
   […]
8. *Aerotows shall take place at the end of the strip – which end depends on the direction of the wind. Other pilots who wish to fly must then stand together with the glider pilots and tow pilots.*

The aerotow checklist was intended to help ensure that everyone was familiar with how an aerotow took place. The following rules were listed for takeoff (paragraph 2 is of particular relevance):

1. *The radio must be switched on before entering the runway.*
2. *The model aircraft must be placed right outside the pilot stand. Use a trolley if necessary.*
3. *Check control surface movements. Are the control surfaces moving the right way?*
4. *Inform the tow pilot if you would like reduced speed during the tow.*
5. *The tow pilot tightens the line before take-off.*
6. *Signal OK to the tow pilot.*
7. *Be ready with your finger on the trigger. Better to release once too many than once too few.*
8. *The tow pilot calls out 'Start'*

Pilots:

1. *The pilots must stand together during flying.*

1.17.3 IGG NORWAY (INTERESSENGEMEINSCHAFT GROßSEGLER)

IGG Norway is a special interest organisation for large scale glider pilots and tow plane models in Norway. The organisation was established in Norway in 2001, and similar organisations exist in several other European countries. The board of IGG Norway organises flying events (meets) for its members about four times a year.

IGG Norway has drawn up instructions that regulate activities that take place at the glider meets they organise. According to the instructions for IGG meets, the Board of IGG Norway is responsible for organising IGG meets and appointing a meet organiser. The meet organiser is responsible for holding a daily pre-flight briefing that reviews the schedule for the day, any information about coordination with manned flights, as well as other information for safe execution. IGG Norway has published guidelines for what the briefing should contain.

Under certain conditions, the meet organiser must also ensure that a flight line coordinator is appointed. In which cases this is required, as well as the duties of the flight line coordinator, is described in a separate set of instruction (see Appendix C). Essentially, it is the flight line coordinator's duty to contribute to smooth and safe model aircraft operations, but they are not responsible for accidents that occur involving model aircraft.

1.18 Additional information

The Model Aircraft Section of NLF issued Safety Bulletin 1/2023 after the accident, which included two immediate safety actions. The second of these immediate actions is of particular relevance to the accident, and the NSIA has endorsed this suggestion:

> *All members must check to ensure that no one is in front of the model aircraft before takeoff. Look around and check that the runway is clear. We urge all members to be particularly cautious of their surroundings before takeoff, to prevent the risk of other pilots being hit by model aircraft veering off the runway.*

In addition, the Model Aircraft Section of NLF has published a separate report on the accident that contains further recommendations and actions. Both the report and Safety Bulletin 1/2023 are available on the NLF website.

Sarpsborg MFK has updated its guidelines and safety regulations after the accident. The changes include, among others, that aerotows shall not be conducted at the same time as other model flying activities.

1.19 Useful or effective investigation techniques

No methods warranting special mention have been used in this investigation.

2. Analysis

2. Analysis

2.1 Introduction

This is the first time the NSIA is investigating an accident or incident involving the model aircraft community. The pilot who was struck by the model glider was hospitalised for 11 days. The accident shows the potential for serious injuries also in the context of model flying.

The analysis starts by looking at the sequence of events and factors that may have contributed to the model glider veering off the runway during takeoff. The further analysis deals with two issues: why Pilot B was standing at the edge of the runway before the aerotow, and why no one noticed him before the tow started.

2.2 Course of events

The glider swerved to the left during takeoff as a result of the left wing dragging along the ground and the aircraft pivoting around the wing. Several circumstances may have given rise to or exacerbated the situation. The most important factor was that Pilot A, after applying aileron input to lift the right wing off the ground, failed to stop the roll motion to the left in a wings level position. Due to their large wingspan, gliders are less manoeuvrable in roll than aircraft with a smaller wingspan. A large moment of inertia means that it takes longer to build up a roll rate and longer to stop a motion that has started. In practice, this means that, the larger the wingspan, the slower the aircraft responds to aileron input. When the model glider in this case was configured with the longest wings, it was less manoeuvrable than it had been earlier in the day when the shorter wings were used. The fact that it was the first day in over six months that the pilot had flown the model in question may have contributed to him being less observant of the issue. Supporting the wing, for example with one's foot, during the first part of the takeoff run would have facilitated the takeoff by requiring smaller aileron inputs during the initial phase.

Another factor that may have contributed to impeding the glider pilot's directional control was that the tow plane remained slightly to the left of the glider. This may have pulled the glider's nose to the left and thus made it more difficult to control the roll motion.

Based on the video of the incident, there appears to have been little or no wind during takeoff, and crosswinds do not appear to have been a factor.

When the glider veered off course, Pilot A released the towline. Immediately afterwards, according to his own statement, he discovered Pilot B standing on the side of the runway. From this point on, it took just under two seconds before the glider hit Pilot B. If Pilot A had steered the glider towards the ground instead of trying to lift it over Pilot B, there is good reason to believe that the aircraft would not have hit Pilot B, or that his injuries would have been less serious. Two seconds is nonetheless a short time to process what is happening and react with anything other than a reflex, and few pilots will steer into the ground on reflex.

Model aircraft will occasionally veer off course during takeoff. Reducing the risk associated with these types of incidents is therefore more a question of reducing the consequences than reducing the likelihood. The easiest way to reduce the consequences is by ensuring that no one is in the area where a model aircraft may depart the runway during takeoff.

2.3 Pilot B's position during the tow

It is not possible to ascertain why Pilot B moved forward and positioned himself on the side of the runway. He does not remember anything from the accident. One possibility is that he was not aware that more gliders were to be towed. In such case, it would be natural to move forward towards the pilot stand after a local club member told him that he would be flying from the pilot stand, and that Pilot B had to position himself so that it would be possible for them to communicate. Another possibility is that Pilot B had misunderstood the local flying regulations or become uncertain whether he had understood them correctly after talking to the local club member. Pilot B's understanding of what was said may have been that he had to move to the pilot stand regardless of aerotows in progress. Language problems and different procedures in Norway and Germany may have contributed to possible misunderstandings. It is nevertheless difficult to envision that Pilot B would move to the pilot stand without questions if he regarded this as a location where he risked being struck by a model aircraft during take off.

A brief of the rules for flying at Rønneld was held for the IGG guest pilots on the Thursday. According to the participants the NSIA has spoken to, the review was clear and concise, and there were no questions relating to the rules. The briefing was translated simultaneously into German for the two German guest pilots who were present. No one remembers exactly what was said during this translation, but one of the guest pilots has stated that the briefing differed little from what they were used to in Germany.

The guest pilots and some of the members of SMFK seemed to have a clear understanding of rules surrounding the towing of gliders: During the aerotow, all the pilots – of gliders, tow planes and other aircraft – were to stand together behind the tow at the start of the runway. At the same time, it seems that not all members of SMFK interpreted the rules in the same way. The disagreement appeared first and foremost related to where one should stand. It appeared to be a general consensus and established routine that everyone should stand together in order to be able to communicate during flying.

The local club member who spoke to Pilot B just before the incident and who told him that he was going to fly expressed an understanding of the local rules that was limited to paragraph 6. It stated that all flying was to take place from the pilot stand. Paragraph 6 referred to paragraph 8 for aerotows. According to paragraph 8, aerotows were to take place 'at the end of the strip', and pilots who wanted to fly should stand together with the glider pilots and tow pilots. The rules were clear with regard to pilots having to stand together, but less clear about where they should stand. The wording of paragraph 8 that "aerotows shall take place at the end of the strip" could be interpreted as the model aircraft having to start from the end of the runway without saying anything about where the pilots should stand. This wording provided for the possibility of misunderstandings. Other information available also deviated from the local guidelines. Paragraph 2 of the tow rules that were posted on the club's bulletin board stated that 'The model aircraft must be placed just outside the pilot stand', which deviated from paragraph 8 of the local guidelines. However, the tow rules do not appear to be as essential for the activity at Rønneld as the safety regulations established in the local guidelines for Rønneld airfield. Despite a few ambiguities and contradictory information the intention behind the local safety regulations seems clear – namely that all pilots were to stand together at the end of the runway during aerotows and in the pilot stand during all other flying.

The guidelines and safety rules for Rønneld have been updated after the accident. It may nonetheless be challenging to draw up rules that are concise and easy to understand, while at the same time being accurate with regard to the safety issues they are intended to address. It is important to ensure that members understand both what the rules say and why they exist. For new model aircraft pilots, this can be ensured through training and certification. Appendix B to

Modellflyhåndboken states the following in connection with the theoretical test for issuing a remote pilot licence class A:

> *If any part of the performed programme deviates from approved conduct, the evaluator may choose to supplement the test with up to five questions about the safety regulations and/or the local airfield regulations.*[6]

The wording suggests that it is only when the candidate deviates from approved conduct that the evaluator may ask questions relating to the safety regulations. Circumstances during the check flight may mean that candidates rarely ends up in situations where the safety regulations are challenged. An oral check of the candidate's understanding of the general and local safety regulations should therefore be a mandatory part of the practical test, regardless of whether the regulations have been violated during flying.

The NSIA recommends that NLF/Model Aircraft Section amend the requirement for issuing remote pilot licences to include a mandatory check of the candidate's understanding of the safety rules for flying model aircraft.

A clarification of the requirements for issuing new remote pilot licences may address the need for ensuring that new model aircraft pilots understand the safety rules, but not for those already holding a remote pilot licence. Changes relating to model aircraft types, infrastructure etc. may alter the risk assessment and require changes to safety rules and other local regulations. At present, the clubs are required under *Modellflyhåndboken* to inform their members of local regulations and safety information. SMFK also has a system where members must sign to confirm they have read the provisions. However, having received and read the safety regulations is no guarantee that they are understood, and other arenas where members can discuss the regulations and ensure a common understanding may also be appropriate. As an example from another NLF aircraft segment, *Sportsflyhåndboken* (air sport manual), published by Motor- og Sportsflyseksjonen, establishes requirements for attendance at flight safety meetings in order to maintain flying privileges.

2.4 Why did no one spot Pilot B?

The video of the incident clearly shows Pilot B standing on the side of the runway, flying. Pilot A, the tow pilot and the photographer were all looking down the runway and should have had ample opportunity to spot Pilot B. So why did none of them spot him?

Two phenomena can help explain this. One is related to central and peripheral vision. The other is what is referred to as 'inattentional blindness'.

Central vision is what we use to recognise what something is, and it is what we direct our gaze at that is brought to our consciousness. This is generally limited to a cone of 3–4 degrees around the line of vision. Outside this area, we use our peripheral vision. Peripheral vision has low visual acuity, but a good ability to detect anything or anyone moving. If we notice something in our peripheral vision, we rely on directing our gaze towards it in order to recognise what it is. In the video of the accident, Pilot B can be seen standing near the pilot stand and the windsock. He is dressed in light grey and is standing completely still. Given the fact that none of those who were involved in or watching the takeoff were actively scanning the side of the runway, it is unlikely that they would have become aware of a person standing still with the help of their peripheral vision.

[6] *Modellflyhåndboken, Appendix B, sections 6.4, 7.4 and 8.4.*

Although Pilot B was within the field of visual acuity, people's ability to become aware of something that is taking place right in front of them is limited in some situations. When all our attention is focused on a specific thing, we tend to overlook other highly visible objects even if we are looking directly at them. This phenomenon is referred to as inattentional blindness and has been documented in several experiments. The phenomenon has also been used to explain a number of road accidents in which cars have collided with motorcycles, and where the driver has explained that he was looking for traffic but never saw the motorcycle ('looked-but-failed-to see'). Research[7] indicates that drivers who do not expect to share the road with a motorcycle often tend to overlook them. There is much evidence that the frequency of a phenomenon and our expectation that the phenomenon may occur affects our ability to become aware of it, even when it is considered critical.

Both Pilot A and the tow pilot have explained that they considered the local safety rules to be clear: In connection with aerotows, everyone was to stand together behind the tow, and no one was supposed to stand along the runways or in the pilot stand in front of the tow. The expectation that everyone who was present was familiar with and understood the rules in the same way may have contributed to Pilot A and the tow pilot not spotting Pilot B even though he was clearly visible. At the same time, the threat evaluation the guest pilots had conducted in advance of the event had identified the pilot stand on the west side of the runway as an obstacle in case the model aircraft should veer off course during takeoff or landing. When Pilot B was standing still close to the pilot stand he might have "disappeared" in the obstacle that was already known and accepted.

The accident underlines the importance of all model aircraft pilots actively scanning the runway and their surroundings for people and obstacles before taking off. In connection with this accident there was an expectation that everyone present knew the rules, but in many instances there will also be people present that have not read the safety regulations and do not understand the risk involved in model flying. When there are no physical barriers people may inadvertently enter the area surrounding the runway.

After the accident, NLF issued Safety Bulletin 1/2023, where one of the immediate measures highlighted the importance of checking the runway and surroundings before takeoff. The NSIA has endorsed the safety action.

2.5 Other circumstances

When the IGG meet at Lunde airfield was cancelled and moved to Rønneld, and the event was changed from a meet to guest flying, it affected the way the event was organised. IGG Norway's procedures for meets were set aside, and the activity was carried out in accordance with SMFK's regulations and guidelines. In many ways, the setting became less formal. That in itself is not a cause of the accident, but probably removed some of the barriers that could have helped prevent it.

If the event had been defined as a display (see footnote 5 for the use of "display" in this context), an event organiser would have been appointed, as per *Modellflyhåndboken*. The event organiser would have been responsible for the safety of any spectators, for conducting safety briefings for those who were going to fly, and for checking proofs of competence. Although the activity was not considered a display and no official event organiser had been appointed, the head of SMFK attended de facto to the duties of event organiser vis-à-vis the guest pilots. At Rønneld, all the guest pilots were given a safety briefing the day before. However, it is uncertain whether all the local members who attended on Friday were aware of what was to take place that day, or how.

[7] *See, inter alia, Jeremy M Wolfe, Anna Kosovicheva and Benjamin Wolfe: Normal Blindness: When we look but fail to see. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9378609/*

A shared briefing with a plan for the day and a reminder of the safety rules for both the guest pilots and the local members could have helped prevent the incident, especially considering how many people were present. At the same time, it is challenging to gather everyone for a joint briefing when there is no official event with a formal start time.

In its regulations, IGG Norway had set out instructions for both meet organisers and flight line coordinators. Their duties included conducting pre-flight briefings every day, organising the tow queue and overseeing the runway. According to the instructions, it was not the responsibility of the flight line organiser to prevent accidents involving model aircraft. It is nonetheless likely that the coordination and supervision the flight line organiser normally provided could have helped prevent the situation that led to this accident.

In its report, NLF has discussed the requirement for an event organiser in *Modellflyhåndboken*.[8] It states, among other things, that a event organiser was not required given that it was an activity with a limited number of guest pilots. Although there were few guest pilots, they flew other and larger model aircraft types than was common at Rønneld airfield. In addition, a couple of foreign pilots attended, which meant that language was a challenge. Overall, it may have made the situation more challenging than the number of guest pilots alone would indicate. How extensive or complex an activity should be before it is considered a display event that requires an event organiser is not specified in *Modellflyhåndboken*.

[8] 'Rapport – ulykke med modellfly på Rønneld modellflyplass 28 april 2023' (in Norwegian only), available at https://nlf.no/grener/modellfly/sikkerhet-utdanning/rapporter/

3. Conclusion

3. Conclusion

3.1 Main conclusion

The accident occurred when a glider veered off course during takeoff and struck a German guest pilot standing on the side of the runway in the back of the head.

Model aircraft will occasionally veer off course during takeoff. Reducing the risk associated with these types of incidents is therefore more a question of reducing the consequences than reducing the likelihood. The easiest way to reduce the consequences is by ensuring that no one is in the area where a model aircraft may depart the runway during takeoff.

The NSIA cannot say for certain why the German guest pilot was moving along the edge of the runway, positioning himself at the pilot stand while preparations were made for a new areotow. Misunderstandings related to the local safety regulations appear to have been a factor. Language problems may have contributed.

Insufficient clearance of the area immediately surrounding the runway before the aerotow started resulted in the German guest pilot not being spotted.

3.2 Investigation results

A. IGG Norway's meet at Lunde in Telemark was cancelled due to the runway conditions. The event was moved to Rønneld airfield for model aircraft where they would be flying as guest pilots together with the club's own members.

B. All guest pilots received a briefing covering the local safety regulations the day before the accident. The briefing was translated simultaneously from Norwegian into German for the two German guest pilots.

C. The wording of the local safety regulations were somewhat ambiguous and provided the possibility for misunderstandings with regard to where the pilots were to stand during aerotows. However, the intention behind the provisions, that all the pilots were to stand together behind the tow, seemed clear.

D. The local club member who spoke to the German guest pilot and told him that he was going to fly expressed an understanding of the rules as meaning that he always had to fly from the pilot stand – regardless of ongoing tows.

E. The pilots had to be able to communicate during flying.

F. All those involved had many years' experience of flying model aircraft.

G. The pilot who was hit does not remember anything from the accident or why he had positioned himself at the pilot stand.

4. Safety recommendations

4. Safety recommendations

The Norwegian Safety Investigation Authority proposes the following safety recommendations[9]:

Safety Recommendation Aviation No 2024/09T

On 28 April 2023, a 1:2 scale ASG-29 glider hit a person in the back of the head after the aircraft veered off course during takeoff at Rønneld airfield for model aircraft near Skjeberg. The person was seriously injured. Ambiguities in and inadequate understanding of the local safety rules contributed to the accident.

The Norwegian Safety Investigation Authority recommends that the Model Aircraft Section of the Norwegian Air Sports Federation (NLF) amend the requirement for issuing remote pilot licences to include a mandatory check of the candidate's understanding of the safety rules for flying model aircraft.

Norwegian Safety Investigation Authority
Lillestrøm, 27 June 2024

[9] The Ministry of Transport forwards safety recommendations to the Norwegian Civil Aviation Authority and/or other involved ministries for evaluation and follow-up; see Section 8 of the Norwegian Regulations on Public Investigations of Accidents and Incidents in Civil Aviation.

Appendices

Appendix A Sarpsborg model aircraft club – local guidelines as of 28 April 2023

Sarpsborg Modellflyklubb

Retningslinjer på Rønneld modellflyplass

1. Kun medlemmer kan benytte stripa og depoet og det kreves medlemskap i Norges Luftsportsforbund.
   1.1. Bilen skal parkeres oppe ved låven eller i hestehagen, av og på-lessing skjer i hestehagen.
2. Medlemmer kan bruke stripa 3(tre) ganger pr.uke, hvorav kun en dag i helgen(lørdag eller søndag).
3. Flytider:
   3.1. Mandag til torsdag 09:00 til 21:00
   3.2. Fredag 09:00 til 19:00
   3.3. Lørdag 10:00 til 17:00
   3.4. Søndag 12:00 til 17:00
4. Disse dagene er det ikke lov å benytte seg av stripa:
   4.1. Skjærtorsdag, langfredag, påskeaften, 1.påskedag og 2.påskedag.
   4.2. 1.mai, 17.mai og kristihimmelfart.
   4.3. Pinseaften, 1.pinsedag og 2.pinsedag.
   4.4. Juleaften, 1.juledag og 2.juledag.
   4.5. Nyttårsaften og 1.nyttårsdag.
5. Støymåling, se instruks på NLF sine nettsider.
6. All flyvning skal foregå fra pilotstand, gjelder også helikopter, og i gjeldene flysoner. For slep av seilfly, se punkt 8.
7. Sikkerhetsinstruks
   7.1. All oppstart av motorer skal foregå i eget område. Bukker eller stokker som står i startboks kan brukes til oppstart
   7.2. Modellen kan monteres på bukkene i depot, men settes på bakken når montering er utfør. Dette for å frigjøre bukken for andre som trenger å montere sin modell.
   7.3. Ta hensyn i forbindelse med taxing på stripa.
   7.4. Take off skal foregå fra pilotstand.
   7.5. Det er tillatt med inntil 3 fly i lufta av gangen, men det må avklares med de pilotene som flyr eller skal fly.
   7.6. Pilotene må snakke sammen og gjøre avtaler under flyvning.
   7.7. Flysonen må overholdes, og flyvning i syd og over gården er strengt forbudt!
8. Sleping av seilfly skal foregå ved enden av stripa, hvilken ende er avhengig av vindretning. Andre piloter som ønsker å fly skal da stå med seilflygere og slepekusk.
9. Ved "landing" i åkeren er det kun en person som leter etter flyet.
10. Ta med søppel hjem eller bruk dunker som er satt opp!
11. Overtredelse kan medføre midlertidig bortvisning og disiplinærstraff.

Styret i Sarpsborg modellflyklubb

Appendix B Proof of competence for model aircraft

The Norwegian Air Sports Federation issues proofs of competence (remote pilot licences) to model aircraft pilots. The licences are specific to Norway. The NSIA is not aware of similar requirements for model aircraft pilots outside Norway.

The following is a summary of the various proofs of competence, according to *Modellflyhåndboken* version 2.0, published by the Norwegian Air Sports Federation.

Remote pilot licence class A

A remote pilot licence class A is a basic proof of competence that is valid for life. The licence is issued after completing a training programme (theoretical and practical) and a practical test, and entitles the holder to fly fixed-wing models of 2–12 kg, helicopters with rotor diameters greater than 650 mm, and multicopters heavier than 1 kg.

Remote pilot licence class B – large scale model and turbine

A class B remote pilot licence requires a valid class A licence. The pilot licence class B is available in two versions: a B licence that entitles the holder to fly large scale models over 12 kg, and a B turbine licence that entitles the holder to fly jet and turbine models with liquid fuel.

The licence is issued after completing a training programme and a practical test, and has a duration of three years. For models over 75 kg, additional requirements apply.

Remote pilot licence class D – display licence

The display licence entitles the holder to conduct demonstration flights with model aircraft at air shows within the scope of the Regulations relating to air shows (FOR-2015-04-23-424, previously BSL D 4-2). A display licence is issued with a duration of up to three years based on a written recommendation from the model aircraft club, and requires a class A or B remote pilot licence for the model to be flown.

Instructor licence

Instructor licences are issued in class I1 and I2. I1 is issued to instructors who are to conduct training and approve pilots for remote pilot licence class B, as well as approve models that fall under the requirements for a class B licence. I2 is issued to instructors who are to conduct training and approval of pilots for remote pilot licence class A. To be issued an instructor licence, the holder must have completed an instructor course under the auspices of the Model Aircraft Aection of NLF. The licence is issued for three years at a time.

FAI Sporting Licence

Fédération Aéronautique Internationale (FAI) is an international special interest organisation that works to promote air sports, approve records and coordinate international competitions. An FAI Sporting Licence is a prerequisite for participating in competitions under the auspices of FAI, and entails acceptance of the FAI Sporting Code. NLF issues the FAI Sporting Licence on behalf of FAI in Norway.

Competence requirements for foreign participants

NLF sets out the following requirements for foreign model aircraft pilots to be able to fly model aircraft in Norway at events under the auspices of NLF/Model Aircraft Section:

- The model aircraft pilot must hold a valid third party liability insurance and be a member of a model aircraft club affiliated to their national model aircraft federation.
- The participant is obliged to use CE-marked radio equipment.
- For flying at display events organised by a model aircraft club affiliated to NLF/Model Aircraft Section, or as a guest at the club's airfield for model aircraft, the display organiser or the club's safety officer shall ensure that the model pilots have the necessary competence to fly the model under the prevailing conditions, and that they are familiar with the safety regulations for the airfield in question.
- To take part in display events and/or competitions, the participant must hold a valid FAI Sporting Licence.

Appendix C Instructions for Flight Line Coordinator at model aircraft meets organised by IGG Norway

Instruks for Flyleder ved modellflytreff i regi av IGG-Norge.

1. Definisjoner.

Flyleder	Person oppnevnt av treffledelse for å oppnå en smidig og sikker avvikling av modellflybevegelser.
Modellflyger	Fører av modellfly.
Modellfly	Flygende innretning tyngre enn luft kontrollert av modellflyger fra bakken.
Pilot	Fører av luftfartøy.
Luftfartøy	Flygende innretning tyngre enn luft kontrollert av ombordværende pilot.
Slepefly	Motorisert modellfly som benyttes til slep av modellseilfly.
Kontrollert luftrom	Luftrom kontrollert av angjeldende flygekontrollenhet.

2. Målsetning.
   a) Flyleder skal sørge for en smidig og sikker avvikling.
   b) Flyleder skal bidra til å skape en ryddig men avslappet og hyggelig atmosfære på flyfeltet.

   Anm. 1. Funksjonen skal være til hjelp for modellflygere på bakken og i luften.
   Anm. 2. I tilfelle felles operasjoner med ordinære luftfartøy tillegger det treffledelse å gjøre avtale med disse om overordnet plan for trafikkavvikling. Treffledelse er videre ansvarlig for at Flyleder er inneforstått med slik avtale.

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Godkjent av: [redacted]

Side 1 av 2.

3. Krav til Flyleder på IGG-treff.

3.1 I følgende tilfeller skal det brukes Flyleder:

a) I tilfelle fellesoperasjoner med luftfartøy.
b) Ved operasjoner som grenser til kontrollert luftrom.
c) Ved operasjoner som grenser til områder hvor aktivitet med luftfartøy finner sted.
d) Dersom treffledelse eller styret i IGG- Norge av andre årsaker finner det nødvendig.

3.2 I følgende tilfeller bør det brukes Flyleder:

a) Dersom flere enn ett slepefly er i aksjon.
b) Dersom flere enn 4 modellfly er i luften samtidig.
c) Andre spesielle årsaker.

4. Oppgaver.

4.1 Generelle oppgaver:

a) Koordinere bruk av slepefly.
b) Organisere slepekø.
c) Kontrollere at seilfly har løkke før oppstilling for avgang..
d) Ved bruk av avgangstralle, sjekke at seilflyger har medhjelper, sjekke at tralle er fjernet fra rullebane etter bruk.
e) Ved opplysning til piloter bidra til en smidig rekkefølge for landing.
f) Ved opplysning til piloter bidra til en smidig avpassing av slep i forhold til landing.
g) Holde overoppsyn med rullebane og informere modellflygere når banen er klar for landing.
h) Være til generell hjelp for modellflygere uten at Flylederfunksjonens primæroppgaver blir skadelidende.
i) Være behjelpelig med å skaffe medhjelpere til modellflygere som trenger bistand f.eks ved avgang.

4.2 Oppgaver ved felles aktivitet med ordinære luftfartøy.

a) Ved bruk av radio være bindeledd mellom modellflygere og piloter.
b) Holde oversikt over luftfartøy samt holde modellflygere orientert om disses bevegelser for å unngå konflikter.
c) Anvise alternative landingsplasser for modellfly i tilfelle konflikt med luftfartøy.
d) Informere treffledelse dersom modellflygere eller piloter ikke innretter seg etter overordnet plan).

Anm. Luftfartøy skal alltid gis prioritet.

5. Ansvar.

a) Flyleder har intet ansvar for uhell med modellfly,
b) Flyleder har intet ansvar for sammenstøt mellom modellfly, eller mellom modellfly og luftfartøy.

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