

FINAL REPORT

ACCIDENT

occurred to the aircraft

**AS350 B3 reg. marks I-EDIC and Jodel D.140E reg. marks F-PMGV,
at Rutor glacier, La Thuile (AO),
January 25th 2019**

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OBJECTIVES OF THE SAFETY INVESTIGATION

The Agenzia nazionale per la sicurezza del volo (ANSV), instituted with legislative decree No 66 of 25 February 1999, is the Italian Civil Aviation Safety Investigation Authority (art. 4 of EU Regulation No 996/2010 of the European Parliament and of the Council of 20 October 2010). **It conducts, in an independent manner, safety investigations.**

Every accident or serious incident involving a civil aviation aircraft shall be subject of a safety investigation, by the combined limits foreseen by EU Regulation No 996/2010, paragraphs 1, 4 and 5 of art. 5.

The safety investigation is a process conducted by a safety investigation authority for the purpose of accident and incident prevention, which includes the gathering and analysis of information, the drawing of conclusions, including the determination of cause(s) and/or contributing factors and, when appropriate, the making of safety recommendations.

The only objective of a safety investigation is the prevention of future accidents and incidents, without apportioning blame or liability (art. 1, paragraph 1, EU Regulation No 996/2010). Consequently, it is conducted in a separate and independent manner from investigations (such as those of Judicial Authority) finalized to apportion blame or liability.

Safety investigations are conducted in conformity with Annex 13 of the Convention on International Civil Aviation, also known as Chicago Convention (signed on 7 December 1944, approved and made executive in Italy with legislative decree No 616 of 6 March 1948, ratified with law No 561 of 17 April 1956) and with EU Regulation No 996/2010.

Every safety investigation is concluded by a report written in a form appropriate to the type and seriousness of the accident or serious incident. The report shall contain, where appropriate, safety recommendations, which consist in a proposal made with the intention of preventing accident and incidents.

A safety recommendation shall in no case create a presumption of blame or liability for an accident, serious incident or incident (art. 17, paragraph 3, EU Regulation No 996/2010).

The report shall protect the anonymity of any individual involved in the accident or serious incident (art. 16, paragraph 2, EU Regulation No 996/2010).

This report has been translated and published by ANSV for the English-speaking concerned public. The intent was not to produce a factual translation and as accurate as the translation may be, **the original text in Italian is the work of reference.**

GLOSSARY

(A): Aeroplane.
AEMC: Aeromedical Center.
AFIU: Aerodrome Flight Information Unit.
AGL: Above Ground Level.
AIP: Aeronautical Information Publication.
AIS: Aeronautical Information Services.
AISP: Aeronautical Information Services Provider.
AMSL: Above Mean Sea Level.
ANSV: Agenzia nazionale per la sicurezza del volo, Italian Safety Investigation Authority.
AOC: Air Operator Certificate.
ARO: Air traffic services Reporting Office.
ATC: Air Traffic Control.
ATPL: Airline Transport Pilot Licence.
ATS: Air Traffic Services.
BEA: Bureau d'Enquêtes et d'Analyses pour la Sécurité de l'Aviation civile, French Safety Investigation Authority.
BRIEFING: description beforehand on manoeuvres or procedures.
CAT: Commercial Air Transport.
CHECK LIST: list of controls.
COCKPIT: flight crew cabin.
COD. NAV.: navigation code.
CPL: Commercial Pilot Licence.
CVR: Cockpit Voice Recorder.
DGAC: Direzione generale dell'aviazione civile, Directorate General of Civil Aviation.
DM: Ministerial Decree.
EASA: European Union Aviation Safety Agency.
ELT: Emergency Locator Transmitter.
ENAC: Ente nazionale per l'aviazione civile, Italian Civil Aviation Authority.
ENAV SPA: Italian Air Navigation Service Provider.
EOBT: Estimated Off-Block Time.
ETA: Estimated Time of Arrival.
FCL: Flight Crew Licensing or Flight Crew Licence.
FDR: Flight Data Recorder.
FI: Flight Instructor.
FIC: Flight Information Center.
FIS: Flight Information Service.
FL: Flight Level.
FPL: Flight Plan.
FT: Foot, unit of measurement, 1 ft = 0.3048 meters.
GND: Ground.
GPS: Global Positioning System.
GS: Ground Speed.
(H): Helicopter.
HDG: Heading.
HTL: Helicopter Technical Logbook.
IAS: Indicated Air Speed.
ICAO/OACI: International Civil Aviation Organization.
IFR: Instrument Flight Rules.

IR: Instrument Rating.
KT: Knot, unit of measurement, nautical mile (1852 metres) per hour.
METAR: Aviation routine weather report.
MHZ: Megahertz.
MTOM: Maximum Take Off Mass.
NM: Nautical Miles (1 nm = 1852 metres).
NTSB: National Transportation Safety Board, U.S. Safety Investigation Authority.
OM: Operations Manual.
OML: Operational Multi-pilot Limitation.
PF: Pilot Flying.
PIC: Pilot in Command.
PLN: Flight Plan.
P/N: Part Number.
PPL: Private Pilot Licence.
QNH: Altimeter sub-scale setting to obtain elevation when on ground.
RPM: Revolutions per Minute.
SAR: Search and Rescue.
SEP: Single Engine Piston.
S/N: Serial Number.
SOC: Operational safety and flight monitoring.
SRGC: Safety Recommendation of Global Concern.
SRUR: Safety Recommendation of Union-wide Relevance.
SSL: Special Restriction as Specified.
TML: Time Limitation.
UTC: Universal Time Coordinated.
VFR: Visual Flight Rules.
VHF: Very High Frequency (from 30 to 300 MHz).
VMC: Visual Meteorological Conditions.
VML: Multifocal Vision Lenses.
VNE: Velocity Never Exceed.
VNL: Near Vision Lenses.
VS: Stall speed.

INTRODUCTION

The accident occurred on January 25, 2019, at 13:25 UTC (14:25 local time), on the Rutor glacier, in the municipality of La Thuile (AO), and involved the AS350 B3 helicopter, registration marks I-EDIC and the Jodel D.140E airplane, registration marks F-PMGV.

The AS350 B3 I-EDIC helicopter and the Jodel F-PMGV aircraft collided in flight in an area immediately at the beginning of the Rutor glacier, at an altitude of about 2777 meters AMSL.

As a consequence of the collision, both aircraft were damaged to such an extent that they could not sustain themselves in flight and crashed to the ground. The pilot and 4 of the 5 passengers in the helicopter and 2 of the 3 pilots on board the aircraft died.

ANSV was informed of the accident the same day by the ENAV SpA, the Guardia di finanza and the helicopter operator.

The ANSV carried out the first operational survey on January 26 and 27, 2019.

ANSV proceeded to send an initial notification of the event, in accordance with the relevant international and EU legislation (Annex 13 to the Convention on International Civil Aviation, EU Regulation No. 996/2010), to the following entities:

- BEA, France;
- NTSB, USA.

The BEA and the NTSB accredited their representatives in the investigation conducted by ANSV and have been supported by technical advisors, as provided for by the above mentioned regulations.

All hours mentioned in this final report, unless otherwise specified, are expressed in **UTC** (Universal Time Coordinated), which, on the date of the event, corresponded to the local time minus 1h.

CHAPTER I

FACTUAL INFORMATION

1. GENERAL

The factual information collected during the safety investigation are presented below.

1.1. HISTORY OF THE FLIGHT

The AS350 B3 helicopter, mark I-EDIC, operated by GM Helicopters (GMH) of Entrèves (Courmayeur), with the pilot and another trainee pilot on board, had carried out the morning of the accident day, personal transport and aerial work, for a total flight time of 4h 35 min.

The same pilot, carrying an mountain guide and 4 skiers, had started the flight at 12:42 hrs and had taken off from Bonne to release the guide and skiers at "Le Vedette del Rutor", near Rifugio degli Angeli-Testa del Rutor at about 13:03 hrs, then descended to the valley and landed at about 13:07 hrs at Lago dei Seracchi-Cascade (Superiore).

From this point the pilot had started again at 13:21 hrs and had taken off at about 13:24:36 hrs with the mountain guide and skiers on board, presumably for a further release of the guide and skiers at "Le Vedette del Rutor" or for their return to Bonne.

The aircraft Jodel D.140E, registration marks F-PMGV, had taken off at 13.00 hrs from Megève aerodrome (F) with an instructor and two pilots on board, to carry out a training mission to obtain and maintain the mountain rating.

At 13:25:36 hrs the two aircraft collided in flight, at an altitude of about 2777 m ASML, along the Valle Sospesa (La Thuile), close to the last position recorded in flight by the ski tracking system installed on the I-EDIC, with coordinates 45°39'30.94"N 6°58'46.31"E.

1.2. INJURIES TO PERSONS

Helicopter I-EDIC

Injures	Crew	Passengers	Total of persons on board	Other
Fatal	1	4	5	
Serious		1	1	
Minor				
None				
Total	1	5	6	

Airplane F-PMGV

Injures	Crew	Passengers	Total of persons on board	Other
Fatal	1	1	2	
Serious	1		1	
Minor				
None				
Total	2	1	3	

1.3. DAMAGES TO AIRCRAFT

As a result of the in-flight collision, both aircraft sustained catastrophic damage.

1.4. OTHER DAMAGES

No damages to third parties reported.

1.5. PERSONNEL INFORMATION

1.5.1. Flight crew

Helicopter I-EDIC

Captain

General: male, 53 years old, Italian citizen.
Licence: CPL (H), first release 18th November 2013, currently valid.
Ratings: AS350/EC130, R44, R22, FI, FII.
Abilitazioni non in esercizio: NN
Autorizzazioni: NN
English proficiency level: level 4, currently valid.
Medical examination: first class medical check, valid at the time of the accident, VNL limitation.

Captain's flying experience, see following table.

	Total time	Flight hours on the helicopter type	IFR flight time	Night flight time
Last 24 hours	2:53	2:53		
Last 7 days	17:38	17:38		
Last 90 days	34:51	34:51		

The pilot was reported to have about 7120 flight hours on helicopter as PIC.

Airplane F-PMGV

Pilot

General: male, 50 years old, Belgian citizen.

Licence: PPL (A), currently valid.

Ratings: SEP (land), valid, MON R since 2014 e MON S since 2017.

Medical examination: second class medical check, valid at the time of the accident.

Pilot's flying experience, see following table.

	Total time	Flight hours on the helicopter type	IFR flight time	Night flight time
Last 24 hours	2:50			
Last 7 days				
Last 90 days	2 :50			

Professional history of the pilot: see table below.

a/c type	Flight time	Ratings	Authorizations	company	
Jodel D.140E	83:30				

Member of the Megève Aeroclub since March 2012.

During the last 10 years, he had flown on Jodel aircraft at the Aéroclub, totalizing 79:40 hours as no PIC and 3:50 hours as PIC.

During the previous 36 months he had flown 66:20 hours, including 1:40 hours with the instructor of the accident flight.

Flight instructor

General: male, 64 years old, French citizen.
 Licence: ATPL (A), CPL (A), PPL (A), currently valid.
 Ratings: A320 TR, SEP Land, FI MON R (A) and S (A), MON R e S, FI (A), IR/ME.
 English proficiency level: level 5, 7th December 2010.
 Medical examination: first and second class medical check, valid at the time of the accident, OML limitation, TML (6 months), SSL (under surveillance of AeMC Roussy), VML.

Instructor's flying experience, see following table.

	Total time	Flight hours on the a/c type	IFR flight time	Night flight time
Last 24 hours	1:50	1:50		
Last 7 days				
Last 90 days	08:05	08:05		

Professional history of the flight instructor.

a/c type	Flight time	Ratings	Authorizations	Company positions
Several types	16400	captain	FI	

Member of the Megève Aeroclub since February 2012, where during the last 36 months he had flown 284:40 hours, of which 253:40 hours as instructor.

According to the chief pilot of the Megève Aeroclub, the instructor was present for flying activities about 10 days per month, flying about 100f/h per year at the Aeroclub.

1.6. AIRCRAFT INFORMATION

1.6.1. General information

AS350 B3 "Écureuil"

Lightweight multi-mission three-blade helicopter, metal construction, skid-type landing gear and a capacity of up to six passengers and pilot.

On board a Turbomeca Arriel 2B1 turboshaft of 847 SHP, managed by FADEC and has a MTOM of 2250kg. The main dimensions are shown in the figure below:

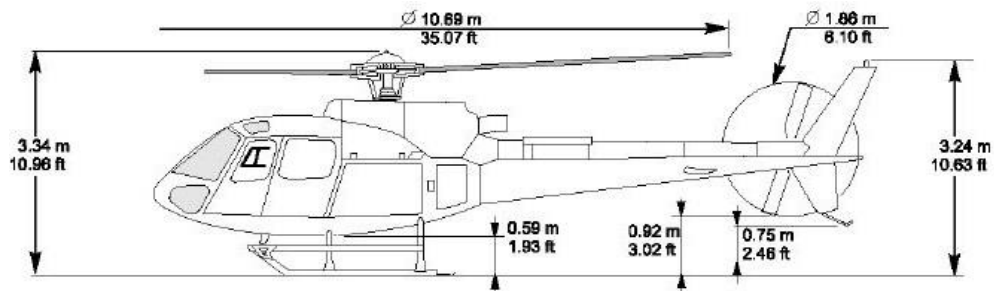


Figure 1: AS350 B3 dimensions.



Photo 1: Helicopter I-EDIC (Source Star Work Sky).

Jodel D.140E "Mousquetaire IV"

A 4-seater tourist airplane, with a mixed wood-metal structure, low wing and fixed bicycle undercarriage on which snow skis can be installed; it has the following dimensions: (L x W x H) 7.92m x 10.27m x 2.13m.

The E version, with respect of the previous ones, has a larger tail fin, modified ailerons and a fully mobile tailplane. It installs a Lycoming O-360-A3A engine of 180 HP, has a VNE of 290 km/h and a MTOM of 1200kg.



Photo 2: F-PMGV aircraft (Photo from www.ctaerotics.com).

1.6.2. Specific information

Helicopter I-EDIC

Manufacturer:	Eurocopter France.
Model:	AS350 B3.
Manufacture number:	4458.
Year of manufacture	2008.
Registration marks:	I-EDIC.
Certificate of registration:	no. 11801, 13 th June 2008.
Operator:	GMH Srl Entrèves (Courmayeur, AO) since 15 th January 2019.
Owner:	Star Work Sky s.a.s.
Airworthiness review certificate:	n. 00545-ARS-OTT, 11 th July 2018.
Total hours:	2892:10 F/H.
Hours since last revision:	N.A.
Hours since last inspection:	6:19.
Hours since last maintenance:	6:19.
Maintenance programme:	Manufacturer.
Technical documentation, compliant with current regulations/directives: YES.	

Engines

Manufacturer:	Turbomeca.
Model:	Arriel 2B1.

Engine position	S/N	Year of manufacture	Date of installation	Total hours (TSN)	Hours since last overhaul (TSO)	Hours since last scheduled maintenance	Hours since last unscheduled maintenance
1	46049			2892:10		4:35	

Fuel

Type(s) of fuel authorized: Jet A1.

Type of fuel used: Jet A1.

Distribution of fuel in the onboard tanks: 240 l.

Jodel D.140E

Manufacturer: Hard Laurent.

Model: D.140E.

Manufacture number: 463.

Year of manufacture 2004.

Registration marks: F-PMGV.

Certificate of registration: no. B27751 11th August 2004.

Owner: Megève Aeroclub.

Airworthiness review certificate: 23rd March 2017.

Total hours: 7341:30 F/H (at 2nd January 2019).

Hours since last revision: 1642:50 (at 2nd January 2019).

Technical documentation compliant with current regulations/directives: YES.

Engine

Manufacturer: Lycoming.

Model: O-360-A3A.

Engine position	S/N	Year of manufacture	Date of installation	Total hours (TSN)	Hours since last overhaul (TSO)	Hours since last scheduled maintenance	Hours since last unscheduled maintenance
1	L-11581-36A			11368:25 (2 nd January 2019)	861:45 (2 nd January 2019)		

Propeller

Manufacturer: Sensenich.

Model: 76E-M8-0-58.

Propeller position	S/N	Year of manufacture	Date of installation	Total hours (TSN)	Hours since last overhaul (TSO)	Hours since last scheduled maintenance	Hours since last unscheduled maintenance
1	100856K			3522:25 (2 nd January 2019)	1525:15 (2 nd January 2019)		

Fuel

Type(s) of fuel authorized: AVGAS 100LL.

Type of fuel used: AVGAS 100LL .

Fuel onboard: 90 l estimated, based on the refuelling made.

1.6.3. Additional information

Weight and balance

AS350 B3: empty weight, 11th January 2019: 1281,83 kg.

Jodel D.140E: empty weight 27th November 2017: 684 kg (dist. CG: 0,425).

I-EDIC flight activities

On the day of the accident, the pilot and the helicopter had been engaged in flight activities starting from 07.32', initially for some training/ambient flights in favour of another pilot, then as a single pilot for CAT activities with take-off and landing at Bonne-Valgrisenche.

From the following excerpt from the HTL, with respect to the last two flights, the following is noted:

- in the first of the two flights the helicopter took off from Bonne at 12:45 (start-up at 12:42) and landed at Lac Glassier (in reality, the landing took place at Cascade (Superiore), close to the Seracchi Lake, the latter also referred to as Rutor Lake in some cartographies) at 13:05 (shutdown at 13:07);
- in the second one, which ended with the accident, the start-up from Lac Glassier (as mentioned, actually from Lago dei Seracchi) occurred at 13:.21, with take-off at 13:24.

E: 1/01/2019		HELICOPTER TYPE: AS 350 B3		GMH S.r.l.										HTL N° 4/0003	
		ENGINE TYPE: ARRIEL 2B4		HELICOPTER TECHNICAL LOG										PAG N° 154	
		REGISTRATION: I-EDIC		ED.2 REV.0											
LT TYPE	W/B CONF	PIC COPILOT	FROM TO	START STOP	OP TIME	TAKE-OFF LANDING	FLT TIME	LDG	ROT	MG INF	SC	POB CREW	PAX	Refuel liters	On board T/O
SPO			COURM.	08:32		08:35	62'							354	1740
			BONNE	-:-		09:37								200	1800
CAT			BONNE (VALGRISA)	-:-		09:42	70'							60	240
			BONNE	-:-		10:52								130	240
CAT			BONNE	-:-		10:56	65'							130	240
			BONNE	-:-		12:01								140	270
CAT			BONNE	-:-		12:07	58'							140	100
			BONNE	13:07	4 ^h 35'	13:03								200	300
CAT			BONNE	13:42	25'	13:45	20'							200	240
			LAC GLASSIER	14:07		14:03								-	240
CAT			LAC GLASSIER	14:21		14:24								-	240

Figure 2: excerpt from the I-EDIC HTL, flights on 25th January 2019 (in local time).

Recording of failures or malfunctions

There were no significant failures on the two aircraft prior to the accident.

Aircraft accessories and equipment

AS350 B3

The I-EDIC helicopter installed on board a system, named "Bolero", essentially consisting of a high-sensitivity 50-channel GPS receiver that transmits, every 10 seconds if the ground speed is greater than 10 m/s (36 km/h), the following data:

1. date and time, localized with respect to the helicopter position;
2. latitude and longitude, expressed in decimal degrees (DD);
3. ground speed, expressed in km/h;
4. course, expressed in degrees with respect to magnetic north;
5. altitude, expressed in meters above sea level.

These data are transmitted on GSM band to the GMH operations center and to GMH operators in possession of a suitable receiver.

The presence of a flight tracking system on board the helicopter is required by regional regulations governing heliski flights in Valle d'Aosta.

Alerting systems

The two aircraft were not equipped with on-board anti-collision systems or systems designed to detect the proximity of other aircraft, however not requested by the regulations in force.

Flight procedures

The ANSV has acquired from the Megève Aeroclub information regarding the procedures used to perform landings at high altitude.

The Megève Aeroclub uses a checklist for mountain flights that contains information and procedures.

According to the checklist and the statements made by the chief pilot of the Aeroclub, emerges that pilots of the latter, before a high altitude landing, are instructed to make 3 reconnaissance flights (at 1000, 500 and 300 feet above the runway), to assess obstacles, wind, turbulence and snow conditions.

There is also a general rule that is adopted for high altitude landings, which states that the speed to be maintained is equal to the stall speed multiplied by 1,45 on approach and by 1,30 on short final.

The above mentioned general rule, compared to the Jodel D.140E aircraft, which has a stall speed of about 90 km/h, implies the following:

- reconnaissance are flown at a speed of 140/150 km/h, with flaps on position 1; this configuration is used for approach;
- the reconnaissance at 300 feet is flown at a speed of 135/140 km/h;
- the final, after intercepting the landing path, is flown with flaps on position 2 (landing configuration) and the speed is reduced to about 120 km/h.

At the same aeroclub is in use a Mountain flight manual¹, which, in summary, for the aspects of interest, suggests the following.

- The direction and shape of the circuit to be made for landing are determined by the characteristics of the place and the weather conditions. The circuit is flown at a maximum altitude of 300 feet above the turning point, making left turns.
- Low reconnaissance is at 500 feet. During this reconnaissance the pilot tries to visually define the contact point ("C") with the runway, the stopping point ("S") and the back track direction, the aim point ("A") with respect to which to lead the descent path, to be connected with the final flare with point "C", dependent on the slope of the glacier and the wind present on the ground.

For further information on the landing circuit, please refer to paragraph 1.18.3. below (AIP France).

¹ DANIEL AGNOUX, *Le vol en montagne expliqué au pilote*, Cépadués Editions.

1.7. METEOROLOGICAL INFORMATION

Weather conditions at the time of collision were characterized by sunshine, absence of cloud cover, unlimited visibility.

According to pilots who had flown in the accident area before and after the accident, there was no wind.

According to pilots of the Megève Aeroclub, the wind coming from the North was, according to those who flew in the area in the morning and in the afternoon, perceptible only at altitudes close to the local peaks, while the accident area was protected from the wind coming from the North due to the surrounding orography.

1.8. AIDS TO NAVIGATION

Not expected in the area where the incident occurred.

1.9. COMMUNICATIONS

The present paragraph contains the most interesting information about the means available for communications and their efficiency status.

1.9.1. Mobile service

There is no evidence that both aircraft had established radio contact with ATS authorities; VHF communications, as far as reported by pilots usually flying in the Rutor area, are sometimes received by the AFIU of Aosta, but only when the flight altitude is close to that of the peaks surrounding the Rutor glacier, on average higher than 3000 m.

Both aircraft were flying according to VFR rules in a class G space, therefore not controlled.

In “G” class airspace, navigation is free, ATS does not provide separation but, where possible, only the FIS service.

In such spaces speed is limited to 250 kts below FL100 and neither radio contacts nor clearances with ATS are required.

Therefore, separation between aircraft engaging the area is left to the pilots of the aircraft through visual acquisition and the use of appropriate radio calls.

1.9.2. Landline service

Not applicable.

1.9.3. Transcription of the communications

Not applicable.

1.9.4. Radios on board of the two aircraft

The Jodel D.140E aircraft had a Honeywell KY97A VHF radio on board, P/N 064-1051-60, S/N 5898.

The AS350 B3 helicopter was equipped with the following equipment:

- COM 1: Garmin GNS 430 radio/navigator, P/N 011-00280-10, S/N 97135558;
- COM 2: Garmin GTR 225A VHF radio, P/N 011-02807-00, S/N 2A6012235, for communications on the aeronautical VHF band;
- COM 3: a Motorola GM360 VHF-FM radio for communications with personnel on the ground.

The three radios were managed on board by a Garmin GMA 340H audio selector (Figure 3).



Figure 3: Control panel GMA340H.



Photo 3: Switch for radio transmission.

By means of this selector it was possible to select in reception the three VHF radios installed on board (using the COM 1, COM 2 and COM 3 buttons) and transmit through one of them, using one of the three COM MIC buttons on the panel or through a switch placed on the cyclic control stick (photo 3), this feature being present on the I-EDIC helicopter.

1.10. AERODROME INFORMATION

Not applicable.

1.11. FLIGHT RECORDERS

Current regulations do not require installation on board of Flight Data Recorders (FDR) and Cockpit Voice Recorders (CVR) of both the helicopter and the airplane. As mentioned earlier, the I-EDIC helicopter was equipped with a GPS in-flight tracking system, named "Bolero". It has been possible to retrieve data of all flights performed on the day of the

accident through the relevant service provider; in this context, some significant flight paths were selected for the present safety investigation.

The following figure shows the flights performed by the I-EDIC from Bonne, from where it took off at 12:45:03 to the Vedette del Rutor, where it landed at 13:02:29, after an intermediate landing near Chalet De L'Epée, Alpe de Brevil.

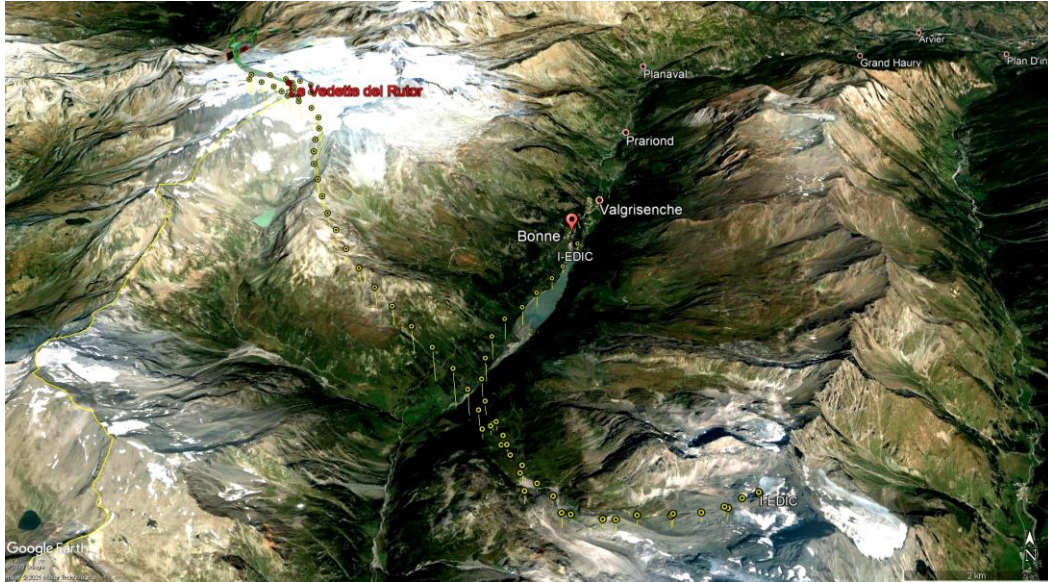


Figure 4: I-EDIC route from Bonne to the Vedette del Rutor (on Google Earth Pro).

In the following image are shown:

1. the point of release of the skiers at Le Vedette del Rutor, the descent of the helicopter down along the valley and its landing close to Lago dei Seracchi-Cascade (Superiore) (green track);
2. the take-off of the helicopter after having re-embarked the skiers, the climb along the Valle Sospesa, up to the last point recorded by the system, at 13:25:36 and at an altitude of 2777 m (red track).

For this last flight, the data recorded by the system from the take-off from Rutor/Seracchi Lake to the last point recorded are shown below.

Date	UTC	Long	Lat	Altitude (AMSL)	GS (Km/h)
2019/01/25	13:24:36 ²	6.9757192	45.6675311	2411	0.27
2019/01/25	13:24:46	6.9782149	45.6666791	2434	51.74
2019/01/25	13:24:56	6.9810495	45.6661072	2523	34.50
2019/01/25	13:25:06	6.9817699	45.6648353	2592	33.26
2019/01/25	13:25:16	6.9812119	45.6630099	2643	44.35
2019/01/25	13:25:26	6.9800404	45.6609761	2703	51.67
2019/01/25	13:25:36	6.979531	45.6585956	2777	46.81

² Deduced take-off time, as the “Bolero” system records the position every 10 seconds if the ground speed has been greater than 10 m/s (36 km/h).

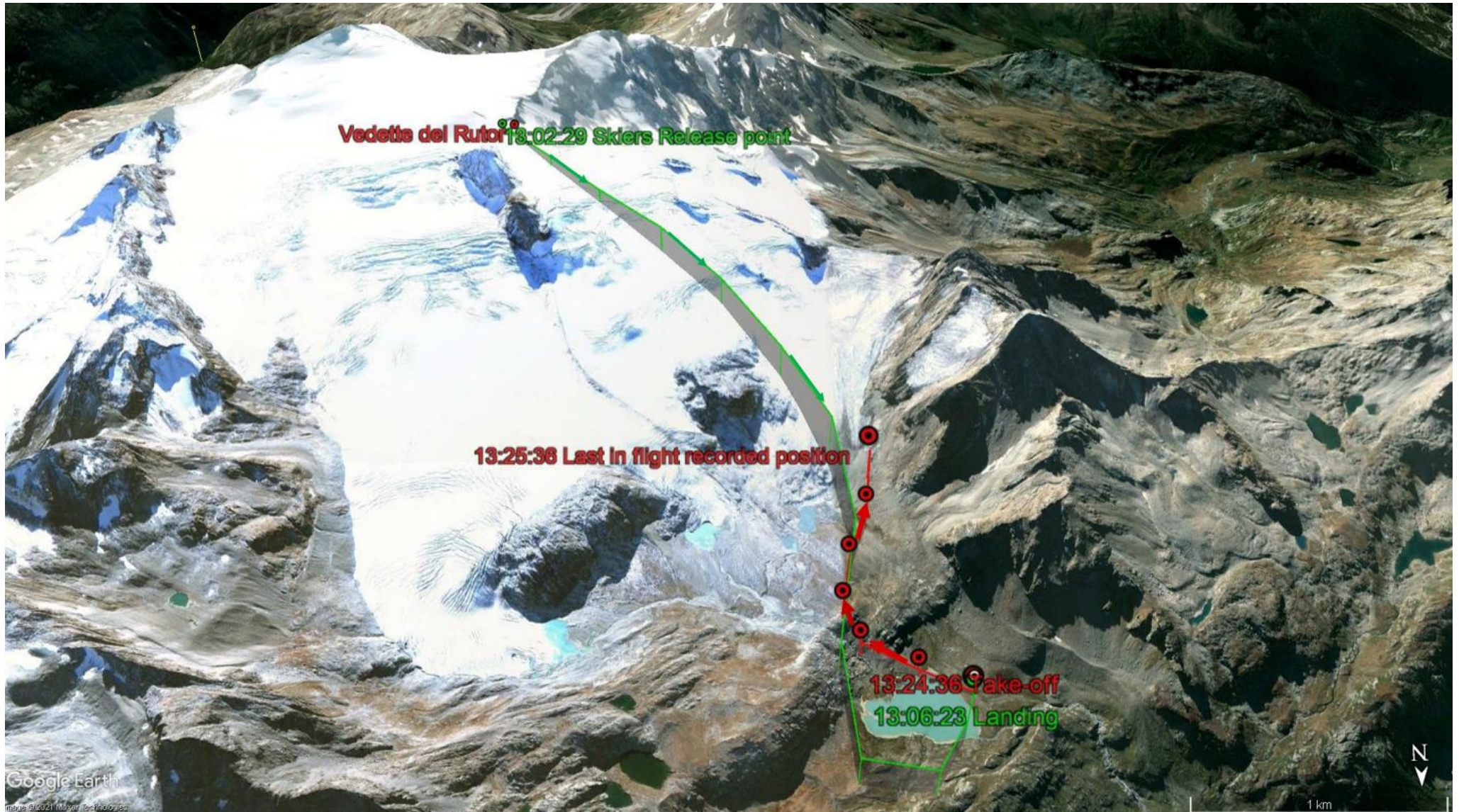


Figure 5: I-EDIC tracks. Descent from Vedette del Rutor, in green, and climb from Seracchi Lake-Cascade (Superiore) to the point of impact, in red. (On Google Earth Pro).

Thanks to the partial melting of the snow on the glacier, in the weeks following the accident, the Guardia di finanza Mountain Rescue Service of Entrèves personnel found various electronic equipment, belonging to the personnel involved in the accident.

Among this equipment there were two GoPro cameras: on the basis of witnesses and videos recorded by them it has been possible to determine they were installed, respectively, on the right front windshield of the I-EDIC helicopter (hereinafter called, for convenience, pilot camera) and on the helmet of the mountain guide, seated on the left front seat of the same helicopter (hereinafter called, for convenience, mountain guide camera).

The duration of the video up to the moment of impact is respectively 65 seconds for the pilot camera and 17 seconds for the mountain guide camera.

The following are some screenshots extracted from the pilot camera video, which go from the take off point Cascate (Superiore) at Lago dei Seracchi to the impact with the F-PMGV aircraft, from which is possible to appreciate the complete flight path performed by the I-EDIC



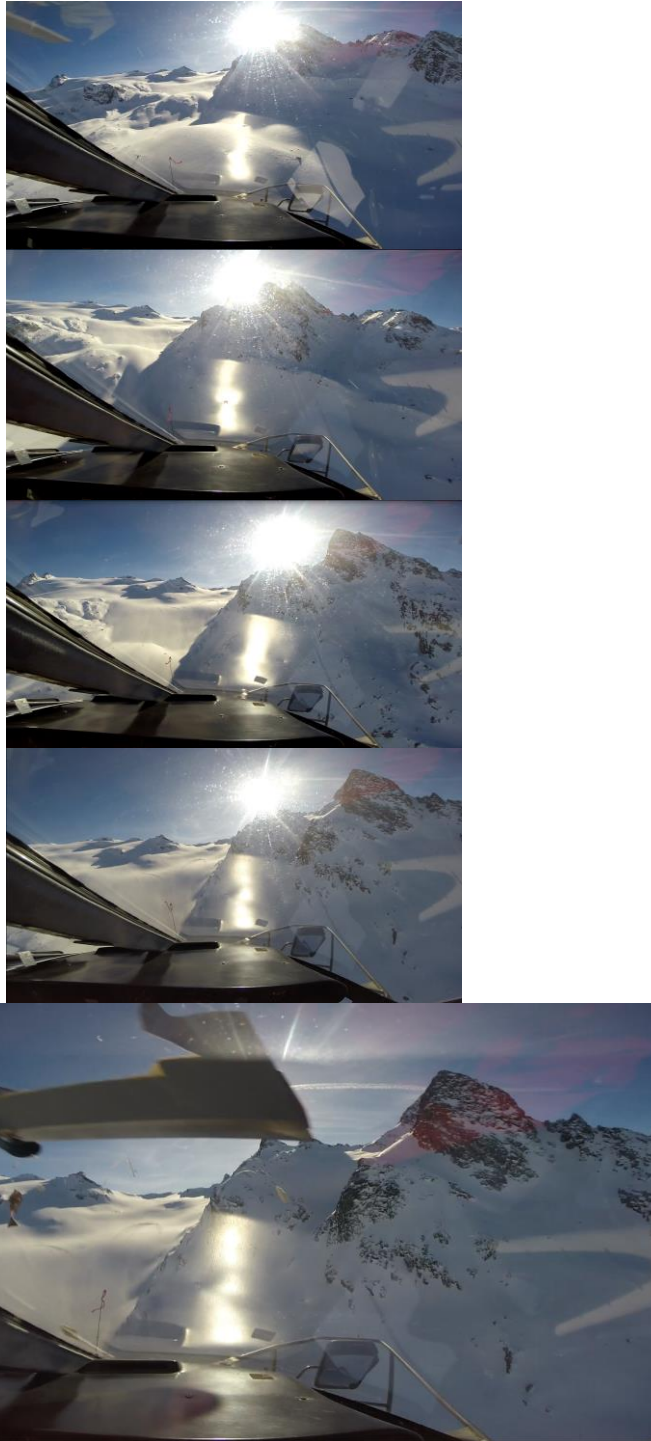


Photo 4: Frames from the I-EDIC pilot camera, sequence of the last 30 seconds of flight.

The moment of impact is instead extracted from the footage retrieved from the camera installed on the helmet of the mountain guide, who is in a more favorable position to document the first impact with F-PMGV.

To be noted that from the lateral windows of the front left seat, the airplane becomes visible only at the time of impact.



Photo 5: frames of the impact with F-PMGV, taken from the mountain guide camera.

Throughout the entire duration of the film, in the in the visible portion of the sky framed by the camera, there are no indications of other aircraft present in the area.

In particular, 50 and 40 seconds before the impact, the east and south sectors of the surrounding sky, respectively, are framed by the camera, without the presence of any aircraft in the visible portion of the sky.



Photo 6: Sky visible to the east, about 50 seconds before the collision.



Photo 7: Sky visible to the south, about 40 seconds before the collision.

An analysis of the environmental audio recorded by the pilot camera has been carried out, while the audio recorded by the mountain guide camera was not usable.

From this analysis it has been possible to deduce, with difficulty, due to the excessive signal strength associated with engine and main rotor noise compared to human voices, that during the 65 seconds between take off and collision, the pilot and the mountain guide have discussed some aspects of the landing site (Vedette del Rutor) and ground tracks; the same analysis has not revealed any radio calls made by the pilot or answered by him during that time.

1.12. WRECKAGE AND IMPACT INFORMATION

This paragraph contains the information acquired from the examination of the wreck and from the crash site.

1.12.1. Crash site

The accident occurred along the Valle Sospesa, at a distance of about 900m from the French border and 550m from the first landing tracks on the glacier, the latter at an altitude of about 2750 m AMSL.

1.12.2. Ground evidence and wreckage distribution

The wreckage of both the helicopter and the aeroplane presented a distribution on the ground along a N-S axis and for about 250 m.

From the following image, it is possible to verify that the skid of the aeroplane (its point of initial impact on the ground (it then slides towards the valley, see photo n. 26 and 27) and the blade section of the helicopter rotor, are the most significant and closest parts to the last point recorded by the in-flight tracking system of the helicopter.

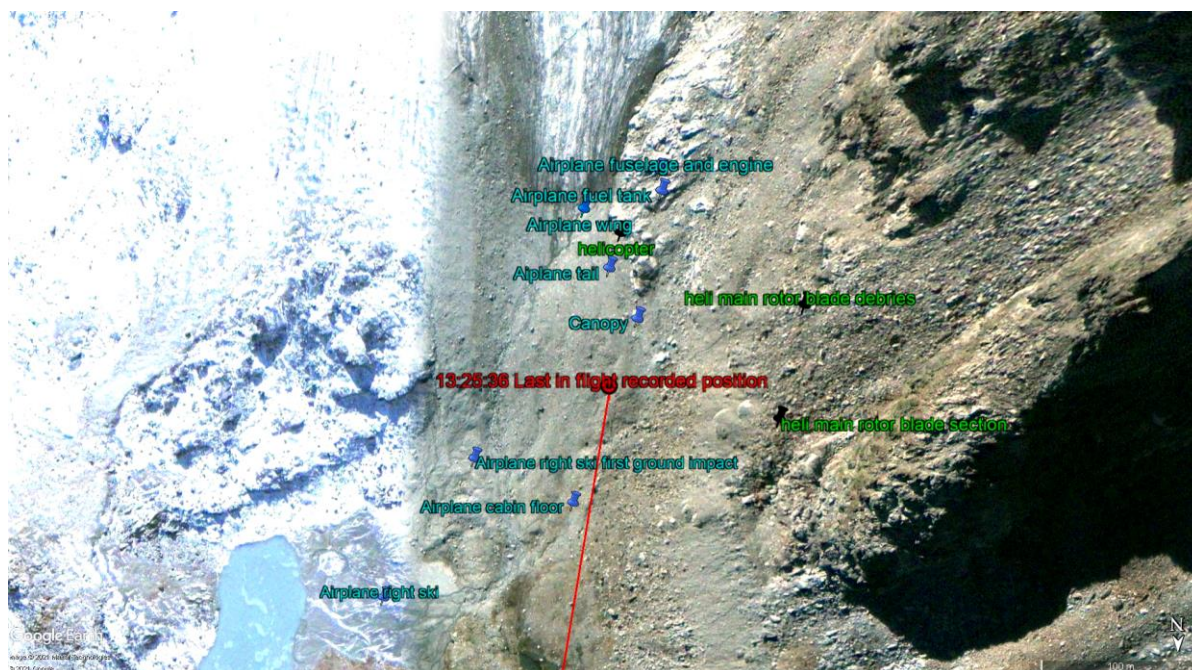


Figure 6: Wreckage distribution (on Google Earth Pro).

1.12.3. Wreckage examination

Both aircraft showed a very high level of destruction. Below the details of the damages.

a) I-EDIC

Fuselage

The wreckage of the helicopter was upside down and nose down, the pilot and passenger cabins completely missing, the front part of the fuselage severely damaged, the tail beam disconnected from the fuselage.



Photo 8: I-EDIC, rear view.



Photo 9: I-EDIC, front view.



Photo 10: I-EDIC, tail beam disconnected from the fuselage.

Main rotor

The main rotor and its blades had sunk into the snow. Once brought to the surface and transported down the valley, it was found out that the three blades were still connected to the rotor head and were heavily damaged, with clear signs of impact against a red painted surface.

The blades were deformed due to impact against a metal object. One of the blades outer section, approximately 1.20 m in length, was missing.



Photo 11: main rotor blade.



Photo 12: main rotor blade with outer section missing.



Photo 13: signs of red paint on main rotor blade.



Photo 14: main rotor blade deformations due to impact against metallic parts.

Cockpit and instruments

The cockpit was destroyed, as was the passenger cabin. The instrument panel was completely separated from the rest of the adjacent structures.



Photo 15: I-EDIC helicopter cabin.



Photo 16: I-EDIC instrument panel.

Engines and fuel system

The turboshaft was found to be completely torn from its housing and with the drive shaft separated from the main transmission.



Photo 17: I-EDIC engine.

b) F-PMGV

Fuselage

The fuselage was heavily damaged and the lower part was missing. The canopy, the rear seats, the engine compartment and the tail were also separated and found on the ground at some distance from each other.

After having moved the wreckage from the glacier down to the valley, a partial reconstruction of the wreckage was made, to better appreciate the damages.



Photo 18: F-PMGV reconstruction.



Photo 19: F-PMGV reconstruction.

Wings and relative surfaces

The wing was completely separated from the fuselage, with the right front seat still partially attached to the central structure, while the left seat was present close to it. The right wing had damages on its ventral part, damages not present on the left wing.

On the right wing, the position of the flap and aileron were not indicative, considering the high level of damage to the flight control rods, still partially attached to the wing inside together with the two front seats.

As for the flaps, on the left wing the surface was free to rotate and there were deformations and partial breakage of the flaps control linkage (base of the control lever shaft, photo 22 and flap control lever shaft, photo 23).

The right main landing gear was heavily damaged by impact with a metal objects, the ski attachment cables were cut and a large part of the ski was missing (Photo 25). The latter has been found at the lowest point respect to all the other parts scattered on the ground, having slipped on the snow for an estimated distance of some tens of meters (Photos 26 and 27).



Photo 20: F-PMGV wing.



Photo 21: ventral side of the right wing, blu paint traces.



Photo 22: flight controls and pilots' seats.



Photo 23: flight controls.



Photo 24: ventral side left wing.



Photo 25: right wing, landing gear and ski.



Photo 26: right wing landing gear ski,
slid down the valley



Photo 27: right wing landing gear ski

Cockpit and instruments

The upper part of the cockpit, essentially the canopy, and the rear seat cushion, were found distant from the rest of the fuselage components.



Photo 28: F-PMGV canopy.



Photo 29: F-PMGV rear seat.

The instrument panel and engine controls were found separated from the rest of the fuselage, together with the fuel tank and near the engine mount.



Photo 30: F-PMGV instrument panel.



Photo 31: F-PMGV engine controls.

Tail and control surfaces

The tail and related moving surfaces were also found to be distant from the other parts of the airplane and heavily damaged.



Photo 32: F-PMGV tail cone and I-EDIC panel.



Photo 33: F-PMGV tail cone.

Engine and propeller

The engine was still connected to the engine mount and cowlings. The propeller blades shown clear damages at the tips due to multiple impacts against metal objects.



Photo34: F-PMGV engine cowlings.

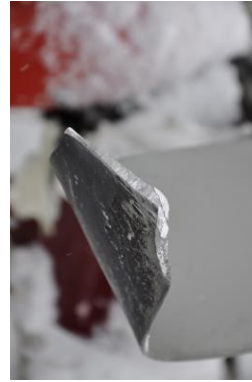


Foto 35: propeller blade tip.

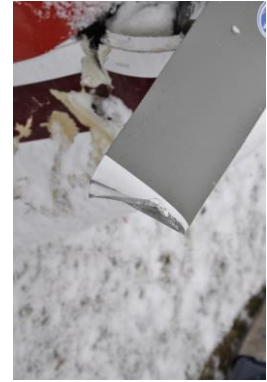


Photo 36: propeller blade tip.

In a subsequent wreckage survey, carried out on May 14th, 2019, in coordination with the judicial authority that had placed both wreckages under seizure (located at the sport field of the municipality of La Thuile), the ANSV removed a Honeywell K97A radio (Photo 37, part. 1) from F-PMGV and two radios from I-EDIC (Garmin GNS 430 and Garmin GTR 225A, respectively part. 2 and part. 3 of Photo 37) from their respective instrument panels, for their subsequent transfer to the laboratories of the same ANSV.

The GMA340 radio control panel was not found among the wreckage parts moved to the sport field.



Photo 37: radios from the two aircraft: n. 1 from F-PMGV; n. 2 and n. 3 from I-EDIC.

1.12.4. Impact dynamics

Based on the video footages recovered from the above cameras, on the distribution of the wreckages and on the damages found on some of them, it has been possible to reconstruct the following impact dynamics.

While the helicopter was climbing from Lago dei Seracchi-Cascate (Superiore) to release the 4 skiers and the mountain guide on board, presumably at Vedette del Rutor or to bring

them back to Bonne, at an altitude of 2777 m AMSL, with a ground direction of 191°, and a GS of about 47 km/h, the collision took place in flight with the airplane, positioned a few feet higher than the helicopter and with a flight direction substantially similar to the latter.

Based on GPS data recovered from the “Bolero” system, the helicopter's climb rate in the last 30 seconds of flight was about 1200ft/min.

The initial impact was between the forward blade of the helicopter and the right main landing gear of the airplane, followed by subsequent impacts of the blades against the lower side of the aircraft fuselage and the ventral part of the right wing.



Figure 7: reconstruction of the impact between I-EDIC and F-PMGV (ANSV animation; the silhouette of a similar aircraft has been used to simulate F-PMGV).

The airplane broke up into several parts in flight; the helicopter, deprived of the front part of the cockpit, with one of the main rotor blades partially missing and the other two seriously damaged, went upside down in flight, and with such attitude impacted the ground.

1.12.5. Failures connected with the event

The collision caused in-flight separation of the airplane's wing and cabin, damage to the main rotor and failure of the helicopter's forward fuselage.

1.13. MEDICAL AND PATHOLOGICAL INFORMATION

In the accident two of the three pilots aboard F-PMGV and 5 out of 6 people aboard the I-EDIC (pilot, mountain guide and 3 of the 4 skiers) died.

The ANSV has acquired the autopsy and toxicological examinations conducted on the pilots bodies: these investigations have not revealed any pathologies or medical criticalities that could have affected the accident dynamic.

1.14. FIRE

Not applicable.

1.15. SURVIVAL ASPECTS

The helicopter operator, having noted that the helicopter was delayed with respect to the daily flight schedule, attempted to establish a radio link with the pilot, without success; the same operator, having not received any notification of ELT activation at the contact point of Star Work Sky, owner of the helicopter, alerted the Valle d'Aosta Mountain rescue service and dispatched two helicopters to take some mountain guides of the heliskiing company on the scene, in order to carry out a search of the Rutor area, in particular at the collection point Lago dei Seracchi-Cascate (Superiore) and Testa del Rutor-Le Vedette.

A few minutes after take-off, both wreckages were identified.

Mountain guides were disembarked and found still alive one of the skiers and the F-PMGV pilot instructor.

Both were transferred to the intensive care unit of the Aosta Regional Hospital, for proper medical treatments.

Below is a map of the positions where the two survivors and the 7 deceased were found (the direction of flight of the helicopter, in the final stages of the flight, is about 185°).

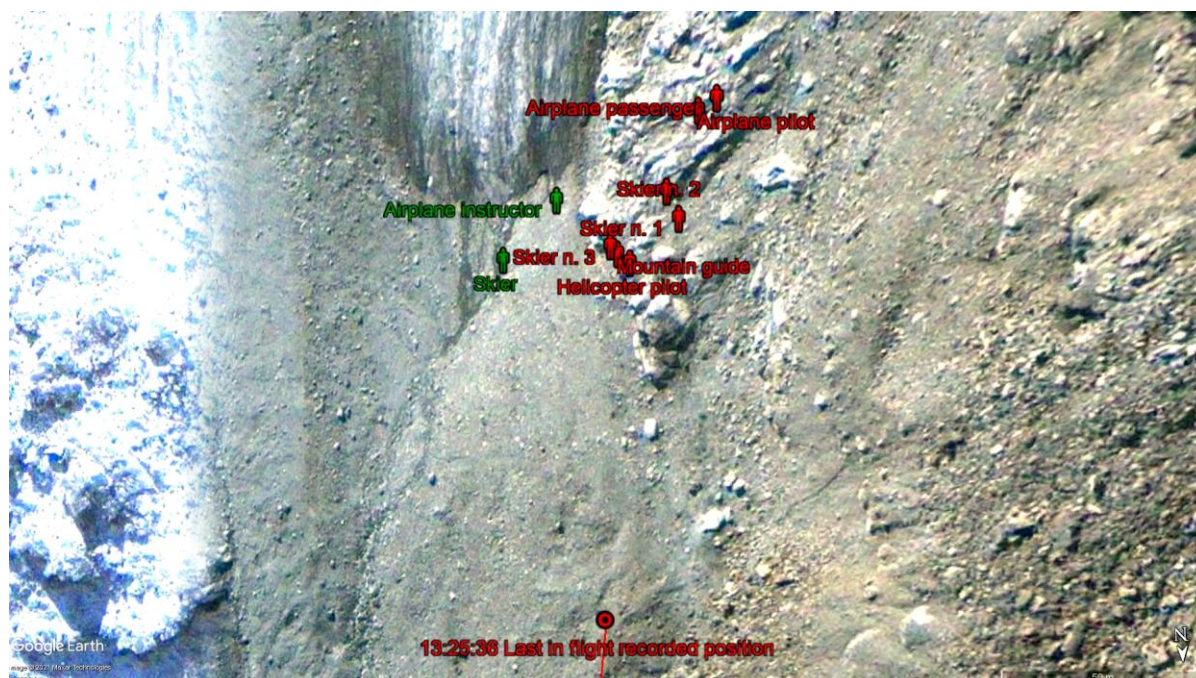


Figure 8: positions of the last point recorded in flight, of survivors and deceased (On Google Earth Pro).

In particular, the pilot instructor on board of the F-PMGV was found still belted to the right front seat, which was partially restrained to the wing structure; he was released from the belt thanks to the intervention of the rescuers on the scene.



Photo 38: survivor position on F-PMGV.

1.16. TESTS AND RESEARCH

Not applicable.

1.17. ORGANISATIONAL AND MANAGEMENT INFORMATION

GMH S.r.l.

The operator of the I-EDIC helicopter held, at the time of the accident, the COA T-AC.166 and was authorized to conduct the following general and specific AS350 B3 helicopter operations:

1. CAT (passengers and cargo);
2. Helicopter operations over hostile environment located outside a congested area;
3. Helicopter operations without a safe forced landing capability;
4. Non commercial operations;
5. Continuing airworthiness

It operates from the Entrèves base (Courmayeur) with its own hangar and a fleet of three AS350 B3s, of which I-EDIC was dry-leased by Star Works Sky s.a.s.

Among the activities carried out, the skiers transport with helicopters (heliski), an activity authorized within the District made of three municipalities of Valgrisenche, Arvier and La Thuile, through a special agreement signed by GMH and other operators with the same municipalities, according to applicable norms.

The agreement regulates, among other things, also the areas for the exercise of the activity of heliski, establishing departures exclusively from authorized helipads and landing at

high altitude exclusively on temporary landing spots for release or recovery.

The operator GMH had requested to ENAC - Turin Caselle Airport -Direzione Aeroportuale- to open, from 08:00 to 16:00 local time, a series of temporary landing spots, located within the municipality of La Thuile (Testa del Rutor -Le Vedette, the Rutor Glacier) for January 25th, 2019.

- The departure helipad, located in Entrèves, is not equipped with radionavigation equipment, therefore the trades will have to remain listening on the general VHF frequency of 130,000 MHz and send communications about their flight intentions;
- Within the Municipality of Bonne there is an area (Figure 9, Part. H), destined to the loading and transport of passengers to the areas authorized by Valle d'Aosta, among them, also the Testa del Rutor (part. D) and the Chateau Blanc (part. B);

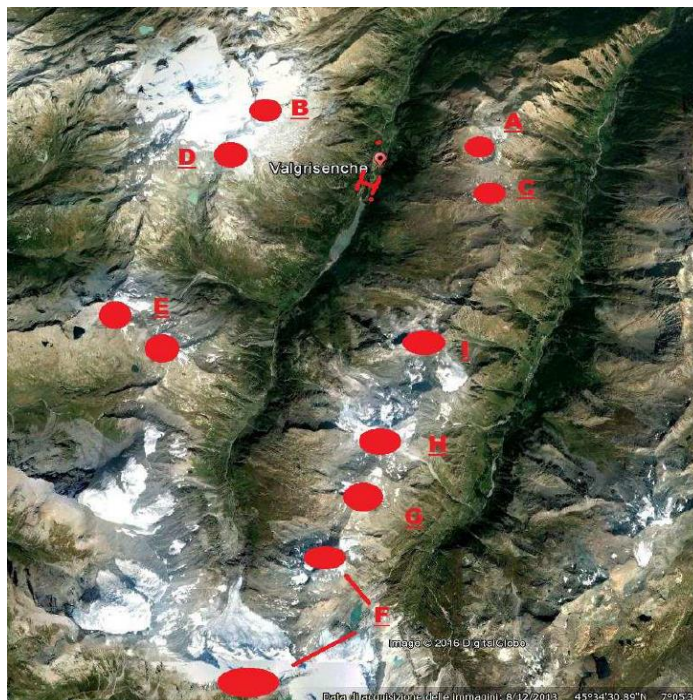


Figure 9: release areas within the district of municipalities of Valgrisenche, Arvier e La Thuile (from GMH OM).

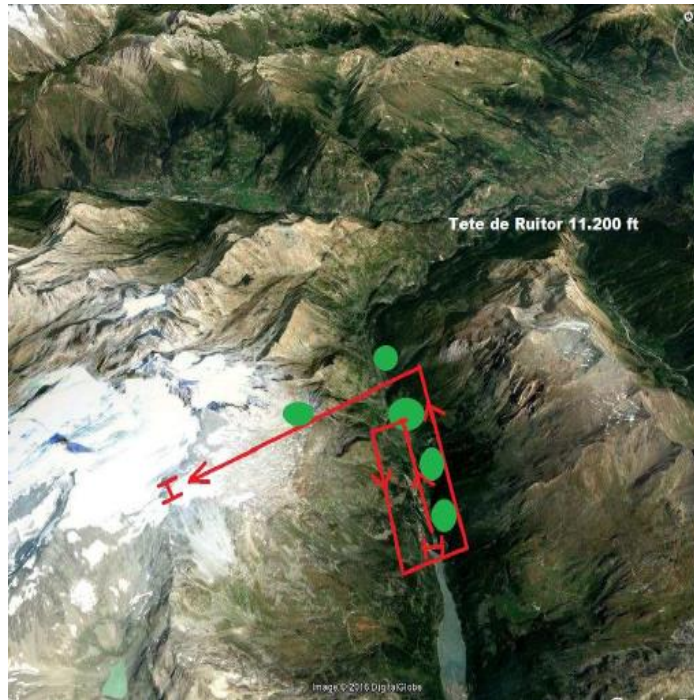


Figure 10: flight trajectory from Bonne recovery point to Testa del Rutor (from GMH OM).

The same OM also provides as a point of collection / recovery of skiers "Cascade" distinguished in a lower point ($45^{\circ}40'21''$ N $06^{\circ}58'07''$ E) and an upper one ($45^{\circ}40'03''$ N $06^{\circ}58'32''$ E), both close to Lake Seracchi.

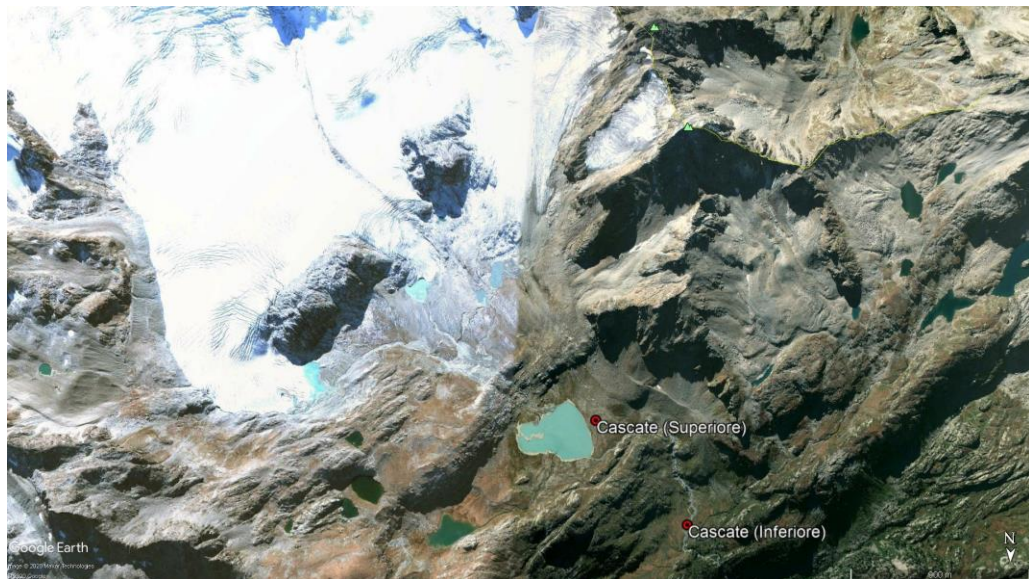


Figure 11: "Cascade" lower (Inferiore) and upper (Superiore) recovery points (from GMH OM).

Altiport de Megève and Megève Aeroclub

The airport, owned by the Municipality of Megève, ICAO code LFHM, is located in Haute-Savoie, at an altitude of 1472 m (4830 feet).

It has only one runway is oriented 16/34, 620 m long, it is permitted to operate in VFR;

night flight or low visibility operations are not permitted. The VHF frequency in use is 132.050 MHz.



Figure 12: Megève altiport (on Google Earth Pro).

On the airport operate two companies of aerial work, both with airplanes and helicopters, and the Megève Aeroclub.

The latter is also a flight school for the attainment of PPL (A), it also carries out mountain flying activities for pilots in possession of PPL for the achievement of the mountain rating, both on wheels and on skis.

It has a number of airplanes Jodel "Mousquetaire" D.140E, it performs an intense annual flight activity (in 2019 about 3000 flight hours) and has about 300 members.

1.18. ADDITIONAL INFORMATION

1.18.1. Mountain rating

The mountain rating is regulated by Commission Regulation EU No 1178/2011 of 3 November 2011 (it enestablishes the technical requirements and administrative procedures related to civil aviation aircrew), FCL.815, which provides as follows.

- (a) Privileges. The privileges of the holder of a mountain rating are to conduct flights with aeroplanes or TMG to and from surfaces designated as requiring such a rating by the appropriate authorities designated by the Member States.

The initial mountain rating may be obtained either on:

- (1) wheels, to grant the privilege to fly to and from such surfaces when they are not covered by snow; or

- (2) skis, to grant the privilege to fly to and from such surfaces when they are covered by snow.
- (3) The privileges of the initial rating may be extended to either wheel or ski privileges when the pilot has undertaken an appropriate additional familiarization course, including theoretical knowledge instruction and flight training, with a mountain flight instructor.
- (b) Training course. Applicants for a mountain rating shall have completed, within a period of 24 months, a course of theoretical knowledge instruction and flight training at an ATO. The content of the course shall be appropriate to the privileges sought.
- (c) Skill test. After the completion of the training, the applicant shall pass a skill test with an FE qualified for this purpose. The skill test shall contain:
 - (1) a verbal examination of theoretical knowledge;
 - (2) 6 landings on at least 2 different surfaces designated as requiring a mountain rating other than the surface of departure.
- (d) Validity. A mountain rating shall be valid for a period of 24 months.
- (e) Revalidation. For revalidation of a mountain rating, the applicant shall:
 - (1) have completed at least 6 mountain landings in the past 24 months; or
 - (2) pass a proficiency check. The proficiency check shall comply with the requirements in (c).
- (f) Renewal. If the rating has lapsed, the applicant shall comply with the requirement in (e)(2).

1.18.2. AIP Italy

AIP Italy is a publication issued and distributed on behalf of the Italian State by the Aeronautical Information Service Provider (AISP) and is intended to meet the reporting and dissemination requirements of aeronautical information of a lasting nature essential for air navigation. It is published in compliance with Annex 15 "Aeronautical Information Services" to the Convention on International Civil Aviation, as referred to in the ENAC "Aeronautical Information Service" norm.

ENAV SpA is, on behalf of the Italian State, the provider of the above mentioned Aeronautical Information Service and is responsible for a series of official publications, including AIP Italy. This activity is carried out under the constant supervision of ENAC, in compliance with the above mentioned Annex 15 and in accordance with the applicable EU and national legislation.

The structure of AIP Italy (GEN/ENR/AD) is consistent with that defined by Annex 15; within this structure each State reports the information it considers useful for air navigation within the airspace under its jurisdiction.

National AIS publications (AIP and related amendments, Supplements, NOTAM, AIC) contain aeronautical information that, directly or through ENAC, the parties responsible for originating them produce and supply ENAV SpA in the prescribed manner. The originators, as indicated in the aforementioned ENAC "Aeronautical Information Service" publication, are the following: ENAC, the Air Force, air navigation service providers and certified airport operators. These parties are responsible for the quality of the aeronautical data and information supplied to ENAV SpA in its capacity as supplier of the Aeronautical Information Service.

ENAV SpA is not responsible for the accuracy of the data/information it receives, having only the task of providing for its dissemination by means of national AIS documentation; it is instead responsible for the quality of the data/information it originates itself.

No news can be published through AIS publications if it is not officially communicated by its own act by the competent originator.

Data and information originated by parties other than those listed above are published via AIS documentation following their evaluation by ENAC.

Below are some extracts from AIP Italy that present elements of interest for the investigation.

Entry, transit and departure of aircraft (GEN 1.2)

Aircraft entering, leaving or passing through the territory of the Italian Republic, or landing on such territory, shall be operated in accordance with Italian regulations applicable to civil aviation.

Flight Plan (ENR 1.10)

A flight plan must be submitted prior to operating any flight across international boundaries. A VFR flight plan must be submitted to the appropriate ATS reporting office (ARO) prior to departure.

A flight plan must be submitted beginning 120 hours prior to EOBT and ending at least 60 minutes prior to EOBT for any flight scheduled to be operated across international borders.

An in-flight flight plan may be submitted to the appropriate ATS office responsible for the provision of air traffic services in the airspace in which the aircraft is flying, unless instructed to forward the flight plan to another ATS office; the flight plan must be submitted as soon as possible after take-off and in any case in time to be received by the appropriate ATS office.

The ARO offices present in Italy (in the past present on national airports) are now present in Milan (flight activities in Northern Italy) and in Rome (Central and Southern Italy).

The ARO office sends the flight plan to the ATS authorities involved in the flight.

Mountain flight

In AIP Italy, unlike the information contained in AIP France, there are no specific instructions for mountain flights.

In this context it should be pointed out that in GEN 1.2 of AIP Italy it is stated that the use of airfields/helipads for flights to/from EU countries is allowed in compliance with national regulations as per Interministerial Decree of August 8, 2003 (subsequently replaced by Ministerial Decree of Infrastructure and Transport of February 1, 2006). Flight information must be notified by the pilot in charge of the flight at least 12 hours prior to the scheduled arrival/departure time, both to the competent Direzione di circoscrizione aeroportuale and to the Police and Customs authorities having jurisdiction over the interested area.

Contrary to the Ministerial Decree of February 1, 2006, AIP Italy does not mention the use of the VHF 130.000 MHz frequency in case of air operations in mountainous areas or in areas where bilateral radio contact with the competent ATS is not possible, nor the obligation for pilots to make self-information radio calls.

Natural parks and wildlife protection areas (ENR 5.6.1)

In AIP Italy, ENR 5.6.1 ff, a list of natural parks and areas subject to wildlife protection is reported where flying is prohibited, with some exceptions.

In fact, the following is stated in the foreword of this list: "To protect the environment of some areas like natural parks, areas of biological, faunistic interest, under provision art. 11 of Law 6.12.91 n° 394, further local and regional restrictions, and according to Italian civil aviation Authority's provision n°42/1060/R1/6-1-1 dated 14-05- 98, take-off, landing and low level overflying are prohibited to all aircraft (ultralight machines also) over Natural Reserves unless under emergency, rescue, firefighting operations or for wild life reserve advantages, authorized by the Reserve's Authority.

List of these interdictions with the specification of the coordinates and the dimensions of the areas and the level prohibited are listed in ENR 5.6.1.1-1 and following".

ENR 5.6.1-1 et seq. lists several areas that are geographically located in various regions of Italy. In the case of Valle d'Aosta, there are no parks, wildlife protection areas or other areas with overflight/take-off/landing restrictions. In other sections of AIP Italy (e.g. the section listing prohibited areas, regulated areas, etc.) there are no reports of restricted areas in Regione Valle d'Aosta.

In relation to the above, reference should be made to ENAC Circular ATM-03B, dealing with 'Establishment, modification or cancellation of restricted areas'. In fact, among the areas taken into consideration by the above mentioned circular, there are also "areas subject to protection of natural parks and/or wildlife reserves". On such areas, full or partial restrictions on airspace may be envisaged, if justified by requirements for the protection of the territory and the environment, in line with the provisions of national legislation.

For such needs, the parties entitled to request airspace restrictions are the competent Administration or the subject which is entitled to manage the territory concerned (for example, the Park Authority), when delegated.

On completion of the requests evaluation, the ENAC issues a measure establishing the restriction/prohibition and activates the process for its publication in the AIS documentation.

1.18.3. AIP France

Flight plan

AIP France requires that when crossing national borders, a flight plan must be submitted at least 60 minutes before departure.

Mountain flight

In the AIP France there is the following specific information for mountain flight.

**ADDITIONAL PROVISIONS RELATING TO ALTIPO RTS AND ALTISURFACES
(HIGH ALTITUDE AERODROMES OR LANDING FIELDS)**

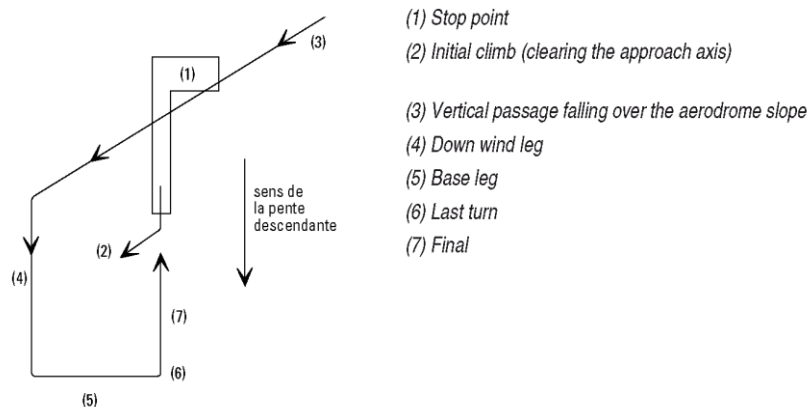
General

Altiports and altisurfaces are aerodromes and locations with non-traditional characteristics generally located in mountainous regions, usually with significant differences of level between the two ends of the runway or of the landing axis. Landings and take-offs are made

in opposite directions, take off in the direction of the falling slope and landing in the direction of the rising slope, whatever the wind direction.

Characteristic positions

The characteristic positions of typical ground traffic circuits and typical aerodrome traffic circuit when applied to altiports or altisurfaces are as follows:



Typical circuits

The dimensions of aerodrome circuits are usually not strictly specified. It is the pilot's duty to adapt his flight path to the ground relief, to the controllability of his aircraft and to circumstances in order to avoid causing disturbances to other aircraft flying in the aerodrome traffic, and taking care not to fly over regions when prohibited by particular instructions.

When not otherwise specified in particular instructions pilots shall fly the downwind leg of the aerodrome circuit at about 100 m (300 ft) above the highest deck on the side with the fewest obstacles or, when not possible leftward.

Radio equipment

Pilots shall only fly in the traffic area of an altiport or altisurface when able to receive and transmit, at any time the messages required for the supply of air traffic control on controlled altiports; and on non-controlled altiports and altisurfaces, self-information messages on the specified frequency.

Radio frequencies

When no specific frequency has been assigned to the altiport or altisurface pilots shall give self-information on 130.000 MHz.

1.18.4. French regulation for mountain flight

The procedures for obtaining a mountain rating are disciplined by the Arrêté du 2 février 2004 relatif aux formations de site, aux qualifications montagne et aux équipements requis pour le vol en montagne en avion.

1.18.5. National and regional regulation for mountain flights in Italy

Mountain flying is regulated by many national and regional regulations.

The following are the sources that have been taken into consideration during the investigation of the present accident.

Law n. 518 of April 2, 1968, known as "GEX Law"

Such law, relating to the liberalization of landing areas, states that the aircraft landing, whose particular technical structures do not exclusively impose the use of airports, may take place in other suitable locations, known as airfields, including glaciers, snowfields and natural runways.

The same law then refers to subsequent norms for the definition of detailed rules, in particular for the classification of airfields, for their characteristics and for the requirements necessary to obtain the authorization to operate on such areas.

Art. 701 navigation code, paragraph 1

Airfields, including helipads, are areas, other than airports, which do not belong to the "Demanio aeronautico" and are ruled by special regulations, without preventing the competences of ENAC regarding air safety, and of the regions, local authorities and other authorities in accordance with their respective competences and powers.

Interministerial Decree of December 27, 1971

This Interministerial Decree contains the implementing rules for the above mentioned law no. 518/1968.

In particular, in classifying airfields, it also provides for sloping airfields with signs (ApS) and sloping airfields without signs (ApNS), and establishes the respective requirements to operate on them.

Ministerial Decree 467/T of June 25, 1992

Sheet 27/V, attachment A, of the above mentioned Ministerial Decree regulates the training requirements to acquire the qualification to operate sloping airfields with snow or ice.

Ministerial Decree February 1, 2006

The above-mentioned Ministry of Infrastructure and Transport decree contains implementing regulations for Law no. 518/1968. Among the various provisions contained therein, the following are of particular note.

- A temporary airfield is considered to be any area of a suitable size to permit temporary take-off and landing of aircraft.
- The use of temporary airfields by aircraft is only permitted for aerial work activities.
- The use of temporary airfields is also allowed for the practice of mountain flying in activities other than public transport.
- The use of temporary airfields is limited to flights with origin and destination in the national territory without intermediate stops in the territory of another State.
- If temporary airfields are located on properties of State or other public entities, the use is subject to the clearance or concession of use by the competent administrative authority.
- The pilot is responsible for complying with current legislation on land use and environmental protection.
- If the flight activity takes place in the mountains or in any case in an area where bilateral radio contact with the competent air traffic control authority is not possible, the pilot must tune the on-board radio to the frequency of 130.000 MHz and make periodic self-information radio calls, in order to avoid traffic conflicts.
- Prior to the commencement of a transfer flight to a temporary airfield, the pilot shall provide to the “Direzione aeroportuale” and to the authority for public security having territorial jurisdiction over the location of the destination airfield, certain information, including: place of departure, geographical coordinates of the destination area (or name of the location), estimated take-off/landing times, type of local air activity, estimated duration of use of the airfield.

Valle d’Aosta, Regional Law n. 15 of 4 March 1988

The regional law in question regulates the activity of mountain flying for the purpose of

environmental protection. In particular, it prohibits the landing and take-off of motorized aircraft in parks, protected natural areas and fauna protection oases within the territory of the Region. In the same areas it is also forbidden, for motorized aircraft, the overflight at altitudes lower than 500 m from the ground.

Similar prohibitions apply in areas at altitudes above 1500 m, with the exception of airfields within the districts and airfields of base and recovery duly authorized by the municipalities responsible for the area and reported by them to the region.

The provisions of the above law do not apply to the education-sport activities and pilot training carried out by aeroclubs which are in possession of the requirements of Article 3, paragraph 1, of Regional Law 31 July 2012 n. 24 (Regional interventions in support of amateur flight); transport of tourists and skiers by the same aeroclubs remains subject to the limitations of the same Regional Law n. 15/1988.

It is allowed, in compliance with safety standards established by ENAC, the establishment of helipads at an altitude higher than 1500 m AMSL, with particular reference to glaciers and snow-covered land, for operations aimed at the maintenance and development, also touristic, of the regional territory; these helipads are to be considered like the temporary ones mentioned in the art. 7 of the Ministerial Decree of August 8, 2003 and are not subject to limitations of movements.

Landing at high altitude is permitted only with departure and recovery from the respective airfields authorized by the municipalities responsible for the territory; with regard to fixed-wing aircraft, the departure must be mandatory and exclusively from the airport "Corrado Gex" of Saint-Christophe.

The heliski operations are regulated by special agreements between municipalities which held jurisdiction on such territories, and subjects which offer heliski services to the public, on the basis of a standard agreement drawn up by the regional Department of Tourism and approved by the Regional Council, subject to the opinion of the competent council committees. Such agreements must provide, among other things, the maximum number of helicopters to be used and the flight trajectories; the activity of heliski is allowed between 07:00 and 16:00 hours.

For safety reasons, each municipality authorizes only one operator to carry out heliski activities, identifying it with the procedures provided by the laws in force for the provision of services by public entities.

The high altitude landing airfields are usually accessible, for the authorized flight activities, in the period between December 20 and May 15; the Regional Council may, however,

provide derogations to the time period mentioned for short periods, acquired the opinion of the structure responsible for civil protection.

The Corpo forestale valdostano, the local police and the public security entities are responsible for the supervision of the application of the regional law.

Art. 6 of the regional law states that Valle d'Aosta region shall communicate the regional law to ENAV to be published also in the state aviation documentation and in AIP Italy, for duly information to pilots.

ANSV took steps to ascertain whether the law had been transmitted to ENAV, there are no proofs of such transmission within the regional Environmental Department.

Research carried out in the historical archives of the Region did not find any trace of this communication either.

Researches carried out at ENAV SpA were also unsuccessful; it would appear that the limitations laid down in Regional Law n. 15/1988 were never included in the AIP Italy.

The limitations and prohibitions contained in the above regional law are published on the website of the Valle d'Aosta Region, in Italian and French.

The screenshot shows the official website of the Valle d'Aosta Region. The header features the region's name in Italian and French, along with its coat of arms. A navigation bar includes links to various services and documents. The main content area is titled 'Aree di divieto' (Prohibited Areas) and references 'Legge regionale 4 marzo 1988, n. 15 - Disciplina delle attività di volo alpino ai fini della tutela ambientale.' (Regional Law of March 4, 1988, No. 15 - Discipline of alpine flight activities for environmental protection). Article 1 of the law is displayed, detailing prohibitions on engine-powered flights in natural parks and protected areas, with specific altitude restrictions. A sidebar on the right, enhanced by Google, provides a table of contents for the 'ACUSTICA' (Acoustics) section, with 'Volo alpino' (Alpine flight) and 'Aree di divieto' (Prohibited areas) highlighted.

Regione Autonoma Vallée d'Aoste Regione Autonoma Valle d'Aosta

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Normativa

Linee guida

Piani classificazione acustica

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Volo alpino

Aree di divieto

Come ottenere l'autorizzazione

Homepage Territorio e ambiente Ambiente Acustica Volo alpino Aree di divieto

Aree di divieto

Legge regionale 4 marzo 1988, n. 15 - Disciplina delle attività di volo alpino ai fini della tutela ambientale.

Articolo 1

- Al fine di assicurare la tutela dell'ambiente naturale e la sua difesa anche dall'inquinamento acustico, **è vietato**, nell'ambito dei **parchi**, delle **aree naturali protette** e delle **oasi di protezione della fauna**, ricadenti nel territorio della Regione Autonoma della Valle d'Aosta, l'atterraggio e il decollo dei veicoli a motore. Negli stessi ambiti è vietato, per i velivoli a motore, il sorvolo a quote inferiori a m. 500 dal suolo. Nelle oasi di protezione della fauna è ammessa la deroga, disposta dalla Giunta regionale, ai divieti di cui sopra previo assenso della struttura competente in materia di fauna selvatica.
- Analoghi divieti vigono nel restante territorio della Regione per tutte le **zone site ad altitudine superiore a mt. 1.500 slm**, con l'eccezione delle aviosuperfici nell'ambito dei comprensori, di cui al successivo articolo 2, comma 1 e delle aviosuperfici di base e di recupero debitamente autorizzate dai Comuni competenti per territorio e da questi segnalate alla Regione.

Figure 13: regional law n. 15/1988 published on the Valle d'Aosta website.

In the same website it is also present the map below, indicating reserves, natural parks, Sites of Community Importance (SCI) and Special Protection Areas (SPA). On the other hand, the areas of the regional territory located at altitudes higher than 1500 m, in which it is

forbidden to land/take-off, are not highlighted, including the Rutor area, circled in red on the same map.

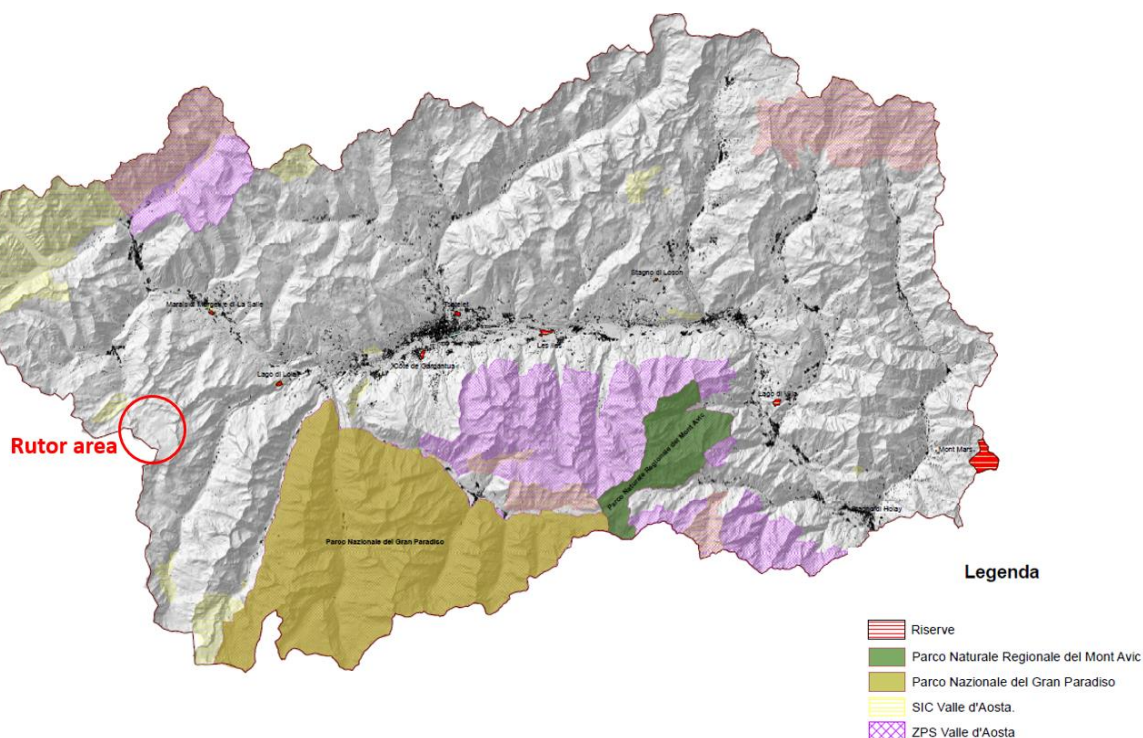


Figure 14: regional map with areas subjected to flight limitations.

Annex A to the mentioned regional law, for the district no. 3 of La Thuile, includes, among the areas where exercise heliski activities, the Testa del Rutor-Le Vedette, while among the recovery areas, the Lac Glacier.

The same Region, with resolution no. 1342 of October 10, 2016, establishes, among other things, that the skiers' recovery zones must be considered as recovery areas and that it is left to the discretion of the pilot or mountain guide to choose the recovery point on the basis of wind conditions, snow on the ground, visibility, etc.

Valle d'Aosta, oversight activities regarding compliance with regional law March 4, 1988 n. 15

As mentioned above, the Corpo forestale valdostano, the local police and public security entities are responsible for the oversight regarding compliance with the regional law n. 15/1988.

Since year 2000, numerous reports have been made by the Corpo forestale valdostano regarding the non-observance of the prohibitions laid down in the regional law; these reports mainly concerned fixed wing aircraft that had landed mainly on Rutor (but also on Mont Miravidi and Aiguille de l'Hermite) without the required requirements.

The reports in question, sent mainly to the competent regional bodies and, when identifiable, directly to foreign and Italian operators, have often highlighted the environmental impact produced in uncontaminated areas and the dangers for the safety of authorized heliski operations due to law infringements.

From the review of the reports, emerges that a considerable number of landings on forbidden areas by foreign aircraft had taken place, in the majority of cases, with French registration marks and coming from the Megève Aeroclub.

The same reports also underlined the difficulty for the authorities in charge of supervising the observance of the law to exercise an adequate and effective "dissuasive and repressive" action against aircraft that violate the prohibitions.

In 2004, the Corpo forestale valdostano reported the infringement of regional law n. 15/1988 by a Jodel aircraft landed on the Rutor glacier and belonging to the Megève Aeroclub, notifying such infringement to the same aeroclub.

After the present accident, further law infringements consisting in landings on Rutor have been reported; in one case, for instance, from a yellow colored aircraft, likely a Maule MK-7 or similar, with hidden identification marks, whose pilot responded in French to the request to leave the area in question as soon as possible by a helicopter engaged in heliski operations.

1.18.6. Witness statements

Several witness statements were collected, including those of the French instructor on board the F-PMGV and the surviving skier who was on board the I-EDIC. The latter testimony did not provide elements of interest for the investigation.

Of the other statements, a synthesis is reported, with the most significant elements.

Area coordinator of the Valgrisenche, Arvier and La Thuile district area

The coordinator of the district area of Valgrisenche, Arvier and La Thuile reported the following.

- In the afternoon of the day of the accident two helicopters of GMH srl were operating in the area of Valgrisenche, Arvier and La Thuile.
- At about 13.30 hrs he tried to contact I-EDIC for a sightseeing flight to be made in the late afternoon but did not receive any reply.
- Noticing the delay of the I-EDIC, he made a radio call on the operator's frequency, but received no reply; he tried, without success, also through the telephone line.

- He asked the other GMH helicopter present at Champoluc to carry out a reconnaissance on Rutor. The helicopter searched unsuccessfully for the I-EDIC at the recovery point Lago dei Seracchi-Cascade (Superiore) and at the release point at Vedette del Rutor, without detecting its presence; it returned to the GMH home base due to limited fuel on board.
- The “Bolero” system indicated that the I-EDIC was positioned in the Rutor area and therefore it was decided to request the intervention of the Mountain Rescue Service.
- Two helicopters operating for GMH took off in search of the I-EDIC, whose wreckage was identified with difficulty in the shaded area of the valley, also because white colour of the helicopter lower cabin; they detected the position of the surviving skier and rescued him.
- Shortly afterwards an AW139 of Air Green arrived at the accident site with some rescuers on board; they located the surviving instructor on board of the F-PMGV and rescued him.

Mountain guide rescuer

- He was the first to render aid to the F-PMGV instructor, who was found still tied with the safety belts to the front seat, the latter partially connected to the airplane wing.
- On request from the instructor, he released him from the seat, acting on the release device and handed over him to the care of the medical personnel.

Pilot in training at GMH srl

- He was flying for the first time together with the I-EDIC pilot on the morning of the accident day, in order to carry out training/ambient flights (two flights for CAT and aerial work) in mountain areas different from the one including also the Rutor glacier.
- He reported that the pilot of the I-EDIC was a meticulous professional, prudent, very accurate in flight planning, very careful about flight parameters, an example for the aircrew in training.
- At about 11:00 hrs he was disembarked at the GMH base in Bonne-Valgrisenche, in order to allow the boarding of the 5 skiers present there for heliski activities.
- At about 11:30 hrs he communicated with the pilot of the I-EDIC on the company VHF FM frequency.

- On board of the I-EDIC a video camera was installed on the front windscreen, upper left side, pilot side, while a second video camera was installed on the helmet of the mountain guide.
- In flight the VHF 130.000 MHz frequency was used for self-information radio calls, where helicopter registration marks, position and intentions were communicated.
- During heliski rotations radio calls were made on VHF 130.000 MHz; on the same frequency the helicopter remained in listening mode; additional radio calls were made on the company VHF FM frequency, as more than one helicopter of the same operator was flying in the area.
- During the morning flights, the GNS430 (COM 1) was set to the Aosta AFIU frequency (119.950 MHz), the GTR225A (COM 2) was set to 130.000 MHz and the VHF-FM (COM 3) was set to the frequencies in use in the various areas in which they were flying.
- On the GNS430 radio selection panel the three radios (COM 1, 2 and 3) were selected to remain in listening mode; radio transmission was made by switches on the same panel or by means of the switch on the cyclic command.
- When flying at altitudes close to the peaks surrounding the Rutor area, it is possible to establish radio contact with Aosta AFIU; at lower heights, descending towards La Thuile such radio contact is no longer possible.
- In February 2020, during a heliski mission in the same Rutor area, he was overtaken on his left by a yellow airplane, not aware of his presence and with French registration marks; he tried to contact it on VHF 130.000 MHz without a reply; only afterwards he received a communication in French from the pilot on the airplane, notifying he would take off immediately from the glacier; he sent a occurrence report about the event to the Corpo forestale valdostano local station of Pré-Saint-Didier.

Head of GMH operation centre

- The day before the accident he carried out the activities required for the opening of the needed temporary airfields.
- At about 14:00 hrs he contacted the I-EDIC by radio and telephone, without success.
- He found out that the position of the helicopter provided by the “Bolero” system corresponded to the position where the wreckage of the helicopter was later found.

Pilot of the Megève Aeroclub and other witnesses present at the scene (interviewed by the French Gendarmerie)

- The F-PMGV took off at 13:00 hrs, as documented by the airport surveillance cameras. The French instructor was seated on the right front, the Belgian pilot on the left front, another French pilot on the right rear.
- On the morning of the accident, the French instructor and the Belgian pilot had flown from 10:00 to 11:50 with the F-PMGV for a recurrent training, carrying out high altitude landings. At the end of the flight, both pilots had met for lunch at Megève Aeroclub with the other French pilot in training; no alcoholic beverages had been consumed.
- At the end of the lunch, the chief pilot of Megève reminded the three pilots that they had planned an instructional flight for 13:00 hrs.
- The chief pilot, the three pilots who would board the F-PMGV and an additional pilot discussed the weather conditions and the flights destinations; it was agreed to land on the Rutor glacier (as they would find weather conditions more suitable for training flights) and to meet all together on the glacier.
- The three crews (chief pilot with a student, three F-PMGV pilots and an additional pilot) filled in the "Mountain Note" (notes on a school board indicating aircraft markings, crew member's names, planned destination, flight duration and ETA).
- The sequence of take-offs of the three airplanes, confirmed by the vision of the surveillance cameras, took place at the following times and sequence:
 1. F-PMGV take-off 13:00;
 2. F-BMBV take-off 13:09;
 3. F-PDJD take-off 13:15.
- The pilot on board of the F-PDJD, while approaching Col de la Seigne, decided to return to Megève due to turbulence encountered.

Chief pilot of the Megève Aeroclub

- His job at the Megève Aeroclub was to make sure that the crews and the airplanes were distributed according to their flying ability and the weather conditions, in agreement with the instructors and the pilots.

- The accident flight consisted of a Megève-Rutor-Megève, with ETA around 16:00 local time; the decision to go to Rutor had been taken before take-off and discussed with the chief pilot of Megève.
- The most direct and safe flight path from Megève to Rutor was to reach an altitude of 9500 feet, to cross the Col de la Seigne and then to reach Rutor.
- The French pilot who survived in the accident would have acted as an instructor, while the Belgian pilot would have flown for recurrent training to maintain his ski landing rating, acquired in 2017 (on wheels in 2014).
- The Belgian pilot had been flying with the Megève Aeroclub since about 10 years to regularly renew his high-altitude landing ratings on wheels and skis, showing himself to be a serious, calm, balanced and respectful pilot.
- The other French pilot on board would have been a passenger for the first phase of the flight, then he would have exchanged position with the Belgian pilot and carried out training activities to obtain the mountain rating.
- After take-off, the chief pilot and the student, on board of the F-BMBV, headed to Col de la Seigne, encountered turbulence and decided to head south, cross the border at Col du Petit St Bernard and reach the Tour glacier. Then they flew to the Rutor glacier, where they arrived at about 13:35; here, after a reconnaissance, they made 6 take-offs and landings.
- During the flight the chief pilot tried to contact the F-PMGV on both VHF frequencies (130.000 and 122.850 MHz) but he did not receive a reply, therefore he believed that the instructor pilot on board of the F-PMGV had decided to change flight destination or possibly return to Megève.
- During the activity on the Rutor, they noted particularly favourable weather conditions, absence of clouds, wind calm, they did not notice anything abnormal in the area, even less the wreckages of the F-PMGV or the I-EDIC.
- The chief pilot and the student landed at Megève at 14:15; at 15:00, having received no news from the F-PMGV, the chief pilot alerted the French SAR service and was informed after a few minutes of the accident.
- He confirmed that for none of the three flights in the afternoon operated with the F-PMGV, F-PDJD and F-BMBV aircraft, flight plans had been filled in, being too complicated to compile and send them, since during the flight (especially in the case of training flights), it is possible to change the destination on the basis of the local

weather conditions encountered; furthermore, radio communications are difficult due to alpine orography, therefore it is not easy to open, close, cancel or modify a flight plan via radio with ATS entities.

- Rutor is only a few minutes flight from Megève and with the wind coming from the North most of the high altitude areas on the French side present strong turbulence, while the Rutor glacier presents calm wind conditions. Moreover, at the beginning of the year, due to the low trajectory of the sun, glaciers on the Italian side are more favourably positioned than the French ones; for this reason the former are more frequently used during the beginning of the winter season.
- The use of radios is mandatory for mountain landings; the frequency in use in France and Italy is 130.000 MHz.
- A radio call is made when entering the area, to announce to those listening the intention to carry out a reconnaissance of the site before landing. The first reconnaissance is made at 1000 feet AGL. A second radio call is made to announce a second reconnaissance at 500 feet AGL. A third call is made to announce the last reconnaissance around 300 feet AGL, before the aircraft commences the landing procedure.
- Since the start of flights on glacier in the 1960's, glacier landings have been carried out following procedures shared among all countries, although there is no standardization in terms of flight plans presentation and radio communications with ATS authorities.
- The chief pilot reported that he did not know the exact regulations in force in Italy for high altitude landings.
- He had been contacted by the GMH operator in order to use VHF 122.85 MHz, probably aimed at avoiding VHF 130.000 MHz, which is often disturbed and saturated.

Phone SMS were used to inform about flight activities; however, this method of communication was not always used, as radio contact with GMH pilots was sought on both VHF frequencies and, in case they did not speak French, communication was done in English. Prior to these agreements, the 130.000 MHz VHF frequency was always used.

Instructor pilot on board of the F-PMGV

- At Megève the training flights were managed and organized by the chief pilot, who used to indicate destinations, crew pairing and took charge of all organizational aspects.
- The flight on the morning of the accident with the Belgian pilot in recurrent training had been excellent; landings had been made during the flight.
- The flight that ended with the accident, he remembers only a few minutes of flight time after taking off from Megève.
- He could not recall having made any landing during the accident; in any case the time elapsed between take off from Megève and the collision would not have allowed him to fly from Megève to Rutor and make a landing.
- He was aware of the heliskiing activity on Rutor, as well as helicopters were aware of the possible presence of other aircraft, being a “G” class airspace.
- It was usually the chief pilot of Megève in charge of relations with GMH pilots, communicating flights to Rutor.
- On the Jodel D.140, the downward visibility is affected by the large engine cowling and the wide wing, which is why there are significant blind spots under the aircraft. In addition, having viewed the video footage of the accident, he noted that the F-PMGV was against the sun, so visibility was disturbed by this, generating a strong counter sun effect.
- He did not remember receiving any radio messages during the accident flight; however, he believes that the Belgian pilot had made the required standard calls on 130.000 and 122.850 MHz, because he had made them perfectly and scrupulously during the morning flight.
- According to the practice in use at Megève Aeroclub , a flight plan is not submitted, because the chief pilot of Megève had explained that this procedure is not applicable, as it is the latest updated weather conditions that determine the final choice of the site to operate over.
- Well before the accident flight, he had consulted, as expected, the ENAV SpA website, to acquire information on Italian regulations (national or local) regarding mountain flights or high altitude landings, but had not found any traces in the AIP Italy (the only official document accessible in English) of the Law n. 518 of April 2, 1968, of the Ministerial Decree February 1, 2006 on liberalization and use of

temporary airports, of the Aosta Valley Regional Law n. 15/1988. He had never been aware of the above mentioned laws nor had he been told about them by the chief pilot or the instructors of the Megève Aeroclub.

- In case of landing on Rutor, the chief pilot of Megève had informed them that they had to make the standard radio calls requested on frequency 130.000 MHz and also on frequency 122.850 MHz.
- He had been informed by the chief pilot of an agreement between the Megève Aeroclub and the operator GMH, which provided, in addition to the self-information radio calls on frequency 130.000 MHz, also on 122.850 MHz, and a communication to GMH, made by the same chief pilot, to inform about the presence of aircraft on Rutor.

Pilot qualified for mountain flight who had made landings on Rutor on the morning of the accident

- On the morning of the day of the accident he had made, together with two friend on board of other two aircraft, several landings on various areas of the glacier (figures 15 and 16), approximately between 10:00 and 11:30, without hearing or seeing any other aircraft in the area.
- Upon arrival they realized the presence of a North/Northwest wind, which forced them to operate at lower altitudes of the Rutor glacier.
- Upon their arrival, there were signs in the snow of landings/take-offs performed by other aircraft, particularly in the area of Col Loydon [which is the closest landing area to the area where the collision took place].
- At the end of their flight activity, they were contacted on VHF 130.000 MHz by a Mosquetaire coming from Megève, who intended to land on the glacier.

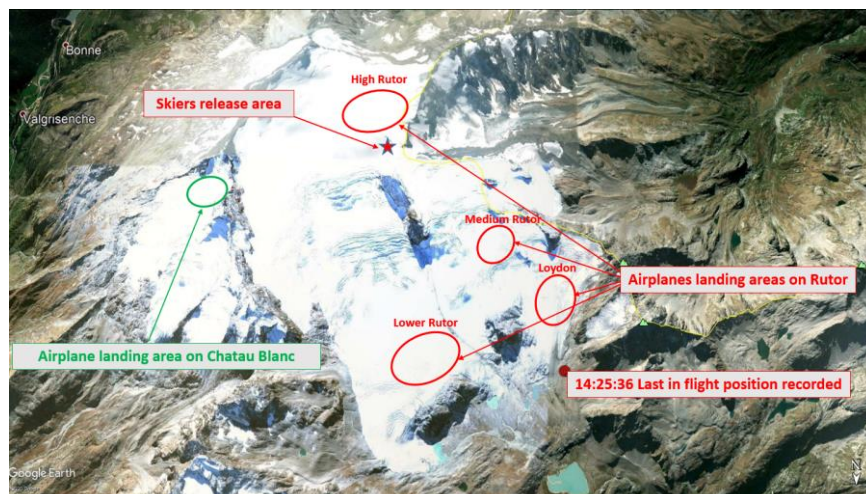


Figure 15: Landing areas on Rutor glacier and Chateau Blanc (on Google Earth Pro).

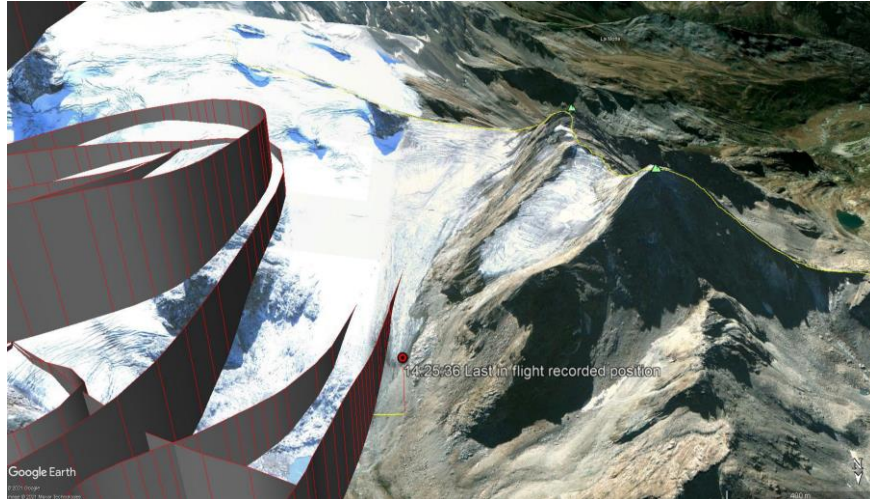


Figure 16: flight trajectories for landing to and take-off from Col Loydon with respect to the last I-EDIC recorded position in flight.

1.19. USEFUL OR EFFECTIVE INVESTIGATION TECHNIQUES

The recovered radio equipment were delivered to the ANSV laboratories in order to determine the last VHF frequency selected on them.

As seen, the I-EDIC helicopter was equipped with two aeronautical band VHF radios (one Garmin GNS 430 and one GTR 225A).

The manufacturer of the radios informed that it was not possible to perform any data recovery from the damaged radios. Nevertheless, the activities carried out at ANSV laboratories have allowed the recovery of information from the GTR 225A radio.

The Garmin GTR 225A radio has the following controls on its front panel:

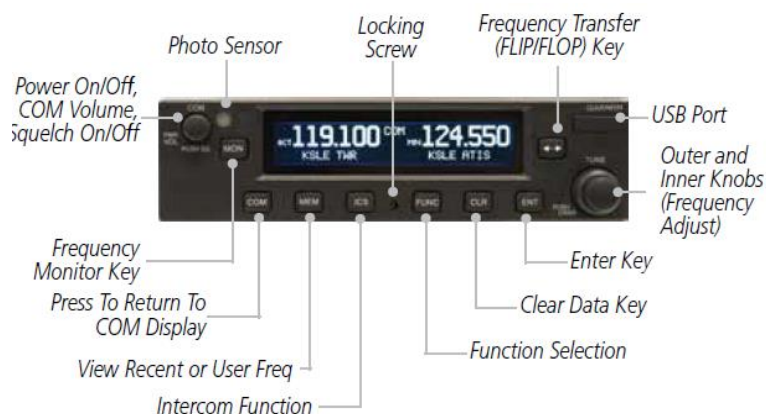


Figure 17: Front panel of Garmin GTR 225A radio (From radio user manual).

It was possible to proceed, after technical checks, to provide electric power to the radio and obtain the following presentation on the display: on the left side, as "COM ACTIVE", the

frequency of 130.000 MHz, while on the right side, as "COM STANDBY", the frequency of 136.975 MHz. No changes have been made to the control position and settings already present on the front panel.



Photo 39: Garmin GTR 225A radio, recovered from the I-EDIC wreckage, powered in the ANSV laboratories.

The latter frequency is the upper limit of the aeronautical VHF band and therefore the maximum frequency that can be selected by the radio; this frequency does not coincide with any of the frequencies in use among the various operators involved in the accident or local operators, nor with the AFIU of Aosta airport or other operators operating in the district of Valgrisenche, Arvier and La Thuile.

The display position of 130.000 MHz as active frequency, as reported by the manufacturer in the radio user manual, indicates that it may have been either initially selected as stand-by frequency and then, using the "FLIP/FLOP" command, transferred as active frequency, or selected from the stored frequencies using the "MEM" command.

With regard to the Honeywell 97A radio installed on board of the F-PMGV, due to the damages suffered, it was not possible to determine which VHF frequency had been selected. Any further investigation on such radio (even if with no certainty of success) by the radio manufacturer in the USA have been precluded by the restrictive measures adopted by the USA to contain the COVID-19 pandemic.

CHAPTER II

ANALYSIS

2. GENERAL

In the present chapter the objective evidence acquired in the course of the investigation and described in the previous chapter, are analysed.

The objective of the analysis is to establish a logical link between the evidence gathered and the conclusions.

2.1. FLIGHT EXECUTION

Flight phase of the airplane

The flight of the F-PMGV would have consisted of two phases, the first of which was dedicated to a recurrent training of the Belgian pilot, who already possessed a mountain rating, both on wheels and skis.

According to the witness statements of the staff present at Megève altiport and the chief pilot of the local Aéroclub, due to the direction of the wind coming from North, the crew of the F-PMGV had decided to head towards the Rutor glacier to perform a number of reconnaissance, circuits and landings, similar to what had already been carried out by both the French instructor and the Belgian pilot, as PIC, on the morning of the accident.

The Megève airport is about 31 km away from Rutor as the crow flies; considering the usual flight path indicated by the chief pilot of the Megève Aéroclub, with a fly over the Col de la Seigne, the flight distance to be covered is around 44 km.

Considering the best rate of climb (about 150 km/h) at a rate of about 200 m/min up to Col de la Seigne and the cruising speed (about 200 km/h) of the D.140E, it can be assumed that after take-off at 13:00, the aircraft reached the Rutor area no later than 13:15.

Since the impact took place at 13:25:36, the 10 minutes of presence in the area until impact could have been used for one or more reconnaissances of the landing area. It is probable that Col Loydon had been chosen because of its "training" characteristics; pilots who frequently land on this point consider high reconnaissance not feasible due to the surrounding orography. In this respect it is useful to remember that the area had been object of several reconnaissances in the morning by the French instructor and the Belgian pilot.

The landing circuit suggested by Mountain Flight Manual in use by Megève Aéroclub and AIP France consists of a low reconnaissance to be flown at 300 feet above the landing point,

a overhead pass on the runway axis, a downwind leg and a base leg all flown at about 300 feet above the touchdown point.

The final is flown by the D.140E at about 120 km/h of IAS (33 m/s); in the case of the accident, the aircraft was at an altitude of 2777 m (9100 feet) and presumably in the absence of wind; with these parameters and considering that the GS increases (in the absence of wind) by about 2% with respect to the IAS every 1000 feet, it can be calculated a GS of about 39 m/s (33 m/s +18%).

The rate of descent and consequently the length of the final chosen by the pilot may depend on the site and weather conditions.

With a normal descent rate of 400 ft/min, 300 ft are lost in 45" and in the same time a ground distance of about 1750 m is covered, which is the distance of the final (section #7 in the following figure) flown by the airplane.

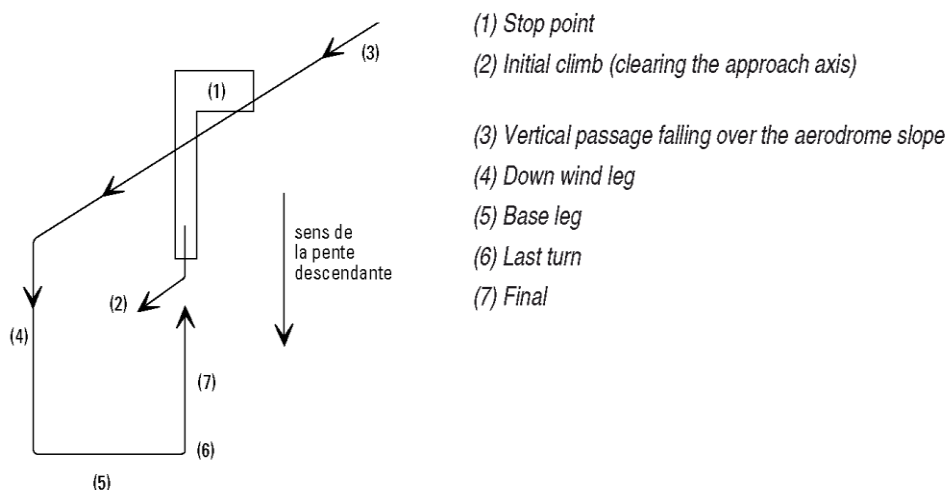


Figure 18: Landing circuit for high altitude landing (from AIP France)

Camera images and evidence on the wreckage indicate that at the time of impact the aircraft should not be in the last left turn to align to the final.

The video footage recovered from the video camera placed on the helmet of the mountain guide appears to indicate a certain angle between the direction of flight of the aircraft and the helicopter as a consequence of the optical illusion caused by the fact that the camera was not pointed ahead, along the direction of the helicopter flight, but laterally, at about 10 hrs from the direction of the helicopter flight. This angle between the flight directions of the two aircraft, if real, would have meant for the F-PMGV to fly towards the mountains, among them the Grand Assaly, located to the right of the Valle Sospesa, whose altitudes are, on average, much higher than the altitude of the airplane at the time of impact (2777 m), making this direction of flight of the F-PMGV, at the altitude of the impact, not logical.

Therefore it is more likely that the F-PMGV was actually already aligned for landing and that its direction of flight was close to the one of the helicopter.

From the wreckage examination, it was not possible to determine the position of the flaps at the time of the collision, the only relatively undamaged surface being the left wing flap (which was free to move) and the kinematic chain to transfer the command from the cockpit, damaged and partially torn off.

It is possible that the necessary reconnaissances (the middle and the low, given the orographic conformation of Rutor), if actually performed, were flown during the 10 minutes period when, likely, the F-PMGV was flying in the Rutor area and that the aircraft was stabilized on its path, in final.

The impact probably occurred with the airplane stabilized and configured for landing, at about 500/550 m from the possible touchdown point on Col Loydon, therefore at about 1/3 of the 1750 meters of its possible landing path length, placed at an altitude of about 80/100 feet above the touchdown point on the same Col Loydon, located at approximately at 2760 m.

It is worth mentioning that in-flight positions are recorded by the “Bolero” system every 10 seconds of flight and although the distribution of debris on the ground suggests a substantial coincidence between this point and the actual collision point between the two aircraft, considering that the helicopter was climbing, the altitude at which the impact occurred could actually be slightly higher than the 2777 m recorded.

The collision could have taken place at an altitude of about 20-25 m above that of the touchdown point on Col Loydon, an altitude that would be consistent with the probable position of the aircraft along the landing path, which had flown about 2/3 of its length at the time of collision.

In support of the hypothesis that the F-PMGV was landing is the fact that the position of the last recorded point of the helicopter was close (about 50/60 m) to the flight path of another aircraft, which had also landed on Col Loydon and whose flight path could be acquired (see figure 16).

In conclusion, although it is not possible to establish with incontrovertible certainty whether the F-PMGV was in reconnaissance or landing phase at the time of the collision, the investigation has revealed elements that would reasonably suggest the second hypothesis as the most probable one, i.e. that the aircraft was in the final phase of landing on Col Loydon.

Flight phase of the helicopter

The helicopter, after having landed near the Vedette del Rutor at 13:02:29 and having disembarked the 4 skiers and the mountain guide, took off to descend along the Rutor and landed near the Seracchi Lake at 13:06:23.

At 13:21 the engine started and the helicopter took off at around 13:24:36, after having boarded again the 5 skiers who had descended to the valley, following a route coherent with what is presumed to be the last heliski flight of the day, but also with a trajectory to take the skiers to the initial gathering point, close to a hotel in Bonne-Valgrisenche.

The helicopter then gained altitude by ascending along the Valle Sospesa, keeping an average of 500 feet above the ground, with a GS around 50 km/h.

The last point recorded by the “Bolero” system indicated 13:25:36, an altitude of 2777 m AMSL, a ground speed of about 47 km/h and a heading of 191°.

The following figure the flight paths of the two aircraft are shown, whose relative positions are reported every two seconds, starting from ten seconds before collision. While for the I-EDIC the flight path is the one indicated by the data provided by the “Bolero” system, for the F-PMGV an IAS of 120 km/h (equivalent to a GS of about 141 km/h, considering the altitude of about 9100 feet) and a flight direction of about 190° have been assumed, i.e. the one approximately required to land on Col Loydon.



Figure 19: ANSV reconstruction of the trajectories of the two aircraft from ten seconds before the collision (from ANSV animation; the silhouette of a similar aircraft has been used to simulate the F-PMGV).

2.2. AIRCRAFT

The analysis of video footage, documentation and witnesses did not reveal any technical issues that could have contributed to the in-flight collision between the two aircraft.

As previously mentioned, it has been possible to recover the two Garmin radios from the I-EDIC and the Honeywell radio from the F-PMGV, while the GMA340H selector panel has not been found among the helicopter wreckages that had been brought down the valley and seized.

It has been possible to power up the Garmin GTR 225A radio from the I-EDIC and verify that the latter was in the on position (Power On/Off button to On) and that 130.000 MHz was the last frequency selected and in the "active" position on the radio display.

From what was stated by the trainee pilot who flew the I-EDIC on the morning of the accident, it is probable that the crew had selected on the GMA340H panel to listen to all installed radios (COM 1, 2 and 3), while selecting from time to time (either through the button on the panel or through the control on the cyclic) the radio to transmit with.

Therefore, it can be assumed that the I-EDIC crew, at the time of the accident, was able to receive radio calls on VHF frequency 130.000 MHz.

Due to the the damages of the Honeywell radio installed on the F-PMGV, it has been not possible to recover useful data to determine which VHF frequency had been selected on this radio.

Any further investigation of the radio (even if without certainty of success) by the radio manufacturer, to be carried out in the USA, has been prevented by the restrictive measures adopted by the manufacturer to contain the COVID-19 pandemic.

It is worth noting that both aircraft, although operating in isolated mountainous areas and in class "G" class airspace, where often no assistance/flight information is available, were not equipped with on-board anti-collision systems or systems designed to detect the proximity of other aircraft.

In the type of flight conducted by the two aircraft in question on the day of the accident, the principle of "see and avoid", as well as the execution of self-information radio calls on the expected frequency, represent safety nets sometimes not sufficient to prevent in-flight collisions.

On these safety nets, some human factors (e.g. complacency, lack of attention, lack of perception, overload, task saturation during demanding manoeuvres, etc.) often have an effect, which may make them less effective than might be expected.

A further "barrier" against possible in-flight collisions between aircraft operating under VFR could be the presence on board of systems capable of detecting the presence of other aircraft not acquired visually or through radio communications: in this regard, systems based on GPS receivers capable of calculating and transmitting the future position of the aircraft to other nearby aircraft equipped with similar systems, preventing the risk of possible collisions by sending alert messages to the respective crews, who thus become aware of the position of other aircraft with respect to their own position.

More advanced versions of such systems also provide the integration of an ADS-B receiver and transponder, which allows visibility on a greater number of aircraft among those that present a position and flight path with a risk of collision. Systems such as those described above are present on a large number of general aviation aircraft; their presence on board, although constituting an additional safety net that has only an "alert" character, does not exempt pilots from the timely and careful application of the procedures and measures previously outlined (visual separation from other traffic and, in addition, self-information radio calls).

In the present accident, the possible presence of systems similar to those described above on both aircraft would have allowed both crews to be aware of the presence of another aircraft operating in the Rutor area.

2.3 HUMAN FACTOR

Mutual visibility

As previously stated, in "G" class airspace, separation between aircraft operating under VFR is the sole responsibility of the respective pilots, who exercise this responsibility by constantly monitoring the surrounding airspace and making self-information radio calls to notify their position.

The accident has been caused by an insufficient look-out by both crews, which should have been performed in a more incisive manner, considering the restricted area and the critical flight phases in which both aircraft were operating.

In this respect, it should be noted that the investigation has revealed several objective elements that may help to explain the missed visual acquisition by both crews.

A common factor for both crews is the fact that, in the flight phases preceding the collision, the two aircraft had a flight path such that the sun was in an almost frontal position, which certainly influenced significantly the ability to perceive, even with peripheral vision, elements coming from other sectors than the frontal ones.

With regard to pilots on board the F-PMGV, the following considerations can be made.

- The airplane design is characterized by a limited visibility towards the lower sectors, due to its wide wings and large engine cowling.
- From the reconstruction of probable trajectories in the phases preceding the collision, the helicopter, coming from below and slightly to the side with respect to the F-PMGV trajectory, ended up being in the lower sectors of the latter.
- The western part of the Valle Sospesa was already in shade, creating a strong contrast between the part of the valley in shade and the one in the sun.
- The helicopter, with its dark blue upper fuselage, flew for most of its trajectory in the shaded part of the valley and reached the sun only once it increased its altitude and shortly before the collision.
- The possibility of seeing the helicopter by the F-PMGV crew has been strongly influenced by the fact that the I-EDIC flew against a very dark terrain with a dark coloured livery.

In addition to these objective elements, the airplane was probably aligned and relatively close to landing, with the crew's attention focused on maintaining and controlling the flight parameters during a particularly delicate phase, such as a landing on a glacier.

With regard to the pilot on board the I-EDIC, the following considerations can be made.

- He was seated in the right front seat (the captain's seat), thus opposite the side from which F-PMGV was arriving.
- He was tall (about 1,90 m), thus further limiting the visibility in the upper left sector of the helicopter, which is already very limited (see the following picture that shows the visibility available to a pilot of that height in that sector).



Photo 40: AS350 B3, visibility upper left side from the captain's seat.

Notwithstanding what has been said above regarding the need for a more incisive look-out by both crews, the objective elements above have however contributed to penalize the field of view of both crews.

Radio calls

It is reasonably probable that there was no radio contact between the two aircraft, not even when the helicopter was stationary on the ground in the Rutor area.

From the evidence gathered on this matter, the following can be stated.

- One of the radios on board the helicopter was tuned (and probably listening) on VHF 130.000 MHz at the time of the collision.
- The analysis of the environmental audio recorded by the pilot's video camera did not reveal any radio calls made or responses to radio calls received by the I-EDIC during the 65 seconds elapsed between take off from Lago dei Seracchi-Cascade (Superiore) and the collision; it is presumable that the pilot of the I-EDIC had not received, through the audio system integrated in the flight helmet, any radio calls indicating the presence of another aircraft in his flight area, to which he would have responded with reasonable certainty.
- The other aircraft carrying the chief pilot of the Megève Aeroclub, which took off 9 minutes after the F-PMGV, failed, once in flight, to establish contact on 130.000 MHz with the F-PMGV, not excluded due to the surrounding orography, which might have prevented radio contact between the two aircraft.

The helicopter remained stationary on the ground at the collection point Lago dei Seracchi-Cascade (Superiore) from 13:06:23 until 13:24:36.

During that time, the pilot had probably shut down the engine and stopped the rotor, as evidenced by the flight stop at 13:07 as reported on the HTL; the HTL also reported that the engine was restarted at 13:21. It is less probable that the helicopter had been completely shut down during these 14 minutes and consequently not been able to communicate with the operations coordinator in the district of Valgrisenche, Arvier and La Thuile, with the GMH operations room, with the rest of the GMH personnel located in various points of the same district, as well as with other helicopters of the same operator or other aircraft flying in the area.

During such period of time in which the helicopter was stationary on the ground at Lago dei Seracchi-Cascade (Superiore), it is possible to assume that the arrival of the F-PMGV in the

Rutor area, as said occurred about 10 minutes before the collision; during this period the crew of the aircraft should have announced on VHF 130.000 MHz its arrival in the area and its intentions, as well as make radio calls associated with reconnaissances at various altitudes before landing.

However, it has not been possible to determine with incontrovertible certainty if these calls were made by the F-PMGV crew.

2.4 ORGANIZATIONAL AND ENVIRONMENTAL FACTORS

Failure to submit a flight plan

Both aircraft, operated under VFR, were flying in “G” class airspace, where no separation service is provided by ATS.

As seen, in “G” class airspace, separation is requested to pilots.

The airspace above the Rutor area is not under the responsibility of the Aosta AFIU; moreover, the terrain orography makes almost impossible to contact the Aosta AFIU, unless flying at an altitude higher than the mountain peaks in the area (the flight profiles of the I-EDIC and the F-PMGV are at much lower altitudes).

The competent ATS authority to be contacted, which could have possibly provided traffic information, if known, would have been the FIC of Milan, compatibly, however, with the radio coverage in the area in question, which was reasonably critical also due to the orography of the territory.

In this context, it is not possible to define with certainty if the failure to file a flight plan by the F-PMGV, although representing a blatant violation of the applicable regulations, actually played a role in the accident. In fact, there is no certainty that, if the F-PMGV crew had filed the flight plan, the pilot of the I-EDIC and other crews that might have been present in the area would have been aware of the presence of the French aircraft.

The fact remains that the evidence obtained shows that the Megève Aeroclub tolerated, at pilot school level, flights across the State border into Italy without the required flight plan being completed, and thus in total disregard of the regulations in force.

Opening of temporary airfield

As seen, the opening of a temporary airfield (in this case possible at various landing sites on the Rutor glacier) is expressly regulated by Italian law and is allowed exclusively for aerial work, with the exception of mountain flying, in activities other than CAT. The use of

temporary airfields is limited to flights with origin and destination in the national territory, without intermediate stops in the territory of another State. If temporary airfields are located on State or public entities properties, the use is subject to the clearance or concession of use by the competent administrative authority. Prior to the commencement of a transfer flight to a temporary airfield, the pilot shall provide to the “Direzione aeroportuale” and public security authority having territorial jurisdiction over the destination temporary airfield, certain information, including: place of departure, geographical coordinates of the destination area (or name of the location), estimated times of take-off/landing, type of local aviation activity, estimated duration of use of the airfield.

The GMH operator, as part of his heliski activity in the district of Valgrisenche, Arvier and La Thuile, had provided for the opening of temporary airfields in that area, with communication to “ENAC Torino Caselle Direzione aeroportuale”.

The activity carried out by the F-PMGV on the occasion of the flight that ended with the accident was not permitted by Italian law, as the flight had not originated in Italy, but had come from abroad.

Notwithstanding what has been said regarding the violation of Italian regulations, it is not possible to ascertain with certainty whether the violation of Italian regulations (which cannot be easily recovered by searching the AIP Italy) played a contributing role in the accident.

In this regard, it can be observed, with respect to the obligation to notify the “Direzione aeroportuale” and the competent public security authority, that these subjects do not play any role in airspace management and consequently do not play (nor would they have played at the time of the accident) any role in providing information to aircrews.

AIP Italy

The AIP Italy, written in Italian and English, represents the official document through which those who operate in the aeronautical field, *in primis* aircrews, can become acquainted with the relevant regulations and procedures in force in Italy.

In AIP Italy it is only stated that the use of airfields/helipads for flights to/from EU countries is allowed in compliance with national regulations as per Ministerial Decree of August 8, 2003 (however, details of the mentioned regulation are not present, not even in summary); the Ministerial Decree in question was subsequently replaced by Ministerial Decree of Infrastructure and Transportation of February 1, 2006, of which there is no trace in AIP Italy.

In AIP Italy, contrary to the Ministerial Decree of February 1, 2006, no mention is made of the use of VHF 130.000 MHz frequency in case of aerial activity in mountainous areas or in areas where bilateral radio contact with the competent ATS is not possible, nor of the obligation for pilots to make periodical self-information radio calls.

In general, AIP Italy does not provide specific information regarding mountain flight, unlike AIP France.

Finally, it should be noted that the reference made by AIP Italy to specific regulatory sources (without even providing a summary) or to the ENAC website does not make it easy for pilots to know the relevant regulations/procedures, obliging them to carry out searches that are not always convenient.

Finally, it should be noted that the reference made by AIP Italy to specific regulatory sources (without even providing a summary) or to ENAC's website does not facilitate knowledge of the regulations/procedures of interest, obliging those who consult it to undertake research that is not always easy, not to mention the fact that the sources referred to are written in Italian and therefore not necessarily understandable by foreigners.

The purpose of a publication such as the AIP should be to provide a clear and exhaustive picture to aeronautical operators, including foreigners one, of the norms in force in a given country: from this point of view, the AIP Italy presents, as seen, some critical aspects.

It should also be added that the AIP Italy also presents critical aspects with regard to information of interest for VFR flights.

In this regard, it seems appropriate to recall that ANSV issued, in 2013, the safety recommendation ANSV-19/SA/3/13, addressed to ENAC, Aeronautica Militare and ENAV SpA for the aspects of their respective competences, which recommended, among other things, to proceed to an extensive review of the official cartography available and that published in AIP Italy, in order to allow pilots operating under VFR to carry out adequate flight planning, as well as to easily and immediately identify the boundaries of controlled airspace and its typology, so as not to incur in unauthorised penetrations. The ANSV also recommended to evaluate the possibility of publishing, as in other States, a VFR AIP, in order to facilitate the acquisition of information by pilots who are not professionally exercising flying.

The Italian AIP does not include some areas of the Aosta Valley that are subject to flight restrictions. Information obtained during the investigation suggests that this is due to the fact

that the Regione Valle d'Aosta Region failed to forward Regional Law No 15/1988 to ENAV SpA.

Research carried out at ENAV SpA has also confirmed that the restrictions laid down in Regional Law No 15/1988 were never included in AIP Italy.

It therefore seems necessary for the restrictions laid down in Regional Law No 15/1988 to be included in the Italian AIP and, at the same time, a survey to be carried out at national level of the areas subject to flight restrictions, so as to include any missing areas in the Italian AIP.

Knowledge of Italian regulations

According to the statement made by the instructor pilot on board of the F-PMGV, the above mentioned lack of information in the Italian AIP did not allow him to have an accurate knowledge of the Italian regulations and the areas in the Regione Valle d'Aosta subject to flight restrictions.

Regardless of the critical aspects in the AIP Italy, it should be clear from statements gathered during the investigation that the practice to carry out high altitude landings in Italy had been consolidated over the years by the Megève Aeroclub and that such practice depended exclusively on a last minute evaluation of the weather conditions in the area so as to disregard compliance with aeronautical legislation with regards to submit a flight plan in case of national borders crossing and compliance with flight restrictions on Italian territory.

Regarding the last point, it may be assumed that the Megève Aeroclub was aware, at least since 2004 (when it was charged with an administrative sanction for infringement of the Italian legislation), of the existence of flight restrictions on Italian territory, but that its pilots continued to land on either side of the border, in particular, as far as is relevant here, on Italian territory, in violation of Italian national legislation.

In the light of the above, it would seem essential for the Italian authorities to improve their oversight and vigilance on such flight activity.

It would also seem appropriate for the French DGAC to improve its own surveillance activities and consider carrying out safety promotion activities with French operators carrying out this type of activity, making them aware of the problems that emerged during the investigation carried out by ANSV.

Infringement reports

The reports produced by the Corpo forestale valdostano reveal the following.

- For at least twenty years, aircraft with foreign markings, in particular French markings, which do not meet the requirements of the relevant Italian legislation, have been landing on glaciers in Italian territory, including Rutor.
- The difficulty in detecting and prosecuting infringements, due to the inaccessibility of the places where they are committed, means that the number of reports made by the competent Italian police forces is only a fraction of the total number of infringements that have occurred over the years.
- In 2004, the Corpo forestale valdostano discovered a violation of Regional Law No 15/1988 by a Jodel aircraft that had landed on the Rutor glacier and belonged to the Megève Aeroclub, notifying the infringement directly to the latter, since then the aeroclub was aware of the ban in Italy.
- The process of reporting such infringements did not have a deterrent effect and was therefore substantially ineffective.

It is clear that the infringements detected, in addition to the environmental aspects, also concern flight safety, since the conduct in question jeopardises regularly authorised activities (such as heliski) in the interested areas. Coordination between local police forces and the ENAC would therefore be desirable, in order to allow the latter to have an adequate visibility of the phenomenon and to promote the relevant initiatives, also together with the corresponding foreign authorities.

Agreement between Megève Aeroclub and GMH operator

The chief pilot of the Megève Aeroclub would have informed the instructor pilot on board of the F-PMGV of an agreement between the Megève Aeroclub and the GMH operator, which foresaw, in addition to the calls to the air on the frequency 130.000 MHz, also calls on the frequency 122.850 MHz, as well as a communication to GMH by the same chief pilot to inform about the presence of aircraft on Rutor, so as to ensure a coordination of the respective flight activities.

The existence of such agreements has been denied by GMH.

In view of the above mentioned conflicting statements and taking into account that no documents were provided in the course of the investigation to substantiate the existence of such agreements, it was not possible to reach any certainty on this aspect.

2.5 SURVIVAL ASPECTS

The I-EDIC helicopter was equipped with a Kannad 406 ELT system. Following the in-flight collision and subsequent catastrophic impact of the helicopter on the ground, the ELT system was presumably not activated as no activation notification was received at the Star Work Sky contact point.

The location of the helicopter was possible thanks to the last position reported by the flight following system received by the various operators and the GMH operations centre, which indicated as the last position of the helicopter the one corresponding to the last data recorded in flight. The same GMH alerted the Mountain rescue service of Valle d'Aosta and sent two of its helicopters to transport some guides of the heliski company, in order to carry out a patrol in the Rutor area, in particular in the Lago dei Seracchi-Cascade (Superiore) collection point Testa del Rutor-Le Vedette release point. A few minutes after take-off, both wreckages were located. Alpine guides were disembarked and one of the skiers and the French instructor of the F-PMGV were found still alive. Both were flown to the intensive care unit of Aosta Regional Hospital for treatment.

Considering the circumstances and the failure of the ELT to function, the rescue was timely enough.

For incidents such as the one in question, the chances of survival are very slim in the absence of a timely search for a precise location. This makes an adequate localization system essential when operating in a hostile environment. In this regard, reference is made to the recent ANSV study entitled "Activation of alert and search and rescue services in case of air accident", attached to the *Rapporto informativo sull'attività svolta dall'ANSV e sulla sicurezza dell'aviazione civile in Italia - Year 2020*³.

In the above study, in addition to highlighting the existing criticalities, proposals are put forward, both with regard to the alert service and the SAR service.

³ The Report can be downloaded at the following web address: <https://ansv.it/lo-stato-della-sicurezza-dellaviazione-civile-in-italia-pubblicato-il-rapporto-informativo-ansv-2020/>

CHAPTER III

CONCLUSIONS

3. GENERAL

This chapter shows the facts ascertained during the investigation and the causes of the event.

3.1. FINDINGS

F-PMGV

- The aircraft had taken off from Megève airport at 13:00 for a flight Megève-Rutor-Megève, with an ETA around 16:00 local time.
- The following persons were on board: the instructor, French nationality, seated in the front right seat; the pilot, Belgian nationality, seated in the front left seat, holding a mountain rating; a pilot, French nationality, seated in the back right seat, in training to acquire a mountain rating.
- The first phase of the VFR flight consisted of a recurrent flight in favour of the pilot who had a mountain rating; subsequently, there would be an exchange seats on the ground, between the two pilots, whereby the pilot in the rear seat would be transferred to the left front seat for the training mission to obtain the mountain rating.
- The crew of the F-PVGM was in possession of the necessary aeronautical qualifications and was qualified to conduct the flight; in particular, the pilot was already in possession of the mountain rating both on wheels and on skis, while the other pilot was in training to obtain the rating.
- Despite the fact that the flight that ended with the accident involved the crossing of national boundaries, the crew did not submit a flight plan, as required by current regulations.
- The aircraft had undergone the required maintenance and no significant inefficiencies had occurred on the previous flight performed during the day.
- At 13:25:36 the aircraft collided with the I-EDIC helicopter, initially against the main rotor blades and later against the fuselage, at an estimated altitude of about 2777 meters, at coordinates 45°39'30.94" N and 65°58'46.31" E, approximately 500/550 meters from the presumed landing site on the glacier, at Col Loydon.
- Following the collision, the aircraft separated while still in flight into three main parts: wing, cockpit and tail boom.

- The instructor remained belted to the right front seat and the wing; after the impact on the snow he suffered injuries but survived.
- The other two occupants of the aircraft crashed completely separated from the aircraft and died on impact with the ground.
- The procedures for radio calls on the VHF 130.000 MHz frequency in force at the Megève Aeroclub included a call on arrival at the area where the aircraft was to land, a call before each of the three planned reconnaissance flights and a call when positioned for landing.
- Due to the damaged state of the Honeywell radio installed on the F-PMGV, no useful data could be retrieved to determine which VHF frequency had been selected on this radio.
- The instructor pilot reported that well before the accident he had consulted the ENAV SpA website, to obtain information about Italian regulations (national or local) related to mountain flights or high altitude landings, but he had found no traces in the AIP Italy (the only official document accessible in English language) of the Law of April 2, 1968 n. 518, of the Ministerial Decree of February 1, 2006 on liberalization and use of temporary airports, of the Valle d'Aosta Regional Law n. 15/1988. He had never been aware of the above mentioned laws nor had he been told about them by the chief pilot or instructors of the Megève Aeroclub.
- According to Megève Aeroclub practice, a flight plan was not submitted because the chief pilot of Megève had explained that this procedure was not applicable since it was the latest updated weather conditions that determined the final choice of the site of operation.
- Assuming the most direct route between Megève airport and the Rutor glacier, via Col de la Seigne, it is probable that F-PMGV reached the Rutor area around 13:15, about 10 minutes before the collision.
- It has not been possible to ascertain with certainty if the F-PMGV was still in reconnaissance phase or lined up for landing at the time of the collision, although the latter hypothesis is the most probable one.

I-EDIC

- The operator held licenses and authorizations required to carry out heliski activities in the area district of Valgrisenche, Arvier and La Thuile.

- The same operator had activated the temporary airfields located in the Rutor area, giving prior notice to the ENAC Turin Caselle Direzione aeroportuale.
- The helicopter was engaged in some VFR flights for heliski activities: the accident occurred after a flight during which 4 skiers and a mountain guide had been picked up at Bonne-Valgrisenche and released on the Rutor glacier at Le Vedette del Rutor.
- The pilot was in possession of the necessary aeronautical qualifications and flight experience.
- Following the release of skiers, the helicopter descended towards the valley and landed at Lago dei Seracchi-Cascate (Superiore), where the helicopter was to pick up the skiers.
- At 13:24:36 the helicopter took off again towards South.
- At 13:25:36 was recorded the helicopter last position in flight, during the ascent along the Valle Sospesa at a GS of 47 km/h, an altitude of 2777 m and a heading of 191°.
- At or immediately after this time, the helicopter impacted with the main rotor blades against the ski and the right main landing gear of the F-PMGV.
- After the collision the main rotor blades were destroyed causing the helicopter to fall to the ground.
- Five of the six occupants of the helicopter died on impact with the ground.
- The wreckage distribution on the ground is consistent with a collision that occurred substantially in correspondence with the helicopter last recorded position in flight.
- The helicopter had been maintained according to the relevant programme and no significant inefficiencies had occurred during previous flights during the day.
- One of the two radios on board, the Garmin GTR 225A was powered at the time of impact and had selected 130.000 MHz as active VHF frequency.

Further evidence

- Weather conditions were characterized by unlimited visibility, clear skies, wind coming from the North but noticeable at altitudes higher than the one at which the collision occurred, being the valley protected to the North by the Vette del Rutor and Grand Assaly.
- The area where the collision occurred is “G” class airspace.
- The Rutor glacier is part of the area district of Valgrisenche, Arvier and La Thuile, belonging to Valle d'Aosta, within which the areas above 1500 m AMSL are forbidden to fly less than 500 m above ground level and to land, with the exception of aerial work/CAT flights (such flights may however be carried out subject to a specific

agreement with the authorities of the above area district and are subject to specific authorizations).

- According to video footage acquired during the investigation, the F-PMGV, at the time of collision, appeared to be several feet higher than the I-EDIC, which was climbing and had a flight direction of about 185/190 degrees.
- The audio analysis of the above mentioned video from the helicopter pilot camera [documenting the flight from take-off from the pick-up point Lago dei Seracchi-Cascate (Superiore) to the time of collision] did not reveal the presence of radio calls made by the pilot or responses given by the pilot to radio calls received.
- The Italian AIP in force at the time of the accident did not report any areas in the Valle d'Aosta subject to flight restrictions. Information obtained during the investigation suggest that this was due to a missed transmission of Regional Law n. 15/1988 to ENAV SpA by the Regione Valle d'Aosta. Research carried out at ENAV SpA also confirmed that the limitations laid down in Regional Law 15/1988 had never been included in AIP Italy.
- The Megève Aeroclub had been fined in 2004 by the Corpo forestale valdostano for landing of one of its Jodel aircraft on the Rutor glacier, not allowed by Italian norms.
- From the investigation it emerged that the practice of landing at high altitude in Italian territory had been consolidated over the years by the Megève Aeroclub and that this practice depended exclusively on a last minute evaluation of the weather conditions in the area, so as to disregard the aviation regulations concerning the submission of the flight plan in case of crossing the national borders and the respect of the flight limitations present in Italian territory.

3.2. CAUSES

The accident, which consisted of an in-flight collision between the two aircraft, was caused by insufficient look-out activity by both crews, which should have been carried out in a more incisive manner considering the restricted area and the critical flight phases in which both aircraft were operating.

The following factors contributed to the occurrence of the accident.

- The probable absence of bilateral radio communications between the crews of the two aircraft in the flight phases proceeding the collision.

- The limited or no visibility available to both crews towards the sector occupied by the other aircraft, resulting from the design shape of the respective aircraft and, in the case of the helicopter, also from the captain position on board.
- The sun position, in front of both aircraft, which could have significantly affected the crews capabilities in terms of visual perception of the respective positions.
- The critical aspects of AIP Italy, which do not make it easy for aeronautical operators, including foreigners ones, to understand the relevant regulations/procedures, obliging those who consult it to carry out researches that are not always easy, not to mention the fact that the sources referred to are written in Italian and therefore not necessarily understandable by foreigners.
- The organizational behaviour of the Megève Aeroclub; it can be assumed that the latter was aware, at least since 2004 (when it was fined for an infringement of Italian law), of the existence of flight restrictions on Italian territory, but that its pilots continued to land indifferently on both sides of the border, in particular, as far as we are concerned, on Italian territory, in violation of Italian national law.

The investigation has not been able to determine with incontrovertible certainty, in the light of the evidence gathered, whether the crews of the two aircraft had transmitted their respective positions by means of self-information radio calls during the flight which ended in the collision.

CHAPTER IV

SAFETY RECOMMENDATIONS

4. RECOMMENDATIONS

In light of the evidence collected and the analyses carried out, the ANSV considers it necessary to issue the following safety recommendations.

4.1. RECOMMENDATION ANSV-3/68-19/1/A/21

Type of recommendation: -.

Reasoning: the purpose of a publication such as the AIP should be to provide a clear and exhaustive picture to operators in the aviation sector, foreigners included, of the regulations in force in a given country: from this point of view, the AIP Italy presents, as we have seen, some critical aspects. In this context, it is worth mentioning the following. The Italian AIP does not report some areas of the Aosta Valley subject to flight restrictions. From information obtained during the investigation, it would appear that this was due to a criticality in the transmission of Regional Law n. 15/1988 to ENAV SpA by the Aosta Valley Region. Research carried out at ENAV SpA also confirmed that the limitations set forth in Regional Law 15/1988 had never been included in AIP Italy.

In the light of the above, it would seem reasonable to assume that other local laws, providing for limitations of a similar nature, are not referred to in the Italian AIP.

Addressee: ENAC

Text: ANSV recommends that the limitations set forth in the above mentioned Regional Law n. 15/1988 be reported in the Italian AIP and that in parallel a national survey of the areas subject to flight activity limitations be carried out, in order to report any missing areas in the Italian AIP.

4.2. RECOMMENDATION ANSV-4/68-19/2/A/21

Type of recommendation: -.

Reasoning: the purpose of a publication such as the AIP should be to provide a clear and exhaustive picture to the aviation industry, foreigners included, of the regulations in force in a given Country: in this regard AIP Italy presents, as seen, some criticalities. In particular, the reference made by AIP Italy to specific regulatory sources (without even providing a summary) or to the ENAC website does not make convenient to know the relevant

regulations/procedures, obliging those who consult it to make researches not always easy, not to mention the fact that sources referred to are written in Italian language and therefore not necessarily understandable by foreigners, with negative consequences on flight safety. Moreover, the reference to certain regulatory sources could be improper, in case such sources have been substituted by new sources.

Addressee: ENAC.

Text: ANSV recommends a comprehensive revision of AIP Italy, in order to remedy the above mentioned criticalities and make AIP Italy more accessible not only to Italian operators, but also to foreigners ones.

4.3. RECOMMENDATION ANSV-5/68-19/3/A/21

Type of recommendation: -.

Reasoning: the purpose of a publication such as AIP should be to provide a clear and exhaustive picture to aeronautical operators, including foreign ones, of the provisions in force in a given Country: in this regard P Italy presents, as seen, some criticalities. With Safety Recommendation ANSV-19/SA/3/13, ANSV recommended, among other things, to evaluate the possibility of publishing, as in other Countries, a VFR AIP (to be made available in hard copy and on-line), so as to favour the acquisition of information by pilots not involved in professional flying activities. The ENAC responded to this recommendation with FACTOR No 02/2014 dated 6.6.2014, rev. 0, in which it stated that: "Regarding the publication of an AIP for VFR, ENAC intends to carry out a reconnaissance among the existing ones by March 2015". ANSV has not received the results of the reconnaissance that ENAC should have carried out by March 2015.

Addressee: ENAC

Text: ANSV reiterates its recommendation to evaluate the possibility of publishing, as in other States, a VFR AIP (to be made available in pdf format and on-line), so as to favour the acquisition of information for non-professional pilots to obtain information.

4.4. RECOMMENDATION ANSV-6/68-19/4/A/21

Type of recommendation: -.

Reasoning: the repeated non-compliance of aircraft operators, especially foreigners ones, with the flight restrictions in the Regione Valle d'Aosta, has led to numerous reports from the local police, but for the reasons stated in this report, these reports have not had any deterrent effect.

It is evident that the infringements detected, beyond the environmental aspects, also concern flight safety, as such fined behaviours jeopardize regularly authorized activities (such as heliski) in the interested areas.

Addressee: ENAC.

Text: ANSV recommends that a coordination between local police entities and ENAC takes place, in order to allow ENAC to have an adequate visibility of such phenomenon (not limited to the Valle d'Aosta) and to promote relevant initiatives, also towards foreigners' authorities.

4.5. RECOMMENDATION ANSV-7/68-19/5/A/21

Type of recommendation: -.

Reasoning: according to the statements acquired during the investigation, the practice of landing at high altitude in Italy had been consolidated over the years at the Megève Aeroclub and that this practice depended exclusively on a last minute assessment of the weather conditions in the area, thus disregarding the observance of aeronautical regulations regarding the submission of a flight plan in case of crossing national borders and the observance of flight restrictions in Italy. In this respect, it can be assumed that the Megève Aeroclub was aware of the existence of flight restrictions on Italian territory at least since 2004 (when it was fined for an infringement of Italian law), but that pilots of the Megève Aeroclub continued to land on both sides of the border, and in particular on Italian territory, in violation of Italian law.

Addressee: Direction générale de l'aviation civile (DGAC), France.

Text: ANSV recommends a more effective surveillance activity and safety promotion be carried out among French operators, making them aware of the issues that emerged during the investigation carried out by ANSV, in particular with respect to activity carried out on Italian territory, in high mountains, close to the State border.

4.6. RECOMMENDATION ANSV-8/68-19/6/A/21

Type of recommendation: SRUR/SRGC.

Rationale: both aircraft involved in the in-flight collision, although operating in isolated mountainous areas and in class "G" class airspace, where often no flight assistance/information is available, were not equipped with on-board collision avoidance systems or systems designed to detect the proximity of other aircraft. In the type of flight conducted by the two aircraft on the accident day, the principle of "see and avoid", as well

as the execution self-information radio calls on the expected frequency represent safety nets sometimes insufficient to prevent in-flight collisions. A further "barrier" against possible in-flight collisions between aircraft operating under VFR could be the presence on board of systems capable of detecting the presence of other aircraft not acquired visually or through radio communications: in this respect, systems based on GPS receivers capable of calculating and transmitting the future position of the aircraft to other nearby aircraft equipped with similar systems have been available for years, preventing the risk of possible collisions by sending alert messages to the respective crews, who thus become aware of the position of the other aircraft with respect to their own position. More advanced versions of such systems also provide for the integration of an ADS-B receiver and transponder, which allows visibility on a greater number of aircraft among those that present a position and flight path with a risk of collision.

Addressee: EASA.

Text: ANSV recommends to evaluate the feasibility to install on board of aircraft operating under VFR in class "G" airspace, as mandatory equipment, anti-collision systems or systems designed to detect the proximity of other aircraft.

APPENDIX

In line with what is allowed by international and EU law regarding safety investigations (Annex 13 to the Convention on International Civil Aviation, EU Regulation n. 996/2010), the BEA forwarded comments to the draft of the final investigation report prepared by ANSV, while the NTSB shared the draft and provided no comments.

The comments provided by BEA and shared by ANSV have been integrated into the text of the report, while those not shared are reported below.

1. The BEA did not fully agree with the analysis regarding radio calls between the two aircraft during the period when I-EDIC was stationary on the ground, waiting for skiers. In this regard, the BEA represented the following.

(omissis) it is likely to assume that (omissis) these communication [the ones between the two aircraft] took place with the helicopter off the ground in the vicinity of the upper Cascades, waiting for the descent of the skiers.

2. The BEA did not fully agree with the cause of the accident as identified by ANSV. In this respect, the BEA submitted the following.

The report states that crews failed to make a visual acquisition due to a “lack of attention”. The BEA does not support this cause, because, as stated in the report, the path simulation shows that the two aircraft were respectively in a blind spot. In addition, the analysis of the audio recordings and of the radio does not permit a conclusion to be drawn about the transmission (or not) of auto information by both crews, and about the active listening on the 130.00 mountain frequency by other crews.

For the helicopter, the airplane was in the rear sector and higher. For the airplane, the right wing masked the helicopter and in addition, the color of the helicopter associated with the shadow of the relief made the visual detection very difficult.

This means that even with an "aggressive" visual search, the pilots would probably not have been able to see or visually detect each other as the aircraft were in blind spots.

It can only be said that the standard and normally practiced vigilance was not sufficient to avoid the mid-air collision.

The BEA suggests modifying the sentence as follows:

“The accident, resulting from the mid-air collision between the two aircraft, was due to the failure of the respective crews to visually acquire each other. The respective position and trajectory of the two aircraft rendered the detection by each flight crew of the other aircraft extremely difficult, even if they had been aware of the presence of another aircraft in the area”.