Safety Investigation Report

AAIU
Air Accident Investigation Unit

ACCIDENT
DYNALI CHICKINOX KOT KOT
AT ASSESSE
ON 26 FEBRUARY 2021

Ref.:
AAIU-2021-02-26-01

Issue date:
24 October 2025

Report status:
Final

ABOUT THIS REPORT

General	
What?	This safety investigation report is a technical document that reflects the views of the investigation team on the circumstances that led to the accident or serious incident and is conducted in accordance with Annex 13 to the Convention on International Civil Aviation and Regulation (EU) No 996/2010.
Objective	**The sole objective of the safety investigation and the Final Report is the determination of the causes, and to define safety recommendations in order to prevent future accidents and incidents. It is not the purpose of this investigation to apportion blame or liability.** In particular, Article 17-3 of Regulation (EU) 996/2010 stipulates that the safety recommendations made in this report do not constitute any suspicion of guilt or responsibility.
Investigation authority	This investigation was conducted by the Air Accident Investigation Unit of Belgium, (AAIU for the rest of this publication). It is the Belgian permanent national civil aviation safety investigation authority as defined in Article 4 of Regulation (EU) No 996/2010 and established in accordance with the Royal Decree of 8 December 1998. This unit is part of the Federal Public Service Mobility and Transport and is functionally independent from the Belgian Civil Aviation Authority and other interested parties.
This investigation	
Investigation initiation	The accident was reported to the AAIU by a call from Skeyes (ATC - Belgium) at 13:00 UTC. The 2 AAIU investigators arrived at 15:25 UTC. at the accident site. The local police and the air police (LPA) were present on the spot.
Scope	**Extended** As per ICAO Annex 13 and EU regulation EU 996/2010, decisions regarding whether to conduct a civil aviation safety investigation, and the extent of an investigation, are based on many factors, including the level of safety benefit expected to be drawn from such an investigation. For this occurrence, an extended investigation was performed concluded with a thorough analysis covering several aspects of the operation.
Other parties involved	• The BEA - France representing the country of registration of the aircraft as well as the authority that issued the license to the pilot of the accident aircraft. • The Belgian Civil Aviation Authority representing the country of design, construction and operation of the damaged aircraft. • The designer of the aircraft.
	AAIU Belgium would like to thank the mentioned parties above and all other entities and individuals that have contributed to this safety investigation.

SYNOPSIS

Occurrence class	Accident
Occurrence category	Loss of control - inflight (LOC-I)
Date and time[1]	26 February 2021 – 12:30 UTC
Location	Wooden area close to the Maillen Airfield (EBML)
Aircraft	Chickinox Kot Kot 3AA
Aircraft category	Fixed wing - Ultralight
Location of departure	Maillen Airfield - EBML
Planned destination	Maillen Airfield - EBML
Type of operation	Non-commercial - Local
Phase of flight	Approach
Injuries	1 Fatal
Aircraft damage	Destroyed

What happened

The accident took place during a local flight carried out by the Belgian pilot-owner of an ultralight aircraft from his home aerodrome (EBML) located in the municipality of Maillen in Belgium. After takeoff from runway 27, the ULM was seen climbing with a low rate of climb. The aircraft was then seen making a U-turn to the left, heading back towards the airfield. Above a wood, the left wing of the aircraft fell down and the aircraft nosed down, falling vertically into the woods.
The wreckage was found flipped on its back, severely damaged. The main damages were noted at the level of its rear structure, the wings, the engine and the propeller. The deceased pilot was ejected from his seat during the crash.

The investigation determined that works have been recently performed by the pilot-owner on the aircraft, including parts replacement on the tail section. The adjustments made on the elevator controls may have rendered the aircraft more difficult to operate. This resulted in a low rate of climb on takeoff observed by the witnesses.
After the crash, the pilot was found outside the wreckage. The safety belt was found open on its right hand adjustment side.
The crosswind conditions, perpendicular to the axis of the runway may have aggravated the difficulties to control the aircraft.

The investigation explored the medical condition of the pilot, but could not determine whether the past medical condition of the pilot had influenced his ability to work on his aircraft and conduct the flight.

[1] All time data in this report are indicated in UTC, unless otherwise specified

What has been done as result

Safety recommendations[2]:

On 17/04/2019 the AAIU already issued Safety Recommendation 2019-05 to the Belgian Civil Aviation Authority (BCAA) in order to amend the Regulation in order to introduce a requirement for a medical examination for pilots operating regularly, in Belgian airspace, an ULM aircraft registered abroad and making the object of a flight permit issued by the BCAA.

Action taken :

The BCAA issued the new Royal Decree of 24 December 2024 where the foreign registered ultralight aircrafts stationed more than 180 nights in Belgium must comply to the Belgian regulation on ultralight aircrafts, this including a medical examination for the pilot.

Safety message

AAIU issues:

A safety message to manufacturers, pilots and owners of ultralight airplanes to make them aware of the importance to comply with the equipment manufacturers' installation instructions. This message concerns, among other things, the adjustments made to the critical systems of an ULM.

[2] *A **safety recommendation** is a proposal by the safety investigation authority in response to a safety issue and based on information derived from an investigation and/or study. It's aimed to improve the safety of an organisation and/or system and therefor always addressed to an organisation and/or agency, never to a specific individual. The sole purpose of a safety recommendation is the prevention of accidents or incidents and the reduction of the consequences of such occurrences. It, in no case has the purpose of creating a presumption of blame or liability for an accident or incident. Neither does it reflect the level of contribution to a specific accident or incident.*

TABLE OF CONTENTS

1. FACTUAL INFORMATION

1.1 History of flight

The pilot flew regularly with his Chickinox, making almost daily flights in various meteorological conditions. Most of these flights were limited to circuit flights around the airfield of Maillen - EBML, where he had based his aircraft. The accident took place in the afternoon of February 26, 2021 on departure from EBML runway 027, in sunny weather, clear skies with a crosswind almost perpendicular to the runway axis (value of 6 to 9 kt - coming from 360°).

During the days preceding the accident, the pilot-owner of the ultralight carried out various maintenance work to replace parts on the tail section of the aircraft.

After completion of the work, the pilot-owner carried out a flight test a few days before the accident. Following this check and fine-tuning flight, he was not fully satisfied with the behavior of the ultralight. He shared with others that the ultralight took off on a shorter distance after the works performed and that he had to move the control column in a more forward position than before to keep the aircraft flying level. He then decided to make new adjustments to the aircraft. Reportedly, the purpose of the accident flight was to verify these latest adjustments.

According to witnesses (pilots based at EBML) present on the airfield at the time of the accident, the pilot (alone on board) carried out his pre-flight checks and was seen taxiing on the taxiway. The take-off was normal with an adequate roll and pitch control in spite of the crosswind. During the climb, at the level of the hangar located in the axis of the runway, the ULM made a momentarily roll movement to the left, after which the wings soon were levelled off again. Witnesses stated the climb gradient of the aircraft seemed abnormally lower than usual, as if the airplane was unable to gain altitude. The low climb path led the ULM far beyond the West border of the airfield normal circuit. The ultralight aircraft made then a U-turn to the left, like willing to come back anticipatively to the airfield. The ULM was flying on a straight path, with wings levelled horizontal, above a wood located 900 m in a West - South - West of EBML, when it suddenly tipped over on its left wing, out of control, pitching down towards the ground before disappearing from sight.

Witnesses to the event immediately alerted the emergency services and then went to the rescue of the aircraft. After 20 to 30 minutes, they found the ULM in the wood, severely damaged by the impact in the trees. The deceased pilot laid on the ground next to the damaged aircraft.

Impact location : N 050° 22’ 21.43”- E 004° 54’ 51.72” - Elevation : 255 m.

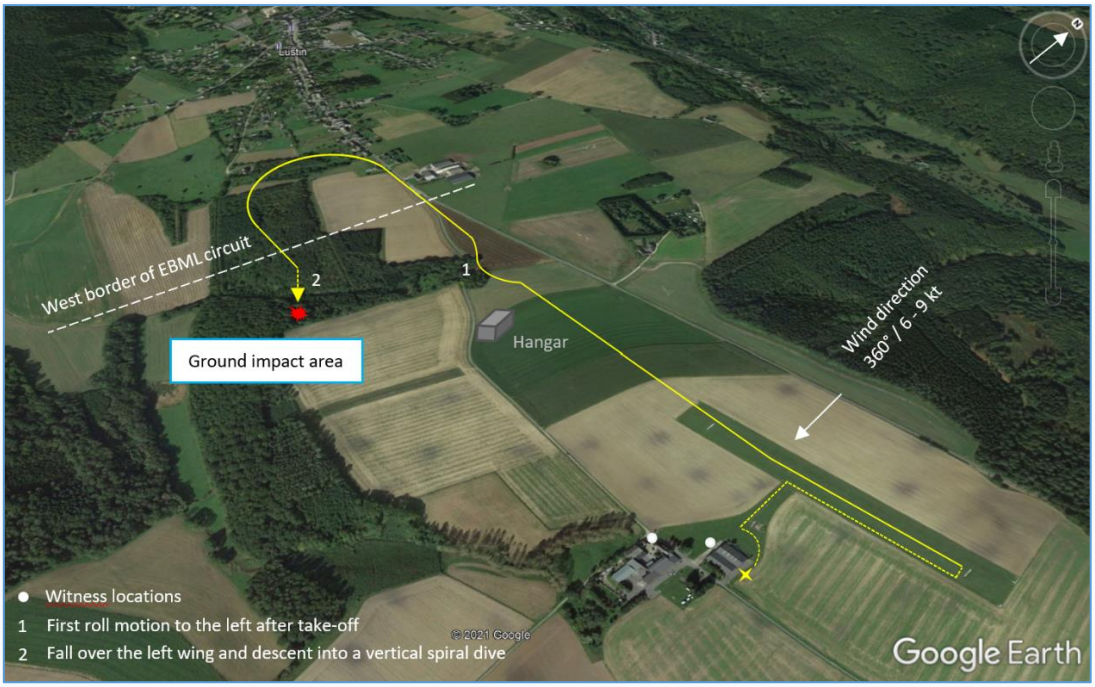

Figure 1 : Illustration of the accident flight based on witness statements.

1.2 Injuries to persons

Table 1: List of injuries

Injuries	Crew	Passenger	Others	Total
Fatal	1	-	-	1
Serious	-	-	-	-
Minor	-	-	-	-
None	-	-	-	-
Total	1	-	-	1

1.3 Damage to aircraft

The ULM was totally destroyed at impact

1.4 Other damage

The fall of the ULM in the wood caused impact damages to the trees.

1.5 Personnel information

Table 2 : General data

Nationality	Belgian	Age	75
License	Valid ULM Pilot license, issued by the French DGAC on May 13, 2014		
Ratings	Multi-axis ULM Carrying of Passenger (20/09/2016) Radio qualification (13 May 2014)		
Checks	No data available		
Medical certificate	No data available		

Table 3 : Flying experience

Total time:	No data available
Total past 90 days:	No data available
Total past 28 days:	No data available

Notes:

1) The Pilot held a Belgian Private Pilot License - Single Engine Piston (PPL - SEP) valid from 14/08/1991 until 31/08/2008.

2) The French Regulation for ULM does not mandate the registration of flights in a log book. The registration is required for all flights departing from Belgian ULM airfield. However, the flight log of EBML contained only few records of flight performed by the ultralight airplane. Various witnesses confirmed the pilot and his airplane were flying very regularly ('daily') from EBML.
   The same witnesses confirmed the pilot was very experienced on the Chickinox, this making from him a reference in the aeroclub.

1.6 Aircraft information

1.6.1 General information

The Chickinox is a ULM category aircraft developed and manufactured by the Belgian company Dynali S.A. in the 1980s. The high-wing aircraft, built in a tubular metal structure around a central keel, could be configured as a two-seater tandem or side by side (referred to as Kot-Kot). The profile of the wing was offered in 2 options, a wing where only the upper surface was covered (single surface) or a wing with, in addition to the upper surface, the lower surface covered over half of its surface (double surface).

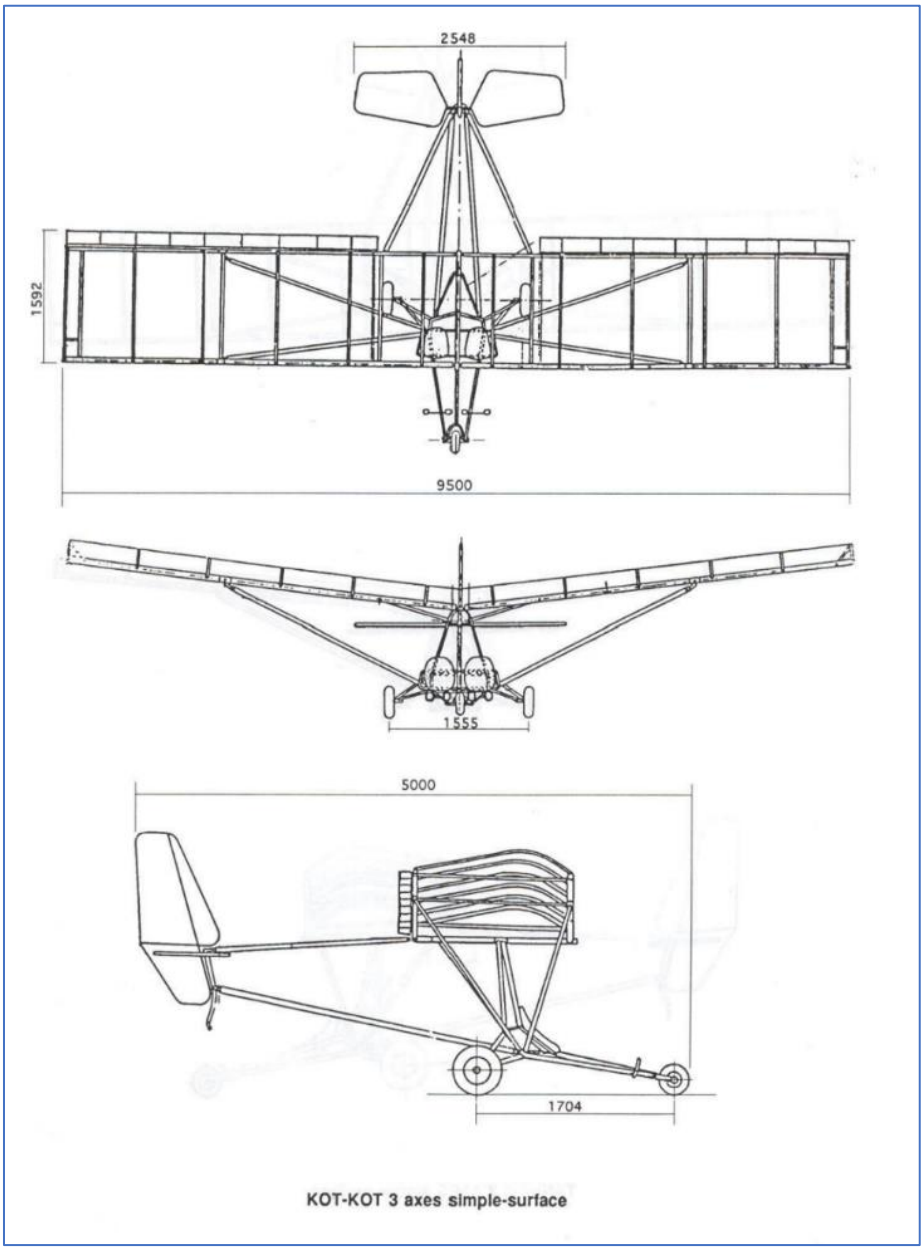

Figure 2 : Chickinox Kot-Kot 3-view without cockpit fairing and engine.

Different versions were available;

- Either in 2-axis control:
    - version 2A, with wing dihedral of 7° or 3.5°, rudder and elevator controlled by the control column and which can be optionally fitted with the wing spoilers controlled by the feet.

- Or in 3-axis control:
    - 3ASP version with wing dihedral of 3.5°, rudder controlled by the feet, elevator and spoilers controlled by the control column.
    - 3AA version with single surface ailerons, rudder controlled by the feet, elevator and ailerons controlled by the control column.

The engine and propeller are installed in a pusher configuration. The cockpit is either open, or enclosed in a plastic fairing.
The tail section consists of a rudder and elevator, mounted on a stainless steel one-piece connector, called 'Kangourou', connected to the front section by 4 tail struts. The 'Kangourou' supports the hinges of the rudder and elevator surfaces. The inputs on the control column and rudder pedal are transmitted to the control surfaces by telefex cables.

A location for ballast weight is provided in the cockpit frame, at the front end.

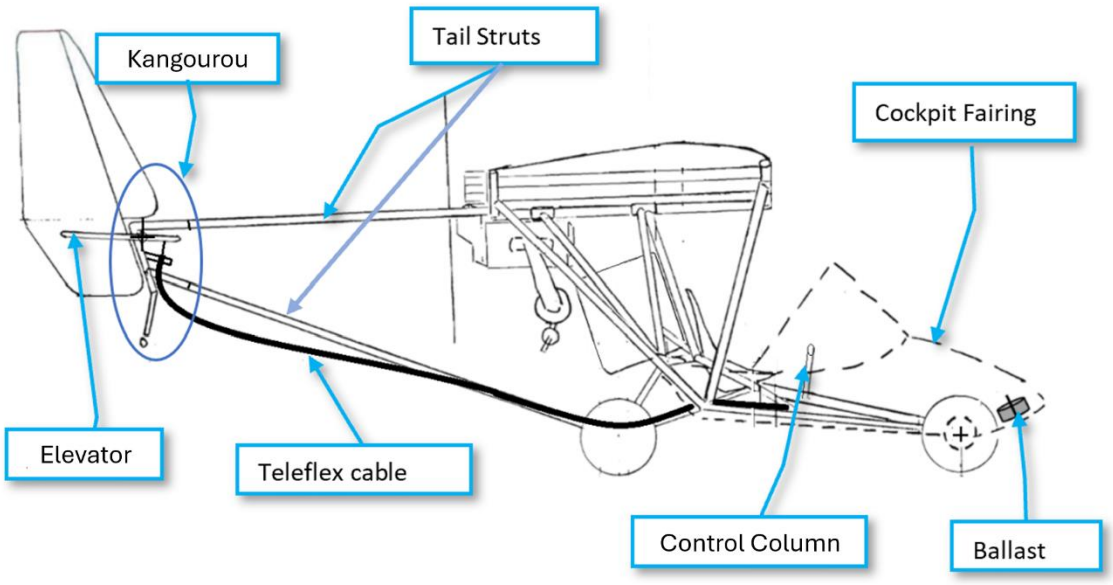

Figure 3 : Chickinox overview

1.6.2 Specifics about the 'Kangourou'

The designer of the Chickinox confirmed that the 'Kangourou', being located in the airflow of the propeller, would over time twist or deform this causing to modify the initial setting of the tail control surfaces of the aircraft. This would require regular adjustments of the rudder and elevator control cables and the eventual replacement of parts. The user manual describes the necessary procedure.

1.6.3 Specifics about the teleflex control cable

The teleflex control cable (manufactured by Morse) is a type of flexible cable used to transmit mechanical force by the movement of an inner cable relative to a hollow outer cable housing.

On either side (cockpit and tail), the teleflex cable housing is clamped on a support plate. A groove in the housing allows for its positioning and securing. The inner cable is screwed onto a clevis, allowing for length adjustment (as described in the Chickinox user manual). A spring allows the system to be stable around a neutral position.

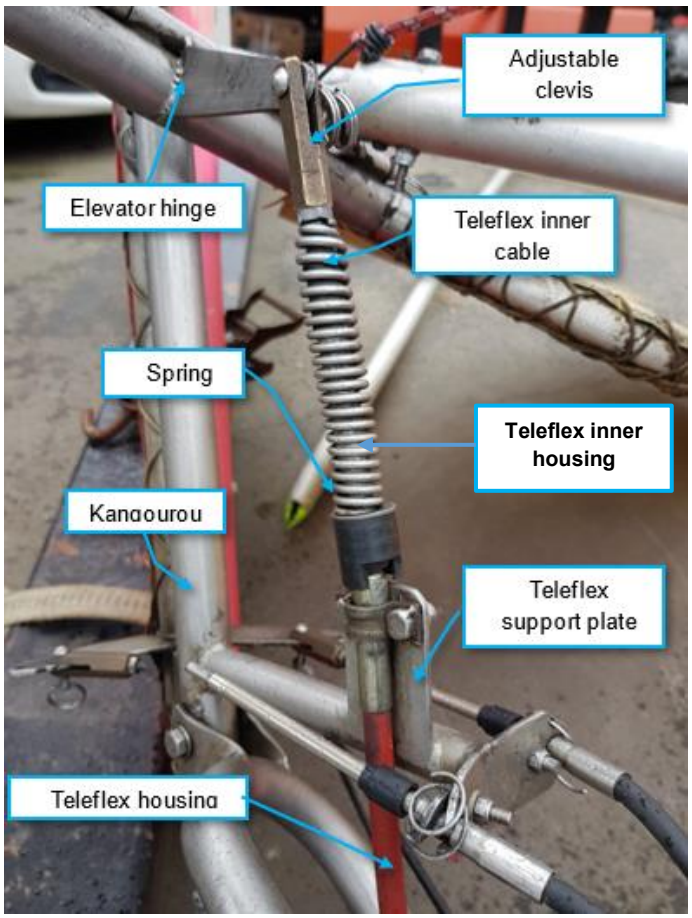

Figure 4 : Elevator control at the tail section

1.6.4 Accident aircraft information

Table 4 : Airframe data

Model	Chickinox Kot Kot 3AA (single surface)
Manufacturer	Dynali SA
Serial number	31245354
Year of manufacture	1989 (Chickinox Kot-Kot 2A-503B) modified in 1994 (Chickinox 3AA-503B)
Capacity	2 seats; 1 crew + 1 passenger
ULM Identification card	Issued by DGAC on 09 April 2014
Flight aptitude statement	Issued 08 may 2020, valid until 08 April 2021
Registration	French ULM
Total airframe time	unknown
MTOM	368 kg
Fuel capacity	1x 30 liters (central fuselage tank)

Table 5 : Engine data

Fuel	MOGAS or AVGAS 100LL
Model	503 (reducteur B)
Manufacturer	Bombardier - Rotax
Performance	50 HP / 37kW at 6600 rpm
Serial number	3763910
Time since new	No data available
Time since last overhaul	No data available – engine overhauled in 2014
On aircraft	Originally installed

Table 6 : Propeller data

Type	Wooden - 2 blades - fixed
Model	Diameter, 1.52m
Manufacturer	Poncelet
Serial number	92973
Time since new	No data available
Time since last overhaul	No data available
On aircraft	Originally installed

Table 7 : Dimensions and performance

Length - Height	5,00 m - 2,00 m	Take-off speed	60 Km/h
Wingspan	9,50 m	Climb speed	65 Km/h
Wing surface	13,2 m²	Rate of climb	2,5 m/s at 65 km/h
Wing max. load	25 dN/ m²	Finesse max.	9,5 at 70 Km/h
		Max.speed (Vne)	115 Km/h
		Cruise speed (Vc)	70 to 100 Km/h
		Approach speed	80 Km/h
		Stall speed engine idle	50 Km/h - 55 Km/h
		T/O limit facing wind	40 Km/h / 22 kt
		Crosswind limit	20 Km/h / 11 kt
		Load limit	+4G -2G

Optional equipment installed on the aircraft:

- A manual trim in the cockpit coupled to tab installed on the elevator.
- A steerable nose wheel.
- A radio.

1.6.5 History of the accident aircraft.

The accident aircraft, a Dynali Chickinox ULM with serial number 31245354 was built from a kit in 1989. The model initially corresponded to a Chickinox III Kot-Kot 2A-503B /503, responding to a 2-axis configuration (rudder and elevator on the control column) with single-surface wing fitted with spoilers (feet-operated) and side-by-side two-seater seats. The ULM was registered in 06/04/1990 in Belgium.

The airplane was then modified and transformed into a Chickinox III Kot-Kot 3AA-503B (3-axis) in 1994. The modification included a wing with a different dihedral, the removal of wing spoilers, the installation of ailerons, elevator trim tab and a new 35 L tank. The ultralight aircraft was also equipped with a Dynali manufactured semi-open cockpit fairing.

A location inside the cockpit fairing, on the right of the nose wheel, is provided for the ballast consisting of one or two removable weights for a total mass of approximately 8 to 12 kg.

The ULM was then operated in this last configuration from 1994 until 2014 by various owners under the Belgian and French registration.
The airplane left the Belgian register on 26/02/2008 and was registered by DGAC with 59- markings on 24/07/2008. (Home base identified as LFQJ - Maubeuge / Ellesmes).

After a test in flight, the accident pilot purchased the ultralight airplane in 2014, for which a new identification card was issued by the DGAC on 09/04/2014 (same home base LFQJ - Maubeuge / Ellesmes).

The pilot also owned another ULM Chickinox III Kot-Kot 2A/582C (serial number 3110168) (single surface) acquired before the purchase of the accident airplane. This ULM, registered in Belgium, had a wing with spoiler (without ailerons), a fixed nose gear and manual brake controls (levers near the seat). The ballast consisted of 2 fixed weights mounted on either side of the axle of the nose gear. The aircraft had also been fitted with a different type of cockpit fairing (Muschang-type).

The wreckage was found with the engine, propeller, wings and control surfaces of the original configuration (3 axis - 1994), but parts different from the configuration as sold in 2014 were also found. The investigation determined that the pilot-owner installed various parts from other airplane of the same type on his ultralight aircraft, making it into an hybrid configuration. The seats and their associated harnesses, the cockpit pedals and the Muschang-type fairing found on the wreckage came from the second airplane belonging to the pilot.

The fuselage was equipped with a steerable nose gear fork whose configuration does not correspond to any of the configurations of the 2 airplanes belonging to the pilot. Also, the instrument panel did not match any of the 2 aircraft known to the pilot, such as the 2-lever manual brake system installed in the middle of the cockpit.

The pilot-owner operated this airplane in this configuration from September 2017 until February 26, 2021 without any known accident.

Note: the aircraft designer has confirmed that, besides from the different dihedral of the 2-axis version (obtained by wing struts of a length specific to this version), the airframe, the Kangourou as well as the flight and control surfaces are identical for all Kot-Kot versions.

Figure 5 : configuration of the accident ULM as modified by the last owner with Muschang fairing, picture dated September 24, 2017 (Source : Printed with permission of Raymond DC, Photographer).

1.6.6 Weight and Balance

Table 8 : Weight and balance data (POH 10/96)

Empty mass	201.5 kg
MTOM	368 kg
Ballast weight (pilot only)	8 - 10 kg
Ballast weight (2 POB)	8 - 10 kg
CG position (empty)	808.6 mm
Limit forward	460 mm aft of datum (wing LE)
Limit aft	640 mm aft of datum

The airplane weight report was not available for the investigation. From witnesses who knew the airplane and the pilot well, the weight configuration of the airplane during the accident flight did not differ from the usual, the pilot using a 15 l water can (ballast) on the passenger seat when flying alone.

The investigation attempted to compute the actual weight and balance of the airplane for the flight, with the support of the airplane designer, with the following conditions :

- The pilot weight was estimated at 75 kg.
- The nose fairing ballast installed weighed 3.5 kg.
- A water can of 15 l (allegedly to improve lateral balance) was placed on the passenger seat.
- The Muschang cockpit fairing was slightly longer and heavier than the Dynali one.
- Fuel quantity of 10 l (1/3 of full).
- Wheel fairing.
- Second carburetor.

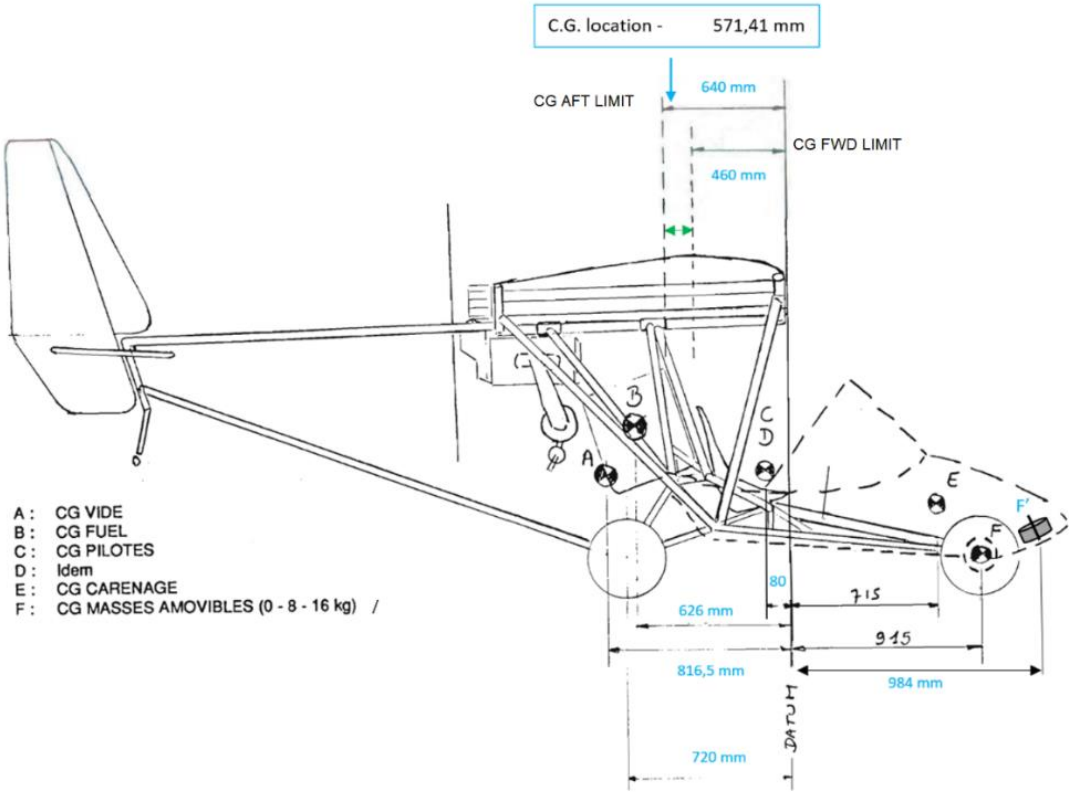

Figure 6 : Location of Center of Gravity

Table 9 : Weight and balance computation

	Position of centre of gravity (CG en mm)	Mass (Kg)	Moment (Kg x mm)
Kot Kot 3AA + fairing (11,5 kg)	816,5	201,5	164532
Wheel fairings	720	3	2160
Second carburetor	2,229	1,1	2,452
Total empty	**810,77**	**205,6**	**166694,452**
Nose ballast	-984	3,5	-3444
Pilot	80	75	6000
Ballast (passage seat)	80	15	1200
Fuel (1/3 x 35 L, d=0,72)	626	8,4	5258,4
Total (solo - accident)	**571,41**	**307,5**	**175708,852**

The computation shows that the weight of the airplane and its center of gravity were within limits.

1.7 Meteorological conditions

The meteorological conditions around the time of the accident recorded at the Brussels Airport (EBBR), with the accident area located 68 km on the South-East of EBBR - 41 km on the East of Charleroi Airport (EBCI), and 42 km on the South-West of Liege airport (EBLG) - were :

SABX90 EBBR 261220
METAR EBBR 261220Z 34010KT 300V360 9999 SCT032 09/01 Q1035 NOSIG=
METAR EBCI 261220Z 36010KT 9999 SCT020 09/02 Q1035 NOSIG=
METAR EBLG 261220Z 36008KT 9999 FEW020 SCT045 09/05 Q1034 NOSIG=

SABX90 EBBR 261250
METAR EBBR 261250Z 34011KT 310V010 9999 SCT036 10/M00 Q1035 NOSIG=
METAR EBCI 261250Z 35007KT 320V020 9999 SCT022 09/01 Q1035 NOSIG=
METAR EBLG 261250Z 36007KT 9999 FEW024 BKN045 09/03 Q1034 NOSIG=

In EBML, the windsock indicated a wind direction was of 360 degrees, with a velocity of 6 to 9 kt.

1.8 Aids to navigation

None

1.9 Communication

Basic information is provided by “Maillen Radio” on the 118.765 Mhz frequency. No witness recalls having heard a radio message from the aircraft. The frequency is not recorded at EBML.

1.10 Aerodrome information

The Assesse/Maillen aerodrome (EBML), which is operated by the “Loisir Club Mosan” association, is exclusively intended for private operations of ultralight aircraft (ULM). It is located 10 km south of the city of Namur.

The airfield consists of a two-way grass track oriented 090- 270 degrees. The dimensions are 400 m x 30 m without slope. The elevation of the airfield is 879 ft.

The take-off and landing circuit used at EBML is subject to overflight restrictions to avoid noise pollution for residents in the vicinity of the airfield. The landing circuit is located south of the field at an altitude of 1400 ft (QNH) / 500 ft (QFE).

The distance is approximately 630 m between the limit of the East circuit and the threshold of runway 27. The distance is longer and measures 880 m between the limit of the West circuit and the threshold of runway 09. It appears however that the circuit airside 09 is carried out in current practice with an early turn at hangar level close to the runway centerline. The distance between the edge of the shortened circuit and the runway threshold is then approximately 630 m, practically equal to that of the runway on the threshold 27 side.

Figure 7 : EBML airfield

Note:

It is common knowledge among pilots familiar with EBML that the surroundings to the West of the airfield provide adequate open fields which can be used in the event of an emergency, such as engine failure on take-off from the runway 27 (see Figure 7- area 1 in blue). The persons interviewed during the investigation confirmed that this information was known to the accident pilot.

1.11 Recorded information

The aircraft was not equipped with any device, such as GPS, capable of recording flight parameters. The radar imagery was also not available due to the absence of transponder and the nature of the ULM aircraft.

1.12 Wreckage and impact information

1.12.1 Impact location

The airplane fell into a wood located 900 m west-south-west of EBML aerodrome.

The main wreckage was oriented at 240 degrees. Damage to the treetops surrounding the main wreckage area was clearly visible and indicate the aircraft went into the wood vertically, its belly facing the airfield. The tip of the right wing remained attached to the high branches of a tree.

The left wing was complete but severely damaged. The tail section with vertical stabilizer and elevator showed no major damage. The engine and cockpit sat cushioned in shrubs and branches low to the ground.

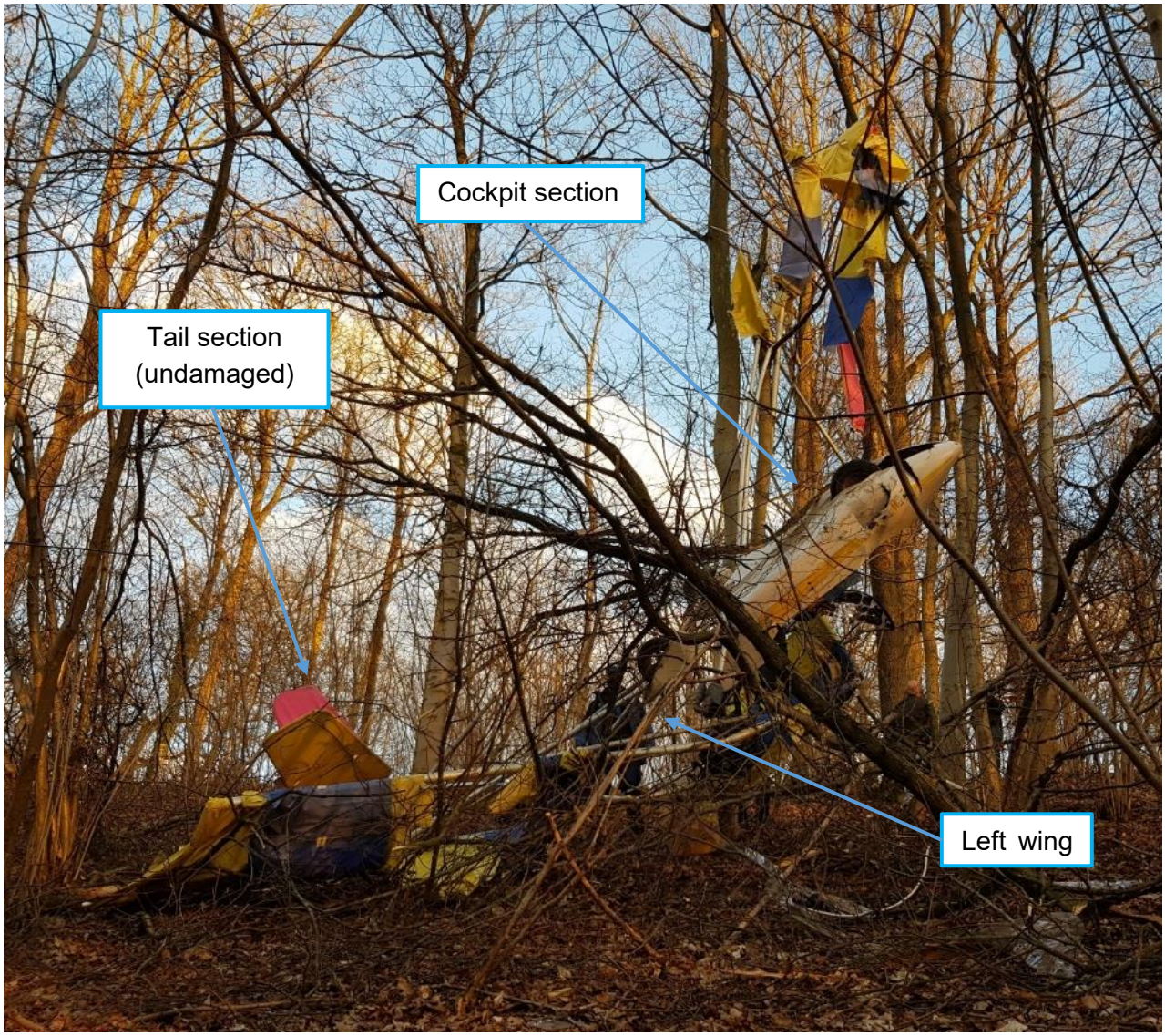

Figure 8 : General view of the accident area.

Figure 9: view from the back of the wreckage

1.12.2 Damage found at impact

The following damages were observed at the accident site:

- All the main components of the aircraft were still connected together.
- The tubular structure of the aircraft showed deformations and ruptures, mainly at the level of the wings and the rear section of the fuselage.
- The right wing was completely destroyed in the fall. The wing tip was severed, twisted and remained attached to the high branches of a tree.
- The left wing, although severely damaged, had still an identifiable structure with the leading and trailing edge. It was resting partially on the ground and in the branches.
- The two-bladed wooden propeller hub was still installed on the engine flange. The blades were completely shattered, with only small fragments of wood from the propeller littering the crash site, indicating the propeller was rotating at high speed during impact.

- The tubular section of the fuselage aft of the cockpit was upside down and showed signs of fracture, twisting and bending due to impact forces.
- The tail section showed signs of fractures and twisting at the junction with the 'Kangourou' and the rear fuselage tubes and was resting on its rear strut in a normal position on the ground.
- The rudder and horizontal stabilizer planes showed little damage.
- The engine mounting points were broken at the rear support fixed to the main keel (central tubular beam supporting the wings and the engine.
- The aft carburetor was disconnected from the engine and remained attached to the aircraft by the throttle cable.
- The instrument panel, support broken, was hanging by the electrical connections and the piping. The instruments themselves were intact. The clock showed: 02:15, the engine counter (Hobbs): 253 FH 5/10, the altimeter was set on a QNH 1035 and indicated an altitude of 760 ft.
- The passenger seat, whose harness was buckled, showed no visible damage.
- The pilot's seat also showed no apparent damage. The right side of the pilot's seat harness was no longer attached to the aircraft structure, otherwise, the harness was buckled.
- The flight controls cable were uninterrupted and the control surfaces were moving freely.
- The fuel tank, consisting of a 35 L plastic container, had been removed from the aircraft by the fire brigade. The amount of gasoline remaining corresponded to 1/3 of a tank (about 10 L).
- A 15 l plastic container filled with water was found next to the wreckage; attached to the passenger seat, it serves as ballast. A 3.5 kg lead ballast was also found on the ground, in the immediate vicinity of the cockpit.

1.12.3 Inspection of the wreckage

The wreckage was reconstructed for deeper inspection. Besides confirming the findings made during the on-site inspection, the following findings were made :

a) Carburetor:

The aft carburetor was disconnected due to a weak connection to the intake manifold flange. The carburetor could be easily reinstalled manually, staying then inserted in place on the manifold flange.

Figure 10 : aft carburetor disconnected from manifold flange

b) Flight controls - general:

The inspection of the flight controls, including the aileron, elevator trim and rudder revealed no anomaly from the cockpit to the control surfaces.

The elevator trim tab control cable, installed along the tail tubular structure, was found disconnected after impact from the tab surface. The lever in the cockpit was in full forward position. The position of the trim tab during flight could not be determined with certainty as the damage due to twisting of the entire tail section during impact could have affected the control cable and modified the position of the lever in the cockpit.

c) Elevator controls :

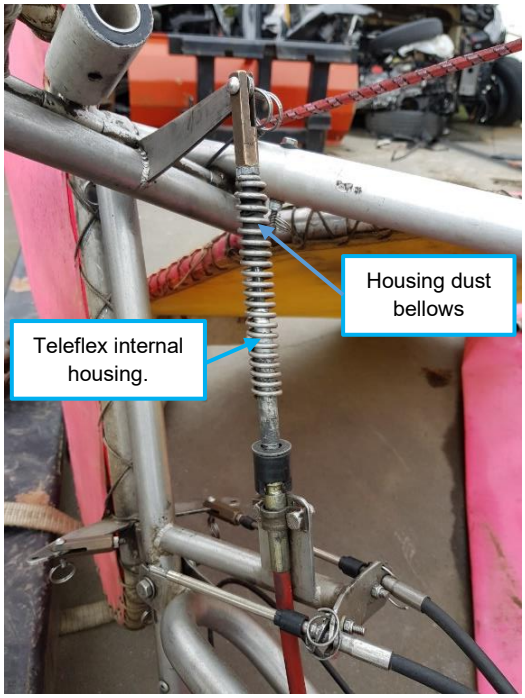

Figure 11 : View of the Teleflex & elevator on maximum upper extension (A/C pitch down).

Figure 12 : View of the Teleflex & elevator on the minimum lowest deflection (A/C pitch up) - (1) Clevis on contact against the Teleflex inner housing and dust bellows.

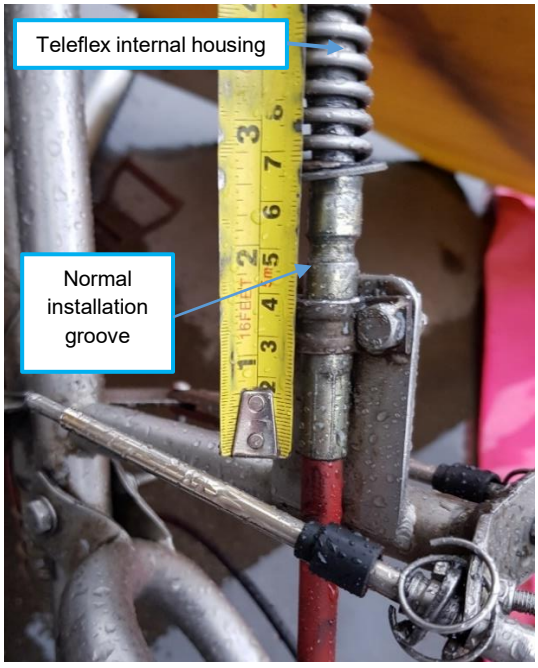

Figure 13: Installation of the teleflex control cable on its fixation plate

- On the wreckage, the teleflex cable housing for the elevator control was not clamped at the location of the groove, but 2 cm lower of it (see Figure 13). Nevertheless, the assembly was tight.
- The forward end of the teleflex cable housing, in the cockpit, was clamped at the groove and the internal moving part of the teleflex was connected to the control column.
- Other aircraft of the same type were inspected and contact was made with the aircraft type designer. From measurements made on the wreckage and other aircraft, it was found that, on the accident aircraft, with respect to a normal rigging of the elevator , the total angular travel of the elevator was tilted. Furthermore, the downward deflection (nose-up attitude) limit was constrained due to the reduced clearance between the clevis and the internal housing of the teleflex (See Figures 11 & 12).

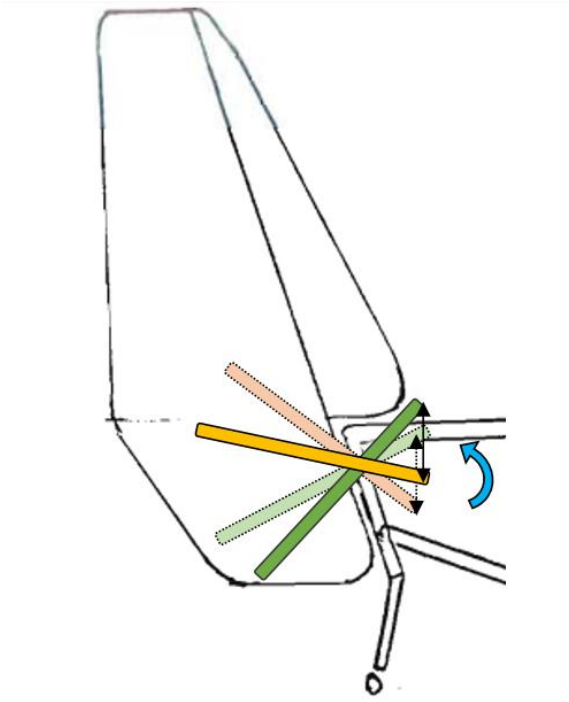

Figure 14 : sketch (not on scale) of the modified angular travel of the elevator. The green position indicates the max upward deflection (nose-down), the orange position indicates the max downward deflection (nose-up). The dotted lines reflect the normal angular travel of the elevator. The blue arrow shows the tilted travel of the modified aircraft.

- The aircraft designer confirmed that the installation and rigging of the elevator controls is described in the user's manual ('building manual' version 01/91 and 'users manual' version 07/96 issued by Dynali SA), however these instructions do not describe precisely how the Teleflex control cable extremities should be clamped onto the support plate. Precise information regarding the fixation of the teleflex control cable is to be found in documentation of the teleflex cable manufacturer (Morse).
- The deformations of the kangaroo did not make possible to determine the neutral position of the leading edge of the elevator before the accident.

d) Failed safety belt

See chapter 1.15. Survival aspects.

1.13 Medical and pathological information

During the year preceding the accident, the pilot was recovering from a long illness requiring substantial medical treatment. Reportedly, he developed a heart condition a few months before the accident. This condition had not prevented the pilot from continuing to fly.
Reportedly, he looked more tired than usual in the days leading up to the accident.

Note :

At the time of the accident, the performance of the privileges of a ULM pilot authorization issued in Belgium was conditioned by the holding of a Class 4 medical certificate (Royal Decree of 12 July 2013). This certificate is obtained after a medical examination by an Aeronautical Medical Examiner to confirm the physical fitness. This certificate, for pilots older than 40 years, must be renewed every two years. In addition (Title 5, Chapter 2, article 56), the regulation requires pilot under medical treatment to refrain from flying and to seek advice from an Aeronautical Medical Examiner.

In France, there is no provision in the French ULM regulation for a mandatory medical certificate for ULM pilots.
However, for the members of the French ULM Pilots Federation, ULM Pilots, for the first issue of the ULM pilot license, are required to provide an initial medical certificate of non-contra-indication, delivered by a General Practitioner. This certificate must be renewed annually in case the pilot engages in competition flying. Otherwise, the pilot must fill a health-questionnaire (self-statement) and satisfy himself that he is physically fit for flying. This requirement is based upon a Sports Regulation,
There is no obligation for French ULM pilots to become a member of the French ULM Pilots Federation.

1.14 Fire

There was no fire.

1.15 Survival aspects

The restraint system found on both seats of the aircraft consisted of a 4-point harness with a push button buckle from Sabelt/Britax, a model widely used in car racing.

On the wreckage, the right side of the pilot's seat harness was no longer attached to the aircraft structure. The chest strap adjustment buckle broke at the connection with the harness attachment clip on the structure. The investigation looked into the strap adjustment system.

A tilt lock adjuster system is used to adjust the length of the webbing. Tilt lock adjuster rely on the mechanism of clamping the webbing between a locking bar (slider) and the frame of the adjuster (rectangular ring). The clamping force is produced by tension from the anchored end of the webbing. FAA AC21-34 describes the various shoulder harness - safety belt installation and stresses : " The primary precaution regarding the tilt lock adjuster is that proper occupant restraint is provided only if the webbing is properly looped around the lock bar ".

In this case, the system consists of a metal rectangular ring, a C-shaped locking bar /slider and a plastic cover. The C-shape slider is a metal bar with curved ends resting on one side of the rectangular ring and held in place by two small lips. Some play ensures that the locking bar can slide freely over the rectangular ring.

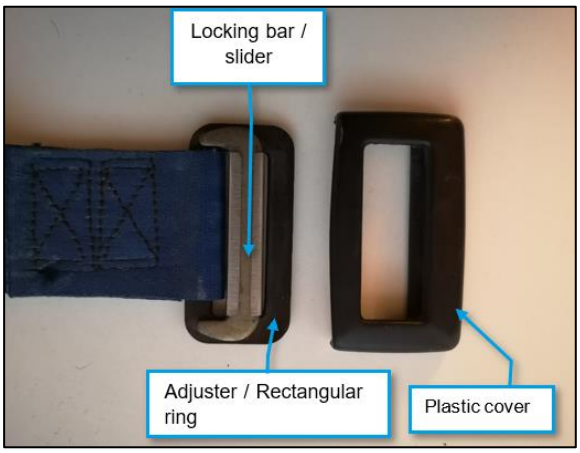

Figure 15 : front side of the adjuster assembly

Figure 16 : other side of the adjuster assembly

The webbing has to be looped over the locking bar /slider and pulled back through the rectangular ring so that when a force (F) is exerted on lap belt, the slider is forced against the rectangular ring clamping the webbing in between.

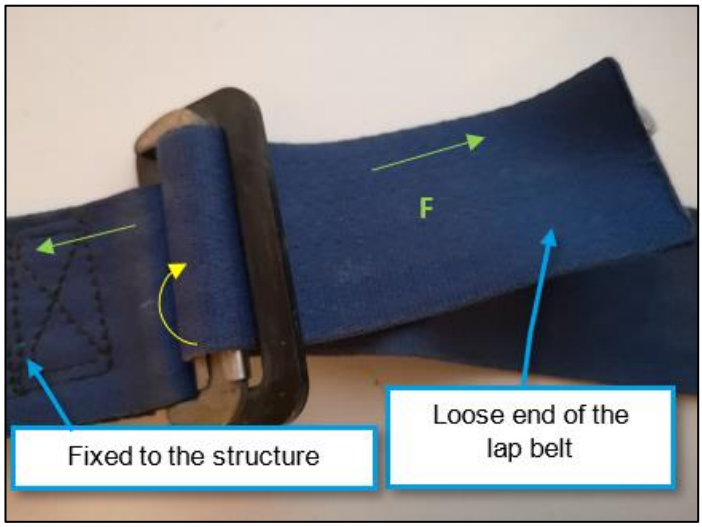

Figure 17 : correct installation

Figure 18 : correct installation with cover

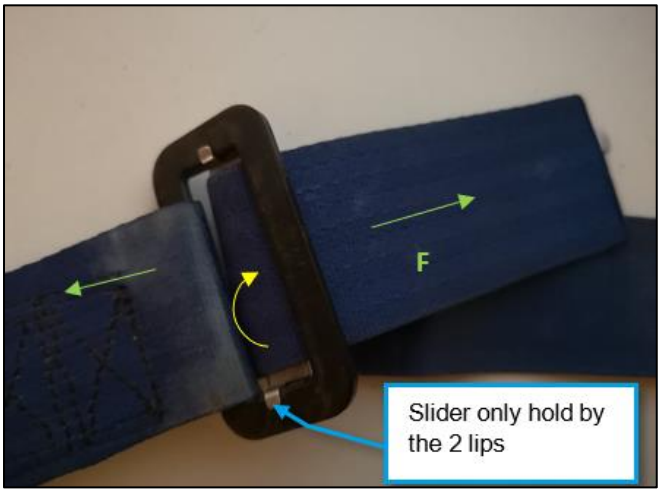

Figure 19 : Incorrect installation

On the accidented aircraft, the adjuster was found separated. The rectangular ring still fixed to the structure and the plastic cover with the locking bar /slider on the harness assembly, the 2 small lips were bent open.

In the event that the webbing is wrapped around the other side of the locking bar / slider, the forces exerted on the lap belt will only be taken up by the two small lips holding the locking bar in place. These lips are not sized to withstand impact shocks.

Figure 20 : failed RH adjuster

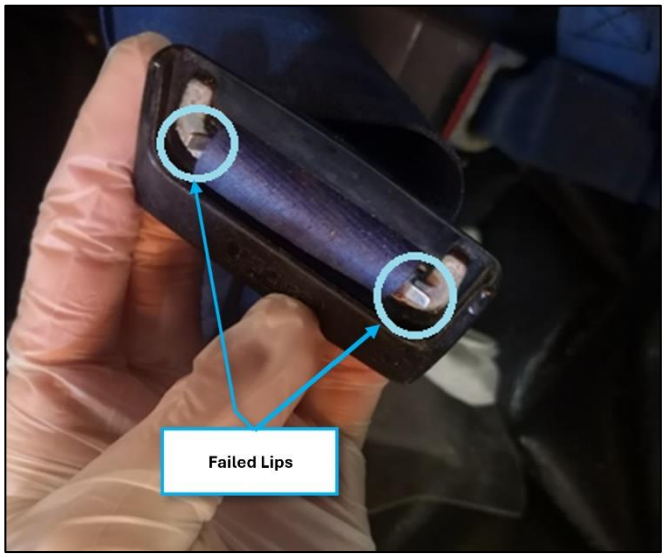

Figure 21 : The failed lips show the belt was incorrectly installed.

1.16 Tests and research

Not applicable.

1.17 Organizational and management information

1.17.1. Operation of the accidented ultralight

The aircraft was flying under the French identification markings and provided with an Identification Card issued by the French DGAC on 09/04/2014. This identification card was accompanied by the document (DGAC issued) : "Acknowledgement of receipt of the declaration of airworthiness of an ULM", valid from 08/05/2020 until 07/05/2022.
While under French identification markings, the ultralight aircraft appears to have always been operated and based in Belgium by its various previous owners and exclusively in Maillen (EBML) by the last pilot-owner of the accident.

The maintenance was carried out by the pilot-owner in accordance with the regulations in force.

On 2 September 2009, the Belgian CAA issued to the accident ultralight a permanent overflight authorisation above the Belgian territory for an unlimited period, this document being subject to the validity of both the French identification card and aircraft insurance coverage.

The conditions of validity of the Belgian flight-permit document included the following restrictions :

- the pilot must be in possession of an appropriate and valid French ULM pilot licence;
- the aircraft must not be subject to any structural modification;
- this authorisation allows in-flight visits but does not authorise the aircraft to be kept permanently on Belgian territory.

1.17.2. National regulations on ULM

a) The French national regulations for admission to airworthiness of ULM (aircraft weighing less than 500 kg in class 3 - multi-axis without parachute) are based on a declaration system done by the owner, in accordance with the legislation included in the Decree of September 23, 1998 and the Instruction of June 24, 2019 relating to ultralight motorized aircraft (ULM).

These regulations require for the in-flight operation of the aircraft :

- a valid ULM Identification Card (document issued by the DGAC);
- a declaration of airworthiness for the ultralight aircraft completed and signed by the owner, renewed every 24 months and sent to the DGAC ;
- the acknowledgment of receipt provided by the DGAC and valid for 24 months after reception of the airworthiness declaration sent by the owner.

The French national regulations on ULM pilot's certificates and licenses are issued under the amended Decree of 31 July 1981, related to certificates, licenses and qualifications of non-professional pilots in civil aviation (aircraft flight crew) and the amended Decree of 4 May 2000 related to the programs and examination system for the ULM pilot's certificate and license. These regulations require a theoretical examination with the DGAC as well as practical instruction with a qualified instructor, but do not require a specific medical examination in order to renew the ULM pilot's license.

b) At the time of accident, the Royal Decree of 12 February 1999 sets out, as national regulation in Belgium, the technical conditions that ultralights must meet in order to be a model which is authorized in flight by the BCAA (type authorization - certificate of conformity).

This Royal Decree of 12 February 1999 also sets out the conditions required to obtain a restricted air traffic authorisation (ARCA), the training formalities and the conditions required to obtain an ultralight pilot's licence. The validity of the ultralight pilot's licence in Belgium was subject to a class 4 medical certificate.

According to this national regulation, the Belgian CAA could issue 2 different kind of authorisation to a foreign registered ultralight aircraft, in order to fly over the Belgian territory :

- A permanent authorisation (without any time limitation on the validity of the document) if the applicant's ultralight model is among the list of models recognised as airworthy compliant by the BCAA ;

- a temporary authorisation for other ultralight models not recognised by the BCAA. This document would authorise the applicant to operate the aircraft for a period of 30 days of overflight during the year of validity of the authorisation.

Overflight permits issued to foreign ULMs only concern the type conformity of the model and the airworthiness condition of the ultralight aircraft.
No other condition or restriction other than the validity of the foreign issued license, related to the aircraft identification marks, would affect the pilot.

1.18 Additional information

Effectiveness of the elevator system on the Chickinox.

The elevator system installed on the Chickinox is made of a fabric covered tubular monobloc surface. During investigation interviews, the Chickinox designer and many pilot users highlighted the importance of the propeller downwash (airstream) on the elevator surface to ensure its effectiveness.

The example often mentioned was about an engine-off landing. During this maneuver, with the engine switched off, an adequate flare is more difficult to perform at low speed. This maneuver requires a higher approach speed to ensure sufficient downforce on the elevator and to be able to perform the final pitch-up of the aircraft during the flare, before the wheels touch the ground. Depending on some flight conditions, it was also mentioned the need to "blow" the elevator surface by increasing engine power (throttle) to improve its effectiveness.

As a conclusion, the speed of airflow is an important factor acting on the authority of the Chickinox elevator surface, which could be influenced either by an unexpected loss or by a throttle increase/decrease of engine RPM. However, when the elevator's rigging is within limits, the aircraft should remain controllable throughout the entire operating range of the engine.

2. ANALYSIS

2.1 Technical condition of the aircraft

The inspection of the wreckage revealed three anomalies :

- An inadequate installation and rigging of the elevator control cable (Teleflex).
- An inadequate installation of the righthand lap-belt adjuster of the pilot's safety harness (see chapter 2.5. survivability hereunder).
- A weak fixation of one of the carburettors (2 installed on the engine).

2.1.1 Inadequate installation and rigging of the elevator control cable.

The inspections performed on the elevator assembly and the elevator control cable showed that the works performed by the pilot-owner resulted in an inadequate rigging of the elevator, limiting the downward travel of the elevator.

The works were required due to the in-service normal deformation of the tail parts, in particular the 'Kangourou'. Replacement parts, with possible slight differences in geometry were taken from another aircraft. The aircraft manufacturer's instructions are available and describe how these works have to be performed, concluding with the rigging of the elevator. However, these instructions may not cover all details and suppose that the person performing the work should have an adequate technical knowledge, or when faced with a problem would look for specialised help or further search for additional documentation.

The installation instructions define that the rigging should be made on the adjustable parts of the elevator control cable clevis and spring to ensure that the neutral position of the control column corresponds to a specific neutral position (deflection) of the elevator. The adjustable clevis was found fully screwed (while it should have been unscrewed somewhat), while a geometric correction was brought by changing the fixation point of the Teleflex control cable onto its fixation plate. This last action is not described in the manufacturer's documentation and actually changed the deflection range of the elevator.

The pilot would have replaced the parts on aircraft based on their similitude and expecting probably that the original rigging would remain valid. He performed a first test flight that showed that the aircraft had a different behaviour after the works (tendency of pitching up). The changes brought before the second test flight (as described in chapter 1.12.3 c - 'Elevator controls' of this report) show that the pilot did not managed adequately the adjustment of the elevator control system.

The corrections to the elevator control system brought by the pilot-owner had the following consequences :

- The former reference positions of the control column (neutral - pitch up - pitch down) do no longer reflect the actual airplane behavior.
- The inadequate rigging was found to induce a pitch down tendency of the airplane when the control column would be in the marked neutral position, forcing the pilot to a constant correction in level flight (although the airplane was equipped with an elevator trim tab).
- The achievable rate of climb of the aircraft was limited, due to new rigging decreasing the leading edge lower deflection of the elevator (shorter travel against the Teleflex internal housing).

Nevertheless, the inadequate rigging of the elevator control cable would have rendered the aircraft more difficult to control, but would not explain the sudden loss of control of the ULM after an anticipated successful turn back to the airfield, as observed by the witnesses.

2.1.2 Weak fixation of one of the carburettors.

The attachment of the second carburettor to the intake manifold flange was weak. This could have led to the disconnection of the carburettor from the engine block in flight.
The investigation has not been able to determine if the disconnection of the carburettor from the manifold was due to the ground impact or happened at another moment of the flight.

2.2 The accident flight

The aircraft was not equipped with any equipment (GPS) able to record parameters from the flight. Only recollection of witnesses could be used during the investigation, along with the findings on the ground.

From these information, the investigation determined that the ultralight aircraft took off in crosswind condition, but its rate of climb was abnormally low due to the limited action of the elevator, caused by the inadequate rigging of the elevator control cable.

Nevertheless, the aircraft continued to fly straight ahead, West of the runway, until gaining sufficient altitude. It was then seen turning left, back to the runway.

While the aircraft was above the wood bordering the airfield (located 900 m in a West - South - West of EBML), witnesses reported the aircraft went out of control, seeing the aircraft tipping over on its left wing, pitching down. The damage on the trees indicates a vertical fall into the

wood. The wreckage being found with an orientation of 240 degrees could indicate a deviation of 140 degrees with respect to its assumed heading, the airfield.

A possible contributing factor to take into account is the effectiveness of the elevator surface. During the climb at full engine power, the propeller wash has accelerated the airflow over the elevator surface. This could have provided enough downforce in the nose-up attitude for the ultralight to climb on a low path to a sufficient altitude, despite the reduced angle of attack of the elevator compared to an adequate rigging of the teleflex.

After the turn, in stabilized horizontal flight, it is possible that the pilot reduced the engine RPM on the throttle like done usually during a normal flight. The reduced propeller wash over the elevator surface could then also have modified the maneuverability of the ultralight, impacting the control cues on the stick and the authority of the elevator for nose-up inputs.

2.3 The pilot

The pilot was qualified and had a lot of flying experience on this aircraft.

The recent medical history of the pilot and the fatigue due to the physical work on the aircraft, as reported by some fellow-pilots at EBML, could have hindered his capacity to manage adequately the fine rigging performed on the elevator system of the ultralight aircraft. The same factors coupled with a possible increase in personal stress due to the unwanted reaction of his aircraft during the accident flight may have influenced his capacity of piloting the aircraft in unusual conditions.

Holder of a French ULM pilot's license (instead of a Belgian licence), the pilot was not required by the Regulations to seek a medical opinion on the maintenance of his ability to fly.

This could lead to the possibility that the pilot became ill during the flight, performed the turn, but became eventually incapacitated, resulting in the loss of control. No autopsy was performed on the body of the pilot, so this cannot be confirmed.

2.4 Meteorological aspects

The accident occurred above a wooden area at low height with a cross wind of 6 to 9 kt when the aircraft was flying level. The meteorological report does not mention wind gusts and witnesses only recall the wind direction.

2.5 Survivability

The webbing of the safety belt was installed wrongly, causing the right-hand side of the safety harness to open when subjected to unusual forces, such as the impact forces or the full weight of the pilot.

The investigation determined that the safety harness installed on the aircraft originated from another aircraft but could not determine when or how the faulty installation of the RH adjuster occurred. The aircraft POH and installation manual do not describe the installation of the safety harness.

The death of the pilot may have occurred as a consequence of the accidental opening of the safety belt, causing him to be ejected during the fall of the aircraft into the wood, however, this could not be determined with certainty, as no autopsy was performed.

3. CONCLUSIONS

3.1 Findings as to causes and contributing factors

- As described hereunder, the investigation determined several technical issues, none of which would cause an immediate loss of control of the airplane. No other major technical defect on the aircraft and its engine was found.
- No autopsy was performed to determine the cause of the death of the pilot. Owing to the medical condition of the pilot in the recent past, the physical activity carried out on the aircraft in the days preceding the accident and the stress induced by an airplane becoming difficult to control, the investigation could not exclude that the pilot may have felt unwell and unable to control the aircraft during the return flight to the airfield.

3.2 Findings as to risk

- The first flight performed after the replacement of the tail section parts was characterized by a shorter takeoff of the aircraft and a neutral position of the control column abnormally too much forward. This phenomenon is in relation with the change in the geometry of the tail section resulting from the installation and rigging of the new tail section parts.
- The modification performed before the second (accident) flight consisted with installation and rigging of the teleflex cable for the elevator control that was not carried out in accordance with the instructions in the user manual.
- The teleflex cable housing for the elevator control was found installed higher than normal on its support plate, without any change on the cockpit side. This change would modify the position of the elevator and the range of its deflection. This had the following consequences:
    - The former reference positions of the control column do no longer reflect the actual airplane behavior.
    - The inadequate rigging was found to induce a pitch down tendency of the airplane when the control column would be in the marked neutral position, forcing the pilot to a constant correction in level flight (although the airplane was equipped with a trim tab).
    - The inadequate rigging has been found to limit elevator action, thereby limiting the airplane's achievable rate of climb and ultimately forcing the pilot to fly farther beyond the normal distances of the circuit to reach a sufficient altitude.

- Due to a faulty installation, the safety harness opened, causing the pilot to be ejected from his seat during the fall of the airplane in the wood.

3.3 Other findings

- The pilot-owner had extensive knowledge on flying and on the flight characteristics of his Chickinox, recognized by his peers in the flying club.
- The airplane was found to incorporate several parts reportedly originating from other ULM airplanes owned by the pilot-owner. These installations were performed by the pilot-owner.
- The airplane was flown by the pilot-owner without known accident since the year 2017.
- From its manufacture, the airplane has always been based and operated in Belgium by Belgian owners. The French registration, dating from 2008, was issued for various owners residing in Belgium and flying under permanent authorization to fly over Belgian territory.
- The pilot-owner performed the replacement of the Kangourou and tail struts before the accident due to the normal deformation of these parts.
- The weight and balance of the airplane for the flight was estimated to be within the design limits.
- The pilot managed adequately the take-off with a crosswind of 6 to 9 kt, under the maximum crosswind limit of 11 kt determined by the airplane manufacturer.
- After having reached a sufficient altitude, the airplane turned back towards the airfield.
- The aircraft was seen to tip onto its left wing and spiral down to the ground into the wood.
- Due to a faulty installation, the safety harness opened causing the pilot to be ejected from his seat.
- The engine and its propeller were rotating at high speed at impact.

4. SAFETY ACTIONS AND RECOMMENDATIONS

*A **safety issue** is a safety factor that (a) can reasonably be regarded as having the potential to adversely affect the safety of future operations, and (b) is a characteristic of an organization or a system, rather than a characteristic of a specific individual, or characteristic of an operational environment at a specific point in time.*

*A **safety action:** the steps taken or proposed to be taken by an organization or agency on its own initiative in response to a safety issue.*

*A **safety recommendation** is a proposal by the safety investigation authority in response to a safety issue and based on information derived from an investigation and/or study. It's aimed to improve the safety of an organisation and/or system and therefor always addressed to an organisation and/or agency, never to a specific individual. The sole purpose of a safety recommendation is the prevention of accidents or incidents and the reduction of the consequences of such occurrences. It, in no case has the purpose of creating a presumption of blame or liability for an accident or incident. Neither does it reflect the level of contribution to a specific accident or incident.*

*A **safety lesson learned** is the knowledge and insight gained through an individual's experience, intended to be applied to prevent similar events from occurring in the future.*

*A **safety message:** An awareness which brings to attention the existence of a safety factor and the lessons learned. AAIU can distribute a safety message to a community (of pilots, instructors, examiners, ATC officers), an organization or an industry sector for it to consider a safety factor and take action where it believes it appropriate. There is no requirement for a formal response to a safety message.*

4.1 Safety issue: less strict medical requirements for ULM pilots holding a foreign license but in general flying in Belgian territory

The medical condition of the pilot may have been a contributing factor to this accident. The accident pilot was of Belgian nationality and living in Belgium. He was holding a French ULM pilot licence, flying a French-registered aircraft that was permanently based in a Belgian airfield and flown over Belgian territory with a permanent permit to fly issued by the BCAA. He was able to determine that he was fit to fly during and after a period of illness, without the support of a medical advice. The Belgian Regulation pertaining to medical fitness of ULM pilot requires a medical examination while the French regulation requires no medical survey for the renewal of ULM pilot licence.

Similar cases occurred with ultralight aircrafts in previous accident over the Belgian territory. This situation led to Safety Recommendation 2019-05, issued on 17/04/2019 by the AAIU:

It is recommended that the Belgian Civil Aviation Authority (BCAA) couples the permission (either temporary or permanent) to fly over Belgian territory to a foreign registered aircraft without a Certificate of Airworthiness i.a.w. ICAO Annex 8 (such as ultralight aircraft) to all license holders who will fly with that aircraft (thus not only the owner) and requires those license holders to have a valid medical certificate that is at least equal to the one required for pilots flying such a Belgian registered aircraft.

Actions taken by the BCAA :

At the time of this accident, the above safety recommendation wasn't addressed yet and Royal Decree regulating the operation of ultralight aircraft (Royal Decree of 25 May 1999) was still in force.
In the meantime, the latter has been repealed and replaced by the new Royal Decree of 24 December 2024. This Royal Decree still obligates Belgian pilots of a Belgian registered ultralight aircraft to hold a medical certificate. However, the previous national class 4 requirements have been replaced by the requirement to hold at least a medical certificate LAPL (or Class 1 or 2), issued and valid in accordance with EASA Part-MED (Annex IV) rules of Commission Regulation (EU) No 1178/2011.

This new Royal Decree also amends the Royal Decree of 16 March 2009, establishing the conditions for the admission to air traffic of certain aircraft that do not have a certificate of airworthiness. Article 9/1 is added: "*Any ULM (ultralight aircraft) registered abroad and stationed on the territory of the Kingdom for a period of more than 180 nights per calendar year must comply with the royal decree concerning ultralight motorized aircraft*".
It was confirmed by the BCAA that the obligation to comply with the Belgian regulations also concerns the medical requirement to hold at least a medical certificate LAPL.

The dispositions of the Royal Decree of 25 May 1999 concerning the issuance of a permanent permit to fly to foreign registered ULM have also been repealed by this new Decree.

4.2 Safety factor: Carrying out extensive maintenance without detailed guidance

The investigation showed that the pilot-owner performed extensive maintenance actions on critical parts of the aircraft. The findings indicate that these actions did not comply with the manufacturer's documentation and had a significant influence on the flight characteristics of the aircraft and the good working of safety equipment. The various regulations - according to the country of aircraft registration - pertaining to ULM maintenance may not impose requirements that would alleviate the risk of maintenance errors.

Safety message:

AAIU Belgium encourages ULM pilot-owners, wanting to perform extensive maintenance on critical systems, to ensure the use of the aircraft / engine / optional equipment manufacturers' instructions, to study them thoroughly and in case of unclear situation or when facing with a problem, to take contact with the manufacturer.

4.3 Impact on future investigation procedures

AAIU Belgium will proactively work with Belgian justice in order to facilitate the execution of an autopsy in future aviation accidents in which the pilot got fatally injured and by absence of immediate other evidence, the incapacitation of the pilot cannot be excluded.

5. SYMBOLS AND ABBREVIATIONS

’	Minute
‘’	Second
°C	Degrees centigrade
AAIU(Be)	Air Accident Investigation Unit (Belgium)
BCAA	Belgian Civil Aviation Authority
cm	Centimeter
C of G	Center of Gravity
DGAC	Direction Générale de l’Aviation Civile (French Authorities)
DGTA-DGLV	Direction Générale du Transport Aérien -Directoraat-Generaal Luchtvaart (Belgian CAA or BCAA)
EBBR	Brussels Airport
EBCI	Charleroi Airport
EBLG	Liege Airport
EBML	Maillen airfield
FH	Flight Hour
ft	Feet
GPS	Global Positionning System
HP	Horse Power
kg	Kilogramme
km	Kilometer
kt/KT	knot
kW	KiloWatt
l	Liter
LE	Leading Edge
LFQJ	Maubeuge airfield
LOC-I	Loss of Control in flight
m	Meter
MHz	Megahertz
MTOW	Maximum Take-Off Weight
NOSIG	No significant change
QFE	Atmospheric pressure at aerodrome elevation
QNH	Atmospheric pressure at mean sea level (MSL),
ULM	Ultralight Motorized Aircraft
UTC	Universal Time Coordinated
Vne	Speed never exceed
Vs	Stall speed
Vc	Cruise speed

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