

الهيئة العامة للطيران المدني
GENERAL CIVIL AVIATION AUTHORITY



Air Accident Investigation Sector Accident – Final Report –

AAIS Case N°: AIFN/0002/2018

Impact with Building After Takeoff

Operator:	UAL Incorporated
Make and Model:	SkyRunner MK 3.2
Nationality:	The United States of America
Registration:	N143SR
Place of Occurrence:	Sky Hub Margham, Dubai
State of Occurrence:	The United Arab Emirates
Date of Occurrence:	9 February 2018



This Investigation was conducted by the Air Accident Investigation Sector of the United Arab Emirates (AAIS) pursuant to Civil Aviation Law No. 20 of 1991, in compliance with Air Accident and Incident Investigation Regulations, and in conformance with the requirements of Annex 13 to the Convention on International Civil Aviation.

This Investigation was conducted independently and without prejudice. The sole objective of the investigation is to prevent future aircraft accidents and incidents. It is not the purpose of this activity to apportion blame or liability.

The AAIS issued this Final Report in accordance with the national and international standards and best practice. Consultation with applicable stakeholders, and consideration of their comments, took place prior to the publication of this Report.

The Final Report is publicly available at:

<http://www.gcaa.gov.ae/en/epublication/pages/investigationReport.aspx>

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Accident Brief

AAIS Report No.:	AIFN/0002/2018
Operator:	UAL Incorporated
Aircraft Type:	SkyRunner MK 3.2
Registration:	N143SR
MSN:	0116C 914 MK 32503 007
Number and Type of Engines:	One ROTAX 914 UL (Elite) – Inflight use One Polariz Prostar 1000 – Ground manoeuvring
Date:	9 February 2018
Location:	Sky Hub Margham, Dubai, the UAE
Type of Flight:	Powered parachute
Persons onboard:	2
Injuries:	The pilot and the passenger sustained serious injuries

Investigation Process

The Duty Investigator of the Air Accident Investigation Sector (AAIS) was informed of the Accident, involving a SkyRunner powered parachute, which occurred during a demonstration flight conducted at the Sky Hub facility in Margham, Dubai. The occurrence was notified to the Duty Investigator hotline number +971 50 641 4667.

The AAIS appointed an investigator-in-charge (IIC) and notifications and participation entitlement letters were sent to the National Transportation Safety Board (NTSB) of the United States as the State of the Aircraft Design and Manufacture, and the Federal Safety Investigation Authority of Austria as the State of the engine manufacturer. The General Civil Aviation Authority, Dubai Civil Aviation Authority, Skydive were also notified. The AAIS led the Investigation and issued this Final Report.

The information contained in this Final Report is derived from the factual information gathered during the Investigation. Comments received from the stakeholders were reviewed and amendments were made before the Report was finalized.

This Final Report is published at the link below:

<https://www.gcaa.gov.ae/en/epublication/pages/investigationreport.aspx>

Notes:

¹ Whenever the following words are mentioned in this Report with the first letter capitalized, it shall mean:

- (Accident) – this investigated accident
- (Aircraft) – the SkyRunner powered parachute involved in this accident
- (Investigation) – the investigation into this accident



- (Operator) – UAL Incorporated (UAL Inc.)
 - (Pilot) – the pilot of the accident flight
 - (Report) – this investigation Final Report
- ² Photos and figures used in this Report are taken from different sources and are adjusted from the original for the sole purpose of improving the clarity of the Report. Modifications to images are limited to cropping, magnification, file compression, or enhancement of color, brightness, contrast or insertion of text boxes, arrows or lines.
- ³ Unless otherwise mentioned, all times in this Report are local time (LT) (UTC plus 4 hours).



Abbreviations and Definitions

AAIS	Air Accident Investigation Sector of the United Arab Emirates
AGL	Above ground level
CCTV	Closed-circuit television
CG	Center of Gravity
CHT	Cylinder head temperature
°C	Degree Celsius
EGT	Exhaust gas temperature
EMS	Engine monitoring system
°F	Degrees Fahrenheit
FAA	The Federal Aviation Administration of the United States
ft	Feet
fpm	Feet per minute
GCAA	The General Civil Aviation Authority of the United Arab Emirates
hp	Horsepower
kg	Kilogram
kN	Kilonewton
kW	Kilowatt
lb	Pound
lbf	Pound-force
LSA	Light sport aircraft
LT	Local time
METAR	Meteorological terminal aviation routine weather report
MHz	Megahertz
mm	Millimeter
mph	Miles per hour
MSN	Manufacturer serial number
MTOW	Max take-off weight
nm	Nautical mile(s)
POH	Pilot operating handbook
PPC	Powered parachute
SLSA	Special light sport aircraft
rpm	Revolutions per minute
UAE	The United Arab Emirates
UTC	Universal time coordinated



Synopsis

On 9 February 2018, at 1005 local time (LT), a SkyRunner powered parachute, registration N143SR, departed SkyHub, Margham, Dubai, the United Arab Emirates, to conduct a demonstration flight with a private Pilot and a passenger onboard. After takeoff, which was towards the southeast, the powered parachute failed to gain height and impacted a building resulting in serious injuries to both occupants and extensive damage to the Aircraft. After initial first aid on site, both the Pilot and the passenger were transported to the hospital to continue medical treatment.

A video recording obtained from closed-circuit television (CCTV) cameras and video recorded by personnel on the ground, who witnessed the event, provided valuable information to the Investigation. The video recordings also provided information on wind direction, and indications of a cross-wind during the takeoff were observed.

The Aircraft was certified by the Federal Aviation Administration of the United States (FAA) and registered by the Operator (UAL Inc.), it was imported into the United Arab Emirates for demonstration purposes. The Pilot possessed a private powered parachute pilot category license, which was issued by the FAA in January 2018. UAL Inc. did not obtain flying permission from the authorities in the United Arab Emirates, and no airworthiness inspection of the Aircraft involving the General Civil Aviation Authority (GCAA) was carried out.

This Final Report recommends that the Operator review its pilot hiring procedures and procedures related to seeking permission to operate flights. Further recommendations relate to adherence to policies and procedures regarding flying permits and airworthiness inspections.

The special airworthiness certificate issued by the FAA should be checked for validity as the ROTAX engine warranty is voided upon modification of the fuel injection system.



Contents

Accident Brief	iii
Investigation Process	iii
Abbreviations and Definitions	v
Synopsis	vi
1. Factual Information	1
1.1 History of the Flight	1
1.2 Injuries to Persons	2
1.3 Damage to Aircraft	2
1.4 Other Damage	2
1.5 Personnel Information	3
1.6 Aircraft Information	3
1.6.1 General data	3
1.6.2 Aircraft data	5
1.6.3 Aircraft Altimeter	5
1.6.4 Aircraft Performance	6
1.6.5 Engines	6
1.6.6 Engine Fuel System Modification	7
1.6.7 Engine limitations	7
1.6.8 Aircraft parachute wing	7
1.6.9 Parachute risers	8
1.6.10 Crosswind limitations	9
1.6.11 Pre-flight check	9
1.7 Meteorological Information	11
1.8 Aids to Navigation	11
1.9 Communications	11
1.10 Aerodrome Information	11
1.11 Flight Recorders	11
1.12 Wreckage and Impact Information	12
1.13 Medical and Pathological Information	12
1.14 Fire	12
1.15 Survival Aspects	12
1.15.1 Pilot and passenger restraint and safety equipment	12



1.15.2	Fuselage.....	13
1.15.3	Undercarriage and brakes	13
1.15.4	Flight control surfaces.....	14
1.16	Tests and Research.....	14
1.17	Organizational and Management Information.....	14
1.17.1	UAL Inc.....	14
1.17.2	Skydive Dubai.....	14
1.18	Additional Information	14
1.19	Useful or Effective Investigation Techniques.....	14
2.	Analysis	16
2.1	General.....	16
2.2	Flight Sequence.....	16
2.2.1	Set wing.....	16
2.2.2	Wing suspension lines twist	17
2.2.3	Start of the take-off roll	18
2.2.4	Liftoff	19
2.2.5	Aircraft flight profile	19
2.3	Wind Conditions.....	20
2.3.1	The National Center of Meteorology (NCM) report.....	20
3.	Conclusions	22
3.1	General.....	22
3.2	Findings	22
3.2.1	Findings relevant to the Aircraft	22
3.2.2	Findings relevant to the Pilot.....	23
3.2.3	Findings relevant to Skydive Dubai incorporated	23
3.2.4	Findings relevant to the Operator.....	23
3.3	Causes	23
3.4	Contributing Factors to the Accident	23
4.	Safety Recommendations	24
4.1	General.....	24
4.2	Final Report Safety Recommendations.....	24
4.2.1	UAL Incorporated	24
4.2.2	The Federal Aviation Administration of the United States (FAA)	24
4.2.3	SkyRunner LLC	24



4.2.4	Skydive Dubai.....	25
4.2.5	General Civil Aviation Authority of the United Arab Emirates (GCAA)	25
5.	Appendices	26
	Appendix 1. Increased Maximum Weight on Sunriser PG-550	26
	Appendix 2. Special Airworthiness Certificate issued by FAA	27
	Appendix 3. Grant of Exemption No. 15422A issued by FAA.....	28

List of tables

Table 1. Pilot information
Table 2. Aircraft data
Table 3. Aircraft performance data
Table 4. Engine and propeller data
Table 5. Engine Limitations
Table 6. SkyRunner parachute equipment

Table of Figures

Figure 1: Sky Hub location of the Accident
Figure 2: General view of Aircraft damage
Figure 3: Damage to the building
Figure 4: SkyRunner carriage and parachute assembly
Figure 5: SkyRunner Altimeter
Figure 6: ROTAX 914 UL (Elite) engine
Figure 7: Parachute PG-550
Figure 8: Parachute Quick links
Figure 9: Parachute Shackles
Figure 10: Pre-flight check steps
Figure 11: Engine Monitoring System - Dynon EMS-D10
Figure 12: SkyRunner wreckage
Figure 13: Wing arm CG adjustment mechanism
Figure 14: Wing Inspection by Pilot
Figure 15: Set Wing before take-off
Figure 16: Wing suspension lines
Figure 17: Crosswind effect on a parachute at start of the takeoff roll
Figure 18: Still from take-off video
Figure 19: Windsock angle
Figure 20: Take-off environment and wind effect

1. Factual Information

1.1 History of the Flight

On 6 February 2018, a SkyRunner Aircraft, registration N143SR, conducted a demonstration flight at Skydive, Nad Al Shiba, Dubai, the United Arab Emirates. The occupants of the privately operated Aircraft were the Pilot and a passenger.

On 9 February 2018, at 1005 local time (LT), a further demonstration flight was conducted from SkyHub, Margham, Dubai, by the same Pilot and with the same passenger.

For the second flight, the Aircraft took off toward the southeast on a heading of 160 degrees. After liftoff, the Aircraft failed to gain height and within 15 seconds it impacted a 23 ft. high building which was located on the runway heading, resulting in the occupants of the Aircraft suffering serious injuries. The building was located 300 meters from the liftoff point.

After receiving initial first aid on site, both the Pilot and the passenger were transported to the hospital to continue medical treatment. The Aircraft sustained extensive damage to its structure, chassis, and propeller.

Closed-circuit television (CCTV) camera recordings and observations by personnel on the ground, who witnessed the occurrence, provided valuable information to the Investigation. The video recordings also provided an indication from flags and a windsock¹ positioned at the side of the take-off area as to the wind direction during the takeoff. The recording showed that the Aircraft was subjected to a significant crosswind component.

At 0953 LT, the Pilot positioned the Aircraft on an open grass area for the pre-flight check. He completed the engine start and the warm-up pre-takeoff checklist at 0958 LT. He then taxied the Aircraft to the north side of the runway to prepare for takeoff (figure 1).

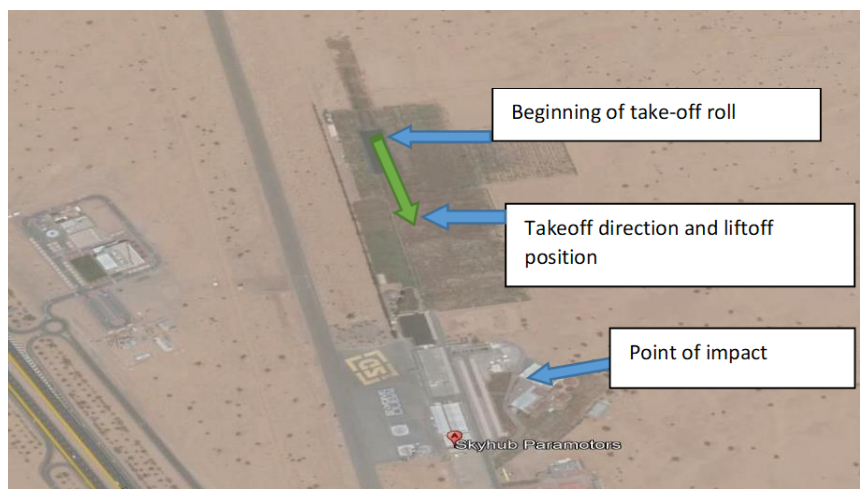


Figure 1. Sky Hub location of the Accident

¹ A windsock is a conical shaped textile tube, which resembles a giant sock. Hence its name: windsock. It is designed to indicate wind direction and relative wind speed. It is normally placed next to the runway or a helipad, so that pilots can easily see it after lining up on the runway or coming in for landing. It is also indicated on most airport ground charts with a specific symbol, that resembles the shape of a fully blown windsock. <https://www.hollandaviation.nl/en/aviation-windsock/>

The take-off roll was commenced at 1015 LT approximately on a southerly heading of 160 degrees. The Aircraft lifted off after 150 meters and was airborne for 15 seconds before it impacted a building located to the southeast of the runway heading (figure 1).

The Aircraft impacted the edge of the building roof, some seven meters above ground level, at a distance of approximately 300 meters from the liftoff point. The impact caused the Aircraft to be deflected over the roof and it fell to the ground on the right side of the building. The Accident was reported to the paramedics, at approximately 1035 LT. Both the Pilot and passenger were transported to the hospital with serious injuries due to the impacts with the building and the ground.

1.2 Injuries to Persons

The Pilot and passenger suffered serious injuries.

1.3 Damage to Aircraft

The forward wheels of the Aircraft impacted the building, separated, and fell to the ground. The Aircraft frame structure was damaged and both left side wheel shafts were broken and detached. There was no external damage to the engine but the propeller was damaged. The Aircraft structure was damaged beyond repair (figure 2).



Figure 2. General view of Aircraft damage

1.4 Other Damage

There was damage to the building as shown in figure 3, but no other damage to the environment.



Figure 3. Damage to the building

1.5 Personnel Information

The Pilot held a temporary airman certificate with the classification of private pilot powered parachute land, which was issued on 24 January 2018 in accordance with the existing requirements of the Federal Aviation Administration of the United States (FAA). He had previous experience in paramotor parachute flying and had an unregistered total flight time of five hours on the SkyRunner Aircraft prior to the Accident.

Table 1 below provides the Pilot information:

Table 1. Pilot information	
Age	33
Type of license	Temporary airman certificate
Valid to	23 April 2018
Rating	Private pilot powered parachute land
Total flying time (hours)	5 hours (unregistered)
Total on this type (hours)	5 hours
Total last 90 days (hours)	5 hours
Total on type last 90 days (hours)	5 hours
Total last 7 days (hours)	1 hour
Total on type last 7 days (hours)	1 hour
Total last 24 hours (hours)	nil
Medical class	3
Valid to	22 October 2019
Medical limitation	None

1.6 Aircraft Information

1.6.1 General data

The Aircraft was certificated under the special light-sport aircraft (SLSA) type according to the certification specifications of the *Federal Aviation Regulations* of the United States (*FAR*).

The FAA issued a grant of exemption, number 15422A, regulatory docket number FAA-2015-8564 (Appendix 3 attached to this report). The exemption allowed the SkyRunner MK3.2 powered parachute aircraft to be designed, operated, and to be issued with an airworthiness certificate in the SLSA category with a maximum take-off weight (MTOW) of 1,800 pounds. The airworthiness certificate issued did not have an expiry date and was described as unlimited (Appendix 2 attached to this report).

The SkyRunner aircraft (figure 4) is a powered parachute with a carriage constructed of welded steel tubing. It was fitted with two engines: one for ground movement and a second with an attached propeller for air operation. The Aircraft does not require a flat paved surface for takeoff or landing. It can take off and land in off-road conditions. The parachute provides the necessary lift.



Figure 4. SkyRunner Aircraft: carriage and parachute assembly

The major components of the Aircraft were:

1. Two Engines: ROTAX 914 UL (Elite) – Inflight use
Polariz Prostar 1000 – Ground manoeuvring
2. Ground steering: Steering wheel (right, to turn right, left to turn left).
Center of gravity brackets: Compensate for pilot weight, putting the Aircraft into a slightly nose-high attitude.
3. In-flight Steering: Operated by the foot pedals and/or hand toggles, and attached to the trailing edges of each side of the wing to control drag and result in turning the Aircraft.
4. Throttle Quadrant (located on the right side): Pushing the throttle up would cause ascent, pulling it down would cause descent.
5. Parachute wing with 13 cells: Open at the front and closed at the back to maintain the air pressure required to form a rigid wing.
6. Risers: Were the connection between the suspension lines and the carriage. Also known as “V lines,” the risers were the intermediate link between the suspension lines and the airframe.

1.6.2 Aircraft data

Table 2 provides general Aircraft data:

Table 2. General Aircraft data			
Manufacturer		SkyRunner LLC	
Model		MK 3.2 Elite	
Manufacture serial number		0116C 914 MK 32503 007	
Date of manufacture		2016	
Nationality		The United States of America	
Registration		N143SR	
Maximum take-off weight		1,800 lb (816 kilograms)	
Take-off distance	450 feet	Landing distance	450 feet
Special airworthiness certificate issued by the FAA Category: Light sport Issue date: 24 February 2017 Valid to: Unlimited			

1.6.3 Aircraft Altimeter

The Aircraft was equipped with a velocity altimeter shown in figure 5, the ALT-3, a 3 1/8" instrument that contained a precision altimeter and a wide range vertical speed indicator. The altimeter conformed to ANSI standard atmosphere rules from -700 ft. up to a maximum of 30,000 ft.

The altimeter displayed altitude in feet or meters, local pressure could be set to inches of mercury. The onboard vertical speed indicator (VSI) was altitude compensated and readings could be displayed in either feet/minute (ft/min) or meters/second (m/s). It also offered a digital readout with a wide range from +/-20 ft/min to +/-10,000 ft/min, and a logarithmic analog display with a +/-2000 ft range.

The Vertical Speed Indicator (VSI) could be calibrated by the user once the instrument had been installed in the aircraft. In addition, the ALT-3 provided an outside air temperature (OAT) sensor used to determine the density altitude² of the aircraft.



Figure 5. SkyRunner Altimeter

² Density altitude is pressure altitude corrected for temperature. In layman's terms it directly affects the performance parameters of any aircraft, and in effect it is the equivalent altitude of where, performance-wise, the aircraft "thinks" it is at. The higher the density altitude, the lower the aircraft performance, and vice versa. https://www.skybrary.aero/index.php/Density_Altitude

1.6.4 Aircraft Performance

The performance of the Aircraft depends on various factors relevant to the environmental and operating conditions such as fuel range, take-off distances, landing distances and wind conditions. The following table illustrates the performance and operation limitations:

Table 3 provides Aircraft performance data:

Table 3. Aircraft performance data:						
Density altitude: 1,100 ft						
Gross weight 1800 lb	Take-off speed 38 mph	Cruise speed 46 mph	Take-off distance 350 ft	Climb rate 520 fpm	Sink rate 725 fpm	50 ft obstacle 480 ft
Density altitude: 2,900 ft						
Gross weight 1800 lb	Take-off speed 38 mph	Cruise speed 47 mph	Take-off distance 400 ft	Climb rate 425 fpm	Sink rate 725 fpm	50 ft obstacle 540 ft

1.6.5 Engines

The SkyRunner is equipped with a turbocharged ROTAX 914UL (Elite) edition engine for propulsion in flight as shown in figure 6, and with a Polariz Prostar 1000 engine for ground movement.



Figure 6. ROTAX 914 UL (Elite) engine



Table 4 illustrates engine and propeller data:

Table 4. Engine and propeller data	
Manufacturer	Rotax
Model	914 UL (Elite) Edition
Serial number	66749
Date installed	7 June 2016
Propellers	Powerfin 75 inch 4 "J" blades
Fuel	Octane (95 RON)
Cylinder diameter	84 mm
Stroke	61 mm
Displacement	1,352 cm
Compression ration	10.8:1
Power	119.3 kW/160 Hp
Max rpm	5800

1.6.6 Engine Fuel System Modification

The ROTAX 914 UL (Elite) Edition was modified by the Edge Performance Company for lower compression with forged pistons to accommodate the turbocharger and electronic fuel injection system. The carburetor was replaced with a fuel injection system and integrated fuel filters.

1.6.7 Engine limitations

Table 5 illustrates the engine limitations:

Table 5. Engine limitations	
Model	ROTAX 914 UL Elite
rpm	Takeoff: 5,800 (for 5 minutes maximum) Maximum continuous speed: 5,200 Idle: 1,500 (recommended 1,700)
Coolant Temp	Maximum temperature: 247 °F
EGT	Normal: 1,472 °F Maximum: 1,652 °F 4-6" From Exhaust valve - 2" From Engine

1.6.8 Aircraft parachute wing

The SkyRunner Aircraft comprised a flexible or semi-rigid wing connected to the carriage so that the wing is only in the position for the flight when the Aircraft is in motion. The 13 cells of

the parachute wing open at the front and closed at the back to maintain sufficient air pressure to form a rigid wing. The wing is manufactured by Performance Designs, Inc. (figure 7).

The Aircraft was equipped with a carriage of two seats, two engines, and wheels such that the wing and engine cannot be flown without the wheels and seats. The maximum structural weight of the carriage was 1,800 lb (816 kg) as per the American Society for Testing and Materials (ASTM), standard F2244-14 → *Specification for Design and Performance Requirements for Powered Parachute Aircraft*, section 5.2.1. The useful load was 580 lbs. (265 kg) (Appendix 1 attached to this report).

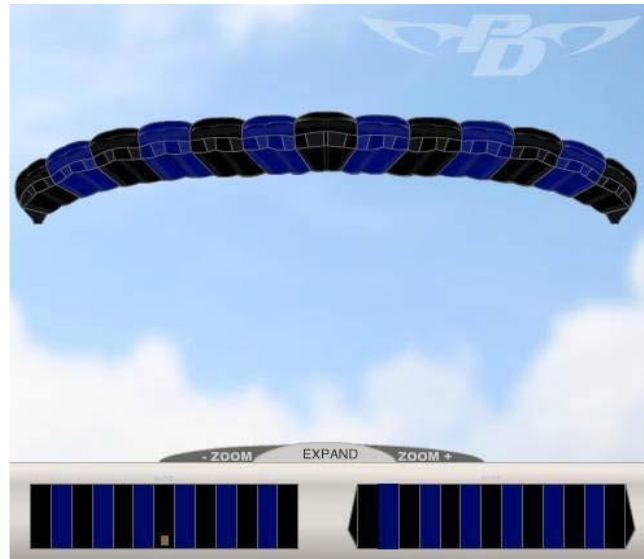


Figure 7. Parachute PG-550

Table 6 illustrates the parachute specifications:

Table 6. The SkyRunner parachute equipment				
Equipment	Manufacturer	Model	Serial number	Date of manufacture
Parachute	Performance Designs Inc.	SUNRISER PG-550	003730	November 2016

The large displacement between the center of lift and center of gravity (CG) creates a pendulum effect. The pendulum effect limits the angle of attack changes and provides stall resistance and maintains flight stability. According to the operations manual, the crosswind for normal takeoff should not exceed 20 degrees to either side of the runway heading, and the crosswind component should not exceed 15 mph.

1.6.9 Parachute risers

The parachute risers were the connection between the suspension lines and the carriage. Also known as “V lines,” the risers were the intermediate link between the suspension lines and the carriage. The risers were manufactured by Perkins Powered Parachute Inc.

Quick links: As shown in figure 8, the wing/parachute is connected to the shackles by stainless steel high-strength MAILLON RAPIDE QUICK LINK Diameter: 7 mm Inside Length: 2-1/16 inch (52 mm)
Work load limit: 5.4 kN (1,213 lbf)
Breaking strength: 27 kN (6,060 lbf)



Figure 8. Parachute Quick links

Shackles: As shown in figure 9, the shackles connect the wing and quick links to the carriage.

Manufactured from oxide steel, high-strength anchor shackle with safety pin.

Diameter: 3/8 mm

Work load limit: 8.9kN (2,000 lbf).

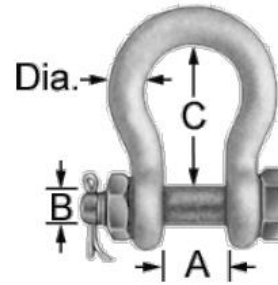


Figure 9. Parachute Shackles

1.6.10 Crosswind limitations

As per the Aircraft manufacturer's recommended crosswind limitation, the wing system does allow for moderate crosswind landings and takeoffs within the following general guidelines:

- Crosswinds for normal takeoffs should not exceed 20 degrees to either side of the take-off heading, and the crosswind component should not exceed 13 knots.
- Crosswind landings can be made, but the wind direction should not exceed 20 degrees from the landing heading, and the crosswind component should not exceed 13 knots.

1.6.11 Pre-flight check

The manufacturer provided the following information and the figure 10 for a pre-flight inspection.

“Use the preflight checklist in your Pilot Operations Handbook (POH) for every flight.

- I. Cockpit & Fuselage Inspection
- II. Wing and Suspension Line Inspection
- III. Power Plant/ Propeller Inspection
- IV. Equipment/ Systems Inspection
- V. Engine warm-up

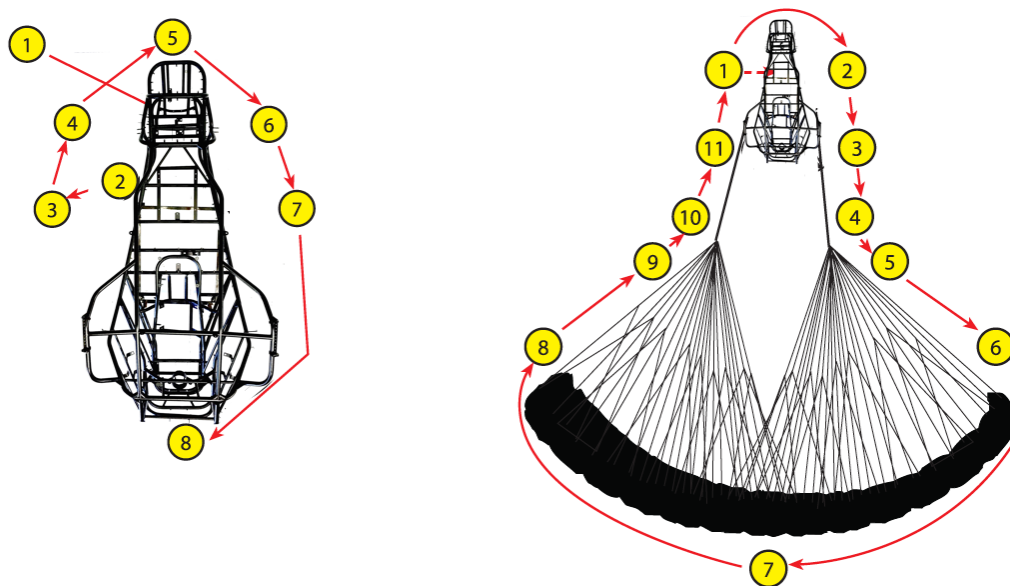


Figure 10. Pre-flight check steps

Wing and suspension line inspection

- Risers: hardware, links & pulleys
- Wing layout & Condition - Look for wear or holes in the top skin, bottom skin, and any loose stitching
- Steering lines and mechanisms for proper routing and smooth operation
- Look for frayed or damaged suspension lines (white lines)
- No twists.

POWER PLANT / PROPELLER INSPECTION

- Propeller Secured
 - o Verify that it is attached securely and safety wired to the engine
- Propeller Integrity
 - o Cracks, nicks (repair or replace as necessary)
- Fuel level
- Strain fuel filter and fuel quality
 - o Verify no presence of water or to remove water from the tank (fuel sump is located underneath the tanks)
- Check engine oil and verify within an acceptable range.
- ROTAX 914 UL/914 UL (Elite) Fuel pumps (dual/two) secured, not leaking. No leaks, filter secured."

1.7 Meteorological Information

The weather reports provided by the National Center of Meteorology (NCM) were not published in the format of meteorological terminal aviation routine weather reports (METAR), as the Accident location was not certified aerodrome by the General Civil Aviation Authority (GCAA). The report produced by NCM was from the weather station closest to the Accident site. The wind conditions were more accurate than the nearest aerodrome weather station report.

At the time of the Accident, between 0930 and 1030 LT, the temperature at the nearest weather station to the location of the Accident site was 19 to 21 °C, with the wind from the southwest at 200 to 240 degrees, and a wind speed of 7 to 8 knots. The visibility was 5 kilometers with scattered clouds.

The 200 to 240 degrees southwest wind direction, which was a 40 to 70 degrees crosswind off the runway heading, is considered one of the contributory factors to this Accident.

1.8 Aids to Navigation

Onboard navigation aids serviceability was not a factor in this Accident.

1.9 Communications

There were no specific communication aids provided by the manufacturer. There were portable radios with a communication frequency at 142.250 MHz.

1.10 Aerodrome Information

Sky Hub is not a certified aerodrome facility. All the flying activities conducted are by paramotor and non-powered parachutes.

1.11 Flight Recorders

The Aircraft was not required to have a flight recorder fitted. However, the Dynon engine monitoring system (EMS) - D10 (figure 11), was fitted to record engine parameters such as engine rpm, exhaust gas temperature (EGT), and cylinder head temperature (CHT). The Investigation downloaded the recorded engine data, which provided information for the Accident flight. The EMS was set to record snapshot data every 10 seconds in the internal non-volatile memory as the power switch was turned to the ON position.



Figure 11. Engine monitoring system Dynon EMS-D10

The downloaded data consisted of engine parameters such as rpm, fuel pressure, oil pressure, EGT, HOBBS (Electrical System History), TACH (rpm/Reference history). When the power switch is turned ON, the EMS starts recording. The initial parameter was called 'boot' for power on/off.

The EMS recorded data parameters indicated that the total time recorded since the most recent boot was 33 minutes 15 seconds. The data revealed that the engine reached 5,504 to 5,835 rpm within 10 seconds of being switched on, and remained at 5,800 rpm until the impact when the EGT was 1164 °F and CHT was 170 °F, which were within operational limits as per the recommendations of the Aircraft manufacturer for a normal takeoff.

1.12 Wreckage and Impact Information

The Aircraft undercarriage impacted the edge of the building roof and then fell approximately seven meters to the ground where three wheels separated from the carriage. The Pilot and passenger seat belts were intact after the impact. The four propeller blades were fractured as projected in the figure 12.



Figure 12. Aircraft wreckage

1.13 Medical and Pathological Information

The Pilot and passenger were transported by the paramedic services to the hospital for treatment of their injuries. The Pilot's pathological blood tests conducted at the hospital did not reveal the presence of any psychoactive material, which could have influenced his performance.

1.14 Fire

There was no evidence of fire either prior to or post-impact.

1.15 Survival Aspects

1.15.1 Pilot and passenger restraint and safety equipment

The Aircraft was fitted with three-point restraint harnesses for the Pilot and the passenger. A post-Accident inspection found that the safety equipment was serviceable at the time of the Accident. Both the Pilot and passenger seat belts were fastened post-impact and their seats were intact. As per the Aircraft manufacturer recommendations, the Pilot and the passenger

were required to wear safety helmets and protective clothing. It was observed that the Pilot and the passenger were not wearing helmets or any protective clothing.

1.15.2 Fuselage

The Aircraft had a welded steel tube frame. The main chassis is bolted to the lower and upper engine mount portions and the rear suspension drag struts. The front suspension consisted of A-arms. The CG adjustment mechanisms are welded to the frame (figure 13).

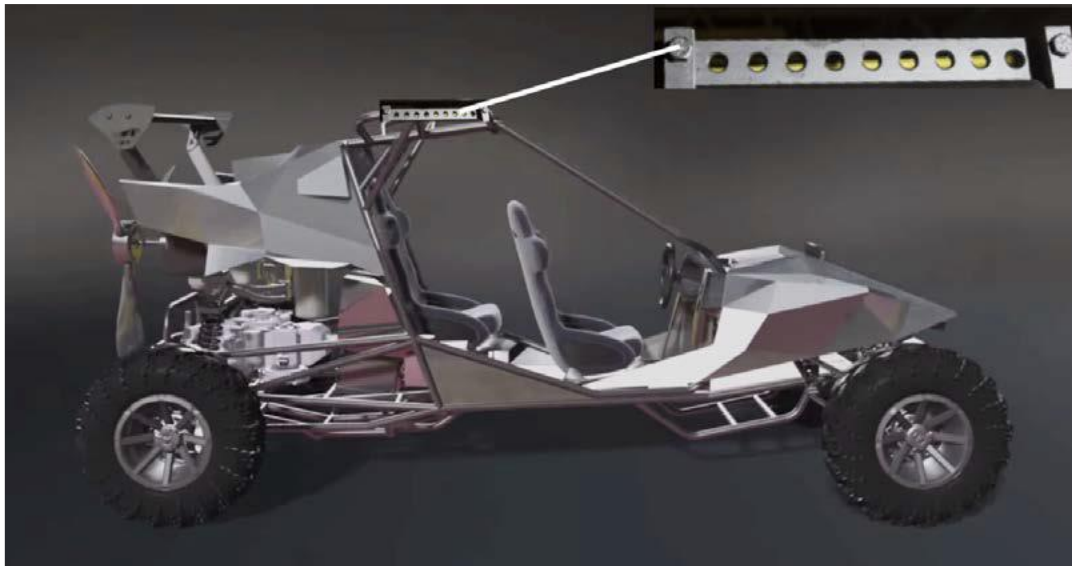


Figure 13. Wing arm CG adjustment mechanism

The balance of the carriage could be set by adjusting the wing arm CG adjustment mechanism. Variations in the cockpit and fuel loading do not affect the Aircraft's balance significantly. However, the distribution of the load in the carriage affects the attitude of the carriage in-flight in a minor way so long as the prescribed weight limits per seat are followed. These limits were a maximum of 250 lb per seat with a minimum of 80 lb in the pilot seat.

Information related to weight and center of gravity requirements for the safe operation of the aircraft were:

- Empty weight: 1,220 lb
- Max gross weight: 1,800 lb (with exemption 15422A)
- Useful load: 580 lb (with exemption 15422A).

1.15.3 Undercarriage and brakes

The front suspension system included double A-frame suspension arms with shock absorbers, the front two wheels, and the suspension/wheel connection parts (wheel hub and spindle). The rear suspension assembly included two struts, the two rear wheels, two rear axles connecting the wheels and transaxle, two air shock absorbers, and the suspension/wheel connection components (wheel hub, bearing holder, and adapters).

The air pressure could be varied in each shock absorber. All wheels had hydraulic disc brakes actuated simultaneously by an automobile-style, foot-actuated brake pedal.



1.15.4 Flight control surfaces

The direction of flight is controlled by deflecting the outer trailing edges of the wing as with a conventionally powered parachute. Parachute lines connected the outer trailing edges to the steering lines (hand brakes), so pulling on the steering lines would deflect the trailing edges of the parachute. There are two polyester steering lines rated at 1,000 lb. tensile strength each.

The steering lines are pulled in by hand brakes or with manual foot-operated steering pedals (similar to a conventionally powered parachute) as a redundant, independent, or companion system. The manual foot-operated steering pedals can be used to produce landing flare.

1.16 Tests and Research

No testing or research were required for this Investigation.

1.17 Organizational and Management Information

1.17.1 UAL Incorporated (Inc.)

UAL Inc. was registered in Wilmington, Delaware (DE), the United States. It conducts aviation activities for special light-sport aircraft (SLSA). UAL Inc. was operating one SkyRunner (the Accident Aircraft) for demonstration purposes. The company did not have an organization structure with assigned experienced professional employees to conduct its aviation activities. UAL Inc. had no in-place a procedures manual or safety procedures manual for such activities.

The sole responsibility for conducting demonstration flights in the United Arab Emirates rested with the Pilot. The Pilot's responsibility included risk assessment of operations at a new location. There was no documented risk assessment procedure. The Pilot did not apply to the local Civil Aviation Regulatory Authority for the required documentation and permissions for the demonstration flight nor did he confirm that Skydive Dubai had applied for permission as per the *Civil Aviation Regulations* requirement.

1.17.2 Skydive Dubai

Skydive Dubai conducts skydiving, light sport aircraft flights, and paramotor operations at the Sky Hub Margham, Dubai.

Skydive Dubai was the official sponsor³ for the UAL Inc. demonstration flights of the SkyRunner. The Skydive management coordinated the shipment of the Aircraft to Dubai and the engagement of the Pilot. The Skydive management should have filed the demonstration flight plan with the GCAA under the light sport activity requirements.

1.18 Additional Information

The Investigation has no additional information.

1.19 Useful or Effective Investigation Techniques

The Investigation was conducted in accordance with the legislation and Civil Aviation Regulations of the United Arab Emirates, in accordance with the AAIS approved policies and

³ Sponsor: A sponsor in the United Arab Emirates is responsible for fulfilling the official requirements in terms of regulation, security clearance, and permissions to conduct demonstration flights.



procedures, and the Standards and Recommended Practices of Annex 13 to the Chicago Convention.

2. Analysis

2.1 General

The Pilot was licensed and medically fit to operate the demonstration flight. He had previously performed a demonstration flight successfully at the Skydive facility at Nad al Sheba, Dubai, on 6 February 2018.

Data from the engine monitoring system (EMS) - D10 was successfully retrieved and analyzed. Based on the analysis the engine provided power as per manufacture specifications.

The environmental conditions at the Sky Hub facility in Margham, Dubai, on the day of Accident were having crosswind component with unstable wind direction.

2.2 Flight Sequence

Videos retrieved from the from the Sky Hub premises closed-circuit television (CCTV) showed that the Pilot conducted the preflight checks as per the manufacturer's checklist in the *pilot operating handbook (POH)* and the Aircraft operating instructions as seen in the figure 14. The engine warm-up test and walk around checks were conducted. The Pilot stated that no Aircraft systems malfunctions or abnormal conditions were noted prior to the flight.



Figure 14. Wing inspection by the Pilot

2.2.1 Set wing

It was observed in the video recorded just before the commencement of the take-off roll that the wing was set correctly on the ground as shown on the figure 15.



Figure 15. Set Wing before takeoff

2.2.2 Wing suspension lines twist

As per the manufacturer's pre-flight check requirement, inspection of the wing suspension must be conducted on the ground. The Investigation confirmed that the Pilot laid out the wings on the ground as per the specification. The suspension lines are the structural skeleton of the parachute and their function is critical since twisted lines cause steering control difficulties once the machine becomes airborne and twisted lines can wrap around the parachute airfoil⁴.

The pilot shall not attempt to fly as a wing with line twists is not airworthy until the twists have been removed (Roy's Powered Parachute, page 184)



Figure 16. Wing suspension lines

⁴ A para airfoil is a non-rigid (textile) airfoil with an aerodynamic cell structure which is inflated by the wind. Ram-air inflation forces the para airfoil into a classic wing cross-section. Para air foils are most commonly constructed out of rips top nylon. The air flow into the para airfoil is coming more from below than the flight path might suggest, so the front most ropes tow against the airflow. When gliding, the angle of attack is lowered and the airflow meets the para airfoil head on. This makes it difficult to achieve an optimum gliding angle without the para airfoil deflating.
<https://adventure.howstuffworks.com/skydiving2.htm>

However, the Investigation could not confirm whether the Aircraft parachute wing suspension lines were twisted or not due to lack of factual data. As shown in the figure 16 the wing suspension prior to the take-off.

2.2.3 Start of the take-off roll

During the initial take-off roll, a crosswind effect was observed in the video still shown in figure 17. The crosswind direction of between 42 and 72 degrees off the take-off heading caused inadequate inflation of the right outboard section of the parachute during the early stage of the take-off roll. Subsequently, the canopy rapidly inflated and liftoff from the runway was normal.



Figure 17. Crosswind effect on the parachute at the start of the takeoff roll

2.2.4 Liftoff

Analysis of a still from the take-off video of the Aircraft just before liftoff (figure 18) indicated that the take-off procedures were conducted as per the operations manual and that the Aircraft was in the correct configuration for takeoff. The wing had fully inflated with the cells open and the carriage and the canopy centerlines were aligned. After the liftoff, the Aircraft climbed slowly to a height of approximately 10 ft and remained at that height for five seconds.



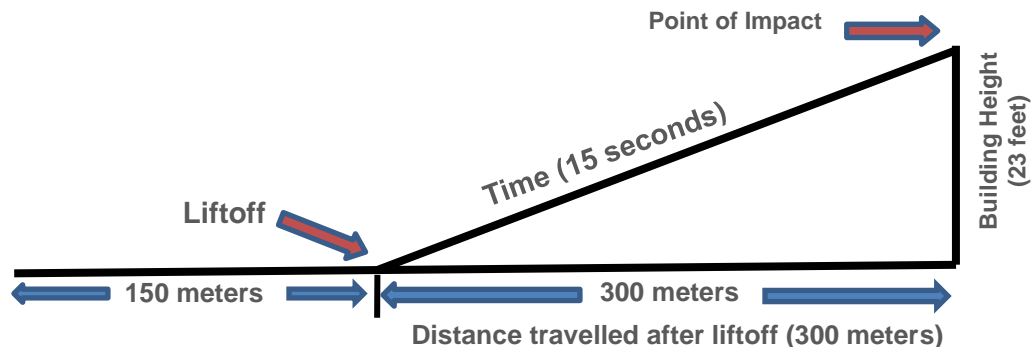
Figure 18. Still from take-off video

2.2.5 Aircraft flight profile

After liftoff, the Aircraft climbed to 10 ft within the first five seconds. Within eight seconds after liftoff, the Aircraft slowly reached a height of 15 ft. It maintained this height until 11 seconds after liftoff and then climbed slowly to a height of 20 ft. until 13 seconds after liftoff. At 13 seconds after liftoff, the Pilot made large control inputs. The control inputs caused a slight deviation towards the southwest to the direction of flight. The Aircraft impacted the building some 15 seconds after liftoff at a height of 23 ft. (7.1 meters)

The length of the take-off roll to liftoff was 150 meters, and from liftoff to impact with the building was approximately 300 meters. The Aircraft impacted the building at roof height, 23 ft above ground level.

The overall rate of climb and ground speed were calculated to be approximately 92 feet per minute (fpm) and 45 mile per hour (mph), respectively.⁵



⁵ In reference to impact:

Rate of climb = (23 ft/15 seconds) X (60 seconds/1 minute) = 92 fpm

Ground speed = (300 meters distance/15 seconds) = 20 meters per second = 45 mph

The Aircraft performance at 1,100 ft AGL as per manufacturer specification would be as below.

Gross weight	Take off speed	Cruise speed	Take off distance	Climb rate	Sink rate	50 ft obstacle
1,800 lb.	38 mph	46 mph	350 ft	520 fpm	725 fpm	480 ft

The engine recorded maximum rotation speed was 5,800 revolutions per minute (rpm), the Aircraft performance on the ground did not contribute to the Accident, but after the liftoff the crosswind had a significant effect on the Aircraft performance. The take-off runway heading direction was 160 degrees southeast whereas the wind direction was 200 to 240 degrees. The take-off runway heading and crosswind direction are the primary contributing factors in degrading the Aircraft performance during the climb.

2.3 Wind Conditions

2.3.1 The National Center of Meteorology (NCM) report

The wind conditions provided by the NCM were recorded at the onsite weather station nearby to the Accident site. Since the Aircraft take-off location was not a certified aerodrome by the General Civil Aviation Authority (GCAA), no official aviation weather observations such as METARs were available for this site.

The weather data provided showed that the wind direction on 9 February 2018, between 1000 and 1030 LT, was from the southwest between 200 and 240 degrees with a speed of 4 to 5 knots.



Figure 19. Windssock angle

As per the operations manual, the crosswind during the takeoff shall not exceed more than 20 degrees off the take-off heading. The change in wind direction from 200 to 240 degrees relative to the 160-degree runway heading gave a crosswind component between 2.5 and 5 knots, which was within the limitation. However, in this case, the wind direction change was outside the wind direction limitation, which was between 40 and 80 degrees.

As per the standards, published by the Federal Aviation Administration of the United States (FAA) a windsock angle of 90 degrees to the windsock pole is 15 knots of wind speed. The Investigation observed in the video captured during the take-off and climb that the windsock located adjacent to the runway heading was at a 45-degree angle to the pole as shown in figure 19. Therefore, the wind speed is considered seven knots from the 200-240 degrees direction towards the northeast. In this case, the crosswind component was between 4.5 and 7 knots.

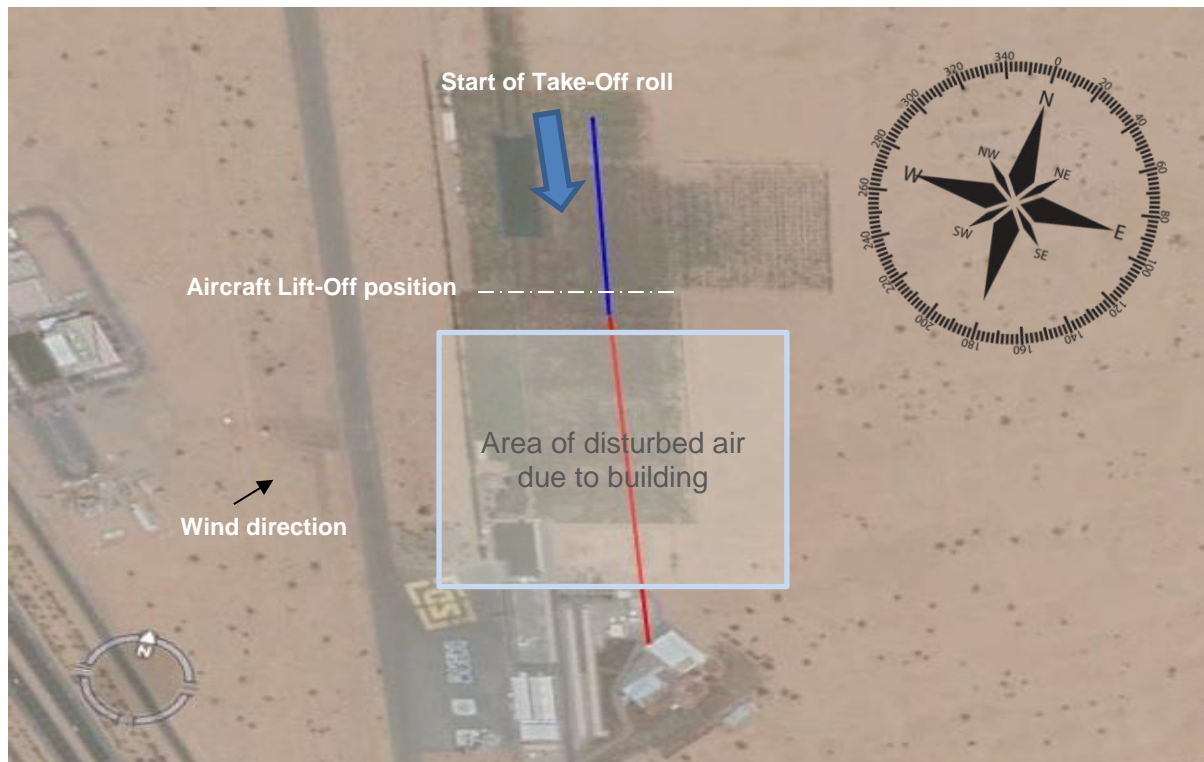


Figure 20. Take-off environment and wind effect

After lift-off, the Aircraft only achieved a slight increase in height over the runway due to the effect of the take-off crosswind limitation. As the flight continued and the Aircraft climbed slowly, it entered an area of turbulent air that caused it to descend slightly.

The Investigation believes that the area of turbulent air was due to the effect of rotors produced by the passage of the wind over and around the buildings located to the side of the runway on the take-off heading. As illustrated in figure 20, the combination of the out of limits crosswind take-off and the entry of the Aircraft into the area of turbulent air caused a reduction in lift, which prevented the Aircraft from climbing and led to the impact with the building.



3. Conclusions

3.1 General

The Investigation comes to its conclusions based on the evidence available. The following findings, causes, and contributing factors were made with respect to this Accident. These shall not be read as apportioning blame or liability to any particular organisation or individual.

To serve the objective of this Investigation, the following sections are included:

- **Findings.** Statements of all significant conditions, events or circumstances in this Accident. The findings are significant steps in the Accident sequence but they are not always causal nor do they necessarily indicate deficiencies.
- **Causes.** Actions, omissions, events, conditions, or a combination thereof, which led to this Accident.
- **Contributing factors.** Actions, omissions, events, conditions, or a combination thereof, which, if eliminated, avoided or absent, would have reduced the probability of the Accident occurring, or mitigated the severity of the consequences of the Accident. The identification of contributing factors does not imply the assignment of fault or the determination of administrative, civil or criminal liability.

3.2 Findings

3.2.1 Findings relevant to the Aircraft

- (a) The Federal Aviation Administration of the United States (FAA) issued a grant of exemption, number 15422A, regulatory docket number FAA-2015-8564. The proposed exemption allowed the SkyRunner MK 3.2 powered parachute aircraft to be designed, operated and be issued an airworthiness certificate in the special light-sport aircraft (SLSA) category with a maximum take-off weight (MTOW) of 1,740 pounds.
- (b) The FAA issued an unlimited special airworthiness certificate for the SkyRunner MK 3.2 under the SLSA category on 24 February 2017.
- (c) The FAA issued registration number N143SR to the last registered owner of the Aircraft in the name of UAL Inc, in the United States.
- (d) The Aircraft parachute, Sunriser model PG-550, manufactured by Performance Designs was certified to a maximum take-off weight of 1,800 pounds when installed on the SkyRunner fuselage as per standard F2244-14, section 5.2.1 of the American Society for Testing and Materials (ASTM).
- (e) The Aircraft parachute Sunriser model PG-550 manufacturer specified a crosswind limitation for normal takeoff that should not exceed 20 degrees to either side of the take-off heading, and the crosswind component should not exceed 13 knots.
- (f) The Aircraft engine was manufactured by ROTAX. The ROTAX 914 UL (Elite) Edition engine was modified by the installation of lower compression forged pistons to accommodate the turbocharger and electronic fuel injection system produced by the Edge Performance company.



3.2.2 Findings relevant to the Pilot

- (a) The Pilot was issued with a Temporary Airman Certificate for the Private Pilot Powered Parachute Land on 24 January 2018 as per the existing requirements of the FAA.
- (b) As per his statement, the Pilot had an unregistered flight time total of five hours on the SkyRunner aircraft type.
- (c) The Pilot held a third class medical certificate, and a student pilot certificate issued by the FAA.
- (d) Prior to the accident flight, the Pilot had successfully conducted one demonstration flight at Nad Al-Shiba, Dubai, on 6 February 2018 with the same passenger on-board.

3.2.3 Findings relevant to Skydive Dubai incorporated

The Skydive Organization did not apply for a security clearance for the Pilot, nor was the required documentation and permission for the demonstration flight applied for, as required by the General Civil Aviation Regulatory Authority of United Arab Emirates.

3.2.4 Findings relevant to the Operator

- (a) The Operator is a licensed light-sport aircraft operator registered in the United States.
- (b) The Operator did not comply with the Civil Aviation Regulations CAR Part V CAR ML ML.A.906 Airworthiness review of aircraft imported into the UAE of the United Arab Emirates for requirements of airworthiness inspections of the SkyRunner Aircraft.
- (c) The Operator did not obtain flight permission from the General Civil Aviation Authority (GCAA) to operate the aircraft in the United Arab Emirates.
- (d) The Operator's pilot hiring process and procedures were not documented.
- (e) There was no documented risk assessment process for demonstration flights.
- (f) There was no documented safety policy or procedures.
- (g) The Operator adapted the SkyRunner manufacturer pilot operations handbook (POH) and aircraft operating instructions manual for its operations.
- (h) There was no standard organization management structure to manage operations.

3.3 Causes

The Air Accident Investigation Sector (AAIS) determines that the cause of the Accident was the lack of Pilot experience and proficiency in operating the SkyRunner Aircraft, combined with the attempt to takeoff in crosswind conditions, which were outside the Aircraft crosswind limitations.

3.4 Contributing Factors to the Accident

The AAIS determines the following to be contributing factors to the Accident:

- (a) The lack of the Operator adherence to safety precautions, and documented safety procedures.
- (b) The Operator did not verify the competence of the Pilot to conduct the demonstration flight.
- (c) The Operator did not comply with the applicable GCAA regulatory requirements.



4. Safety Recommendations

4.1 General

The safety recommendations listed in this Report are proposed according to paragraph 6.8 of *Annex 13 to the Convention on International Civil Aviation*, and are based on the conclusions listed in Part 3 of this Report; the Air Accident Investigation Sector (AAIS) expects that all safety issues identified by this Investigation are addressed by the receiving States and organizations.

4.2 Final Report Safety Recommendations

The demonstration flights conducted by UAL Inc. in the United Arab Emirates were not carried out in compliance with the Light-Sport Aircraft Operations regulations issued by the General Civil Aviation Authority of the United Arab Emirates (GCAA). The Pilot hiring process, which allowed the Pilot with no experience to operate the SkyRunner Aircraft, was a primary cause of this Accident. Therefore, the Investigation recommends that:

4.2.1 UAL Incorporated

SR60/2020

Establish an organization management structure with policies, procedures and defined responsibilities as per the regulatory requirements of the Federal Aviation Administration of the United States (FAA) applicable to light-sport aircraft operations.

SR61/2020

Establish a hazard identification and risk assessment process for flights conducted from new locations for the first time or where significant changes to the location have occurred.

SR62/2020

Establish recruitment policies regarding the minimum qualifications and experience of pilots who will conduct demonstration or flights.

4.2.2 The Federal Aviation Administration of the United States (FAA)

SR63/2020

Introduce expiry dates for special airworthiness certificates.

SR64/2020

Examine the terms of the SkyRunner special airworthiness certificate as the ROTAX 914 UL (Elite) edition engines installed in SkyRunner Aircraft have been modified and the modification voids the ROTAX engine manufacturer warranty.

4.2.3 SkyRunner LLC

SR65/2020

Equip the SkyRunner Aircraft with a video camera(s) as standard equipment to record cockpit view(s) and pilot actions.



4.2.4 Skydive Dubai

SR66/2020

Develop a process to obtain required security clearance, documentation, and permissions for pilots who possess a foreign pilot's license, as per national civil aviation requirements.

4.2.5 General Civil Aviation Authority of the United Arab Emirates (GCAA)

SR67/2020

Improve and strengthen regulatory oversight of light-sport aircraft activities.

SR68/2020

Conduct an immediate, and thereafter regular, oversight audit and/or inspection of Skydive Dubai to assure pilots, who possess a foreign pilot license, are conducting air operations with official security clearance, documentation, and permission as per GCAA regulatory requirements.



5. Appendices

Appendix 1. Increased Maximum Weight on Sunriser PG-550



Performance Designs, Inc.
1300 E. International Speedway Blvd
DeLand, FL 32724 USA
Tel: +1 (386) 738 2224 | Fax: +1 (386) 734 8297
www.performancedesigns.com

January 4, 2018

SkyRunner, LLC.
2929 Baird Rd., Building #50
Shreveport, LA 71118

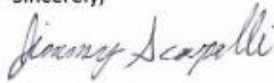
Regarding Increased Maximum Suspended Weight on Sunriser 550.

The PD Sunriser powered parachute wing has been demonstrated via testing to be structurally sound up to 6,820 pounds. Per ASTM F2244-14 §5.2.1; at a takeoff weight of 1,800 pounds the provided safety factor is 3.78. Please note that this safety factor applies only to the wing assembly consisting of parachute fabric, reinforcement tapes, cord, and connector links. Performance Designs cannot include the safety factor of riser assemblies as Performance Designs does not manufacture or sell powered parachute risers.

Performance Designs Sunriser model PG-550 is certified to handle a maximum takeoff weight of 1,800 pounds when installed on the SkyRunner fuselage. This rating is applicable to any PG-550 model manufactured prior to this date, and is in serviceable working condition, and **ONLY if the parachute cord type is Vectran™ or HMA assembled by Performance Designs.** (Vectran™ has been the standard line option on the Sunriser since March 2015.)

This letter supersedes the design load capability listed on wing interface documentation previously issued to SkyRunner and is to serve as "pass-through" information from Performance Designs to SkyRunner per ASTM F2244-14 §5.2.1, Note 1.

Sincerely,



Jimmy Scarpelli
R&D Project Lead,
Product Specialist



Appendix 2. Special Airworthiness Certificate issued by FAA

UNITED STATES OF AMERICA DEPARTMENT OF TRANSPORTATION - FEDERAL AVIATION ADMINISTRATION SPECIAL AIRWORTHINESS CERTIFICATE		
A	CATEGORY/DESIGNATION LIGHT SPORT	
	PURPOSE SPECIAL LIGHT SPORT	
B	MANUFACTURER NAME SKYRUNNER LLC	
	ADDRESS 2929 BAIRD RD. SHREVEPORT, LA 71118	
C	FLIGHT FROM N/A	
	TO N/A	
D	N- 143SR OSER 004MK32503007	
	BUILDER SKYRUNNER LLC MODEL MK 3.2	
E	DATE OF ISSUANCE 24 FEB 2017 EXPIRY UNLIMITED	
	OPERATING LIMITATIONS DATED 24 FEB 2017 ARE PART OF THIS CERTIFICATE	
	SIGNATURE OF FAA REPRESENTATIVE <i>Joseph B. Ware</i> JOSEPH B. WARE	DESIGNATION OR OFFICE NO. DAR-T 831141SW

Any alteration, reproduction or misuse of this certificate may be punishable by a fine not exceeding \$1,000 or imprisonment not exceeding 3 years, or both. THIS CERTIFICATE MUST BE DISPLAYED IN THE AIRCRAFT IN ACCORDANCE WITH APPLICABLE TITLE 14, CODE OF FEDERAL REGULATIONS (CFR).

FAA Form 8130-7 (04/2011) Previous Edition 07/04 May be Used until Depleted

SEE REVERSE SIDE NSN: 0052-00-693-4000



Appendix 3. Grant of Exemption No. 15422A issued by FAA

UNITED STATES OF AMERICA
DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
WASHINGTON, D.C. 20591

In the matter of the petition of

SKYRUNNER, LLC

for an exemption from §§
21.181(a)(3)(i), 21.190(a), 21.191(i)(3),
43.3(c), 43.7(g), 61.89(c)(1), 61.303(a),
61.315(a), 61.411(g), 61.415(a),
61.429(b), 65.107(b) and (c) of Title
14, Code of Federal Regulations (14
CFR)

Exemption No. 15422A
Regulatory Docket No. FAA-2015-8564

GRANT OF EXEMPTION

By letter dated March 6, 2017, Emanuel Anton, Lead Counsel for SkyRunner, LLC (SkyRunner), Polsinelli PC, 1401 Lawrence Street, Suite 2300, Denver, CO 80202, petitioned the Federal Aviation Administration (FAA) on behalf of SkyRunner for an exemption from §§ 21.181(a)(3)(i), 21.190(a), 21.191(i)(3), 43.3(c), 43.7(g), 61.89(c), 61.303(a), 61.315(a), 61.321, 61.325, 61.327(a), 61.411(g), 61.415, 61.419, 61.429(b), 65.107(b) and (c) of Title 14, Code of Federal Regulations (14 CFR). The proposed exemption, if granted, would allow the SkyRunner MK 3.2 powered parachute (PPC) aircraft to be designed, operated, and maintained under the regulations and standards applicable to aircraft issued a special airworthiness certificate in the special light-sport aircraft (SLSA) category with a maximum takeoff weight (MTOW) of 1,740 pounds.

To obtain the desired relief, the petitioner requires exemption from the following regulations:

Section 21.181 prescribes, in pertinent part, that:

- (a) Unless sooner surrendered, suspended, revoked, or a termination date is otherwise established by the FAA, airworthiness certificates are effective as follows:
 - (3) A special airworthiness certificate in the light-sport category is effective as long as—
 - (i) The aircraft meets the definition of a light-sport aircraft.

AIR-17-114429-E