



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

May 3, 2021

Helicopter Specialist Factual Report

AIRWORTHINESS

WPR20LA029

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HELICOPTER SPECIALIST FACTUAL REPORT**NTSB No: WPR20LA029****A. ACCIDENT**

Operator: IHC Health Services Inc
Aircraft: A109SP
Location: Salt Lake City, UT
Date: November 12, 2019
Time: 20:08 Mountain Standard Time

B. GROUP

No group was formed

LIST OF ACRONYMS

FAA	Federal Aviation Administration
FMS	Flight Management System
Ft	Feet
inHg	Inches of mercury
KCMA	Camarillo Airport, CA
KSNA	Santa Ana Airport, CA
PN	Part Number
SAS	Stability Augmentation System
SN	Serial Number
TCDS	Type Certificate Data Sheet
TGB	Tail rotor Gear Box

C. SUMMARY

On November 12, 2019, about 2008 mountain standard time, an AgustaWestland A109SP helicopter, N271HC, was substantially damaged during cruise flight near Spanish Fork, Utah. The airline transport pilot and flight nurse were not injured. The airplane was registered to and operated by IHC Health Services, Inc. as an unscheduled air medical flight, conducted under the provisions of Title *14 Code of Federal Regulations* Part 135. Visual meteorological conditions prevailed and a company flight plan was filed for the local flight, which was destined for an off-airport location in Spanish Fork, Utah.

According to the pilot, when the helicopter was about 5 minutes from its destination, the flight nurse, seated in the left front seat, attempted to contact personnel on the ground to coordinate their landing. He attempted to step on the press-to-talk button located on the cabin floor, to activate the radio microphone, but instead he inadvertently stepped on the left anti-torque pedal, which caused a rapid yaw to the left. The pilot recounted the yaw to be severe and violent. The pilot immediately countered the movement and re-established straight and level flight. They landed the helicopter uneventfully and conducted a walk-around inspection in dark night conditions, which did not reveal any anomalies. During a subsequent flight, after they arrived at the company's home base and went off-duty, the oncoming pilot conducted a walk-around inspection in daylight conditions and discovered damage to the tailboom as he approached the helicopter.

D. FACTUAL INFORMATION

1. HELICOPTER INFORMATION

1.1 HELICOPTER DESCRIPTION¹

The AW109SP is a high-speed, high performance, multipurpose helicopter powered by two Pratt & Whitney Canada PW207C engines. The helicopter has a four-bladed, fully articulated main rotor; a low drag titanium and composite main rotor head with elastomeric bearings; a two-bladed tail rotor; a retractable tricycle-type landing gear; a fuselage section, and a tail boom. The helicopter is designed to fulfill many roles, which include transport of personnel, equipment and cargo. The airframe consists of two major assemblies: the fuselage and the tail boom. The fuselage comprises the forward fuselage, the center fuselage and the aft fuselage. The forward fuselage includes a nose bay for the installation of electric and avionic equipment and a bottom bay that accommodates the nose landing gear, the hydraulic accumulators and other hydraulic components. The forward fuselage also includes the cockpit. A hinged door on each side of the forward fuselage provides access to the cockpit. The center fuselage includes the passenger compartment (cabin), the fuel tank bay, the landing gear bays. A sliding door is located on each side of the center fuselage for access to the passenger compartment. The cabin is generally configured to carry six passengers in two three-seat benches. The aft fuselage includes the avionic equipment bay, the electric equipment bay and the baggage compartment. A hinged door on the right side of the aft fuselage permits access to the baggage compartment. The deck located above the center fuselage and the aft fuselage accommodates the hydraulic components (reservoirs, filter groups, shut-off

¹ AW109SP RFM, Sec 7, System description

valves), the main transmission, the oil coolers and the engines. The upper deck is enclosed by removable fairings and cowlings. The tail boom is attached to the aft fuselage at four points. The vertical fin is an integral part of the tail boom structure. The tail boom accommodates the Number 3 tail-rotor drive-shaft, the 90-degree gearbox, the tail rotor, the elevators and the tail skid. The tail cone is attached to the aft end of the tail boom.

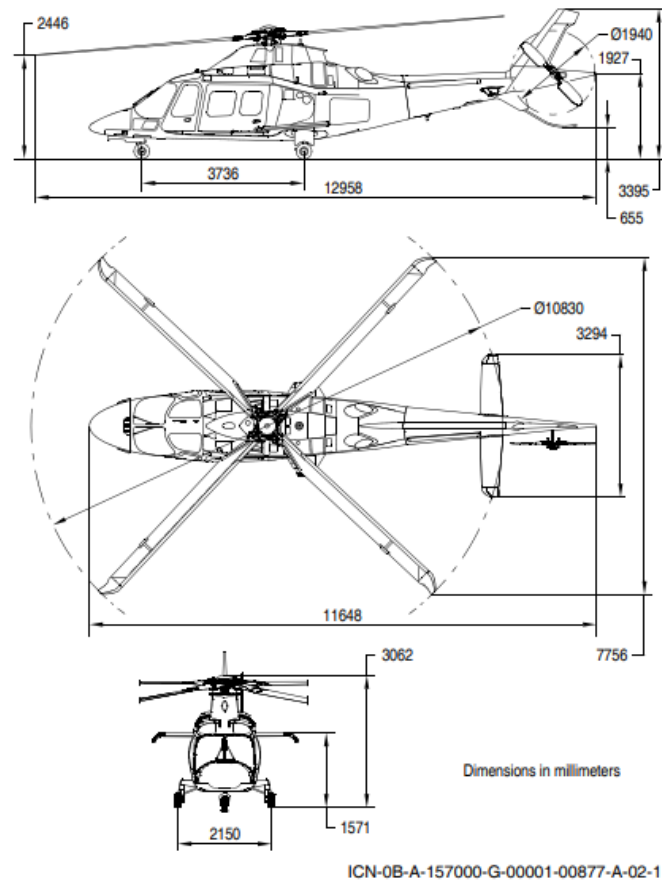


Figure 1 - 3 view diagram of the AH109S

1.2 HELICOPTER HISTORY

The accident helicopter, serial number (S/N) 22250, was manufactured in 2011. According to helicopter records, the airframe had accumulated 3712.8 flight hours (aircraft total time) at the time of the accident. Two Pratt & Whitney PW207C engines were installed on the helicopter with the number 1 engine accumulating 3,652.9 hours and the number 2 engine accumulating 3,589.1 hours.

2.0 DAMAGE DOCUMENTATION

2.1 TAIL ROTOR DAMAGE

The tail rotor assembly was sent to the NTSB Materials Laboratory for complete examination. Refer to the NTSB Materials Laboratory Factual Report for details.

2.2 TAILBOOM DAMAGE



Photo 1 - Tail section showing tail rotor blade tip strike on the empennage.



Photo 2 - Close-up view of strike damage to empennage.

Safety Board investigators did not physically examine the helicopter or the damage to the empennage. The operator provided photo documentation of the damage, which are included here (photos 1 & 2). The damage was located in the vicinity of the tail rotor's tip path, a witness mark where a discolored area and a paint chip were evident on the empennage.

3.0 FLIGHT DATA RECORDINGS²

3.1 RECORDING

The aircraft was equipped with an Appareo which recorded time, latitude, longitude, altitude, groundspeed, and vertical speed. It recorded course, heading, pitch, and roll and their rates of change. Accelerations in the vertical, longitudinal, and lateral direction were also recorded.

² Sourced from WPR20LA029 Performance Study Specialist Report

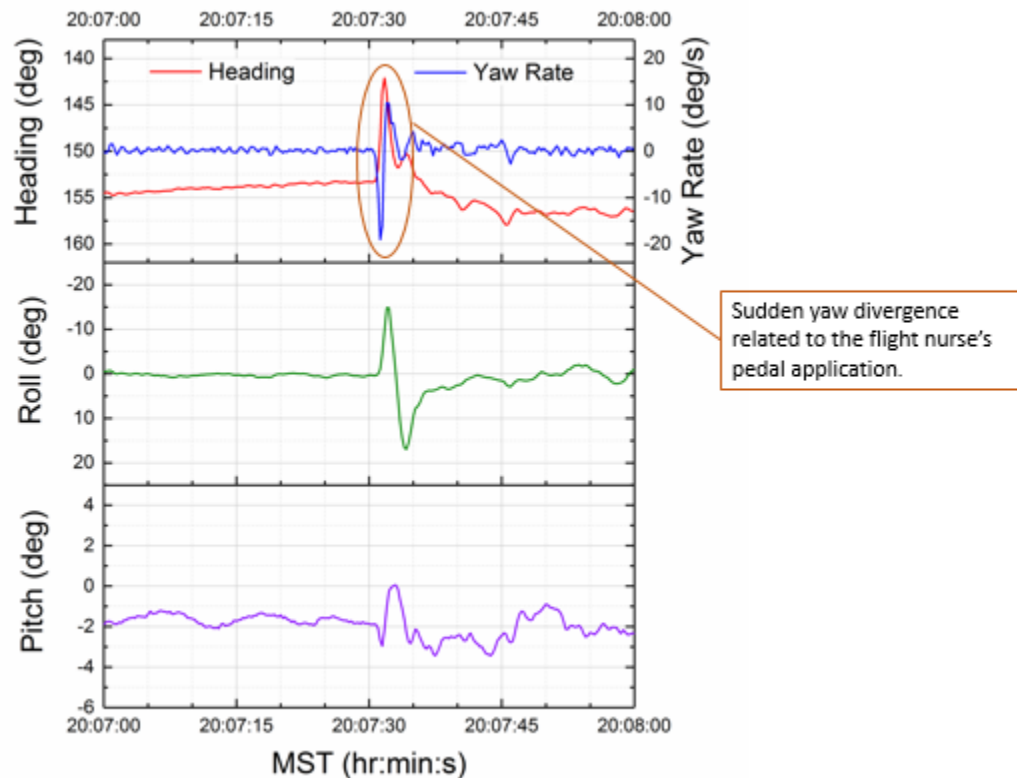


Figure 2- Graphic time plots of pitch, yaw, and roll around the time of the divergence event.

3.2 PERFORMANCE STUDY

The helicopter was flying at 7,500 ft msl and a groundspeed of 150 kts when the pilot reported the flight nurse accidentally stepped on the left tail rotor pedal. Onboard data recorded that at 20:07:30.5 the helicopter rapidly turned left from a heading of 153° to 142° in 1.25 seconds, a yaw rate of nearly 20 deg/s. The pilot reported immediately countering which is reflected in the data as the helicopter returned to 151°. The helicopter also responded by rolling left then right from -15° to 15° and pitching up 2° before returning to its original attitude.

4.0 CERTIFICATION FLIGHT TEST DATA AND FLIGHT SIMULATION

4.1 CERTIFICATION FLIGHT TEST DATA

Leonardo Helicopters provided flight data handling qualities obtained during the certification of the A109SP. The certification test point that most closely corresponds to flight conditions that were present at the time of the incident was the $0.9V_h$ side slip $\pm 15^\circ$ demonstration for static stability. Dynamic stability test point was performed in level flight at $0.9V_h$, $\pm 10^\circ$ yaw. V_h is the calculated maximum horizontal airspeed based on atmospheric conditions. To achieve the desired yaw sideslip, coordinated application of pedal and lateral cyclic input was applied. The condition was stabilized, control position and data was recorded. The dynamic stability test involved a step input (pulse) of about 15% pedal

displacement over 0.5 seconds, and pitch, roll, and yaw deviations recorded. Pedal travel is measured 0% – 100 %, with 50% corresponding to pedals in the neutral (middle) position.

Static Stability

Test Type	0.9V _h at PA	Yaw (Sideslip)	Pedal Position (%)
Static Stability	136 KIAS at 3000 ft	+ 14.5°	Right pedal forward, 83% position
Static Stability	136 KIAS at 3000 ft	-14.2°	Left pedal forward, 5% position

Dynamic Stability

Test Type	0.9V _h at PA	Yaw (Sideslip)	Pedal Pulse
Dynamic Stability	140 KIAS at 3000 ft	3°	Left 12% input, 0.5 sec (6°/sec)
Dynamic Stability	140 KIAS at 3000 ft	4°	Right 13% input, 0.5 sec (8°/sec)
Dynamic Stability	140 KIAS at 3000 ft	5°	Right 13% input, 0.5 sec (10°/sec)
Dynamic Stability	140 KIAS at 3000 ft	3°	Left 16% input, 0.2 sec (15°/sec)

4.2 SIMULATION

Leonardo Helicopters utilized the incident helicopter's flight data and matched the event parameters with Flightlab simulation software³.

Given the available data, the following initial aircraft and ambient conditions were used:

GW = 2700 kg
 CG STA = 5.386 m
 TAS = 148 kt
 HP = 7500 ft
 OAT = 5.6 °C

Starting from a steady flight condition, pitch and roll angles, available from recorded flight data, were used as known input data, while a sharp pedal input was injected into the model. The shape and the amplitude of the pedal input were iteratively modified until the simulation results matched the heading angle time history. Good results were achieved with a pedal input which increases by $\Delta\theta_{TR}=40\%$ in $\Delta T=0.5s$, with respect to the trim pedal value, and then returns to the trim value in $\Delta T=0.5s$ ⁴.

³ The latest AW109SP model was used (model n° F364-109-SXX-C09)

⁴ Aerodynamics angles are not recorded in flight, but were reconstructed from other available parameters (GPS). Some uncertainty affected the results, due to the fact that no information was available on wind direction and intensity and the Indicated Air Speed indicator wasn't captured by the Appareo Camera.

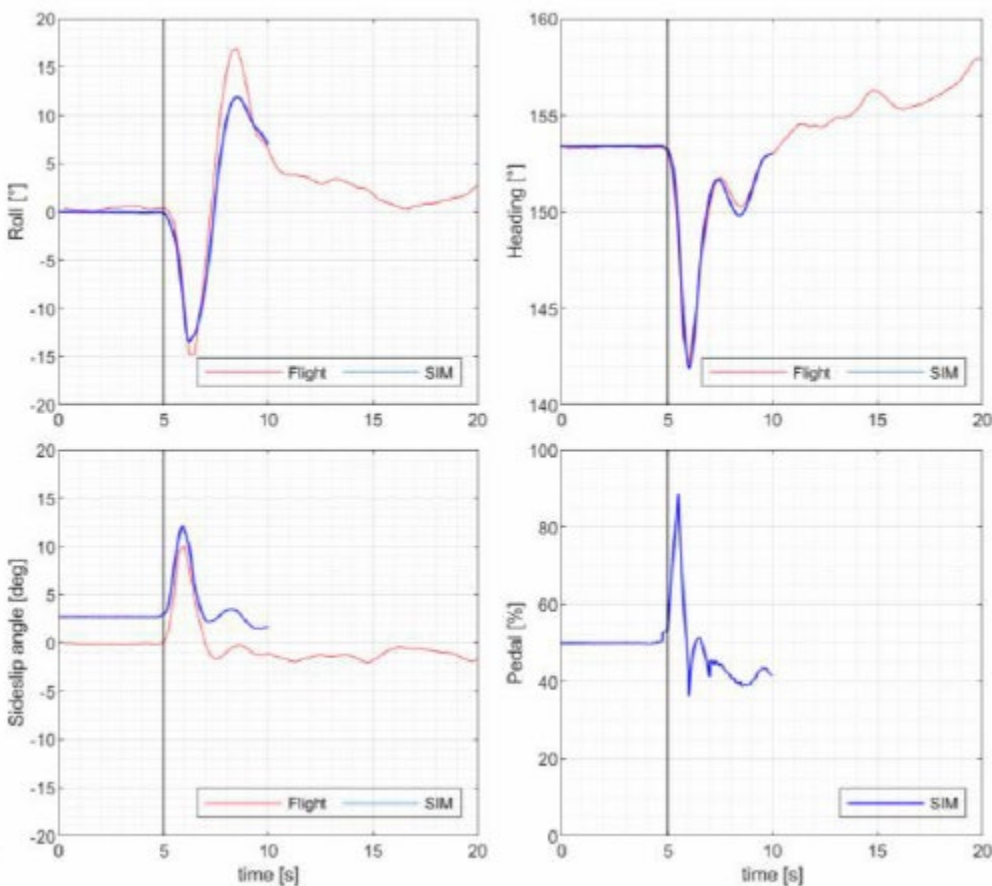


Figure 3 - Plots compare simulated and flight data for sideslip, roll, heading, and pitch parameters.

By matching the accident event heading and roll change over the same period of time, the simulation illustrates that the required left pedal pulse input would be 40% (90% pedal position).

Comparing the pedal input applied during the accident event and pedal input shape used during the dynamic stability is useful. During certification of the A109SP dynamic stability test performed at $0.9V_h$, were limited to 15% pedal input, resulting between 6° deg/s to 15° deg/s sideslip deviation. The accident event resulted in a 20° deg/s deviation which was much more extreme than parameters tested for during certification.

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