



MEMORANDUM FOR RECORD

Albert Nixon
Senior Aviation Accident Investigator
Western Pacific Region-Aviation Safety

Date: Sep 26, 2023
Subject: Record of Email from Benjamin Allen (Legal Representative for Draken International)
NTSB Accident Number: WPR21FA203

In an email from Benjamin Allen, the following is a summary:

The summary below was fine for the public docket.

The following are references from the final report.

Slats/Flaps System:

- The airplane is equipped with high-lift devices consisting of two types of leading-edge slats and double-slotted flaps on each wing.
- The internal drooping slats occupy the 2/5 of the leading edge and have a camber of 25°.
- The external slotted slats occupy 3/5 of the leading edge, are in line with the drooping slats, and have a variable camber.
- The flaps have slots and slips in two parts (internal and external).
- Their camber is different and variable depending on the configuration.
- In the 1/2 extended position, the internal flap is about 28° and the external flap is 13°.
- In the fully extended position, the internal flap is about 48° and the external flap is 25°.
- The airplane's manual control of the high-lift devices was controlled electronically by the "SLATS-FLAPS" lever.
- This control level must be used on takeoff and landing and overrides the combat high-lift device controls.
- There were three positions of the handle: the forward position was fully retracted and guarded by a guard cover, the middle position was ½ flaps and slats completely extended. The rear position was flaps and slats completely extended.
- The slat control system and the two flap actuating jacks were supplied by the hydraulic system 1, ancillary subsystem.

- The airplane's high-lift device selector switch had an EMERGENCY RETRACTION position for slat and flap emergency retraction.
- This position would take precedence over all other current functions selected.
- The combat flaps were for use during combat and increase the lift performance by 25% up to about 18° nose up.

Landing High-Lift Devices Fail to Extend” checklist:

- Calls to check the Slats/Flaps (S/F) circuit breaker, utility hydraulic pressure, and that the high-lift device selector switch is not at EMERGENCY RETRACT position; S/F light out. If the checks confirm the failure, set the slat/flap lever to IN and land without high-lift devices: angle-of attack (AOA) incidence about 11°.

The hydraulic system ancillary shutoff emergency checklist:

- The no-flap landing speeds were incorporated in the hydraulic system ancillary shutoff emergency checklist.
- The checklist states that if the high-lift devices (slats and flaps) do not extend, land with and airspeed between 195 kts to 215 kts depending on aircraft weight and also with an AOA incidence about 11° as per the “Landing High-Lift Devices Fail to Extend” checklist.
- Given the accident airplane was at landing weight, its no-flap landing speed would have been about 195 kts, which assumes the airplane was straight and level and configured with the gear extended.

The aircraft flight manual for the normal F-1 “Break” pattern:

- Depicts initiating the break to downwind about 350 kts, 60° of bank, throttle back to below 6,500 rpm and airbrakes as required.
- Abeam the runway, the airplane should be about 215 kts, configured with the airbrakes in, gear down, and flaps down. The pilot should, according to the manual, extend the downwind leg sufficiently to stabilize speed before the final turn. Approaching the runway at 45°, the key point for the final turn, airspeed should be about 160 kts and AOA incidence about 10°, and RPM about 7,300 rpm.
- During the final turn, airspeed should be about 150 kts and the pilot should use the AOA incidence indicator to control airspeed, less or equal to 13° (12° - 13° on average).

The airplane's incidence indicator is attached to the left side windshield post and displays incidence (AOA) information:

- At a greater than 17° limit incidence, a warning horn activates, and cuts off when the incidence is reduced to 14°.
- The maximum permissible incidence (AOA) is 17°.
- According to the airplane's flight manual: The aircraft behavior at high incidence is very sound. The permissible limit is easily exceeded unless the incidence indicator is watched, the control forces on the control stick are very light and the buffering level is low and constant. The control stick is often pulled up to the pitch travel limit without any obvious anomaly, especially with the combat flaps.

Master Failure Warning light:

- The amber light would illuminate an annunciator on the Failure Warning Panel, which depicts specific system failures, malfunctions, or cautions.
- Illumination of an amber light on both the Master Failure Warning light and Failure Warning Panel would allow for delayed action for the issue.
- If a red light was illuminated, it would call for immediate action.

The airplane was scheduled on an Other Approved Inspection Program (AAIP):

The program consisted of three levels of progressive aircraft inspections. The maintenance and inspection levels were organizational, intermediate, and depot. Organizational inspections consisted of servicing, preventive maintenance, and operational inspections. Intermediate level inspections consisted of intermediate inspections at an interval of 250 flight hours and a minor inspection at 800 flight hours. The depot inspections consisted of a major inspection at 2,400 flight hours.

Draken International completed an assessment of the accident aircraft's final turn performance:

- By attempting to match the accident flight parameters (at a safer and higher altitude) in similarly equipped F-1 aircraft. An aircraft configuration of gear up, flaps up, and slats down was assumed.
- The assessment noted that the accident airplane's overhead pattern track was flown at a tighter track than normal pattern spacing flown by the number two aircraft in the formation.
- During final turns, at various power settings, the assessment noted that the airplane required an additional 1,000 ft to 1,300 ft to recover from the end of the turn and also had a tendency to continue turning at the end of the profile (180-190 kts and 17° AOA).
- It also noted that the pilots needed to unload to roll wings-level to regain airspeed, and furthermore that the afterburner took about 5 seconds to light.
- All of the final turn test runs resulted in excessive AOA of 17° incidence or greater, except for one run, at a low power setting, which resulted in the airplane unable to turn more than 110°.
- A review of the airplane's performance charts indicated that the accident airplane's no-flap configuration would have depleted energy even at maximum afterburner during the final turn and would be at or above 17°AOA incidence (the maximum limit).
- The F-1 Mirage Flight Manual Turn Rate and Radius, Subsonic Envelope Incidence Value, and Available Turning Power – Max AB, Combat Flaps, standard Atmosphere, charts were referenced from the F-1 Performance and Configuration Flight Manual.

Ejection Seat and associated components Examination:

- Examination of the ejection hardware revealed that the ejection equipment functioned normally.
- A review of the airplane's ejection seat envelope revealed that at 130 kts; at a bank of 45°, the minimum altitude was about 300 ft, and at 60° of bank, the minimum altitude was about 450 ft.