

National Transportation Safety Board

Office of Aviation Safety
Central Region



CEN22FA405

FLIGHT TESTING SUMMARY

ACCIDENT

Location: Tomball, Texas
Date: September 1, 2022
Time: 1707 central daylight time
Airplane: Cirrus Aircraft SR22, s/n 8750, registration No. N420SS

ACCIDENT SYNOPSIS

On September 1, 2022, about 1707 central daylight time, a Cirrus SR22 airplane, N420SS, was substantially damaged when it was involved in an accident near Tomball, Texas. The flight instructor was fatally injured; the pilot and passenger sustained serious injuries. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 instructional flight.

FLIGHT TESTING SUMMARY

The National Transportation Safety Board (NTSB) Investigator-In-Charge (IIC) asked the airplane manufacturer, Cirrus Aircraft, to conduct several flight tests to determine if the recovered data from the accident airplane could be used to identify the cause of the total loss of fuel flow during the flight.

Cirrus Aircraft provided the NTSB IIC with recorded flight test data and general observations made during each flight test. For the purposes of this summary, the flight test datasets were identified as Tests A-G, as shown in Table 1. The NTSB IIC plotted and annotated the data discussed in this summary.

Test ID	Date	Make/Model	S/N	Test Scenario
Test A	10 SEP 2022	Cirrus SR22	8814	Mixture Idle Cutoff, Electric Pump OFF
Test B	10 SEP 2022	Cirrus SR22	8814	Mixture Idle Cutoff, Electric Pump OFF
Test C	09 SEP 2022	Cirrus SR22	8814	Mixture Idle Cutoff, Electric Pump ON
Test D	13 SEP 2022	Cirrus SR22	2334	Simulated Fitting Failure, Electric Pump OFF
Test E	13 SEP 2022	Cirrus SR22	2334	Simulated Fitting Failure, Electric Pump OFF
Test F	13 SEP 2022	Cirrus SR22	2334	Simulated Fitting Failure, Electric Pump ON
Test G	13 SEP 2022	Cirrus SR22	2334	Simulated Fitting Failure, Electric Pump ON

Table 1 - Flight tests flown in support of investigation

Mixture Idle Cutoff, Electric Pump OFF (Test A, Test B)

Flight testing revealed that when the mixture control was moved full aft to the idle cutoff position with the electric fuel pump off, the decrease in fuel flow closely matched the recorded data from the accident flight, as shown in Figure 1. The fuel

flow decreased from 7.6 gph to zero in 8-9 seconds. During the flight test, the throttle initially remained unmoved when the mixture control was placed in the idle cutoff position, but after a small rise in manifold pressure, the test pilot made one throttle reduction followed by two throttle advances to match the recorded accident data. Normal fuel flow and engine operation were restored when the mixture control was increased forward of the idle cutoff position.

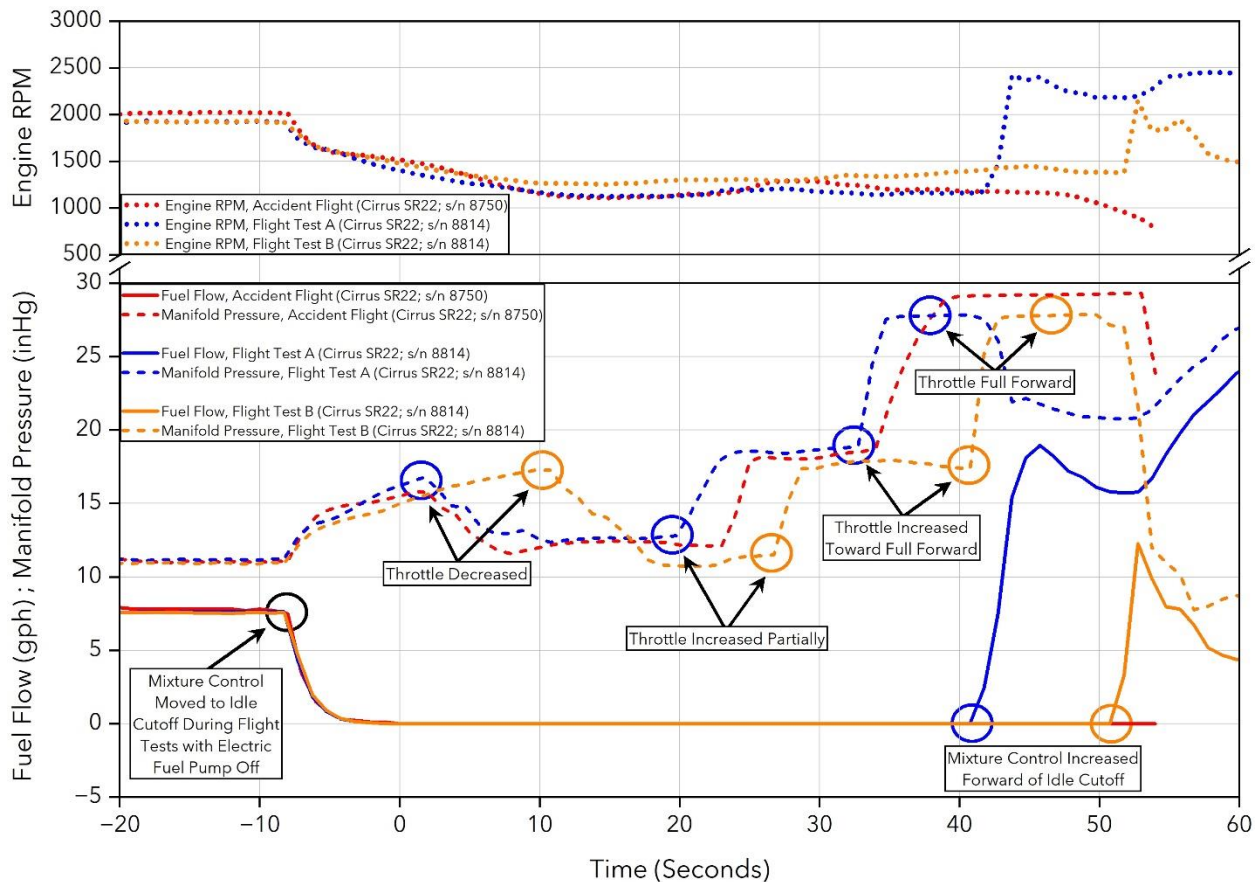


Figure 1 - A plot comparing accident data with flight test data. The flight test scenario was the placement of the mixture control to the idle cutoff position with the electric fuel pump off. The plotted parameters include engine speed, fuel flow, and manifold pressure. The flight test data is time-aligned with the accident data to depict the loss of fuel flow at the same time.

Mixture Idle Cutoff, Electric Pump ON (Test C)

Flight testing revealed that when the mixture control was moved full aft to the idle cutoff position with the electric fuel pump on, the decrease in fuel flow did not match the recorded data from the accident flight, as shown in Figure 2. Notably, the fuel flow did not decrease to zero; the fuel flow was 2.5 gph to 5.0 gph, depending on the throttle position. The test pilot noted that the engine continued to operate with

noticeable roughness while the mixture control was in the idle cutoff position with the electric fuel pump on. Normal fuel flow and engine operation were restored when the mixture control was increased forward of the cutoff position.

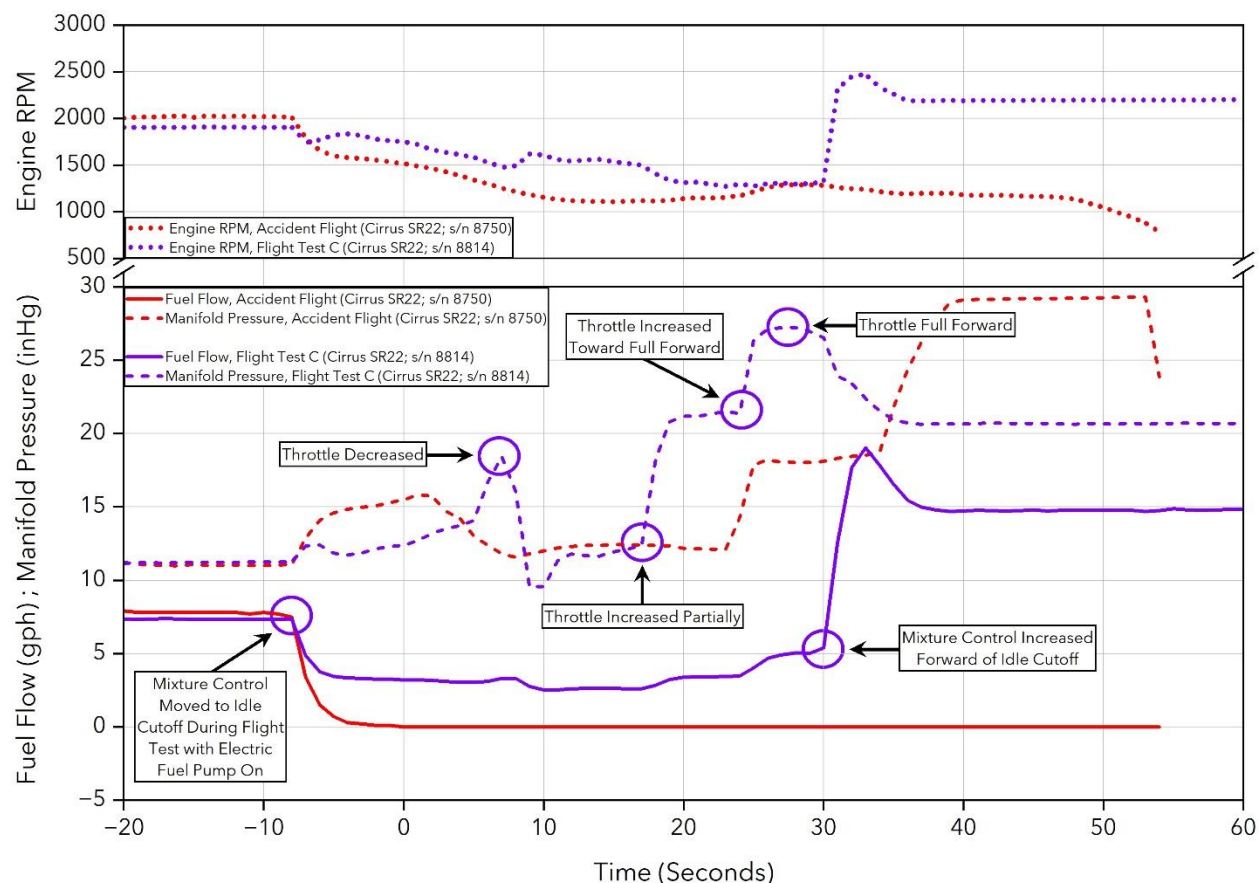


Figure 2 - A plot comparing accident data with flight test data. The flight test scenario was the placement of the mixture control to the idle cutoff position with the electric fuel pump on. The plotted parameters include engine speed, fuel flow, and manifold pressure. The flight test data is time-aligned with the accident data to depict the loss of fuel flow at the same time.

Simulated Fitting Failure, Electric Pump OFF (Test D, Test E)

A Cirrus Aircraft SR22 test airplane, operated in the experimental category, was modified with an electronic fuel valve installed before the inlet fitting to the electric fuel pump to simulate a separation failure of the 90° elbow inlet fitting. The electronic fuel valve, when actuated, resourced the electric fuel pump inlet from the fuel line to ambient air. The modified installation required an additional 6-inch segment of fuel line between the electronic valve and the electric fuel pump.

The modified test airplane was flown to altitude before the test pilot entered a descent with engine power settings similar to the accident flight. During the descent with the electric fuel pump off, the electronic fuel valve was activated to simultaneously shutoff access to the fuel line and vent the electric fuel pump inlet to ambient air. The results of two similar tests did not replicate the total loss of fuel flow recorded during the accident flight, as shown in Figure 3. Notably, the fuel flow did not immediately decrease to zero, rather there was a slower decrease of fuel flow that extended past 25 seconds. In one test, the fuel flow eventually decreased to 0.02 gph about 30 seconds after the electronic fuel valve was activated. Normal fuel flow and engine operation were restored when the test pilot selected the electronic fuel valve to draw fuel from the fuel line instead of being vented to ambient pressure.

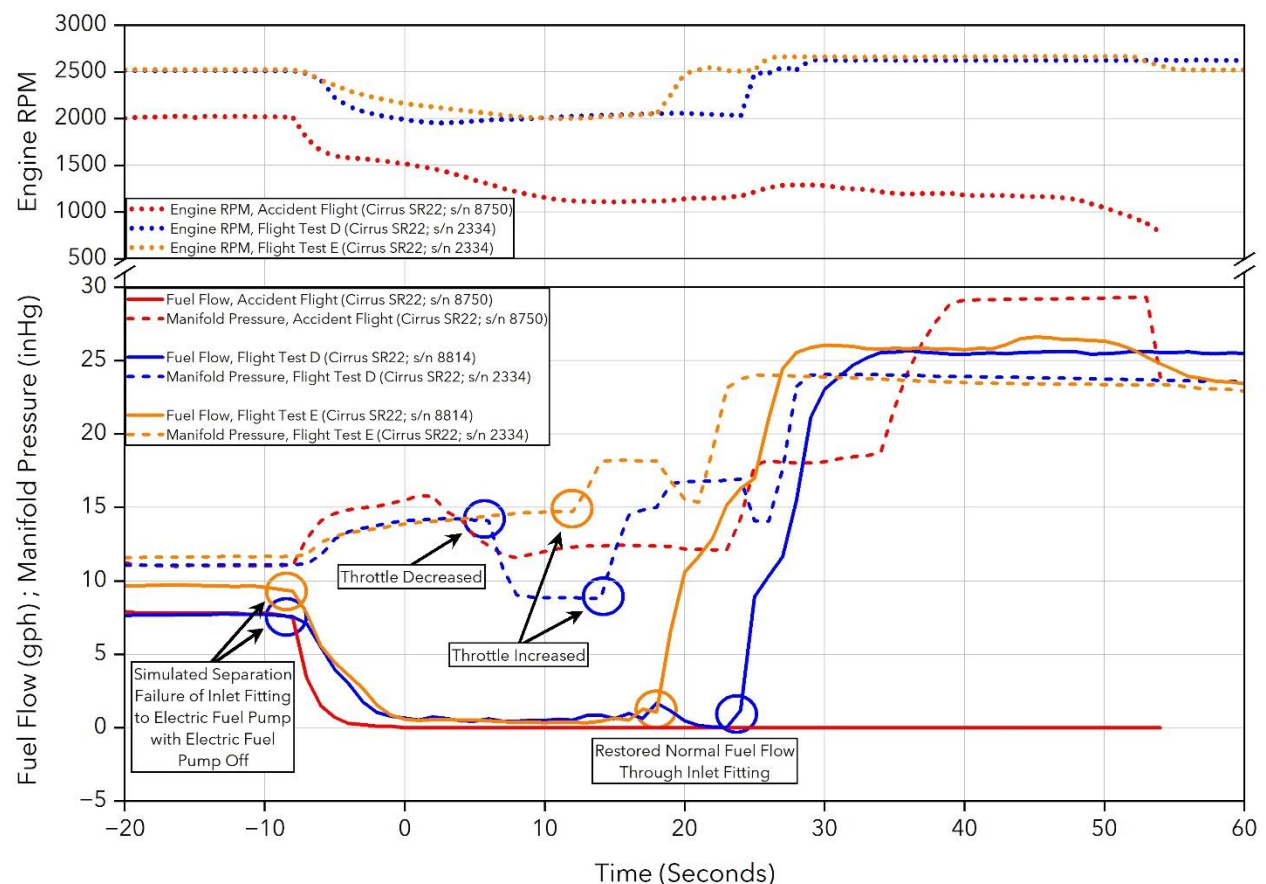


Figure 3 - A plot comparing accident data with flight test data. The flight test scenario was a simulated separation failure of the 90° elbow inlet fitting to the electric fuel pump with the electric fuel pump off. The plotted parameters include engine speed, fuel flow, and manifold pressure. The flight test data is time-aligned with the accident data to depict the loss of fuel flow at the same time.

Simulated Fitting Failure, Electric Pump ON (Test F, Test G)

Further flight testing was conducted to determine what affect an operating electric fuel pump had during a simulated separation failure of the electric fuel pump inlet fitting. The flight test data showed that the fuel flow did not immediately decrease to zero, rather an initial 20 second decrease toward a low fuel flow rate (< 0.5 gph) that continued another approximately 20 seconds before the test pilot restored normal fuel flow and engine operation by selecting the electric fuel valve to draw fuel from the fuel line instead of being vented to ambient pressure, as shown in Figure 4.

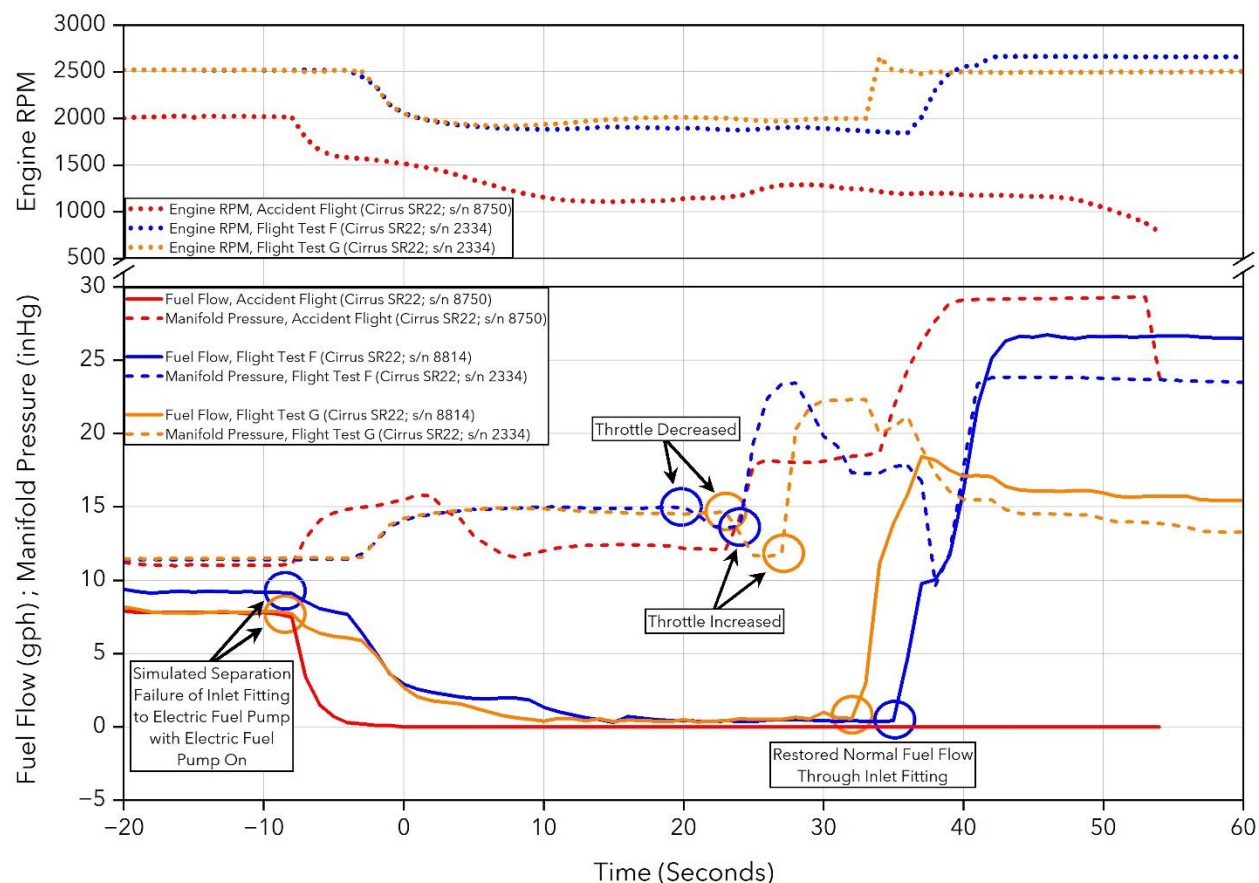


Figure 4 - A plot comparing accident data with flight test data. The flight test scenario was a simulated separation failure of the 90° elbow inlet fitting to the electric fuel pump with the electric fuel pump on. The plotted parameters include engine speed, fuel flow, and manifold pressure. The flight test data is time-aligned with the accident data to depict the loss of fuel flow at the same time.