The Engine Out Pedals

I was very fond of Roby Craft. I was his substitute copilot for a flight one fine morning in an RB-47K, a photo-mapping version of the RB-47 series. We were to fly up to Michigan to map a large part of the state for low level training routes for bombers.

At lift-off the plane banked hard to the left, threatening to drag the wing tip. Full aileron throw to the right would not stop the increasingly rapid roll to the left. From the back seat I saw the 'ball' in the turn and bank indicator fully displaced to the right and pressed hard on the corresponding right rudder pedal which, we found out later, was the only way to stop the roll to the left. It had to be done within 2 or 3 seconds.

There had been several identical incidents of this sort across the B-47 fleet before, but there was never enough burnt wreckage left after the fuel-fed fires for Boeing to figure out what caused them. In fact, a short time before, an RB-47H flown by a highly experienced 55th crew, had crashed alongside that same runway. Max Moore: “The crash you refer to was Woolbright’s, on 27 Sept 1962. The crew I was on, deployed later that day with the wreckage still smoldering”.

After a lengthy investigation of our RB-47K incident, the cause was traced to an unrecognized outboard engine flame-out. A pressure sensing tube to the fuel regulator on the #6 engine broke, causing the RPM to drop slightly. Normally this would not cause a problem. The loss of thrust would be barely noticed. But water-alcohol injection was often used during take-off to increase engine thrust. If an engine’s RPM dropped below 96%, the fluid would douse the flame, causing the engine to “flame out”.

The B-47 had three design features that could turn a simple problem of this sort into a tragedy. The first was a bicycle type of main gear. While other types of aircraft would veer towards the dead engine during takeoff roll, it would be corrected with rudder application. But the B-47 would track effortlessly down the runway until lift-off, then veer suddenly towards the dead engine.

The second feature was a low speed roll control augmenting system using the trailing edge flaps. With the flaps extended, control wheel input towards a wing would spill the outboard segment of that flap, called a flaperon, flap/aileron, on that wing to increase the roll rate.

The third feature was swept back wings. The advancing wing on this type of aircraft generates more lift than the receding wing on the other side during yawed flight.

As the doomed RB-47 broke ground the loss of thrust on that side caused that wing to lag, losing lift while the advancing wing gained lift. The lagging wing began to drop so

the pilot naturally turned the control wheel away to raise it. This spilled the outboard flap, or flaperon, on the rising wing with the three operating engines, which would normally cause that wing to fall.

But in an engine out situation at low airspeed, the reduced drag of the spilled flap caused the wing with all three engines at full thrust to advance even faster, gaining more lift then the spilled flap could give up. Worse, on the wing with the inoperative engine, the outboard flap, or flaperon, remained in the full flap position, increasing drag, further slowing that wing. Even the aileron in its full down position added to the drag on the engine out wing.

Only rudder application or retarding the outboard engine on the opposite side to remove the severe yaw could save the plane. Retarding an engine at lift-off on an under powered, fully loaded plane would be done only as a last resort. Even so, if full rudder were not applied within 2 or 3 seconds, the plane's roll would progress to a point where loss of lift would cause it to fall on its wing along the side of the runway.

Before the cause of this accident was determined an identical engine failure happened to us on takeoff on the same runway. While in the co-pilot's seat at lift off I saw the left wing begin to drop, and the control wheel being turned full right by the AC to bring it up, without success. The skid ball in the turn and bank instrument was fully displaced to the right. Agonizing hours spent in Training Command TB-25's holding the rudder pedal full travel to maintain control during engine out practice caused me to automatically push the right rudder pedal full in to center the ball. The wings rapidly came level, the airspeed increased, and the plane proceeded to climb as control was regained.

Later, when the two incidents were compared, we were told that rudder application at that critical low speed period of flight saved us from the fate of Woolbright's plane. Most of our pilots were trained in single engine, center thrust trainers. Rudder was used mostly to steer the planes during taxi. There wasn't a need for rudder application during an engine failure, so in a critical moment such as in these incidents it was forgotten. After our incident, the rudder pedals were renamed "Engine out Pedals".

- Franc Andrijeski