

BUSINESS CASE

UNITED AIRLINES 232

by Jan U. Hagen

Communication during crisis



UAL flight 232: get this thing down

Four months later, and before the positive experiences gained from UAL 811 were made public, there was an even more dramatic case involving United Airlines flight 232 (UAL 232). During this flight on July 19, 1989, the main rotor blade of the middle engine of the McDonnell Douglas DC-10 broke.¹⁷³ The engine exploded, destroying all of the plane's hydraulic lines. As the DC-10 was designed with three independent and redundant systems, this situation should never have arisen. Although the plane could still fly with the two remaining engines, it could no longer be controlled; without the hydraulic systems neither the aileron, rudder, nor elevator could be moved.¹⁷⁴ Still, the crew managed to land the plane at the airport in Sioux City, Iowa, 44 minutes after the explosion. Controlling this large passenger plane without hydraulic systems was thought to be fundamentally impossible and only succeeded due to some extraordinary teamwork.

The three-strong cockpit crew was already on the third day of a four-day rotation. Captain Alfred "Al" Haynes (57) had been flying for United for 33 years, notching up a total of almost 30,000 flying hours. He had been captaining DC-10s for four years and knew the plane inside out.

With around 20,000 hours, copilot William "Bill" Records (48) was also an extremely experienced pilot. However, he had only been with United for four years and had not yet achieved the rank of captain, despite all his flying hours.¹⁷⁵ Although he had been flying the DC-10 for United for just one year, he had previously flown this type of plane for National Airlines and Pan Am.

172 House of Representatives (1989), p. H1798.

173 The following information is based on the report by the National Transportation Safety Board, cf. NTSB (1990), Haynes, A.C (1991), and on an interview with Bill Records.

174 In smaller planes, the control surfaces are operated using mechanical cables. This is not an option in larger planes because of the size of the control surfaces and the force required to manipulate them. The control surfaces on larger planes are therefore operated either hydraulically or electrically.

175 Quite apart from being fundamentally suitable to take command of a plane, the appointment to captain is largely based on seniority, that is, the length of service for that particular airline. As Records only joined United as part of a company takeover, he had low seniority within the company at the time of the accident.

Flight engineer Dudley Dvorak (51) had been working for United for three years. He was also very experienced, having accumulated 15,000 flying hours. However, he had only been flying in the DC-10 for a month.

One of the passengers on board was captain Dennis “Denny” E. Fitch (46), who was flying to Chicago on UAL 232 as an off-duty pilot in the cabin. Like Haynes, he was a veteran and had already been flying for United for 21 years. He had racked up a total flying time of nearly 23,000 hours, of which 2,987 had been spent in the DC-10. What is more, he also worked as a training captain for United in Denver. He was not acquainted with any members of the UAL 232 crew.

The plane was an 18-year-old McDonnell Douglas DC-10-10 that had completed more than 43,000 flying hours and nearly 17,000 rotations. Maintenance work had been carried out as prescribed and no technical defects had occurred.

On July 19, UAL flight 232 left Denver without incident at 2:09 p.m. local time and set course for Chicago (Figure 3.4). On board were 285 passengers and 11 crew members – three in the cockpit and eight in the cabin. It was a clear summer afternoon and Bill Records was the pilot at the



Figure 3.4 Planned route of UAL 232 from Denver to Chicago

controls. Captain Haynes was in the middle of drinking a cup of coffee when, at 3:16 p.m.,¹⁷⁶ engine number two (Figure 3.5) exploded.

The pilots in the cockpit heard the explosion, as did the passengers. The plane began to shake violently.¹⁷⁷ Acoustic alerts sounded and warning lights flashed in the cockpit. The plane was shuddering so hard that it was almost impossible to read the instruments, but Haynes and Records finally managed to establish that engine number two had failed. To compensate for this failure, Records applied full thrust to the other engines. The crew pulled out the relevant checklists and worked through them. There are no recordings for the conversations in the cockpit at this time. The voice

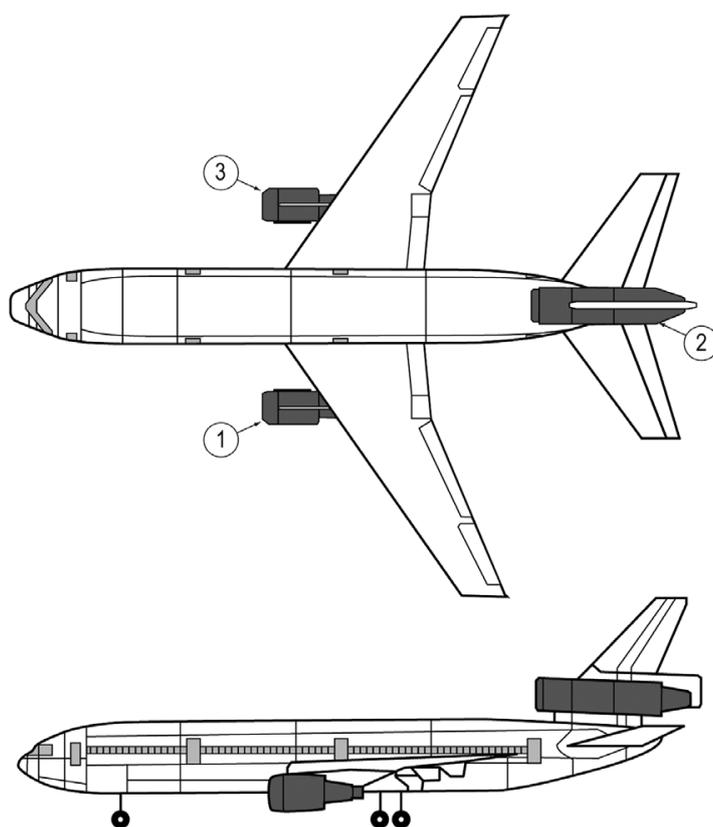


Figure 3.5 **View of the DC-10 showing the engines**

176 Central daylight time.

177 The first 10 minutes of this emergency could only be reconstructed afterwards using interviews with the crew. As the voice recorder records information in an endless loop lasting a little more than 30 minutes, only the recordings made after 3:26 p.m. remain.

recorder only records 30 minutes of a flight at a time and is constantly overwritten.

Dvorak realized that the pressure in all three hydraulic systems had fallen to zero. Despite the fully deployed left aileron, the DC-10 kept rolling further and further to the right. If that continued, the plane would end up on its back. As Al Haynes said later, “An airplane about to roll onto its back at 35,000 feet is pretty scary, so you just do anything to make it stop.”¹⁷⁸ Haynes reduced the power to engine number one and took control of the plane from Records. The plane returned to the horizontal position.

Not long after, the plane had dropped 2,000 feet (700 m). Although Haynes had managed to stabilize the plane, he knew it was virtually impossible to control it without the hydraulic systems. Records or Dvorak tried to reactivate the hydraulics using a wind-driven auxiliary generator extended below the plane. It did not work, so Haynes had to manipulate the thrust lever extremely carefully to keep the DC-10 even vaguely stabilized.

At 3:20 p.m., Records reported the emergency to Minneapolis Air Route Traffic Control (ARTCC) and requested that the plane be diverted to the nearest airport. The controller at Minneapolis suggested Des Moines International Airport (Iowa), which was 170 miles away. Shortly after, he said that Sioux Gateway Airport would be a better option. Although smaller and with shorter runways, it was only 70 miles away. Air traffic control in Minneapolis handed over to Sioux City. The radar screen in the control room of Sioux City Tower was manned by 27-year-old Kevin Bachman, who had only gained his license for approach control three months earlier.¹⁷⁹

Minneapolis ARTCC [to Sioux City Approach]: “Sioux City, got an emergency for you.”

Sioux City Approach: “All right.”

Minneapolis ARTCC: “I’ve got a United aircraft coming in, lost number two engine, having a hard time controlling the aircraft right now. He is out of twenty-nine thousand (feet) and descending to Sioux City. Right now he is just east of your VOR, but he wants the equipment standing by right now. He’s east forty miles.”

Sioux City Approach: “Radar contact.”

178 Haynes, A.C. (1991).

179 Tri-City-Herald (1989), C-3.

Minneapolis ARTCC: “He is having a hard time controlling the plane right now and trying to slow down and get steady on a heading. As soon as I get comfortable, I’ll ship him over to you and he’ll be in your control.”

Sioux City Approach: “All right.”

From the cockpit, Dvorak informed the passengers that an engine had failed and the plane would now be heading for an alternate airport. He promised to keep them updated.

Haynes asked purser Janice Brown to come to the cockpit and explained the situation to her. He told her she would have to prepare the passengers for an emergency landing. Brown returned to the cabin and passed the information on to the other flight attendants. Next, training captain Denny Fitch, who was in the first-class section, spoke to Brown and offered to help out in the cockpit. Brown promptly got back to Haynes and asked whether that would be okay. Haynes said, “Bring him up.” By this time, he and Records barely managed to keep the plane leveled. At 3:26 p.m., Haynes reported to Bachman in Sioux City. There are recordings of the conversations in the cockpit from this point on. The following parts are extracts, minus an overload of technical details.

Haynes [to Sioux City Approach]: “Sioux City approach, United two thirty two heavy, with you out of twenty-six [thousand feet]. We got about a five-hundred-foot rate of descent. Okay, you know, we have almost no control ability, very little elevator, almost no aileron. We’re controlling the turns by power. I don’t think we can turn right. I think we can only make left turns.”

Sioux City Approach: “United two thirty two heavy, understand you can only make right turns.”¹⁸⁰

Haynes: “That’s affirmative.”

Haynes [to Records]: “Now that goddamn elevator doesn’t want to work. Rolling right.”

Records: “Very little elevator. It’s hard or sluggish. Al, do you want me to slew this elevator?”

Haynes: “Yeah, do whatever you can.”

180 Bachman already saw on his radar screen that UAL 232 was only turning right. He just asked Haynes for a confirmation and therefore clarified Haynes’ slightly confused radio transmission.

Despite both their efforts, the DC-10 continued to rise and drop in a two-minute cycle.¹⁸¹ Each time the plane dropped a further 2,000 feet in altitude. For the passengers, it was like riding a rollercoaster.

By this time, Dvorak had established radio contact with the United maintenance center in San Francisco (San Francisco Aero Maintenance, SAM). He wanted to know how they could stabilize the plane. Perhaps he was too matter-of-fact in describing their dilemma because the engineers from SAM did not appear to grasp the full severity of the situation. Also, for such situations there were no emergency procedures in place; the loss of hydraulic power was thought impossible due to a triple redundant system. Should such a loss occur, it was considered hopeless for all involved. Al Haynes later described this failure as a further example of “Murphy’s Law.”¹⁸² No emergency procedures were in place for such situations.

Dvorak [to SAM]: “This is United two thirty two heavy. We blew number two engine and we’ve lost all hydraulics and we are only able to control level flight with the asymmetrical power settings. We have very little rudder or elevator.”

SAM: “United two thirty two, understand you lost number two engine totally, sir.”

Dvorak: “That’s affirmative.”

SAM: “System one and system three? They are operating normally?”

Dvorak: “Negative. All hydraulics are lost.”

SAM: “Okay, United two thirty two, where you gonna set down?”

Dvorak: “We need some assistance right now. We can’t – we are having a hard time controlling it.”

SAM: “Okay, United two thirty two. I’ll try to help you. I’ll pull out your flight manual.”

Records: “Wonder about the outboard ailerons. If we put some flaps out, you think that would give us outboard?”

Dvorak: “God, I hate to do anything.”

Haynes: “Well, we’re going to have to do something.”

181 Known as phugoid oscillations, these occurred due to incorrect trimming following the engine failure and could no longer be corrected due to the failure of the hydraulic systems. The crew managed to limit these oscillations by adjusting the engine power.

182 Haynes, A.C. (1991).

The time was now 3:29 p.m. It had been 13 minutes since the explosion. In the tower of Sioux City, Bachman had ordered preparations for an emergency landing. On the radar screen he could see that the plane was now nearly impossible to control. The DC-10 kept wallowing to the right. Bachman spoke to his supervisor, Mark Zielezinski, and told him they would probably lose the plane. In San Francisco, the engineers at SAM tried to help the crew of UAL 232. The crisis team at United had also been notified. A rescue team was sent to Sioux City. The fire service at the airport had put the hospitals in Sioux City on alert.

Fitch entered the cockpit. Without pausing to greet him, Haynes asked Fitch to see what he could see from the cabin. Fitch returned to the cabin.

Records: "Don't pull the throttles off. What's the hydraulic quantity?"

Dvorak: "Down to zero."

Records: "On all of them?"

Dvorak: "All of them."

Haynes: "Quantity is gone?"

Dvorak: "Yeah, all the quantity is gone. All pressure is gone."

Haynes: "You got hold of SAM?"

Dvorak: "Yeah, I've talked to him."

Haynes: "What's he saying?"

Dvorak: "He's not telling me anything."

Fitch now reentered the cockpit. Haynes turned to him.

Haynes: "We've lost – no hydraulics. We have no hydraulic fluid. That's part of our main problem."

Fitch: "Okay. Both your inboard ailerons are sticking up. That's as far as I can tell."

Haynes: "Well that's because we're steering – we are turning – maximum turn right now."

Fitch: "Tell me. Tell me what you want and I'll help you."

Haynes: "Right throttle. Close one, put two up. What we need is elevator control. And I don't know how to get it."

Fitch: "Okay."

Haynes asked Fitch to help them control the remaining two engines. Fitch took up position at the middle console between Haynes and Records. Haynes focused on coordinating other activities. Dvorak received a radio communication from United Dispatch, which had just been informed of the emergency.

Dispatch: “United two thirty two, do you want to put that thing on the ground right now or do you want to come to Chicago?”

Dvorak: “Well, we can’t make Chicago. We’re gonna have to land somewhere out here, probably in a field.”

Haynes turned to Fitch. “How are they doing on the evacuation?”

Fitch: “They’re putting things away, but they’re not in a big hurry.”

Haynes: “They better hurry. We’re gonna have to ditch, I think.”

Fitch: “Yeah.”

Haynes: “Okay, I don’t think we’re going to make the airport.”

Records: “No. We got no hydraulics at all.”

Haynes: “Gotta put some flaps and see if that’ll help.”

Records: “You want them now?”

Haynes: “What the hell. Let’s do it. We can’t get any worse than we are.”

Records: “Slats are out.”

Fitch: “No, you don’t have any slats.”

Haynes: “We don’t have any hydraulics, so we’re not going to get anything.”

Sioux City Approach: “United two thirty two heavy, can you hold that present heading, sir?”

Fitch: “Ask them where the hell we are.”

Haynes [to Sioux City Approach]: “Where’s the airport to us now, as we come spinning down here?”

Sioux City Approach: “United two thirty two heavy, Sioux City airport is about twelve o’clock and three six miles.”

Haynes: “Okay we’re trying to go straight. We’re not having much luck.”

Fitch: “Okay, if you get denser air, you should get level flight back again. Whatever you got you got.”

Haynes [laughing]: “We didn’t do this thing on my last performance check in a simulator.”

All four laugh.

Haynes: “I poured coffee all over – it’s just coffee. We’ll get this thing on the ground. Don’t worry about it.”

Records: “It seems controllable, doesn’t it, Al?”

Fitch: “Yeah. The lower you get, the more dense the air is and the better your shots. Okay?”

Haynes [to Sioux City Approach]: “Sioux City, United two thirty two, could you give us please your ILS frequency, the heading, and length of the runway?”

Sioux City Approach: “Two thirty two heavy, the localizer frequency is one zero nine point three. It’ll take about two four zero heading to join it. The runway is nine-thousand-feet long.”

Thanks to the lower altitude and therefore denser air, Fitch, Haynes, and Records had now managed to stabilize the DC-10, although the intermittent rise and fall continued.

SAM: “United two thirty two, this is SAM.”

Dvorak: “SAM, two thirty two, we’re gonna try and put into Sioux City. We’re very busy right now. We’re trying to go into Sioux City. We’ll call you as soon as I can.”

SAM [to Dispatch]: “He has no control. He’s using that kind of sink rate, I believe. This is what he’s doing. He’s got his hands full for sure.”

Haynes: “Start dumping fuel. Just hit the quick dump. Let’s get the weight down as low as we can.”

Dvorak: “I didn’t have time to think about that.”

Haynes: “Try not to lose any more altitude than we have to.”

Records: “Okay. Go ahead and dump.”

Fitch: “This thing seems to want to go right more than it wants to go left, doesn’t it?”

Sioux City Approach: “United two thirty two heavy, did you get the souls on board count?”

Haynes [to Dvorak]: “What did you have for a count for people?”

Haynes [to Sioux City Approach]: “Let me tell you, right now we don’t even have time to call the gal.”

Dvorak [to Sioux City Approach]: “Two ninety two.”¹⁸³

Fitch: “Power’s coming back in.”

Haynes: “Bring it to the right one. You got to go left. We just keep turning right, still turning right.”

Fitch: “That’s what I am trying to do.”

Haynes [to Sioux City Approach]: “Two thirty two, we’re just gonna have to keep turning right. There’s not much we can do about turning left. We’ll try to come back around to the heading.”

Records: “Is that Sioux City down to the right?”

Haynes: “That’s Sioux City.”

Haynes [to Dvorak]: “Did you ever get hold of SAM?”

Dvorak: “Yep. Didn’t get any help.”

Records [to Sioux City Approach]: “Where is Sioux City from our present position, United two thirty two?”

Sioux City Approach: “United two thirty two, it’s about twenty on the heading and thirty-seven miles.”

Haynes to Fitch: “You had the thing leveled off for minute. My name’s Al Haynes.”

Fitch: “Hi, Al. Denny Fitch.”

Haynes: “How do you do, Denny?”

Fitch: “I’ll tell you what. We’ll have a beer when this is all done.”

Haynes: “Well, I don’t drink, but I’ll sure have one.”

Fitch: “You lost the engine?”

Haynes: “Yeah, well, yeah. It blew. We couldn’t do anything about it. We shut it down.”

Fitch: “Yeah.”

183 There were in fact 296 people on board – 285 passengers and 11 crew members.

Haynes: “Can’t think of anything that we haven’t done. There really isn’t a procedure for this.”

SAM: “United two thirty two, in your handbook page ninety-one.”

Dvorak: “We already have a no flap, no slat made up and we’re getting ready. We’re gonna try to put into Sioux City with gear down.”

Sioux City Approach: “When you get turned to that two-forty heading, sir, the airport will be about twelve o’clock and thirty-eight miles.”

Records: “Okay, we’re trying to control it just by power alone now. We have no hydraulics at all, so we’re doing our best here.”

Sioux City Approach: “Roger, and we’ve notified the equipment out in that area, sir. The equipment is standing by.”

Haynes called Janice Brown into the cockpit.

Haynes: “Everybody ready? We’ve almost no control of the airplane. It’s gonna be tough, gonna be rough.”

Brown: “So we’re gonna evacuate?”

Haynes: “Yeah. And if we can keep the airplane on the ground and stop standing up, give us a second or two before you evacuate. ‘Brace’ will be the signal; it’ll be over the PA system – ‘brace, brace, brace.’”

Brown: “And that will be to evacuate?”

Haynes: “No, that’ll be to brace for landing. And if you have to evacuate, you’ll get the command signal to evacuate, but I really have my doubts you’ll see us standing up, honey. Good luck, sweetheart.”

Brown: “Thank you.” The purser returned to the cabin.

Dvorak: “She [Janice Brown] says there appears to be some damage on that one wing. Do you want me to go back and take a look?”

Fitch: “No, we don’t have time.”

Haynes: “Okay, go ahead. Go ahead and see what you can see, not that it’ll do any good. I wish we had a little better control of the elevator. They told us the autopilot would do this, but it sure as hell won’t. Try yours again.”

Fitch: “All right, we came into the clean air.”

Haynes: “Turn, baby.”

Fitch: “Which way do you want it, Al?”

Haynes and Records: “Left.”

Haynes: “Back on that sucker down a little bit more.”

Haynes: “How do we get the gear down?”

Fitch: “Well, they can freefall. We got the gear doors down?”

Haynes: “Yep.”

Records: “We’re gonna have trouble stopping too.”

Haynes: “Oh yeah. We don’t have any brakes.”

Fitch: “Braking will be a one-shot deal. Just mash it, mash it once. That’s all you get. I’m gonna give you a left turn back to the airport. Is that okay?”¹⁸⁴

Haynes [to Sioux City]: “Okay, United two thirty two, we’re starting to turn back to the airport. Since we have no hydraulics, braking is gonna really be a problem. I would suggest the equipment be toward the far end of the runway. I think under the circumstances, regardless of the condition of the airplane when we stop, we’re going to evacuate. So you might notify the ground crew that we’re gonna do that.”

Sioux City Approach: “United two thirty two heavy, wilco,¹⁸⁵ sir. If you can continue that left turn to about two-twenty heading, sir, that’ll take you to the airport.”

Haynes: “Two-twenty, roger.”

Haynes [to Dvorak]: “What did SAM say? Good luck?”

Dvorak: “He hasn’t said anything.”

Haynes: “Okay, we’ll forget them. Tell them you’re leaving the air and you’re gonna come back up here and help us... and screw them. Ease her down just a little bit.”

At 3:49 p.m., Haynes gave the order to deploy the landing gear.

Haynes: “Okay, put it [the gear] down.”

Fitch: “Got to get my glasses on or can’t see shit.”

Records [to Sioux City Approach]: “Where’s the airport?”

Sioux City Approach: “United two thirty two, the airport’s currently twelve o’clock and two one miles. You’re gonna have to widen out just

184 This is odd given that the crew was convinced they could not make any left turns. After the flight, none of the four crew members could remember having flown a left turn. However, both the voice recorder and radar recordings provided evidence of this.

185 Used in radio communications to confirm “will comply.”

a little to your left, sir, to make the turn to final and also it'll take you away from the city."

Haynes [to Sioux City Approach]: "Whatever you do, keep us away from the city."

Sioux City Approach: "You are currently one seven miles north-east of the airport. You're doing good."

Dvorak was having trouble coping with controlling the engines and turned to Fitch.

Dvorak: "Do you want this seat?"

Fitch: "Yes, do you mind?"

Dvorak: "I don't mind. I think you know what you're doing there."

Fitch and Dvorak swapped places.

Haynes: "Want to keep turning right. Want to go to the airport."

Fitch: "I got the tower."

Haynes: "Come back, all the way back."

Fitch: "I can't handle that steep a bank."

Haynes: "Damn it. Wish we hadn't put that gear down."

Dvorak: "Ah, well."

Fitch: "We don't know."

Haynes: "I want to get as close to the airport as we can."

Fitch: "Okay."

Haynes: "If we have to set this thing down in dirt, we set in the dirt."

Dvorak [over PA]: "We have four minutes to touchdown, four minutes to touchdown."

Sioux City Approach: "United two thirty two heavy, roger. Can you pick up a road or something up there?"

Fitch: "Airport's down there. Got it."

Haynes: "I don't see it yet."

Fitch: "No left at all."

Haynes: "Back, back – forward, forward. Won't this be a fun landing?"
[Laughter]

Sioux City Approach: “United two thirty two heavy, roger. The airport’s currently at your one o’clock position, one zero miles.”

Fitch: “I got the runway.”

Haynes: “I don’t. Come back, come back.”

Fitch: “It’s off to the right over there.”

Sioux City Approach: “United two thirty two heavy, if you can’t make the airport, sir, there is an interstate that runs north to south, to the east side of the airport. It’s a four-lane interstate.”

Haynes [to Sioux City Approach]: “We have the runway in sight. We’ll be with you shortly. Thanks for your help.”

Fitch: “Bring it down. Ease her down.”

Records: “Oh, baby.”

Sioux City Approach: “United two thirty two heavy, the wind’s currently three six zero [degrees] at eleven [knots]. You are cleared to land on any runway.”

Haynes [laughing]: “Roger. You want to be particular and make it a runway, huh?”

Sioux City Approach: “There’s a runway that’s closed, sir. That could probably work.”

Haynes [to Sioux City Approach]: “We’re pretty well lined up on this one here.”

Two minutes before the landing, Bachman realized that UAL 232 was heading for runway 22 rather than the planned runway 31 that had been cleared in preparation. As it was not in use, runway 22 was currently occupied by all the fire vehicles and heavy equipment waiting for UAL 232 to land on runway 31. Bachman immediately redirected the rescue teams and cleared runway 22. Haynes and Records noticed the vehicles scrambling to the side.

Sioux City Approach: “United two thirty two heavy, roger, sir. That’s a closed runway, sir, that’ll work, sir. We’re getting the equipment off the runway.”

Haynes [to Sioux City Approach]: “How long is it?”

Sioux City Approach: “Sixty-six-hundred feet, six thousand six hundred. Equipment’s coming off.”

Haynes [to Fitch]: “Pull the power back. That’s right – pull the left one back.”

Records: “Pull the left one back.”

Sioux City Approach: “At the end of the runway it’s just wide-open field.”

Dvorak [on PA]: “Brace, brace, brace.”

Haynes: “Close the throttles.”

Records: “Left A1. Left, left, left – we’re turning.”

The impact is audible at 4:00 p.m. The voice recorder stopped.

The plane hit the runway with its right wing and right landing gear. The tail sheared off, the plane slid along the runway and broke into several pieces. The fuel remaining in the wings ignited, creating a massive fireball. A local TV station that had happened to hear of the situation had sent a camera team to the airport. They filmed the plane as it approached and then broke apart on the runway: 111 passengers and one flight attendant died; 184 people – most of them uninjured or only lightly injured – survived (Figures 3.6 and 3.7).

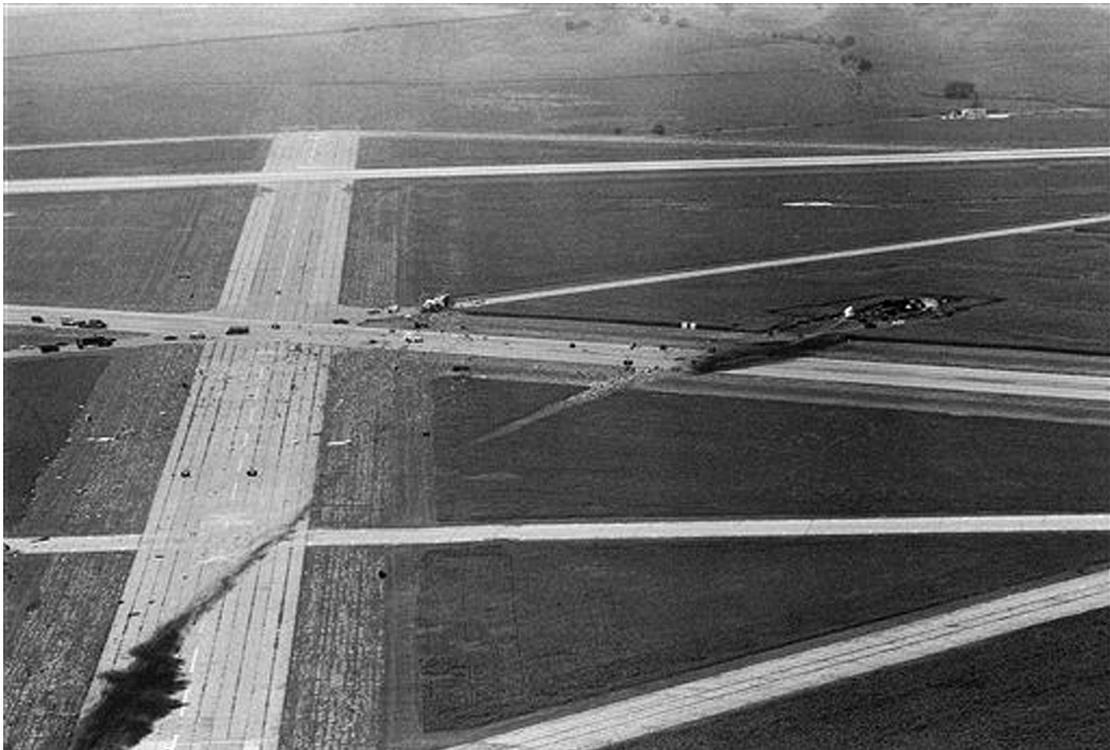


Figure 3.6 **Flight path of UAL 232**

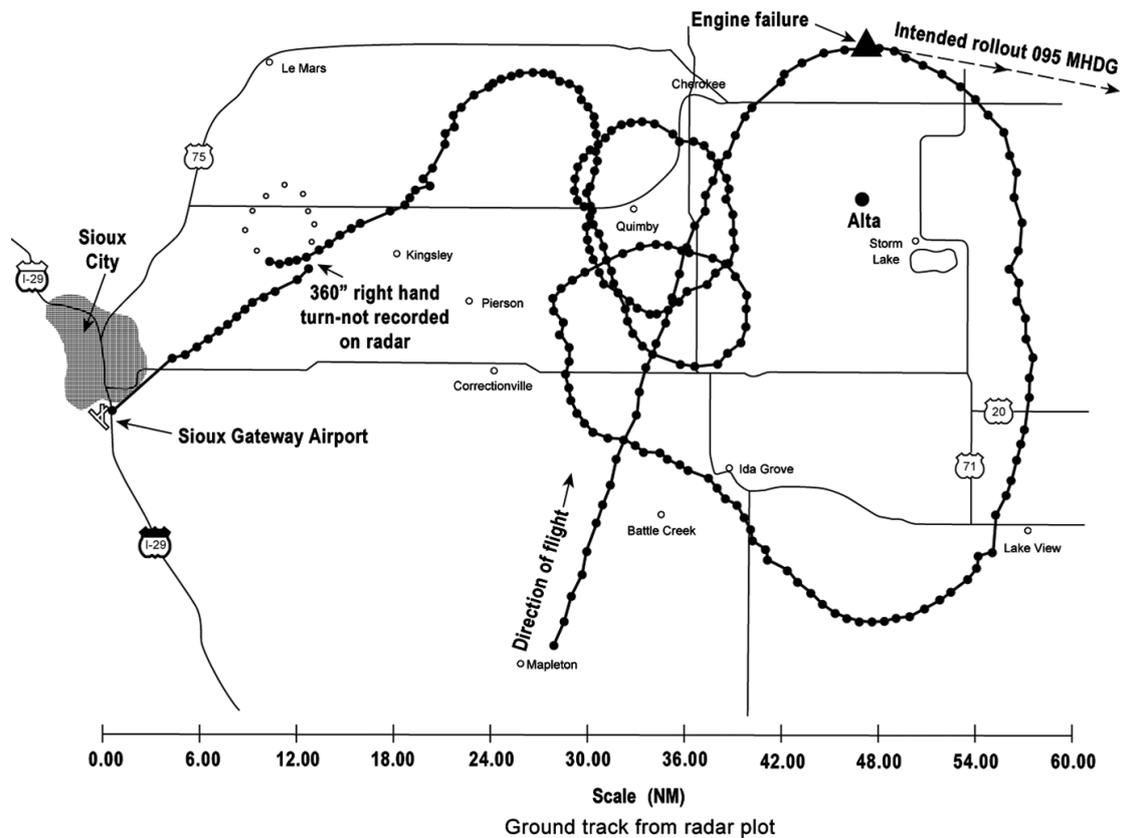


Figure 3.7 Wreckage path of UAL 232

Almost 45 minutes had passed before the firefighters became aware of the pilots stuck in the demolished front section of the aircraft. Al Haynes later described what happened in the cockpit: “[...] the four of us are right there. That area is normally about ten feet high. [...] In the rescue operation, they came in and tried the jaws of life. They put it up on Bill’s side, and as they did it put pressure on my side. And I happened to be conscious at the time. And I strongly recommended they stop doing it. So they came to my side, and tried my side, and Bill did the same thing. Bill’s seat had collapsed, the back of the seat, with him inside it. He had eight broken ribs [...] and a broken pelvis. So he was in a little bit of pain. So what they did was they came up with the idea to bring a fork-lift over, and run the chains [...] and lift the cockpit straight up. And by doing this raised the cockpit to this height, and pulled us all out of the bottom. That’s how they got us out of the airplane (Figure 3.8).”¹⁸⁶

The NTSB investigation into the accident concluded that the main rotor disc of engine two had broken due to material fatigue. Pieces of

¹⁸⁶ Haynes, A.C. (1991).



Figure 3.8 **Al Haynes at the first press conference after the crash**

debris ejected at high speed destroyed all three hydraulic lines that, in this particular part of the plane, lie together largely unprotected. The NTSB later drew up proposals for ways to improve protection for the planes' control systems,¹⁸⁷ and these were subsequently implemented by McDonnell Douglas. In addition, McDonnell Douglas' test pilots developed a series of recommendations for how to control DC-10 planes in similar emergency situations.¹⁸⁸

The NTSB reserved particular praise for the crew of UAL flight 232. Based on its analysis, it should have been impossible for them to make the emergency landing in Sioux City. The CRM crisis management displayed by the UAL 232 crew is still viewed today as exemplary. In a speech given at the NASA Ames Research Center,¹⁸⁹ Al Haynes summed up the reasons for the successful emergency landing as follows: "I think there are five factors that contributed to the degree of success that we had at Sioux City: that is, luck, communications, preparation, execution, and cooperation."

187 NTSB (1990), pp. 102–109.

188 Ibid., pp. 116–123.

189 Haynes, A.C. (1991).

One of the factors that made Haynes and the other survivors so *lucky* was the fact that they were flying over Iowa and not Manhattan or the Pacific. “We knew in the back of our mind that where we were, if we had to ditch, we could probably find some fairly flat land, and we might have a chance of survival.”¹⁹⁰ The weather also played a decisive role, as did the time of day. On that clear afternoon in July 1989, the crew was able to spot the airport at Sioux City from a distance of five miles.

In terms of *communication*, Haynes singled out his interaction with Bachman, “this extremely calm young man,” who was so focused in providing support, information, and suggestions. In hindsight, Al Haynes even cut his helpless colleagues at SAM some slack. “When I first had Dudley stop communicating with them and turn around for the landing, I was a little ticked, until I realized how frustrating it must have been for these four or five people, there, with all those computers, with all the knowledge at their fingertips [...] and there’s absolutely nothing they could do to help a crew. [...] I have not yet had a chance to go down and see them and apologize for what I was thinking, but at least I didn’t say it out loud.”¹⁹¹

In his speech at NASA, Haynes also addressed the external communications that took place between Bachman and the teams at the airport and in the nearby hospitals, which I have not documented here, as they exceed our area of interest. The same applies to Haynes’ reference to cooperation, meaning the concerted efforts of the external support teams. Let us just think for a moment what it takes to spring into action upon receiving an Alert 3 saying “an airplane has crashed,” alert fire service, rescue teams, and post-traumatic stress units in order to instigate a rescue mission, care for the survivors, and treat the next of kin of those who died with due sympathy and respect.

With regard to *preparation*, as Haynes rightly says, there was none: “But the preparation that paid off for the crew was something that United started in 1980 called Cockpit Resource Management. [...] Up until 1980, we kind of worked on the concept that the captain was THE authority on the aircraft. What he says, goes. And we lost a few airplanes because of that. And we would listen to him and do what he said and we wouldn’t know what he’s talking about. [...] So if I hadn’t used CRM, if we had not let everybody put their input in, it’s a clinch we wouldn’t have made it. [...] The days of the captain being the ultimate authority are gone. He may be

190 Ibid.

191 Ibid.

the authority on the airplane, he may sign for the papers and all this, but you don't work that way."¹⁹²

Haynes' description of *execution* has an almost literary quality and illustrates the interaction between Haynes, Records, and Dvorak even more clearly than the voice recordings:

"We've lost several airplanes because everybody was working on the problem and nobody was flying the airplane. [...] But somebody has got to fly the airplane. Bill immediately took hold of the airplane, immediately called ATC and said we lost an engine and had to get a lower altitude [...] all those things you're supposed to do. So my attention now is diverted do Dudley [...]. Dudley got out his book and the first thing it said was, close the throttle. And when I tried to pull the throttle back, it wouldn't come back. Now, I've never shut an engine down in flight on a jet, so I didn't know that when you pulled the throttle back, it didn't come back. In the simulator when you do it, it always came back. [...] Dudley says, well, try the fuel. [...] I tried to shut the fuel off, and the fuel lever wouldn't move. [...] We did get the fuel shutoff by pulling down the firewall shutoff; which shut off all the electrics and hydraulics to the engine. And then the fuel went off, whether it was coincidental, or I had actually helped it, I don't know. [...] And Bill says to me, Al, I can't control the airplane. [...] This is when I said the dumbest thing I've ever said in my life, I said 'I got it.' I didn't have it very long."¹⁹³

As it happens, years later, the cockpit crew of the DHL Airbus OO-DLL took a leaf out of the UAL 232 crew's book when their plane was hit by a ground-to-air missile fired by Iraqi insurgents following takeoff from Baghdad on November 22, 2003.¹⁹⁴ In this case, the left wing was badly damaged and caught fire, and the three hydraulic lines were also severed. Like Al Haynes, captain Eric Gennotte and his crew managed to fly back and make an emergency landing in Baghdad using just the engine throttle power. Among other things, he and his crew, too, attributed their ability to manage the crisis to their CRM training.¹⁹⁵

I want to come back to the increased performance capacity of CRM teams and stress that the disasters we dealt with in the first part would have been avoidable had the cockpits been fear-free environments that promoted cooperation. In contrast, in the cockpits of UAL flights 811 and 232 – where everyone had a reason to panic – the psychological

192 Ibid.

193 Ibid.

194 Rosay, J. (2004).

195 Lutz, T. (2004), p. 33.

stability of those in charge made it possible to rescue a situation that could have ended fatally for everyone on board. Nearly everyone on UAL 811 survived, as did more than 60 percent of those on board UAL 232. Naturally, not every aspect of the achievements of the two crews can be ascribed to CRM. Al Haynes mentioned the other factors in his speech at NASA. Nonetheless, CRM training facilitated the flow of information in the cockpit. As to UAL 232, during the most intense moments, there were 60 notifications and comments per minute.¹⁹⁶ I have listed one after another, but in reality they were constantly overlapping. Their basic purpose was to communicate information, but they were also a valuable way to let off steam (“Turn, baby. Back on that sucker down a little bit more”) or to express annoyance (“Damn it. Wish we hadn’t put that gear down”) or provide encouragement (“You’re gonna make this”). Sometimes they provide corrections (“Don’t get any lower, captain”), or (“Pull the power back. That’s right – pull the left on back”). Or they lighten the mood (“Back, back – forward, forward. Won’t this be a fun landing?”) as well as offer a way to provide reassurance (“We’ll get this thing on the ground. Don’t worry about it”). They help with expressing fear (“God, I hate to do anything”). They are used to ask for help (“Al, I can’t control the airplane”), to regroup seconds before the landing (“Bring it down. Ease her down”), and as a way to seek comfort (“It seems controllable, doesn’t it, Al?”).

The humor employed by captains Cronin and Haynes is not reproducible, neither is it an essential leadership quality, even if it can smooth the path of cooperation and interaction. However, what is clearly evident is their air of egalitarianism and the way they create an environment where communication is open and free from any fear or inhibition – instead of insisting on ruling the roost.¹⁹⁷

196 Helmreich, R.L. (1994), p. 275.

197 The communication of the UAL crew has been described as a prime example for swift action teams in managing an extreme crisis situation. McKinney, E.H. et al. (2005).