NASA
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Dryden Flight Research Facility
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presents

The Crash of United Flight 232

by
Capt. Al Haynes

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Glossary:

ATC : Air Traffic Control
CLR : Command Leadership Resource Training
       (i.e., Cockpit Resource Management)
GPWS : Ground Proximity Warning System
NTSB : National Transportation Safety Board
PTS : Post-Traumatic Stress
UAL : United Airlines

??   : garbled
(xxxx ??) : my interpretation of garbled phrase.

MC: Good morning. Today, we're privileged to have Capt. Al Haynes with us. He's a Texas A&M graduate, a Marine Corps flight instructor, and a 35-year veteran of United Airlines. I think everyone probably remembers that on July 19, 1989, United Airlines flight 232 departed Denver at about 2:09 p.m., climbed uneventfully to a cruise altitude of 37 000', and at approximately 3:16, the flight notified ATC centre that the #2 engine had failed. The aircraft was only marginally stable at that point, and this is the rest of the story.

[6-minute excerpt from Alert 3: The Crash of United Flight 232 omitted: ATC and ground communications]

[July 19, 1989: 15:23 hrs.]

Centre: Sioux City, got an emergency for you. Got a United aircraft, coming in, lost #2 engine, having a hard time controlling the aircraft right now, he's out of 29 000 right now, descending to Sioux City right now. He's ?? VOR but he wants the equipment standing by right now.

[15:25]

Sioux City: Radar contact.

UAL 232: So you know we have almost no controllability. Very little elevator, and almost no ailerons, we're controlling the turns by power. I don't think we can turn right, I think we can only make left turns. ?? We can only turn right, we can't turn left.

[15:26]

Sioux City: United 232 heavy, understand, sir, you can only make right turns?

UAL 232: That's affirmative.

[15:29]

Sioux City: 32 heavy, say souls on board, and fuel remaining.

UAL 232: We have 376, fuel ??

[15:32]

Sioux City: United 232 heavy, Sioux City.

UAL 232: Confirm we have no hydraulic fluid, which means we have no elevator control, almost none, and very little aileron control. I have serious doubts about making the airport. Have you got someplace near there, that we might be able to ditch? Unless we get control of this airplane, we're going to put it down wherever it happens to be.

Sioux City: United 232 heavy, roger, standby ??

[15:40]

Sioux City: United 232 heavy, say again. 232 heavy, think you'll be able to hold about a 240 heading?

UAL 232: We're going to turn into it about right now.

Sioux City: When you turn to that 240 heading, sir, the airport will be about oh, 12 o'clock and 38 miles.

UAL 232: Okay, we're trying to control it just by power alone, we have no hydraulics at all, sir, we're doing our best, here.

Sioux City: Roger, and we've notified the equipment out in that area too, sir. The equipment's here on the airport, standing by, and they're sending some out to that area.

[15:46]

UAL 232: 232, we're going to have to continue in a right turn. We've got the elevators pretty much under control, but that's 3 or 4 hundred feet, but still can't get much ?? steering.

Sioux City: United 232 heavy, roger, understand you do have the elevators possibly under control, will you be able to hold altitude?

UAL 232: Negative, we don't have it. We're better, that's all.

Sioux City: Roger.

Sioux City: United 232 heavy, there's a small airport 12 o'clock and seven miles. The runway's 4000' long, there.

UAL 232: Control, ?? myself right now, soon as the captain gets back on, he'll give me a hand here. He's talking on the PA.

Sioux City: Roger.

UAL 232: United 232, we're starting a left turn back to the airport. Since we have no hydraulics, braking is going to really

be a problem. I would suggest the equipment be ?? towards the far end of the runway. And 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 going to do that.

Sioux City: United 232 heavy, wilco, sir, and if you can continue that left turn, to about a 220 heading, sir, that'll take you right to the airport.

[15:47]

Sioux City: United 232 heavy, you're going to have to widen out just slightly to your left sir, to make the turn to final, and also to take you away from the city.

[15:51]

UAL 232: Whatever you do, keep us away from the city.

[15:53]

Sioux City: 232 heavy, be advised, there is a four lane highway up in that area, sir, if you can pick that up.

UAL 232: Okay, we'll see what we can do, here. We've already put the gear down, and we're going to have to be putting on something solid, if we can.

[15:59]

Sioux City: United 232 heavy, roger, airport's currently at your 1 o'clock position, 10 miles.

Sioux City: United 232 heavy, if you can't make the airport, sir, there's an interstate that runs north to south to the east side of the airport, it's a four lane interstate.

UAL 232: We're just passing it right now. We're going to try for the airport.

Sioux City: United 232 heavy, roger, and advise me when you get the airport in sight.

UAL 232: We have the runway in sight, and will be with you shortly. Thanks a lot for your help.

Sioux City: United 232 heavy, winds currently 360 at 11, three sixty at eleven, you're cleared to land on any runway.

UAL 232: You don't want to be particular and make it a runway, huh?

Sioux City: ...010 at 11, and there's a runway that closed, sir, that could probably work too, it runs northeast to southwest.

UAL 232: We're pretty much lined up on this one, here, I think we will be.

Sioux City: United 232 heavy, roger sir, that's a closed runway, that'll work, sir. We're getting the equipment off the runway, and they'll line up to that one.

UAL 232: How long is it?

[16:00]

Sioux City: At the end of the runway is just a wide open field, sir, so the length won't be a problem.

UAL 232: OK.

[GPWS alarm on CVR]

[jumbled ground communications, followed by]

Ground #1: Orville, what's the situation out there?

Ground #2: ??

Ground #1: 10-4, you're going to need a lot of additional assistance out there, it sounds like?

Ground #2: 10-4, I've got engine 3, engine 5, and truck 3, I'm going out to the scene, I'll advise you in just a few minutes.

Ground #1: 10-4, I'm going to go ahead and go en route out there to the command post. Let me advise anything that you need, I'll have the comm centre go ahead and notify emergency hospitals and also the ambulances.

MC: It's my sincere pleasure to introduce to you the person you heard on that video and you saw land the plane, Capt. Al Haynes.

Haynes:

Thank you, thank you very much. "Land" is a rather loose term for that. Anyone who has seen this video seems to have this one question in their mind, and that is: how did anyone survive an

accident of that magnitude? I think there are five factors that contribute to the degree of success that we had at Sioux City: that is, luck, communications, preparation, execution, and co-operation. And I would like to talk about those five things today.

First of all, we all have our own personal beliefs and convictions, and I would never intrude on yours, so for the sake of discussion, we call our first factor "luck". You may call it whatever you wish. But what did luck have to do with it? Well, first of all, how did we get the airplane to Sioux City? We're an aviation oriented audience here tonight, you basically have the idea of how an airplane works. When the #2 hydraulics on the DC-10 blew, or when the #2 engine blew, it took out the #2 accessory drive section, which took out the hydraulics for the #2 system. And some 70 pieces of shrapnel penetrated the horizontal stabilizer and severed the #1 line and the #3 line, and as a result we ended up with no hydraulics. Now, the DC-10, like a lot of aircraft today, and those that'll be made in the future, has no cables going to the controls. You have no manual reversion in the airplane at all. The cables go to the servos, and then hydraulic pressure does your work. So in order to protect against the loss of all fluid, a lot of redundancies are built into the system. The DC-10, for instance, has three completely independent hydraulic systems. They have two engine driven pumps per system, their own hydraulic reservoir, their own supply lines, their own return lines, they are not connected fluid-wise, in any way. They are connected mechanically, so that if we shut down say, the #1 engine, the fluid in the #3 system runs a motor which runs a pump in the #1 system and the pressure's built right back up, and that's all automatic, you don't do anything about it. Should you lose the fluid in the #1 system due to a leak in one of the components, you won't lose the #2 and #3 system, because they're not all connected together, and all the major component flight controls have at least two, some of them three, of the systems providing power to these controls. And then we have as the last resort an air driven generator which drops out of the bottom of the fuselage and runs a motor in the tail, that will provide hydraulic pressure to one of the systems. So enough redundancy was built into the system to where the odds were placed at 1 to 10 to the 9th power, or a billion to 1, that complete hydraulic failure would occur. And that is satisfactory to where it is considered fail-safe, if I guess is the word.

Well, on July 19th, Murphy's Law caught up with us, and we did lose all three systems. And as a result, we had no ailerons to bank the airplane, we had no rudder to turn it, no elevators to control the pitch, we had no leading edge flaps or slats to slow the airplane down, no trailing edge flaps for landing, we had no

spoilers on the wing, to help us get down, or help us slow down, once we were on the ground. And on the ground, we had no steering, nose wheel or tail, and no brakes. So what we had, is, what we kind of went through today, on one of the simulators, was the throttles on #1 and #3 engine to control us. And by manipulating those throttles, we were able to somewhat control the heading, by skidding the airplane into a turn. And controlling the pitch was just about out of the question. We kept saying we think we had the elevators under control. We never had the elevators under control. We thought we did, but we didn't. And I'll get into that, when I talk about reaction. So you see, with those two things to work with - one engine, and the other -just getting the airplane on the ground was a tremendous piece of luck. Amazing. Because it has been tried again, and it didn't work. Everything had to work in the right sequence, and it happened to work, so we got the airplane, at least, to an airport.

Another piece of luck was where we were. We could have been halfway to Honolulu, or we could have been over the Rockies, or we could have just been taking off from, say, New York's Kennedy Airport, right over Manhattan. So you see the trouble we could have had. As it was, we were over the relative flatlands over Iowa. And all of us, in the back of our minds, you heard me on the tape, I had serious doubts as to making the airport. Well, there were times when all four of us had serious doubts as to making the airport. But 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. So that relieved a lot of pressure on us, in whether or not we were going to make the airport. At least we could get it on some pretty flat ground, another piece of luck in our case.

The weather was an amazing piece of luck. I just tried to fly the F-15 simulator under moderate turbulence, and man, if we'd try to control this DC-10 under any kind of turbulence, we'd never have made it. If you are familiar in the Midwest, from the Canadian border to the Gulf of Mexico, in the summer time, there are usually a line of thunderstorms that are doozies. We had one little build-up that we went around, but the rest was clear skies. 4500' scattered, and about ten miles visibility was the weather, so it was amazing that the weather was that good. A year to the day later, when we went back for a memorial service, there was a huge thunderstorm over Sioux City, directly over the airport. Had that been there a year before, we would never had made the airport. So the weather was a tremendous factor.

The time of day was also very advantageous, in two ways: 1, it was day, we could see what we were trying to find. To try find an airport seventy miles away at night over strange territory

would be very difficult. By having, especially if it had been runway 22, because there are no lights on that runway. It's a closed runway, it's not used, so the lights are not operative. As it was, it was daytime, we could see what we were doing, we found the airport four or five miles out, we were able to see it, and direct ourselves in that general direction. So that was very important. But more important to the time of day was that it was right at shift change time for the hospitals. Marion health centre, which happens to be a regional trauma centre, and St. Luke's, which happens to be a regional burn centre, and are both located in Sioux city, were just changing their shifts, and so they were double-shifted for our arrival. Not only that, but all the clinics and health centres around town were all releasing their workers from work, and of course with a 45-minute notice, about a 30-minute notice that we were going to Sioux City, that was broadcast on the radio, and all these emergency services were able to head to the hospital, they had so many volunteers at the hospital, they had to turn them away. They had more than they could use.

And the last piece of luck, which turned out to be very fortunate for the crew, and you'll see why in a minute, it was Wednesday, the one day of the month when the Air National Guard at Sioux City was on duty, and 285 trained National Guardsmen were at the airport, waiting for us, when we got there. So, you can see how the luck factor was way up here for us. Some of the other crews who have had accidents, the luck factor was down here. Our luck ran out about fifty feet in the air, but it lasted for a long time.

So luck played a very important part in getting the airplane to Sioux City, and having the survival rate that we did have.

The second big factor was communications. We had quick response by ATC, MSP centre was the one we were talking to, they quickly turned us over to this extremely calm young man that you just heard, Kevin Bockman. He's a controller that happened to be on the radar station at approach control when we turned it over. I met Kevin personally, at the White House about a month later, and when I finally could talk to him - we couldn't say much, the first time we met - but when I finally could, I learned he had moved to Sioux City because he found his previous duty station too stressful. [laughter] And he was looking for something a little quieter. I haven't the foggiest idea where he is now - he's not in Sioux City.

But the calmness of his voice, the communications with him was outstanding. The DME did not work at Sioux City that day, and although it's not on this tape, the cockpit voice recorder shows numerous times we were asking where we were in relation to the

airport and how far out and he was right there every second giving us every bit of information, he picked out airports we could go to, runways, highways we could land on. The highway state patrol even blocked one of the freeways and had it open for us, if we'd had to land on it, going out to the airport. Communications in the air was tremendous. Probably what helped us the most was the fact that the second officer, Dudley Dvorak - I asked him to get a hold of San Francisco area maintenance, that's maintenance experts sitting in San Francisco for each type of equipment that United flies. They have all the computers, all the logbook history, all the history of the aircraft, all the other information that they can draw on to help a crew that has a problem. Well, unfortunately, in our case, there wasn't anything they could help us with. Every time they tried to find something that we could do, we had either already done it, or couldn't do it, because we had no hydraulics. The hardest problem that Dudley had was convincing them that we didn't have any hydraulics. "Oh, you lost number two," "No, we lost all three," "Oh you lost number three," "No, we've lost all of them," "Well, number one and two work," "No," well we went on like this for quite a while, before he finally convinced them we didn't have anything, and when we told them that, that was all they could do, and I was a little upset with them at first, 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, that they could possibly draw on, and there's absolutely nothing they could do to help a crew. That's got to be extremely frustrating for them. And 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. [laughter]

But Dudley's communications with them did two things; it alerted our crisis centre in Chicago, and it alerted our dispatch centre in Chicago. And those two facilities, knowing that we were going to Sioux City, were able to prepare for our arrival in Sioux City. In fact, they pulled a 727 out of the hangar in Chicago, loaded it with people, and there just happened to be a meeting in our executive offices that day, of our union, and the company, and some other people, and all those people who would be involved in accidents were at the centre, and all they did was run and get on this airplane, and fly to Sioux City, and they were in Sioux City before I was admitted in my room at the hospital. So it was very quick response at the company in getting support people and equipment there, all through the communications that Dudley was able to do. So that communications was very important.

When we declared an emergency, which Bill did, the co-pilot,

Bill ?? declared an emergency, everything stopped on the ground. Everything went to us. They cleared the frequency for us, they gave us all the help they could get. I don't know how many light airplane pilots you have here today, but I've talked to several groups of several pilots, and this one you can pass on Mary, they're afraid to say anything, they don't like to declare an emergency, they're afraid their going to cause some problems or something like that. And they said to me, well, you have all these resources of United Airlines at your disposal, and the centre, and all this. So do you; three words: I'm declaring an emergency, and you've got it. All the help you want. You've got American Airlines' maintenance facility, United maintenance facility, if you stay in the air long enough, they'll patch you through to them, and you can talk to them. So you've got all kinds of help, if you just do that. Now, if you do that, and then land, and nothing happens, you've got a lot of reports to fill out, and you're going to have a lot of airline pilots that are upset at you, especially at a place like Chicago, because they're out holding, while they're getting you on the ground. And you'll probably hear about it. But in truth, and when I've said this, the pilots, yeah, they shake their heads, yeah, they're going to complain, but they're really glad you made it, and they're very happy you're able to use the services available to you. So communicate with the ground, tell them your problem, and they'll help you. They really will.

The communications in the cockpit among ourselves, we'll talk about that under reactions, we'll talk about. The communications between the cockpit and the cabin. Very little, actually, because when I called the ?? flight attendant up - a very single flight attendant - and she said she took one look the cockpit and she knew we didn't have an emergency - we had an enormous crisis. And her thought then was, we're at altitude, we've got some time, he told me to go back and prepare the cabin. I'll do that, and I won't bother them. And I'm sure he'll communicate with me again. And that's what happened. They didn't call us. We called them when we had a problem, when we were ready to go. So that the communications, while it was not there, it was good, because it wasn't necessary. And the training did that.

The inter-communications between response units on the ground, this tape that you just saw is a six minute excerpt from a 54-minute tape called Alert 3, and there's about fifteen minutes of communications on this tape prior to this crash that you just saw. And there's a lot of ground communications between emergency response units and the hospital. Excellent communications in that respect. I'll grant you that the 20-minute warning time that we gave them, that we were coming to Sioux City was a great help to them, a great benefit to them. If any of you serve on emergency rescue stuff, or volunteer fire

fighters, you know that if you're in station and ready to go, it's a lot better than being home or something and having to respond. So the twenty minutes we gave them, they were able to put their disaster plan into effect. In fact, I believe it was fifteen minutes before we crashed, the tower changed the alert from alert 2, which is "an aircraft is on its way with problems," to alert 3. And alert 3 means "an airplane has crashed." That's how much confidence they had in us. [laughter] But fifteen minutes notice of an airplane has crashed. So all the communications were put into motion for an airplane has crashed. The hospital was notified. They called Des Moine and said we were going to need more medical supplies. They were actually loading another Air National Guard plane in Des Moine and took it off shortly after we crashed, heading to the airport with supplies. So, communications and advance notice. Very, very important.

The preparation: how do you prepare for something like this? I gave a talk at Anchorage to the Alaska Air Safety Foundation and they subtitled my talk: disaster in the air, are you ready? No, you're never ready. But you might be prepared. And that's one of the reasons that I'm going around the country doing this, hoping that I can get the message out to be prepared. And the preparation for the ground crew, for the emergency rescue unit was: in 1987 they had a drill, they pretended a wide body aircraft crashed on this closed runway at Sioux City, and they had 150 survivors, and they had this drill, and they found some shortcomings in the drill, which most drills do. They have these once every three years, FAA mandated, live drill, and a paper drill every year, and this was their year for their drill, and they decided to have a crash. They'd had a bus crash from the time before. So in this airplane crash, they found a lot of things they were short. One, they didn't take in enough community. If you're going to have 150 survivors, you're going to need more equipment than the class of airport that Sioux City is. It's not classified for wide bodied aircraft, so they don't have to have quite the emergency response units that larger airports would have. So they had to rely on the outlying communities. And Gary Brown, the director of services, brought the community people in, made them a part of his plan. They attended the meetings, they attended the practices that they were having, everybody was putting their input into this plan.

He also brought in a very important unit, the Post-Traumatic Stress Unit. Now, I was never one to believe much in post-traumatic stress. I had heard it a lot in WWII, from Korean, and Vietnam veterans, and I thought, well, okay, if such a thing exists, I'll let it go, because I don't really believe it. I believe it now. And I'm asking you to believe it. It may never happen to you. I'm fortunate enough not to have suffered PTS -

yet. But it can happen tomorrow. I was a little concerned about flying simulators under these conditions because I was afraid it might key something up. But no problem. I've been very fortunate. But it does exist. And it exists. It happens to not just victims of the crash. The 185th suffered a tremendous amount of PTS. So did the people of Sioux City. So did the staff of the hospital. So PTS has to start at the scene of the accident. Fortunately, Sioux City was prepared for that. It was part of their preparation in getting the things done. Because even though they'd practised this wide bodied aircraft that they didn't have, on July 19, we put a wide bodied aircraft on the very same runway they used for practice, and we gave them 200 survivors to start with, instead of 150, so having a drill, having a plan, and taking it seriously, and working on it, is very, very important for any community, no matter what size you are, or who serves you.

Up in Alaska, a lot of the pilots said, well you know, we're up here in the bush, and we don't have these things. They're the main trans-continental stop for aircraft going to Japan. And an aircraft is not going to happen right over the major airport. It can happen anywhere out in the tules. I'm not calling Sioux City a tule, I'd never do that, [laughter] but in Alaska, you've got a lot of that up there. But it can happen anywhere, so everybody has to be as prepared as they can be. And they were on the ground at Sioux City.

They had a plan that they worked on, and they left some flexibility open in it that it could be changed, and when we get to the reaction, I'll talk about that also.

The flight attendants: they were prepared by their training that we have at Chicago, Denver, and San Francisco. That's where flight attendants have their recurrent training. They go back once a year, they go through all the emergency drill preparation, how to open the doors, what they're all supposed to do, how to prepare the cabin, how to prepare the passengers. We have a 767 simulator in Denver that they've got about 40 seats in. And we'd go down there in one of the sessions, and we'd sit in that simulator and several of the attendants are assigned the job of working and about somewhere on takeoff or shortly after takeoff we have a crash. The simulator tips over on its side, it fills up with smoke, it darkens just like it would on an airplane, there's fires outside some of some of the doors, it's very realistic, and it's the kind of training that they give the flight attendants, and it paid off. Each one of them, in a tape they made later, said the training that we had, the training that we had, they kept saying it. So training is very very important. Sometimes boring, sometimes repetitious, but it's very important.

As for the crew, there was no training procedure for hydraulic failure. Complete hydraulic failure. We've all been through one failure or double failures, but never a complete hydraulic failure. But the preparation that paid off for the crew was something that United started in 1980 called Cockpit Resource Management, or Command Leadership Resource Training, or any number of things that you want to call it. I think we called it CLR to start with. All the other airlines are now using it. Up until 1980, we kind of worked on the concept that the captain was THE authority on the aircraft. What he said, goes. And we lost a few airplanes because of that. Sometimes the captain isn't as smart as we thought he was. And we would listen to him, and do what he said, and we wouldn't know what he's talking about. And we had 103 years of flying experience there in the cockpit, trying to get that airplane on the ground, not one minute of which we had actually practised, any one of us. So why would I know more about getting that airplane on the ground under those conditions than the other three. So if I hadn't used CLR, if we had not let everybody put their input in, it's a cinch we wouldn't have made it. It was, I don't know if any of you remember the old movie Marty, I kind of refer to that, it was Ernest Borgnine, and a group of his cronies, trying to find something to do on a Saturday night, and they said, what do you want to do Marty, and he said, I don't know, what do you want to do Joe, and that's kind of the way we flew the airplane now. What do you want to do, I don't know, and let's try this, and you think that'll work, beats me, and that's about the way it went, really. If you read the cockpit voice recorder transcript, there's a lot of that on there. When are we going to put the gear down, I don't know, how are we going to put it down, well, we do two things, two ways to get it down, which one we're going to use, that type of thing. So CLR really paid off. And CLR is being taken out into other areas. I think it was originally a management course anyway, but now it's being spread all over. I'm going next year to Harrisburg, Pennsylvania to talk to the Nuclear Power Association. Because they are beginning the CLR concept in their control rooms. There have five stations in a control room. You have a nuclear disaster, you want those people working together, you don't want them working separately. So CLR that we had really prepared the crew for what happened.

If you recall the zip-top 737 over at Hawaii, the Aloha, Bob and Mimi used CLR to its utmost, because they could not communicate with each other. They used hand signals to point the things they wanted to do. That's how they got that airplane on the ground. Flight 811, the 747 out of Honolulu, on its way to Sidney, blew the cargo door and lost two engines on the right side, and did damage to the flaps and hydraulics, they used CLR to get the airplane back to Honolulu. They had a grossly overweight

airplane that couldn't maintain altitude with two engines out on one side, and by using CLR and the crew working together, and everybody putting their input in, they got the airplane back. The days of the captain being the ultimate authority is gone. He may be the authority on the airplane, he may sign for the papers and all this, but you don't work that way.

I think Sister Margaret (?? Wicks) said it the best, she's from Sioux City's (Briar Cliff ??) College, I'll talk about her in a minute, her statement was, when you've got a crisis like this, and got so many diverse things going on, let those in charge take charge. Don't let one individual try to run the whole show. Let those who know how to do their specialties handle those things, and you'll get things done, and that's what happened.

Execution: how did we execute? Well, first of all, how did we do it in the air? Not having any experience at all in flying an airplane under those conditions, our basic problem was keeping the airplane in the sky and trying to find an airport. Besides losing all of our hydraulics, which gave us no control, we had two other problems, a problem that I was not really familiar with, maybe you are, I know an awful lot of you are engineers here, is a term called "phugoid". What a phugoid is, an airplane wants to fly its trim speed. And as soon as you cut power on one engine, you lose speed, the nose drops, airspeed starts to build, you'll go through that speed, the nose will come back up, you'll go through the speed again on the slow side, and you'll just oscillate like this. Maybe you can stop it, maybe you can't. The way you have to stop it, is, we found out. Not as much as we know now, a lot of this is after-the-fact knowledge, we weren't this smart in the air. But we found that in order to stop a phugoid, you had to do the opposite of what you would normally do. When the aircraft reached its apex and started down, you had to add power, as the speed built up, you'd have to actually add power to create lift in the wings to get the nose to pitch up. The hardest thing to do though was as the nose start up and started to slow down, and you're approaching a stall, you'd have to close the throttles. And that's very difficult to do. We found out, though, that's what we had to do. Another thing that added to our problem, though, was that the damage to the tail was such that the aircraft constantly wanted to roll to the right. If we left the power alone, the aircraft would roll over. When the engine failed, Bill immediately took hold of the aircraft. Bill is the co-pilot 26 years flying, he's been with National / Pan Am, came over to United when we acquired the Pacific flying. Very competent pilot, I'd flown with him a month before, had no qualms about him flying at all. And when he grabbed a hold of the yoke, he demonstrated step one in any emergency procedure; that somebody fly the airplane.

We've lost several airplanes because everybody was working on the problem and nobody was flying the airplane. One of them was down in the Everglades. Everybody was working on the problem and the airplane flew into the ground. Not to criticise the pilots, because everybody wants to do their share to get the problem solved. 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, was turning off the airway, all those things you're supposed to do. So my attention now is diverted to Dudley to shut the engine down.

At United we don't use much memory items in emergency procedures, we use mostly checklists, and severe engine failure in flight is all textbook. So 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. This one wouldn't come back. Dave says, well, try the fuel. The next step is to shut the fuel off. I tried to shut the fuel off, and the fuel lever wouldn't move. So something was binding these controls. So now we know the damage to the tail, there's damage back there other than just the engine failing. We did get the fuel shut off by pulling down on the firewall shut-off. Which shut off all the electrics and hydraulics to the engine. And then the fuel went off, whether it was coincidental, or it had actually helped it, I don't know, but about that time, it went off. Well, now we'd been about 15 or 20 seconds into our problem. And Bill says to me, Al, I can't control the airplane. Now I divert my attention from down here, shutting down the engine, to up here, on the instrument panel. First thing I notice is, Bill had full left aileron control, calling for a full left turn. You'd never see that anywhere on a DC-10, much less at 35 000'. He's also got the yoke right back in his lap. And the only time to do that is to embarrass the captain on the ground and hit the captain in his fat stomach before he can get it out of the way. That's never there in the air. So that catches my attention real quick. But what really got my attention was with a full left turn called for, and a full nose up called for, we were in a descending right turn. And I tell all pilots around that 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. Because we immediately determined that we could not control the airplane: it wouldn't respond to the inputs of the crew. At this time, we were in a right bank, the bank was increasing, we were up to 38 degrees of bank, we closed the #1 throttle completely, and firewalled the #3 throttle, and very slowly, the wing came back up. And three times on our attempt to

get to the ground, we got to 38 degrees of bank, and we were doing just what those who were running those tests I went to this morning to just fly an airplane with just the throttles, we were overpowering the airplane, over-controlling because panic was one thing, although we didn't appear to be panicked, not having any idea what we were doing was another, and an airplane about to roll onto its back at 35 000' is pretty scary, so you just do anything you can to make it stop.

But by manipulating the throttles this way we kept the wings fairly level - for a while - then we had to start down. Well, we felt like everyone else - that this cannot happen - you cannot lose all the hydraulics in a -10. That's been told us from time when. When we first sat down and they said this isn't hooked up to anything (as you move the wheel) we said, well, what's going to make this fly, in case it, well - it can't, it can't happen, it - just, you can't lose your hydraulics. And we believed it like everybody else. And now while we were reasonably sure we weren't accomplishing anything with the yoke, we kept flying the yoke. The problem is, it kept both of us, to fly the yoke. We couldn't do it, just one of us couldn't do it. Now in flying the yoke with both hands, and all four hands, now we had to operate the throttles, and we had to do them, let go of the yoke, move a throttle, let go of the yoke, move a throttle, and so forth. Had we known what we know now, I don't know if we would let go of the yoke even now. To let go of the yoke completely is extremely difficult to do. After almost 40 years of flying airplanes and holding onto something, not having something to hold on to - I don't know if we could do that. But what we found out is that it was very difficult to move the throttles. And I was about to have Dudley turn around and take over the throttles - and I'm glad we didn't because we would have lost all that communications, if he had - we were told there was a DC-10 captain in the back, who was an instructor, and we like to think instructors know more than we do - so I figured maybe Denny knew something that we didn't, so we asked Captain Fisch to come up. Well, he took one look at the cockpit, and that's his knowledge. It was sort of funny listening to, reading the transcript, because he's about fifteen minutes behind us now, and he's trying to catch up, and everything he says to do we've already done. And after about five minutes - that's 20 minutes into this operation - he says, "We're in trouble!" We thought: that's an amazing observation, Denny. [laughter] And we kid him about it, but he's just trying to catch up with our thinking - we're 15 minutes ahead of him, but he asks - when he found out that he didn't have any knowledge for us, he says, "Now, what can I do?" I said, you can take these throttles, and try to help us with the throttles. So what he did, he stood between us - not kneel on the floor, as the news media said - and he took one throttle in each hand, and now he could manipulate the throttles

together. With the #2 throttle frozen, we couldn't get a hold of the throttles together. Now he could. And we said, give us a right bank, bring the wing up, that's too much bank, try to stop the altitude, he'd try to respond. And after a few minutes of doing this, everything we'd do with the yoke, he could correspond with the throttles. So it was a synchronized thing between the three of us, with Dudley still being able to do all his communications. So that's how we operated the airplane, and that's how we got it on the ground.

And if I can have the slides on now, I'll show you how we got it on the ground. That's why we can't call it a landing.

[Slides]

This the pattern we flew. That's the radar tracking we flew. We are coming along like this and were just turning back toward Debuke, Iowa, when we lost the engine. And this straight line, reasonably straight line that we fly here, here's the line of just trying to keep the airplane upright, while we were trying to figure what was going on. Somewhere up in here, and I can't see it from here, there's three very definite slash-marks, and that's where the airplane almost went over on its back. As Denny came up and took over, and we began to descend, and we determined now we were going to Sioux City, they wanted us to go to Des Moines, and that was over 170 miles away, and there was no way we were going to keep the airplane in the air that long. So when we declared an emergency, and they gave us the nearest suitable airport, it was only 70 miles away, now we had to get down, and we did that through this series of right turns. Some of these we did, others the airplane did on its own, and all we did was keep it from doing any more. So we made these right turns. When the NTSB came in to talk to us, they said, why did you make a left turn? And all four of us said we never made a left turn. Even though I said we were starting a left turn back to the airport, we all four swore we never made a left turn. That looks like a left turn. [laughter] And what we determined was, we remembered then, after a while that we all four remembered that there was a build-up about right there, and we had to get around that build-up, not go through it. So we did that. This, right there, is that last 360 degree right turn, we were too low for the radar to pick it up. Then we came in.

[slide]

There's the airport for Sioux City, Sioux City gateway airport. This is runway 22, this is runway 31. What Kevin was trying to do, since we could only make right turns was bring us in, the city was right down here somewhere. Bring us in this way, a right turn, into the runway. The way things turned out, it was

probably good we didn't do it. Had we been able to make the runway, at the end of runway 31 was the Missouri river. So we might have been better off had we not been able to stop or something, to land on something like this. When I asked the runway was, he doesn't say so on the tape, but he did tell us how long it was, 6600', and then he said at the end was a wide open field. So our scenario was, probably what we do was land, and hopefully stay on our gear, go off the end of the runway, shear our gear, and go on our belly. If we did go sideways, since we couldn't steer it, and we did have a quartering tail wind that was turning us left to right across the runway, we might go off into the field and shear it en route. We kind of hoped we would do that. We came pretty close to the runway. We got the right wing tip in the centre of the runway, the right main gear off to the side. We touched down on the right wing tip, the wing flap fairing, the #3 engine, the one on the right side, the right wing gear, and the nose wheel, all pretty much simultaneously. The right wing broke off - that's the reason for the fire here, spilling all the fuel. The right main gear separated from the airplane. The left gear stayed on. And the airplane slammed on the ground, and we did not hit and cartwheel, like all the news says. We hit and slid on the ground, on the left main gear and the right wing stub. Slid along sideways, for about 2000' or so, when the left wing came up. Also, on impact, the tail broke off, the entire tail section of the aircraft broke off, so there's no weight in the tail at all. So when the left wing came up - probably because of our speed - the tail came up. the aircraft went up on its nose, bounced on the runway three times, on the nose, leaving radome marks on the runway. We went upside down and airborne about right here. We were thinking - even that tape that you see there, that's all we have in the way of tape, and nobody really remembers, and there was so much fire and smoke that nobody could tell. We hit right about here, and upside down. And fortunately for us, the cockpit broke off, and unfortunately for the first class cabin. And then the aircraft went over on its back and skidded to a halt right over here.

[slide]

This is our point of impact, where the right main gear touched down. That concrete is 12" thick, and the hole is 18" deep. You normally land the DC-10 at approximately 140 knots. We were doing 215 knots and accelerating. You normally touch down at about 200 - 300 feet per minute at the most, as a rate of descent. We were doing 1850 feet per minute. And increasing. And you normally like to go straight down the runway, and we were drifting left and right because of the quartering tail wind. Of ten knots, which gave us ten knots more of speed, as we hit the ground.

I'm showing you these for several reasons. One, is to show you that you can survive an airplane crash, because we had survivors in that piece of wreckage. That's the first class cabin. We actually had one of our dead-heading pilots sitting in the back of the first class cabin go out a window. I said, you can't go out a window. He said, yes you can. [laughter] When you realize you're upside down and the thing's on fire, you can get out a window. [laughter] We did lose most of these people, unfortunately, but they did survive. Some of them did survive that.

[slide]

This is the tail section of the aircraft, which, shows it more better here. It broke off, and went straight down the runway, while most of the rest of the aircraft curved off to the right. We had about four row, three or four rows of seats right here, and two flight attendants, who survived this part of the accident. I've always been concerned about a DC-10, it's concerned me that the engine, sitting on top of the tail, as it was, if the engine blew, you might lose the whole tail. Well, after all that happened to this airplane, that engine housing is still sitting there. So Douglas put that on to stay.

[slide-fumbling]

It's the main portion of the aircraft, it's upside down, and it burned, of course, after the fire. This is the forward part of the aircraft, and this is the aft portion. And this is where most of our survivors came from. Unfortunately, 34 were trapped back in here, and died due to smoke inhalation, but most came from right here.

[slide]

In case you don't recognize that, that's the cockpit. There's no metal, no glass, nothing to indicate that's the cockpit. They're guessing that 35-minutes after the crash, we were ignored. They felt that was an uninhabitable part of the avionics compartment. Because all that was holding that airplane together was the wires. Or holding that piece of stuff together was the wires. That gentleman in the blue hat is talking to me. The gentleman without his hat on is talking to the co-pilot, Bill ?? and you can see a little bit of Bill's shirt right there, and the four of us are right there. And that area is normally about ten feet high. Counting the cockpit and the avionics compartment. That's directly behind my seat. So that's where we are. In the rescue operation, they came in and tried the jaws of life. They put it 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 that. [laughter] So they came on to my side, and try 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, two 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, the heavy chains you saw, straight down, 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.

And to say a lot for Douglas and the seat manufacturers, that's my seat. All four of the seats stayed together. All four of the seat belts and harnesses - they had to cut us out to get us out. That's the only thing that saved our lives, I'm sure, was that those belts held.

That was the reaction of the crew, how we got the airplane on the ground.

How did the ground people react? Well, the ground crew did exactly what they had been trained to do. By having advance notice they were in the position to put all the aircraft, all the emergency vehicles in a spot in a designated area, and then dispatch them as they were needed. We only gave them two minutes to line up for runway 22. They were all set up for runway 31. And when I told Kevin we saw this runway ahead of us, and that's where we were going to land, he had two minutes to get the equipment off the runway. They were actually positioned on that runway, and we could see them moving off that runway. That's the reason the video is no better than it was. With all the notice we had, everyone was set up for runway 31. The two hangars that are built right off to the left of runway 22 were built after the airport was closed, and you can't see the runway from the tower. And that's where the operator was. So he went clearing down the steps, and if you've ever tried to get down tower steps in a hurry, it's a long way down, and that's as far as he could get, before we got there.

The first part of the video was taken by a home video camera, showing us in the air.

But that picture in the air is very deceiving. It looks like we have everything pretty much in control. We were starting a down phugoid, and starting a right bank, 300' in the air. And we just, that's where our luck ran out. We just ran out of altitude, trying to correct it. We had the time in the air, trying to correct it. But that close to the ground, we didn't have time. In an attempt to stop the phugoid and the turn,

Dennis added power, and unfortunately the left engine spooled up faster than the right, the first time in the day we noticed that it happened, and the bank increased. And in four seconds, we went from four degrees of right bank, to twenty degrees of right bank, and hit the ground. However, safety experts say the tumbling of the aircraft probably saved a lot of lives. It took up most of the inertia, most of the shock, and allowed the people to get out of the airplane.

But we were talking about reaction, now. The emergency crews responded as they were trained to do. The preparation was the big thing in their reaction time. The tower switching to the alert three way ahead of time really set the wheels in motion, and their reaction there was such that they knew it was going to be bad, and they were able to start that motion.

We had at the hospital an unusual situation. There were so many doctors there, and nurses, that the director was trying to figure out what to do with all these people. So he came up with an idea: he formed a line, and he put a doctor, a nurse, and a tech, and they formed a line, regardless of the doctor's specialty, they all had medical training, so it didn't matter what it was. They had psychiatrists, they had obstetricians, pediatricians, they had everything in this line. And then when they brought the ambulance up, and pulled the gurney out of the ambulance, well, this survivor already been through triage at the airport, he already had EMT care all the way in to the hospital, and now he had a doctor, a nurse, and a tech on him immediately, and they stayed with him until they were either sent to a room, released, or whatever was done with them. So the medical care was instantaneous and continuous, and that was through a preparation, and little bit of flexibility that the plan had that they could use in it.

The other flexibility in the plan was: where was everybody going to stay. I usually get in trouble with the media for saying this, but with that notice that came out that we were going into Sioux City, CNN had broadcast that there was an aircraft was over Sioux City, and on its way in, and that there was a problem. And all the news media was very interested in this. So they reserved all the rooms in all the hotels in Sioux City. So when the survivors started getting through, and being released several hours later, there was no place to put them. And one of the doctors at St. Luke's looked up at Briar Cliff College, which sits up here on a hill overlooking Sioux City, and call Sister Margaret Wicks, and see if she could do anything. It was summer, and they had a skeleton crew there of a small summer staff. Yeah, she did something. By nightfall, she had 250 people in her dormitory. The reaction of everybody was just fantastic.

Which brings us to the fourth thing, the fifth one, rather, the co-operation. The co-operation that took place was outstanding. Just unbelievable. First of all, we start with us in the cockpit. The team effort with the four of us. This is Dudley Dvorak, the second officer. This is his first month in the DC-10. He had just had his initial operating experience flight. This was his first time in the 10. Bill ?? has flown a lot of 1011's for Pan Am, and he flew 1011's for United when he first came over, and then switched to the DC-10, lot of experience in three engined aircraft, but none in what we were doing. But that was his experience. Mine, I had about 7000 hours in the DC-10. I spent about nine years as a co-pilot in the DC-10. I was flying to Honolulu, and was getting 14 days a month on the beach at ?? at the company expense, and I saw no reason to go to work, I stayed as a co-pilot. [laughter] But I had a lot of time in the 10. Denny was a DC-10 instructor, but what we didn't know was it was his first or second month as an instructor in the 10. But what we had was, as I said, was 103 years of experience, but that showed in the way we reacted to the problem. The way we co-operated with each other, in getting things done. Everybody throwing out a suggestion. And when it came time to put the gear time, it was one of the big problems that - not problems, but the way we used CLR, and co-operation with the crew. There are two ways we can get the gear down on the DC-10 with hydraulic failure. You can put the gear handle down, which manually unlocks the doors and the doors fall open and the gear just falls out, because it's been resting on the doors. Or, there's an alternate method of doing that, when you use no flaps. Because we have four ailerons on the DC-10. You fly with the inboard ailerons at high speed, and then you unlock the outboard ailerons for landing when you lower the flaps. Well, we didn't have any flaps. So we couldn't unlock the outboard ailerons. So that's what this alternate gear method is for. And we talked about this: how do we put the gear down, and it was suggested, we unlock with the outboard ailerons, with the alternate gear, because there might be something out there, because we might be able to get some fluid out there, there might be some trapped out there. So this was all talked about. The one thing we all agreed upon was that the gear was going down. Because we had to have a shock absorber. Something had to absorb that shock. With the rate of descents that we had, I was afraid if we had touched down as we did without the gear, we would have just exploded. And if we'd had a higher rate of descent than we had, because we had higher rates of descents somewhere during this time, than we actually had when we touched down. So the gear was going down but the CLR and co-operation of the crew on how to do it.

The co-operation between the cabin and the cockpit crew was very very good. We had some communications gaps there because of our attention to duty that we could not turn. I never turned around

to the flight attendant, looked at her while I talked. In fact, when the second day after the accident, I asked to go see the rest of the crew, and they put me in a wheelchair and wheeled me down to intensive care where Bill and Dudley were, I mean Bill and Dennis, and as they were taking me to Dennis Fitch's room, this captain came up to help us, and I thought, if there's more than one captain in the room, I won't know what he looked like. He stood right here, for thirty minutes, and sat down, and worked the throttles for us for landing, and I haven't the foggiest idea what the man looked like, because I never looked back and looked at him. But he was the only one in the room, so it made it a little easier to find out who he was. But that's the way our communications was - we had to communicate without looking at each other. The aide came up and did her thing, went back. The co-operation among her group - the procedure for United is, when you're going to have an emergency preparation, you call all the flight attendants together, the aide does, the senior flight attendant, she briefs them, then they go out to their duty demonstrations, and demonstrate, and tell what they want done. When this engine blew, it was so loud, and so violent - they even heard it on the ground - everyone in the aircraft knew. Besides that, I had channel 9 on, and everyone with a headset on channel nine knew we'd lost an engine because they were listening to ATC. Fortunately, I got it off, before we got to the really bad stuff. One of the survivors even commented, "We were listening until the captain turned us off," he says. They didn't know how badly we really were until we told them later. But, what Jan decided to do was, go back there, and brief each station individually. Because, bringing everyone together, she thought, would upset the passengers. Any more than they already were. And by their doing this, the co-operation between them and the passengers was outstanding. It was children's day unfortunately, on United, we had some 30 children on the airplane, a lot of them travelling by themselves. What the flight attendants did were ask the adults to move, so that there was at least one adult sitting next to every child. And the passengers co-operated without hesitation. When they selected the people to sit by the emergency exits, they all responded very quickly. Great co-operation. And when the airplane crashed - after the crash - several of the flight attendants were assisted getting out of their harness by the passengers. Because they were upside down in their harnesses as well as their belt and they couldn't get the belt to loosen. John Trance who helped one of them out, Gary Priest who helped one of them out. You've heard - I KNOW you remember this story, I'm sure you do if I recall it - there was an infant, that was separated from her parents. And one of our survivors, Gary (Schimel ??), was just leaving the airplane, getting out of that thing, full of smoke, fire ?? and he hard the baby crying. And he went back into the airplane, searching for the baby, found her in an overhead bin,

she'd actually been thrown up into an overhead bin, and took her out. So that's the kind of way the passengers responded and co-operated with everybody.

I've talked about what ATC did, I've talked about what the 185th, how they helped. The surrounding areas. They actually called these outlying cities, when we said we might not make the airport, and said there's a DC-10 headed your way, coming for the airport, and they'd actually dispatch trucks out to the highway, to look for us, so if they found us, and we didn't make the airport, at least there'd be somebody there. I'm not familiar with mutual aid too much, but I know it exists, and I've seen pictures where a fire truck is sitting on a county line while a house across the street burns because they don't have mutual aid. They threw mutual aid out the window: they didn't even consider it. That was part of their plan: that they wouldn't worry about mutual aid, we'll have response, then we'll worry about the mutual aid end of it, who's going to get paid for what they did. And that's the way they co-operated with each other.

Marion Health Centre, their north campus, which is their mental health campus, their emergency post-traumatic stress program. I was asked, did you get any therapy while you were in the hospital? I said no, I don't think so. They said, no psychiatrists or psychologists came? I said oh yeah, but all they did was come to the room and talk. [laughter] Then it dawned on me just exactly what therapy is. I - when I woke up in the hospital, when I first really remembered what was going on, there was a gentleman holding my hand. Of course, the next thing I looked for was the security guard with my wallet, and he had it in his hand. But this guy was holding my hand, and he said, "I'm doctor (Pensy ??), I'm the staff psychologist." And he was with me from the time I woke up until the last person I saw when I left the hospital before I left the car was doctor Pensy. So I had therapy from day one. Because all of us had guilt complexes. Several guilt complexes. One was this: the captain of the flight, I had felt a responsibility for the accident, but that's this they had to convince us that, really, there wasn't a lot more that we could have done in the airplane to do it, and it took some time, because we all had guilt complexes about this.

And we all had the why me syndrome. Why did 112 people die, and 184 survive? How do we decide who lives, who dies? Why me? Why did I survive? And that's another thing, that's one of the biggest problems of post-traumatic stress. So that's what everybody was working on. But the co-operation there was tremendous. The people of Sioux City, or Sioux-Land, as they like to be called, since it's a four state area, they co-operated, they headed to the airport immediately. And they

didn't go out there to see what was going on. They had with them food, blankets, clothes, whereever they could be sent to take it. They ended up at Briar Cliff. Often in their cars. A lot of people stayed in their homes. A lot of people offered their homes for the night. [click] Does anyone know what that was? I jump at noises, sudden noises. [laughter] Anyway, they offered their cars, they took the clothes from the people that were soiled by the dirt, by the farmland, took them home, washed them, brought them back. They just did everything. Over 400 people lined up at the blood bank to give blood, and there was no call for blood, there was no announcement that we need blood, get out there, they were there, they had to turn them away, they had so many. The co-operation of the people.

United Airlines, the co-operation they gave everyone, I was very impressed with that. A lot of people, were upset at first, there weren't enough people from United to take care of survivors. Well, we have about a five or six person staff at Sioux City. Well, what United did, when they knew this plane was going to crash, they pulled ticket agents, passenger agents, reservations clerks, right off their jobs at San Fran, Seattle, wherever they could, threw them on the first available airplane, without even going home, and headed them to Sioux City. So by the next morning, or the middle of the next day, they had at least one United employee for every family that was there. And I think any airline does that, I'm not just saying that's United's doing. But the co-operation of United with everyone else and us was good. They kind of turned us over to the union. The Airline Pilots Association and the Association of Flight Attendants kind of handled us, relieved the company of any responsibility there. One of the biggest responsibilities is the press. We were not in any condition to talk to the press. We were the survivors of this spectacular crash, so the press wanted to talk to us. The ALPA hired a policeman, they put him on my door, they put him on Dudley's door. They didn't need them on Bill and Denny's, they were in intensive care, and you can't get down there anyway. But I often wondered if that policeman was on my door to keep me in or keep the press out, but whatever it was, it worked. Because, they left us alone. That's why at the end of five days, we had to hold a press conference because we had held the press at bay, and they were entitled to an interview and to a talk. And so we held a press conference and did it that way. But the co-operation from the two unions was great.

I've talked about how well the passengers did. But the best help, I think, came later. And that came from our families, and our friends. And this is where you can come in, if you know anyone that has had any kind of a crisis, or any kind of a trauma in their life. I had a lot of people tell me, I didn't call you, because I felt you were going to be so busy, that I

didn't want to bother you. You're not bothering anybody. If somebody has a crisis or has a trauma, help them: call them, tell them that you're there. Maybe they won't talk to you, maybe someone else will answer the phone. That's all right. At least, give them a call, let them know you're thinking about them. Let them know you're concerned about them, because that's part of the healing process. Talking about it is part of the healing process. This is my 52nd speech on 232. Every time I give it - and I've talked to the doctors about this, and I've asked the psychiatrists about this - every time I give it, I think I convince myself just a little bit more that there was nothing else I could do. And it's part of my healing process. To not talk about it, to bury your head in the sand and pretend it didn't happen, you're going to explode someday. So, if somebody wants to talk about a trauma, listen to them. If they want you to talk, you talk about it, and listen to them. But be there for them, and help them. That's very important.

Having a response program is very important. And I'll close - I want to make a statement about that, as I close. But first of all, they said we had a little time for questions, if any of you have specific questions you'd like answered, I'll try to answer them for you. Don't get too technical on me, now. But if you have some, I'd be happy to try to answer it. Anybody have any? We're going to ask you to step up to the microphone, if you don't mind. That's going to cut down on the questions, see. [laughter] It also does that, too.

Q: What is your personal opinion of the DC-10 aircraft?

H: I love it. It's a great airplane, I've enjoyed flying it. I've flown it, I said, for 9 years as a co-pilot, and I'll end up flying it four years as a captain. It's my favourite airplane. It's a pilot's airplane. It's an old man's airplane. You just have to have one good finger and you can fly a lot of it. [laughter] Nothing wrong with the co-pilot, you just have to switch hands, which may be kind of difficult. No, I love it. It's a great airplane. I have every confidence in the world in MDC and GE, and this is something that happened, and it's going to happen to any airplane - it's happened to almost any airplane. Maybe not exactly the same thing. It's happened to a '47, it's happened to an L-1011, similar. I love the airplane.

Q: What do you think of the mandatory age 60 retirement law?

[laughter]

H: I get that every time. Well, this is kind of not the way to

answer your question, but since I'm going to be sixty, this is great. This is not United, this is not ALPA, this is not even a lot of my friends, this is just me. My feeling. As we get older, we hate to admit it, but things happen to us. We forget things, we react slowly to things. A young pilot can react a lot faster than an older pilot. He may react wrong. The senior pilot, the experienced pilot may wait a second and do the right thing, so they kind of balance each other out. But we do things as we get older that I'm not so sure our physicals can pick up. A very dear friend of mine was having trouble remembering things. The crews he was flying with accused him of early senility, or drinking on layovers. When they finally diagnosed him, after about a year, they found a tumour the size of an orange in the back of his brain. So all this is going on, anytime this is happening in this year, he could have had a very serious situation at a very critical time, and we could have had problems. This doesn't just happen to 55 year old's, this happens to 30 year old's, I know. Until we come up with a very definite way to check the medical aspects of a person as he gets older, and until we find a way to check the ability of a pilot - as you get older, you might lose some of your abilities, rather than gain some. And you can also fake it. Any pilot, on any given day, can pass a checkride. And the best pilot in the world in a given day can flunk a checkride. When you get into that situation, you get into an extended program of trying to test his competency. SO until we have a better way to test the competency, and a better way to test the mental and physical aspects of an individual, I think we need an age to stop. I think that's the best way to do it, just pick an age. We're going to hurt some people. I just met the other day, or a couple of months ago, a guy down in California, he's 82 years old, he just decided it was time to retire as a teacher of acrobatic flying. And he was sharp as a tack. He didn't wear glasses, could hear, didn't wear a hearing aid, and everything else. But he's a freak of nature. [laughter] Well, he's like Nolan Ryan. Nolan Ryan, if you're a baseball fan, is a freak of nature. Nobody 42 years old should be able to throw as hard as he does, and last as long as he does, and most pitchers don't. Yeager is another one. Most his age don't have the eyesight Yeager has, and the hearing Yeager has, and all this sort of thing. But they're exceptions to the rule. The rule is, somewhere along the line you should stop. Now, I don't care if it's sixty. Right after I retire, they can make it 65, it's ok with me. But somewhere along the line, we have to have a place to stop. If they can come up with good medicals, and good things, then go ahead. But I think the cost, and everything else - we're all looking at the bottom line, and it's just not worth it. Anybody else?

Q: Have you done any commercial flying since?

H: Yes. I went back to work Hallowe'en night, as a matter of fact. [laughter] Three months after the accident, I went back to work. Dudley came back a week later, Bill came back two weeks later. Dennis, unfortunately, severed a nerve in his hand that controlled the motor function of his hand. Along with that, he broke his arm, and they had to put a plate in. While in therapy to fix the arm, the plate broke, and they had to redo the plate. And so he's been out almost a year, just waiting for the arm to heal. But I just heard that all of us are back, including the flight attendants. I would have gone sooner, but I had to wait to get the paperwork done. I had a concussion, so the FAA determined I had to have a neurological exam, and they didn't tell us until I was ready to go back to work, so I had to take some extra time to do that. I've been flying since October 1989, now. Anything else?

Q: What were your injuries?

H: My injuries? Just let me go over quickly the injuries of the crew. Bill, sitting right there, had eight broken ribs, hips, and the pelvis, he had internal injuries, multiple bruises and contusions. Sitting in the jumpseat, in the second officer's seat was the captain, Dennis Fitch. And let me clarify something right there, before we get any further, it got out in Sioux City that Denny Fitch came up to take over from Dudley Dvorak because Dudley couldn't handle the job, and that really irritated me. Dudley was doing what we asked him to do. And we'd had him turned around, and started handling those throttles. If any of you have run through this simulator over here, you know how complicated that is. Dudley did not have time to figure out what the power changes it took. So the second time he added power and was corrected by one of us, he looked up to the captain, and said do you want this seat? You know what you've been doing here, do you want this seat? So that's why the captain was sitting in Dudley's seat, and why Dudley was sitting in the jump seat. Cleared that up. Dennis's injuries were a dislocated left shoulder, a broken right shoulder, the hand, broken rib, other internal injuries, serious internal injuries. And Dudley suffered a large burn on his right arm, we don't know where that came from, the only burn in the cockpit. He smashed his right ankle, had to have three pins put in that. And he has a permanent injury. Me, I put a three inch cut in my right ankle, I bruised my sternum, bruised one rib, and I got fourteen lacerations in my head. This ear [left] was almost cut off, and this ear was cut. It took ninety two stitches to sew me up. But I didn't break anything. Varying degree of injury in that small confine.

Some of our flight attendants, a lot of the passengers, weren't even hurt. The next day, four of the flight attendants walked into my room to go home. Three of them looked like they were dressed to go to work. They didn't even get their uniforms dirty.

Q: Were you aware during the slide-out that the airplane ?? --

H: No. Was I aware? No. As soon as we hit the ground, I went out. I have absolutely no recollection of anything from the time we hit the ground until I came to in the cockpit. Trying to figure out where I was. And then we had some conversation, and then the operation started, and I was in and out throughout the whole thing. I remember parts of the rescue, I remember parts of the ambulance ride. I don't remember the ride into town at all. I remember being in the emergency room, but I don't remember what was going on in there. I was on my stomach. They kept me on my stomach. They put me on a thing and threw a towel over my head. I think they were writing me off, I'm not too sure. I woke up with a tag on my big toe, I swear I did. [laughter] They always tag each individual. They put a number on him, and a flag wherever they found him. And I guess they didn't have a grease pencil, Dudley they wrote on his foot. But me, they put a tag on my big toe. I saw that, and get that thing off of there, right now. [laughter] But I don't remember too much about it. In fact, we were all in and out. Bill remembers sliding down the runway, sideways, or on the side, like that. And thinking something was going to happen. But then suddenly the cockpit filled with dirt, and then it started to tumble. And he doesn't recall any tumbling sensation at all. None of them do.

Q: With what you've learned since the crash, if you found yourself in the same situation, would you do anything different?

H: Well, after going to this simulator I went to this morning, I probably would. For one thing, the inputs to the controls would be a lot less than they were. We were shoving the throttles up full board and back again, and it just take very little movement to accomp-- I'm going to go fly the 720 here, and I think it's going to be a little different. But in the F-15, just a little bit of power does it. But basically, I don't think so. I don't know if we'd still try to fly the yoke. And, of course, it can't happen now, since they've modified the airplane. So we'll have an aileron, and leading edge devices, and slats, and all that. But to do it again, the answer to that at the press conference was, we didn't know what would happen when we did something at the time, and there's no way I'd try to second-guess what would happen if we tried something else. With the knowledge that we

have now - I don't think so. If I were still going to try to fly the airplane, which I'd probably do, I'd still have somebody operate the throttles. That's what they do now, they fly the stabilizer with trim, but they have aileron control. And the best way to do it, really, is to put one guy on the throttles for pitch, and the other to fly the yoke. So I don't think we'd try to do it much different. Except try for a better landing.

Q: Was fuel transfer tried, or would it be tried nowadays?

H: It would probably be tried now, if you had the time. Well, 41 minutes seems like a lot of time. But we spent the first fifteen minutes just trying to keep the shiny side up. So we were so busy with that that we didn't have time to experiment with anything. I know that Bob and Mimi on the Aloha accident actually had time to fly the airplane, and the presence of mind to see how many flaps they could put down, and how slowly they could fly, and so forth. This airplane was flying its own speed. We had very little control. And the phugoids. We went down as low as 180 knots. And went right up as high as 280 or 300 knots, that sort of thing. So we didn't really have the time to see how slow we could go or how we could fly it. I wish we had, but we didn't.

Q: Is MDC looking at any redesign of the isolation of the hydraulic lines that caused the emergency?

H: My understanding is that the MD-11, as well as the DC-10, are going to be, well, the DC-10's are, fixed with a fuse in the #3 hydraulic system. An excessive flow or low quantity in the #3 system will close that fuse and direct no more fluid to the tail. And the fluid is then directed to one aileron, the leading edge slats, the nose wheel steering brakes, and so forth, so you that you can fly the airplane. The tail is now operated off a special motor that drives the stabilizer. It's a flying tail. You have no elevators, but you have stabilizer trim. We had no trim at all in the airplane. You fly the pitch of the airplane with the throttles and the stab trim, and you can steer the airplane with the ailerons. And as I understand, that's also the fix on the 11. What they're going to do with the 12, I have no idea, or the 777, or some of those airplanes. They're going to, I think, strictly FBW, and I have no idea how they're going to do that. I don't even know what that means, really. They tried to tell me this morning.

Q: What was your speed when the engine let go?

H: We were doing 272 knots. We were at cruise, M = 0.83, 272, and we thought that was the airspeed the airplane wanted to fly. Engineers told us later that when the engine blew, the disk and the fan, about six feet in diameter, that whole thing went out, and tore this big whole in the side of the airplane, the housing, not the airplane, and when that thing went out and changed the trim speed to 215 knots or something like that. Then we put the gear down and got to a lower altitude, and the trim speed was then, in effect, with the burning of the fuel, was lowered to another thing.

Did I ever answer your question about transferring fuel?

We didn't. We thought about it now, but at the time we didn't. We dumped as much as we could. In the DC-10, you have to have 33 000 some-odd pounds left after you dump, it's an automatic shut off, and you can't stop it, you can't control it, it's going to stop itself. You have to have that much fuel, unfortunately.

Q: ?? Are there ever any emergency situations where a decision has to be made so quickly that ??

H: The only one I can think of right off the bat that did happen that happened to us again was the Colorado Springs 737 where at about 1200' he suddenly in six seconds went from level normal flight to over on his back and into the ground. Who's going to make a decision in six seconds, I don't know. That's the only time where your reaction time would have to be such - for example, in our case, Bill's reaction time was ahead of mine. So his reaction was fine. If we had been right close to the ground, one of us would have had to react, but the CLR has got to come in, where you could have a little time to discuss.

Okay?

Well, I thank you for being here. It's very important to me. I go around now giving these talks. And unfortunately I don't have enough time to sit around and see that we do it in Seattle. But preparation for a disaster is very important. The things you do here at Edwards AFB may prevent a lot of disasters. It would probably prevent this one if we could ever put into use what they're working with right here at Dryden. But you're not going to stop all the disasters, no matter how hard you try. And there's all kinds. There's not just airplane crashes, there's train crashes, there's hurricanes, tornadoes, there's certainly earthquakes, that can spread disaster over a pretty wide area, which can require communication and emergency effort. So having a good, workable emergency plan is very important.

On July 18, 1989, 112 of us - passengers and crew of 232 - did not survive, and I hope you will remember them, and think of them, whenever you have occasion to recall the events of 232. But 184 of us did. And I think that's due largely in part to the fact that Sioux City gateway airport and the surrounding communities were prepared to respond to a practised, organized, updated emergency plan. So what I ask of you, although you're probably aren't familiar with it now, is to go back to your own communities, and look into your emergency plans, check with those people that make them and determine that such a disaster befall your community, would you be as prepared, and more importantly, if not, why not?

Thank you for your time this morning. Appreciate it.

Capt. Haynes refers to flying the F-15 simulation here at Dryden. Here's an article from Dryden's newspaper which discusses it:

From "The X-Press", 31 May 1991:

Study paves way for control of crippled aircraft

A massive hydraulic failure disables the flight controls of an airplane miles from the nearest airport. Is a crash landing inevitable?

Not necessarily. An engineering study at Dryden shows that multi-engine aircraft with specially programmed flight control systems can touch down safely using just the engines to turn and land.

NASA's study resulted from several recent incidents in which the hydraulic control systems on large aircraft failed during flight. The pilots were left with little or no capability to land normally using ailerons, rudder and elevators.

Engineers at Dryden are doing the work on a simulator programmed to look at the engine-only handling and flying qualities of a variety of aircraft, including large transports and a twin-engine jet fighter.

According to Bill Burcham, chief of Dryden's Propulsion and Performance Branch and the study's initiator, the next major step will be to modify the digital flight control system in NASA's F-15 research aircraft for proof-of-concept flights. The flight program, done in co-operation with the U.S. Air Force, could take place within the next 18 to 24 months, pending formal approval.

The system tested at Dryden is solely for research and is not intended for operational use on existing aircraft. Data from current and future phases of the studies will be available to the aircraft industry for possible application to commercial and military planes.

Disastrous flight control system failures are rare in commercial aircraft, said Burcham, "but if you can save just one aircraft every 10 years, the system is worth it."

The augmented flight control system on a disabled aircraft would take the pilot's stick inputs and convey them into engine throttle commands, Burcham said. The flight control system would automatically program the engines to turn the aircraft, climb

and descend, and eventually land safely by varying the speed of the engines individually or collectively.

In the Dryden study, the engineer-pilot research team used the simulator to compare handling and control characteristics of a four engine jet transport and the NASA F-15. They "flew" the aircraft in both the augmented mode and with manual engine control using hand throttles.

The comparative study showed both types of aircraft can be controlled somewhat by manual engine control during level flight and benign manoeuvres, but they are extremely difficult to land. In the augmented mode, safe flight and landings are possible even in turbulence and crosswinds.

Preliminary flight evaluations by NASA pilots in the F-15 and in two business size aircraft (a twin jet and a twin propeller) verified simulator predictions that some control is possible using just the hand throttles. But landing tasks are extremely difficult unless the flight control system has been tailored for engine control.

The engine control idea is limited to multi-engine aircraft with electronic engine and flight control systems. It can be applied to either jet or propeller driven aircraft.

Other members of the Dryden study team are research pilot Gordon Fullerton; Jim Stewart, F-15 Flight Research Facility project manager; Glenn Gilyard, Propulsion and Performance Branch; and Tom Wolf, Integrated Test and Simulation.