

THIS IS THE ROUGH TRANSCRIPT AS IT APPEARED IN REAL TIME DURING THE NTSB SESSION ON MONDAY, AUGUST 27, TO REPORT ON THE PROBABLE CAUSE OF LAST YEAR'S FATAL CRASH AT THE RENO AIR RACES.

>> GOOD MORNING AND WELCOME TO THE BOARDROOM OF THE NATIONAL TRANSPORTATION SAFETY BOARD. I'M DEBORAH HERSMAN, CHAIRMAN OF THE BOARD. AND I'M JOINED TODAY BY MY FELLOW COLLEAGUES, VICE CHAIRMAN CHRIS HART, MEMBER MARK ROTHKIND . AND TODAY WE MEET IN OPEN SESSION AND IS REQUIRED TO CONSIDER THE SEPTEMBER 16, 2011, AIRPLANE CRASH DURING THE NATIONAL CHAMPIONSHIP AIR RACES AT RENO, AT NEVADA'S RENO AIRPORT. I WOULD LIKE TO RECOGNIZE MARK'S EXCELLENT SERVICE AS AN ON-SCENE SPOKESPERSON FOR OUR ACTIVITIES AND ALSO I RECOGNIZE THAT YOU HAVE SOME FAMILY WITH YOU HERE TODAY. WOULD YOU LIKE TO INTRODUCE THEM? I SEE HIS WIFE, MS. BABCOCK AND HIS DAUGHTER, EVE, WELCOME. THE PILOT OF A HIGHLY MODIFIED AIRPLANE COMPETED IN THE LIMITED DIVISION EXPERIENCING UPSET WHILE TURNING BETWEEN PYLONS EIGHT AND NINE. THE AIRPLANE CRASHED INTO THE BOX SEATING AREA KILLING THE PILOT, AND 10 SPECTATORS. MORE THAN 60 OTHER PEOPLE SUFFERED INJURIES RANGING FROM MINOR TO CRITICAL. ON BEHALF OF MY FELLOW BOARD MEMBERS AND ALL OF THE NTSB STAFF, WE OFFER OUR DEEPEST THIS TO THE FAMILIES AND FRIENDS OF THOSE WHO WERE KILLED AND INJURED IN THIS ACCIDENT. THIS CRASH WAS LIFE AT TERG FOR SO MANY PEOPLE AND THE INVESTIGATION HAS ALSO TOUCHED US DEEPLY. WE HOPE THAT EVERYONE CONTINUE SUCCESSFULLY ON THEIR OWN PATH OF RECOVERY WHETHER FROM INJURY OR LOSS. WHILE WE HAVE INVESTIGATED 22 ACCIDENTS ASSOCIATED WITH THE AIR RACES OVER THE LAST 30 YEARS, THIS WAS UNLIKE THE PRIOR INVESTIGATIONS BECAUSE IT AFFECTS THE SPECTATORS AS WELL AS THE RACE PARTICIPANTS. BUT IT ALSO UNDERSCORES THE IMPORTANCE OF LEARNING FROM LOSS, SO WE CAN MAKE RECOMMENDATIONS TO IMPROVE SAFETY, NOT JUST FOR THOSE WHO RACE, BUT ALSO FOR THE FANS OF THE SPORT. KNOWING THAT AIR RACES ARE AN ANNUAL EVENT, OUR INVESTIGATORS WORKED VERY

HARD TO DEVELOP RECOMMENDATIONS IN ADVANCE OF THE 2012 RACES, WHICH ARE SCHEDULED TO BEGIN IN JUST OVER TWO WEEKS. WE ALSO WANTED TO BE OPEN AND TRANSPARENT WITH THE PUBLIC ABOUT OUR FINDINGS. THAT'S WHY WE HELD A HEARING IN JANUARY TO EXAMINE ISSUES RELATED TO AIR RACE AND AIR SHOW SAFETY AND WHY WE ISSUED 10 RECOMMENDATIONS IN APRIL. THE RECOMMENDATIONS ADDRESSED THE PILOT, THE AIRCRAFT, AND THE RACING ENVIRONMENT. OVER THE LAST YEAR, WE HAVE ENGAGED WITH THE REP JEPTS. -- RECIPIENTS OF OUR ASSOCIATION. THE GOOD NEWS IS THAT PROGRESS HAS BEEN MADE AND TODAY, YOU WILL HEAR ABOUT THE IMPLEMENTATION OF MANY OF THOSE RECOMMENDATIONS. THIS INVESTIGATION AND OUR SAFETY RECOMMENDATIONS ARE IN EFFECT, IN A CLASS OF THEIR OWN SINCE AIR RACING IS MORE OF A SPORTING EVENT THAN A TRANSPORTATION INTERFERE. AS WE SAW IN THE -- ENDEAVOR. AS WE SAW IN THE SUMMER OLYMPICS, PEOPLE PUSHING THEIR INDIVIDUAL PERFORMANCE LIMITS. AND THAT IS WHAT THE PILOTS AT THE NATIONAL CHAMPIONSHIP AIR RACES DO, ESPECIALLY IN THE UNLIMITED DIVISION. THEY PUSH THEIR INDIVIDUAL PERFORMANCE LIMITS AS WELL AS THEIR AIRPLANE'S PERFORMANCE LIMITS TO WIN THE COMPETITION AND SET RECORDS. THE POLITE KNOW THAT THEY ARE TAKING -- PILOT KNOW THAT THEY ARE TAKING RISKS BUT AIR RACE PILOTS EXPECT THAT THE RISKS TAKEN ARE THEIRS ALONE. THIS ACCIDENT FORCED EVERYONE TO RE-EVALUATE THAT EXPECTATION. FOR THE FANS ATTENDING AIR RACES AND OTHER SPORTING EVENTS, THEY'RE ATTRACTED TO THE THRILL OF WATCHING COMPETITORS PUSH THEIR LIMITS AND TAKE RISKS. SPECTATORS ATTEND THESE EVENTS EXPECTING TO BE OUT OF HARM'S WAY, BUT THE RISK IS THERE. FLYING DEBRIS FROM RACE CARS HAS KILLED SPECTATORS AS HAVE BASEBALLS, HOCKEY PUCKS AND MORE. WHILE THESE ACCIDENTS ARE INFREQUENT, WHEN THEY HAPPEN, THE RESULTS ARE TRAGIC. IN RESPONSE, CHANGES ARE MADE, AND ADDITIONAL PRECAUTIONS ARE TAKEN. THIS IS THE POINT OF OUR INVESTIGATION TO IDENTIFY WAYS TO MITIGATE RISKS WHERE POSSIBLE AND ULTIMATELY TO PREVENT A FUTURE TRAGEDY. THE CRASH OF THE GALLUPPING GHOST AFFECTED SO MANY LIVES THAT WILL NEVER BE THE SAME. AT THE HEART OF THIS TRAGEDY WAS THE FATAL INTERSECTION IN TRANSFERENCE OF RISKS FROM PARTICIPANT TO THEIR OBSERVERS. ONE MOMENT, SPECTATORS WERE THRILLED AT

THE SPECTACLE OF SPEED ONLY TO HAVE IT FOLLOWED BY INESCAPABLE TRAGEDY IN RENO, THE FINE LINE BETWEEN OBSERVING RISK AND BEING IMPACTED BY THE CONSEQUENCES WHEN SOMETHING GOES WRONG WAS CROSSED. THE PILOTS UNDERSTOOD THE RISKS THEY ASSUMED. THE SPECTATORS ASSUMED THAT THEIR SAFETY HAD BEEN ASSESSED AND ADDRESSED. GOING TO RENO EACH YEAR IS A LONG-STANDING TRADITION THAT THEY SHARE WITH PERFORMERS AND COMPETITORS, HUNDREDS OF VOLUNTEERS AND SOME 75,000 FELLOW SPECTATORS. RENOSTEAD IS WHERE RECONNAISSANCE TAKE PLACE AND AVIATIONS ARE PASSED ON TO YOUNGER GENERATIONS. YES, THE RENO AIR RACE GROUP COMPRISED OF SPECIAL COMMUNITY WITHIN AVIATION. OUR GOAL AS ALWAYS, IS TO MAKE THIS COMMUNITY AND ALL OF TRANSPORTATION -- TRANSPORTATION SAFER FOR EVERYONE. DR. MEYERS, PLEASE INTRODUCE OUR STAFF.

>> SEATED TO MY RIGHT IS JOHN ELISEY. NEXT TO JOHN IS HARVARD PLAYGAN. MARIE MULLER, AIRCRAFT PERFORMANCE AND CHRIS BABCOCK, WHO CONDUCTED THE IMAGE STUDY FOR THIS INVESTIGATION. BEHIND CHRIS IS JEFF MARCUS, AVIATION SAFETY RECOMMENDATION SPECIALIST. NEXT TO JEFF TO HIS LEFT IS JOSH KOTHRE, DEREK NASH FROM OUR MATERIALS LABORATORY, AND SEATED NEXT TO DEREK IS JIM RITTER, THE DEPUTY DIRECTOR OF OFFICE ENGINEERING AND BEHIND ME, TOM ZOLO. HOWARD HAS THE OPENING PRESENTATION.

>> I NOTICE THAT WE HAVE A NUMBER OF INDIVIDUALS THAT CONTRIBUTED IN THE THIRD ROW AS WELL. I DON'T KNOW IF YOU WANT TO TAKE THE OPPORTUNITY TO INTRODUCE THEM AS WELL.

>> THANK YOU. DAN HORACK FROM THE OFFICE OF RESEARCH AND ENGINEERING, JOHN CLARK, OUR KEEFE SCIENTIST. DEN NICE KREIDER, MIKE BOWER, NOW WITH THE OFFICE OF AVIATION SAFETY, PAUL SUFRIN, OUR WEATHER SPECIALIST. THANK YOU.

>> THANK YOU VERY MUCH. AND WE DO HAVE A VERY CROWDED SET OF TABLES TODAY AND I THINK THAT'S REALLY A TESTAMENT TO THE MANY PEOPLE WHO WORKED SO HARD ON THIS INVESTIGATION ACROSS MULTIPLE OFFICES. SO I THINK YOU ALL HEARD THE WORK

THAT YOU PUT IN. BACK TO YOU, MR. DELISI.

>> THANK YOU, AND GOOD MORNING. ON SEPTEMBER 16, 2011, ABOUT 16:25 PACIFIC DAYLIGHT TIME, THE MODIFIED EXPERIMENTAL NORTH AMERICAN GALLUPPING GHOST SLIDED AT THE AIRPORT RAMP IN THE SPECTATOR BOX SEAT AREA FOLLOWING A LOSS OF CONTROL DURING THE NATIONAL CHAMPIONSHIP AIR RACES ON LIMITED CLASS GOLD RACE AT THE RENOSTEAD AIRPORT IN RENO, NEVADA. THE PILOT AND 10 PEOPLE ON THE GROUND SUSTAINED FATAL INJURIES. AT LEAST 60 PEOPLE ON THE GROUND SUSTAINED INJURIES AND AND AT LEAST 16 OF THOSE WERE SERIOUS INJURIES. THIS IS A DIAGRAM OF THE 2011 UNLIMITED CLASS RACECOURSE. THE AIRPLANE WAS IN THIRD PLACE DURING THE THIRD LAP OF THE SIX-LAP RACE. TRAILING THE SECOND PLACE AIRPLANE BY ABOUT 4.5 SECOND AND THE LEAD PLANE ABOUT 8.8 SECOND. IT WAS TRAVELING ABOUT 445 KNOTS AS IT PASSED PYLON EIGHT ON THE COURSE. AS THE AIRPLANE ROUNDED PYLON EIGHT, IT EXPERIENCED A LEFT ROLL-UP SET AND ROLLED RIGHT, BEGAN TO CLIMB, AND CONTINUED IN A FLIGHT PATH TO ITS IMPACT IN THE BOX SEAT AREA. THE PARTIES TO THIS INVESTIGATION WERE THE FEDERAL AVIATION ADMINISTRATION, THE RENO-TAHOE AIRPORT AUTHORITY, THE RENO AIR RACING ASSOCIATION, THE NATIONAL AIR RACING GROUP UNLIMITED DIVISION, L.L.C., AND ARCAT SYSTEMS ON THE AIRPLANE. THIS IS A LIST OF THE NTSB STAFF THAT PARTICIPATED IN THIS INVESTIGATION. NOW WE WILL SHOW A VIDEO OF THE ACCIDENT SEQUENCE AT REAL TIME SPEED FILMED BY A SPECTATOR IN THE GRANDSTAND. IT BEGAN AS THE AIRPLANE CIRCLED IN RED WAS IN THE STRAIGHTAWAY BETWEEN PYLONS SIX AND SEVEN. THEN YOU WILL SEE IT AT HALF SPEED WITH TWO PAUSES. TWO IMPORTANT THINGS TO WATCH FOR ARE WHERE AT PAUSE ONE, THE AIRPLANE EXPERIENCED A LEFT ROLL-UP SET WHICH IS THE FOCUS OF OUR INVESTIGATION AND AT PAUSE TWO, THE POINT IN THE ACCIDENT SEQUENCE WHEN A PORTION OF THE LEFT ELEVATOR TRIM TAB SEPARATED FROM THE AIRPLANE ABOUT 4.6 SECONDS AFTER THE BEGINNING OF THE ROLL. WE WILL NOT SHOW THE IMPACT. HOWEVER, WE WILL NOW PAUSE FOR INWHO WOULD LIKE TO TURN THEIR EYES AWAY. PLAY VIDEO. AGAIN, WE WILL PICK THIS UP AS IT COMES AROUND PYLON EIGHT. YOU'LL SEE THE LEFT ROLL-UP SET. RIGHT NOW, AS IT CLIMBS. TRIM TAB SEPARATED. NOW WE WILL PLAY IT AT HALF SPEED. COMING ON PYLON

SEVEN AND IT STABILIZED 73-DEGREE BANK ANGLE. APPROACHING PYLON EIGHT. LEFT ROLL-UP SET. PAUSE ONE. ROLL BACK TO THE RIGHT AND BEGIN TO DECLINE. WHERE THE LEFT TRIM BOARDS SEPARATE. THE CHAIRMAN FOR THIS ACCIDENT WILL NOW PRESENT THE ACCIDENT SEQUENCE AND DISCUSS THE ISSUES.

>> AN AIRPLANE PERFORMANCE STUDY, A VIDEO STUDY AND AN IMAGE STUDY WERE PERFORMED BY THE OFFICE OF RESEARCH AND ENGINEERING TO GAIN INSIGHT INTO THE ACCIDENT AIRPLANE'S PERFORMANCE AND MOVEMENT DURING THE ACCIDENT FLIGHT. IN MANY INSTANCES, THE STUDY IS CORRELATED TO DATA TO SUPPLEMENT OR REFINE THE ACCURACY OF FINDINGS. SEVERAL HIGH RESOLUTION PHOTOGRAPHS PROVIDED INFORMATION ABOUT THE IN-FLIGHT POSITIONS OF THE AIRPLANE'S CONTROL SURFACES AND ELEVATOR TRIM TABS, BOTH OF WHICH CHANGED POSITION DURING THE UPSET SEQUENCE. BASED ON THE VIDEO STUDY, THE LEFT ROLL UPSET BEGIN AT 16.24 IN 29 SECONDS PACIFIC DELIGHT TIME AND THIS - DAYLIGHT TIME. I WILL NOW PRESENT A SERIES OF PHOTOS THAT SHOW THE ACCIDENT SEQUENCE IN DETAIL. THESE HIGH RESOLUTION PHOTOS ALLOWED US TO ZOOM INTO THE AREAS OF INTEREST AND DETERMINE THE CONTROL SURFACE POSITIONS THAT I WILL SUMMARIZE. THE NUMBER IN THE LOWER RIGHT PORTION OF THE PHOTO IS THE ELAPSED TIME IN SECONDS FROM TIME T, THE START OF THE LEFT ROLL UPSET. THE SEQUENCE BEGINS ONE QUARTER SECOND PRIOR TO THE START OF THE ROLL UPSET AS THE AIRPLANE IS ESTABLISHED IN A 73-DEGREE LEFT BANK TURN AND APPROACHING PYLON EIGHT. ALTHOUGH HARD TO SEE HERE, THE LEFT ELEVATOR TRIM TAB IS DEFLECTED TRAILING EDGE UP, CONSISTENT WITH ITS POSITION THROUGHOUT THE RACE. AND THE RIGHT ELEVATOR TRIM TAB IS FAIRED WITH THE ELEVATOR. THE RIGHT ELEVATOR TRIM TAB IS FIXED AND UNMOVABLE ON THIS AIRPLANE. THE LEFT ONE IS TRAILING EDGE DOWN. IN THIS PHOTO, THE AIRPLANE HAS JUST BEGUN THE LEFT ROLL UPSET, THE LEFT ELEVATOR TRIM TAB IS STILL TRAILING EDGE UP AND THE RIGHT ELEVATOR TRIM TAB IS STILL FARED. THESE OBSERVATIONS ARE IMPORTANT AS WE PROGRESS THROUGH THE PHOTOS. THE DATA IS TRAILING EDGE DOWN CONSISTENT WITH ITS POSITION IN THE PREVIOUS PHOTO AND THROUGHOUT THE RACE. IN THIS PHOTO, THE AIRPLANE IS IN THE MIDST OF THE LEFT ROLL UPSET.

THE TRIM TABS ARE IN THE SAME POSITIONS AS THE PREVIOUS PHOTO BUT THE RIGHT WING DOWN DEFLECTIONS HAVE INCREASED COMPARED TO THE PREVIOUS PHOTO AS THE PILOT ATTEMPTS TO ARREST THE LEFT ROLL. IN THIS PHOTO, THE AIRPLANE HAS REACHED A LEFT ROLL OF ABOUT 90 DEGREES. IT IS DEFLECTED FURTHER RIGHT WING DOWN AND CALCULATIONS REVEAL THAT THE LEFT ELEVATOR TRIM TAB IS DEFLECTED AT LEAST 21 DEGREES TRAILING EDGE UP, EXCEEDING ITS DIVINE LIMIT OF ABOUT 13 DEGREES. AND GIVING THE FIRST VISIBLE INDICATION OF A DISCONTINUITY IN THE LEFT TRIM TAB CONTROL SYSTEM. IN THIS PHOTO, THE AIRPLANE IS SHOWN ABOUT .13 SECONDS PRIOR TO ITS MAXIMUM LEFT BANK ANGLE OF ABOUT 93 DEGREES THE LEFT TRIM TAB HAS MOVED AND IS SHOWN DEFLECTED LAST TRAILING EDGE UP THAN THE PREVIOUS PHOTO. AND THE RIGHT TRIM TAB IS STILL FARED WITH THE ELEVATOR. IN THIS PHOTO, ABOUT 1.3 SECONDS AFTER THE BEGINNING OF THE LEFT ROLL UPSET, THE AIRPLANE HAS ROLL TO THE RIGHT FROM ITS MAXIMUM LEFT BANK ANGLE. THE LEFT ELEVATOR TRIM TAB HAS AGAIN, CHANGED POSITION AND IS NOW FARED WITH THE ELEVATOR. THE RIGHT ELEVATOR TRIM TAB HAS MOVED TO A TRAILING DOWN POSITION. THIS IS THE FIRST VISIBLE INVESTIGATION OF A DISCONTINUITY IN THE RIGHT TRIM TAB CONTROL SYSTEM. BOTH TRIM TABS CAN MOVE FREELY. THE VIDEO STUDY ALSO ESTABLISH THIS IS ABOUT THE TIME THAT THE AIRPLANE EXPERIENCED ITS GREATEST LOAD FACTOR OF ABOUT 17 G. THE INVESTIGATION DETERMINED THAT BOTH THE RATE OF G ONSET AND THE HIGH G LEVEL EXCEEDED HUMAN TOLERANCE. IN THIS PHOTO, THE AIRPLANE HAS ROLLED ALMOST WINGS LEVEL AND BEGUN CLIMBING. THE -- THEY ARE DEFLECTED AND BOTH ELEVATOR TRIM TAB CONTINUE TO MOVE. THE LEFT ELEVATOR TRIM TAB IS DEFLECTED TAILING EDGE DOWN AND THE RIGHT TRIM TAB IS DEFLECTED TRAILING WING UP. THE TAIL WHEEL IS FULLY EXTENDED. IN THIS PHOTO, TAKEN ABOUT 4.6 SECONDS AFTER THE BEGINNING OF THE ROLL UPSET, THE AIRPLANE HAS REACHED THE APEX OF ITS CLIMB. THE INBOARD SECTION OF THE LEFT ELEVATOR TRIM TAB HAS JUST SEPARATED FROM THE AIRPLANE. IN THE -- AND THE PILOT IS SLUMPED FORWARD AND TO THE RIGHT. THE AIRPLANE IMPACTED THE GROUND ABOUT 4.5 SECONDS AFTER THIS PHOTO WAS TAKEN. THE INVESTIGATIVE TEAM EXAMINED WRECKAGE, EXAMINED STOCK AND MODIFIED AIRPLANES AND REVIEWED DESIGN AND FLIGHT TEST DATA FOR THE PLANE. WE KNOW THERE WERE

EXTENSIVE MODIFICATIONS OVER THE YEARS. I'M GOING TO DISCUSS THE MODIFICATIONS IN TWO PRIMARY AREAS, STURL MODIFICATION AND PLIGHT CONTROL MODIFICATIONS. HERE'S A VIEW OF THE GALLUPPING GHOST OVERLAID ON A -- AREAS OF RED SKATE KATES THE INDIVIDUAL. IT WAS THE REMOVAL OF THE LOWER AIR SCOOP AND THE INSTALLATION OF A RACING CANOPY AND ERR DYNAMIC TURTLE BACK. ADDITIONAL STRUCTURAL MODIFICATIONS INCLUDED A CHANGE IN THE HORIZONTAL STABLER -- STABILIZER INCIDENTS, INSTALLATION OF ENGINE MOWNS IN PLACE OF THE STOCK FLEXIBLE MOWNS. COLLECTIVELY, THESE MODIFICATIONS REDUCE THE TRASH AND GROSS WEIGHT OF THE AIRPLANE. FLIGHT CONTROL MODIFICATIONS TO THE AIRPLANE INCLUDED A REDUCED ELEVATOR INERTIA WEIGHT, INCREASED COUNTERWEIGHT TO ABOUT TWICE THE NORMAL WEIGHT AND AN INCREASED RUTTER COUNTER WEIGHT. THE RIGHT ELEVATOR TRIM TAB WAS FIXED IN PLACE AND FARED WITH THE RIGHT ELEVATOR. THE LEFT ELEVATOR TRIM TAB WAS ACK WAITED ELECTRICALLY. THE TRIM TABS WERE MODIFIED WITH AERODYNAMIC FILLER AND PAINT SUCH AS THEIR WEIGHT WAS INCREASED BY ABOUT ONE THIRD AND THEIR CENTER OF GRAVITY WAS MOVED OUT. THE INVESTIGATION DETERMINED THAT THESE MODIFICATIONS WERE INTENDED TO IMPROVE THE HANDLING QUALITIES AND INCREASE THE SPEED OF THE AIRPLANE BUT SOME OF THEM INCREASED THE PITCH SENSITIVITY OF THE AIRPLANE. AND MADE THE PITCH TRIM SYSTEM MORE SUSCEPTIBLE TO ERR DYE DYNAMIC FLUTTER. THE OWNER INFORMED THE F.A.A. ABOUT THE INSTALLATION OF THE BOIL OFF COOLING SYSTEM ON THE AIRPLANE BUT NO RECORD OF ANY NOTIFICATION WAS FOUND TO SUGGEST THAT HE NOTIFIED THE F.A.A. ABOUT ALL OF THE OTHER MAJOR MODIFICATIONS TO THE AIRPLANE. THEY SUGGESTED THEY PERFORM THREE HOURS OF FLIGHT TESTING IN ORDER TO VALIDATE THE INSTALLATION OF THE BOIL-OFF SYSTEM. SEVERAL PARTS FROM THE ACCIDENT AIRPLANE WERE EXAMINED IN THE NTSB MATERIALS LAB. ALL OF THE HINGES FOR THE ELEVATOR TRIM TABS EXHIBITED DAMAGE CONSISTENT WITH RELATIVE MOTION BETWEEN THE HINGE HAVES. THE BLACK ARROWS POINT OUT AREAS OF MISSING PAIN ON ONE OF THE HINGES EXAMINED. THIS DAMAGE COULD ONLY BE GENERATED IF THE TRIM TAB ATTACHMENT SCREWS WERE LOOSE FOR A PERIOD OF TIME PRIOR TO THE ACCIDENT. THE TRIM TABS ON THE ACCIDENT AIRPLANE ARE EACH ATTACHED WITH THREE SCREWS AND

LOCK NUTS. THE LEFT PHOTO SHOWS A NEW SURPLUS LOCK NUT OBTAINED FOR THE INVESTIGATION. THE RED FIBER MATERIAL IN THE CENTER IS DESIGNED TO PROVIDE A RESTRAINING TORQUE ON THE CREW FEDS TO -- TORQUE ON THE CREW FEDS. THESE TYPES OF NUTS SHOULD NOT BE REUSED IF THEY CANNOT MEET THE MINIMUM TORQUE VALUE. ALL OF THE THAT. -- TASMMENT SCREWS WERE LOOSE WITH NEGLIGIBLE RESISTANCE FROM THEIR RESPECTABLE LOCK NUTS SUCH AS THE SCREWS CAN BE INSERTED AND REMOVED USING ONLY FINGERS. SEVERAL HAD EVIDENCE OF YELLOW PAINT BENEATH THE TOPCOAT OF PAINT AS SHOWN IN THE RIGHT PHOTO. THE INFORMATION AVAILABLE INDICATES THAT AIRPLANE WAS PAINTED YELLOW PRIOR TO THE 1985 AIR RACES WHICH IS THEY HAVE NOT BEEN REPLACED FOR AT LEAST 26 YEARS. THE LEFT AND RIGHT ELEVATOR TRIM TAB LINK ASSEMBLIES THAT CONNECT THE TRIM TAB ACK WAITER -- ACK WAITER ROD WERE RECOVERED AND EXAMINED IN THE LAB. BOTH LINK ASSEMBLIES HAD EVIDENCE OF OVERLOAD FAILURE AND BENDING. THE INTERNAL PORTIONS OF THE ELEVATORS HAD DAMAGE CONSISTENT WITH THE EXPRESSIVE FAILURE OF THE LINK SEMI-BLISS. -- ASSEMBLIES. THE FRACTURED LEFT INBOARD TRIM TAB ATTACHMENT SCREW WAS ALSO EXAMINED IN THE NTSB LAB. THE SCREW HAD EVIDENCE OF FATIGUE FRACTURE OVER ABOUT 80% OF THE FRACTURE FACE AND THE REMAINING 20% HAD EVIDENCE OF OVERLOAD. THE CORROSION ON THE FATIGUE FRACTURE INDICATED THAT THE FRACTURE HAD BEEN PRESENT FOR A PERIOD OF TIME POSSIBLY YEARS BEFORE THE INCIDENT FLIGHT. -- ACCIDENT FLIGHT. IT IS CONSISTENT WITH THE SCREW BEING LOOSE. THIS SLIDE IN THE FOLLOWING -- AND THE FOLLOWING TWO WILL PRESENT INDICATIONS AVAILABLE TO THE PILOT AND CREW THAT THERE WERE PROBLEMS WITH THE AIRPLANE. THE INVESTIGATION WAS PROVIDED WITH SEVERAL FLIGHTS OF DATA THAT INCLUDED SIX FLIGHTS KNOWING THE ACCIDENT FLIGHT ON THE RENO RACECOURSE. THE DATA SHOWED THAT THE FLIGHT WAS THE FASTEST THE AIRPLANE HAD EVER FLOWN ON THE COURSE BY ABOUT 35 KNOTS. AND THE ENGINE POWER SETTINGS WERE THE HIGHEST EVER USED AND IT SHOWED THE CHANGE OF THE VIBRATION AND AN INCREASE IN THE MAXIMUM LOAD FACTOR EACH TIME THE AIRPLANE NEARED AND EXCEEDED 400 KNOTS. WHILE THE INCREASE IN THE MAXIMUM LOAD FACTOR IS EXPECTED DUE TO THE HIGHER SPEED, THE INCREASE WAS UNIQUE TO THIS

AIRPLANE. ADDITIONALLY, ONE CREW MEMBER REPORTED THAT WORK WAS DONE TO TIGHTEN UP FREE PLAY IN THE AIRPLANE'S LOOSE TRIM TAB SCREWS PRIOR TO FLYING TO RENO FOR THE 2011 RACES. EVIDENCE INDICATES THAT THE SCREWS WERE LIKELY TIGHTENED OTHER TIMES SINCE THE ASSEMBLY OF THE AIRPLANE IN 2009. PHOTOGRAPHIC EVIDENCE FROM THE ACCIDENT RACE IN EARLIER FLIGHTS ON THE COURSE SHOW STRUCTURAL DEFAMATION IN THE FORM OF DIAGONAL WRINKLES ON THE FUSELAGE. THIS PHOTO SHOWS THE DEFAMATION DURING LAP TWO. THE MODIFIED TURTLE DECK AND REMOVAL OF THE AIR SCOOP INCREASED THE RIDGITY OF THE FUSELAGE BECAUSE THE STRUCTURE WAS NOT AS STRONG OR AS STIFF AS THE ORIGINAL. PHOTOGRAPHIC EVIDENCE ALSO SHOWED IN-FLIGHT DEFAMATION OF THE CANOPY THAT RESULTED IN A SEPARATION BETWEEN THE WINDSCREEN AND THE CANOPY AS SHOWN IN THIS PHOTO. ALL OF THESE FACTORS PROVIDE STRONG CLUES TO THE PILOT AND CREW THAT THE AIRPLANE WAS BEING OPERATED BEYOND ITS STRUCTURAL LIMITS AND SHOULD HAVE FORCED A MORE DETAILED EXAMINATION OF THE AIRPLANE. THE INVESTIGATION DETERMINED THAT THE AIRCRAFT'S HIGH SPEED AND LOOSE TRIM TAB ATTACHMENT SCREWS LED TO FLUTTER OF THE LEFT ELEVATOR TRIM TAB. FLUTTER IS AN AEROELASTIC PHENOMENON THAT CAN OCCUR WHEN THE MODE OF STRUCTURAL VIBRATION COUPLES WITH THE AERODYNAMIC FORCES TO PRODUCE A ADMONITION, OSCILLATION OR VIBRATION. THE VIBRATION CAN BE SOMEWHAT STABLE IF THE NATURAL DAMPING OF THE STRUCTURE PREVENTS AN INCREASE IN THE FORCES OF MOTION OR THE MOTION CAN BECOME DYNAMIC UNSTABLE IF THE DAMPENING IS NOT ADEQUATE RESULTING IN SELF-EXCITED DESTRUCTIVE FORCES BEING APPLIED TO THE STRUCTURE. FLUTTER CAN RANGE FROM AN ANNOYING BUZZ OF A FLIGHT CONTROL TO A VIOLENT DESTRUCTIVE FAILURE OF THE STRUCTURE IN A VERY SHORT PERIOD OF TIME. AIRCRAFT SPEED AND STRUCTURAL STIFFNESS ARE TWO INPUTS THAT GOVERN FLUTTER AS SPEED INCREASES OR STRUCTURAL STIFFNESS DECREASES, THE SUSCEPTIBILITY TO FLUTTER WILL INCREASE. TO GIVE YOU A BETTER UNDERSTANDING OF WHAT FLUTTER LOOKS LIKE, WE HAVE THIS SHORT SLOW MOTION VIDEO TAKEN BY NASA DURING A FAILED FLIGHT TEST IN APRIL OF 1966. THE CONFIGURATION OF THE TAIL IS DIFFERENT FROM THE ACCIDENT AIRPLANE. TO THE MODE IS LIKELY DIFFERENT. BUT YOU

WILL BE ABLE TO SEE THE UNSTABLE FLUTTER MOTION AND THE SHORT AMOUNT OF TIME THAT IT TAKES TO DEVELOP. THE TEST AIRPLANE SLOWED AND THE FLUTTER STOPPED BEFORE IT BECAME DESTRUCTIVE. THE INVESTIGATION DETERMINED THAT TO THE WORN LOCK NUTS ALLOWED THE LEFT ELEVATOR TRIM TAB SCREWS TO LOOSEN WHICH REDUCED THE STIFFNESS OF THE PITCH TRIM CONTROL SYSTEM ON THE AIRPLANE. AND AT THE HIGH RACE SPEEDS FLOWN DURING THE ACCIDENT RACE, EXCITED FLUTTER OF THE LEFT ELEVATOR TRIM TAB. EXCITATION OF THE FLUTTER RESULTED IN EXPRESSIVE LOADS LINK ASSEMBLY CAUSING THE FAILURE. THE LOSS OF THE LEFT TRIM TAB FUNCTIONALITY CAUSED AN INCREASE IN THE CONTROL STICK FORCE IN AN UNCOMMANDED PITCH-UP TO ABOUT 17 G THAT INCAPACITATED THE PILOT AND CAUSED THE AIRPLANE TO GO OUT OF CONTROL. THE FLUTTER AND FAILURE OF THE LEFT TAB LINK ASSEMBLY EXCITED THE FLUTTER OF THE RIGHT TAB, INCREASING THE DYNAMIC COMPREHENSIVE LOADS BEYOND ITS BUCKLING STRENGTH CAUSING A FAILURE. SUBSEQUENTLY, THE INBOARD LEFT TRIM TAB SEPARATE FLED AIRPLANE AND THE AIRPLANE IMPACT TO THE GROUND. THANK YOU. NOW MR. PLAGAN WILL TALK ABOUT THE SAFETY INFORMATION.

>> STAFF IDENTIFIED SIX SAFETY ISSUES DURING THE INVESTIGATION. THE NTSB ISSUED 10 SAFETY RECOMMENDATIONS TO THE FEDERAL AVIATION ADMINISTRATION, THE NATIONAL AIR RACING GROUP UNLIMITED DIVISION AND THE RENO AIR RACING ASSOCIATION TO ADDRESS THESE ISSUES. RECOMMENDATION A-12-A ASKS THE F.A.A. TO CORRECT INCOMPLETE INFORMATION AND RECONCILE ALL DIFFERENCES AND INCONSISTENCIES BETWEEN THEIR TWO GUIDANCE DOCUMENT. F.A.A. ORDERED 91-45C. THE F.A.A. RESPONDED THAT IT AGREED WITH THE RECOMMENDATION. THEY ARE DRAFTING A REVISION TO THE F.A.A. ORDER THAT WILL CORRECT ANY INCORRECTIONS OR OMISSIONS AND THE CIRCULAR WILL BE REVISED ACCORDINGLY. PENDING COMPLETION OF THESE ACTIONS, THE NTSB CLASSIFIED SAFETY RECOMMENDATIONS A-12-8 OPENED ACCEPTABLE RESPONSE ON JULY 25TH, 2012. IN RECOMMENDATIONS A-12-9 TO THE UNLIMITED DECISION AND A-12-13 TO RARA, THE NTSB RECOMMENDED THAT THEY REQUIRE OWNERS OR PILOTS IN THE UNLIMITED CLASS TO PROVIDE A EVALUATION OR FLIGHT DEMONSTRATION WITHIN THE ANTICIPATED

RACING FLIGHT ENVELOPE FOR AIRPLANES WITH ANY MAJOR MODIFICATIONS. THE UNLIMITED DIVISION RESPONDED IN A LETTER THAT THEY BELIEVED THIS RECOMMENDATION WOULD IMPROVE SAFETY AND CONCLUDED THAT THEY SHOULD REQUIRE AIRCRAFT OWNERS AND OPERATORS TO PROVIDE ENGINEERING DATA FOR ANY MAJOR CHANGE OR AT RAFFPLGTSE PENDING ANY RULES CHANGES, THEY WILL REQUEST ANY CHANGE DATA FOR THE AIRPLANES ENTERED IN THE 2012 RACES AND PROVIDE IT TO THEIR INSPECTION COMMITTEE FOR A REVIEW. RAH-RAH RESPONDED THEY WILL BE EMPHASIZING THIS AND ARE REVIEW THEIR PROCEDURES FOR IN THE FUTURE. THEY BOTH APPEAR TO BE A STEP IN THE RIGHT DIRECTION, MORE INFORMATION IS NEEDED FOR THEIR RECOMMENDATION'S INTENT. THEY NEED TO DEVELOP A SYSTEM THAT ATTRACTS ANY DISCREPANCIES AND VERIFIES THAT THEY HAVE BEEN RESOLVED. IN THE MOST RECENT COMMUNICATION FROM THE UNLIMITED DIVISION, THEY INFORMED US THEY HAVE CHANGED THEIR TECHNICAL INSPECTION FORM AND WILL BE USING IT FOR THE 2012 RACES. AIRPLANES WILL NOT BE ALLOW ON THE RACECOURSE AND SIGNED OFF BY THE TECHNICIAN COMMITTEE. RECOMMENDATION A-1312-11 TO THE UNLIMITED DIVISION AND RECOMMENDATION A-12-16 TO RARA ASK THEM TO PROVIDE AWARENESS TRAINING TO PILOTS, INCLUDING TECHNIQUES TO MITIGATE EXPOSURE. AS PART OF PREPARATION FOR THE AIR RACES AND DURING DAILY BRIEFS AT THE RACES. RARA RESPONDED TO THE RECOMMENDATION AND STATED THAT THEY HAVE DEVELOPED A TRAINING PROGRAM AND BRIEFING THAT ALL PILOTS WILL BE REQUIRED TO ATTEND PRIOR TO PARTICIPATING IN THE 2012 RACES. IN THE LATEST LETTER FROM THE UNLIMITED DIVISION, THEY INFORMED US THAT ALL PILOTS WILL ATTEND THE RARA TRAINING AND THEY WILL ALSO DISCUSS G AWARENESS DURING CLASS BRIEFINGS. RECOMMENDATION A-12-12 TO THE UNLIMITED EDITION AND ANDS THEM TO EVALUATE THE PILOTS TO WEAR G SUITS WHILE RACING. BOTH THE UNLIMITED CLASS AND RARA EVALUATED THE USE OF G SUITS. AND BELIEVE THAT G SUIT USE IS NOT FEASIBLE SINCE IT WILL NOT IMPROVE SAFETY TO THE PILOTINGS OR THE SPECTATORS. RARA CITED DISCUSSION THAT THEY HAD WITH THE MEDICAL INSTITUTE, NASA AND THE AIR FORCE. RECOMMENDATION A-12-14 ASKS RARA TO EVALUATE THE DESIGN OF THE LIMITED CLASS COURSE AND SAFETY AREA TO MINIMALIZE MANEUVERING NEAR AND POTENTIAL CONFLICTS WITH

SECRETARIATS AND IF WARRANTED BY THE RESULT, IMPLEMENT CHANGES TO THE RACECOURSE. RECOMMENDATION A-12-15 ASKS RARA TO RELOCATE A FUEL TRUCK AWAY FROM THE RAMP AREA AND TO INSTALL BARRIERS MORE SUBSTANTIAL THAN THOSE CURRENTLY IN PLACE IN FRONT OF ANY AREA WHERE THERE ARE SPECTATORS ARE PRESENT IN ORDER TO RAISE THE LEVEL OF SAFETY NEAR THE RACECOURSE. AS THEY DO ANNUALLY, RARA EVALUATED THE DESIGN OF THE COURSE AND FOR 2012, THEY ARE MOVING SEVERAL PYLONS ON THE RACECOURSE AND REPOSITIONING TWO RACECOURSE SHOW LINES. THE DIAGRAM SHOWS THE OLD COURSE IN BLUE AND THE NEW COURSE IN GREEN. THE WEST RACECOURSE SHOW LINE WAS MOVED EAST 500 FEET FROM THE GRAY LINE TO THE RED LINE TO PROVIDE A BUFFER BETWEEN THE RACE AIRPLANES AND SPECTATORS ON PRIVATE PROPERTY ADJACENT TO THE AIRPORT. THE SOUTH RACECOURSE SHOW LINE WAS REMOVED FROM THE SOUTH TO THE NORTH SIDE TO PROVIDE ADDITIONAL SEPARATION BETWEEN THE RACERS AND THE CROWD. WHILE THE 2012 RACES, RARA WILL ALSO MOVE THE FUEL TRUCK ABOUT ONE AND A HALF MILES AWAY FROM THE SPECTATOR AREA AND THEY WILL PLACE MORE SUBSTANTIAL CONCRETE BARRIERS ALONG THE ENTIRE LENGTH OF THE SPECTATOR VIEWING AREA AND THE PIT. THIS CONCLUDES MY PRESENTATION. STAFF IS NOW OPEN FOR ANY QUESTIONS.

>> THANK YOU VERY MUCH. THIS WAS AN EXCELLENT PRESENTATION AND TO THE R.E. TEAM. THANK YOU SO MUCH FOR THE WORK THAT YOU DO. THOSE STUDIO STUDIES, LOOKING AT THE -- VIDEO STUDIES AND THE VIDEOS WERE HELPFUL TO OUR INVESTIGATION AND FOR YOU ALL TO CORRELATE DEMOSE DO THE ASSESSMENT THAT WAS NEEDED WERE ADVISE HELPFUL. I'M IN AWE OF THE PAINSTAKING WORK THAT YOU'VE DONE. BY EVALUATING THE PHOTOS, LOOKING FOR SUBTLE BUT POWERFUL CUES.

>> AND THINGS LIKE CONTROL DEFLECTION, CANOPY SEPARATION OF GAPS IN THE CANOPY AND I THINK YOUR FORENSIC ANALYSIS OF THIS ACCIDENT WAS EXCEPTIONAL AND I WANT TO CONGRATULATE AND THANK THE NTSB STAFF FOR THAT EXCEPTIONAL WORK. I SUSPECT AND MR. BABCOCK, PERHAPS YOU CAN ANSWER THIS, PERHAPS MR. PLAYGAN CAN, BUT I SUSPECT THIS ACTION WAS THE MOST HEAVILY

PHOTOGRAPHED ACCIDENT OF ANY THAT WE'VE SEEN YET AND TO GIVE US AN IDEA OF THE MAGNITUDE OF THESE PHOTOGRAPHS AND VIDEO EVIDENCE, HOW MANY PHOTOGRAPHS -- HOW MANY FRAMES OF PHOTOGRAPHS DID YOU GO THROUGH OF VIDEO AND GIVE US SOME IDEA OF THAT.

>> THANKS TO THE MANY PHOTOGRAPHERS AND VIDEOGRAPHERS THAT ARE OUT ON THE COURSE. WE EXAMINED HUNDREDS OF PHOTOGRAPHS AND PROBABLY ABOUT A DOZEN OR SO VIDEOS THAT SHOW THE ACCIDENT IMPACT SEQUENCE.

>> THANK YOU. I'LL HAVE TO ADMIT, I'VE LOOKED AT MANY OF THOSE PHOTOGRAPHS AND I CAN'T SEE THOSE THINGS THAT YOU WERE ABLE TO SEE. SO I KNOW IT TOOK A LOT OF PAINSTAKING EFFORT AND PROBABLY HURTING EYEBALLS AS A RESULT OF LOOKING AT ALL OF THAT. SO TO BE CLEAR, THE PILOT OF THE AIRCRAFT WAS ALSO THE OWNER OF THE AIRCRAFT. IS THAT TRUE?

>> THAT'S CORRECT.

>> FROM A REGULATORY PERSPECTIVE , THE OWNER OF THE AIRCRAFT HAS THE RESPONSIBILITY TO MAINTAIN IT IN AN AIR WORTHY CONDITION. SO WAS THIS AIRCRAFT AIR-WORTHY WHEN IT DEPARTED FOR THE ACCIDENT FLIGHT?

>> BASED ON THE INJURIES AND THE LOGBOOK, IT DID HAVE A CONDITION INSPECTION IN JULY OF 2011 SO PRETTY F.A.A. RULES, IT WAS SIGNED OFF AS BEING AIR WORTHY.

>> WE KNOW THAT AIR WORTHINESS IS SOMETHING THAT IS DETERMINE ON A FLIGHT BY FLIGHT BASIS. JUST BECAUSE YOU HAD AN ANNUAL INSPECTION OR SOMETHING ELSE, DOESN'T MEAN THAT IT'S AIR WORTHY FOR THAT PARTICULAR FLIGHT. BUT I WOULD QUESTION AS TO WHETHER OR NOT THE AIRCRAFT WAS ACTUALLY AIR WORTHY FOR THAT FLIGHT. THERE WERE SCREWS THAT COULD BE HAND TIGHTENED, I BELIEVE YOU SAID. IS THAT CORRECT?

>> WHEN WE EXAMINED THOSE IN THE LAB, YES, YOU CAN RUN THE

SCREWS IN AND OUT OF THE LOCK NUTS USING ONLY FINGERS.

>> COULD THAT LOOSENESS OCCUR BECAUSE OF THE IMPACT FORCES OR DO YOU FEEL LIKE THAT DAMAGE THAT WAS DONE TO THE LOCK NUTS OVER THE YEARS WOULD HAVE ALLOWED -- IN FACT YOU MENTIONED IN YOUR PRESENTATION THAT WAS IT THE RACING CREW MENTIONED THEY HAD TO KEEP TIGHTENING THOSE THINGS UP?

>> THEY DID TIGHTEN IT PRIOR TO THE FLYING AND THEY WORKED ON ONE OF THE TRIM TABS WHILE AT RENO DURING 2011. AND THE DAMAGE ON THE LOCK NUTS WAS CONSISTENT WITH THEM BEING EXTENSIVELY WORN FOR A PERIOD OF YEARS.

>> THANK YOU.

>> YOU POINT OUT THERE WAS NUMBER OF MODIFICATIONS THAT ACTUALLY HAD A VERSE CONSEQUENCES. THERE WERE MODIFICATIONS THAT WERE CONDUCTED WITHOUT RISK ASSESSMENTS, WITHOUT FLIGHT TESTING, WITHOUT ENGINEERING EVALUATIONS, WITHOUT WAIT AND BALANCE DETERMINATIONS. AND THE WAY I LOOK AT IT IS IF YOU'RE FLYING -- IF YOU'RE MODIFYING AN AIRPLANE WITHOUT FULLY UNDERSTANDING HOW THIS MODIFICATIONS CAN AFFECT THE AERODIE DAMICS, YOU'RE PLAYING RUSSIAN ROULETTE WITH AN AIRCRAFT. AND IF YOU WANT TO GO OUT AND FLY AND FLY PAST AND TRY TO WIN, THAT'S ONE THING, BUT AS THE CHAIRMAN SAID, UNLIKE RUSSIAN ROUX LET, IN THIS CASE, WHEN YOU GO OUT AND YOU DO THOSE THINGS, YOU NOT ONLY ENDANGER DANGER YOUR OWN LIFE, BUT YOU POTENTIALLY ENDANGER THE LIVES OF OTHERS AND THAT IS WHAT HAPPENED IN THIS PARTICULAR CASE. I DO HAVE MORE QUESTIONS BUT I'M RUNNING OUT OF TIME. I WILL WAIT TILL THE NEXT TIME.

>> THANK YOU.

>> I LIKE TO BEGIN BY MAKING THE SAME COMMENTS THAT DETERMINE THAT THE MEMBER HAVE MADE. WITH REGARD TO A VERY IMPRESSIVE INVESTIGATION, IT'S ASTOUNDING THAT THE CLEAR STORY THAT HAS COME OUT HERE WAS DEVELOPED FROM ALL OF THE PIECES OF

INFORMATION, PHOTOGRAPHS AND PIECES OF STRUCTURE. I'D LIKE TO HAVE A LITTLE DISCUSSION HERE ABOUT FLUTTER. I APPRECIATE THE VIDEO OF THE TWIN COMMAND CHI FLUTTER. BECAUSE FLUTTER IS A FAIRLY DIFFICULT PHENOMENON TO DESCRIBE.

>> WHEN THE CONTROL SURFACES ARE CHANGED IN TERMS OF THEIR WEIGHT AND CENTER OF GRAVITY, WHY DOES THAT BECOME IMPORTANT?

>> AS YOU INCREASE THE WEIGHT AND MOVE THE C.G. AFTER THE UNBALANCED CONTROL SURFACE SUCH AS A TRIM TAB, YOU WILL INCREASE ITS SUSCEPTN'T TO FLUTTER.

>> AND SUSCEPTIBILITY AS WELL AS THE MAGNITUDE OF THE MOTION

>> YES.

>> BECAUSE THE MAGNITUDE OF THE MOTION IS IMPORTANT BECAUSE IT CAUSED THE CONTROL LINK TO BUCKLE. CORRECT?

>> YES. FLUTTER IS A DYNAMIC EVENT. SO IT'S AN UNSTABLE EVENT WHERE THE MOTIONS WILL INCREASE OVER TIME.

>> NOW, ALONG THAT SAME LINE, WE TALKED ABOUT THE PITCH SENSITIVITY. THE AIRPLANE WAS TRIMMED NOSE DOWN FOR NORMAL FLIGHT, THAT'S CORRECT? -- THAT'S CORRECT?

>> YES. IT WAS TRIMMED NOSE-DOWN.

>> WHY WOULD HE BEEN FLYING A TRIM NOSE DOWN?

>> IN ORDER TO MAKE THE CONTROL STICK FORCES COMFORTABLE FOR HIM TO RACE.

>> OK. SO THE REPORT TALKS ABOUT ELEVATOR COUNTERWEIGHTS. WHY IS AN ELEVATOR COUNTERWEIGHT IMPORTANT?

>> GENERALLY, YOU START TO BALANCE THE COUNTERWEIGHTS SO

YOU GET THE APPROPRIATE STICK FORCES IN THE COCKPIT.

>> BUT COUNTERWEIGHTS ARE BASICALLY A DYNAMIC PHENOMENON, RIGHT?

>> THEY HAVE AFFECTED DYNAMIC OFFENSE THE PITCH TRIM SYSTEM.

>> THEY CAN. THE COUNTERWEIGHTS ON THIS AIRPLANE ARE INSTALLED FORWARD OF THE HINGE LINE SO THEY BALANCE THE WEIGHT AFTER THE HINGE LINE. NORMALLY, THEY'RE NEUTRALLY BALANCED FOR THIS AIRPLANE, THEY WERE SIGNIFICANTLY OVERBALANCED.

>> WHICH WOULD HAVE WHAT EFFECT?

>> IT WOULD TEND TO MAKE THE ELEVATOR WANT TO GO TRAILING EDGE UP.

>> WHICH THEN WOULD RESULT IN A VERY SENSITIVE TRIM SYSTEM IN THE PITCH.

>> VERY SENSITIVE ELEVATOR SYSTEM IN THE PITCH, IS THAT CORRECT?

>> YES. IT INCREASED THE PITCH SENSITIVITY OF THIS AIRPLANE.

>> A DIFFERENT QUESTION WITH REGARD TO THE AIRPLANE HAD A TELEMETRY SYSTEM. SO YOU HAD THE BENEFIT OF HAVING SOME INFORMATION ABOUT POWER SETTINGS, R.P.M.'S AND SO FORTH. THE AIRPLANE HAD A CONSTANT SPEED PROPELLER, DID IT NOT?

>> THARK.

>> BUT DURING THE PITCH UP, THE THESE VARIED CONSIDERABLY. THE PROPELLER SPEED WAS DOWN TO AS LOW AS 600 R.P.M. WHAT WAS THE REASON BEHIND THAT?

>> DURING DURING THE UPSET SEQUENCE, THE ENGINE PARAMETERS

ALL WAR LITTLE BIT ABNORMAL AND THAT'S DUE TO THE G LOADS PLACED ON THE AIRFRAME AND THE AIR LOAD AS WELL.

>> SO THE CONSTITUTE SPEED PROPELLER THEN CAUSE THE -- I MEAN, DID NOT GOVERN THE SPEED, IS THAT A PROPER UNDERSTANDING?

>> IT COULD BE. SOME OF THAT MAY BE INCORRECT TELEMETRY DATA AS WELL. SOME OF IT WAS SUSPECT.

>> COULD BE THE TELEMETRY DATA WAS NOT ACTUALLY REFLECTIVE OF THE R.P.M.?

>> IT COULD BE, YES.

>> THE TRAJECTORY OF THE AIRPLANE WAS RE-CREATED BASED ON THE VIDEOS AND THE PHOTOGRAPHS. HOW WAS THAT DONE?

>> THE VIDEO STUDY RE-CREATED FOUR SECONDS RIGHT NEAR THE UPSET AND WE TOOK EACH FRAME OF THE VIDEO AND WE PLACED A WIRE FRAME MODEL OF A P-51 AND MATCHED IT TO THE VIDEO FRAME. WE TOOK EACH OF THE WIRE FRAME MODELS OVER TIME AND YOU WERE ABLE TO BACK OUT THE MOTIONS OF THE AIRPLANE.

>> THE WIRE FRAME TRAJECTORY WITH THE ACTUAL --

>> DAN CAN TELL YOU SOME OF THE DETAILS ABOUT THAT.

>> IT WAS A PROCESS IN WHICH THE MODEL OF THE AIRPLANE, THE FRAME IN THE VIDEO, WHICH ALLOWS US TO GET THE ORIENTATION OF THE PLANE --

>> CAN YOU MAYBE GET A LITTLE BIT CLOSER OR PERHAPS SWITCH SEATS WITH MR. MARCUS? THANKS.

>> IT WAS A PROCESS WHERE FIRST, THE MODEL OF THE PLANE IS 3-D MODEL OF THE PLANE. THE FRAME FROM THE VIDEO, WHICH ALLOWS US TO GET ORIENTATION OF THE PLANE IN A SYSTEM ACCORDING WITH -- STICKS TO THE CAMERA. HOWEVER, THE CAMERA WAS MOVING

BECAUSE THE PHOTOGRAPHER WAS KEEPING THE PLANE IN THE MIDDLE OF ITS FRAME AND WE DID NOT KNOW WHAT WAS THE MOTION OF THE CAMERA. AT THE ELEVATION AND IT WAS UNKNOWN SO WE INITIALLY ASSUME THE PLANE WAS FLYING NORMALLY ALONG THE COURSE AND TAKING THE ORIENTATION FROM THE PROCESS OF ALIGNING THE WIRE FRAME MODEL, BECAUSE THE OTHER ANGLE OF THE PLANE IN A MOVING SYSTEM, ONCE WE ASSUME THAT THE PLANE WAS FLYING NORMALLY, WE WERE ABLE TO TRANSFORM THOSE ORIENTATIONS TO A SIX SYSTEM COORDINATES. HOWEVER, THE FIRST ONE WAS NOT CORRECT BECAUSE WHEN WE TOOK -- WHEN THE -- IT DIDN'T MATCH THE ORIENTATION IN THE MOVING FRAME OF COORDINATES TO THE CAMERA. SO WE PASSED SEVERAL TIMES AND EACH TIME, WE WERE CORRECTING THE TRAJECTORY. LUCKILY, IT WAS VERY STABLE MATHEMATICALLY AND AFTER ABOUT FIVE CYCLES WHICH INVOLVED IMAGES IT CONVERGED PERFECTLY AND WE HAVE THE PERFECT ALIGNMENT. AND THIS IS HOW WE KNEW EXACTLY HOW THE PLANE WAS FLYING.

>> THANK YOU. THAT WAS A VERY COMPLEX THING TO DESCRIBE. I APPRECIATE THAT.

>> YEAH. IT WAS A TIME-CONSUMING PROCESS.

>> WHICH IS WHY I'LL MAKE IT THREE IN A ROW WHICH ACKNOWLEDGE WHAT BEAUTIFUL WORK WAS DONE IN THIS INVESTIGATION. ONE OF THE INITIAL PRESS BRIEFINGS, ONE OF THE QUESTION WAS THERE WERE SO MANY PHOTOS AND VIDEOS WILL THAT HELP IN THE INVESTIGATION IN SOME WAY? CAN YOU MAKE A COMMENT? IF YOU DIDN'T HAVE THAT DATA, WHAT DIFFERENCE THAT WOULD HAVE MADE?

>> THE PHOTOS AND THE VIDEO INFORMATION REALLY PROVIDED A LOT OF INFORMATION TO THIS INVESTIGATION. IF WE DIDN'T HAVE THEM, WE MAY NOT HAVE BEEN ABLE TO GET TO WHERE WE ARE TODAY.

>> AND I THINK JUST TO BE EXPLICIT, WHEN YOU TALK ABOUT A LOT OF INFORMATION, THE ANALYSIS THAT WAS JUST DESCRIBED ALLOWED YOU TO LITERALLY TALK ABOUT DEGREE DIFFERENCES IN DEFLECTION IN SOME OF THESE THINGS AT DIFFERENT MOMENTS. THAT'S THE LEVEL

OF SPECIFICITY YOU GOT TO. ALSO THERE'S BEEN TALK ABOUT TUOLUMNITY. CAN YOU BE MORE EXPLICIT? MY RECOLLECTION WAS THERE WAS RECORDING DEVICE ON THE AIRPLANE BUT THERE WERE SIGNALS BEING SENT TO GROUND CREW. JUST FILL THAT IN FOR JUST A MOMENT AND WHAT WAS AVAILABLE. YOU HAVE THE VIDEOS, THE PHOTOS. TELL US WHAT THE TELEMETRY DATA THAT WAS AVAILABLE.

>> THE TELEMETRY SYSTEM WAS INSTALLED SO THE CREW CAN WATCH IT AND IT RECORDS A COUPLE OF OTHER USEFUL PROGRAMS FOR THE FOR US. -- FRESHMAN TERSE FOR US. AND -- PARAMETERS FOR US. AND THERE'S A MEMORY CARD WITHIN THE BOX. WE TRY TO RECOVER THE DATA FROM THAT. THERE WERE SOME BLANKS BUT WE WERE ABLE TO USE IT FOR THE INVESTIGATION.

>> AND WE'LL TALK A MOMENT ABOUT THE G-LOCK, THE G FORCES AND ANALYSIS OF THAT.

>> THE TUOLUMNITY ACCELERATION WAS CRITICAL. IT WAS MORE THE VIDEO OF THE ACCELERATION TO DERIVE FROM THE VIDEO STUDY THAT GAVE US THE TRUE ACCELERATION.

>> CAN YOU MAKE A COMMENT SHIFTING A BIT TO THE LOOSE SCREWS LOCK NUTS. YOU DID THE MATH THING WHERE THE YELLOW PAINT IS 26 YEARS. DO WE HAVE ANY TIME SENSE OF THE TIME COURSE? YOU DID TALK ABOUT THE RETIGHTENED THE SCENE ON A FREQUENT BASIS. FOR THE LOOSENESS THERE, ARE WE LITERALLY TALKING 26 YEARS OR CAN YOU TALK A LITTLE BIT BETTER TIME COURSE TO WHERE THOSE LOOSE NUTS MAY PLAY A MORE SIGNIFICANT ROLE HERE?

>> THE YELLOW PAINT INDICATES THAT SOME OF THE HARDWARE AND CREWS WERE NOT REPLACED FOR AT LEAST 26 YEARS. THERE WERE ABOUT 220 YEARS WHERE THE AIRPLANE DIDN'T FLY. IT FLEW ABOUT 1989 AND IT DIDN'T FLY AGAIN AFTER THE REBUILD AS THE GALLUPPING GHOST. BUT THE DAMAGE WE'RE SEEING HAD BEEN THERE FOR YEARS.

>> YOU IDENTIFIED IS THERE SOME WAY THAT THAT COULD HAVE BEEN FOUND ON THE GROUND JUST WITH THE NUMBER OF TIMES IT WAS TIGHTENED?

>> IT COULD HAVE BEEN FOUND ON THE GROUND, YES. THE TORQUE THAT YOU'RE SPEAKING OF WERE F.A.A. GUIDANCE. AND WITH THE TRIM TABS INSTALLED ON THE AIRPLANE, IT MIGHT HAVE BEEN DIFFICULT TO DETERMINE THE LOCK NUTS WERE LOOSE BUT ONCE YOU LOOK AT THE HINGES, IT'S VERY EASY TO DETERMINE THAT.

>> SO I REALLY ENJOYED YOUR SLIDES BECAUSE THEY WERE THE FIRST TIME WHERE I SAW THE MODIFICATION LISTED. AND STRUCTURALLY, I SAW FOUR AND IN A FLIGHT CONTROL, SIX. SO IT'S 10 MINIMUM SIGNIFICANT MODIFICATIONS THAT WERE IDENTIFIED. DID THE PILOT HAVE ANY EXPERIENCE FLYING THE AIRCRAFT WITH ALL 10 OF THOSE MODIFICATIONS OR WAS THIS FLIGHT BASICALLY IN THIS RACE, THE FIRST TIME HE HAD EXPERIENCED WITH ALL OF THOSE AT ONE TIME?

>> THIS WAS NOT THE FIRST FLIGHT HE HAD FLOWN THE AIRPLANE IN THIS CONFIGURATION. THIS CONFIGURATION WAS COMPLETED IN 2009. HE ATTEMPTED TO MAKE THE RACES IN 2009 BUT DIDN'T GET THE AIRPLANE FINISHED. SO HE DID RACE AT THE RACES IN 2010 AND THEN HERE IN 2011. WE HAVE SEVEN FLIGHTS OF DATA WHERE HE WAS ON THE COURSE AT RENO. WE ALSO HAVE SEVERAL OTHER FLIGHT WHERE IS HE FLEW AROUND WHERE THE AIRPLANE WAS BASED.

>> SO IS THERE ANY COMMENTS YOU CAN MAKE ABOUT WAS IT SOMETHING ABOUT THE SPEED OR ASPECTS OF THIS COURSE WHERE WE SAW THESE THINGS EMERGE AS OPPOSED TO THE OTHER EXPERIENCES WITH THE MODIFICATION?

>> WE SAW THE DISTINCT CHANGE BE THE VIBRATION OF THE AMPLITUDE AS HE NEAR AND EXCEEDED 400 KNOTS IN THE RENO RACECOURSE. YES. IT WAS A SPEED THING.

>> THANK YOU. I WOULD LIKE TO ADD -- THANK THE MEMBERS OF THE PUBLIC WHO PROVIDED THAT INFORMATION VOLUNTARILY. THAT WAS AMAZING. WITHOUT THAT, WE COULD NOT HAVE DONE WHAT WE DID. THANK YOU FROM THE FLIERS OF THE WORLD AND THE PUBLIC WHO WATCHES THE FLIERS OF THE WORLD. THANKS TO PEOPLE WHO

PROVIDED THAT EXCELLENT FILM FOOTAGE TO HELP THIS HAPPEN. TWO AREAS OF QUESTIONS I HAVE. ONE IS ON THE DIAGONAL WRINKLES ON THE FUSELAGE. I'M CURIOUS ABOUT WHAT YOU KNOW ABOUT THAT. WAS THAT BECAUSE OF OVERSTRESS BY THE VERTICAL FIN THAT WAS A LATERAL OVERSTRESS OR OVERTRESS BY THE HORIZONTAL STABLE STABILIZER OR A VIBRATORY -- WHAT DO YOU KNOW ABOUT THE WRINKLES ON THE SIDE OF THE FUSELAGE?

>> I THINK --

>> BOTH OR NEITHER?

>> IT'S A COMBINATION OF BOTH. THOSE TYPES OF WRINKLES, NOW SOME STRUCTURES ARE DESIGNED SO THAT YOU GET THOSE TYPES OF WRINKLES. ON THIS AIRPLANE, IT IS A SHEER RESISTANT AIRPLANE SO THE LOADS THAT BEING APPLIED ARE CAUSING THE FUSELAGE TO DEFORM IN SUCH A WAY THAT IT BUCKLES THE SKIN. THE REASON THAT WE BELIEVE THEY WERE ON THIS AIRPLANE AND NOT THE OTHERS IS THE CHANGE IN THE STRUCTURE AFTER THE CANOPY SO THE UPPER TURTLE DECK STRUCTURE AND THE REMOVAL OF THE LOWER AIR SCOOP THAT DECREASED THE STRUCTURAL STIFFNESS OF THE FUSELAGE.

>> OK. MY NEXT QUESTION RELATES TO THE WHOLE -- THE LENGTH ASSOCIATED WITH THE TRIM TAB. I'M TRYING TO USE -- USUALLY, I'M THINKING OF A TAB WITH A TONGUE THAT STICKS UP AND A LINK THAT COMES TO THE HOLE AND THAT LINK IS EXTERNAL FOR AT LEAST A WHILE COMES OUT OF THE ELEVATOR AND IS EXTERNAL FOR A WHILE. WOULD YOU GIVE ME SOME SENSE OF THE GEOMETRY OF THE TRIM TAB LANGE CHALLENGE?

>> IT'S EXACTLY AS YOU ARE THINKING OF IT. THERE'S JUST THE OTHER END OF THE LINK ELEVATOR ATTACHES TO THE CONTROL HORN AND IT GETS ALL THE MECHANISM INSIDE THE HORIZONTAL STABILIZER AND GOES THROUGH THE ELEVATOR.

>> THE LOOSE SCREWS WERE WHERE THE LINKS GOES INTO THE CONTROL HORN?

>> NO. THE LOOSE CREWS THAT WE'RE TALKING ABOUT ARE THE THREE CREWS THAT ATTACH THE TRIM TAB TO THE ELEVATOR.

>> OH. OK. SO WHAT WHEN IT FAILED, WHAT ACTUALLY BROKE? DID THE LINK BREAK? DID THE HINGE SCREWS BREAK IF WHAT ACTUALLY BROKE WHEN IT FAILED? WHEN IT SEPARATED FROM THE AIRPLANE. ARE THE INITIAL FAILURE WAS A FAILURE OF EXPRESSED -- COME PRESSED BUCKLING. WHEN THE INBOARD SEPARATED, THAT WAS A SCREW FAILURE. AND THAT'S THE ONE THAT HAD A PORTION THAT WAS CRACKED.

>> WHEN THE LINK FAILED, YOU'RE SAYING IT BUCKLED? THE LINK THAT GOES TO THE CONTROL HORN BUCKED? WAS THERE A SEPARATION AT THAT POINT IN TIME OR COULD YOU TELL THAT?

>> YEAH. THE TRIM TAB BASICALLY BECAME UNSUPPORTED AND UNCONTROLLED. THE ONLY WAY THAT THAT LINK ASSEMBLY COULD BE BROKEN IS TO THE DYNAMIC LOADS PRODUCED THROUGH FLUTTER.

>> SO YOU'RE SAYING THE LINK NOT ONLY BUCKLED BUT ACTUALLY FAILED -- THE LINK ITSELF FAILED.

>> YES.

>> I SEE. AND THEN ONCE IT BUCKLED, THERE WAS NOTHING HOLDING THE LEFT SIDE TRIM TAB IN PLACE?

>> ONCE IT FRACTURED, YEAH. IT COULD NOT HOLD THE LEFT TRIM TAB IN PLACE AND SO THE FLUTTER GOT EVEN MORE DIVERGENT AND EXCITED.

>> SO THAT WAS MY NEXT QUESTION. WHAT FAILED ON THE RIGHT SIDE? IT WAS ACTUALLY DIDN'T STILL HAD THE LINK ON IT BUT IT WAS SECURED IN PLACE SO THE LINK DID NOT MOVE?

>> YEAH. IT WAS SECURED IN PLACE. SO YOU STILL HAD THE SAME LINK ASSEMBLY, THEY FASTEN ID. TO THE STABILIZER REAR SPAR. SO THEY

COULD NOT MOVE. BUT THAT LINK ASSEMBLY WHEN IT -- WHEN THE LEFT TRIM TAB ASSEMBLY FAILED AND THE FLUTTER, IT EXCITED THE FLUTTER OF THE RIGHT TRIM TAB THAT FAILED THAT LINK ASSEMBLY.

>> SO THAT LINK ALSO BROKE?

>> YES. IT BUCKLED AND BROKE.

>> OK. ALL RIGHT. THANK YOU VERY MUCH.

>> IS THE INCREASE IN THE VIBRATION AMPLITUDE AT 400 KNOTS NORMAL FOR A P-51 OR WAS IT UNIQUE TO THE GALLOPING GHOST?

>> IT WAS UNIQUE TO THE GALLOPING GHOST. WE DID RECEIVE DATA FROM ANOTHER P-51 SIMILAR TO THE GHOST AND IT DIDN'T SHOW ANY KIND OF THIS PHENOMENON THAT WE'VE SEEN IN THE GHOST.

>> CAN YOU EXPLAIN WHY THE PILOT REDUCED THE THROTTLE OR APPEAR TO -- THE THROTTLE APPEARED TO BE REDUCED EIGHT SECOND PART OF UPSET OCCURRING?

>> WE DON'T REALLY KNOW WHY HE REDUCED THE THROTTLE ABOUT EIGHT SECOND PRIOR TO THE UPSET. THERE WAS AN OSCILLATION IN THE POUR SETTINGS -- POWER SETTINGS PRIOR TO THAT. IT COULD BE HE FELT SOMETHING. WE JUST DON'T KNOW.

>> DO WE SEE ANY OTHER INSTRUCTIONS -- REDUCTIONS IN THE THROTTLE THROUGHOUT THE COURSE?

>> WE SEE AN OSCILLATION OF THE POWER ALMOST THROUGHOUT THE RACE WHEN HE'S UP AT THE HIGHER SPEEDS. YES, HE HAD JUST PASSED AN AIRPLANE ON THE COURSE. HE MAY BE PASSED NOW.

>> THE KEY HAVE TO RETRIM INFLIGHT?

>> THE INDICATIONS ARE WITH THE LEFT TRIMTAB BEEN ACTUATED, ONLY THE LEFT MADE THAT TRIMTAB CREEP, PROVIDING MORE NOSE DOWN TRIM.

>> HOW WOULD HE RETRIM THE AIRPLANE? BUT THERE REQUIRED?

>> HE WOULD HAVE TO TAKE HIS HAND AND TRIGGER THE CONTROL SWITCH ON THE LEFT-HAND SIDE OF THE COCKPIT.

>> IF YOU COULD BRING NOT FOLLOW UP ON THE LEFT-HAND SIDE OF THE SCREEN, THAT WOULD BE GREAT -- BRING THAT PHOTO OP ON THE LEFT- HAND SIDE OF THE SCREEN, THAT WOULD BE GREAT. I CANNOT IMAGINE WHAT IT IS LIKE IN THE COCKPIT ENVIRONMENT AT 100 M.P.H.. CAN YOU TELL ME HOW HE MIGHT HAVE RECOGNIZED SOMETHING WAS GOING ON HERE?

>> THE NOISE IN THE COCKPIT AND THE AIR RUSHING INTO THE COCKPIT. EVERYONE WE SHOW THIS TO CAN UNDERSTAND WHY THERE WAS NOT A RESPONSE. IT IS NOT NORMAL ON THIS AIRPLANE. IT IS SITTING ON THE GROUND AND THERE IS NO SEPARATION.

>> AND YOU BELIEVE THIS IS CONSISTENT WITH THE OTHER TYPES OF THINGS WE'RE SEEING, THAT IT IS OVER-STRESSED?

>> YES.

>> HOW OFTEN DO YOU THINK THEY WOULD REPLACE PARTS IN OUR RACING ENVIRONMENT?

>> DO NOT KNOW.

>> DO NOT HAVE A CLUE?

>> I HAVE NO IDEA. IT DEPENDS ON CONDITIONS. ONCE THEY FEEL THAT THEY ARE WORN, THEY SHOULD BE REPLACED. THESE HAD NOT BEEN REPLACED FOR QUITE A LONG TIME.

>> WOULD YOU SAY THIS WAS AN IMPORTANT PART OF THE AIRCRAFT?

>> I THINK EVERYTHING IS AN IMPORTANT PART OF THE AIRCRAFT THAT SHOULD BE CHECKED.

>> DID THEY DO ANY KIND OF OVERALL OR COMPLETE CHECK OF THE AIRCRAFT?

>> PRIOR TO ITS ASSEMBLY IN 2009, EVERYTHING WAS REMOVED. ALL THE PARTS WERE REMOVED. THEY WERE REPAINTED AND OVERHAULED.

>> AND THAT WOULD HAVE BEEN A PERFECT TIME TO REEXAMINE ALL OF THIS EQUIPMENT, CORRECT?

>> YES, WE KNOW THE TRIMTABS WERE REMOVED FROM THE AIRCRAFT AT THAT TIME.

>> IS THERE ANY REASON WHY THEY WOULD NOT HAVE REPLACED THESE PARTS, GIVEN HOW OLD THEY WERE? AND WHERE -- IT WAS NOT FLOWN VERY MUCH AFTER 2009. HANDFUL OF FLIGHTS, CORRECT?

>> I THINK THERE WAS ABOUT 25 HOURS OF TIME SINCE THE AIRPLANE WAS REBUILT.

>> THANK YOU VERY MUCH.

>> THANK YOU.

>> WE ARE ALL PRAISING THE PHOTOGRAPHIC EVIDENCE. I DO NOT WANT TO DIMINISH THE ROLE OF THE STOCKS IN THIS INVESTIGATION. YOUR GROUP WAS MEETING AND BACK THERE THIS MORNING. IT WAS AMAZING TO WATCH YOU ALL WORK. TALKING ABOUT THE PHYSICAL EVIDENCE. THE ELEVATOR, THE ELEVATOR TRIMTAB, IT WAS SHEARED AS IF YOU TAKE A ROD AND GO LIKE THAT. IT WILL SHEAR. ANYTHING LIKE THAT HE WOULD LIKE TO TALK ABOUT? THERE WAS A LOT OF PHOTOGRAPHIC EVIDENCE. THERE WAS ALSO A LOT OF INFORMATION THAT WE TYPICALLY USE WHEN WE DO NOT HAVE THIS MUCH PHOTOGRAPHIC EVIDENCE.

>> YES, WE WERE ABLE TO LOOK AT THAT INFORMATION. WE WERE ABLE TO LOOK AT THE CONTROL ROD AND SEE THAT IT DID BUCKLE

AND BREAK. AS THE ROD WAS BREAKING, IT PUSHED INTO THE UPPER AND LOWER SKIN OF THE ELEVATOR.

>> SO THE NTSB WOULD HAVE BEEN ABLE TO DETERMINE THAT PART FAILED IN FLIGHT. WE MAY NOT HAVE BEEN ABLE TO DETERMINE IF THE G LOAD. EVERYTHING KIND OF LINED UP HERE. NO PHYSICAL REASON TO CORROBORATE THE PHOTOGRAPHIC EVIDENCE. -- YOU HAD PHYSICAL EVIDENCE TO CORROBORATE THE PHOTOGRAPHIC EVIDENCE.

>> YES, I THINK LIKE ANY INVESTIGATION. WE LOOK GOOD ALL THE AVAILABLE INFORMATION WE HAVEN'T PUT IT ALTOGETHER.

>> I WANT TO TALK FOR A MOMENT ABOUT THE CHIEF FORCES -- G FORCES. YOU MADE A COMMENT THE 17 G'S EXCEEDED HUMAN TOLERANCE. WHAT DO YOU MEAN BY THAT? WHAT IS HUMAN TOLERANCE? LET'S TALK ABOUT THE PHYSIOLOGICAL ASPECTS OF THIS.

>> I DRAWN WHAT HAD BEEN TOLD TO ME. IT IS NOT A SUBJECT MATTER IN EXPERT ON. WE DID NOT SAY IT MADE HIM UNCONSCIOUS. WE JUST SAID IT INCAPACITATED HIM TO RESPOND TO THE CONTROLS AT THAT POINT.

>> THANK YOU. WHY WOULD THESE MODIFICATIONS BE MADE TO THE AIRCRAFT? I UNDERSTAND WE WANT TO MAKE IT FASTER, THAT'S THE OBJECTIVE. BUT THERE WERE THINGS LIKE THE PILOT SAID HE WANTED TO SET THE AIRPLANE UP LIKE STILETTO, LIKE RACING BACK AND IN 1985 OR SO. WHAT CAN YOU TELL US ABOUT THAT?

>> WE WERE NOT ABLE TO FIGURE OUT EXACTLY WHY MANY OF THESE MODIFICATIONS WERE MADE, BUT YES, WE DO HAVE INFORMATION THAT HE WANTED TO SET IT UP LIKE THIS OLD AIRPLANE CALLED STILETTO. IT WAS JUST LIKE THE GALLOPING GHOST. MANY OF THE MODIFICATIONS ARE TYPICAL FOR ARE RACING MUSTANG. MANY ARE NOT.

>> SO, YOU COULD NOT IDENTIFY EXACTLY WHAT SOME WERE MADE?

DID YOU FIGURE OUT IF THERE WAS AN AERODYNAMICS OR AN ADVANTAGE TO DOING IT THAT WAY FOR MANY OF THEM? AT LEAST BY READING THE REPORT, YOU INDICATED YOU DO NOT SEE A SPEED ADVANTAGE. IS THAT TRUE?

>> YES, SOME OF THEM WERE DETRIMENTAL.

>> THAT IS THE KEY POINT RIGHT THERE. SOME OF THEM HAD DETRIMENTAL EFFECTS ON THE AIRCRAFT, THAT ACTUALLY PROBABLY LEAD TO THE ACCIDENT.

>> YES, WE BELIEVE THE UNDOCUMENTED AND MAJOR MODIFICATIONS WERE CONTRIBUTORY TO THE ACCIDENT.

>> FOR EXAMPLE, FIXING THE RIGHT ELEVATOR TRIMTAB AND HAVING IT FIXED. INSTEAD OF THE WAY IT WAS DESIGNED TO OPERATE. ON THIS AIRPLANE, YOU SHOULD HAVE BOTH TRIMTABS. THIS PILOT PUT A SCREW THROUGH THEIR TO FIX IT IN POSITION, AND WHEN YOU DO THAT, HE LOST REDUNDANCY. YOU HAVE PUT ALL THE EGGS IN THE BASKET OF HOPING THE LEFT ELEVATOR WILL NOT FAIL. AND IT DID FAIL. YOU LOVE LOST REDUNDANCY. WOULD YOU LIKE TO TALK ABOUT THAT?

>> I THINK YOU EXPLAINED IT VERY WELL.

>> THANK YOU. I LEARNED WELL FROM YOU.

>> MEMBER WEENER.

>> AND GOING THROUGH SOME OF THE DOCKET MATERIAL, IT IS OBVIOUS AS THE P51 MATURED IN THE EARLY 1940'S, THE AIRPLANE WENT THROUGH SOME MODIFICATIONS. ONE OF THE CHANGES WAS THE POSITION OF THE ELEVATOR O BOBWEIGHT. WHAT DID THAT CHANGE MEAN?

>> THEY ADDED A 20 POUND BOBWEIGHT TO THE SYSTEM.

>> AND THE FUNCTION WAS TO KEEP THE AIRPLANE FROM DIVERGING

IN PITCH? SO THE AIRPLANE HAD A HISTORY OF BEING SENSITIVE IN PITCH? I NOTICED IN ONE OF THE PARAGRAPHS RELATED TO THE AIR FORCE SURFACE -- SERVICE INFORMATION THAT THEY WERE QUITE CONCERNED ABOUT THE THE POSSIBILITY OF FACTS, -- DEPRESSIBILITY EFFECTS. WHAT WAS THE MOCK NUMBER OF CHEAP ON THIS COURSE?

>> IT WAS LESS THAN 0.69 PIECING -- 0.69.

>> LESS THAN 0.69? SO YOU RULED OUT COMPRESSIBILITY?

>> AT ALL TIMES DURING THE RACE, THE AIRPLANE WAS BELOW THAT BOUNDARY.

>> ALL RIGHT THEN. THANK YOU.

>> MEMBER ROSEKIND.

>> JUST TO WRAP UP ON THE MODIFICATIONS, WAS THAT OF REQUIREMENT TO NOTIFY ANYONE ABOUT THE MODIFICATIONS, AND TO WHO WOULD THAT MODIFICATION GO?

>> YOU SHOULD NOTIFY THE FAA UPON ANY MODIFICATIONS ON THE AIRPLANE.

>> DID HE? PREXY NOTIFIED THE FAA ABOUT ONE MODIFICATION --

>> AND HE NOTIFIED THE FAA ABOUT ONE MODIFICATION. WE COULD NOT FIND EVIDENCE THAT HE NOTIFIED THEM ABOUT OTHER MODIFICATIONS.

>> I WILL NOT PUT YOU ON THE SPOT. I THINK -- YOU WANT TO CALL THIS NOT A LOSS OF CONSCIOUSNESS, BUT ONE THING THAT WAS NOT VERY CLEAR, AFTER AN INDIVIDUAL RIGHT INPUT, THERE WAS LESS THAN ONE SECOND. WE ARE ALWAYS LOOKING AT OPERATOR PERFORMANCE KINDS OF THINGS. THIS TIME, THERE WAS LESS THAN ONE SECOND FOR ANYTHING TO BE DONE. THAT IS WHY ALL THE FOCUS IS ON THE STRUCTURAL, BECAUSE THERE IS REALLY ALMOST NOTHING WHEN THERE IS LESS THAN ONE SECOND RESPONSE.

>> THAT IS CORRECT. BOTH THE MAXIMUM AMOUNT AND THE RATE OF ONSET.

>> I KNOW WE CANNOT WANT TO TALK ABOUT THE NUMBERS. 17 IS WAY TOWARD THE END OF THE SCALE, RIGHT? ONE OF THE THINGS WE OFTEN TALK ABOUT OUR SURVIVAL FACTORS. CAN SOMEBODY TALK ABOUT -- ANOTHER ARE A LOT OF TIMES WHEN WE HAVE -- I KNOW THERE ARE ALLOWED TIMES FROM HAVE FIRST RESPONDERS. BY RECOLLECTION IS THREE MONTHS BEFORE THIS TRAGEDY, THE AIRPORT AND FIRST RESPONDERS JUST HAD AN EXERCISE ABOUT WHAT WOULD HAPPEN IF THERE WAS A CRASH. IN THIS CASE, IN ABOUT AN HOUR, THEN MOVED A LOT OF PEOPLE IN UNBELIEVABLE CIRCUMSTANCES. CAN YOU COMMENT OR GIVE US SOME INFORMATION ABOUT WHAT THE RESPONSE WAS IN THIS CASE? I THINK THAT WAS ACTUALLY A HIGHLIGHT OF HOW ALL THE EXERCISES HAD PAID OFF.

>> YES. THEIR IN JUNE AND MAY OF 2011, THE MASS CASUALTY RESPONSE PRACTICE WAS CONDUCTED AS PART OF A TRIANNUAL EXERCISE, WHICH A LOT OF FIRST RESPONDERS ARE PART OF. BASICALLY, IT IS THE PRE- PLANNING WITH EVERYBODY INVOLVED.

>> CAN YOU JUST REMIND EVERYBODY -- MY RECOLLECTION WAS IT WAS 50 OR 60 PEOPLE WERE TRANSFERRED IN ABOUT AN HOUR? YOU MIGHT HAVE BETTER NUMBERS.

>> IT WAS VERY HARD TO GIVE EXACT NUMBERS GIVEN THE AMOUNT OF INJURIES. THE LEVEL OF PEOPLE TRANSFERRED TO, THEY UTILIZED HELICOPTERS AND GROUND UNITS.

>> GREAT. WE TALKED ABOUT THE RECOMMENDATIONS MADE IN APRIL. I THINK THERE IS AN ACKNOWLEDGMENT THAT THAT WAS DONE TRYING TO GET A RECOMMENDATION PRIOR TO AN ANNUAL EVENT. CAN YOU GIVE US A SUMMARY OF WHAT STILL NEEDED TO GET DONE?

>> AS FAR AS THE ENGINEERING EVALUATION AND RECOMMENDATION, THEY HAVE MADE PROGRESS AND PUT PROCESSES IN PLACE. THE LONG TERM IS WHAT WE'RE STILL WAITING ON. WHAT ARE THEY GOING

TO DO FOR 2013 AND ON?

>> THANK YOU. SO, THE ACTION IS FOCUSED ON THE APRIL RECOMMENDATIONS AND THE QUESTION IS WHAT IS THE LONG TERM EFFECT GOING TO BE ON THE CULTURE THERE?

>> THAT IS CORRECT.

>> THANK YOU.

>> THANK YOU. YOU MENTIONED ABOUT STICK FORCE. IF HE IS IN A 70-DEGREE BANK, AND YOU SAID FROM THE PHOTOGRAPHIC EVIDENCE, IT INCREASED VERY QUICKLY TO 17 G'S, DO YOU HAVE ANY SENSE ONCE THE TRIMTAB SEPARATED WHAT BEAT STICH FORCE WOULD HAVE BEEN? HOW MUCH STICK FORCE WOULD HAVE BEEN NECESSARY TO CONTAIN THAT? WHAT STICK FORCE IT WOULD HAVE TAKEN?

>> DUE TO THE AGE OF THE AIRCRAFT, WE CANNOT HAVE NUMBERS ON WHAT WOULD HAVE HAPPENED ONCE HE LOST THE TRIMTAB. AFTER THE LOSS OF THE TRIMTAB, THE STICK WOULD BECOME MORE AND MORE UNMANAGEABLE.

>> ONE HAND IS BETWEEN YOUR LEGS AND THE OTHER HAND IS ON THE THROTTLE. IT WOULD HAVE REQUIRED SUBSTANTIAL FOR WORD STICK FORCE, AND VERY QUICK, BECAUSE IT WOULD BE VERY SUDDEN TO NOT HAVE THIS INCREASE OF 17 G'S.

>> THAT IS CORRECT.

>> DOES THAT MEAN THAT ONCE THE TRIMTAB SEPARATED, FATE WAS SEALED?

>> ONCE THE TRIMTAB SEPARATED AND THE CLIMB BEGAN IN EARNEST, WE BELIEVE SO.

>> ONCE THE PILOT RESPONDED TO THE LEFT OVER BANK, AND NOW HE WAS TOWARD THE RIGHT SIDE AND COLLAPSED ON AT THE STICK, IT WASN'T THE RIGHT SIDE STICK THAT CAUSED THE COMPLETION OF THE

BANK?

>> NO, WE BELIEVE HE INPUT THE RIGHT STICK AFTER THE INITIATION OF THE LEFT ROLL. HE FOLDED DOWN IN THE COCKPIT BASED ON THE PHOTOGRAPHS THAT WE HAVE. ONCE YOU PUT YOUR BODY AND THAT POSITION, THE STICK IS NOT ALLOWED TO COME BACK TO THE CENTER PORTION, BECAUSE YOUR BODY IS IN THE WHITE.

>> -- YOUR BODY IS IN THE WAY .

>> AT THAT POINT, IS COLLAPSE ON THE STICK -- HIS COLLAPSE ON THE STICK ANTICIPATED THE CRASH. IS THAT WHAT YOU'RE SAYING?

>> YES, THAT IS CORRECT.

>> THANK YOU.

>> JUST TO CLARIFY, ONCE THE UPSET BEGAN, HE REALLY WAS INCAPACITATED, SO THERE IS NOT REALLY AN ISSUE OF WOULD IT HAVE TAKEN HERCULEAN STRENGTH TO CONTROL THE STICK. THAT REALLY IS NOT AN OPTION WHEN YOU ARE NOT AVAILABLE TO DO IT.

>> THAT IS CORRECT.

>> OK. SO, TO FOLLOW ON WITH SOME OF THE QUESTIONS THAT HAVE BEEN ASKED BEFORE, PARTICULARLY WITH RESPECT TO THESE SUSCEPTIBILITIES LETTER, THE AIRCRAFT THROUGH ONLY AN AVERAGE OF 325 MILES PER HOUR IN THE QUALIFYING RACES?

>> YES, IT WAS CLOSE TO 400. HE DID REACH THOSE SPEEDS WITH A COUPLE OTHER FLIGHTS WE HAVE DATA FOR.

>> HE REACHED 325 OR 400?

>> HEAT REACHED ABOVE 400 -- HE REACHED ABOVE 400 KNOTS.

>> OK, SO ESSENTIALLY HE WAS TESTING THE LIMITS OF THE AIRCRAFT WITH THIS FLIGHT. HE HAD NOT REALLY DEMONSTRATED THE

MANEUVERABILITY ISSUE AT RACE SPEEDS, AT THESE RATES SPEEDS.
AN AVERAGE OF 325 IS NOT 400.

>> BASED ON THE DATA THAT WE HAVE.

>> WE HAVE MADE RECOMMENDATIONS ABOUT TESTING, ENGINEERING EVALUATIONS, ENSURING THAT THEY ACTUALLY ARE TESTED. DO YOU THINK IF THIS AIRCRAFT HAD BEEN TESTED AT RACING SPEED IN A RACING ENVIRONMENT, THE DEFICIENCIES WOULD HAVE BEEN NOTICED AND HE WOULD NOT HAVE BEEN ALLOWED TO RACE? OR DO YOU THINK HE WOULD HAVE BEEN ALLOWED TO RACE?

>> I AM NOT SURE ABOUT BEING ALLOWED TO RACE. IF HE HAD TESTED THE AIRCRAFT, THESE ISSUES WOULD HAVE BEEN PRESENT AND HOPEFULLY HE WOULD HAVE ADDRESSED THEM.

>> DO YOU THINK THAT IS STILL PROBLEMATIC, BECAUSE IT IS BACK ON THE RESEARCH, BACK ON THE PILOT WHO HAS THE INTEREST -- BACK ON THE RACER, BUT ON A PILOT WHO HAS THE INTEREST IN COMPETING IN THE RACE. THE FLIGHT TESTING OF THREE HOURS THAT SHOULD HAVE BEEN DONE, BUT WAS NOT DOCUMENTED. THE FACT THAT NONE OF THE OTHER MODIFICATIONS WERE DISCLOSED TO THE FAA OR THE RACE ORGANIZERS WHEN HE ENTERED IN 2010 AND 2011. HE DID NOT IDENTIFY ANY MAJOR PROVOCATION TO THE AIRCRAFT. EVEN THOUGH HE DID NOT COMPETE IN 2011. THE AGE AND THE HOURS OF THE AIRCRAFT WERE INCORRECT ON THE ENTRY FORM. THINGS THAT ARE REALLY NOT ATTENTION TO DETAIL AT ALL. HE WAS 59 YEARS OLD ON ME -- HE WAS 69 YEARS OLD ON THE RACE FOR. HE WAS 74. TO WHAT DO WE ATTRIBUTE THIS LACK OF INFORMATION? AND THE SIGNALS ABOUT THE VIBRATION, AMPLITUDE OF 400 KNOTS, THE VIBRATION BETWEEN THE CANOPY AND THE WEEDS -- WIND SCREEN. WE HAVE A DESIGN ISSUE HERE THAT NEEDS TO BE ADDRESSED.

>> I DO NOT KNOW. IT IS INCUMBENT, THE WAY THE RULES ARE WRITTEN, IF IT IS INCUMBENT ON THE OWNER-OPERATOR TO LEAD THE FAA KNOW THERE ARE MODIFICATIONS.

>> IS THAT THE ISSUE WHEN IT COMES TO THE DESIGN AND

EVALUATION AND TESTING. TO HAVE SOMEONE WHO IS QUALIFIED WITH THE SKILL SET TO DO THAT. THERE HAS GOT TO BE A BACKSTOP IF THE OPERATOR IS GOING TO PRESS FORWARD IN AN ENVIRONMENT WHERE THEY ARE REALLY TAKING THE RISK. I THINK THAT THAT IS THE IMPORTANT THING, BUT THOSE RECOMMENDATIONS THAT ARE STILL OPEN. THOSE OF THE THINGS THEY REALLY NEED TO DEAL WITH. CAN YOU TELL ME WHAT WAS DIFFERENT ABOUT THE THIRD LAP? HE HAD FLOWN AROUND THE COURSE TWO TIMES, ACHIEVING HIGH SPEED. WHAT WAS DIFFERENT ABOUT THE TERM BETWEEN EIGHT AND NINE BACKS -- DIFFERENT ABOUT THE TURN BETWEEN 8 AND 9?

>> LOOKING AT THE ENGINE PARAMETERS, THE THIRD LAP WAS NOT PARTICULARLY DIFFERENT THAN THE EARLIER LAPSE.

>> SO, WHAT COULD HAVE INITIATED THE UPSET?

>> WE LOOKED AT TWO POSSIBILITIES. KNEW THAT MANY OTHER POSSIBILITIES, BUT THERE WERE TWO WE WERE NOT ABLE TO DISMISS. EITHER HE MISSED THE APEX COMING INTO THE TURN, OR IT WAS A FLUTTER OF FAILURE CAUSING THE UPSET. WE JUST DID NOT HAVE THE INFORMATION TO SAY EXACTLY WHICH ONE OF THOSE IT WAS.

>> IS IT NORMAL FOR A PILOT TO ENCOUNTER WEIGHT ON THE COURSE?

>> YES. EVERY PILOT WE TALKED TO SAYS IT IS QUITE COMMON WALT RACING.

>> AND THEY SHOULD BE ABLE TO CONTROL THAT IN DIFFERENT SITUATIONS?

>> IT IS THE FAILURE OF THE LEFT --

>> THE SUSCEPTIBILITY OF THE AIRCRAFT NOT BEING ABLE TO RESPOND WHEN IT IS OPERATING BEYOND ITS SCOPE?

>> THAT IS CORRECT.

>> MEMBER SUMWALT.

>> ON PAGE 83 OF THE DRAFT REPORT, IT SAYS THE ELEVATOR COUNTERWEIGHT INCREASES, MAKING THE RIGHT TRIMTAB FIXED. THE FAA MAY HAVE REQUIRED A MORE SUBSTANTIAL FLIGHT TESTING PROGRAM.

>> HOW CONFIDENT ARE WE THAT THEY WOULD MAKE THAT CALL? THAT IS WHAT THEY ARE THEREFORE. I HAVE NEVER DEALT WITH AN AIR WHARTON -- AIR WARDEN ON THIS. HOW LIKELY IS IT THAT THEY WOULD HAVE REQUIRED A MORE SUBSTANTIAL FLIGHT TESTING PROGRAM?

>> I BELIEVE IF THEY HAD KNOWN ABOUT THE MODIFICATIONS THERE WOULD HAVE BEEN MORE THAN THREE HOURS OF FLIGHT TESTING REQUIRED. THE PARTICULAR GENTLEMAN HE WAS IN CONTACT WITH IS VERY FAMILIAR WITH THESE TYPES OF AIRPLANES AT THE PERINO RACING CENTER. WE BELIEVE HE WOULD HAVE REQUIRED SOMETHING DIFFERENT.

>> I DO SHARE THE CHAIR'S CONCERN. I AM NOT SURE THE OVERSIGHT IS ADEQUATE. THERE ARE A LOT OF INDICATORS THAT SLIPPED THROUGH THE CRACKS. YOU SAY IT DOES DEPEND ON THE INDIVIDUAL INSPECTOR. THAT IS WORRISOME, A LITTLE BIT. WE'RE PUTTING A LOT OF FAITH IN PEOPLE WHO HAVE A LOT OF INTEREST IN RACING THAT AIRCRAFT TO GET IT OUT THERE. I KEEP GOING BACK TO THE LACK OF ENGINEERING EVALUATIONS. I AM READING THE REPORT PRIOR TO PROBABLE CAUSE AND IT SAYS THAT IT IS LIKELY HAD FLIGHT TESTING FOR THE MODIFICATIONS BEEN PERFORMED, MANY OF THE AIRPLANE'S UNDESIRABLE CHARACTERISTICS COULD HAVE BEEN VERIFIED AND CORRECTED. THAT IS SORT OF THE BOTTOM LINE. A LACK OF FULLY APPRECIATING THE FACT THAT THESE MODIFICATIONS COULD HAVE ADVERSE CONSEQUENCES, AND THEY CERTAINLY DID. AS I SAID EARLIER, TALKING AT A BOARD MEETING, IF SOMEONE WAS TO GO OUT AND DO THESE THINGS AND RISK THEIR OWN LIVES, THAT IS ONE THING. TO GET OUT THERE ON THE BREEZE SCORES WERE THERE ARE LITERALLY THOUSANDS OF SPECTATORS, YOU ARE NOT ONLY IN DANGER IN YOUR OWN LIFE. YOU ARE AND INJURING OTHERS AS WELL.

-- YOU ARE AND INJURING OTHERS AS WELL. THANK YOU VERY MUCH.

>> WITH REFERENCE TO THE 17 G PULLUP, IT WOULD SEEM TO MEET THE AIRPLANE IS EITHER STATICLY DIVERGENT AT THIS POINT, BECAUSE IT IS HARD TO IMAGINE THE AIRPLANE IS TRIMMED TO BE NOSE UP TO 17 G'S. IT MAY HAVE BEEN THE ELEVATOR COUNTERWEIGHTS OR THE BOBWEIGHTS -- BOBWEIGHTS. THE ELEVATOR IS NOW IN A TRAILING POSITION WITH BASICALLY NO TRIM ON ITS. THE AIRPLANE IS DIVERGING IN PITCH TO SUCH A DEGREE IT IS CARRYING A 17 G LOAD. WOULD YOU CHARACTERIZE IT AS STATICLY OR DYNAMICALLY DIVERGENT?

>> YES, IT IS DYNAMICALLY -- WHEN THE TRIMTAB IS LOST, THE REQUIREMENT OF THE STICK FORCE IS INCREASED. THE OPERATOR CAN NO LONGER HOLD THE FORT. -- HOLD IT FORWARD. IT BECOMES A FEEDBACK LOOP. THE ELEVATOR INCREASES WHICH INCREASES THE FORCE, WHICH THEN AND TURNED REACHES THE ELEVATOR AS WELL.

>> SO, BASICALLY WE HAVE A CONTROL ISSUE.

>> YES.

>> OK. WOULD THAT HAVE BEEN FOUND BY ANALYSIS? WOULD IT HAVE REQUIRED FLIGHT TESTS? FLIGHT TESTING, IF SOMETHING IS DYNAMICALLY OR STATICLY DIVERGENT.

>> THAT IS CORRECT. WE KNOW THERE ARE INSTABILITY ISSUES. IF THEY HAD DONE A DILIGENT FLIGHT TEST, IT WOULD HAVE UNCOVERED THOSE.

>> WHICH GOES ALONG WITH MAKING SURE THIS FLUTTER TEST -- THANK YOU.

>> I WANT TO GO BACK TO THE ISSUE OF THE COURSE DESIGN. I BELIEVE THE EXPECTATION FOR THE LOAD IS ABOUT AN AVERAGE OF THREE?

>> THE COURSE IS DESIGNED FOR THE MAXIMUM, THE HIGHEST SPEEDS

AT 3 KNOTS.

>> CERTAINLY, 17 IS EXTREMELY SIGNIFICANT. I AM SURE EVERYONE WAS SURPRISED. I THINK THE TELEMETRY STOPS MEASURING AT AROUND 10. IS THAT CORRECT?

>> THAT IS CORRECT. THE TELEMETRY WAS SATURATED.

>> WHEN WE LOOK AT THE COURSE, WHEN WE LOOK AT HOW THEY HAVE MOVED THE COURSE, WE STILL HAVE A SITUATION HERE WHERE WE HAVE AN UNCONTROLLED EVENT. THE WAY THE COURSE IS DESIGNED, THERE IS REALLY NOT ACCOUNTING FOR HOW TO PROTECT SPECTATORS FROM AN UNCONTROLLABLE AIRCRAFT. IS THAT CORRECT?

>> ONCE AN AIRPLANE IS UNCONTROLLED, YOU HAVE NO IDEA WHERE IT IS GOING TO GO. YOU CANNOT CONTROL THAT. YOU CANNOT MODEL THAT.

>> WHAT RATES OF FAILURES ARE WE LOOKING AT WITH RESPECT TO THE SPECTATORS AND THE RACERS?

>> THE COURSE IS DESIGNED ON A BALLISTIC PROJECT OF. THE COURSE IS DESIGNED AROUND HOW MUCH DISTANCE WILL IT TAKE TO IMPACT OUR ROUND, AND THOSE SPECTATOR AREAS ARE WELL OUTSIDE THE BOUNDARIES.

>> OK, SO THE RACE COURSE DESIGN IN THE SPECTATOR PROTECTION AREAS ARE REALLY NOT EVEN SET FOR AN EVENT LIKE THIS, EVEN THOUGH THERE WERE IMPROVEMENTS MADE ON THE BARRIER WALLS WITH THE RECOMMENDATIONS. IN ORDER TO SEPARATE A CROWD FROM AN UNCONTROLLED AIRCRAFT, YOU'D END UP HAVING TO PUT SPECTATORS' SO FAR AWAY.

>> THAT IS CORRECT.

>> YOU CANNOT PROTECT AGAINST AN UNCONTROLLABLE EVENT. YOU DO NOT KNOW WHERE THE AIRCRAFT MIGHT WIND UP.

>> THE MAXIMUM G LEVEL AND THE MAXIMUM SPEED, YOU CAN MAKE TABLES FOR THAT AND COME UP WITH SAFETY AREAS.

>> OK. VERY GOOD. AGAIN, I WANT TO SAY THANK YOU TO OUR TEAM. AND MANY OF THE PARTICIPANTS IN OUR INVESTIGATION, MIKE HOUTEN AND HIS TEAM. AND THE FAA WORK THAT IS ONGOING. AND I SEE INDIVIDUALS TO HAVE EVEN RETIRED WHO HAVE COME BACK TO BE HERE WITH US FOR THE MEETING TODAY. WE VERY MUCH APPRECIATE EVERYONE BEING HERE. MEMBER SUMWALT, I SAW YOU ALSO GREETED MR. -- WE APPRECIATE EVERYONE BEING IN ATTENDANCE IN OUR AUDIENCE. WE APPRECIATE YOU WATCHING THE WEB CAST. WE ARE NOW GOING TO TAKE A BREAK. WE WILL RECONVENE AT 11:15 TO CONSIDER PROBABLE CAUSE.

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>> IF EVERYONE COULD TAKE THEIR SEATS, WE'RE ABOUT TO BEGIN. THE STAFF OF ANY ADDITIONAL PRESENTATION FOR COMMENT?

>> NO, MA'AM.

>> WOULD YOU PLEASE READ THE PROBABLE CAUSE AS PRESENTED IN THE DRAFT REPORT.

>> THE NATIONAL TRANSPORTATION SAFETY BOARD DETERMINES THE PROBABLE CAUSE OF THIS ACCIDENT IS THE REDUCED ASSISTANCE OF THE ELEVATOR TRIM TAB SYSTEM THAT ALLOWED THE AERODYNAMICS FLUTTER TO OCCUR. BE REDUCED STIFFNESS WAS THE RESULT OF A DETERIORATED IN SEARCH, WHICH BECAME LOOSE AND INITIATED FATIGUE CRACKING IN ONE SCREW AT SOME TIME BEFORE THE ACCIDENT. THE ERROR RESULTED IN A FAILURE OF THE LEFT TRIM TAB ASSEMBLY AND THE LOSS OF CONTROL. CONTRIBUTING TO THE ACCIDENT WERE THE UNDOCUMENTED AND UNTESTED MAJOR MODIFICATIONS TO THE AIRPLANE FROM THE PILOT'S OPERATION IN THE RACING ENVIRONMENT WITHOUT TESTING.

>> IS THERE A MOTION TO ADOPT THE PROBABLE CAUSE? MOTION TO ADOPT THE PROBABLE CAUSE IS WRITTEN AND SECONDED. YES. ALL THOSE IN FAVOR, SIGNIFY WITH YOUR HAND AND AYE. THE AYES HAVE IT. DR. MEYER, I BELIEVE THERE ARE SAFETY RECOMMENDATIONS IN THE REPORT?

>> YES, THERE ARE 10 SAFETY RECOMMENDATIONS TO IMPROVE THE SAFE OPERATION. WE HAVE OUR RESPONSE TO EACH OF THOSE RECOMMENDATIONS AND PROPOSAL OF NEW CLASSIFICATIONS FOR NINE OF THE SAFETY RECOMMENDATIONS. TWO RELATE TO BRACE ELIGIBILITY REQUIREMENTS. -- RELATES TO RECENT ELIGIBILITY REQUIREMENTS. -- RACE ELIGIBILITY REQUIREMENTS. IT REQUIRES PARTICIPANTS TO PROVIDE ENGINEERING EVALUATION THAT INCLUDES ANALYSIS IN THE FLIGHT ENVELOPE FOR ANY AIRCRAFT WITH MAJOR MODIFICATIONS, SUCH AS TO THE STRUCTURAL FLIGHT CONTROLS. THE NATIONAL UNLIMITED DIVISION IS ASKED TO PROVIDE THE SAME REQUIREMENTS FOR PARTICIPANTS IN THE UNLIMITED CLASS. TWO RECOMMENDATIONS RELATE TO A SPECTATOR SAFETY, BOTH TO THE RENO AIR RACING ASSOCIATION. ONE RECOMMENDATION ASKED IT TO EVALUATE THE DESIGN OF THE COURSE TO MINIMIZE MANEUVERING AND POTENTIAL CONFLICTS WITH SPECTATORS THAT WARRANT CHANGES TO THE RACE COURSE. THE SECOND RECOMMENDATION ASKED IT TO TAKE THE FOLLOWING ACTION TO RAISE THE LEVEL OF SAFETY FOR SPECTATORS AND PERSONNEL ON THE RACE FOR -- RACE COURSE. ONE IN THE RAMP AREA AND IN ANY AREA WHERE SPECTATORS ARE PRESENT TO INSTALL BARRIERS THAT ARE MORE SUBSTANTIAL THAN THE ONES CURRENTLY IN PLACE. FOUR RECOMMENDATIONS RELATED TO THE FEASIBILITY FOR PILOTS. RECOMMENDATION 16 AND 17 ASK THE RENO AIR ASSOCIATION TO PROVIDE TRAINING TO THE PILOT INCLUDING TECHNIQUES MITIGATING GEXPOSURE. AND 17 ASKS TO EVALUATE -- THE SAFETY RECOMMENDATION A12-11 AND A12-12 ASKS THE RACING LTD. DIVISION TO DO THE SAME. A 12-11 AND A12-12 ARE CLOSED, ACCEPTABLE ACTION. DISCREPANCY TRACKING -- THAT IS A BE RECOMMENDATION A12-10. THAT IS THE NATIONAL RACING GROUP UNLIMITED DIVISION TO DEVELOP A DISCREPANCY TRACKING SYSTEM. STAFF PROPOSES CALLING IT CLOSED, ACCEPTABLE ACTION. THE 10TH RECOMMENDATION RELATES TO COURSE DESIGN. THAT HAS NOT BEEN

CLASSIFIED IN THIS BRIEF, BUT I WILL MENTION IT FOR COMPLETENESS. REVISE FAA ORDER 89, VOLUME 1, CHAPTER 6 AND AC- 49C TO CONDUCT INACCURATE AND INCOMPLETE INFORMATION. ON JULY 5, 2012, THE BOARD CLASSIFIED THESE AND OPEN IT ACCEPTABLE RESPONSE.

>> IS THERE A MOTION TO ADOPT THE CLASSIFICATION FOR THE RECOMMENDATION? IT HAS BEEN MOVED AND SECONDED TO ADOPT THE CLASSIFICATIONS FOR THE RECOMMENDATIONS ISSUED IN APRIL. ALL THOSE IN FAVOR, SIGNAL WITH YOUR HANDS AND AYE. THE AYES HAVE IT. THE RECOMMENDATIONS HAVE BEEN RECLASSIFIED. IS THERE ANYTHING ELSE?

>> NO.

>> THANK YOU. A MOTION TO ADOPT THE BRIEF?

>> SECOND.

>> IT HAS BEEN MOVED AND SECONDED TO ADOPT THE BRIEF AS PRESENTED. ALL THOSE IN FAVOR, SIGNAL WITH YOUR HAND AND AYE. 5 AYES HAVE IT. THE BRIEF HAS BEEN ADOPTED. IN -- SORRY. ARE THERE ANY CONCERNS OR DISSENTING STATEMENTS FROM THE BOARD MEMBERS? SEEING NONE, I WOULD LIKE TO RECOGNIZE OUR STAFF. OUR BOARD MEMBERS HAVE COMPLEMENTED THEM ON AT THEIR WORK, THE TECHNICAL EFFORTS THAT WENT IN WITH THE INVESTIGATION. I THINK IT WAS SO IMPORTANT THAT WE ISSUED THESE EARLY RECOMMENDATIONS IN APRIL TO GIVE THE OPPORTUNITY TO MAKE CHANGES BEFORE THE RACES NEXT MONTH. THAT WAS A GREAT EFFORT AND VERY SUCCESSFUL. I THINK IT IS GOOD IT HAS BEEN LESS THAN A YEAR TO FIND CHANGES HAVE ALREADY BEEN MADE. HOWARD HAS BEEN OUR INVESTIGATOR IN CHARGE. HE HAS DONE A SUPER JOB. MARIE, YOU DID A GREAT JOB. WE VERY MUCH APPRECIATE ALL THE WORK THAT WAS DONE FROM OUR TEAM, THE INVESTIGATORS, THE WRITERS, EVERYONE PARTICIPATING. AND BRIAN, IN TURN, THANK YOU VERY MUCH, TOO. THE MEDICAL ASPECTS OF THE INVESTIGATION, NOTABLY THE RESEARCH AND RECOMMENDATIONS ON HIGH G TRAINING WAS CONDUCTED BY D NTSB MEDICAL OFFICER. MIKE WAS

JUST CALLED TO PLAY AN INSTRUMENTAL ROLE IN THIS INVESTIGATION JUST AS HE PLAYED AN INSTRUMENTAL ROLE IN HIS CAREER IN PUBLIC SERVICE. HE WAS MISSED. AS I WAS REMINDED DURING OUR RECENT VISIT, AVIATORS ARE A PASSIONATE COMMUNITY. IN OSHKOSH, MY COLLEAGUES AND I MET WITH SOME MANY OTHERS WHO TOOK PART IN A SAFE AND ENJOYABLE AIR SHOW. BUT I DO NOT HAVE TO TRAVEL TO WISCONSIN TO SEE PASSION IN AVIATION. WE HAVE IT HERE AT THE NTSB. WE HAVE IT WITH PASSION THAT THE PILOTS AND SAFETY PROFESSIONALS. SOME OF OUR EMPLOYEES JOIN AS AVIATION ENTHUSIASTS WHO TRAVELED TO RENO YEAR-END AND YEAR OUT TO SIMPLY WATCH RACERS DEFY GRAVITY. IN OUR COMMON -- AND OUR COMMUNICATION WITH THE FAMILIES OF THOSE KILLED AND INJURED, WE RECOGNIZE AND APPRECIATE THAT EACH LIFE IS PRECIOUS. WE KNOW THAT INJURY, WHETHER PHYSICAL OR EMOTIONAL, TAKES TIME TO HEAL, AND IN MANY WAYS, NEVER GOES AWAY. LAST YEAR'S TRAGIC CRASH SPURRED OUR TEAM TO WORK DILIGENTLY TO UNDERSTAND WHAT HAPPENED AND TO IDENTIFY WAYS TO IMPROVE THE SAFETY OF RACES IN THE FUTURE. YEARS AGO, WRITING ABOUT THE EARLY DAYS OF AVIATION "FOR A PILOT FATE IS THE HUNTER." TODAY WITH SO MANY ADVANCES IN SAFETY PROCEDURES, IT IS NO LONGER THE HUNTER OF THE PILOT. WE ALL AGREE WITH AIR RACES AND AIR SHOWS, THE RISK TO SPECTATORS SHOULD BE UNDERSTOOD AND ADDRESSED. INNOCENT BYSTANDERS SHOULD NEVER HAVE TO RELY ON FAITH FOR THEIR SAFETY. THANK YOU. WE ARE ADJOURNED.

>> GOOD MORNING AND WELCOME TO THE BOARDROOM OF THE NATIONAL TRANSPORTATION SAFETY BOARD. I'M DEBORAH HERSMAN, CHAIRMAN OF THE BOARD. AND I'M JOINED TODAY BY MY FELLOW COLLEAGUES, VICE CHAIRMAN CHRIS HART, MEMBER MARK ROTHKIND . AND TODAY WE MEET IN OPEN SESSION AND IS REQUIRED TO CONSIDER THE SEPTEMBER 16, 2011, AIRPLANE CRASH DURING THE NATIONAL CHAMPIONSHIP AIR RACES AT RENO, AT NEVADA'S RENO AIRPORT. I WOULD LIKE TO RECOGNIZE MARK'S EXCELLENT SERVICE AS AN ON-SCENE SPOKESPERSON FOR OUR ACTIVITIES AND ALSO I RECOGNIZE THAT YOU HAVE SOME FAMILY WITH YOU HERE TODAY. WOULD YOU LIKE TO INTRODUCE THEM? I SEE HIS WIFE, MS. BABCOCK AND HIS DAUGHTER, EVE, WELCOME. THE PILOT OF A HIGHLY MODIFIED

AIRPLANE COMPETED IN THE LIMITED DIVISION EXPERIENCING UPSET WHILE TURNING BETWEEN PYLONS EIGHT AND NINE. THE AIRPLANE CRASHED INTO THE BOX SEATING AREA KILLING THE PILOT, AND 10 SPECTATORS. MORE THAN 60 OTHER PEOPLE SUFFERED INJURIES RANGING FROM MINOR TO CRITICAL. ON BEHALF OF MY FELLOW BOARD MEMBERS AND ALL OF THE NTSB STAFF, WE OFFER OUR DEEPEST THIS TO THE FAMILIES AND FRIENDS OF THOSE WHO WERE KILLED AND INJURED IN THIS ACCIDENT. THIS CRASH WAS LIFE AT TERG FOR SO MANY PEOPLE AND THE INVESTIGATION HAS ALSO TOUCHED US DEEPLY. WE HOPE THAT EVERYONE CONTINUE SUCCESSFULLY ON THEIR OWN PATH OF RECOVERY WHETHER FROM INJURY OR LOSS. WHILE WE HAVE INVESTIGATED 22 ACCIDENTS ASSOCIATED WITH THE AIR RACES OVER THE LAST 30 YEARS, THIS WAS UNLIKE THE PRIOR INVESTIGATIONS BECAUSE IT AFFECTS THE SPECTATORS AS WELL AS THE RACE PARTICIPANTS. BUT IT ALSO UNDERSCORES THE IMPORTANCE OF LEARNING FROM LOSS, SO WE CAN MAKE RECOMMENDATIONS TO IMPROVE SAFETY, NOT JUST FOR THOSE WHO RACE, BUT ALSO FOR THE FANS OF THE SPORT. KNOWING THAT AIR RACES ARE AN ANNUAL EVENT, OUR INVESTIGATORS WORKED VERY HARD TO DEVELOP RECOMMENDATIONS IN ADVANCE OF THE 2012 RACES, WHICH ARE SCHEDULED TO BEGIN IN JUST OVER TWO WEEKS. WE ALSO WANTED TO BE OPEN AND TRANSPARENT WITH THE PUBLIC ABOUT OUR FINDINGS. THAT'S WHY WE HELD A HEARING IN JANUARY TO EXAMINE ISSUES RELATED TO AIR RACE AND AIR SHOW SAFETY AND WHY WE ISSUED 10 RECOMMENDATIONS IN APRIL. THE RECOMMENDATIONS ADDRESSED THE PILOT, THE AIRCRAFT, AND THE RACING ENVIRONMENT. OVER THE LAST YEAR, WE HAVE ENGAGED WITH THE REP JEPTS. -- RECIPIENTS OF OUR ASSOCIATION. THE GOOD NEWS IS THAT PROGRESS HAS BEEN MADE AND TODAY, YOU WILL HEAR ABOUT THE IMPLEMENTATION OF MANY OF THOSE RECOMMENDATIONS. THIS INVESTIGATION AND OUR SAFETY RECOMMENDATIONS ARE IN EFFECT, IN A CLASS OF THEIR OWN SINCE AIR RACING IS MORE OF A SPORTING EVENT THAN A TRANSPORTATION INTERFERE. AS WE SAW IN THE -- ENDEAVOR. AS WE SAW IN THE SUMMER OLYMPICS, PEOPLE PUSHING THEIR INDIVIDUAL PERFORMANCE LIMITS. AND THAT IS WHAT THE PILOTS AT THE NATIONAL CHAMPIONSHIP AIR RACES DO, ESPECIALLY IN THE UNLIMITED DIVISION. THEY PUSH THEIR INDIVIDUAL PERFORMANCE LIMITS AS WELL AS THEIR AIRPLANE'S PERFORMANCE

LIMITS TO WIN THE COMPETITION AND SET RECORDS. THE POLITE KNOW THAT THEY ARE TAKING -- PILOT KNOW THAT THEY ARE TAKING RISKS BUT AIR RACE PILOTS EXPECT THAT THE RISKS TAKEN ARE THEIRS ALONE. THIS ACCIDENT FORCED EVERYONE TO RE-EVALUATE THAT EXPECTATION. FOR THE FANS ATTENDING AIR RACES AND OTHER SPORTING EVENTS, THEY'RE ATTRACTED TO THE THRILL OF WATCHING COMPETITORS PUSH THEIR LIMITS AND TAKE RISKS. SPECTATORS ATTEND THESE EVENTS EXPECTING TO BE OUT OF HARM'S WAY, BUT THE RISK IS THERE. FLYING DEBRIS FROM RACE CARS HAS KILLED SPECTATORS AS HAVE BASEBALLS, HOCKEY PUCKS AND MORE. WHILE THESE ACCIDENTS ARE INFREQUENT, WHEN THEY HAPPEN, THE RESULTS ARE TRAGIC. IN RESPONSE, CHANGES ARE MADE, AND ADDITIONAL PRECAUTIONS ARE TAKEN. THIS IS THE POINT OF OUR INVESTIGATION TO IDENTIFY WAYS TO MITIGATE RISKS WHERE POSSIBLE AND ULTIMATELY TO PREVENT A FUTURE TRAGEDY. THE CRASH OF THE GALLUPPING GHOST AFFECTED SO MANY LIVES THAT WILL NEVER BE THE SAME. AT THE HEART OF THIS TRAGEDY WAS THE FATAL INTERSECTION IN TRANSFERENCE OF RISKS FROM PARTICIPANT TO THEIR OBSERVERS. ONE MOMENT, SPECTATORS WERE THRILLED AT THE SPECTACLE OF SPEED ONLY TO HAVE IT FOLLOWED BY INESCAPABLE TRAGEDY IN RENO, THE FINE LINE BETWEEN OBSERVING RISK AND BEING IMPACTED BY THE CONSEQUENCES WHEN SOMETHING GOES WRONG WAS CROSSED. THE PILOTS UNDERSTOOD THE RISKS THEY ASSUMED. THE SPECTATORS ASSUMED THAT THEIR SAFETY HAD BEEN ASSESSED AND ADDRESSED. GOING TO RENO EACH YEAR IS A LONG-STANDING TRADITION THAT THEY SHARE WITH PERFORMERS AND COMPETITORS, HUNDREDS OF VOLUNTEERS AND SOME 75,000 FELLOW SPECTATORS. RENOSTEAD IS WHERE RECONNAISSANCE TAKE PLACE AND AVIATIONS ARE PASSED ON TO YOUNGER GENERATIONS. YES, THE RENO AIR RACE GROUP COMPRISED OF SPECIAL COMMUNITY WITHIN AVIATION. OUR GOAL AS ALWAYS, IS TO MAKE THIS COMMUNITY AND ALL OF TRANSPORTATION -- TRANSPORTATION SAFER FOR EVERYONE. DR. MEYERS, PLEASE INTRODUCE OUR STAFF.

>> SEATED TO MY RIGHT IS JOHN ELISEY. NEXT TO JOHN IS HARVARD PLAYGAN. MARIE MULLER, AIRCRAFT PERFORMANCE AND CHRIS BABCOCK, WHO CONDUCTED THE IMAGE STUDY FOR THIS INVESTIGATION. BEHIND CHRIS IS JEFF MARCUS, AVIATION SAFETY

RECOMMENDATION SPECIALIST. NEXT TO JEFF TO HIS LEFT IS JOSH KOTHRE, DEREK NASH FROM OUR MATERIALS LABORATORY, AND SEATED NEXT TO DEREK IS JIM RITTER, THE DEPUTY DIRECTOR OF OFFICE ENGINEERING AND BEHIND ME, TOM ZOLO. HOWARD HAS THE OPENING PRESENTATION.

>> I NOTICE THAT WE HAVE A NUMBER OF INDIVIDUALS THAT CONTRIBUTED IN THE THIRD ROW AS WELL. I DON'T KNOW IF YOU WANT TO TAKE THE OPPORTUNITY TO INTRODUCE THEM AS WELL.

>> THANK YOU. DAN HORACK FROM THE OFFICE OF RESEARCH AND ENGINEERING, JOHN CLARK, OUR KEEFE SCIENTIST. DEN NICE KREIDER, MIKE BOWER, NOW WITH THE OFFICE OF AVIATION SAFETY, PAUL SUFRIN, OUR WEATHER SPECIALIST. THANK YOU.

>> THANK YOU VERY MUCH. AND WE DO HAVE A VERY CROWDED SET OF TABLES TODAY AND I THINK THAT'S REALLY A TESTAMENT TO THE MANY PEOPLE WHO WORKED SO HARD ON THIS INVESTIGATION ACROSS MULTIPLE OFFICES. SO I THINK YOU ALL HEARD THE WORK THAT YOU PUT IN. BACK TO YOU, MR. DELISI.

>> THANK YOU, AND GOOD MORNING. ON SEPTEMBER 16, 2011, ABOUT 16:25 PACIFIC DAYLIGHT TIME, THE MODIFIED EXPERIMENTAL NORTH AMERICAN GALLUPPING GHOST SLIDED AT THE AIRPORT RAMP IN THE SPECTATOR BOX SEAT AREA FOLLOWING A LOSS OF CONTROL DURING THE NATIONAL CHAMPIONSHIP AIR RACES ON LIMITED CLASS GOLD RACE AT THE RENOSTEAD AIRPORT IN RENO, NEVADA. THE PILOT AND 10 PEOPLE ON THE GROUND SUSTAINED FATAL INJURIES. AT LEAST 60 PEOPLE ON THE GROUND SUSTAINED INJURIES AND AND AT LEAST 16 OF THOSE WERE SERIOUS INJURIES. THIS IS A DIAGRAM OF THE 2011 UNLIMITED CLASS RACECOURSE. THE AIRPLANE WAS IN THIRD PLACE DURING THE THIRD LAP OF THE SIX-LAP RACE. TRAILING THE SECOND PLACE AIRPLANE BY ABOUT 4.5 SECOND AND THE LEAD PLANE ABOUT 8.8 SECOND. IT WAS TRAVELING ABOUT 445 KNOTS AS IT PASSED PYLON EIGHT ON THE COURSE. AS THE AIRPLANE ROUNDED PYLON EIGHT, IT EXPERIENCED A LEFT ROLL-UP SET AND ROLLED RIGHT, BEGAN TO CLIMB, AND CONTINUED IN A FLIGHT PATH TO ITS IMPACT IN THE BOX SEAT AREA. THE PARTIES TO THIS INVESTIGATION WERE THE FEDERAL

AVIATION ADMINISTRATION, THE RENO-TAHOE AIRPORT AUTHORITY, THE RENO AIR RACING ASSOCIATION, THE NATIONAL AIR RACING GROUP UNLIMITED DIVISION, L.L.C., AND ARCAT SYSTEMS ON THE AIRPLANE. THIS IS A LIST OF THE NTSB STAFF THAT PARTICIPATED IN THIS INVESTIGATION. NOW WE WILL SHOW A VIDEO OF THE ACCIDENT SEQUENCE AT REAL TIME SPEED FILMED BY A SPECTATOR IN THE GRANDSTAND. IT BEGAN AS THE AIRPLANE CIRCLED IN RED WAS IN THE STRAIGHTAWAY BETWEEN PYLONS SIX AND SEVEN. THEN YOU WILL SEE IT AT HALF SPEED WITH TWO PAUSES. TWO IMPORTANT THINGS TO WATCH FOR ARE WHERE AT PAUSE ONE, THE AIRPLANE EXPERIENCED A LEFT ROLL-UP SET WHICH IS THE FOCUS OF OUR INVESTIGATION AND AT PAUSE TWO, THE POINT IN THE ACCIDENT SEQUENCE WHEN A PORTION OF THE LEFT ELEVATOR TRIM TAB SEPARATED FROM THE AIRPLANE ABOUT 4.6 SECONDS AFTER THE BEGINNING OF THE ROLL. WE WILL NOT SHOW THE IMPACT. HOWEVER, WE WILL NOW PAUSE FOR INWHO WOULD LIKE TO TURN THEIR EYES AWAY. PLAY VIDEO. AGAIN, WE WILL PICK THIS UP AS IT COMES AROUND PYLON EIGHT. YOU'LL SEE THE LEFT ROLL-UP SET. RIGHT NOW, AS IT CLIMBS. TRIM TAB SEPARATED. NOW WE WILL PLAY IT AT HALF SPEED. COMING ON PYLON SEVEN AND IT STABILIZED 73-DEGREE BANK ANGLE. APPROACHING PYLON EIGHT. LEFT ROLL-UP SET. PAUSE ONE. ROLL BACK TO THE RIGHT AND BEGIN TO DECLINE. WHERE THE LEFT TRIM BOARDS SEPARATE. THE CHAIRMAN FOR THIS ACCIDENT WILL NOW PRESENT THE ACCIDENT SEQUENCE AND DISCUSS THE ISSUES.

>> AN AIRPLANE PERFORMANCE STUDY, A VIDEO STUDY AND AN IMAGE STUDY WERE PERFORMED BY THE OFFICE OF RESEARCH AND ENGINEERING TO GAIN INSIGHT INTO THE ACCIDENT AIRPLANE'S PERFORMANCE AND MOVEMENT DURING THE ACCIDENT FLIGHT. IN MANY INSTANCES, THE STUDY IS CORRELATED TO DATA TO SUPPLEMENT OR REFINE THE ACCURACY OF FINDINGS. SEVERAL HIGH RESOLUTION PHOTOGRAPHS PROVIDED INFORMATION ABOUT THE IN-FLIGHT POSITIONS OF THE AIRPLANE'S CONTROL SURFACES AND ELEVATOR TRIM TABS, BOTH OF WHICH CHANGED POSITION DURING THE UPSET SEQUENCE. BASED ON THE VIDEO STUDY, THE LEFT ROLL UPSET BEGIN AT 16.24 IN 29 SECONDS PACIFIC DELIGHT TIME AND THIS - DAYLIGHT TIME. I WILL NOW PRESENT A SERIES OF PHOTOS THAT SHOW THE ACCIDENT SEQUENCE IN DETAIL. THESE HIGH RESOLUTION

PHOTOS ALLOWED US TO ZOOM INTO THE AREAS OF INTEREST AND DETERMINE THE CONTROL SURFACE POSITIONS THAT I WILL SUMMARIZE. THE NUMBER IN THE LOWER RIGHT PORTION OF THE PHOTO IS THE ELAPSED TIME IN SECONDS FROM TIME T, THE START OF THE LEFT ROLL UPSET. THE SEQUENCE BEGINS ONE QUARTER SECOND PRIOR TO THE START OF THE ROLL UPSET AS THE AIRPLANE IS ESTABLISHED IN A 73-DEGREE LEFT BANK TURN AND APPROACHING PYLON EIGHT. ALTHOUGH HARD TO SEE HERE, THE LEFT ELEVATOR TRIM TAB IS DEFLECTED TRAILING EDGE UP, CONSISTENT WITH ITS POSITION THROUGHOUT THE RACE. AND THE RIGHT ELEVATOR TRIM TAB IS FAIRED WITH THE ELEVATOR. THE RIGHT ELEVATOR TRIM TAB IS FIXED AND UNMOVABLE ON THIS AIRPLANE. THE LEFT ONE IS TRAILING EDGE DOWN. IN THIS PHOTO, THE AIRPLANE HAS JUST BEGUN THE LEFT ROLL UPSET, THE LEFT ELEVATOR TRIM TAB IS STILL TRAILING EDGE UP AND THE RIGHT ELEVATOR TRIM TAB IS STILL FARED. THESE OBSERVATIONS ARE IMPORTANT AS WE PROGRESS THROUGH THE PHOTOS. THE DATA IS TRAILING EDGE DOWN CONSISTENT WITH ITS POSITION IN THE PREVIOUS PHOTO AND THROUGHOUT THE RACE. IN THIS PHOTO, THE AIRPLANE IS IN THE MIDST OF THE LEFT ROLL UPSET. THE TRIM TABS ARE IN THE SAME POSITIONS AS THE PREVIOUS PHOTO BUT THE RIGHT WING DOWN DEFLECTIONS HAVE INCREASED COMPARED TO THE PREVIOUS PHOTO AS THE PILOT ATTEMPTS TO ARREST THE LEFT ROLL. IN THIS PHOTO, THE AIRPLANE HAS REACHED A LEFT ROLL OF ABOUT 90 DEGREES. IT IS DEFLECTED FURTHER RIGHT WING DOWN AND CALCULATIONS REVEAL THAT THE LEFT ELEVATOR TRIM TAB IS DEFLECTED AT LEAST 21 DEGREES TRAILING EDGE UP, EXCEEDING ITS DIVINE LIMIT OF ABOUT 13 DEGREES. AND GIVING THE FIRST VISIBLE INDICATION OF A DISCONTINUITY IN THE LEFT TRIM TAB CONTROL SYSTEM. IN THIS PHOTO, THE AIRPLANE IS SHOWN ABOUT .13 SECONDS PRIOR TO ITS MAXIMUM LEFT BANK ANGLE OF ABOUT 93 DEGREES THE LEFT TRIM TAB HAS MOVED AND IS SHOWN DEFLECTED LAST TRAILING EDGE UP THAN THE PREVIOUS PHOTO. AND THE RIGHT TRIM TAB IS STILL FARED WITH THE ELEVATOR. IN THIS PHOTO, ABOUT 1.3 SECONDS AFTER THE BEGINNING OF THE LEFT ROLL UPSET, THE AIRPLANE HAS ROLL TO THE RIGHT FROM ITS MAXIMUM LEFT BANK ANGLE. THE LEFT ELEVATOR TRIM TAB HAS AGAIN, CHANGED POSITION AND IS NOW FARED WITH THE ELEVATOR. THE RIGHT ELEVATOR TRIM TAB HAS MOVED TO A TRAILING DOWN POSITION. THIS IS THE FIRST

VISIBLE INVESTIGATION OF A DISCONTINUITY IN THE RIGHT TRIM TAB CONTROL SYSTEM. BOTH TRIM TABS CAN MOVE FREELY. THE VIDEO STUDY ALSO ESTABLISH THIS IS ABOUT THE TIME THAT THE AIRPLANE EXPERIENCED ITS GREATEST LOAD FACTOR OF ABOUT 17 G. THE INVESTIGATION DETERMINED THAT BOTH THE RATE OF G ONSET AND THE HIGH G LEVEL EXCEEDED HUMAN TOLERANCE. IN THIS PHOTO, THE AIRPLANE HAS ROLLED ALMOST WINGS LEVEL AND BEGUN CLIMBING. THE -- THEY ARE DEFLECTED AND BOTH ELEVATOR TRIM TAB CONTINUE TO MOVE. THE LEFT ELEVATOR TRIM TAB IS DEFLECTED TAILING EDGE DOWN AND THE RIGHT TRIM TAB IS DEFLECTED TRAILING WING UP. THE TAIL WHEEL IS FULLY EXTENDED. IN THIS PHOTO, TAKEN ABOUT 4.6 SECONDS AFTER THE BEGINNING OF THE ROLL UPSET, THE AIRPLANE HAS REACHED THE APEX OF ITS CLIMB. THE INBOARD SECTION OF THE LEFT ELEVATOR TRIM TAB HAS JUST SEPARATED FROM THE AIRPLANE. IN THE -- AND THE PILOT IS SLUMPED FORWARD AND TO THE RIGHT. THE AIRPLANE IMPACTED THE GROUND ABOUT 4.5 SECONDS AFTER THIS PHOTO WAS TAKEN. THE INVESTIGATIVE TEAM EXAMINED WRECKAGE, EXAMINED STOCK AND MODIFIED AIRPLANES AND REVIEWED DESIGN AND FLIGHT TEST DATA FOR THE PLANE. WE KNOW THERE WERE EXTENSIVE MODIFICATIONS OVER THE YEARS. I'M GOING TO DISCUSS THE MODIFICATIONS IN TWO PRIMARY AREAS, STURL MODIFICATION AND PLIGHT CONTROL MODIFICATIONS. HERE'S A VIEW OF THE GALLUPPING GHOST OVERLAID ON A -- AREAS OF RED SKATE KATES THE INDIVIDUAL. IT WAS THE REMOVAL OF THE LOWER AIR SCOOP AND THE INSTALLATION OF A RACING CANOPY AND ERR DYNAMIC TURTLE BACK. ADDITIONAL STRUCTURAL MODIFICATIONS INCLUDED A CHANGE IN THE HORIZONTAL STABLER -- STABILIZER INCIDENTS, INSTALLATION OF ENGINE MOWNS IN PLACE OF THE STOCK FLEXIBLE MOWNS. COLLECTIVELY, THESE MODIFICATIONS REDUCE THE TRASH AND GROSS WEIGHT OF THE AIRPLANE. FLIGHT CONTROL MODIFICATIONS TO THE AIRPLANE INCLUDED A REDUCED ELEVATOR INERTIA WEIGHT, INCREASED COUNTERWEIGHT TO ABOUT TWICE THE NORMAL WEIGHT AND AN INCREASED RUTTER COUNTER WEIGHT. THE RIGHT ELEVATOR TRIM TAB WAS FIXED IN PLACE AND FARED WITH THE RIGHT ELEVATOR. THE LEFT ELEVATOR TRIM TAB WAS ACK WAITED ELECTRICALLY. THE TRIM TABS WERE MODIFIED WITH AERODYNAMIC FILLER AND PAINT SUCH AS THEIR WEIGHT WAS INCREASED BY ABOUT ONE THIRD AND THEIR CENTER OF GRAVITY WAS MOVED OUT. THE INVESTIGATION

DETERMINED THAT THESE MODIFICATIONS WERE INTENDED TO IMPROVE THE HANDLING QUALITIES AND INCREASE THE SPEED OF THE AIRPLANE BUT SOME OF THEM INCREASED THE PITCH SENSITIVITY OF THE AIRPLANE. AND MADE THE PITCH TRIM SYSTEM MORE SUSCEPTIBLE TO ERR DYE DYNAMIC FLUTTER. THE OWNER INFORMED THE F.A.A. ABOUT THE INSTALLATION OF THE BOIL OFF COOLING SYSTEM ON THE AIRPLANE BUT NO RECORD OF ANY NOTIFICATION WAS FOUND TO SUGGEST THAT HE NOTIFIED THE F.A.A. ABOUT ALL OF THE OTHER MAJOR MODIFICATIONS TO THE AIRPLANE. THEY SUGGESTED THEY PERFORM THREE HOURS OF FLIGHT TESTING IN ORDER TO VALIDATE THE INSTALLATION OF THE BOIL-OFF SYSTEM. SEVERAL PARTS FROM THE ACCIDENT AIRPLANE WERE EXAMINED IN THE NTSB MATERIALS LAB. ALL OF THE HINGES FOR THE ELEVATOR TRIM TABS EXHIBITED DAMAGE CONSISTENT WITH RELATIVE MOTION BETWEEN THE HINGE HAVES. THE BLACK ARROWS POINT OUT AREAS OF MISSING PAIN ON ONE OF THE HINGES EXAMINED. THIS DAMAGE COULD ONLY BE GENERATED IF THE TRIM TAB ATTACHMENT SCREWS WERE LOOSE FOR A PERIOD OF TIME PRIOR TO THE ACCIDENT. THE TRIM TABS ON THE ACCIDENT AIRPLANE ARE EACH ATTACHED WITH THREE SCREWS AND LOCK NUTS. THE LEFT PHOTO SHOWS A NEW SURPLUS LOCK NUT OBTAINED FOR THE INVESTIGATION. THE RED FIBER MATERIAL IN THE CENTER IS DESIGNED TO PROVIDE A RESTRAINING TOMORROW MORNING ON THE CREW FEDS TO -- TORQUE ON THE CREW FEDS. THESE TYPES OF NUTS SHOULD NOT BE REUSED IF THEY CANNOT MEET THE MINIMUM TORQUE VALUE. ALL OF THE THAT. -- TASMMENT SCREWS WERE LOOSE WITH NEGLIGIBLE RESISTANCE FROM THEIR RESPECTABLE LOCK NUTS SUCH AS THE SCREWS CAN BE INSERTED AND REMOVED USING ONLY FINGERS. SEVERAL HAD EVIDENCE OF YELLOW PAINT BENEATH THE TOPCOAT OF PAINT AS SHOWN IN THE RIGHT PHOTO. THE INFORMATION AVAILABLE INDICATES THAT AIRPLANE WAS PAINTED YELLOW PRIOR TO THE 1985 AIR RACES WHICH IS THEY HAVE NOT BEEN REPLACED FOR AT LEAST 26 YEARS. THE LEFT AND RIGHT ELEVATOR TRIM TAB LINK ASSEMBLIES THAT CONNECT THE TRIM TAB ACK WAITER -- ACK WAITER ROD WERE RECOVERED AND EXAMINED IN THE LAB. BOTH LINK ASSEMBLIES HAD EVIDENCE OF OVERLOAD FAILURE AND BENDING. THE INTERNAL PORTIONS OF THE ELEVATORS HAD DAMAGE CONSISTENT WITH THE EXPRESSIVE FAILURE OF THE LINK SEMI-BLISS. -- ASSEMBLIES. THE FRACTURED LEFT

INBOARD TRIM TAB ATTACHMENT SCREW WAS ALSO EXAMINED IN THE NTSB LAB. THE SCREW HAD EVIDENCE OF FATIGUE FRACTURE OVER ABOUT 80% OF THE FRACTURE FACE AND THE REMAINING 20% HAD EVIDENCE OF OVERLOAD. THE CORROSION ON THE FATIGUE FRACTURE INDICATED THAT THE FRACTURE HAD BEEN PRESENT FOR A PERIOD OF TIME POSSIBLY YEARS BEFORE THE INCIDENT FLIGHT. -- ACCIDENT FLIGHT. IT IS CONSISTENT WITH THE SCREW BEING LOOSE. THIS SLIDE IN THE FOLLOWING -- AND THE FOLLOWING TWO WILL PRESENT INDICATIONS AVAILABLE TO THE PILOT AND CREW THAT THERE WERE PROBLEMS WITH THE AIRPLANE. THE INVESTIGATION WAS PROVIDED WITH SEVERAL FLIGHTS OF DATA THAT INCLUDED SIX FLIGHTS KNOWING THE ACCIDENT FLIGHT ON THE RENO RACECOURSE. THE DATA SHOWED THAT THE FLIGHT WAS THE FASTEST THE AIRPLANE HAD EVER FLOWN ON THE COURSE BY ABOUT 35 KNOTS. AND THE ENGINE POWER SETTINGS WERE THE HIGHEST EVER USED AND IT SHOWED THE CHANGE OF THE VIBRATION AND AN INCREASE IN THE MAXIMUM LOAD FACTOR EACH TIME THE AIRPLANE NEARED AND EXCEEDED 400 KNOTS. WHILE THE INCREASE IN THE MAXIMUM LOAD FACTOR IS EXPECTED DUE TO THE HIGHER SPEED, THE INCREASE WAS UNIQUE TO THIS AIRPLANE. ADDITIONALLY, ONE CREW MEMBER REPORTED THAT WORK WAS DONE TO TIGHTEN UP FREE PLAY IN THE AIRPLANE'S LOOSE TRIM TAB SCREWS PRIOR TO FLYING TO RENO FOR THE 2011 RACES. EVIDENCE INDICATES THAT THE SCREWS WERE LIKELY TIGHTENED OTHER TIMES SINCE THE ASSEMBLY OF THE AIRPLANE IN 2009. PHOTOGRAPHIC EVIDENCE FROM THE ACCIDENT RACE IN EARLIER FLIGHTS ON THE COURSE SHOW STRUCTURAL DEFAMATION IN THE FORM OF DIAGONAL WRINKLES ON THE FUSELAGE. THIS PHOTO SHOWS THE DEFAMATION DURING LAP TWO. THE MODIFIED TURTLE DECK AND REMOVAL OF THE AIR SCOOP INCREASED THE RIDGITY OF THE FUSELAGE BECAUSE THE STRUCTURE WAS NOT AS STRONG OR AS STIFF AS THE ORIGINAL. PHOTOGRAPHIC EVIDENCE ALSO SHOWED IN-FLIGHT DEFAMATION OF THE CANOPY THAT RESULTED IN A SEPARATION BETWEEN THE WINDSCREEN AND THE CANOPY AS SHOWN IN THIS PHOTO. ALL OF THESE FACTORS PROVIDE STRONG CLUES TO THE PILOT AND CREW THAT THE AIRPLANE WAS BEING OPERATED BEYOND ITS STRUCTURAL LIMITS AND SHOULD HAVE FORCED A MORE DETAILED EXAMINATION OF THE AIRPLANE. THE INVESTIGATION DETERMINED THAT THE AIRCRAFT'S HIGH SPEED AND LOOSE TRIM TAB

ATTACHMENT SCREWS LED TO FLUTTER OF THE LEFT ELEVATOR TRIM TAB. FLUTTER IS AN AEROELASTIC PHENOMENON THAT CAN OCCUR WHEN THE MODE OF STRUCTURAL VIBRATION COUPLES WITH THE AERODYNAMIC FORCES TO PRODUCE A ADMONITION, OSCILLATION OR VIBRATION. THE VIBRATION CAN BE SOMEWHAT STABLE IF THE NATURAL DAMPING OF THE STRUCTURE PREVENTS AN INCREASE IN THE FORCES OF MOTION OR THE MOTION CAN BECOME DYNAMIC UNSTABLE IF THE DAMPENING IS NOT ADEQUATE RESULTING IN SELF-EXCITED DESTRUCTIVE FORCES BEING APPLIED TO THE STRUCTURE. FLUTTER CAN RANGE FROM AN ANNOYING BUZZ OF A FLIGHT CONTROL TO A VIOLENT DESTRUCTIVE FAILURE OF THE STRUCTURE IN A VERY SHORT PERIOD OF TIME. AIRCRAFT SPEED AND STRUCTURAL STIFFNESS ARE TWO INPUTS THAT GOVERN FLUTTER AS SPEED INCREASES OR STRUCTURAL STIFFNESS DECREASES, THE SUSCEPTIBILITY TO FLUTTER WILL INCREASE. TO GIVE YOU A BETTER UNDERSTANDING OF WHAT FLUTTER LOOKS LIKE, WE HAVE THIS SHORT SLOW MOTION VIDEO TAKEN BY NASA DURING A FAILED FLIGHT TEST IN APRIL OF 1966. THE CONFIGURATION OF THE TAIL IS DIFFERENT FROM THE ACCIDENT AIRPLANE. TO THE MODE IS LIKELY DIFFERENT. BUT YOU WILL BE ABLE TO SEE THE UNSTABLE FLUTTER MOTION AND THE SHORT AMOUNT OF TIME THAT IT TAKES TO DEVELOP. THE TEST AIRPLANE SLOWED AND THE FLUTTER STOPPED BEFORE IT BECAME DESTRUCTIVE. THE INVESTIGATION DETERMINED THAT TO THE WORN LOCK NUTS ALLOWED THE LEFT ELEVATOR TRIM TAB SCREWS TO LOOSEN WHICH REDUCED THE STIFFNESS OF THE PITCH TRIM CONTROL SYSTEM ON THE AIRPLANE. AND AT THE HIGH RACE SPEEDS FLOWN DURING THE ACCIDENT RACE, EXCITED FLUTTER OF THE LEFT ELEVATOR TRIM TAB. EXCITATION OF THE FLUTTER RESULTED IN EXPRESSIVE LOADS LINK ASSEMBLY CAUSING THE FAILURE. THE LOSS OF THE LEFT TRIM TAB FUNCTIONALITY CAUSED AN INCREASE IN THE CONTROL STICK FORCE IN AN UNCOMMANDED PITCH-UP TO ABOUT 17 G THAT INCAPACITATED THE PILOT AND CAUSED THE AIRPLANE TO GO OUT OF CONTROL. THE FLUTTER AND FAILURE OF THE LEFT TAB LINK ASSEMBLY EXCITED THE FLUTTER OF THE RIGHT TAB, INCREASING THE DYNAMIC COMPREHENSIVE LOADS BEYOND ITS BUCKLING STRENGTH CAUSING A FAILURE. SUBSEQUENTLY, THE INBOARD LEFT TRIM TAB SEPARATE FLED AIRPLANE AND THE AIRPLANE IMPACT TO THE GROUND. THANK YOU. NOW MR. PLAGAN WILL TALK ABOUT THE SAFETY

INFORMATION.

>> STAFF IDENTIFIED SIX SAFETY ISSUES DURING THE INVESTIGATION. THE NTSB ISSUED 10 SAFETY RECOMMENDATIONS TO THE FEDERAL AVIATION ADMINISTRATION, THE NATIONAL AIR RACING GROUP UNLIMITED DIVISION AND THE RENO AIR RACING ASSOCIATION TO ADDRESS THESE ISSUES. RECOMMENDATION A-12-A ASKS THE F.A.A. TO CORRECT INCOMPLETE INFORMATION AND RECONCILE ALL DIFFERENCES AND INCONSISTENCIES BETWEEN THEIR TWO GUIDANCE DOCUMENT. F.A.A. ORDERED 91-45C. THE F.A.A. RESPONDED THAT IT AGREED WITH THE RECOMMENDATION. THEY ARE DRAFTING A REVISION TO THE F.A.A. ORDER THAT WILL CORRECT ANY INCRACKS OR OMISSIONS AND THE CIRCULAR WILL BE REVISED ACCORDINGLY. PENDING COMPLETION OF THESE ACTIONS, THE NTSB CLASSIFIED SAFETY RECOMMENDATIONS A-12-8 OPENED ACCEPTABLE RESPONSE ON JULY 25TH, 2012. IN RECOMMENDATIONS A-12-9 TO THE UNLIMITED DIVISION AND A-12-13 TO RARA, THE NTSB RECOMMENDED THAT THEY REQUIRE OWNERS OR PILOTS IN THE UNLIMITED CLASS TO PROVIDE A EVALUATION OR FLIGHT DEMONSTRATION WITHIN THE ANTICIPATED RACING FLIGHT ENVELOPE FOR AIRPLANES WITH ANY MAJOR MODIFICATIONS. THE UNLIMITED DIVISION RESPONDED IN A LETTER THAT THEY BELIEVED THIS RECOMMENDATION WOULD IMPROVE SAFETY AND CONCLUDED THAT THEY SHOULD REQUIRE AIRCRAFT OWNERS AND OPERATORS TO PROVIDE ENGINEERING DATA FOR ANY MAJOR CHANGE OR AT RAFLPLGTSE PENDING ANY RULES CHANGES, THEY WILL REQUEST ANY CHANGE DATA FOR THE AIRPLANES ENTERED IN THE 2012 RACES AND PROVIDE IT TO THEIR INSPECTION COMMITTEE FOR A REVIEW. RAH-RAH RESPONDED THEY WILL BE EMPHASIZING THIS AND ARE REVIEW THEIR PROCEDURES FOR IN THE FUTURE. THEY BOTH APPEAR TO BE A STEP IN THE RIGHT DIRECTION, MORE INFORMATION IS NEEDED FOR THEIR RECOMMENDATION'S INTENT. THEY NEED TO DEVELOP A SYSTEM THAT ATTRACTS ANY DISCREPANCIES AND VERIFIES THAT THEY HAVE BEEN RESOLVED. IN THE MOST RECENT COMMUNICATION FROM THE UNLIMITED DIVISION, THEY INFORMED US THEY HAVE CHANGED THEIR TECHNICAL INSPECTION FORM AND WILL BE USING IT FOR THE 2012 RACES. AIRPLANES WILL NOT BE ALLOW ON THE RACECOURSE AND SIGNED OFF BY THE TECHNICIAN COMMITTEE. RECOMMENDATION A-1312-11 TO THE UNLIMITED DIVISION AND

RECOMMENDATION A-12-16 TO RARA ASK THEM TO PROVIDE AWARENESS TRAINING TO PILOTS, INCLUDING TECHNIQUES TO MITIGATE EXPOSURE. AS PART OF PREPARATION FOR THE AIR RACES AND DURING DAILY BRIEFS AT THE RACES. RARA RESPONDED TO THE RECOMMENDATION AND STATED THAT THEY HAVE DEVELOPED A TRAINING PROGRAM AND BRIEFING THAT ALL PILOTS WILL BE REQUIRED TO ATTEND PRIOR TO PARTICIPATING IN THE 2012 RACES. IN THE LATEST LETTER FROM THE UNLIMITED DIVISION, THEY INFORMED US THAT ALL PILOTS WILL ATTEND THE RARA TRAINING AND THEY WILL ALSO DISCUSS G AWARENESS DURING CLASS BRIEFINGS.

RECOMMENDATION A-12-12 TO THE UNLIMITED EDITION AND ASKS THEM TO EVALUATE THE PILOTS TO WEAR G SUITS WHILE RACING. BOTH THE UNLIMITED CLASS AND RARA EVALUATED THE USE OF G SUITS. AND BELIEVE THAT G SUIT USE IS NOT FEASIBLE SINCE IT WILL NOT IMPROVE SAFETY TO THE PILOTS OR THE SPECTATORS. RARA CITED DISCUSSION THAT THEY HAD WITH THE MEDICAL INSTITUTE, NASA AND THE AIR FORCE. RECOMMENDATION A-12-14 ASKS RARA TO EVALUATE THE DESIGN OF THE LIMITED CLASS COURSE AND SAFETY AREA TO MINIMIZE MANEUVERING NEAR AND POTENTIAL CONFLICTS WITH SECRETARIATS AND IF WARRANTED BY THE RESULT, IMPLEMENT CHANGES TO THE RACECOURSE. RECOMMENDATION A-12-15 ASKS RARA TO RELOCATE A FUEL TRUCK AWAY FROM THE RAMP AREA AND TO INSTALL BARRIERS MORE SUBSTANTIAL THAN THOSE CURRENTLY IN PLACE IN FRONT OF ANY AREA WHERE THERE ARE SPECTATORS ARE PRESENT IN ORDER TO RAISE THE LEVEL OF SAFETY NEAR THE RACECOURSE. AS THEY DO ANNUALLY, RARA EVALUATED THE DESIGN OF THE COURSE AND FOR 2012, THEY ARE MOVING SEVERAL PYLONS ON THE RACECOURSE AND REPOSITIONING TWO RACECOURSE SHOW LINES. THE DIAGRAM SHOWS THE OLD COURSE IN BLUE AND THE NEW COURSE IN GREEN. THE WEST RACECOURSE SHOW LINE WAS MOVED EAST 500 FEET FROM THE GRAY LINE TO THE RED LINE TO PROVIDE A BUFFER BETWEEN THE RACE AIRPLANES AND SPECTATORS ON PRIVATE PROPERTY ADJACENT TO THE AIRPORT. THE SOUTH RACECOURSE SHOW LINE WAS REMOVED FROM THE SOUTH TO THE NORTH SIDE TO PROVIDE ADDITIONAL SEPARATION BETWEEN THE RACERS AND THE CROWD. WHILE THE 2012 RACES, RARA WILL ALSO MOVE THE FUEL TRUCK ABOUT ONE AND A HALF MILES AWAY FROM THE SPECTATOR AREA AND THEY WILL PLACE MORE SUBSTANTIAL

CONCRETE BARRIERS ALONG THE ENTIRE LENGTH OF TO SPECTATOR VIEWING AREA AND THE PIT. THIS CONCLUDES MY PRESENTATION. STAFF IS NOW OPEN FOR ANY QUESTIONS.

>> THANK YOU VERY MUCH. THIS WAS AN EXCELLENT PRESENTATION AND TO THE R.E. TEAM. THANK YOU SO MUCH FOR THE WORK THAT YOU DO. THOSE STUDIO STUDIES, LOOKING AT THE -- VIDEO STUDIES AND THE VIDEOS WERE HELPFUL TO OUR INVESTIGATION AND FOR YOU ALL TO CORRELATE DEMOSE DO THE ASSESSMENT THAT WAS NEEDED WERE ADVISE HELPFUL. I'M IN AWE OF THE PAINSTAKING WORK THAT YOU'VE DONE. BY EVALUATING THE PHOTOS, LOOKING FOR SUBTLE BUT POWERFUL CUES.

>> AND THINGS LIKE CONTROL DEFLECTION, CANOPY SEPARATION OF GAPS IN THE CANOPY AND I THINK YOUR FORENSIC ANALYSIS OF THIS ACCIDENT WAS EXCEPTIONAL AND I WANT TO CONGRATULATE AND THANK THE NTSB STAFF FOR THAT EXCEPTIONAL WORK. I SUSPECT AND MR. BABCOCK, PERHAPS YOU CAN ANSWER THIS, PERHAPS MR. PLAYGAN CAN, BUT I SUSPECT THIS ACTION WAS THE MOST HEAVILY PHOTOGRAPHED ACCIDENT OF ANY THAT WE'VE SEEN YET AND TO GIVE US AN IDEA OF THE MAGNITUDE OF THESE PHOTOGRAPHS AND VIDEO EVIDENCE, HOW MANY PHOTOGRAPHS -- HOW MANY FRAMES OF PHOTOGRAPHS DID YOU GO THROUGH OF VIDEO AND GIVE US SOME IDEA OF THAT.

>> THANKS TO THE MANY PHOTOGRAPHERS AND VIDEOGRAPHERS THAT ARE OUT ON THE COURSE. WE EXAMINED HUNDREDS OF PHOTOGRAPHS AND PROBABLY ABOUT A DOZEN OR SO VIDEOS THAT SHOW THE ACCIDENT IMPACT SEQUENCE.

>> THANK YOU. I'LL HAVE TO ADMIT, I'VE LOOKED AT MANY OF THOSE PHOTOGRAPHS AND I CAN'T SEE THOSE THINGS THAT YOU WERE ABLE TO SEE. SO I KNOW IT TOOK A LOT OF PAINSTAKING EFFORT AND PROBABLY HURTING EYEBALLS AS A RESULT OF LOOKING AT ALL OF THAT. SO TO BE CLEAR, THE PILOT OF THE AIRCRAFT WAS ALSO THE OWNER OF THE AIRCRAFT. IS THAT TRUE?

>> THAT'S CORRECT.

>> FROM A REGULATORY PERSPECTIVE , THE OWNER OF THE AIRCRAFT HAS THE RESPONSIBILITY TO MAINTAIN IT IN AN AIR WORTHY CONDITION. SO WAS THIS AIRCRAFT AIR-WORTHY WHEN IT DEPARTED FOR THE ACCIDENT FLIGHT?

>> BASED ON THE INJURIES AND THE LOGBOOK, IT DID HAVE A CONDITION INSPECTION IN JULY OF 2011 SO PRETTY F.A.A. RULES, IT WAS SIGNED OFF AS BEING AIR WORTHY.

>> WE KNOW THAT AIR WORTHINESS IS SOMETHING THAT IS DETERMINE ON A FLIGHT BY FLIGHT BASIS. JUST BECAUSE YOU HAD AN ANNUAL INSPECTION OR SOMETHING ELSE, DOESN'T MEAN THAT IT'S AIR WORTHY FOR THAT PARTICULAR FLIGHT. BUT I WOULD QUESTION AS TO WHETHER OR NOT THE AIRCRAFT WAS ACTUALLY AIR WORTHY FOR THAT FLIGHT. THERE WERE SCREWS THAT COULD BE HAND TIGHTENED, I BELIEVE YOU SAID. IS THAT CORRECT?

>> WHEN WE EXAMINED THOSE IN THE LAB, YES, YOU CAN RUN THE SCREWS IN AND OUT OF THE LOCK NUTS USING ONLY FINGERS.

>> COULD THAT LOOSENESS OCCUR BECAUSE OF THE IMPACT FORCES OR DO YOU FEEL LIKE THAT DAMAGE THAT WAS DONE TO THE LOCK NUTS OVER THE YEARS WOULD HAVE ALLOWED -- IN FACT YOU MENTIONED IN YOUR PRESENTATION THAT WAS IT THE RACING CREW MENTIONED THEY HAD TO KEEP TIGHTENING THOSE THINGS UP?

>> THEY DID TIGHTEN IT PRIOR TO THE FLYING AND THEY WORKED ON ONE OF THE TRIM TABS WHILE AT RENO DURING 2011. AND THE DAMAGE ON THE LOCK NUTS WAS CONSISTENT WITH THEM BEING EXTENSIVELY WORN FOR A PERIOD OF YEARS.

>> THANK YOU.

>> YOU POINT OUT THERE WAR NUMBER OF MODIFICATIONS THAT ACTUALLY HAD A VERSE CONSEQUENCES. THERE WERE MODIFICATIONS THAT WERE CONDUCTED WITHOUT RISK ASSESSMENTS, WITHOUT FLIGHT TESTING, WITHOUT ENGINEERING

EVALUATIONS, WITHOUT WAIT AND BALANCE DETERMINATIONS. AND THE WAY I LOOK AT IT IS IF YOU'RE FLYING -- IF YOU'RE MODIFYING AN AIRPLANE WITHOUT FULLY UNDERSTANDING HOW THIS MODIFICATIONS CAN AFFECT THE AERODIE DAMICS, YOU'RE PLAYING RUSSIAN ROULETTE WITH AN AIRCRAFT. AND IF YOU WANT TO GO OUT AND FLY AND FLY PAST AND TRY TO WIN, THAT'S ONE THING, BUT AS THE CHAIRMAN SAID, UNLIKE RUSSIAN ROUX LET, IN THIS CASE, WHEN YOU GO OUT AND YOU DO THOSE THINGS, YOU NOT ONLY ENDANGER DANGER YOUR OWN LIFE, BUT YOU POTENTIALLY ENDANGER THE LIVES OF OTHERS AND THAT IS WHAT HAPPENED IN THIS PARTICULAR CASE. I DO HAVE MORE QUESTIONS BUT I'M RUNNING OUT OF TIME. I WILL WAIT TILL THE NEXT TIME.

>> THANK YOU.

>> I LIKE TO BEGIN BY MAKING THE SAME COMMENTS THAT DETERMINE THAT THE MEMBER HAVE MADE. WITH REGARD TO A VERY IMPRESSIVE INVESTIGATION, IT'S ASTOUNDING THAT THE CLEAR STORY THAT HAS COME OUT HERE WAS DEVELOPED FROM ALL OF THE PIECES OF INFORMATION, PHOTOGRAPHS AND PIECES OF STRUCTURE. I'D LIKE TO HAVE A LITTLE DISCUSSION HERE ABOUT FLUTTER. I APPRECIATE THE VIDEO OF THE TWIN COMMAND CHI FLUTTER. BECAUSE FLUTTER IS A FAIRLY DIFFICULT PHENOMENON TO DESCRIBE.

>> WHEN THE CONTROL SURFACES ARE CHANGED IN TERMS OF THEIR WEIGHT AND CENTER OF GRAVITY, WHY DOES THAT BECOME IMPORTANT?

>> AS YOU INCREASE THE WEIGHT AND MOVE THE C.G. AFTER THE UNBALANCED CONTROL SURFACE SUCH AS A TRIM TAB, YOU WILL INCREASE ITS SUSCEPTN'T TO FLUTTER.

>> AND SUSPECTIBILITY AS WELL AS THE MAGNITUDE OF THE MOTION

>> YES.

>> BECAUSE THE MAGNITUDE OF THE MOTION IS IMPORTANT BECAUSE IT CAUSED THE CONTROL LINK TO BUCKLE. CORRECT?

>> YES. FLUTTER IS A DYNAMIC EVENT. SO IT'S AN UNSTABLE EVENT WHERE THE MOTIONS WILL INCREASE OVER TIME.

>> NOW, ALONG THAT SAME LINE, WE TALKED ABOUT THE PITCH SENSITIVITY. THE AIRPLANE WAS TRIMMED NOSE DOWN FOR NORMAL FLIGHT, THAT'S CORRECT? -- THAT'S CORRECT?

>> YES. IT WAS TRIMMED NOSE-DOWN.

>> WHY WOULD HE BEEN FLYING A TRIM NOSE DOWN?

>> IN ORDER TO MAKE THE CONTROL STICK FORCES COMFORTABLE FOR HIM TO RACE.

>> OK. SO THE REPORT TALKS ABOUT ELEVATOR COUNTERWEIGHTS. WHY IS AN ELEVATOR COUNTERWEIGHT IMPORTANT?

>> GENERALLY, YOU START TO BALANCE THE COUNTERWEIGHTS SO YOU GET THE APPROPRIATE STICK FORCES IN THE COCKPIT.

>> BUT COUNTERWEIGHTS ARE BASICALLY A DYNAMIC PHENOMENON, RIGHT?

>> THEY HAVE AFFECTED DYNAMIC OFFENSE THE PITCH TRIM SYSTEM.

>> THEY CAN. THE COUNTERWEIGHTS ON THIS AIRPLANE ARE INSTALLED FORWARD OF THE HINGE LINE SO THEY BALANCE THE WEIGHT AFTER THE HINGE LINE. NORMALLY, THEY'RE NEUTRALLY BALANCED FOR THIS AIRPLANE, THEY WERE SIGNIFICANTLY OVERBALANCED.

>> WHICH WOULD HAVE WHAT EFFECT?

>> IT WOULD TEND TO MAKE THE ELEVATOR WANT TO GO TRAILING EDGE UP.

>> WHICH THEN WOULD RESULT IN A VERY SENSITIVE TRIM SYSTEM IN

THE PITCH.

>> VERY SENSITIVE ELEVATOR SYSTEM IN THE PITCH, IS THAT CORRECT?

>> YES. IT INCREASED THE PITCH SENSITIVITY OF THIS AIRPLANE.

>> A DIFFERENT QUESTION WITH REGARD TO THE AIRPLANE HAD A TELEMETRY SYSTEM. SO YOU HAD THE BENEFIT OF HAVING SOME INFORMATION ABOUT POWER SETTINGS, R.P.M.'S AND SO FORTH. THE AIRPLANE HAD A CONSTANT SPEED PROPELLER, DID IT NOT?

>> THARK.

>> BUT DURING THE PITCH UP, THE THESE VARIED CONSIDERABLY. THE PROPELLER SPEED WAS DOWN TO AS LOW AS 600 R.P.M. WHAT WAS THE REASON BEHIND THAT?

>> DURING DURING THE UPSET SEQUENCE, THE ENGINE PARAMETERS ALL WAR LITTLE BIT ABNORMAL AND THAT'S DUE TO THE G LOADS PLACED ON THE AIRFRAME AND THE AIR LOAD AS WELL.

>> SO THE CONSTITUTE SPEED PROPELLER THEN CAUSE THE -- I MEAN, DID NOT GOVERN THE SPEED, IS THAT A PROPER UNDERSTANDING?

>> IT COULD BE. SOME OF THAT MAY BE INCORRECT TELEMETRY DATA AS WELL. SOME OF IT WAS SUSPECT.

>> COULD BE THE TELEMETRY DATA WAS NOT ACTUALLY REFLECTIVE OF THE R.P.M.?

>> IT COULD BE, YES.

>> THE TRAJECTORY OF THE AIRPLANE WAS RE-CREATED BASED ON THE VIDEOS AND THE PHOTOGRAPHS. HOW WAS THAT DONE?

>> THE VIDEO STUDY RE-CREATED FOUR SECONDS RIGHT NEAR THE UPSET AND WE TOOK EACH FRAME OF THE VIDEO AND WE PLACED A

WIRE FRAME MODEL OF A P-51 AND MATCHED IT TO THE VIDEO FRAME. WE TOOK EACH OF THE WIRE FRAME MODELS OVER TIME AND YOU WERE ABLE TO BACK OUT THE MOTIONS OF THE AIRPLANE.

>> THE WIRE FRAME TRAJECTORY WITH THE ACTUAL --

>> DAN CAN TELL YOU SOME OF THE DETAILS ABOUT THAT.

>> IT WAS A PROCESS IN WHICH THE MODEL OF THE AIRPLANE, THE FRAME IN THE VIDEO, WHICH ALLOWS US TO GET THE ORIENTATION OF THE PLANE --

>> CAN YOU MAYBE GET A LITTLE BIT CLOSER OR PERHAPS SWITCH SEATS WITH MR. MARCUS? THANKS.

>> IT WAS A PROCESS WHERE FIRST, THE MODEL OF THE PLANE IS 3-D MODEL OF THE PLANE. THE FRAME FROM THE VIDEO, WHICH ALLOWS US TO GET ORIENTATION OF THE PLANE IN A SYSTEM ACCORDING WITH -- STICKS TO THE CAMERA. HOWEVER, THE CAMERA WAS MOVING BECAUSE THE PHOTOGRAPHER WAS KEEPING THE PLANE IN THE MIDDLE OF ITS FRAME AND WE DID NOT KNOW WHAT WAS THE MOTION OF THE CAMERA. AT THE ELEVATION AND IT WAS UNKNOWN SO WE INITIALLY ASSUME THE PLANE WAS FLYING NORMALLY ALONG THE COURSE AND TAKING THE ORIENTATION FROM THE PROCESS OF ALIGNING THE WIRE FRAME MODEL, BECAUSE THE OTHER ANGLE OF THE PLANE IN A MOVING SYSTEM, ONCE WE ASSUME THAT THE PLANE WAS FLYING NORMALLY, WE WERE ABLE TO TRANSFORM THOSE ORIENTATIONS TO A SIX SYSTEM COORDINATES. HOWEVER, THE FIRST ONE WAS NOT CORRECT BECAUSE WHEN WE TOOK -- WHEN THE -- IT DIDN'T MATCH THE ORIENTATION IN THE MOVING FRAME OF COORDINATES TO THE CAMERA. SO WE PASSED SEVERAL TIMES AND EACH TIME, WE WERE CORRECTING THE TRAJECTORY. LUCKILY, IT WAS VERY STABLE MATHEMATICALLY AND AFTER ABOUT FIVE CYCLES WHICH INVOLVED IMAGES IT CONVERGED PERFECTLY AND WE HAVE THE PERFECT ALIGNMENT. AND THIS IS HOW WE KNEW EXACTLY HOW THE PLANE WAS FLYING.

>> THANK YOU. THAT WAS A VERY COMPLEX THING TO DESCRIBE. I

APPRECIATE THAT.

>> YEAH. IT WAS A TIME-CONSUMING PROCESS.

>> WHICH IS WHY I'LL MAKE IT THREE IN A ROW WHICH ACKNOWLEDGE WHAT BEAUTIFUL WORK WAS DONE IN THIS INVESTIGATION. ONE OF THE INITIAL PRESS BRIEFINGS, ONE OF THE QUESTION WAS THERE WERE SO MANY PHOTOS AND VIDEOS WILL THAT HELP IN THE INVESTIGATION IN SOME WAY? CAN YOU MAKE A COMMENT? IF YOU DIDN'T HAVE THAT DATA, WHAT DIFFERENCE THAT WOULD HAVE MADE?

>> THE PHOTOS AND THE VIDEO INFORMATION REALLY PROVIDED A LOT OF INFORMATION TO THIS INVESTIGATION. IF WE DIDN'T HAVE THEM, WE MAY NOT HAVE BEEN ABLE TO GET TO WHERE WE ARE TODAY.

>> AND I THINK JUST TO BE EXPLICIT, WHEN YOU TALK ABOUT A LOT OF INFORMATION, THE ANALYSIS THAT WAS JUST DESCRIBED ALLOWED YOU TO LITERALLY TALK ABOUT DEGREE DIFFERENCES IN DEFLECTION IN SOME OF THESE THINGS AT DIFFERENT MOMENTS. THAT'S THE LEVEL OF SPECIFICITY YOU GOT TO. ALSO THERE'S BEEN TALK ABOUT TUOLUMNITY. CAN YOU BE MORE EXPLICIT? MY RECOLLECTION WAS THERE WAS RECORDING DEVICE ON THE AIRPLANE BUT THERE WERE SIGNALS BEING SENT TO GROUND CREW. JUST FILL THAT IN FOR JUST A MOMENT AND WHAT WAS AVAILABLE. YOU HAVE THE VIDEOS, THE PHOTOS. TELL US WHAT THE TELEMETRY DATA THAT WAS AVAILABLE.

>> THE TELEMETRY SYSTEM WAS INSTALLED SO THE CREW CAN WATCH IT AND IT RECORDS A COUPLE OF OTHER USEFUL PROGRAMS FOR THE FOR US. -- FRESHMAN TERSE FOR US. AND -- PARAMETERS FOR US. AND THERE'S A MEMORY CARD WITHIN THE BOX. WE TRY TO RECOVER THE DATA FROM THAT. THERE WERE SOME BLANKS BUT WE WERE ABLE TO USE IT FOR THE INVESTIGATION.

>> AND WE'LL TALK A MOMENT ABOUT THE G-LOCK, THE G FORCES AND ANALYSIS OF THAT.

>> THE TUOLUMNITY ACCELERATION WAS CRITICAL. IT WAS MORE THE VIDEO OF THE ACCELERATION TO DERIVE FROM THE VIDEO STUDY

THAT GAVE US THE TRUE ACCELERATION.

>> CAN YOU MAKE A COMMENT SHIFTING A BIT TO THE LOOSE SCREWS LOCK NUTS. YOU DID THE MATH THING WHERE THE YELLOW PAINT IS 26 YEARS. DO WE HAVE ANY TIME SENSE OF THE TIME COURSE? YOU DID TALK ABOUT THE RETIGHTENED THE SCENE ON A FREQUENT BASIS. FOR THE LOOSENESS THERE, ARE WE LITERALLY TALKING 26 YEARS OR CAN YOU TALK A LITTLE BIT BETTER TIME COURSE TO WHERE THOSE LOOSE NUTS MAY PLAY A MORE SIGNIFICANT ROLE HERE?

>> THE YELLOW PAINT INDICATES THAT SOME OF THE HARDWARE AND CREWS WERE NOT REPLACED FOR AT LEAST 26 YEARS. THERE WERE ABOUT 220 YEARS WHERE THE AIRPLANE DIDN'T FLY. IT FLEW ABOUT 1989 AND IT DIDN'T FLY AGAIN AFTER THE REBUILD AS THE GALLUPPING GHOST. BUT THE DAMAGE WE'RE SEEING HAD BEEN THERE FOR YEARS.

>> YOU IDENTIFIED IS THERE SOME WAY THAT THAT COULD HAVE BEEN FOUND ON THE GROUND JUST WITH THE NUMBER OF TIMES IT WAS TIGHTENED?

>> IT COULD HAVE BEEN FOUND ON THE GROUND, YES. THE TORQUE THAT YOU'RE SPEAKING OF WERE F.A.A. GUIDANCE. AND WITH THE TRIM TABS INSTALLED ON THE AIRPLANE, IT MIGHT HAVE BEEN DIFFICULT TO DETERMINE THE LOCK NUTS WERE LOOSE BUT ONCE YOU LOOK AT THE HINGES, IT'S VERY EASY TO DETERMINE THAT.

>> SO I REALLY ENJOYED YOUR SLIDES BECAUSE THEY WERE THE FIRST TIME WHERE I SAW THE MODIFICATION LISTED. AND STRUCTURALLY, I SAW FOUR AND IN A FLIGHT CONTROL, SIX. SO IT'S 10 MINIMUM SIGNIFICANT MODIFICATIONS THAT WERE IDENTIFIED. DID THE PILOT HAVE ANY EXPERIENCE FLYING THE AIRCRAFT WITH ALL 10 OF THOSE MODIFICATIONS OR WAS THIS FLIGHT BASICALLY IN THIS RACE, THE FIRST TIME HE HAD EXPERIENCED WITH ALL OF THOSE AT ONE TIME?

>> THIS WAS NOT THE FIRST FLIGHT HE HAD FLOWN THE AIRPLANE IN THIS CONFIGURATION. THIS CONFIGURATION WAS COMPLETED IN 2009. HE ATTEMPTED TO MAKE THE RACES IN 2009 BUT DIDN'T GET THE

AIRPLANE FINISHED. SO HE DID RACE AT THE RACES IN 2010 AND THEN HERE IN 2011. WE HAVE SEVEN FLIGHTS OF DATA WHERE HE WAS ON THE COURSE AT RENO. WE ALSO HAVE SEVERAL OTHER FLIGHT WHERE HE FLEW AROUND WHERE THE AIRPLANE WAS BASED.

>> SO IS THERE ANY COMMENTS YOU CAN MAKE ABOUT WAS IT SOMETHING ABOUT THE SPEED OR ASPECTS OF THIS COURSE WHERE WE SAW THESE THINGS EMERGE AS OPPOSED TO THE OTHER EXPERIENCES WITH THE MODIFICATION?

>> WE SAW THE DISTINCT CHANGE BE THE VIBRATION OF THE AMPLITUDE AS HE NEAR AND EXCEEDED 400 KNOTS IN THE RENO RACECOURSE. YES. IT WAS A SPEED THING.

>> THANK YOU. I WOULD LIKE TO ADD -- THANK THE MEMBERS OF THE PUBLIC WHO PROVIDED THAT INFORMATION VOLUNTARILY. THAT WAS AMAZING. WITHOUT THAT, WE COULD NOT HAVE DONE WHAT WE DID. THANK YOU FROM THE FLIERS OF THE WORLD AND THE PUBLIC WHO WATCHES THE FLIERS OF THE WORLD. THANKS TO PEOPLE WHO PROVIDED THAT EXCELLENT FILM FOOTAGE TO HELP THIS HAPPEN. TWO AREAS OF QUESTIONS I HAVE. ONE IS ON THE DIAGONAL WRINKLES ON THE FUSELAGE. I'M CURIOUS ABOUT WHAT YOU KNOW ABOUT THAT. WAS THAT BECAUSE OF OVERSTRESS BY THE VERTICAL FIN THAT WAS A LATERAL OVERSTRESS OR OVERTRESS BY THE HORIZONTAL STABLE STABILIZER OR A VIBRATORY -- WHAT DO YOU KNOW ABOUT THE WRINKLES ON THE SIDE OF THE FUSELAGE?

>> I THINK --

>> BOTH OR NEITHER?

>> IT'S A COMBINATION OF BOTH. THOSE TYPES OF WRINKLES, NOW SOME STRUCTURES ARE DESIGNED SO THAT YOU GET THOSE TYPES OF WRINKLES. ON THIS AIRPLANE, IT IS A SHEER RESISTANT AIRPLANE SO THE LOADS THAT BEING APPLIED ARE CAUSING THE FUSELAGE TO DEFORM IN SUCH A WAY THAT IT BUCKLES THE SKIN. THE REASON THAT WE BELIEVE THEY WERE ON THIS AIRPLANE AND NOT THE OTHERS IS THE CHANGE IN THE STRUCTURE AFTER THE CANOPY SO THE UPPER

TURTLE DECK STRUCTURE AND THE REMOVAL OF THE LOWER AIR SCOOP THAT DECREASED THE STRUCTURAL STIFFNESS OF THE FUSELAGE.

>> OK. MY NEXT QUESTION RELATES TO THE WHOLE -- THE LENGTH ASSOCIATED WITH THE TRIM TAB. I'M TRYING TO USE -- USUALLY, I'M THINKING OF A TAB WITH A TONGUE THAT STICKS UP AND A LINK THAT COMES TO THE HOLE AND THAT LINK IS EXTERNAL FOR AT LEAST A WHILE COMES OUT OF THE ELEVATOR AND IS EXTERNAL FOR A WHILE. WOULD YOU GIVE ME SOME SENSE OF THE GEOMETRY OF THE TRIM TAB LANGE CHALLENGE?

>> IT'S EXACTLY AS YOU ARE THINKING OF IT. THERE'S JUST THE OTHER END OF THE LINK ELEVATOR ATTACHES TO THE CONTROL HORN AND IT GETS ALL THE MECHANISM INSIDE THE HORIZONTAL STABILIZER AND GOES THROUGH THE ELEVATOR.

>> THE LOOSE SCREWS WERE WHERE THE LINKS GOES INTO THE CONTROL HORN?

>> NO. THE LOOSE CREWS THAT WE'RE TALKING ABOUT ARE THE THREE CREWS THAT ATTACH THE TRIM TAB TO THE ELEVATOR.

>> OH. OK. SO WHAT WHEN IT FAILED, WHAT ACTUALLY BROKE? DID THE LINK BREAK? DID THE HINGE SCREWS BREAK IF WHAT ACTUALLY BROKE WHEN IT FAILED? WHEN IT SEPARATED FROM THE AIRPLANE. ARE THE INITIAL FAILURE WAS A FAILURE OF EXPRESSED -- COME PRESSED BUCKLING. WHEN THE INBOARD SEPARATED, THAT WAS A SCREW FAILURE. AND THAT'S THE ONE THAT HAD A PORTION THAT WAS CRACKED.

>> WHEN THE LINK FAILED, YOU'RE SAYING IT BUCKLED? THE LINK THAT GOES TO THE CONTROL HORN BUCKED? WAS THERE A SEPARATION AT THAT POINT IN TIME OR COULD YOU TELL THAT?

>> YEAH. THE TRIM TAB BASICALLY BECAME UNSUPPORTED AND UNCONTROLLED. THE ONLY WAY THAT THAT LINK ASSEMBLY COULD BE BROKEN IS TO THE DYNAMIC LOADS PRODUCED THROUGH FLUTTER.

>> SO YOU'RE SAYING THE LINK NOT ONLY BUCKLED BUT ACTUALLY FAILED -- THE LINK ITSELF FAILED.

>> YES.

>> I SEE. AND THEN ONCE IT BUCKLED, THERE WAS NOTHING HOLDING THE LEFT SIDE TRIM TAB IN PLACE?

>> ONCE IT FRACTURED, YEAH. IT COULD NOT HOLD THE LEFT TRIM TAB IN PLACE AND SO THE FLUTTER GOT EVEN MORE DIVERGENT AND EXCITED.

>> SO THAT WAS MY NEXT QUESTION. WHAT FAILED ON THE RIGHT SIDE? IT WAS ACTUALLY DIDN'T STILL HAD THE LINK ON IT BUT IT WAS SECURED IN PLACE SO THE LINK DID NOT MOVE?

>> YEAH. IT WAS SECURED IN PLACE. SO YOU STILL HAD THE SAME LINK ASSEMBLY, THEY FASTENED IT TO THE STABILIZER REAR SPAR. SO THEY COULD NOT MOVE. BUT THAT LINK ASSEMBLY WHEN IT -- WHEN THE LEFT TRIM TAB ASSEMBLY FAILED AND THE FLUTTER, IT EXCITED THE FLUTTER OF THE RIGHT TRIM TAB THAT FAILED THAT LINK ASSEMBLY.

>> SO THAT LINK ALSO BROKE?

>> YES. IT BUCKLED AND BROKE.

>> OK. ALL RIGHT. THANK YOU VERY MUCH.

>> IS THE INCREASE IN THE VIBRATION AMPLITUDE AT 400 KNOTS NORMAL FOR A P-51 OR WAS IT UNIQUE TO THE GALLOPING GHOST?

>> IT WAS UNIQUE TO THE GALLOPING GHOST. WE DID RECEIVE DATA FROM ANOTHER P-51 SIMILAR TO THE GHOST AND IT DIDN'T SHOW ANY KIND OF THIS PHENOMENON THAT WE'VE SEEN IN THE GHOST.

>> CAN YOU EXPLAIN WHY THE PILOT REDUCED THE THROTTLE OR APPEARED TO -- THE THROTTLE APPEARED TO BE REDUCED EIGHT

SECOND PART OF UPSET OCCURRING?

>> WE DON'T REALLY KNOW WHY HE REDUCED THE THROTTLE ABOUT EIGHT SECOND PRIOR TO THE UPSET. THERE WAS AN OSCILLATION IN THE POWER SETTINGS -- POWER SETTINGS PRIOR TO THAT. IT COULD BE HE FELT SOMETHING. WE JUST DON'T KNOW.

>> DO WE SEE ANY OTHER INSTRUCTIONS -- REDUCTIONS IN THE THROTTLE THROUGHOUT THE COURSE?

>> WE SEE AN OSCILLATION OF THE POWER ALMOST THROUGHOUT THE RACE WHEN HE'S UP AT THE HIGHER SPEEDS. YES, HE HAD JUST PASSED AN AIRPLANE ON THE COURSE. HE MAY BE PASSED NOW.

>> THE KEY HAVE TO RETRIM INFLIGHT?

>> THE INDICATIONS ARE WITH THE LEFT TRIMTAB BEEN ACTUATED, ONLY THE LEFT MADE THAT TRIMTAB CREEP, PROVIDING MORE NOSE DOWN TRIM.

>> HOW WOULD HE RETRIM THE AIRPLANE? BUT THERE REQUIRED?

>> HE WOULD HAVE TO TAKE HIS HAND AND TRIGGER THE CONTROL SWITCH ON THE LEFT-HAND SIDE OF THE COCKPIT.

>> IF YOU COULD BRING NOT FOLLOW UP ON THE LEFT-HAND SIDE OF THE SCREEN, THAT WOULD BE GREAT -- BRING THAT PHOTO OP ON THE LEFT- HAND SIDE OF THE SCREEN, THAT WOULD BE GREAT. I CANNOT IMAGINE WHAT IT IS LIKE IN THE COCKPIT ENVIRONMENT AT 100 M.P.H.. CAN YOU TELL ME HOW HE MIGHT HAVE RECOGNIZED SOMETHING WAS GOING ON HERE?

>> THE NOISE IN THE COCKPIT AND THE AIR RUSHING INTO THE COCKPIT. EVERYONE WE SHOW THIS TO CAN UNDERSTAND WHY THERE WAS NOT A RESPONSE. IT IS NOT NORMAL ON THIS AIRPLANE. IT IS SITTING ON THE GROUND AND THERE IS NO SEPARATION.

>> AND YOU BELIEVE THIS IS CONSISTENT WITH THE OTHER TYPES OF

THINGS WE'RE SEEING, THAT IT IS OVER-STRESSED?

>> YES.

>> HOW OFTEN DO YOU THINK THEY WOULD REPLACE PARTS IN OUR RACING ENVIRONMENT?

>> DO NOT KNOW.

>> DO NOT HAVE A CLUE?

>> I HAVE NO IDEA. IT DEPENDS ON CONDITIONS. ONCE THEY FEEL THAT THEY ARE WORN, THEY SHOULD BE REPLACED. THESE HAD NOT BEEN REPLACED FOR QUITE A LONG TIME.

>> WOULD YOU SAY THIS WAS AN IMPORTANT PART OF THE AIRCRAFT?

>> I THINK EVERYTHING IS AN IMPORTANT PART OF THE AIRCRAFT THAT SHOULD BE CHECKED.

>> DID THEY DO ANY KIND OF OVERALL OR COMPLETE CHECK OF THE AIRCRAFT?

>> PRIOR TO ITS ASSEMBLY IN 2009, EVERYTHING WAS REMOVED. ALL THE PARTS WERE REMOVED. THEY WERE REPAINTED AND OVERHAULED.

>> AND THAT WOULD HAVE BEEN A PERFECT TIME TO REEXAMINE ALL OF THIS EQUIPMENT, CORRECT?

>> YES, WE KNOW THE TRIMTABS WERE REMOVED FROM THE AIRCRAFT AT THAT TIME.

>> IS THERE ANY REASON WHY THEY WOULD NOT HAVE REPLACED THESE PARTS, GIVEN HOW OLD THEY WERE? AND WHERE -- IT WAS NOT FLOWN VERY MUCH AFTER 2009. HANDFUL OF FLIGHTS, CORRECT?

>> I THINK THERE WAS ABOUT 25 HOURS OF TIME SINCE THE AIRPLANE

WAS REBUILT.

>> THANK YOU VERY MUCH.

>> THANK YOU.

>> WE ARE ALL PRAISING THE PHOTOGRAPHIC EVIDENCE. I DO NOT WANT TO DIMINISH THE ROLE OF THE STOCKS IN THIS INVESTIGATION. YOUR GROUP WAS MEETING AND BACK THERE THIS MORNING. IT WAS AMAZING TO WATCH YOU ALL WORK. TALKING ABOUT THE PHYSICAL EVIDENCE. THE ELEVATOR, THE ELEVATOR TRIMTAB, IT WAS SHEARED AS IF YOU TAKE A ROD AND GO LIKE THAT. IT WILL SHEAR. ANYTHING LIKE THAT HE WOULD LIKE TO TALK ABOUT? THERE WAS A LOT OF PHOTOGRAPHIC EVIDENCE. THERE WAS ALSO A LOT OF INFORMATION THAT WE TYPICALLY USE WHEN WE DO NOT HAVE THIS MUCH PHOTOGRAPHIC EVIDENCE.

>> YES, WE WERE ABLE TO LOOK AT THAT INFORMATION. WE WERE ABLE TO LOOK AT THE CONTROL ROD AND SEE THAT IT DID BUCKLE AND BREAK. AS THE ROD WAS BREAKING, IT PUSHED INTO THE UPPER AND LOWER SKIN OF THE ELEVATOR.

>> SO THE NTSB WOULD HAVE BEEN ABLE TO DETERMINE THAT PART FAILED IN FLIGHT. WE MAY NOT HAVE BEEN ABLE TO DETERMINE IF THE G LOAD. EVERYTHING KIND OF LINED UP HERE. NO PHYSICAL REASON TO CORROBORATE THE PHOTOGRAPHIC EVIDENCE. -- YOU HAD PHYSICAL EVIDENCE TO CORROBORATE THE PHOTOGRAPHIC EVIDENCE.

>> YES, I THINK LIKE ANY INVESTIGATION. WE LOOK GOOD ALL THE AVAILABLE INFORMATION WE HAVEN'T PUT IT ALTOGETHER.

>> I WANT TO TALK FOR A MOMENT ABOUT THE CHIEF FORCES -- G FORCES. YOU MADE A COMMENT THE 17 G'S EXCEEDED HUMAN TOLERANCE. WHAT DO YOU MEAN BY THAT? WHAT IS HUMAN TOLERANCE? LET'S TALK ABOUT THE PHYSIOLOGICAL ASPECTS OF THIS.

>> I DRAWN WHAT HAD BEEN TOLD TO ME. IT IS NOT A SUBJECT MATTER IN EXPERT ON. WE DID NOT SAY IT MADE HIM UNCONSCIOUS. WE JUST SAID IT INCAPACITATED HIM TO RESPOND TO THE CONTROLS AT THAT POINT.

>> THANK YOU. WHY WOULD THESE MODIFICATIONS BE MADE TO THE AIRCRAFT? I UNDERSTAND WE WANT TO MAKE IT FASTER, THAT'S THE OBJECTIVE. BUT THERE WERE THINGS LIKE THE PILOT SAID HE WANTED TO SET THE AIRPLANE UP LIKE STILETTO, LIKE RACING BACK AND IN 1985 OR SO. WHAT CAN YOU TELL US ABOUT THAT?

>> WE WERE NOT ABLE TO FIGURE OUT EXACTLY WHY MANY OF THESE MODIFICATIONS WERE MADE, BUT YES, WE DO HAVE INFORMATION THAT HE WANTED TO SET IT UP LIKE THIS OLD AIRPLANE CALLED STILETTO. IT WAS JUST LIKE THE GALLOPING GHOST. MANY OF THE MODIFICATIONS ARE TYPICAL FOR ARE RACING MUSTANG. MANY ARE NOT.

>> SO, YOU COULD NOT IDENTIFY EXACTLY WHAT SOME WERE MADE? DID YOU FIGURE OUT IF THERE WAS AN AERODYNAMICS OR AN ADVANTAGE TO DOING IT THAT WAY FOR MANY OF THEM? AT LEAST BY READING THE REPORT, YOU INDICATED YOU DO NOT SEE A SPEED ADVANTAGE. IS THAT TRUE?

>> YES, SOME OF THEM WERE DETRIMENTAL.

>> THAT IS THE KEY POINT RIGHT THERE. SOME OF THEM HAD DETRIMENTAL EFFECTS ON THE AIRCRAFT, THAT ACTUALLY PROBABLY LEAD TO THE ACCIDENT.

>> YES, WE BELIEVE THE UNDOCUMENTED AND MAJOR MODIFICATIONS WERE CONTRIBUTORY TO THE ACCIDENT.

>> FOR EXAMPLE, FIXING THE RIGHT ELEVATOR TRIMTAB AND HAVING IT FIXED. INSTEAD OF THE WAY IT WAS DESIGNED TO OPERATE. ON THIS AIRPLANE, YOU SHOULD HAVE BOTH TRIMTABS. THIS PILOT PUT A SCREW THROUGH THEIR TO FIX IT IN POSITION, AND WHEN YOU DO THAT, HE LOST REDUNDANCY. YOU HAVE PUT ALL THE EGGS IN THE

BASKET OF HOPING THE LEFT ELEVATOR WILL NOT FAIL. AND IT DID FAIL. YOU LOVE LOST REDUNDANCY. WOULD YOU LIKE TO TALK ABOUT THAT?

>> I THINK YOU EXPLAINED IT VERY WELL.

>> THANK YOU. I LEARNED WELL FROM YOU.

>> MEMBER WEENER.

>> AND GOING THROUGH SOME OF THE DOCKET MATERIAL, IT IS OBVIOUS AS THE P51 MATURED IN THE EARLY 1940'S, THE AIRPLANE WENT THROUGH SOME MODIFICATIONS. ONE OF THE CHANGES WAS THE POSITION OF THE ELEVATOR O BOBWEIGHT. WHAT DID THAT CHANGE MEAN?

>> THEY ADDED A 20 POUND BOBWEIGHT TO THE SYSTEM.

>> AND THE FUNCTION WAS TO KEEP THE AIRPLANE FROM DIVERGING IN PITCH? SO THE AIRPLANE HAD A HISTORY OF BEING SENSITIVE IN PITCH? I NOTICED IN ONE OF THE PARAGRAPHS RELATED TO THE AIR FORCE SURFACE -- SERVICE INFORMATION THAT THEY WERE QUITE CONCERNED ABOUT THE THE POSSIBILITY OF FACTS, -- DEPRESSIBILITY EFFECTS. WHAT WAS THE MOCK NUMBER OF CHEAP ON THIS COURSE?

>> IT WAS LESS THAN 0.69 PIECING -- 0.69.

>> LESS THAN 0.69? SO YOU RULED OUT COMPRESSIBILITY?

>> AT ALL TIMES DURING THE RACE, THE AIRPLANE WAS BELOW THAT BOUNDARY.

>> ALL RIGHT THEN. THANK YOU.

>> MEMBER ROSEKIND.

>> JUST TO WRAP UP ON THE MODIFICATIONS, WAS THAT OF REQUIREMENT TO NOTIFY ANYONE ABOUT THE MODIFICATIONS, AND TO

WHO WOULD THAT MODIFICATION GO?

>> YOU SHOULD NOTIFY THE FAA UPON ANY MODIFICATIONS ON THE AIRPLANE.

>> DID HE? PREXY NOTIFIED THE FAA ABOUT ONE MODIFICATION --

>> AND HE NOTIFIED THE FAA ABOUT ONE MODIFICATION. WE COULD NOT FIND EVIDENCE THAT HE NOTIFIED THEM ABOUT OTHER MODIFICATIONS.

>> I WILL NOT PUT YOU ON THE SPOT. I THINK -- YOU WANT TO CALL THIS NOT A LOSS OF CONSCIOUSNESS, BUT ONE THING THAT WAS NOT VERY CLEAR, AFTER AN INDIVIDUAL RIGHT INPUT, THERE WAS LESS THAN ONE SECOND. WE ARE ALWAYS LOOKING AT OPERATOR PERFORMANCE KINDS OF THINGS. THIS TIME, THERE WAS LESS THAN ONE SECOND FOR ANYTHING TO BE DONE. THAT IS WHY ALL THE FOCUS IS ON THE STRUCTURAL, BECAUSE THERE IS REALLY ALMOST NOTHING WHEN THERE IS LESS THAN ONE SECOND RESPONSE.

>> THAT IS CORRECT. BOTH THE MAXIMUM AMOUNT AND THE RATE OF ONSET.

>> I KNOW WE CANNOT WANT TO TALK ABOUT THE NUMBERS. 17 IS WAY TOWARD THE END OF THE SCALE, RIGHT? ONE OF THE THINGS WE OFTEN TALK ABOUT OUR SURVIVAL FACTORS. CAN SOMEBODY TALK ABOUT -- ANOTHER ARE A LOT OF TIMES WHEN WE HAVE -- I KNOW THERE ARE ALLOWED TIMES FROM HAVE FIRST RESPONDERS. BY RECOLLECTION IS THREE MONTHS BEFORE THIS TRAGEDY, THE AIRPORT AND FIRST RESPONDERS JUST HAD AN EXERCISE ABOUT WHAT WOULD HAPPEN IF THERE WAS A CRASH. IN THIS CASE, IN ABOUT AN HOUR, THEN MOVED A LOT OF PEOPLE IN UNBELIEVABLE CIRCUMSTANCES. CAN YOU COMMENT OR GIVE US SOME INFORMATION ABOUT WHAT THE RESPONSE WAS IN THIS CASE? I THINK THAT WAS ACTUALLY A HIGHLIGHT OF HOW ALL THE EXERCISES HAD PAID OFF.

>> YES. THEIR IN JUNE AND MAY OF 2011, THE MASS CASUALTY RESPONSE PRACTICE WAS CONDUCTED AS PART OF A TRIANNUAL

EXERCISE, WHICH A LOT OF FIRST RESPONDERS ARE PART OF. BASICALLY, IT IS THE PRE- PLANNING WITH EVERYBODY INVOLVED.

>> CAN YOU JUST REMIND EVERYBODY -- MY RECOLLECTION WAS IT WAS 50 OR 60 PEOPLE WERE TRANSFERRED IN ABOUT AN HOUR? YOU MIGHT HAVE BETTER NUMBERS.

>> IT WAS VERY HARD TO GIVE EXACT NUMBERS GIVEN THE AMOUNT OF INJURIES. THE LEVEL OF PEOPLE TRANSFERRED TO, THEY UTILIZED HELICOPTERS AND GROUND UNITS.

>> GREAT. WE TALKED ABOUT THE RECOMMENDATIONS MADE IN APRIL. I THINK THERE IS AN ACKNOWLEDGMENT THAT THAT WAS DONE TRYING TO GET A RECOMMENDATION PRIOR TO AN ANNUAL EVENT. CAN YOU GIVE US A SUMMARY OF WHAT STILL NEEDED TO GET DONE?

>> AS FAR AS THE ENGINEERING EVALUATION AND RECOMMENDATION, THEY HAVE MADE PROGRESS AND PUT PROCESSES IN PLACE. THE LONG TERM IS WHAT WE'RE STILL WAITING ON. WHAT ARE THEY GOING TO DO FOR 2013 AND ON?

>> THANK YOU. SO, THE ACTION IS FOCUSED ON THE APRIL RECOMMENDATIONS AND THE QUESTION IS WHAT IS THE LONG TERM EFFECT GOING TO BE ON THE CULTURE THERE?

>> THAT IS CORRECT.

>> THANK YOU.

>> THANK YOU. YOU MENTIONED ABOUT STICK FORCE. IF HE IS IN A 70-DEGREE BANK, AND YOU SAID FROM THE PHOTOGRAPHIC EVIDENCE, IT INCREASED VERY QUICKLY TO 17 G'S, DO YOU HAVE ANY SENSE ONCE THE TRIMTAB SEPARATED WHAT BEAT STICH FORCE WOULD HAVE BEEN? HOW MUCH STICK FORCE WOULD HAVE BEEN NECESSARY TO CONTAIN THAT? WHAT STICK FORCE IT WOULD HAVE TAKEN?

>> DUE TO THE AGE OF THE AIRCRAFT, WE CANNOT HAVE NUMBERS ON WHAT WOULD HAVE HAPPENED ONCE HE LOST THE TRIMTAB. AFTER

THE LOSS OF THE TRIMTAB, THE STICK WOULD BECOME MORE AND MORE UNMANAGEABLE.

>> ONE HAND IS BETWEEN YOUR LEGS AND THE OTHER HAND IS ON THE THROTTLE. IT WOULD HAVE REQUIRED SUBSTANTIAL FORCE, AND VERY QUICK, BECAUSE IT WOULD BE VERY SUDDEN TO NOT HAVE THIS INCREASE OF 17 G'S.

>> THAT IS CORRECT.

>> DOES THAT MEAN THAT ONCE THE TRIMTAB SEPARATED, FATE WAS SEALED?

>> ONCE THE TRIMTAB SEPARATED AND THE CLIMB BEGAN IN EARNEST, WE BELIEVE SO.

>> ONCE THE PILOT RESPONDED TO THE LEFT OVER BANK, AND NOW HE WAS TOWARD THE RIGHT SIDE AND COLLAPSED ON AT THE STICK, IT WASN'T THE RIGHT SIDE STICK THAT CAUSED THE COMPLETION OF THE BANK?

>> NO, WE BELIEVE HE INPUT THE RIGHT STICK AFTER THE INITIATION OF THE LEFT ROLL. HE FOLDED DOWN IN THE COCKPIT BASED ON THE PHOTOGRAPHS THAT WE HAVE. ONCE YOU PUT YOUR BODY AND THAT POSITION, THE STICK IS NOT ALLOWED TO COME BACK TO THE CENTER PORTION, BECAUSE YOUR BODY IS IN THE WAY.

>> -- YOUR BODY IS IN THE WAY .

>> AT THAT POINT, HIS COLLAPSE ON THE STICK -- HIS COLLAPSE ON THE STICK ANTICIPATED THE CRASH. IS THAT WHAT YOU'RE SAYING?

>> YES, THAT IS CORRECT.

>> THANK YOU.

>> JUST TO CLARIFY, ONCE THE UPSET BEGAN, HE REALLY WAS INCAPACITATED, SO THERE IS NOT REALLY AN ISSUE OF WOULD IT

HAVE TAKEN HERCULEAN STRENGTH TO CONTROL THE STICK. THAT REALLY IS NOT AN OPTION WHEN YOU ARE NOT AVAILABLE TO DO IT.

>> THAT IS CORRECT.

>> OK. SO, TO FOLLOW ON WITH SOME OF THE QUESTIONS THAT HAVE BEEN ASKED BEFORE, PARTICULARLY WITH RESPECT TO THESE SUSCEPTIBILITIES LETTER, THE AIRCRAFT THROUGH ONLY AN AVERAGE OF 325 MILES PER HOUR IN THE QUALIFYING RACES?

>> YES, IT WAS CLOSE TO 400. HE DID REACH THOSE SPEEDS WITH A COUPLE OTHER FLIGHTS WE HAVE DATA FOR.

>> HE REACHED 325 OR 400?

>> HEAT REACHED ABOVE 400 -- HE REACHED ABOVE 400 KNOTS.

>> OK, SO ESSENTIALLY HE WAS TESTING THE LIMITS OF THE AIRCRAFT WITH THIS FLIGHT. HE HAD NOT REALLY DEMONSTRATED THE MANEUVERABILITY ISSUE AT RACE SPEEDS, AT THESE RATES SPEEDS. AN AVERAGE OF 325 IS NOT 400.

>> BASED ON THE DATA THAT WE HAVE.

>> WE HAVE MADE RECOMMENDATIONS ABOUT TESTING, ENGINEERING EVALUATIONS, ENSURING THAT THEY ACTUALLY ARE TESTED. DO YOU THINK IF THIS AIRCRAFT HAD BEEN TESTED AT RACING SPEED IN A RACING ENVIRONMENT, THE DEFICIENCIES WOULD HAVE BEEN NOTICED AND HE WOULD NOT HAVE BEEN ALLOWED TO RACE? OR DO YOU THINK HE WOULD HAVE BEEN ALLOWED TO RACE?

>> I AM NOT SURE ABOUT BEING ALLOWED TO RACE. IF HE HAD TESTED THE AIRCRAFT, THESE ISSUES WOULD HAVE BEEN PRESENT AND HOPEFULLY HE WOULD HAVE ADDRESSED THEM.

>> DO YOU THINK THAT IS STILL PROBLEMATIC, BECAUSE IT IS BACK ON THE RESEARCH, BACK ON THE PILOT WHO HAS THE INTEREST -- BACK ON THE RACER, BUT ON A PILOT WHO HAS THE INTEREST IN

COMPETING IN THE RACE. THE FLIGHT TESTING OF THREE HOURS THAT SHOULD HAVE BEEN DONE, BUT WAS NOT DOCUMENTED. THE FACT THAT NONE OF THE OTHER MODIFICATIONS WERE DISCLOSED TO THE FAA OR THE RACE ORGANIZERS WHEN HE ENTERED IN 2010 AND 2011. HE DID NOT IDENTIFY ANY MAJOR PROVOCATION TO THE AIRCRAFT. EVEN THOUGH HE DID NOT COMPETE IN 2011. THE AGE AND THE HOURS OF THE AIRCRAFT WERE INCORRECT ON THE ENTRY FORM. THINGS THAT ARE REALLY NOT ATTENTION TO DETAIL AT ALL. HE WAS 59 YEARS OLD ON ME -- HE WAS 69 YEARS OLD ON THE RACE FOR. HE WAS 74. TO WHAT DO WE ATTRIBUTE THIS LACK OF INFORMATION? AND THE SIGNALS ABOUT THE VIBRATION, AMPLITUDE OF 400 KNOTS, THE VIBRATION BETWEEN THE CANOPY AND THE WEEDS -- WIND SCREEN. WE HAVE A DESIGN ISSUE HERE THAT NEEDS TO BE ADDRESSED.

>> I DO NOT KNOW. IT IS INCUMBENT, THE WAY THE RULES ARE WRITTEN, IF IT IS INCUMBENT ON THE OWNER-OPERATOR TO LEAD THE FAA KNOW THERE ARE MODIFICATIONS.

>> IS THAT THE ISSUE WHEN IT COMES TO THE DESIGN AND EVALUATION AND TESTING. TO HAVE SOMEONE WHO IS QUALIFIED WITH THE SKILL SET TO DO THAT. THERE HAS GOT TO BE A BACKSTOP IF THE OPERATOR IS GOING TO PRESS FORWARD IN AN ENVIRONMENT WHERE THEY ARE REALLY TAKING THE RISK. I THINK THAT THAT IS THE IMPORTANT THING, BUT THOSE RECOMMENDATIONS THAT ARE STILL OPEN. THOSE OF THE THINGS THEY REALLY NEED TO DEAL WITH. CAN YOU TELL ME WHAT WAS DIFFERENT ABOUT THE THIRD LAP? HE HAD FLOWN AROUND THE COURSE TWO TIMES, ACHIEVING HIGH SPEED. WHAT WAS DIFFERENT ABOUT THE TERM BETWEEN EIGHT AND NINE BACKS -- DIFFERENT ABOUT THE TURN BETWEEN 8 AND 9?

>> LOOKING AT THE ENGINE PARAMETERS, THE THIRD LAP WAS NOT PARTICULARLY DIFFERENT THAN THE EARLIER LAPSE.

>> SO, WHAT COULD HAVE INITIATED THE UPSET?

>> WE LOOKED AT TWO POSSIBILITIES. KNEW THAT MANY OTHER POSSIBILITIES, BUT THERE WERE TWO WE WERE NOT ABLE TO DISMISS. EITHER HE MISSED THE APEX COMING INTO THE TURN, OR IT WAS A

FLUTTER OF FAILURE CAUSING THE UPSET. WE JUST DID NOT HAVE THE INFORMATION TO SAY EXACTLY WHICH ONE OF THOSE IT WAS.

>> IS IT NORMAL FOR A PILOT TO ENCOUNTER WEIGHT ON THE COURSE?

>> YES. EVERY PILOT WE TALKED TO SAYS IT IS QUITE COMMON WALT RACING.

>> AND THEY SHOULD BE ABLE TO CONTROL THAT IN DIFFERENT SITUATIONS?

>> IT IS THE FAILURE OF THE LEFT --

>> THE SUSCEPTIBILITY OF THE AIRCRAFT NOT BEING ABLE TO RESPOND WHEN IT IS OPERATING BEYOND ITS SCOPE?

>> THAT IS CORRECT.

>> MEMBER SUMWALT.

>> ON PAGE 83 OF THE DRAFT REPORT, IT SAYS THE ELEVATOR COUNTERWEIGHT INCREASES, MAKING THE RIGHT TRIMTAB FIXED. THE FAA MAY HAVE REQUIRED A MORE SUBSTANTIAL FLIGHT TESTING PROGRAM.

>> HOW CONFIDENT ARE WE THAT THEY WOULD MAKE THAT CALL? THAT IS WHAT THEY ARE THEREFORE. I HAVE NEVER DEALT WITH AN AIR WHARTON -- AIR WARDEN ON THIS. HOW LIKELY IS IT THAT THEY WOULD HAVE REQUIRED A MORE SUBSTANTIAL FLIGHT TESTING PROGRAM?

>> I BELIEVE IF THEY HAD KNOWN ABOUT THE MODIFICATIONS THERE WOULD HAVE BEEN MORE THAN THREE HOURS OF FLIGHT TESTING REQUIRED. THE PARTICULAR GENTLEMAN HE WAS IN CONTACT WITH IS VERY FAMILIAR WITH THESE TYPES OF AIRPLANES AT THE PERINO RACING CENTER. WE BELIEVE HE WOULD HAVE REQUIRED SOMETHING DIFFERENT.

>> I DO SHARE THE CHAIR'S CONCERN. I AM NOT SURE THE OVERSIGHT IS ADEQUATE. THERE ARE A LOT OF INDICATORS THAT SLIPPED THROUGH THE CRACKS. YOU SAY IT DOES DEPEND ON THE INDIVIDUAL INSPECTOR. THAT IS WORRISOME, A LITTLE BIT. WE'RE PUTTING A LOT OF FAITH IN PEOPLE WHO HAVE A LOT OF INTEREST IN RACING THAT AIRCRAFT TO GET IT OUT THERE. I KEEP GOING BACK TO THE LACK OF ENGINEERING EVALUATIONS. I AM READING THE REPORT PRIOR TO PROBABLE CAUSE AND IT SAYS THAT IT IS LIKELY HAD FLIGHT TESTING FOR THE MODIFICATIONS BEEN PERFORMED, MANY OF THE AIRPLANE'S UNDESIRABLE CHARACTERISTICS COULD HAVE BEEN VERIFIED AND CORRECTED. THAT IS SORT OF THE BOTTOM LINE. A LACK OF FULLY APPRECIATING THE FACT THAT THESE MODIFICATIONS COULD HAVE ADVERSE CONSEQUENCES, AND THEY CERTAINLY DID. AS I SAID EARLIER, TALKING AT A BOARD MEETING, IF SOMEONE WAS TO GO OUT AND DO THESE THINGS AND RISK THEIR OWN LIVES, THAT IS ONE THING. TO GET OUT THERE ON THE BREEZE SCORES WERE THERE ARE LITERALLY THOUSANDS OF SPECTATORS, YOU ARE NOT ONLY IN DANGER IN YOUR OWN LIFE. YOU ARE AND INJURING OTHERS AS WELL. -- YOU ARE AND INJURING OTHERS AS WELL. THANK YOU VERY MUCH.

>> WITH REFERENCE TO THE 17 G PULLUP, IT WOULD SEEM TO MEET THE AIRPLANE IS EITHER STATICLY DIVERGENT AT THIS POINT, BECAUSE IT IS HARD TO IMAGINE THE AIRPLANE IS TRIMMED TO BE NOSE UP TO 17 G'S. IT MAY HAVE BEEN THE ELEVATOR COUNTERWEIGHTS OR THE BOBWHITES -- BOBWEIGHTS. THE ELEVATOR IS NOW IN A TRAILING POSITION WITH BASICALLY NO TRIM ON ITS. THE AIRPLANE IS DIVERGING IN PITCH TO SUCH A DEGREE IT IS CARRYING A 17 G LOAD. WOULD YOU CHARACTERIZE IT AS STATICLY OR DYNAMICALLY DIVERGENT?

>> YES, IT IS DYNAMICALLY -- WHEN THE TRIMTAB IS LOST, THE REQUIREMENT OF THE STICK FORCE IS INCREASED. THE OPERATOR CAN NO LONGER HOLD THE FORT. -- HOLD IT FORWARD. IT BECOMES A FEEDBACK LOOP. THE ELEVATOR INCREASES WHICH INCREASES THE FORCE, WHICH THEN AND TURNED REACHES THE ELEVATOR AS WELL.

>> SO, BASICALLY WE HAVE A CONTROL ISSUE.

>> YES.

>> OK. WOULD THAT HAVE BEEN FOUND BY ANALYSIS? WOULD IT HAVE REQUIRED FLIGHT TESTS? FLIGHT TESTING, IF SOMETHING IS DYNAMICALLY OR STATICLY DIVERGENT.

>> THAT IS CORRECT. WE KNOW THERE ARE INSTABILITY ISSUES. IF THEY HAD DONE A DILIGENT FLIGHT TEST, IT WOULD HAVE UNCOVERED THOSE.

>> WHICH GOES ALONG WITH MAKING SURE THIS FLUTTER TEST -- THANK YOU.

>> I WANT TO GO BACK TO THE ISSUE OF THE COURSE DESIGN. I BELIEVE THE EXPECTATION FOR THE LOAD IS ABOUT AN AVERAGE OF THREE?

>> THE COURSE IS DESIGNED FOR THE MAXIMUM, THE HIGHEST SPEEDS AT 3 KNOTS.

>> CERTAINLY, 17 IS EXTREMELY SIGNIFICANT. I AM SURE EVERYONE WAS SURPRISED. I THINK THE TELEMETRY STOPS MEASURING AT AROUND 10. IS THAT CORRECT?

>> THAT IS CORRECT. THE TELEMETRY WAS SATURATED.

>> WHEN WE LOOK AT THE COURSE, WHEN WE LOOK AT HOW THEY HAVE MOVED THE COURSE, WE STILL HAVE A SITUATION HERE WHERE WE HAVE AN UNCONTROLLED EVENT. THE WAY THE COURSE IS DESIGNED, THERE IS REALLY NOT ACCOUNTING FOR HOW TO PROTECT SPECTATORS FROM AN UNCONTROLLABLE AIRCRAFT. IS THAT CORRECT?

>> ONCE AN AIRPLANE IS UNCONTROLLED, YOU HAVE NO IDEA WHERE IT IS GOING TO GO. YOU CANNOT CONTROL THAT. YOU CANNOT MODEL THAT.

>> WHAT RATES OF FAILURES ARE WE LOOKING AT WITH RESPECT TO THE SPECTATORS AND THE RACERS?

>> THE COURSE IS DESIGNED ON A BALLISTIC PROJECT OF. THE COURSE IS DESIGNED AROUND HOW MUCH DISTANCE WILL IT TAKE TO IMPACT OUR ROUND, AND THOSE SPECTATOR AREAS ARE WELL OUTSIDE THE BOUNDARIES.

>> OK, SO THE RACE COURSE DESIGN IN THE SPECTATOR PROTECTION AREAS ARE REALLY NOT EVEN SET FOR AN EVENT LIKE THIS, EVEN THOUGH THERE WERE IMPROVEMENTS MADE ON THE BARRIER WALLS WITH THE RECOMMENDATIONS. IN ORDER TO SEPARATE A CROWD FROM AN UNCONTROLLED AIRCRAFT, YOU'D END UP HAVING TO PUT SPECTATORS' SO FAR AWAY.

>> THAT IS CORRECT.

>> YOU CANNOT PROTECT AGAINST AN UNCONTROLLABLE EVENT. YOU DO NOT KNOW WHERE THE AIRCRAFT MIGHT WIND UP.

>> THE MAXIMUM G LEVEL AND THE MAXIMUM SPEED, YOU CAN MAKE TABLES FOR THAT AND COME UP WITH SAFETY AREAS.

>> OK. VERY GOOD. AGAIN, I WANT TO SAY THANK YOU TO OUR TEAM. AND MANY OF THE PARTICIPANTS IN OUR INVESTIGATION, MIKE HOUTEN AND HIS TEAM. AND THE FAA WORK THAT IS ONGOING. AND I SEE INDIVIDUALS TO HAVE EVEN RETIRED WHO HAVE COME BACK TO BE HERE WITH US FOR THE MEETING TODAY. WE VERY MUCH APPRECIATE EVERYONE BEING HERE. MEMBER SUMWALT, I SAW YOU ALSO GREETED MR. -- WE APPRECIATE EVERYONE BEING IN ATTENDANCE IN OUR AUDIENCE. WE APPRECIATE YOU WATCHING THE WEB CAST. WE ARE NOW GOING TO TAKE A BREAK. WE WILL RECONVENE AT 11:15 TO CONSIDER PROBABLE CAUSE.

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>> IF EVERYONE COULD TAKE THEIR SEATS, WE'RE ABOUT TO BEGIN.

THE STAFF OF ANY ADDITIONAL PRESENTATION FOR COMMENT?

>> NO, MA'AM.

>> WOULD YOU PLEASE READ THE PROBABLE CAUSE AS PRESENTED IN THE DRAFT REPORT.

>> THE NATIONAL TRANSPORTATION SAFETY BOARD DETERMINES THE PROBABLE CAUSE OF THIS ACCIDENT IS THE REDUCED ASSISTANCE OF THE ELEVATOR TRIM TAB SYSTEM THAT ALLOWED THE AERODYNAMICS FLUTTER TO OCCUR. BE REDUCED STIFFNESS WAS THE RESULT OF A DETERIORATED IN SEARCH, WHICH BECAME LOOSE AND INITIATED FATIGUE CRACKING IN ONE SCREW AT SOME TIME BEFORE THE ACCIDENT. THE ERROR RESULTED IN A FAILURE OF THE LEFT TRIM TAB ASSEMBLY AND THE LOSS OF CONTROL. CONTRIBUTING TO THE ACCIDENT WERE THE UNDOCUMENTED AND UNTESTED MAJOR MODIFICATIONS TO THE AIRPLANE FROM THE PILOT'S OPERATION IN THE RACING ENVIRONMENT WITHOUT TESTING.

>> IS THERE A MOTION TO ADOPT THE PROBABLE CAUSE? MOTION TO ADOPT THE PROBABLE CAUSE IS WRITTEN AND SECONDED. YES. ALL THOSE IN FAVOR, SIGNIFY WITH YOUR HAND AND AYE. THE AYES HAVE IT. DR. MEYER, I BELIEVE THERE ARE SAFETY RECOMMENDATIONS IN THE REPORT?

>> YES, THERE ARE 10 SAFETY RECOMMENDATIONS TO IMPROVE THE SAFE OPERATION. WE HAVE OUR RESPONSE TO EACH OF THOSE RECOMMENDATIONS AND PROPOSAL OF NEW CLASSIFICATIONS FOR NINE OF THE SAFETY RECOMMENDATIONS. TWO RELATE TO BRACE ELIGIBILITY REQUIREMENTS. -- RELATES TO RECENT ELIGIBILITY REQUIREMENTS. -- RACE ELIGIBILITY REQUIREMENTS. IT REQUIRES PARTICIPANTS TO PROVIDE ENGINEERING EVALUATION THAT INCLUDES ANALYSIS IN THE FLIGHT ENVELOPE FOR ANY AIRCRAFT WITH MAJOR MODIFICATIONS, SUCH AS TO THE STRUCTURAL FLIGHT CONTROLS. THE NATIONAL UNLIMITED DIVISION IS ASKED TO PROVIDE THE SAME REQUIREMENTS FOR PARTICIPANTS IN THE UNLIMITED CLASS. TWO RECOMMENDATIONS RELATE TO A SPECTATOR SAFETY, BOTH TO THE RENO AIR RACING ASSOCIATION. ONE RECOMMENDATION

ASKED IT TO EVALUATE THE DESIGN OF THE COURSE TO MINIMIZE MANEUVERING AND POTENTIAL CONFLICTS WITH SPECTATORS THAT WARRANT CHANGES TO THE RACE COURSE. THE SECOND RECOMMENDATION ASKED IT TO TAKE THE FOLLOWING ACTION TO RAISE THE LEVEL OF SAFETY FOR SPECTATORS AND PERSONNEL ON THE RACE FOR -- RACECOURSE. ONE IN THE RAMP AREA AND IN ANY AREA WHERE SPECTATORS ARE PRESENT TO INSTALL BARRIERS THAT ARE MORE SUBSTANTIAL THAN THE ONES CURRENTLY IN PLACE. FOUR RECOMMENDATIONS RELATED TO THE FEASIBILITY FOR PILOTS. RECOMMENDATION 16 AND 17 ASK THE RENO AIR ASSOCIATION TO PROVIDE TRAINING TO THE PILOT INCLUDING TECHNIQUES MITIGATING GEXPOSURE. AND 17 ASKS TO EVALUATE -- THE SAFETY RECOMMENDATION A12-11 AND A12-12 ASKS THE RACING LTD. DIVISION TO DO THE SAME. A 12-11 AND A12-12 ARE CLOSED, ACCEPTABLE ACTION. DISCREPANCY TRACKING -- THAT IS A BE RECOMMENDATION A12-10. THAT IS THE NATIONAL RACING GROUP UNLIMITED DIVISION TO DEVELOP A DISCREPANCY TRACKING SYSTEM. STAFF PROPOSES CALLING IT CLOSED, ACCEPTABLE ACTION. THE 10TH RECOMMENDATION RELATES TO COURSE DESIGN. THAT HAS NOT BEEN CLASSIFIED IN THIS BRIEF, BUT I WILL MENTION IT FOR COMPLETENESS. REVISE FAA ORDER 89, VOLUME 1, CHAPTER 6 AND AC- 49C TO CONDUCT INACCURATE AND INCOMPLETE INFORMATION. ON JULY 5, 2012, THE BOARD CLASSIFIED THESE AND OPEN IT ACCEPTABLE RESPONSE.

>> IS THERE A MOTION TO ADOPT THE CLASSIFICATION FOR THE RECOMMENDATION? IT HAS BEEN MOVED AND SECONDED TO ADOPT THE CLASSIFICATIONS FOR THE RECOMMENDATIONS ISSUED IN APRIL. ALL THOSE IN FAVOR, SIGNAL WITH YOUR HANDS AND AYE. THE AYES HAVE IT. THE RECOMMENDATIONS HAVE BEEN RECLASSIFIED. IS THERE ANYTHING ELSE?

>> NO.

>> THANK YOU. A MOTION TO ADOPT THE BRIEF?

>> SECOND.

>> IT HAS BEEN MOVED AND SECONDED TO ADOPT THE BRIEF AS PRESENTED. ALL THOSE IN FAVOR, CIGNA WITH YOUR HAND AND AYE. 5 AYES HAVE IT. THE BRIEF HAS BEEN ADOPTED. IN -- SORRY. ARE THERE ANY CONCERNS WERE DISSENTING STATEMENTS FROM THE BOARD MEMBERS? SEEING NONE, I WOULD LIKE TO RECOGNIZE OUR STAFF. OUR BOARD MEMBERS HAVE COMPLEMENTED THEM ON AT THEIR WORK, THE TECHNICAL EFFORTS THAT WENT IN WITH THE INVESTIGATION. I THINK IT WAS SO IMPORTANT THAT WE ISSUED THESE EARLY RECOMMENDATIONS IN APRIL TO GIVE THE OPPORTUNITY TO MAKE CHANGES BEFORE THE RACES NEXT MONTH. THAT WAS A GREAT EFFORT AND VERY SUCCESSFUL. I THINK IT IS GOOD IT HAS BEEN LESS THAN A YEAR TO FIND CHANGES HAVE ALREADY BEEN MADE. HOWARD HAS BEEN OUR INVESTIGATOR IN CHARGE. HE HAS DONE A SUPER JOB. MARIE, YOU DID A GREAT JOB. WE VERY MUCH APPRECIATE ALL THE WORK THAT WAS DONE FROM OUR TEAM, THE INVESTIGATORS, THE WRITERS, EVERYONE PARTICIPATING. AND BRIAN, ARE IN TURN, THANK YOU VERY MUCH, TOO. THE MEDICAL ASPECTS OF THE INVESTIGATION, NOTABLY THE RESEARCH AND RECOMMENDATIONS ON HIGH G TRAINING WAS CONDUCTED BY D NTSB MEDICAL OFFICER. MIKE WAS JUST CALLED TO PLAY AN INSTRUMENTAL ROLE IN THIS INVESTIGATION JUST AS HE PLAYED AN INSTRUMENTAL ROLE IN HIS CAREER IN PUBLIC SERVICE. HE WAS MISSED. AS I WAS REMINDED DURING OUR RECENT VISIT, AVIATORS ARE A PASSIONATE COMMUNITY. IN OSHKOSH, MY COLLEAGUES AND I MET WITH SOME MANY OTHERS WHO TOOK PART IN A SAFE AND ENJOYABLE AIR SHOW. BUT I DO NOT HAVE TO TRAVEL TO WISCONSIN TO SEE PASSION IN AVIATION. WE HAVE IT HERE AT THE NTSB. WE HAVE IT WITH PASSION THAT THE PILOTS AND SAFETY PROFESSIONALS. SOME OF OUR EMPLOYEES JOIN AS AVIATION ENTHUSIASTS WHO TRAVELED TO RENO YEAR-END AND YEAR OUT TO SIMPLY WATCH RACERS DEFY GRAVITY. IN OUR COMMON -- AND OUR COMMUNICATION WITH THE FAMILIES OF THOSE KILLED AND INJURED, WE RECOGNIZE AND APPRECIATE THAT EACH LIFE IS PRECIOUS. WE KNOW THAT INJURY, WHETHER PHYSICAL OR EMOTIONAL, TAKES TIME TO HEAL, AND IN MANY WAYS, NEVER GOES AWAY. LAST YEAR'S TRAGIC CRASH SPURRED OUR TEAM TO WORK DILIGENTLY TO UNDERSTAND WHAT HAPPENED AND TO IDENTIFY WAYS TO IMPROVE THE SAFETY OF RACES IN THE FUTURE. YEARS AGO, WRITING ABOUT THE EARLY DAYS OF AVIATION "FOR A PILOT FATE IS THE HUNTER." TODAY WITH SO MANY ADVANCES IN SAFETY PROCEDURES, IT IS NO LONGER THE HUNTER OF THE PILOT. WE ALL AGREE WITH AIR RACES AND AIR SHOWS, THE RISK TO SPECTATORS SHOULD BE UNDERSTOOD AND ADDRESSED. INNOCENT BYSTANDERS SHOULD NEVER HAVE TO RELY ON FAITH FOR THEIR SAFETY. THANK YOU. WE ARE ADJOURNED.