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ATTACHMENT 2

GULFSTREAM G650 PERSONNEL DOOR OPERATION INTERVIEWS

30 Pages

1.0 Interviews

The following interviews were conducted at Gulfstream Aerospace in Savannah, Georgia on October 31 through November 2, 2011 by members of the Survival Factors Group including: Courtney Liedler (NTSB), Alan Donnelly (Gulfstream), Steven Litke (FAA), and Brian Powell (Roswell Fire Department). Lorenda Ward (NTSB, Investigator-in-Charge) was also present to assist with the following interviews.

Neal Panhuyzen

(Interview conducted October 31, 2011. The interview began at 0940 and ended at 1136.)

Mr. Panhuyzen was the Lead of Doors and Mechanism Group for G650. He had worked on the 650 program since 2006.

Exits on the airplane were the MED, used to enter and exit the airplane, the overwing exit and unofficially the baggage compartment. The baggage door was not governed by the regulations for 800 series. It was not deemed an exit by Gulfstream. The baggage door was operable from the inside and outside. On 6001, the baggage door was a specially designed egress option for use in-flight with parachutes.

Mr. Panhuyzen described the operation of the mechanical MED. The door was hydraulically closed and lifted to the closed position but not locked yet. It was hinged at bottom. To lock, squeeze handle pull down and release the handles. To open the door, grab the handle and squeeze to unlock. Lift arm to lift door from stops, bayonets retract and door lifts. Give the door a tug to release from safety hook to fall open. Door falls open and rate was controlled by hydraulic damper.

Overwing exit was a plug door, opened inwards. To open, you grab the red t-handle and pull down. The exit would fall in and you lift it out of the way. To close overwing exit, put it back on stops and push t-handle to engage latches which were two arms on top that swing to hold exit in place. There was a panel on the exterior of the aircraft to open to operate the exits from the outside. The panel had three latches that were opened and there was a handle inside that you rotate and it mimics the use of the t-handle on the inside. The push/pull cable attaches the linkages to swing the latches.

The baggage door was operated by rotating a t-handle. Push dial to unlock and release handle. Turn handle 90 degrees to retract four bayonets and door would slide up like a garage door. The baggage door does not meet the same requirement because it was not an emergency exit. A lock was not required.

On the G650, the MED and 4 overwing exits were designated emergency exits. The process to open was the same in an emergency condition as in the normal operation.

The electric main entry door was currently on 6005 and subsequent airplanes. To operate the electric MED, momentarily depress a switch located on the upper left hand side of the door. The

door actuates on own with no intervention. The locking and latching was all automatic. To open, depress ‘open’ side of switch and door opens on its own automatically.

For all the doors, you need to check the exterior. MED had a fiber optic view port. To make sure the egress path was clear.

The electric door was similar to the mechanical door; it had the same hydraulic actuator. A latching actuator replaces the large (latching) handle and locking actuator replaces the red locking handle.

Emergency operation for the electric MED was exactly the same - just push the button. The electric MED was a dual channel system. The primary system runs off the primary power. If it was a dark aircraft, such as when power was off, the door can use emergency battery as back-up. Same emergency batteries used for emergency lights/exit sign illumination.

FAA regulations used for design standards of the doors were 783 and 800 series, 801-812 governing emergency exits. The requirements were the same for MED and overwing exits. Compliance was demonstrated with analysis, flight test, and component qualification test. Strength and fatigue testing were done in the fuselage structure test articles. Supplier components go through environmental and endurance testing, etc. Analysis for mechanisms (rods, linkages, tubes) can vary. Analysis was done up front followed by testing. System safety analysis was completed by safety group and structure analysis was completed by structures group. Analysis aspect was not part of what he does. Documentation was produced; and test procedures and test reports were all submitted to the FAA. Test procedures depend on the testing. Flight tests were defined by the flight test group. The suppliers write the test plans and the reports. His group writes requirements (environment, loads, condition) and reviews test reports. Ultimate approval was done by DER and FAA (Atlanta ACO). The stress group would create stress reports from analysis. These reports go through a similar approval process.

Doors were chosen as emergency exits based on FAA regulation. The regulation requires a certain number of emergency exits based on size, number of passengers and crew. The 650 was 19 passengers and crew as maximum occupancy. The 650 had four exits, and he was not sure of methodology for why 4 overwing exits were chosen. All Gulfstream legacy aircraft have 4 exits. The main entry door was an emergency exit based on being a floor level exit. FAA regulations were followed for designating exits for G650. Gulfstream determines exits and design, then FAA approves. The certification plan documents which exits were emergency exits.

Mr. Panhuyzen was not sure how the door meets the minor crash criteria in the FAA regulations; he deferred the question to the stress and structures group.

Problems with keeping the manual main entry door working properly were experienced early on. There were a lot of rigging issues. It was not operating as smoothly as it could. The door did not yet have optimal rigging. One rigging issue was the lifting handle was hard to lift. The rigging specification describes guides, steps, gaps, etc., and the final step was to actuate door. Sometimes you could not open or close the door, or the door would not unlatch. There was one occasion

when the door guides had to be removed for door to open, but that was very early on too. Some people could open the door, some could not. First few months, before aircraft flew, there were complaints every few weeks that the door was difficult to operate by FTE or maintenance. These complaints became rare as the fleet began flying unless maintenance on door had occurred. Any new design airplane would have issues to work out though. Now, adjustments were rare and engineering had not been called once to look at a MED in the past year.

If there were to be a problem in the field, engineering would get a call from the flight test department. Engineering would talk maintenance through the process to fix. If that did not fix the problem, Gulfstream could fly an engineer to a site to assist. The airplane would not be allowed to fly until corrected. Mr. Panhuyzen was not aware of any occurrence where the door was out of alignment during flight or could not be opened after a flight. When asked, Mr. Panhuyzen said no door work completed on 6002 while it was in Roswell.

If there was a problem with the door, the DRDI system would have documentation of substantial work or physical modifications. Some issues were resolved with a phone call, but if it requires re-working a part of re-rigging, it needs a DRDI. It might be in the daily report from crew during testing if it was significant. The DRDI system was able to be accessed remotely, and there would be an entry for any rigging issue done. If there was a re-rigging of the door or rework of the part, it would be entered into the Solumina program. A work order describing the condition; i.e., baggage door not operating, was given by maintenance. It goes to engineering and there was then a section in the program for the engineering disposition on the issue, describing steps for fixing. Maintenance then gets that disposition and fixes the problem accordingly. Quality signs off if fixed by steps in already approved process without deviation. If a step was deviated from, the work order would be sent back to engineering to be reevaluated and would go back through the process. If maintenance was doing something not prescribed, engineering must be notified. Mr. Panhuyzen was not aware of any specific type of fight testing or operation that led to a problem with the MED.

In the beginning of the electric main entry door operation, there were problems with closing the door. The latch actuator would stall out because of a problem with the springs. Everyone knew of the problem, which started during initial production. Maintenance now knows to rig door and would not need to call engineering. The same process was followed each time. The 4 springs were too heavy and would cause trouble in the closing sequence. One of the four springs was removed. Since removing a spring a couple months ago, problems with electric MED were rare. The door would go back to four spring of lighter tension equal to the three springs now. Engineering learned of the issues with the electric door and documented the problem in resolution the same as the mechanical door’s problems in Solumina.

He does not operate the mechanical or electric main entry door on a regular basis. He only operates it when he was called to help with a problem. When operating the mechanical main entry door to resolve a problem, he would gage the smoothness of operation or force needed to operate. If it was hard to close the MED, it would be hard to open the MED. They go hand in hand. For the electric door, he would gage based on the time to operate or the sounds/noises from

the motor. Depending on problem found with either door, he would remedy problem with mechanics.

There was a problem with the overwing exit initially. When the t-handle was pulled, the exit would not fall in and it would need to be pulled away from the opening. This was due to the positioning of the exit in opening. It was re-rigged with additional guides, and now all the overwing exits fall away. He was not too involved in the re-rigging of the overwing exits.

All overwing exits were interchangeable, but they were individually rigged at the stop positions. In order for one exit to fit into another location, adjustments would need to be made. Adjustments were in increments of sixteen thousandths. Then the open process would need to be gone through to verify its operation. If not readjusted, the exit might not be flush to the airplane but he thinks it would still fit into opening. He had never put an exit in another opening and had never done a tolerance analysis. But he does not think there would be any sealing or pressurization issues if it were done. There was no marking individual serialization on the exit for specific locations.

Mr. Panhuyzen was not sure if an exit had been designated as a primary exit for crew of flight tests. The question was out of his scope of knowledge.

The electric door was connected to battery pack for emergency. He was not sure of FAR requirements for battery, would need to ask the electrical group. The door can be operated manually from inside, as a maintenance action. Nine bolts would need to be removed to remove the air stairs to do so. Gulfstream tested the procedure in training and it took 17 minutes, and was not intended as an emergency egress operation. There was no other way to manually operate the door. The electric MED was an improvement, it seems much more simple and reduces confusion. A second switch to operate the MED was put in the cockpit for certification. The switch was on the overhead panel and was accessible from the pilot seat. The switch would only open the MED, not close it.

Peter Hendy
(Interview conducted October 31, 2011. The interview began at 1143 and ended at 1259.)

Mr. Hendy was a Flight Test Engineer. He had been in Flight Test since 2002 and had been working on the G650 since 6 months prior to First Flight. Mr. Hendy was the primary flight test engineer for 6002. Mr. Hendy flew a G650 about three or more times per week.

The airplane had 3 means of egress, the main entry door, the overwing exits, and the baggage door. This was the initial order of priority that would be used but would be modified as necessary based on circumstances outside that were seen by looking through the windows. The priority stays the same for each kind of flight test mission; it did not change pre-flight thinking.

The Mechanical Main Entry Door was opened by squeezing the handle and then raising it up until it stops moving. Then pull the door in slightly to release the upper hook and then the door falls open freely. The door was closed by pressing the switch on the bulkhead just aft of the door.

When the door was closed, squeeze the handle and pull it down to lock and latch the door. When the door was latched, check for 3 dots visible on the bayonets and verify there was no door CAS message.

The Electrical Main Entry Door was opened by pressing OPEN on the OPEN/CLOSE switch on the bulkhead aft of the main entry door. The door was closed by pressing CLOSE on the OPEN/CLOSE switch and confirming the amber unlock light goes out. The unlock light was just under the door OPEN/CLOSE switch. Verify the CAS message was not present with the door closed. The CAS message would be blue on the ground and amber in flight if the door was not fully locked.

The Baggage Door was opened by rotating and pushing the lock knob to pop the handle out. Rotate the handle about 90 degrees to retract the bayonets. The door would then come in and up on a track, assisted by spring reels.

The baggage door and main entry doors were operated on every preflight. The overwing exits were checked approximately once per week. Mr. Hendy flew in a G650 about 3 or more times per week.

Early main entry doors prior to first flight had some issues. Rigging procedures have advanced and now the doors were acceptable. If a door was a concern the flight would be cancelled and the door would be fixed or re-rigged. Mr. Hendy does not recall this ever happening. If he found a problem or had difficulties with a door he would report the problem to maintenance. Maintenance may enlist engineering to assist, which was up to maintenance. Maintenance would enter the problem into the DRDI system, even if not asked, engineers can still see it. A problem can also be reported on the squawk sheet, which was handwritten and filled out for every flight by pilots. The sheet was given to quality, even if nothing entered. There was no problem that Mr. Hendy would trouble shoot himself. Mr. Hendy also does not recall any issues with the main entry door on 6002 during flight or on a preflight. Mr. Hendy said there was a 24-hour hotline a customer can call if they needed assistance.

Mr. Hendy had had approximately 20 flights on 6005 and had not experienced any issues with the electrical main entry door.

Mr. Hendy checks the overwing exits periodically on any plane he flies on. This was his personal preference. Mr. Hendy personally checked the overwing exits on 6002 about 2 weeks prior to the accident and they were working fine.

Mr. Hendy operated the baggage doors frequently. He had only ever heard of one issue with the baggage door. On 6002, early in its life, a baggage door handle came apart once. This was superseded with a new design baggage door handle.

Mr. Hendy had only encountered one difficulty with the main entry door operation. Aircraft 6004 had a full interior installed. When the cosmetic closeouts were installed onto the bulkheads on the forward side of the main entry door the panel was too thick and caused his hand not to fit

when operating the main entry door handle. This was fixed. He did not report this because it was already a known issue.

Mr. Hendy had never encountered any issues with the electrical main entry door. In the flight test fleet this door was only installed on 6005 and Mr. Hendy had not been flying in 6005 until recently.

When asked to describe his training on the doors, Mr. Hendy states that he was initially trained by a mechanic and he repeatedly opened and closed the doors until he was comfortable with their operation. Now he trains people on the doors. He stated that it was the responsibility of Flight Test Engineers to make sure everyone on the airplane knows how to operate the doors in the event of an emergency. Mr. Hendy conducts hands-on training and stated the training method used could vary based on the FTE. He said it typically takes 5 to 10 cycles to become proficient in the operation. When asked if a lay person could operate the door, he responded no. The person would have to develop proficiencies. When asked if Flight Test Engineer or Flight Test Pilot could open the main entry door blindfolded, he responded yes. Mr. Hendy said that typically, the pilot in command would not close the door. The first officer may, but it was typically the FTEs that would open/close the door on routine basis. He also stated that everyone on the airplane was trained operate the door. All the training given was demo and hands-on. There was no documentation or official guidance. There was no difference for the operations whether it was in normal or emergency procedures.

On the electrical main entry door there have been some changes to the switch over time. This was not formally retrained but there was a familiarization with the new switch. For operating the electrical door from the outside the training included opening the switch panel door forward of the main entry door, turning on battery power, and pushing the switch.

The overwing exit training was done on both the interior and the exterior of the aircraft. There was a demo and then hands-on. It took only 2 operations to feel comfortable. He was allowed to do it as often as he wanted to feel comfortable. Egress through the exit was included in the training.

The baggage door training was similar with demo and hands-on. Mr. Hendy stated he spent about 20 minutes until he felt proficient with the baggage door.

Mr. Hendy was asked if he had ever been trained on the main entry door viewport. He stated no and he would not use it. But in the flight test aircraft with no interiors installed situational awareness was known clearly through the large G650 windows.

Mr. Hendy stated that there were no established procedures for evacuation other than establishing the priority of the door to use based on circumstances.

Anne Carobine

(Interview conducted October 31, 2011. The interview began at 1403 and ended at 1426.)

Ms. Carobine was a Flight Test Engineer in the Systems group. Ms. Carobine works for Mr. Hendy. Ms. Carobine had been employed at Gulfstream for 6 years and had been working on the G650 since August of 2010. Ms. Carobine had only flown 3 flights on the G650. The last flight was in March of 2011. It was Ms. Carobine's decision not to fly.

Ms. Carobine states that the Main Entry Door was the primary means of entry and exit for the aircraft during normal conditions. Under emergency conditions the overwing exits and the baggage door were means of egress, in addition to the main entry door.

Ms. Carobine had not flown in over 6 months and did not remember all the details of actuating the main entry door. Specifically she remembers the need to squeeze the handle. On the overwing exits Ms. Carobine remembers that you pull the red T-handle, grab the exit handles, pull the exit in, and lift away. She does not recall how to open the overwing exits from the exterior. For the baggage door Ms. Carobine remembers to step on the bottom handle, push button on handle, rotate handle, and door was spring loaded and comes up. Ms. Carobine had never operated the baggage door from the outside.

Ms. Carobine had operational experience operating the mechanical main entry door, the overwing exits, and the baggage door. Ms. Carobine had not operated the electrical main entry door.

Ms. Carobine's training on the main entry door consisted of a demo, with verbal explanations of every step, followed by her operating it hands-on. During training Ms. Carobine had some difficulty the first time she tried to operate the main entry door. Specifically she tried to move the handle without squeezing the locking handle and the handle would not move. She was given the opportunity to continue operating the door during training until she was comfortable with its operation. She states she got it by the 2nd or 3rd time. She also opened it prior to every flight she was on. Ms. Carobine's training was conducted by Chris Booth, who keeps a spreadsheet of who was trained. She stated that she was the guinea pig and everyone else got it on the first time. All of this training was on the inside of the aircraft and she felt comfortable with the interior operations of all the doors.

Ms. Carobine had the same demo and hands-on type of training on the overwing exits. She stated she had no problems with the overwing exits' operation; however they were a little bit heavy.

Ms. Carobine also received the same type of hands-on / demo training for the baggage door. She operated the baggage door with no problem the first time.

On another occasion Ms. Carobine thinks she was trained on the exterior operations of the main entry door, but was not sure. She was not trained on exterior of the overwing exits or the baggage door. Ms. Carobine was not provided with any written training documentation on door or exit procedures. Because Ms. Carobine does not fly very often she undergoes retraining prior to every

flight and stated she felt comfortable opening all the doors. Ms. Carobine also received formal Emergency Egress training from Flight Safety International.

When asked to describe the primary egress options during a crash Ms. Carobine described the main entry door was the primary exit with the overwing exits as secondary. This would be her personal preference and first thought since she entered the plans from there. But she would assess the best way out by looking out the windows to assess the situation. In an emergency, she would just find a way out.

Harold "Chip" King

(Interview conducted October 31, 2011. The interview began at 1442 and ended at 1550.)

Mr. King was a Senior Production Test Pilot, had been here at Gulfstream since August 2002. He had been on the G650 program since before the first flight. He had military experience but no formal test pilot training.

Main Entry Door (MED) was the primary crew egress door. His second option would be the baggage door because of his size but overwing was normally the secondary option. But normally he uses the MED.

He does not normally operate the MED because the Flight Test Engineers (FTE) normally does. Mr. King described the operation as first squeeze the handle, move the lever up. The lever was on the right side. The door actually moves up then out. You may have to jiggle the handle to get door open. Sometimes the door did not move up which means you did not do it right and you have to reseat the lever and start over.

To close the MED, it comes up and when it gets to the top you pull the lever down. It was hydraulic to close. It was not an electric door, but it was electrically initiated.

Operating the electric door was pretty easy. Just throw the switch. It was all electric. Mr. King had been on 6005 just a couple times.

To operate an overwing exit there was a lever over each window. You pull down to release the lock and use handles to pull it in the cabin. He had never actually operated an overwing exit but he had seen it done.

Baggage door opens kind of like a safe. He does not normally operate the baggage door because he just verifies the doors were closed during preflight. Mr. King was not exactly sure how it works but thinks it had a big arm on a center post with button, rotates right to open and left to close. The door moves in then it slides up.

When opening the door, he says he was a 90 percent kind of guy. He can open the door about 90 percent of the time. About 10 percent of the time he had to try a second time. Sometimes the door does not move in the grooves and he had to start over. Mr. King stated he does not want to handle the plane and had always been able to open it on subsequent attempts.

He says he was an 80 percent kind of guy on closing, meaning he can close the door about 80 percent of the time. Sometimes it did not line up quite right and he had opened it again and tries again. The FTEs were more proficient at closing the door so they normally do it. If Mr. King had difficulty more than once or twice he would let the FTE do it, because he does not want to break something and cause a missed flight.

He had never had a problem with the door while flying and had never written up any door issues.

Mr. King said 6002 and 6003 were the airplanes that he flies more often. He feels 6002 had one of the better operating doors; it operated "very nicely." He flew 6002 in Roswell for two weeks and did not recall any issues with the door, although he did not operate the door while there. (He left Roswell the day before the accident)

He had never had a problem with the electric door. He had operated it once and found it very simple to operate. He says he was a 100 percent kind of guy with this door. Normally the FTE operates the door. They have a FTE on every flight including high risk flights.

If he had a problem with a door he would call a technician. He would not attempt to diagnose any door issues himself. He does not want to be the guy who damaged something on the airplane. He does not recall an instance where they needed to postpone a flight for a door issue.

Training on the door operations was given by Jake Howard or Gary Freeman (other pilots). They described then demonstrated the operation. And usually Mr. Howard flew with everyone when it was their first time on the airplane. Mr. King thought Mr. Howard had a training sheet but he was not sure the door was on the training sheet. He also received "B course" training from Flight Safety, but was not sure if doors were covered. He feels hands-on training was the best way to learn door operation. Mr. King's training on the doors was received from other pilots. He did not operate doors from the outside. The training was a demonstration that he observed and then he performed the operation.

When training on the main entry door he operated the door once. The normal operation was the same as emergency operation. Mr. King thought he was shown how to open from the outside but he did not know much about it.

When he was trained on overwing exits it was demonstrated by someone else then he climbed through the exit. He chose not to actually pull the T-handle. Mr. King did not operate the exit from the exterior and does not know how to operate it from there.

Training on the aft cargo door was also a demonstration and observe. He did not get it on the first try. It took a couple of times but now thinks it was fairly intuitive. Mr. King thinks it was easier to do than the legacy aircraft.

He was trained on the electric door, and operated it once. He does not know how to operate it from the outside.

Mr. King had no formal documentation for training. He was not sure if Mr. Howard had something on his formal check sheet but he was not handed anything.

He did not think operating the door was difficult. Mr. King had not been retrained formally but he took the opportunity to look at the exits closer himself after the accident. The first time he flew the airplane after the accident, he made sure he could open and shut the door.

He says the primary emergency egress door was the MED because of proximity to the cockpit and because it was the larger of all the exits. The overwing exits were the primary exits in water. Every scenario was different.

Mr. King says there were no company procedures for designated emergency exits. They do not fly with passengers nor was an interior installed. If flying with a new FTE, that FTE would be briefed on safety procedures. He says it was the Pilot in Command (PIC) responsibility to do that.

He flew with the same people for two weeks so he would not have briefed door operation every time. The FTE's would brief new FTE's on the operation of the door. Mr. King would ask if new FTE's needed a brief. He would get a positive confirmation that everyone had been briefed and the FTE would tell him if there were any problems.

A demonstration show was done in Roswell for the Roswell Fire Department. He thinks Mr. Kent Crenshaw did the briefing in Roswell. He flew with Mr. Crenshaw and knew Mr. Crenshaw could open the door but had not flown with the other 6002 accident crew members.

Mr. King never felt like he would not be able to get off the airplane.

Paul Rothweiler

(Interview conducted November 01, 2011. The interview began at 0933 and ended at 1047.)

Mr. Rothweiler was a Flight Test Engineer and a Designated Engineering Representative (DER). He had been on the Gulfstream 650 program approximately one year.

The primary path of egress for normal operations was the MED. To close the mechanical MED, there was a switch on the upper left hand portion of the door. The stairs would retract into closed, not seated, position. Once the door stops auto retraction, there was a closing and locking lever arm on right side of door. Arm had a release lock on the hand grip. Squeeze the lock, engaging hooks on top. Pull bar down, seating the door in the closed position. Release lock handle, make sure fully released to painted line. Check the bayonets, 2 on the door, to make sure three dots were exposed when fully seated. To open the mechanical MED, squeeze lock and raise lever arm. Release lever arm and lock at same time. Pull door toward self, tiny motion, releases door to fall open. This was the same on 6003 and 6004.

To operate the electric MED, there was a two-position switch located in the same position as the mechanical switch in the other aircraft. It was a rocker switch. Push switch, the door raises and

seats, and the bayonets engage themselves. It's an amazingly stout door in its closed position. To open, push on bottom part of rocker switch. Door raises and opens itself.

The primary paths for egress during emergency conditions were the four overwing exits and the cargo door in the aft of airplane. He would use the MED also depending on conditions.

The overwing exit on 6004, with an interior installed, had a short panel to remove on top part of window. Behind the panel was a t-handle painted red. Pull the handle and window was released. It would fall inward. The overwing exits on other 650 airplanes without the interior have the red t-handle exposed. Same thing, pull handle to release. Overwing exits were marked from outside, he does not recall if they were marked inside.

To open the cargo door, there was a lock center button. Arrow on button would point aft, rotate to point upward and push in. The handle would release and retract toward door, exposing cargo handle on outside of airplane. Rotate handle 90-degrees. The door was counterbalanced and the door would start retracting into fuselage, upwards and inwards. To close the cargo door, grab door overhead, slide down, and push on it to seat it. Turn handle 90-degrees, pull handle toward you to lock. Now, it would be flush on outside. Rotate the center button 90-degrees into lock position.

At least every other flight, Mr. Rothweiler would be the person operating the door. He flies once, if not twice a week, on average. Pilots were typically engaged in cockpit and would radio to an FTE to close the door. Depending on where he was sitting, he may be the FTE to close the door or it may be the other FTE. The FTE closest would operate.

The only difficulty he had encountered with the door was during closing on 6003 and 6004 (mechanical). The closing mechanism was power assist. Part of circuit for the hydraulic lift does not function right if the pins were not aligned. Door would not lift at all when that happens. He had to go down stairs, jiggle handle to align pins, and then retry. He learned of this fix to the problem from talking to other FTEs that experienced a problem for similar reasons. He did not write up or document the error because all it took was to jiggle handle and it would go on. Not a big deal and everyone knew about it. There was not a problem locking and latching the door once it was raised. He had not experienced any difficulty with the electric MED.

Mr. Rothweiler said there was no problem with the MED that he would troubleshoot on his own.

He had only operated the overwing exit and baggage door a few times, and had never experienced a problem with either of them.

Mr. Rothweiler was trained on the operation of the main entry door by another FTE. They went out to the 650 airplane and opened/closed the door several times. He was trained on 6003 by Chris Booth and on 6004 by Mr. Michael Brinley. Both doors were the same. Typically, the lead FTE for the airplane, or Chris Booth, would conduct training. It was hard for Mr. Rothweiler to recall his training with clarity, but he boarded the airplane and the FTE demonstrated and verbally stepped through the process of closing door and the things that occur when you pull the

handle down to lock and final safety checks. Then he was allowed to operate the door. He operated it three or four times until he felt comfortable with the operation. The same process was followed for the overwing exit and baggage door. Mr. Rothweiler operated the overwing exit once and baggage door twice to feel comfortable with their operations. Mr. Rothweiler said this way of training was not consistent for each trainee. No formal training documents were provided to Mr. Rothweiler, all of the training he received was hands on. He feels hands-on was the best way.

Mr. Rothweiler received additional training from Chris Booth since his initial training. After the 6002 accident, he was given specific retraining on all doors and windows. All FTEs were retrained, whether they said they felt comfortable operating the door or not. The difference with the training this time was that everyone had to egress onto wing.

He was not familiar with how to operate either the mechanical or electric MED, or overwing exits, from the outside. He was familiar with how to operate the cargo door from the outside. He had never unlocked the cargo door from the outside, but he had turned the handle to open the door. To open the cargo door, turn the handle and the door retracts into upward position.

If there was a problem with the door, Mr. Rothweiler would tell the pilots. Because the G650 was experimental, it takes a lot to launch one. There were always ground crews at the airplane and he would reach out to mechanic. Depending on what was found to be the problem, either the airplane was not launched or it would be written up to be repaired after flight. This had never happened on any of his flights.

There was a checklist for the FTEs. It contains particulars about the data system and to take data correctly. He thinks there were steps for action in an emergency on the checklist. If there was an unusual incident, direction would come from the front of the airplane.

The MED was the primary egress route; the overwing exit would be secondary. There were no evacuation procedures he knows of, but may be on a checklist. If he needs to get out of the airplane, he just gets out.

Aubrey Edenfield

(Interview conducted November 01, 2011. The interview began at 1058 and ended at 1120.)

Mr. Edenfield was Mechanical Team Lead in the flight test maintenance organization. He had been working on the G650 for about 2 to 2.5 years. He primarily works on the legacy aircraft but does help on the G650 on the weekends on an overtime basis. He had limited experience on the G650; he had done some structural work on 6001, but typically was involved with regular maintenance items, towing, fueling, etc.

Mr. Edenfield stated that he never tried to open or close the main entry door from the inside. From the outside he tried to close the door once but did not know the technique and could not do it so he had another mechanic do it for him. Mr. Edenfield stated that he never tried to open the main entry door from the outside.

Mr. Edenfield stated he never tried to operate an overwing exit, the baggage door, or an electric main entry door. Mr. Edenfield stated he had never been trained in the operation of any of the doors.

Mr. Edenfield had done some work on a baggage door. He replaced a spring reel assembly once and early on he disassembled and then reassembled a worn out baggage door handle for engineering root cause analysis. Mr. Edenfield was not sure if this was documented or not, he was not comfortable with the use of the DRDI system, although he knows how it was supposed to work. He had not worked on any other doors.

Mr. Edenfield described the method that was used to document discrepancies and rework for the aircraft. A DRDI was written in the Solumina system to track problems. The original description was written by QC. Engineering writes the disposition and then ME writes the required steps and test specs as a work order. Then it goes to the mechanics. After the mechanics have completed their work it goes to QC to verify. The DRDI was a permanent record. Mr. Edenfield uses the term "crab" interchangeably with DRDI, as this was what he was used to from the old MRB system.

Mr. Edenfield stated that he did not understand CATIA or Solumina. His primary responsibilities include maintenance, preflight, fueling, towing, etc.

Kevin M Claffy

(Interview conducted November 01, 2011. The interview began at 1239 and ended at 1337.)

Mr. Claffy was a Junior Experimental Test Pilot, had been at Gulfstream since January 2011. He received production training on the G450 and G550. He began working on the G650 in July, 2011. He had about 150 hours in the G650 in approximately 25 flights. Mr. Claffy mostly flies s/n 6001; 6003 and 6005. He had very little experience in 6004.

He explained that the crew egress options in the G650 were the main cabin door, 4 window doors, and the external baggage door.

Mr. Claffy described the mechanical MED operation. The door had a handle that was on the right side. Compress the lever against the main handle and lift handle and the door raises up and out. The door kind of catches on levers, you have to pull the door a little toward you so door releases from levers and swings open.

He said he does not close the door very often. The focus of his training was on the door opening operation. When the door swings closed the handle was in the same position. Bring the handle in toward you.

The only time he closed the door was in initial training. Mr. Claffy had opened the MED a few times to practice since initial training. Normally FTEs open and close the door. When he does open the door the most difficult part was the force needed pushing the red handle and moving it outward. Mr. Claffy feels practiced enough that he could do it.

FTEs have told him there were idiosyncrasies with the MED from airplane to airplane but he could not tell what the differences were. He had been asked by FTEs to practice opening the door, on 6001 and 6003. It was sort of a normal practice.

Mr. Claffy had not operated the electric MED. He had not operated any MED from the outside. He feels comfortable opening the MED and does not have to kneel to open the mechanical MED.

He described the operation of the overwing exits. The red T-handle was exposed. Pull that handle down to unlock the 2 locking mechanisms on top of the window. There were two silver bar handles that you pull toward you, and the window and part of the fuselage (door) comes toward you.

He had never operated an overwing exit from the outside. Mr. Claffy knows there were two access panel doors on outside one each side for each window. He had never opened or seen inside the access panel but was familiar with their locations.

Mr. Claffy said the aft baggage door raises and lowers inside the fuselage on rollers. It had a kind of weighting mechanism or counterbalance. To close it, you push the door down and hold in place, then pull a T-handle towards you, rotate the handle 90 degrees, then the little twist knob goes to the locked position. It was common for the aircrew (pilots) to close the baggage door because it was part of the preflight inspection.

To open baggage door, push in knob in center of T-handle, rotate T-handle then push T-handle forward and raise the door.

He experienced some difficulty operating the MED but only during initial training. The force required to squeeze the handle and move the lever was more than he expected. The trainer suggested kneeling down before operating the lever and he found that this helped. Now that he was used to it he can operate the door without kneeling. He said the baggage door was tricky to close because you have to hold the door against the frame while pulling on the handle. The window exits were relatively easy.

Mr. Claffy had never operated the electric MED.

Mr. Jake Howard provided training on cockpit familiarization, the overwings and baggage door as part of differences training when Mr. Claffy transitioned to the G650. There were printed diagrams or pictures of the door in the differences training provided by Jake Howard. But he feels there was greater value in the hands-on training than any slides or presentation material.

Before he was allowed to fly, a FTE provided initial training on the MED operation. Training on MED was done with demonstration first and then operated the door himself while the FTE watched as he did it. The forces and the releasing of the hooks to allow the door to free fall required a little extra instruction. He opened the door five or six times before he felt comfortable operating the door.

Overwing exit training was also demonstrated then he opened the window three or four times and felt comfortable opening it. He also reinserted the door.

Baggage door training was also demonstrated then he did it. Baggage door was tricky because you have to hold door against frame while pulling on handle. Mr. Claffy was comfortable operating this door after doing it three of four times. He often checks this door as part of his preflight of the aft area when he also checks the smoke vent and other items.

There was no dedicated re-currency training for the doors but some FTEs offer to let him operate the doors and he does this while the other pilot completes the shutdown checklist. The FTE reiterated to pull the door in toward you to release the hooks.

Mr. Claffy had not experienced problems with the door while he was flying or needed to write up a squawk for maintenance. There were a couple times there was a Cockpit Alerting System (CAS) message that did not clear. This message lets the crew know the door was not locked. Sometimes the switches did not make contact and they had to cycle the door to clear the CAS message. The bayonets were in place indicating the door was closed when they had the CAS message. It was a known issue and had already been written up. He would not have flown if they did not clear the CAS message. Mr. Claffy does not know of any flight cancellation because of a door issue.

The MED was the primary emergency egress door. Secondary would be the windows. It would depend on the proximity and availability of the other exits.

Mr. Claffy estimated he could get to the MED from a pilot seat in seconds. It takes one motion to release the seat belts, then you swing one leg over the center console and get out of the cockpit and the MED was right there.

He was concerned that if the NTSB report does not come out soon and share any issues now, then the pilots and FTEs were at risk for an unknown issue that would not be share for a year and a half. This was an unnecessary risk for the pilots and FTEs.

William "Bill" Dobbs

(Interview conducted November 01, 2011. The interview began at 1402 and ended at 1504.)

Mr. Dobbs was an Experimental Test Pilot. He had been working on the G650 program for over 2 years.

Crew egress options under emergency procedures- MED, over-wing exits, cargo door can be used. He does not operate the MED every flight. He operates door the MED every 5 or 6 flights. He operates the baggage door every time he flies which was about 3 times per week.

Operation to open MED was to squeeze red handle, move it up to release locks then door would open. Closing the MED door pushing button for door to come up and reverse order with the hardest part being getting the hooks to latch for the door to come down. Closing the MED was

harder than opening. Have not opened MED from outside, he may have been shown it, but typically it was open.

For the electrical MED door, turn the external battery on push button and it opens up, closing it was push the close button and the door comes up and latches itself. He can open the electric MED from the inside with the emergency batteries.

For overwing exit operation, make sure the 'Remove Before Flight' pins were out. The pins were to prevent inadvertent deployment. The checklist had a step to remove them. Then pull red handle and remove the door out of the way. Mr. Dobbs does not know how to put window exit back in position. From the outside, open cover and pull handle. Had never operated from the outside, but had seen the handle visually.

To close the baggage door, slide down, and push outwards to plug. Turn handle clockwise and pull handle out to lock. To open baggage door, turn lock 90 degrees to right, push with his thumb. Turn handle and lift door. He had not operated the door from the outside but knows how. Push center release to pop out handle and then turn handle.

All doors operate a little differently, if he operates a door and it does not seem smooth, he operates the door again until it was smooth. He never had trouble getting doors closed or opened. FTEs were most familiar with the door; they open and close it most of the time due to checklist process. If there a problem occurs, he would get help from FTE or maintenance. If he could not get MED opened, he would shut down engines and go out baggage door. This had never happened to him and he was not aware of it happening to anyone on the G650. He had not experience any problems with doors during flight test.

He had one electric door not close due to a relay failure. This was during a production G650 flight test after the airplane was cleared for flight. This was found during a checklist walk around. He tested the battery by removing the panel and pushing the button. If the light was green, it was good. He reported to the problem to maintenance person at the airplane. The relay was replaced and the door operated normally.

Training on mechanical MED was demonstration training, show you how to do it then you would do it yourself. Demonstration was done by FTE and it took one or two tries to feel comfortable operating. For electrical MED, he went out to airplane with FTE and the FTE demonstrated with the switch. Mr. Dobbs then operated the switch himself. Someone trained him on the external operation of the electric MED too. He typically does not open externally but would open from external switch if he was the first one there.

He was initially trained on the overwing exits at flight safety at the emergency procedures course for the G450 and G550. He was shown where the exits were on the G650, but did not have a demonstration and had not pulled the handle. He had completed training on the overwing exits for the G450 and G550 which operate the same. He never exited the overwing exit in the G650.

Baggage compartment training was demonstration training and then he actuated. He was comfortable operating the baggage door after one attempt.

Since his initial training, he had not been retrained other visual confirmation or use during flights. If he ever felt uncomfortable with the operation of the doors, he could ask maintenance to let him operate at any time. This training was available whenever he requests it.

Mr. Dobbs received no written training documents or guidance for exits. Jake Howard, the Chief Pilot, had a list of tasks to accomplish during training. Door operation was one of those tasks. Mr. Dobbs signed off he received training.

Mr. Dobbs had not had any occasion to trouble shoot the door before any flight. He does not know of any issues with normal operation of the MED or electric MED doors.

The MED was the primary exit, and then the overwings.

If he finds a problem with door, he would write it on a Gulfstream form called a squawk sheet. The squawk sheet goes to maintenance and then it gets entered into a computer process. Before the next flight, Mr. Dobbs would get briefed by the maintenance technician responsible for airplane on what had been fixed or changed. Then the airplane was ready to fly and he signs for the airplane after the brief. Some things were deferred to be fixed. Anything regarding safety of flight would cause the flight to be canceled.

Mr. Dobbs said there was an evacuation checklist that includes items such as batteries, flaps, cabin depressurization, etc. There was a scenario for everything on the checklists, including ground evacuations. Mr. Dobbs likes to use checklists opposed to his memory.

Mr. Dobbs goes to flight safety at least once a year as a Gulfstream and FAA requirement. The course was 2 days academics and 3 days simulator. There were training scenarios for in-flight and on the ground, including high speed rejected takeoff and ground evacuations.

All crews were briefed before a flight. The briefing includes how the flight would be conducted and abort procedures (i.e., what would happen if abort, who does what during an abort and when they would abort). He said either the FTE or pilots can call for an abort.

Mr. Dobbs feels training was a resource that needs more support. Often there were not enough resources dedicated to training everyone. Mr. Dobbs does not know if the FTEs have a formal program or requirement for training. These airplanes were test airplanes and crews were very casual but take the training very seriously. Airplane configurations change and he had been a test pilot since 1980.

Chris Ghem

(Interview conducted November 01, 2011. The interview began at 1537 and ended at 1703.)

Mr. Ghem was a Mechanical Team Lead for the G650 on 6003. He had been on the G650 program for 2-2.5 years. He worked on 6001 in final assembly line, and then was loaned to flight test in April of 2010. He got hired into Flight Test officially in May 2011.

Mr. Ghem's operational experience with the MED included installation, rigging, and modifications to the door with the door engineering group. His operational experience with the overwing exits was similar, assisting the door engineering group with rigging adjustments. Mr. Ghem's experience with the baggage door consisted of removal and installation a couple times, but not really maintenance work. He had not worked on the electric MED other than opening and closing. He was there when the electric MED was installed, but not really trained. Push the button and it "does its' thing." He had never operated the electric door from the outside and does not know how to do so.

He was not formally trained on operating the mechanical MED, from either the outside or inside. No one had trained on it yet when he began working on it, because it was a new design. He used his general aviation experience and trial/error to train himself initially. Mr. Ghem currently trains others on the MED. He explained it had three switches that could operate the door. One in the cockpit overhead panel, one on the aircraft bulkhead, and one on the service panel on left nose of aircraft. He would then take a person into the aircraft and demonstrate the opening/closing of the door until comfortable to operate of their own. Mr. Ghem would walk the trainee through step by step, then he would demonstrate, and then let them actuate.

To close the MED, push one of the three buttons and the door would rise into opening. Once up into aircraft, there was a main white handle and small red one at fingertips. Squeeze the red and white handle together and move downwards. Door would close into frame. To open, squeeze red and white handle together. With steady pressure, push handle up and door would move out of guides. Door would be hooked on right side, pull back on door slightly to free from hooks. Or the way he does it to free from hooks, with his hand still on handle, he would flick the red handle with the back of his fingers to separate the handle as he pulls door in. There were times where he had pulled on door because it still was hooked. To open from the outside, he demonstrates depressing the secondary handle in the center of the primary handle and pulling the primary handle with steady pressure outward and upward. He had people push the bottom portion of the door with their other hand to help the door so it does not bend the handle.

He was not formally trained on operating the overwing exits, from either the inside or outside. He trained himself by reading the placards. He did not work on the overwing exit on 6001. When he trains someone else on the overwing exit, he shows the trainee the red handle to pull down on to release the two tabs that allow the window to release and free fall into cabin. Grab the window by two handles and pull window up. To operate the overwing from the outside, there was an access panel with three latches. Behind the panel was a handle that was turned to release the window. When he trains others on operating from the outside, he walks through the operations

but does not actively move the handle because there was no one inside the airplane to catch the window.

Mr. Ghem was not trained on operation of the baggage door. He figured out how to operate based on his past experiences. It was simple. He does train others on the operation. He explained to open the baggage door, with the handle fully locked, there was a button in the middle. Rotate the lock button 90 degrees; push in to release t-handle. The handle would collapse and then you turn it. Baggage door would unlock and move upward in tracks. To close the baggage door, move the door down as far as you can push it. While holding door down, rotate t-handle until locking pins engage and pull handle toward you. Once pulled fully, the lock would rotate and pop out into the 'locked' position. Mr. Ghem also operates the baggage door from the outside. To operate the baggage door from outside, insert the key to the airplane into lock. Push the small square button on the handle to unlock. The handle would pop out and turn to open door.

In the beginning of operating 650 doors, there were some problems experienced with the MED. The red handle was too stiff for some people to move. Some people had trouble with force needed to move main handle. The only mechanical problem he knows of was for a lifting pin that was not adequate for the weight of the door. This problem was on 6001 and was fixed prior to the aircraft flying. He performed regular maintenance including lubricating the mechanism, the main handle and keeping guides lubricated on the aircraft side. He used to get a lot of flight squawks the door was difficult to open. This was resolved by taking the pilots and FTEs out to airplane for training on the operation of the MED. It was also resolved by making engineering modifications to help with problems crew had opening door. The last engineering modification done was before 6004 went to NBAA conference in Atlanta a year ago, in September 2010. Mr. Ghem never had a time when he could not get the MED opened or closed.

There was one problem he knew about with the baggage door that was difficult to open. It had a bad handle that needed to get re-worked. That was a long time ago.

Mr. Ghem did not encounter any difficulties with the overwing exits.

He recalls problems reported on a squawk, like a stop out of adjustment slightly. He would fix the adjustment, without engineering to meet rigging procedures in DRDI. To adjust, there were small washers to stack to get the specified gap range. He does not recall any major mechanical problem that would cause the door not to open or close. Squawks stopped coming in regularly about the MED about a year ago. They started really going away after crew was taken into hangar and trained on the door.

If maintenance got a report of a problem with the MED, maintenance would start troubleshooting the problem when the aircraft came back to the floor. Squawks may not get put into the system until the next day, by then; maintenance may have an answer for the problem. Either way, it goes into DRDI. Maintenance would tell engineering what they found and how it was fixed. Engineering may say 'okay' if minor. If major, engineering may give guidelines for items to look at and report findings back before resolution. For any squawk, engineering must buy off before the airplane can fly again. There were times when engineering may not get involved, such as a

rework per blueprint. For example, if an aircraft comes in with tire chords showing. A DRDI would be created for tire and 'rework per blueprint' would be entered by quality. All DRDIs go through quality and they decide to label 'blue print' or send to engineering. All actions to fix a problem were recorded in DRDI. Even if in the field conducting flight tests, a DRDI was generated for review. Mr. Ghem would still brief flight crew on the resolution as well.

If Mr. Ghem were to see a problem reoccurring regularly, he would pull DRDI report for problem and ask quality to issue a new DRDI asking engineering to evaluate the issue. Quality usually issues DRDI into the system. He does not know of a part in the MED that had a reoccurring problem.

Rigging a MED, could take a few minutes or all night. It depends on what was needed to get it back into proper rigging. You may adjust one thing and it affects others in the system. It does not always require a complete re-rig, thought at times it does. Mr. Ghem had not had to do a lot of whole re-riggings. More often than not, it had only taken him a few minutes to re-rig. There was a rigging procedure located in PDocM, Gulfstream's library for engineering documents. Re-rigging a door was a procedure engineering would request be done. A re-rigging procedure would have text for step by step process with diagrams and limits/tolerances. Some procedures include part to replace. Then, Mr. Ghem would go to the blueprint to get part number for the item needing replacement. He did not feel the door needed to be completely re-rigged often, from his experience. Once it was rigged, the door was "pretty well set other than fine tuning here and there."

Overwing exits were interchangeable. Once the exit was rigged, it would physically fit into another exit opening. It would still function but it would not fit exactly right. Mechanics would try not to interchange. If he pulls an overwing exit out of aircraft, he would put tape on the exit indicating which location it came from. Mr. Ghem believes taping or marking an exit was standard practice for maintenance to use if removing an overwing exit. There was a paper document used also, called the removal and installation log. It details the title of component, the part serial number, the date removed, hours and cycle on component, software revision/hardware level, mechanic name that removed, stamp from quality verifying removal and reason for removal.

Mr. Ghem prefers using the 3D model when consulting a drawing, opposed to the 2D drawings. He can get the whole system and a better feel for the part. He can get dimension and the material part was made of. He normally referenced the 3D models to check it meets the blue print.

Jim LeMaster

(Interview conducted November 02, 2011. The interview began at 0804 and ended at 1002.)

Mr. LeMaster was a Senior Aircraft Technician with the flight test department. He had been in flight test for 10 years and on the G650 since the beginning (more than 2 years).

He was shown MED operation very early by Casey English, an engineer from the Door Engineering Group. He had assisted engineering with the rigging and adjustments and some of the measurements they were taking early on.

He explained that to close the door from the inside, turn battery power on the aircraft, and turn the aux hydraulic pump on, and hit the door close switch. When the door comes up to where it was completely closed, squeeze the red handle, then pull the white handle until it was completely closed. Then you turn the aux hydraulic pump off then the battery off, and then you were done. To close from the outside, there was a door-close switch on the front of the aircraft towards the nose. Hit that switch, it automatically turns on the power and pumps and closes the door. Then you push the secondary handle in and pull primary handle down and inboard. Once it closes the hydraulic and electric power was shut off.

To open the door from the inside requires no power. Squeeze the red handle; pull the handle up and outboard all the way. Normally have to pull back on the door just a touch and the door free falls open.

To open from outside, no power was required. Push the secondary handle inboard, pull primary handle out and up, then the door should free fall open.

He had very little experience with the electric MED because he does not work on that airplane. He does not think he had every operated the electric door.

He worked with Casey English with the overwing exits also. Casey showed him how the mechanisms worked. To operate from inside, hold upper handle of window then pull the red T-handle. Window comes inboard and you lift window from frame. For external operation there were two panels in the overwing fairing, open those panels and there was a red handle. You pull it up, it was a rotating handle. If you were the only one there, and you pull the handle the window (exit) would fall in.

He was not trained on the aft baggage door, but he figured it out. It was similar to the legacy airplanes. To open the aft baggage door from the inside it was normally locked, so you have to turn to unlock it and push the button. Handle goes outboard. Turn the handle 90 degrees to release bayonets. Door would come inboard and ride up tracks. To close it, you have to pull it down on the tracks, push the door outboard to make sure it was seated, rotate the T-handle, bring handle inboard.

To open aft baggage from the outside, push the release button and the handle goes outboard. Rotate the handle and the door goes inboard and up.

He was not sure if there was training for new mechanics. They ask new people if they know how to operate doors and if not they show them. He was not sure if he had ever trained anyone.

Early in the program they had a problem with the MED because there was a hook at the top that was designed to catch the door and it was not clearing the structure of the aircraft. It was just one

of the things we had to learn. The door would open just a little bit and you'd have to bring it back, and then try to open it again. Problem was caused by the hook being out of alignment. They've had problems off and on with this. He believes it was a rigging problem but not really sure. It had been fixed now. That was addressed early on. They were determined to fix it since everybody was having an issue with it. Do not know if it was fixed prior to first flight.

Everybody had a problem when they close the door from the inside. But it was an operational thing, squeeze the handle and pull. People have a tendency to release the handle too soon. You have to keep squeezing the handle. If you release the handle too soon it would not latch and you need to open the door all the way again and then close it again. He did not know if opening the door all the way again was necessary but it was always how he had done it. No message was sent to other people to let them know the proper way to close the door and it still happens. It was an issue with Mr. LeMaster because he had a lot of experience on other models that work differently and he did not have a problem with those doors. If you do not do it properly the handle want even come close to coming all the way down but when you do it properly it would come down in one smooth motion.

Early on, they had an issue with overwing exits where the windows were moving in flight and had to pull them to get them instead of them just falling in. Sometimes it would take quite a bit of effort, but they were always able to get them open. They had to give it a good tug not just a wiggle. The edge of the exit was pushed against the skin of the airplane around the opening. Engineering fixed that problem since the accident. They added a for-and-aft adjustment on the bottom and added a plastic stop that contacts before the exit contacts the aircraft skin. The issue was not consistent would vary from window to window; airplane to airplane. But we expect trial and error on a test airplane. Compared to legacy aircraft, the G650 overwing exits were easier to open.

Mr. LeMaster had no problems with the baggage door, and had never operated the electric MED.

Most the time when the crew had a problem it was squawked and it was put into the computer system. Pilots would write it down as a squawk and QC would take it and put it into the DRDI system. A lot of time when things occur on this airplane engineering was contacted since everything was still new. They try to duplicate the problem and engineering comes up with some sort of recommendation that was given as a disposition to address the flight squawk. Maintenance follows the instructions and if everything works then maintenance and QC would sign off. This was all documented in the DRDI system. If the problem was not fixed or another fix was used, engineering would take it again and they would add another line in the DRDI to address the issue. If there was something that needs further recurring inspections, each inspection was logged into DRDI. Engineers were pretty hands on, on this particular program.

When Mr. LeMaster was trained on the MED, Casey operated the door and showed him and told him what he was doing. He stepped back and Mr. LeMaster operated it a few times until he got the hang of it. It took 5 or 6 times of operating the door before he felt comfortable. He operated the door from both inside and outside.

Training on the overwing exits used the same basic method Casey demonstrated to him. Mr. LeMaster took over and operated the exit himself. He operated the exits just a couple of times before he felt comfortable with it and found it pretty simple. He thinks that they just operated it from the inside. He was familiar with the exterior operation of overwing exits on the GV and GIV, which were very similar, so he did not ask to operate it from the outside.

Mr. LeMaster was not trained on the aft cargo door but the operation was similar to legacy aircraft.

Problems with doors were addressed differently depending on the situation. They would get engineers out to the test pad wherever they need to be. Everything must clear through the paperwork system. It would clear before they release the aircraft. If it was something that they have an established procedure for, engineering may not get called, maintenance would follow the procedure but still create a DRDI. Once maintenance signs off, then Quality Control (QC) would have to sign off the work. Everything was documented in DRDI.

He had helped engineering to rig a door a little bit but not a whole lot. He had not stepped through the whole rigging process. When he had helped with rigging, a DRDI was done for the rigging but he was not sure if there was any other documents use, such as drawings. He does not think they have had to re-rig doors lately. He thinks most problems were just part of the learning curve and the door had now found 'its happy spot.'

He said that overwing exits were rigged to a particular position. If an overwing exit was rigged and was taken out, it could go into another location but the exit would need to be re-rigged. He assumes the exit can be put in another position but he had never tried it. The exit and the airplane side were both rigged so they do not move exits around. If an exit was removed, mechanics typically use tape to mark the location it goes into. He was not sure if it was a requirement but this was normal mechanic practice that they do even on the older models. The tape was removed when the exit was reinstalled. He was not sure if the exits were serialized.

To rig an overwing exit, they rig the stops, and adjust the fore and aft adjustment. They also adjust the exit inboard and outboard, and shimming up and down. There were also adjustment tabs at the top.

The 3D drawings took getting used to but he likes it because he can check any measurement and see each part, stack up, and orientation. It was a very handy tool.

Once they release an airplane to flight, it was ready to go. He estimates that maybe five percent had been stopped due to general maintenance issues, and that number may be high. The only issue he can remember was they had a baggage door handle that came off in someone's hand.

He thinks the handle location on the G650 MED was in an odd spot. It seems to be kind of hidden compared to legacy aircraft. He was used to it being on the door right in front.

Paul Donovan

(Interview conducted November 02, 2011. The interview began at 1004 and ended at 1052.)

Mr. Donovan was a Flight Test Engineer on G650. He had been at Gulfstream for 10 years and had worked on the G650 for more than 2 years with G650 being his full time job for the past year. His primary job was field performance testing on the G650 and he did the field performance of the G450 and the G550. Mr. Donovan mostly flew on 6002 and rotated home the day before the accident. He works field performance so he had only flown one time since the accident.

Mr. Donovan described his egress options as the main entry door and the overwing exits, with the baggage door available as a last resort.

Mr. Donovan describes the closing of the main entry door as follows: First you swear a lot, and then you hit the switch for the door to come up. When the door closes you grab the handle on right side at the top, squeeze it together and pull it down. At the end of its movement you jiggle it a little to make sure the CAS message was extinguished. This process was the same for all MEDs but there were idiosyncrasies. For opening the door he states he had not done it in a while but from what he remembers you squeeze the handle and then lift it up. You pull the door in a little to release it and then it opens out. Mr. Donovan stated he never operated the door from the outside. Usually the door was already opened when he gets to the airplane.

On the overwing exits Mr. Donovan explains that you pull the handle to release the clips and you have to grab the exit handles, the exit falls into the cabin and then you push it out of the way. Mr. Donovan had not reinstalled the overwing exit. Usually maintenance was there and they were responsible for reinstalling. He had not opened one from the outside on a G650 but had on a legacy aircraft and understands that the action was the same. They do not open the overwing exit for ventilation when they were parked outside for a long period of time.

Mr. Donovan had not operated a baggage door in over a year and cannot remember enough of the operation to describe it.

Mr. Donovan describes any difficulties he had had on the main entry door. The only difficulty he had was having a tough time closing the door on the first few flights. He stated that you had to remember to squeeze the red handle or you would have a hard time getting it to go all the way down to close door on 6001 and 6002. He had to try several times to close it the first time. He stated that it took 10 to 12 times to get a feel for it and become familiar. To open the door, it was the same way as closing. That's where the cursing comes in. If you do not get the handle right, sometimes the door would not open. You have to squeeze the red handle to the white handle; and if not, the handle would not move to open the door. When asked in more detail about operating to become proficient he stated that it took 6 to 7 times to become proficient. He also stated that one time in the beginning he had to get someone else to open it but once he began operating it regularly he had no more issues with it. He followed on to say that he was always able to get the door open and it was easier to open for him than it was to close. He had to see it done and know what to watch for to get it to open correctly. He only struggled and needed help when he was

initially shown how to do it. He mentioned that it was a different operation than the legacy aircraft handles that were not squeeze handles, he did not have difficulty with the handle on legacy airplanes.

He cannot remember ever having to write up a mechanical problem with the door.

Mr. Donovan stated that he was trained on the mechanical main entry door prior to his first G650 flight. Everyone was required to be trained before their first flight. Another experienced flight test engineer demonstrated it, explains what happens in each step and what the correct order was. Then you perform it as many times as you wanted to. He states he operated it until he felt comfortable but did not remember the exact number of times. He did not remember being trained to operate the door from the outside, and had never closed or opened the outside.

The overwing exit training was the same way, with a demonstration, explanation, and then hands-on until you felt comfortable. The training also included removing the exit and an egress through the opening. They did not attempt to remove each of the overwing exits, just one of them. He thought it was probably because it was the most accessible. The method for opening the overwing exits from the outside was explained and the locations were pointed out but they did not operate it from the outside. It was understood to be the same operation as the legacy aircraft.

The baggage door training was done the same way but he did not remember the details. He knows he was given an explanation and a demo and he was able to operate it. He does not remember being shown how to operate the baggage door from the outside.

All the training he received was hands-on. He does not remember being given any training documents. There was an informal training spreadsheet that was used to document who had been trained and when. This was only to document FTE training. He did not sign anything to show training was received. The person conducting the training would note who did it and when it was completed. Mr. Donovan kept the spreadsheet up himself for a time and now thought Kurt kept up with it. The flight test engineer training was separate from the pilots.

After the 6002 accident he had operated some of the overwing exits to get familiar again. This was not formal training, just him practicing. He thinks his group was going to be re-trained on doors before flying again, but he had not completed it yet. Also, since the accident, all flying FTEs retook the Flight Safety cabin safety course. This course includes training on generic operation of exits, egress, dark, smoke, hypoxia, water survival, etc.

Mr. Donovan described that in normal operations he only ever used the main entry door. In emergency conditions he would use the main entry door as his primary egress and then the overwings but this would depend on the situation and what he needed. He was not aware of any written procedures for evacuation. Nothing formal that he was required to do for evacuation that he knows of.

When asked what station Mr. Donovan sat at on test flights, he said he typically sat in the right hand first FTE station on 6002 and others. He said he had flown with the accident crew, and when asked if he thought the crew was proficient in opening the MED, he said he was not sure.

Craigrey Tripp

(Interview conducted November 02, 2011. The interview began at 1236 and ended at 1404.)

Mr. Tripp was a Senior Technical Aircraft Mechanic. He had worked on the G650 program since January 2010 and had been with Gulfstream 6 years.

Mr. Tripp works on mechanical and electric doors with engineering. He had done a lot of taking the stairs off and on for pressurization checks. He had put some rigging on stops and adjusted some guides for the door. He had completed these tasks for both the mechanical and electric MED. He also had shown some people how to open and close the electric MED from inside and outside of the aircraft.

Mr. Tripp experience with overwing exits had been on 6005 since the accident. He had readjusted the overwing exits on 6005 since Roswell, adjustments to stops, the t-handle and upper sliders.

He had not done any adjustment with the baggage door, mainly just opens and closes it from the inside and outside.

The first time he tried to open the door on 6002, they could not open it. It was a technique issue on opening the door. He had to stand square with door to get really underneath. He had to use his knees, took a good bit of effort. He knew that many people could not open three or four times out of five. After learning process occurred, he could open it every time. Some instances it was more or less difficult, such as on jacks, with different ballasts or fuel loads. The same thing occurred with overwing exits. Adjustments made to the MED occurred in beginning, and an adjustment was made to the MED before the trip to Roswell in November 2010. He does not recall any adjustments during this trip.

When in Roswell during the November flight tests, it was difficult for him to reach the handle and lift to stop without stool. He could not get muscle behind it and had to push up on door to get it opened without stool. It was a height issue for him not being able to get the door open, but there were no mechanical problems.

There were no overwing exit issues he experienced personally. He knows of the jamming issue, but had not seen the issue himself. Adjustments were made for a better fit; he assisted in putting serrated plates on the over-wing exits to help with the jamming problem for the exit. The exit went through numerous re-riggings to get it correct. They re-rigged it 3 times; it would be just out of tolerance with fuel or off jacks. This was done post accident in Roswell.

Baggage doors have had no problems and he had not messed with them much.

Mr. Tripp was trained on the MED by a co-worker in the maintenance department. He was taken into the airplane, shown how to close. He grabbed the handle and pushed in, then opened again. He was shown how to open and closed the door twice. Then he did it. He could not open the first time, he had trouble with sequence. He just went up and pushed handle forward without squeezing. It took him 3 to 5 times to feel comfortable doing it. There was no trouble closing from inside. He was also shown how to open the door from the outside. It was hard to open due to his height; he was 5-foot 7-inches. He was not sure if he was able to open it the first time but did so until he was able to open and close.

He did not receive formal training on the overwing exits on the G650. He had operated other overwing exits from legacy aircraft at the service center. Interface with the T-handle and regular handle behind panel outside was identical on legacy aircraft. He would only operate the overwing exit from the outside in the event on an emergency because it would fall into the cabin and hit the floor. He had only operated the window for maintenance with engineering and for ventilation reasons because it was warm in the cabin.

Buster showed Mr. Tripp how to close the baggage door from the outside. He cannot remember if he was shown from inside how to open baggage door. For a hull check, he opens and closes the baggage from the outside. He closed the MED from the inside and crawled out the baggage door, then closed it from outside behind him. No other training guidance was given to him.

The mechanical door was opened from the inside by squaring off, with handle on the right side. The red lever was squeezed on the door until you hear a click. Push the handle up and away from you. Physically pull in on the door, the latch drops and door falls open. To close from the inside, turn the main battery on and make sure the safety was off. Toggle the switch and let door come up. Once at top, steady it and grab handle. Squeeze and pull down. Once down see that the red handle releases fully.

To open mechanical MED door from the outside, push the secondary handle in and grab the main part of the door handle. Pull out and push up above head. Once handle comes to stop, door opens. To close mechanical MED from outside, make sure the safety not on inside. Come out of aircraft and open switch panel on left nose to access the external battery switch. Turn on battery and hit MED close switch. Door comes up and hits stops. Push the secondary handle in and bring down main part of door handle.

To close the electric MED from the inside, make sure the safety was off. Turn main battery on and hit toggle switch. Door comes up into detent position. Turn the battery off. To open, hit the ‘open’ button by the door, door comes up and drops open.

To close the electric MED from the outside, make sure the door safety was off. Open the access panel on the left side of nose. Turn the power on and hit door ‘close’ toggle. Door comes up and closes. Turn off the external battery. To open from the outside, Mr. Tripp could not remember if the ship battery needs to be on. But you would hit ‘open’ on the toggle in the same access panel and door opens.

To open the overwing exit from the inside, hold onto exit and pull down T-handle. The door drops down by gravity. Pick up and put where you need to. He reinstalled the window while engineering was present and explained everything to him. To open from the outside, pull handle under three push-button panel to open. He went through rigging process on exterior handle, he pulled the handle to make sure the force required to pull was not higher than the value in the rigging specification.

To close the baggage door from the inside, it automatically puts feet onto floor. Push down and rotate handle. Pull handle out and lock would go into the lock position. To open the door from the inside, unlock by pushing button in. T-handle moves out and rotates to left. Door springs open and it was cable driven up.

To close the baggage door from the outside, reach up and grab door to where it starts to engage. Pull hard toward you. As it contacts the fuselage, turn the handle. Once in position, push handle into door to lock in position. Handle moves flush with the door. To open from outside, push the lever button and handle pops out. Rotate the handle and spring moves it in; and then push up.

He was not aware of any door problems on the G650 during flight tests, or knows of any reports on squawks. He had only heard about issues of the overwing exits jamming.

If there was a problem with the doors, he would get it from the aircraft squawk sheet from a pilot or FTE. This sheet then goes to inspector and it was put into the system. It then goes to engineering and they look at the problem to get a fix. It goes to QC and then to the ME, who writes a work order off of what engineering put in. Then it comes to him on the maintenance floor. He does not get involved much in the process, only when the work order reaches him. The work he completes had to be completed step by step. If multiple steps, he cannot move ahead on work order until step was QC'd. All of this information was included in work order. All problems go through QC and this process. In the field, any problem there was during testing had to go to QC for the process. In the field there were people from maintenance, avionics, QC, flight ops and shift leads. Any reports from pilots have to go thru QC and then engineering. There would be nothing he would do on airplane without orders or documentation.

Mr. Tripp had not completed a full rigging of an MED. If helping with rigging, he followed DI in system and uses the rigging procedure. He had an engineer with him. Even with engineer next to him, there would be documentation. They used the riggings specification. He made rigging adjustment on 6005 electric door once. He changed the door guide and shim adjustments before he went to Roswell. He also observed 6001 or 6002 getting rigging work in October or November of 2010. Saw maintenance and engineering rig the mechanical door, but he did not observe the whole thing.

Overwing exits were absolutely not interchangeable. You must always put the same exit in the same location. He was not sure if they were the same size, but interchanging them would throw off steps and gaps. If he pulls one out, the window would get marked and tagged for a specific location. Each window gets an aircraft number and location, and part number for the R and I log. Every aircraft component he pulls out must go into the R and I log. If he takes it out, he was not

sure if it was required but he would put it into the R and I log. If an FTE pull out a window, it would need to go into R and I, even if just to open for ventilation.

Mr. Tripp works with the 3D cad program weekly or almost daily. It was an amazing tool. Get measurements and part numbers from these drawings.

Mr. Tripp had concerns about the electric MED. He did not know how he feels relying on a push button and battery to open door. He likes the mechanic interface of the handle with the door.

Peter Anthony Swiderski

(Interview conducted November 02, 2011. The interview began at 1411 and ended at 1447.)

Mr. Swiderski was a Flight Test Engineer contractor. He had worked on the G650 program about 2 years, starting in January 2010. He flew on 6002 and now flies on 6003. He averages flying once every couple months. As a contractor, he flies and then writes reports for the test he conducted. His last flight was on 6003 a week prior to this interview.

Crew egress options during an emergency include the MED, four overwing exits and the baggage door. To close the MED, there was a switch on the upper left to press for the door to come up. When it was up almost all the way, pull the top of door in. Pull the handle down and squeeze while pulling all way down. There were indications on the left and right side of the door that show three dots, like dominos. To open the MED, squeeze and push the handle up. Pull the door in a little because sometimes it sticks, and the door falls out. Mr. Swiderski had never opened or closed the MED from outside and does not know how.

To open the overwing exit, there was a red t-handle to pull down. The window releases. Pull the window in and push off to the side. To close, put the overwing exit up and push t-handle back in. Mr. Swiderski had not operated the overwing exits from outside and does not know how.

Mr. Swiderski did not remember how to open the baggage door in back, he had not used it. To open, he thinks there was a button in the middle of the handle. Turn handle and pull in door, door would come up. To close, pull down and turn handle. Button latches itself. He really cannot remember.

Mr. Swiderski experienced difficulty opening and closing the MED the first time he operated it, he got it on the second or third try. Need to know how to pull in the door, if not, the door just stays there. Pulling on the door was a step for opening or closing. Other than this learning curve to open and close, he did not have any other problems with door. He had never reported a problem with the door to the flight crew for a squawk.

He received training and guidance for the main entry door at Flight Safety. He had to step through windows in a generic aircraft body there. Then, Mr. Swiderski was brought to the G650 and given an opportunity to open/close the door and go through the overwing exit. An FTE, maybe Chris Booth, provided the training for a group of five or six on the G650. He demonstrated the operation first and each person had to open/close the door. He could do it as

many times as he wanted, but each person had to operate the door at least once successfully. If someone wanted to see the demonstration again before attempting, the FTE would do it again. It took him just once to operate the MED successfully; he chose not to continue to practice. Each person also had to open the window and step through. It took Mr. Swiderski one attempt to operate the overwing exit successfully. The only thing was you have to watch your step when you step over onto wing, but it was not difficult. He could not remember if he was trained on the baggage door at that time.

He was not given any additional training guidance for door operation, but Mr. Swiderski could go on-line on the internal Gulfstream site and look it up in the manual on his own. It was an airplane flight manual (AFM) type manual. He was offered training since his initial training, to go out to the G650 to get re-trained. Mr. Swiderski decided not to take the training because he knew how to open the doors.

There was no circumstance he would try to troubleshoot a door problem.

Mr. Swiderski usually sits at the back-left station; usually the person closest to the door operates it. But Mr. Swiderski said he had operated, it as well.

He was trained in emergency operation procedures at Flight Safety. There, he was trained to put out fire, did water training, and other areas he does not recall. For the G650, crew may provide emergency information to him during taxi. He does not recall though. He does not know of any tasks he had, specifically. As crew, whoever gets to the door first opens it.

Training on doors was part of the training on all emergency equipment given by an FTE without formal training materials. This training includes where the axe was located, the life rafts, the portable fire extinguishers, etc. He does not know if there were training records, or who keeps them. He would guess the secretary might keep track of training.

The MED was the primary emergency egress, then the overwings and last would be baggage but would have to access the scenario when selecting. Mr. Swiderski estimated, from his position in the aft left station, it would take him approximately four to seven seconds, including unbuckling and getting forward, to get to the MED.

Mr. Swiderski was not aware of any documentation for established evacuation procedures. Does not remember any procedures, but there may be.