**NATIONAL TRANSPORTATION SAFETY BOARD**

Office of Aviation Safety
Washington, D.C. 20594

August 8, 2012

# AIRWORTHINESS

## Group Chairman's Factual Report

## WPR11MA454

Attachment 1 – Interview summaries
(25 pages)

November 14, 2011
12:00 pm

Interviewee: Erik L. Hokuf, FAA A&P IA [redacted]
Witness: Gregory J. Reigel, Esq.

NTSB: Clint Crookshanks, Josh Cawthra
No other parties present

DESIGN
Can you give a brief history of the airframe and the modifications?
Got involved in august 2009, when airp lane was al most finished, jimm y needed help getting it finished, started ion McKi nney, com ing on as helper, becam e crew chief for 2010, 2011. Airframe mods were done when he arrived, need ed help w ith final assem bly, was in 2 pieces when he started

Can you give a history of the engine modifications and the performance increases?
Don't know

Were there any offset angles on the engine installation?
Don't know

How was the engine mounted? What were the mounts made of?
Mounts were in stock configuration but were hard mounts. Machined m etal adapter that is the same dimensions as the original rubber

What was the inlet duct made from?
Composite, leading edge is metal

Was the induction trunk solid? Was the induction inlet modified?
Same as above

What was the intake ram air pressure?
Don't know

What was done to the engine before the races this year?
Don't know

To what level (RPM, MP, etc.) was the new engine tested?
Don't know

Was the accident flight the hardest the engine had been run?
In Minden and during qualifying the airplane was run at race power

What was the wing incidence on the airplane?

Wing incidence to fuselage was stock

What was the vertical stabilizer incidence on the airplane?
Not sure where it was but it wasn't stock

Where and how were the wings clipped on the airplane? Did it affect the pitch trim?
Not sure of the station, don't know

Were the wing airfoils changed?
Stock airfoil

What was the MAC?
Don't know

Were the ailerons stock with the exception of length?
With exception of length they were stock

What was the rigging of the ailerons (cable tension, range of travel, etc.)?
Should be stock, set to the farthest travel on the stock bell crank, on e of three choices

How was aileron trim accomplished?
Left side trim tab, electric trim on this airplane, autopilot servo in wing under fuselage

How was the roll response of the airplane with the shorter ailerons?
Don't know

How was the rudder control system set up? Was there a bungee installed?
All stock other than the rudder tab had been removed, done for sa fety before he w as involved.
No trim bungee.

What was the rigging of the rudder (cable tension, range of travel, etc.)?
All stock

How was rudder trim accomplished?
None

How was the flight control system balanced?
All balanced neutral

Were any of the primary or secondary control surfaces replaced during 2009 re-build?
Was all there when he arrived

Were there any modifications to the flaps or to their installation?
The flaps had a direct control from the handle in the cockpit to th e control valve. Originally the airplane had detents, Now the airplane had infin itely selectable flaps. As far as he knows the trailing edge was at stock location

Was the flap rigging any different from the stock airplane?
No difference

Was the fuselage skin replaced during 2009 re-build ? If so, was a different g auge than orig inal used?
Doesn't know, everything was painted when he got involved

Was there a flight test program perform ed a fter the airplane was built? Any profile data including speeds, power settings (RPM, manifold pressure, prop, G's)?
Doesn't know of a flight test program, that was Jimmy's area, maybe other racers would know.

Was the aircraft ever flown to Vne?
Don't know, never since he has been involved

Was any low or high speed stability testing done?
Don't know

Were any stall tests performed?
Don't know

Which propeller was installed on the airplane?
Hamilton standard stock mustang, cuffed prop. First flown with aero products prop

What fuel boost pump was installed on the airplane (F-86 or P-51)?
Stock mustang boost pump as far as he knows

What was the fuel boost pump setting?
Don't know

What engine fuel pump was installed?
Don't know

What was the engine fuel pump setting?
Don't know

What size was the fuel line from the boost pump to engine fuel pump?
1" line

What was the size of the fuel shut off valve?
1" valve

Where were the fuel tank vents located?
Fuel was in right wing stock tank and tank extensions in a mmo bays. Left held ADI, sam e capacity left and right

What is the operational fuel pressure at race power?
Don't know

Was the airplane ever test flown at race speeds?
Jimmy pushed up power during Minden testing.

What, if any, modifications were performed after the 2009 build?
The one modification is that the fuel and water quantity indications were put in cockpit. Added float type system that was more compatible with ADI fluid going to digital indication in cockpit.

Where and how was the boil off cooling system installed in the airplane? Drawings? Airframe modifications?
Boilers were installed on stock shelf behind pilot seat where fuselage fuel tank sat. doesn't know about drawings and analysis.

What are the weights/dimensions of the boil off system components?
When both were filled there was 25 gallons of ADI fluid. Any more than 25 gallons would overflow on engine start up.

What are the fluid capacities for the main radiator/boiler and the oil radiator/boiler?
Don't know

Was the floor for the boiler original or modified? Any photos?
Shelf was extended forward but in stock location.

What was the boiler cycle rate vs. power setting?
Don't know

How was the scoop removed from the airplane?
The parts were removed from stiletto for the scoop removal, all done before he got involved

Where were the batteries installed? How many and weight?
Two batteries installed (12V) in aft hell hole.

Was there any equipment installed in the hell hole area?
Batteries and 12V DeWalt battery for telemetry system.

Drawings of modifications
Aerodynamic loads
Structural calculations
Engineering data
Doesn't know

THE 2011 RACES/ACCIDENT FLIGHT
What was the qualifying speed for the airplane this year? RPM and manifold pressure?

Don't recall 465 mph lap speed he thinks

What was done to rectify the squawk for elevator trim tab screws too short?
The right elevator tab has screw head up. He stood with Mark Moodie and remembers looking at right tab, th ere was m ovement in the joint. Re moved screw and reinstalle d in correct position. Absolutely positive that the right side was the issue.

Was the aircraft ever re-inspected by the tech inspectors?
Is not aware of any re-inspec tion. Not aware of any process to insp ect for compliance with squawks

Do you recall looking at the left trim tab screws?
Did not look at left side because it wasn't squawked.

Who did pre-flight on airplane prior to accident?
Jimmy would have done pre-flight

Was anything different in the set up for the accident flight?
Nothing different

Do you recall any issues with the airplane?
Had nothing to do day before race since there was nothing wrong with the airplane

How many flights have been performed with the airplane in this configuration?
Airplane was essentially the same since 2009 build

Is there any telemetry or other data from the previous flights this year or last?
Should be with family

What, if anything, did the crew do to the airp lane from the tim e it arrived in Ren o until the accident flight?
He put seal on front engine cowling, Rick did some engine work.
Some work was done to tighten up free-play in control tabs in Minden prior to com ing to Reno.
He didn't perform the tab work. All tabs were done. Bo Case would have done that.

The data shows a drop in engine parameters about 8 seconds prior to the upset. Do you recall the reason for this? Any thoughts on why it occurred? Did the crew instruct the pilot to do this?
No instructions from crew. Doesn't recall seeing data.

PITCH CONTROL AND TRIM
What was the horizontal stabilizer incidence on the airplane? Was it changed?
Don't know. Told it wasn't changed from previous racing.
- Why and how much?
- How was it set? Washers? Level?
- Any data or calculations?

Who would have the data?
Who made the calculations?

What was the horizontal stabilizer span? Shorter or longer than stock?
The tips had been removed and square cover installed at close out.

Was the horizontal stabilizer airfoil changed?
Doesn't think so.

Can you explain the elevator and trim system on the airplane?
Elevator tips were rem oved but everything else was st ock. Some of the we ight had been taken off bob weight.

What was the rigging of the elevators (cable tension, range of travel, etc.)?
All stock from his knowledge

Were there any modifications to the pitch control system on the airplane?
Don't know

Were there any modifications that were near the pitch control system or that could interfere with the pitch control (ie. cooling system)?
There was a fair lead to prevent the possibility of elevator cable rubbing on the coolant tubes.

Where could parts or pieces be close enough to worry about binding in the pitch con trol or pitch trim system?

Where is the elevator trim tab servo located on the airplane?
Servo was attached to horizontal stabilizer on tip surface in the center under fairing.

Why was the right elevator trim tab fixed in place?
Don't know, done before he got there.

How was it disabled/fixed in place?
Machined aluminum rod attached to location of jackscrew.

Any photos of the elevator trim system?
Doesn't have any

Are the elevator trim tabs original equipment? If not, how were they modified and why?
Stock metal tabs

How were the elevators balanced (neutral, over, or under)?
Balanced neutral

Was the elevator bob weight still installed? Or was it removed and/or modified? How?

There was a bob weight. Some material had been removed but was done before he joined team.

What is the original weight of the bob weight?
Don't know

What were the stick forces at race speed? Straight and level? In a turn? Any data?
Don't know

Do you have stick force/G data?
There should be some tech orders for stock airplane. He has some of the tech orders.

Is there or should there be stick force and/or elevator trim tab deflection at race speed?
Don't know. In Minden they did some tab testing. Jimmy ran airplane up to full power, set trim , and landed without changing trim. He was told trim was good.

Was the trim set to have the elevator or tab neutral at cruise speed?
Don't know

What was the full travel of the trim tab, from takeoff speed to race speed?
Don't know

Were there any aero load calculations or measurements for the elevator trim tabs?
Not aware of any

Load on one working tab?
Load on pinned tab?

Were there any structural load calculations or measurements for the elevator trim tabs?
Not aware of any

What were the push rod loads? On servo unit? On pinned side?
Don't know

Was there any mention of any pitch sensitivity issues?
Never mentioned to him

Have you heard the term "digging in"? What does it mean?
Pilot manual tells of controls becoming sensitive above 350 m ph. Never heard of anything like this from Jimmy.

TAIL WHEEL
Is the tail wheel assembly original equipment or modified?
All original stock

Why/how could the tail wheel doors be partially open?

Doors are connected with links to tail wheel. If there is play th e doors could be open. Not aware of any problems with the links. Or if the gear handle is not all the way up.

How was the tail wheel rigged?
All stock

How could it deploy during the pitch-up maneuver?
The only w ay he know s it could happen is if the hook wasn't hooked all the way if handle was not all the way in up position. Stock uplock was still installed

Are any of the tail w heel doo r linkages clo se to the p itch control or p itch trim system components? Close to the modified areas?
All of the controls were stock

CG
What is the weight and balance? Empty and Full? Where was the CG? When was it performed?
Performed in Minden

Was the CG set to achieve a trim objective?
None

How did the CG change during the flight?
Go from full to empty

How did the CG change from the first flight to the race?
Pre-oiler pump was added after the 2009 weighing. Doesn't know if it was installed for race.

What were the quantities and locations of consumables (fuel, oil, water, ADI) on the airplane?
Oil was minimal, 50/50 water/alcohol mix

What should the coolant level have been at the time of the upset?
Don't know

What are the coolant boil-off and fuel burn rates?
Comes from data

Did you put any weight in the airplane to move the CG?
Not that he is aware of.

FLUTTER
Were there any reported vibrations (even minor)?
There was a prop dynam ic balance done in Minden prior to races. After balan cing Jimmy still felt a vibration. Prop was re-balanced with sensor in correct position and it was fixed.

Is there a history of flutter with this airframe?
Not aware of any with this airplan e. There was a vibration in one of the races that he heard about, the cause was a screw on governor prior to it being the Ghost.

Not aware of any vibration on this airplane. Does n't recall ever seeing a P-51 com e back with a missing screw.

AIRFRAME/STRUCTURE DURABILITY
How many hours per year was this airplane flown?
Don't know

Are you aware of any known areas of wear?
Wing leading edges where gear attaches will have wear during racing.

What areas required preventative maintenance or continuing airworthiness type inspections?
Doesn't know of any

MISCELLANEOUS
Who else flew this airplane?
To his knowledge only Jimmy flew it.

Did Mr. Leeward wear any kind of G-suit during racing?
No.

What type of oxygen system was used?
Portable bottle in cockpit

Was Mr. Leeward using diluter demand or 100% oxygen?
100% oxygen

What type of seat and seat rails were installed in the airplane?
No height adjustment, fixed in place, stock seat.

Where and how was the shoulder harness attached?
Manual locking shoulder harnesses. Inertia reel was attached to back of seat.

Was there a manual locking mechanism for the shoulder harness or an automatic inertial reel?

What was the temperature in the cockpit?
Warm in cockpit, had a cool suit system.

What was cockpit pressure and fuselage pressure?
Not aware of any

What was used for the steam vent lines?
Hi-temp skeet double wall tubing (red)

How was the boiler isolated from the cockpit?
Firewall between boiler and cockpit. Boiler compartment was air tight. No way for boiler vapors to get into cockpit.

What was the hydraulic pressure in the system?
Stock

Are you familiar with the shear wrinkling on the right fuselage? Is this common?
Never seen it before on this airplane.

What speed were you shooting for or expecting during the 2011 races?
They wanted to go 1 mph faster than second place airplane. The idea was to go fast on less power.

Who does the engineering and performance work? Any drawings/logbooks/calculations for modifications?
Don't know

Where was the RCATS system mounted?
Behind access panel aft of cockpit on left side of airplane. Panel was added for system. Transmitter was located in same place, one on top of the other.

Where was the RACTS receiving station located?
Located in the pits at their man-lift. Had never raced against Voodoo before.

ANALYSIS
What do you think caused the upset?
Can't remember hearing or seeing anything.

Did you see anything unusual prior to the accident? Any cause for concern?
Nothing

Everything seemed normal with Jimmy before the races. Didn't have any complaints.

November 15, 2011
1:30 pm

Interviewee: Rick Shanholtzer, A&P [redacted]
Witness: Gene Bland

NTSB: Clint Crookshanks, Josh Cawthra
No other parties present

Started at Zeuchal racing engines in high school in 1978, worked way up to rebuilding, took over shop when he was killed, bought shop from widow in late 80's, moved shop to McKinney in 1991. Frontier Aviation, rebuild liquid cooled V-12 engines mainly merlins and griffons

DESIGN
Can you give a brief history of the airframe and the modifications?
Involved with the accident airplane in 1978 when airplane was going from Miss Candace (Cliff Cummings) to Genie (Dave Zeuchal sold it to Wiley Sanders who named it Genie). At this time the outer wing panels were removed (standard clip) and had small canopy and the horizontal stab caps were removed. Raced as Genie 1979-1982 by Wiley Sanders. Jimmy got it before 1983 races. Wing was clipped shorter at this point. Raced as Specter, Leeward Air Ranch Special. Raced it 1983-1988 he thinks before it was parked. His involvement stopped once Jimmy bought the airplane. Got back involved in 2005 when Jimmy decided to try to get it running again. Had fiberglass scoop installed after belly landing in 1980. Scoop was removed altogether when it became the Ghost. Canopy was changed by Jimmy when rule change requiring helmets came into being. Canopy and turtle deck above longerons was taken from "Somethin Else". All the structure covering scoop area came from Stiletto. Rudder trim was removed after 2005.

Can you give a history of the engine modifications and the performance increases?
Packard built -9A engine (originally built for later P-51D and H models). Top end was Rolls Royce. Blower clearances were tightened up, different piston (Rousch) and rings, oil pump was modified to be higher capacity.

Were there any offset angles on the engine installation?
Don't know

How was the engine mounted? What were the mounts made of?
Rubber was removed from stock mount and replaced aluminum.

What was the inlet duct made from?
Front of inlet duct was stock, carbon fiber for the rest all the way back to the carburator

Was the induction trunk solid? Was the induction inlet modified?
Same dimensions as stock ducting

What was the intake ram air pressure?
Don't know

What was done to the engine before the races this year?
Before each race, new plugs get installed, added some oil. Sometimes they will re-torque heads between races. Heads were not re-torqued after qualifying on Tuesday

To what level (RPM, MP, etc.) was the new engine tested?
Doesn't know how many test flights were done between last year and this year. Engine had probably 9 hours since the top end was removed for inspection.

Was the accident flight the hardest the engine had been run?
No. Was doing test flights week before races at Minden and he thinks one of the test flights they pushed it to 3800 RPM.

What was the wing incidence on the airplane?
Stock

What was the vertical stabilizer incidence on the airplane?
Zero degree offset.

Where and how were the wings clipped on the airplane? Did it affect the pitch trim?
Don't know. Clipped to outboard of center aileron hinge. Jimmy said it flew fine with short wings on course. Slow speed was a little harder to fly.

Were the wing airfoils changed?
No.

What was the MAC?
No.

Were the ailerons stock with the exception of length?
As far as he knows.

What was the rigging of the ailerons (cable tension, range of travel, etc.)?
No.

How was aileron trim accomplished?
Stock to the center of wing. Electric trim actuator installed here.

How was the roll response of the airplane with the shorter ailerons?
Don't know

How was the rudder control system set up? Was there a bungee installed?
Stock except trim tab was removed.

What was the rigging of the rudder (cable tension, range of travel, etc.)?
Don't know

How was rudder trim accomplished?
None

How was the flight control system balanced?
Don't know

Were any of the primary or secondary control surfaces replaced during 2009 re-build?
No.

Were there any modifications to the flaps or to their installation?
No.

Was the flap rigging any different from the stock airplane?
Don't know

Was the fuselage skin replaced during 2009 re-build ? If so, was a different g auge than orig inal used?
Only above longerons where canopy area was and below longeron where scoop was modified.

Was there a flight test program perform ed a fter the airplane was built? Any profile data including speeds, power settings (RPM, manifold pressure, prop, G's)?
There was a flight test program. Should have telemetry data for most of the test flights.

Was the aircraft ever flown to Vne?
Don't know. Ran over 525 mph on one test flight in Minden based on telemetry speed.

Was any low or high speed stability testing done?
Flew simulated courses during testing at different power settings.

Were any stall tests performed?
Don't know

Which propeller was installed on the airplane?
Hamilton Standard cuffed propeller.

What fuel boost pump was installed on the airplane (F-86 or P-51)?
Each wing had a boost pum p. Thinks that fuel wing had F-86 pum p and water wing had stock pump.

What was the fuel boost pump setting?
Fuel pressure was 23-24 psi with generator online, thinks water was 18 psi.

What engine fuel pump was installed?
700 gal/hr pump off of different engine, stock was 400 gal/hr

What was the engine fuel pump setting?

26 psi

What size was the fuel line from the boost pump to engine fuel pump?
1 inch

What was the size of the fuel shut off valve?
1 inch

Where were the fuel tank vents located?
Out of bottom of fuselage aft of wing

What is the operational fuel pressure at race power?
26-27 psi

Was the airplane ever test flown at race speeds?
In 2010 Jimmy would push power up for ½ to 1 lap. Did some high power tests Sunday morning of 2010 races.

What, if any, modifications were performed after the 2009 build?
None. Some instrument changes.

Where and how was the boil off cooling system in stalled in the airplane ? Drawings? Airframe modifications?
Floor and boilers (copied from Stiletto) were made by Goshawk aviation for 2007. Airplane was together except firewall forward when Jimmy picked it up. Airplane was taken apart and brought to McKinney, TX. Airplane was almost finished then taken apart again and moved to Minden.

What are the weights/dimensions of the boil off system components?
Don't know

What are the fluid capacities for the main radiator/boiler and the oil radiator/boiler?
Thinks 10-12 gallons for oil boiler, 15 gallons for coolant boiler

Was the floor for the boiler original or modified? Any photos?
New floor aft of cockpit.

What was the boiler cycle rate vs. power setting?
Don't know

How was the scoop removed from the airplane?
Production break at the lower longeron. Piece installed was from Stiletto.

Where were the batteries installed? How many and weight?
Forward of hell hole. Two 12-volt batteries, Optima style battery.

Was there any equipment installed in the hell hole area?

Nothing besides batteries

Drawings of modifications
Aerodynamic loads
Structural calculations
Engineering data
None that he ever saw.

THE 2011 RACES/ACCIDENT FLIGHT
What was the qualifying speed for the airplane this year? RPM and manifold pressure?
Thinks 465 mph. MP was 90-95 inches he thinks.

What was done to rectify the squawk for elevator trim tab screws too short?
Erik told h im that scre w on right trim tab was too short. They rem oved the screw and found it was not too short but cross-threaded

Was the aircraft ever re-inspected by the tech inspectors?
Don't know.

Do you recall looking at the left trim tab screws?
Doesn't recall looking.

Who did pre-flight on airplane prior to accident?
Don't know

Was anything different in the set up for the accident flight?
No.

Do you recall any issues with the airplane?
The only thing done between qualifying and acciden t flig ht was to remove and replace wing fairings. Oil on bottom of airplane was making aluminum tape come off. Removed wing fairings to find leak and found the oil coming from engine breather.

How many flights have been performed with the airplane in this configuration?
Probably 10-15 flights

Is there any telemetry or other data from the previous flights this year or last?
There is data. Data was taken on most flights ever since install.

What, if anything, did the crew do to the airp lane from the tim e it arrived in Ren o until the accident flight?
Routine race work.

The data shows a drop in engine parameters about 8 seconds prior to the upset. Do you recall the reason for this? Any thoughts on why it occurred? Did the crew instruct the pilot to do this?

They didn't tell him to back off power. What he watches is coolant temp, induction temp, oil temp, and oil pressure. RPM was not working correctly, not consistent. Saw no issues.

PITCH CONTROL AND TRIM
What was the horizontal stabilizer incidence on the airplane? Was it changed?
Don't know. Front had spacers.
Why and how much?
How was it set? Washers? Level?
Any data or calculations?
Who would have the data?
Who made the calculations?

What was the horizontal stabilizer span? Shorter or longer than stock?
Only cap fairings were removed.

Was the horizontal stabilizer airfoil changed?
Stock.

Can you explain the elevator and trim system on the airplane?
Stock

What was the rigging of the elevators (cable tension, range of travel, etc.)?
Don't know

Were there any modifications to the pitch control system on the airplane?
None.

Were there any modifications that were near the pitch control system or that could interfere with the pitch control (ie. cooling system)?
Not that he knows of

Where could parts or pieces be close enough to worry about binding in the pitch control or pitch trim system?
Not that he knows of

Where is the elevator trim tab servo located on the airplane?
Located on front of horizontal stabilizer at centerline

Why was the right elevator trim tab fixed in place?
Jimmy wanted the airplane set up like Stiletto. Stiletto had no right trim or aileron tab.

How was it disabled/fixed in place?
Don't know

Any photos of the elevator trim system?
Don't know

Are the elevator trim tabs original equipment? If not, how were they modified and why?
Stock aluminum trim tabs

How were the elevators balanced (neutral, over, or under)?
Don't know

Was the elevator bob weight still installed? Or was it removed and/or modified? How?
It was installed but doesn't know if it had been modified

What is the original weight of the bob weight?
Don't know

What were the stick forces at race speed? Straight and level? In a turn? Any data?
Don't know

Do you have stick force/G data?
Not that he knows of

Is there or should there be stick force and/or elevator trim tab deflection at race speed?
At race speed they had talked that th ere should be no elevator trim at race speed. It was always set to zero before takeoff. At Minden they did some testing where he flew fast, trimmed airplane, didn't move it, landed to check. Jimmy never mentioned any problems with the way the airplane was flying

Was the trim set to have the elevator or tab neutral at cruise speed?
Intention was to have zero trim at race speed

What was the full travel of the trim tab, from takeoff speed to race speed?
Trim (aileron or elevator) was always zeroed before takeoff

Were there any aero load calculations or measurements for the elevator trim tabs?
Not aware of any

Load on one working tab?

Load on pinned tab?

Were there any structural load calculations or measurements for the elevator trim tabs?
Not aware of any

What were the push rod loads? On servo unit? On pinned side?
Don't know

Was there any mention of any pitch sensitivity issues?
None were mentioned after qualifying run. Airplane was flying fine.

Have you heard the term "digging in"? What does it mean?
Pull and the tail wants to dig in. Jimmy never mentioned this for the Ghost.

TAIL WHEEL
Is the tail wheel assembly original equipment or modified?
Stock

Why/how could the tail wheel doors be partially open?
Don't know

How was the tail wheel rigged?
Don't know

How could it deploy during the pitch-up maneuver?
Thinks something had to break. Never heard of a Mustang tail wheel extending. It should have an uplock and hydraulic pressure to hold it.

Are any of the tail wheel door linkages close to the pitch control or pitch trim system components? Close to the modified areas?
Don't know

CG
What is the weight and balance? Empty and Full? Where was the CG? When was it performed?
Don't know. Batteries were in back in order to help with CG.

Was the CG set to achieve a trim objective?
No.

How did the CG change during the flight?
Don't know

How did the CG change from the first flight to the race?
Prop was changed after weighing in 2009.

What were the quantities and locations of consumables (fuel, oil, water, ADI) on the airplane?
Fuel total 150 gallons, water total 150 gallons. Oil – engine hold 3 gallons, tank holds 9 gallons.

What should the coolant level have been at the time of the upset?
Don't know

What are the coolant boil-off and fuel burn rates?
Don't know

Did you put any weight in the airplane to move the CG?
None other than batteries

FLUTTER
Were there any reported vibrations (even minor)?

Not that he know of

Is there a history of flutter with this airframe?
Not aware of any.

AIRFRAME/STRUCTURE DURABILITY
How many hours per year was this airplane flown?
Don't know

Are you aware of any known areas of wear?
None

What areas required preventative maintenance or continuing airworthiness type inspections?
None. On Ham Standard propeller there is an AD.

MISCELLANEOUS
Who else flew this airplane?
No one else.

Did Mr. Leeward wear any kind of G-suit during racing?
No.

What type of oxygen system was used?
Had small portable bottle.

Was Mr. Leeward using diluter demand or 100% oxygen?
Thinks he ran 100% oxygen

What type of seat and seat rails were installed in the airplane?
Seat frame was steel tubing. Seat was attached to longerons. Stock mustang seat, heavy duty.

Where and how was the shoulder harness attached?
All the seat belts were hooked to the seat, 5 –point harness with turn release. New in 2009.

Was there a manual locking mechanism for the shoulder harness or an automatic inertial reel?
Inertia reel with manual locking mechanism.

What was the temperature in the cockpit?
Don't know. Too warm without cockpit vent. Jimmy wore cool suit.

What was cockpit pressure and fuselage pressure?
Don't know

What was used for the steam vent lines?

Scat tubing

How was the boiler isolated from the cockpit?
In separate sealed compartment lined with heat shielded aluminum. No vapors or liquid could get into cockpit.

What was the hydraulic pressure in the system?
1000 psi

Are you familiar with the shear wrinkling on the right fuselage? Is this common?
First seen after the accident

What speed were you shooting for or expecting during the 2011 races?
During accident race they were thinking they would hit 475 mph. Wanted to maintain position at least.

Who does the engineering and perfor mance wo rk? Any drawings/logbooks/calculations for modifications?
Not that he knows of.

Where was the RCATS system mounted?
Mounted in upper compartment in aft left side of fuselage.

Where was the RACTS receiving station located?
Receiver in pits

ANALYSIS
What do you think caused the upset?
All (Erik, R ick, Dave H athaway) had headsets o n to talk to each oth er so didn't hear anyth ing. Wasn't really watching airplane. Did not see airplane until he was pitched up.

Did you see anything unusual prior to the accident? Any cause for concern?

This year everything was going s mooth, not rushed. Jimmy was happy with the way things were working. The only concerns Jimm y had was that he had crew install an altim eter on W ednesday to make sure he didn't bust any altitudes. Jimmy seemed real relaxed, joking around. No health issues that he knew of. Took racing serious.

In 1982 skip Holm was flying airplane as Genie, he didn't feel any vibr ation but airplane was running funny during taxi in. Th ey found carburetor m ount nuts were m issing/loose and cotter pin and castellated nut on linkage w as disconnected. Next day during qualifying airplane shook governor mount nuts off, engine oversped, an d bl ew. The se were the first races with a new engine. They think the engine prop combination caused the vibration.

He's never heard of a trim tab screw coming off.

# RECORD OF TELEPHONE CONVERSATION

**Clinton R. Crookshanks**
**Aerospace Engineer**

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**Date: May 4, 2012**

**Person Contacted: Rick Shanholtzer, Crew Member N79111**

**Subject: WPR11MA454**

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The Galloping Ghost airplane is like Stiletto. The trim tab is like Stiletto, the boiler is based on Stiletto, some of the parts are the same, there is no lower air scoop like Stiletto. The elevator trim tab is zeroed on ground and Jimmy was not supposed to use it during race. They did flight test of the trim at high speed, one possibly two flights. Jimmy took off at zero trim ran the airplane up over 500 mph and didn't touch the elevator trim. When he landed it was still at zero. Jimmy practiced a few times in 2011 and qualified. They checked the trim between the 2010 and 2011 races. There was a zero trim indicator light in the cockpit. He thinks it lit up at zero. The wings, tail, and ailerons were the same since Jimmy purchase the airplane. He thinks that the horizontal and vertical were not changed from when it was purchased. The holes were modified on the stock vertical stabilizer casting. He will send me burn rates for fuel and ADI.

END

# RECORD OF TELEPHONE CONVERSATION

**Clinton R. Crookshanks**
**Aerospace Engineer**

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**Date: May 15, 2012**

**Person Contacted: Rick Shanholtzer, Crew Member N79111**

**Subject: WPR11MA454**

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He sent the burn rates for the engine. The fuel burn rate plus the engine ADI burn should equal the boiler ADI use rate. Below about 60 inches MAP there is no appreciable engine ADI use even though the data says there is. They typically use about 15-20 gallons of ADI for start/taxi/warm-up. They drained the boiler at the end of each race/day so they knew what was in the tank. Procedure was to fill the boiler then fill wing tank. The boilers were full for accident race. Two separate boilers in the same fuselage compartment one for coolant and one for oil. Oil boiler was at the same longitudinal location in the fuselage as a stock oil cooler. There was a separate boiler for the oil cooler. Aftercooling was done with ADI fluid. ADI ran from wing to aftercooler then to boiler then overboard as steam. The telemetry reads about 10 psi low on oil pressure due to sensor connection issues, cockpit was the most accurate, normally want to run between 80 and 100 psi, he likes to see about 80 degrees for temperature, doesn't recall seeing the pressure drop at the beginning of the race, he watches a gage on the computer. They had trouble with most of the telemetry parameters initially. Erik is the only crew member that can talk to airplane/pilot. Everyone else is on comm system to be able to talk to each other. They can all hear each other, pilot and race control. He specifically remembers asking after a qualification run how the airplane flies and Jimmy said it was just like he remembered it being, nice and easy. The rudder tab, electric elevator trim, right tab fixed, boiler, new canopy were done to make it the Ghost. He remembers seeing the bob weight installed.

END

# RECORD OF TELEPHONE CONVERSATION

**Clinton R. Crookshanks**
**Aerospace Engineer**

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**Date: June 5, 2012, 4:15 MDT**

**Person Contacted: Rick Shanholtzer, Crew Member N79111**

**Subject: WPR11MA454**

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The first flight of the Ghost was on Monday after 2009 races. They flew on Tuesday too. The Saturday flight there was fumes into the cockpit so Jimmy did not take-off, they decided to fix the problem before flying. They were in Minden until end of the week after Reno 2009 he thinks, they flew more than one day. They were having connection problems with telemetry and it was intermittent during fall 2009. They repaired connection problem before 2010 races but he is not sure when. They came back to Minden in October and November 2009 for more testing. Lots of times when flying the telemetry was not running if there weren't enough crew members to run it. In the beginning the air time was about 15-20 minutes per flight, then got up to 30 minutes and finally 45 minutes after a while. The standard fluid load was used for the test flights. With the engine running on the ground the boiler would overfill and blow fluid overboard because the float would not pick up level correctly. There was some flying done between 2010 and 2011 races, there was one trip to Minden in 2010 and they went back once or twice in 2011 before races. They did not fly between July 29, 2011, and the start of Reno 2011. They arrived at Reno the Sunday before and did 3-4 flights before races in 2011. He thinks that the 9/14/2010 flight on the course was a practice not a qualification since he was not able to qualify because he missed the pilot briefing. He was a conditional entry in 2010. AN 02-55AC-3 is the Overhaul Manual for -7 engine, he will look for manual numbers AN 01-60JE-5, -6. By the end of 2009 he is sure they had 3 hours on airplane.

END

# RECORD OF TELEPHONE CONVERSATION

**Clinton R. Crookshanks**
**Aerospace Engineer**

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**Date: August 2, 2012, 0830 MDT**

**Person Contacted: Rick Shanholtzer, Crew Member N79111**

**Subject: WPR11MA454**

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Prior to the 2010 races they were having a clam shell door coming open. During the 9/14/10 flight on the course Jimmy hit a bump and inadvertently turned the boiler system off, he pulled up and reset system before coming back on the course. Because of that the switches were moved. Pretty sure that Jimmy gets a light if the gear door opens enough. They painted the edge of the door to see if door was open. Rigging was off and linkage was worn out allowing inner clam shell door to come open. Between 2010 and 2011 the doors and mechanism was rebuilt. Doesn't think the gear doors were the problem on the 9/14/10 flight. Doors would only come open on course at high speeds.

Stock mustang throttle quadrant with friction locks on propeller, mixture, and throttle controls. They had been having trouble with RPM reading on telemetry.

END

# RECORD OF TELEPHONE CONVERSATION

**Clinton R. Crookshanks**
**Aerospace Engineer**

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**Date: August 3, 2012, 0845 MDT**

**Person Contacted: Erik Hokuf, Crew Chief N79111**

**Subject: WPR11MA454**

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If he remembers correct, this was the last qualification period, the flight was an attempt to qualify, Jimmy pulled off the course because he accidently hit the switches for the coolant controls and turned then off, Jimmy felt that the engine was heating up so he pulled off. After that the switches were moved to the forward panel. He doesn't remember at what point in 2010 that the gear door issue came up. Mark Moodie helped with adjustment of the door. They felt that the takeoff procedures were not sufficient to allow doors to come all the way up so Jimmy started pulling the gear up sooner after takeoff.

Doesn't remember what the pull-up flights were for in 2010. This airplane was not abnormal from a vibration standpoint.

There was an additional support added to the left horizontal stabilizer rear spar. The support was done like the Australian modification to install a support on the trim control rod aft of the stabilizer rear spar. Thinks it was installed after the 2009 build up. Thinks it is a pretty standard modification on the Mustang.

END