

From: [Rupert, Judson](#)
To: [Stein, Stephen](#)
Subject: RE: WPR20LA144 -- JPI700 & Horizon Instruments P-1000 -- preliminary report
Date: Thursday, March 25, 2021 10:29:47 AM
Attachments: [image003.png](#)

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Stephen due to the location of EGT probes in the exit of the exhaust near the exhaust valve I would not expect to see heat signatures that show up on a crank journal show up on EGT. Possibly an overall increase in oil temperature might show a crank/bearing heat signature.

Judson L. Rupert
Sr. Manager, Air Safety and Product Support
Lycoming Engines
[REDACTED]

From: Stein, Stephen <[REDACTED]>
Sent: Thursday, March 25, 2021 12:16:34 PM
To: Rupert, Judson <[REDACTED]>
Subject: RE: WPR20LA144 -- JPI700 & Horizon Instruments P-1000 -- preliminary report

Hi Jud – Another question about the data. For excessive heat would we expect to see a sharp rise in EGTs?

From: Rupert, Judson <[REDACTED]>
Sent: Wednesday, March 24, 2021 10:25 AM
To: Stein, Stephen <[REDACTED]>
Subject: RE: WPR20LA144 -- JPI700 & Horizon Instruments P-1000 -- preliminary report

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Concur, cylinder 3 and 4 crank journals show signs of lack of lubrication with high heat signatures on the connecting rod cap and bolts.

From: Stein, Stephen <[REDACTED]>
Sent: Wednesday, March 24, 2021 1:20 PM
To: Rupert, Judson <[REDACTED]>
Subject: RE: WPR20LA144 -- JPI700 & Horizon Instruments P-1000 -- preliminary report

Jud,

That's very helpful. One other thing...

Based on the evidence at the cyl 3 and 4 rod caps/bolts, would you agree this is consistent with thermal damage to the cylinder no. 3 and 4 connecting rod caps and bolts and some evidence of high heat at the crankshaft. Even go so far as to say it's evidence of an absence of lubrication and excessive heat?



From: Rupert, Judson <[REDACTED]>
Sent: Wednesday, March 24, 2021 9:42 AM
To: Stein, Stephen <[REDACTED]>
Subject: RE: WPR20LA144 -- JPI700 & Horizon Instruments P-1000 -- preliminary report

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Stephen,

Firing order is 1-3-2-4, so I'm only theorizing here, but if 4 let go and the next in line was 1 to fire, it could have been effected by 4. 2 and 3 also drop at the same point but not nearly as much as 1. Once you have a broken connecting rod beating everything up, I'm not sure the intake charges are what they're supposed to be from that point forward.

Again, just one plausible explanation. The other could be one of cylinder probe location and wiring harness, are you sure the cylinder #1 trace is really cylinder #1 or could it be #3? Would not be the first time I've found connections crossed on the same side of the engine.

From: Stein, Stephen <[REDACTED]>
Sent: Wednesday, March 24, 2021 12:16 PM
To: Rupert, Judson <[REDACTED]>
Subject: RE: WPR20LA144 -- JPI700 & Horizon Instruments P-1000 -- preliminary report

Hi Jud –

I'm re-reviewing the JPI results and was wondering since all the damage seems to be around cylinder no. 4 and subsequently cylinder no. 3, any reason why the JPI results would show cylinder no. 1's EGT reading drop around the same time as no. 4?

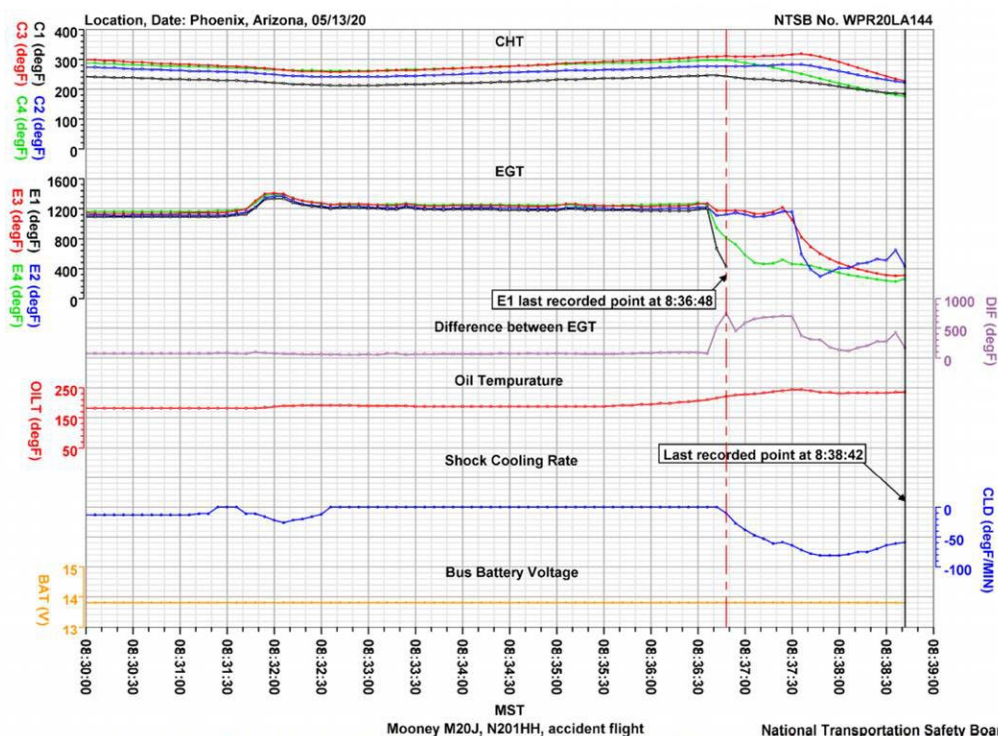


Figure 4: Plot of JPI EDM 700 data for the final portion of the accident flight recorded on May 13, 2020.

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Electronic Devices Factual Report, Page 6 of 9

From: Rupert, Judson <[REDACTED]>
Sent: Thursday, October 22, 2020 1:00 PM
To: Stein, Stephen <[REDACTED]>
Subject: RE: WPR20LA144 -- JPI700 & Horizon Instruments P-1000 -- preliminary report

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Stephen-direct answers to your question below:

- 1 I've never seen shock cooling in a JPI reading and not sure what is considered normal here. The May 6, 11, and 12 flights are nearly flat line under shock cooling. Lycoming does not list any defining shock cooling numbers, and in reality with today's manufacturing processes, Lycoming isn't really concerned about "shock" cooling in normal or even rapid descent.
- 2 If you look at "final portion" the engine oil temp starts to rise at 08:35:30, so I'm wondering if this seems excessively high to you. Unfortunately we don't have oil pressure, but maybe you can tell me your thoughts regardless. It's not excessively high but you can see the gradual increase in the oil temp that tells me that more than likely at time 08:35:30 the badness started happening in the engine. Looks like cylinders 1 and 4 lost combustion starting at 08:36:45. Before the event, the oil temp looks normal around 200-210 deg.
- 3 EGTs and CHTs don't look bad, but would like your thoughts on this as well. Agree, CHT and EGTs up until the time mentioned above all look normal for that installation. No outliers in EGT spread and standard spread in the CHTs.

Judson L. Rupert
Sr. Manager, Air Safety and Product Support
Lycoming Engines, a div. of Avco Corporation



"Testing leads to failure, and failure leads to understanding" - Burt Rutan

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From: Stein Stephen <[REDACTED]>
Sent: Thursday, October 22, 2020 11:25 AM
To: Rupert, Judson <[REDACTED]>
Subject: FW: WPR20LA144 -- JPI700 & Horizon Instruments P-1000 -- preliminary report

Hi Jud –

This concerns that accident I spoke to you about a few weeks back that involved a Mooney with a recent prop and prop gov overhaul that suffered a brief overspeed and then catastrophic failure

Enclosed is the JPI data from the accident flight and a few flights prior I m curious about a few things...

- 1 I ve never seen shock cooling in a JPI reading and not sure what is considered normal here The May 6, 11, and 12 flights are nearly flat line under shock cooling
- 2 If you look at “final portion” the engine oil temp starts to rise at 0835:30, so I m wondering if this seems excessively high to you Unfortunately we don t have oil pressure, but maybe you can tell me your thoughts regardless
- 3 EGTs and CHTs don t look bad, but would like your thoughts on this as well

Finally, I don t think we can get MAP and RPM, but I m going to see if there s something else we can look at The materials lab examination has not started to my knowledge

Thanks,

Stephen

From: Chen Deven <[REDACTED]>
Sent: Monday, October 19, 2020 2:36 PM
To: Stein Stephen <[REDACTED]>
Subject: RE: WPR20LA144 -- JPI700 & Horizon Instruments P-1000 -- preliminary report

Hi Stephen,
Here are some updates on the two devices:
The Horizon Instruments P-1000 only retains tach time, thus on data extraction attempted
The JPI 700 powered up normally and data extracted successfully

- The extracted data contained 37 sessions from 7/29/2019 to 5/13/2020 No data before July 2014 (engine rebuilt) were available
- The last session on 5/13/2020 was identified to be the accident flight
- There were total of 4 flights in May 2020: May 6, May 11, May 12 and May 13 The plots of those 4 flights are attached to this email
- The tabular data from the accident flight and the flight on May 12 are attached to this email as well The recorded parameters are listed on the table below For the May 12 flight, the tabular data showed the JPI 700 recorded 8 extra data points from 10:17:10-10:17:52, after the 8 09:16-8:22:40 flight

e	Parameter Description
Date	Date for recorded data point (MM/DD/YYYY)
Time	Derived mountain standard time (MST) for recorded data point (HH:MM:SS)
C1-6 (degF)	Cylinder Head Temperature Cylinder # (degrees Fahrenheit)
E1-6 (degF)	Exhaust Gas Temperature Cylinder # (degrees Fahrenheit)
DIF (degF)	Difference between low and high Exhaust Gas Temperature (degrees Fahrenheit)
CLD (degF/MIN)	Shock Cooling Rate (degrees Fahrenheit per minute)
OILT (degF)	Oil Temperature (degrees Fahrenheit)
BAT (V)	Bus Battery Voltage (voltage)

Please let me know if you have any questions

Regards,
Deven

From: Chen Deven
Sent: Tuesday, September 22, 2020 9:49 AM
To: Stein Stephen <[REDACTED]>
Subject: WPR20LA144 -- JPI700 & Horizon Instruments P-1000

Hi Stephen,
I m just assigned to this case
It seems that there is no damage to these devices I haven t had chance to further examine them yet
What particular data you are looking for from these device?

Regards,

W Deven Chen
Recorder Specialist
National Transportation Safety Board



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