Date: 6/16/65

From: R. L. Calhoun
To: Ozzie

Attached summary is a copy of one I made up primarily for my own library.

R.L.
Dear Miss:

With reference to our discussions on the subject of instrumentation for the first airplane I am summarizing below our thoughts.

A. For the first flights we would suggest only the minimum amount of instrumentation until we have an indication of the nature of any particular problems that may require further investigation. This minimum instrumentation should include the following:

1. Turbine Discharge Pressure Gage indicates the total pressure aft of the third stage turbine.
2. Tachometer indicates per cent of MAXIMUM high pressure rotor speed blamed by the tachometer gear ratios.
3. Exhaust Gas Temperature Gage indicates the temperature of the exhaust gas immediately down stream from the turbine unit which serves as a relative indication of the temperature at the turbine inlet.
5. Fuel Inlet Pressure Gage indicates fuel boost pump output.
6. Oil Temperature Gage indicates the temperature of the oil as it enters the oil pressure pump.
7. Oil Pressure Gage indicates oil pressure pump discharge pressure.
8. Fuel flow gage indicates fuel flow from the engine fuel control.
9. Free air temperature gage which will indicate total temperature for any air speed.

In addition to the above some thought and planning should be given to the following as a provisional instrumentation to assist in evaluating any particular specific problem. This follows basically the outline which I have previously supplied to you but expands slightly on some of the details.

B. On oscillograph

1. Burner pressure ("T" into the control sense line) approximately 800 psi gage required.
2. Low compressor discharge pressure (we will supply pick up shunt and if needed).
3. Engine fuel flow rate. (Present stable fuel flow not attempting to get dynamic changes except to record status and time of dynamic change taking place. Photo panel would be satisfactory).
4. Primary differential pressure (fuel pressure across the pressurizing valve). The differential can be measured on a gage having a range of from 0 to 600 psi.)
5. Low pressure bleed valve actuator position lights (be means of adapting mechanical switches to bleed valve.)
6. Static pressure within accessory compartment near low pressure bleed port exit.
7. Power lever position.
8. High rotor speed (N1 tachometer drive ratio equals 420785.)
9. Low rotor speed (N2 tachometer drive ratio equals 679945.)
10. Outside air temperature.
11. \( P_9 \)

I have checked further on the measurement of \( P_9 \) and as we discussed the arrangement will provide for connection to two indicators; one presumably the cockpit and one the photo panel. The other four pads originally used for the electronic type control are not identical and hence a standard \( P_9 \) type thermocouple would not fit in those locations. In addition measurements at these points will differ from those taken at the other points indicated and hence we question the value of taking these additional readings at this time.

C. On the photo panel we should record the following:

1. Outside air temperature.
2. Fuel temperature at the fuel meter.
3. Altitude.
4. Indicated air speed.
5. Turbine discharge temperature.
6. Bailey bleed governor sense pressure. (This would be essentially inlet duct pressure at the governor sense location.)
7. Fuel pump inlet pressure.
8. Inlet duct pressure (rakes)

**NOTE:** For inlet duct distribution we do not have mounting bosses on the inlet flange at the proper location for surveying your particular duct configuration but would suggest on the basis of visual observation and wind tunnel testing to date that we consider the following locations in the duct immediately ahead of the engine. For this purpose we are willing to make available ten sets of inlet rakes (eight for installation and 2 spares). I would appreciate it if you could process a purchase order to NAA Spare Parts to cover the purchase of these rakes #19404. The price on these rakes is $212.20 each not to the aircraft manufacturers. If you would prefer to make up your own rakes, this is, of course, perfectly satisfactory to us.
May 23, 1963

Dear [Name]:

In response to your request I am enclosing a copy of the fuel control
drawing No. 20102 with change 0-1 included therein. On this drawing you
will find the location marked in red pencil at which the connection should
be made for the switch to shift the control from primary to emergency
operation and for the locating light which will show that the emergency is
on. The control at this point of connection has a common plug No. 0509-
163-1P-002 which will mate with end. You should, therefore, supply a
connection such as 0509-165-16.

You will note that these connectors are seven plug connectors but
only four of the prongs are utilized in this set up. The location of these
four prongs are identified by the letters in red pencil on the referenced
drawing. The four prongs which are utilized are as follows:

- B "Emergency on"
- D "Primary on"
- E "Indicator light for emergency on"
- F "Common"

The power requirement of the motor actuator which selects the normal
or emergency fuel system is 6.5 ampere-hours at 25 volts. Enclosed is a
"Schematic wiring diagram for fuel control motor actuator" from our
Installation Handbook, Section 7. Also enclosed is a copy of J75 Information
Letter No. dated June 30, 1964 which describes the emergency control system
of the type we will be using except that our system will not have any
automatic transfer to the emergency system.

[Signature]

Sincerely,

P.S.

Enclosed is a picture showing at least a portion of the ground disassembly
stand for which four are being procured for this project. This shows enough
to indicate that it is a somewhat heavy and bulky stand and your people may
wish to proceed with additional lightweight stands along the lines of our
discussion when I was last there.
The above is largely a review so that we might have a base line for any questions or discussions which you may have on the subject of instrumentation. In addition, I intend to supply you with a more complete story on our recommendations concerning the use of P, for flight operation.

Sincerely,

P/K
A. Contractual & Support

1. Amendment No. 154 to MOA 53-1069-1 received and signed May 13, 1955 for 90 each J37-F-57s.  
   Total price [redacted]
   1st F-57 shipped May 23, 1955

2. Amendment to Spare Parts contract to cover 50 overhauls and 50 maintenance cycles.
   a. List prepared by FWA based on 2/1/55 R/4.
   b. List submitted by FWA April 15.
   c. Orders (7) received covering above Apr. 20
   d. Orders not yet accepted due to engineering changes to original list

   (Peculiar parts originally ordered on E.O.A. M-568 of 8/1/55)
   (Final order accepted for

5. Amendment #154 (see A-1 above) provides for special tools and ground handling equipment. Specific order is now in ABO's hands who in turn are seeking "Bureau" approval to order. (Tools released by E.O.A. M-568 dated 4/18/55). (6-5-55 order now received at BAR)


5. MIPR issued to Bureau for 90 J37-P-61A's. Order now in process at Bureau (through negotiation stage)


6. An E.O.A. #M-568 was issued in March 19, 1955 with supplements aimed to cover support of 25 overhauls and 50 maintenance cycles. (Proposed order sent 6/7/55)

7. Additional supplementary referral orders being prepared to submit to ABO via ANC to cover following:
a. Additional parts introduced by engineering changes since original list. (EIC-IB 5-25)

b. Change in controls from JPU-22-5 to JPU-12 in order to "incorporate" emergency control features. (EIC-IB 5-25)

c. Retrofit kits for adding one generator drive to top of D3 drive. (EIC-IB 5-25)

d. "Bits and Pieces" list for maintenance and overhaul of H.S. control, Geco fuel pump, and GEA ignition system. (EIC-IB 5-25)

e. Parts to incorporate change #6014 (#5 bearing seal) in first engine. (EIC-IB 5-25)

f. Maintenance and overhaul parts for (b) and (e) above. (EIC-IB 5-25)

g. Deletion of parts not needed for support due to removal of anti-icing lines at airplane manufacturers. (submitted proposed order to AMC 6/5/55)

8. HIFR has been issued by AMC to ABG to cover 50 overhauls on P-57 and 25 overhauls of P-31A's. (Will check again on 6-11 as to status at ABG.)

30 x
25 x

(6/6/55 repairing contract actually received at Airports)

9. Suggested spare parts orders for "Bits and Pieces" on P-57 to cover Geco fuel pump, Hamilton fuel control and GEA ignition system submitted to AMC 6/14/55

B. Technical - Engineering and Installation

On P-57 Engine


   a. R.H. oil press line.
   b. Fuel pump and fuel drain line
   c. Drain elbow on oil tank
   d. Oil inlet temperature bulb.

Bringing out fuel control revisions 6/6/55 by EIC-IB.
2. Installation Drawing - #225501 sheets 1, 2 & 3.
   5/29 change OS, A-1
   newest copy sent 5/6/55 - R.L.G.

3. Suggested Initial and potential supplementary Instrumentation.
   5/29/55 ELC to R.G.

4. Made arrangements to cover conversion of JFO-12-5 controls to
   JFO-12-2 controls with "emergency" features at N.E. Std.
   5/13/55 ELC to S.Sherwood - R.G.

5. Reviewed Report #10537 on wind tunnel testing of inlet ducts.
   Indicated concern that distribution indications may cost as much
   as 5,000' in critical altitude.  5/13/55 ELC - CEJ

6. Reviewed prospects of altitude stand testing in response to
   request.  Summarized experience to date and hope of additional
   testing.  5/12/55 WPQ to CEJ

7. Discussed special fuel with O.R. and C.E.I. and agreed samples
   is worth calculated risk of procurement for test base.  Agreed to
   advise of any adverse full scale test results as soon as available.
   To restart test next week.  5/28/55 ELC to CEJ
   Verbal ELC to O.R.
   (On 6/15/55 advised O.R. that full scale running completed but
   inspection and results not yet determined.)

8. On Fuel Control - have pointed out that manual control to tail
   pipe temperature will be required above 55,000' on P-57.
   4/6/55 ELC to R.B.
   Have supplied target curve on P-51A showing auto control to
   50,000' and manual heating above.

9. The present Fuel-Oil system in the Installation provides fuel-oil
   cooler (small) plus two "Constellation size" air-oil coolers.  The
   fuel-oil cooler provides a source of heat to prevent "icing" in the
   control and in the line filter since it is located in the "fuel-in"
   line.  It does result in fuel temperatures under limiting conditions
   of 160°F.  We have expressed concern about -(a.) effect of high fuel
   temperature on control metering characteristics and (b) effect of
   pressure drop in fuel-in line on engine fuel pump performance.  We
   have been requested to run tests at sight experience with (a.) above.
   (b) is not considered serious because it is primarily a take-off
   condition that becomes critical and this project could operate with
   reduced I.O. power if necessary.  5/28/55 ELC - CEJ
   5/31/55 verbal ELC - CEJ
10. On the effect of high pressure bleed flow on engine performance we have pointed to spec. curves when operating by auto. control-
fixed power lever position - result 15 bleed costs approx. 5% in
thrust and 15% SFC (F-87 spec. A-1097-4). We made a specific
calculation assuming 'fixed turbine inlet temp and advised cost
3% in T. and 3% in SFC. (ELO-NE 4/8/58)

11. Having Engineering review exhaust nozzle size recommendations in
view of Martin tail pipe test. (ELO - WED 5/27)

(On 6/1/55 recommended to GEJ the same nozzle size as we recomended
for Martin.)

12. Preparing story on Pt7 as operating variable for control.

(ELO - WED 5/27)

(Gave GEJ and O.R. copies of suggested operating curves for Pt7
and/or Pt7.)
1. Clearance has been obtained and [redacted] is now assigned to this project.

2. Estimate building up to minimum of 8 service men and a maximum of 16 by end of 1955. HLC to 17 5/25/55

3. Clearances are in process for:
   - Project Engineer
   - Control Engineer
   - Flight Test Engineer (O.K. on 6/12. Notified to have his returned for discussion.)

4. Clearances obtained on following service men
   - [redacted] (O.K. on 6/12. Notified D. Pierce we desire available no later than 7/15.)
   - [redacted] (O.K.)
Technical (Cont'd)

P-51A (J75C)

1. Instr. Drawing replaced layout on J75C-1
   Prototype #237001 sheet 1 & 2 Apr. 16, 1955

2. Requested control system bias be established for military power
   (full) at 50,000' and up.
   HLC-WEB 5/4/55

3. Requested reinstallation of single E1 rotor accessory drive for
   alternator (approx. 7500 RPM at alt.) in "C" HLC-WEB 5/4/55

4. Requested "Emergency" system in control.

5. Suggested elimination of diaphragm (not used in installation).
   (weight saving).

6. Agreed elimination of front mount pads (weight saving) and constant
   speed drive support. verbal HLC-5/5/55.