



Application Note

General Dynamics G500 (GV)

Fan Trim Balance

Part Number: 11-200-0236

AppNote Number: A-GD-G500-4040-FB (Rev. 0, May 2007)

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Application Note

Application Note Number	A-GD-G500-4040-FB
Version	0
Function	Fan Trim Balance
Airframe	General Dynamics G500/Gulfstream GV
Engine	Rolls-Royce BR710A1-10
Other Application Notes Required	None
ACES Systems Analyzer	Viper 4040
Firmware Version	1.04 or greater
Procedure Cards	N/A

Introduction

This Application Note is number 1 of 1 Application Notes required to perform a fan trim balance on a Gulfstream GV with Rolls-Royce BR710A1-10 engines. This Application Note describes the steps necessary for set up and operation of the Viper 4040 analyzer and associated equipment.

Required Equipment: The following equipment is required to accomplish a single engine fan trim balance.

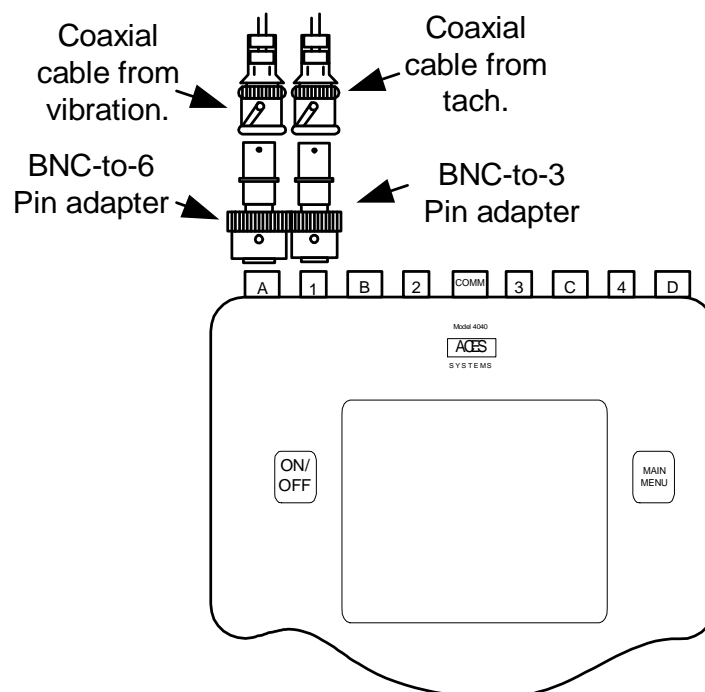
Item	Quantity	Description	Part Number
1.	1EA	Analyzer, Viper 4040	10-100-4040
2.	1EA	Adapter, Six pin vibration-to-BNC	10-320-0261
3.	1EA	Adapter, three pin tach-to-BNC	10-320-0083
4.	2EA	Coaxial Cable with BNC connectors, length as required	Local Manuf.

Optional Equipment: The following items are optional and are required only if you are unable to use the onboard 1 per rev output from the engine.

5.	1EA	Tachometer, Lasetach II, 299 (Reflective tape included)	10-100-1300
6.	1EA	Mount, Lasetach Swivel	10-100-0369
7.	2EA	Cable, Tachometer, Generic, 50 Ft.	10-320-0126

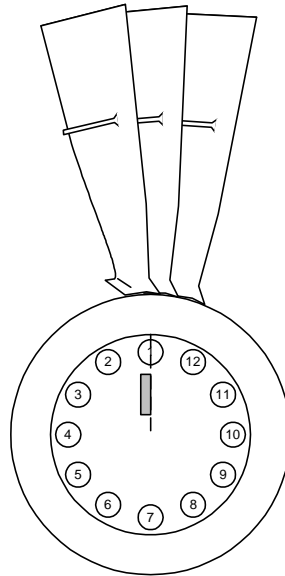
A. Equipment Set Up

1. Route the Coaxial cables, item 4, from the onboard vibration and tach output connectors for the selected engine to the location where the analyzer, item 1, will be operated.
2. Connect the Six pin vibration to BNC adapter, item 2, to the CHANNEL A input of the analyzer, item 1.
3. Connect the Three pin tachometer-to-BNC adapter, item 3, to the TACH 1 input of the analyzer, item 1.
4. Connect the coaxial cable from the onboard vibration and tachometer to the adapters as appropriate.



5. **If it is necessary to use the Lasetach** for balancing:
 - a. Secure the Lasetach, item 6, to the leading edge of the wing, directly in front of the engine. Secure the base of the Lasetach assembly to the wing with duct tape or aluminum speed tape across all four edges of the base.
 - b. Attach the 50 foot generic tachometer cable, item 8, to the Lasetach and route the cable to the cockpit or location where the analyzer will be used. Connect the cable to the TACH 1 input of the analyzer. (NOTE: If using the Lasetach, the three pin tachometer to BNC adapter is not used).
 - c. On the engine spinner, draw an imaginary line from the center of the spinner to the center of the number 1 weight attachment boltholes. Clean the surface of the spinner with a degreaser and dry thoroughly. Align the leading edge of a two-inch length of reflective tape with the imaginary line. Remove the protective backing from the tape

and apply at this location. (See Figure below.) The bolt aligned with the tape is now designated #1. The remaining numbers, 2 through 12, are in a clockwise ascending order, from forward looking aft, as shown in the drawing below. Alignment of the laser will be accomplished later in this procedure.



B. Fan Balance Analyzer Set Up

6. This section will give you the steps to enter the BR710A1-10 Setup into the Viper Analyzer. If the setup has been previously entered, you need not repeat this step. If the setup is available, go to section B. Data Acquisition. Otherwise proceed to 11.1 below.
7. Turn the analyzer on by pressing the ON/OFF key.
8. From the Main Menu, select Miscellaneous Items.

Model 4040 VIPER Analyzer				
Sensor Setup				
Name :	GV ONBOARD			
Amplitude Units :	IPS			
Probe Sensitivity :	1000.000			
Reverse Polarity :	No			
Input Type :	Single Ended			

- 10.3 In the **Reverse Polarity:** field, use the ⇒ key, if necessary, to select “No” indicating the sensor polarity is not reversed. Press the ↓ key to move to the next field.
- 10.4 In the **Input Type:** field, use the ⇒ key, if necessary, to select “Single Ended” indicating the type input to the sensor.
- 10.5 When all fields are complete, press ENTER to accept and save. The screen will return to the “Manage Sensors” screen. From that screen, press [BACKUP] repeatedly until the Main Menu is again displayed.
11. From the Main Menu, select “Fan / Turbine Balance”

Model 4040 VIPER Analyzer				
Main Menu				
Propeller Balance				
Main Rotor Track & Balance				
Tail Rotor Balance				
Fan/Turbine Balance				
Vibration Spectrum Surveys				
Overall Vibration Surveys				
Transient Vibration Surveys				
Monitor Spectrum				
Monitor Magnitude and Clock				
Monitor Magnitude and Phase				
Monitor Overall				
Check Track				
Transfer Data with PC				
Miscellaneous Items				
Show Forms				

- 11.1 If there are other setups already in the analyzer, the Setup List banner screen will be displayed. From that screen, press the [F1] “New” key. If no setups are in the analyzer, the “Fan / Turbine Balance Setup” screen will be displayed. Complete the Balance Setup screen as follows:
 - 11.1.1 Use the keypad to enter “GULFSTREAM GV” in the **Name:** field. Press the ↓ key to move to the next field.

Model 4040 VIPER Analyzer	
Fan/Turbine Balance Setup	
Name:	GULFSTREAM GV
Num Engs:	1
Eng Rotation:	CCW
Num Baln Planes:	1
Num Optional Planes:	0
Balance Wt Type:	Class
Num Class Wt Sets:	1
Label Detail Wts:	Yes
Baln Weight Unit:	g
Num Sens / Eng:	1
Num Baln Speeds:	3
Slow Roll RPM:	0
Min Baln RPM:	4458
Actual RPM @ 100%:	7431
Vib Unit:	mm/sec
Modifier:	Peak

- 11.1.2 In the **Num Engs:** (number of engines) field, use the use the ⇒ key to select a number that indicates the number of engines that will be balanced using this setup. This is typically “1”. Press the ↓ key to move to the next field.
- 11.1.3 In the **Eng Rotation:** field, use the ⇒ key to select “CCW” indicating the fan rotates counter-clockwise as viewed from the front looking into the intake. Press the ↓ key to move to the next field.
- 11.1.4 In the **Num Balan Planes:** (number of balance planes) field, use the ⇒ key to select “1”. Press the ↓ key to move to the next field.
- 11.1.5 In the **Num Optional Planes:** (number of optional balance planes), use the ⇒ key to select “0”. Press the ↓ key to move to the next field.
- 11.1.6 In the **Balance Wt Type:** field, use the ⇒ key to select “Class”. The class weights will be defined on another page. Press the ↓ key to move to the next field.
- 11.1.7 In the **Num Class Wt Sets:** (number of class weight sets), use the ⇒ key to select “1”. The BR710 has two one weight set that may be used to trim balance the engine. Press the ↓ key to move to the next field.
- 11.1.8 In the **Label Detail Wts:** field, use the ⇒ key to select “Yes”. This will allow you to inform the analyzer that holes used for spinner attachment bolts cannot be used to add weight. If the answer is yes in this field, the analyzer will optimize the balance solution on available holes only. Press the ↓ key to move to the next field.
- 11.1.9 In the **Baln Weight Units:** field, use the ⇒ key to select “g” for grams. The class weights for the BR710 are measured in grams. Press the ↓ key to move to the next field.
- 11.1.10 In the **Num Sens / Eng:** field, use the ⇒ key to select 1. Press the ↓ key to move to the next field.
- 11.1.11 In the **Num Baln Speeds:** field, use the ⇒ key to select the total number of speeds (up to 9) you will use for this setup. Optionally, you may choose “Select in Job” which will allow you to specify the number of balance speeds with each new job rather than defaulting to a number you select here in the setup. Three speeds are recommended for balancing the BR710. Press the ↓ key to move to the next field.

- 11.1.12 In the **Slow Roll RPM:** field, use the keypad to enter “0”. Slow roll is a compensating RPM for use in engine applications where proximity probes are used and does not apply to this engine. Press the ↓ key to move to the next field.
- 11.1.13 In the **Min Baln RPM:** field, use the keypad to enter the minimum speed at which this engine can be balanced. This speed will normally be a speed in the flight range. Press the ↓ key to move to the next field.
- 11.1.14 In the **Actual RPM @ 100%:** field, use the keypad to enter the speed of the fan at 100% rpm. For the BR710, this is 7431. Press the ↓ key to move to the next field.
- 11.1.15 In the **Vib Unit:** field, use the ⇒ key to select “mm/sec”. The BR710 engine is balanced using velocity units of millimeters per second. Press the ↓ key to move to the next field.
- 11.1.16 In the **Modifier:** field, use the ⇒ key to select “Peak”. When all fields are complete, press [ENTER] to accept and continue.
- 11.2 The Define Class Weights banner screen will be displayed where each of the class weights used for the BR710 fan trim balance will be added to the setup. Because the 4040 has a limited number of characters for the “Name” field of each individual weight, the conversion below is used. Notice that the “ACES Designation” in the fourth column is a single letter. This allows the use of multiple weight combination and also allows for the removal of the W4 Spreader washer, designated by (-D) in the Name field of the analyzers weight definition screen.

BR700 Trim Balance Weights	Part Number	Weight (grams)	ACES Designation
Cup washer	AS44522-020	2	A
Cup washer	AS44522-030	3	B
Cup washer	AS44522-040	4	C
W4 - Spreader washer	AS12945	4.5	D
W1 - Cup washer	AS44522-050	5	E
Cup washer	AS44522-060	6	F
Cup washer	AS44522-070	7	G
Cup washer	AS44522-080	8	H
Cup washer	AS44522-090	9	I
W2 - Cup washer	AS44522-100	10	J
Cup washer	AS44522-120	12	K
Cup washer	AS44522-140	14	L
W3 - Trim balance plate	BRR40214	15.5	M

Possible Combinations	End Weight (grams)
E-D	0.5
F-D	1.5
A	2
G-D	2.5
B	3
H-D	3.5
C	4
D	4.5
E	5
J-D	5.5
F	6
G	7
K-D	7.5
H	8
I	9
L-D	9.5
J	10
M-D	11
K	12
MA-D	13

Possible Combinations	End Weight (grams)
L	14
MC-D	15
M	15.5
MF-D	17
MA	17.5
MB	18.5
MH-D	19
MI-D	20
MF	21.5
MG	22.5
MK-D	23
MH	23.5
MI	24.5
ML-D	25
2M-D	26.5
MK	27.5
ML	29.5
2M	31
3M-D	42

11.3 Complete each field in the screen as follows:

11.2.1 In the **Name or PN:** field, use the keypad to enter “BR710”. This name is used in lieu of the multiple part numbers used for BR710 balance weights. Press the ↓ key to move to the next field.

Model 4040 VIPER Analyzer						
Define Class Wts						
Name or PN: BR710						
Num Wts: 39		Placement: Spread				
Name	Wt	Span	Name	Wt	Span	
(The min wt must be a base wt)						
NONE	0.000	1	G	7.000	1	
E-D	0.500	1	K-D	7.500	1	
F-D	1.500	1	H	8.000	1	
A	2.000	1	I	9.000	1	
G-D	2.500	1	L-D	9.500	1	
B	3.000	1	J	10.00	1	
H-D	3.500	1	M-D	11.00	1	
C	4.000	1	K	12.00	1	
D	4.500	1	MA-D	13.00	1	
E	5.000	1	L	14.00	1	
J-D	5.500	1	M	15.00	1	
F	6.000	1	MF-D	17.00	1	
More						

Model 4040 VIPER Analyzer						
Define Class Wts						
Name or PN: BR710						
Num Wts: 39		Placement: Spread				
Name	Wt	Span	Name	Wt	Span	
(The min wt must be a base wt)						
MA	17.50	1	ML	29.50	1	
MB	18.50	1	2M	31.00	1	
MH-D	19.00	1	3M-D	42.00	1	
MI-D	20.00	1				
MF	21.50	1				
MG	22.50	1				
MK-D	23.00	1				
MH	23.50	1				
MI	24.50	1				
ML-D	25.00	1				
2M-D	26.50	1				
MK	27.50	1				
More						

11.7.1 In the **Num Wts:** field, use the keypad to enter a total number of weights in this class weight set 38, plus 1 for a total of 39. The first weight will be the NONE weight which means a negative or null weight having no influence on the balance (in this case the D weight). Press the ↓ key to move to the next field.

11.7.2 In the **Name, Wt,** and **Span** columns, enter the information as shown in the illustration above for the 39 class weights and weight combinations. The name will be the letter combinations of the various weights, the weight is measured in grams for each combination of class weights and the span is the number of holes each combination weight covers when installed. When all information is entered as shown for the first 24 weights, press [F1] “More” key to switch screen views for the remaining weights. Note that where letter and combinations of letters are followed by the “-D”, this indicates the removal of the “D” weight, which is the W-4 Spreader Washer, part number AS12945.

When all weights have been entered on the second page, press [ENTER] to accept and continue.

- 11.8 The Balance Plane Information screen will be displayed. Complete the screen as follows:

Model 4040 VIPER Analyzer				
Balance Plane Information				
Plane ID:	1	Num Holes:	16	
Usable:	6	RivetWt:	0.000	
Hole Num Dir:	CW	Spacing:	Even	
MaxWt/Hole:	42.00	MaxWt/Plane:	252.0	
Wt Set:	BR710	Trial Wt:	10.00	
Angle of No.1 Hole:	0			

- 11.8.1 If the Plane ID: field does not read < 1 >, press the [RIGHT ARROW] key to select “1”. Press the [DOWN ARROW] key to move to the next field.
- 11.8.2 In the Num Holes: field; use the analyzer keypad to enter “16”. Press the [DOWN ARROW] key to move to the next field.
- 11.8.3 In the Usable: field; use the analyzer keypad to enter “6”. Press the [DOWN ARROW] key to move to the next field.
- 11.9 The Sensor Information screen will be displayed. Complete the screen as follows:
- 11.9.1 In the **Eng ID:** field; use the keypad to enter a single alphanumeric character to identify this engine such as L, R, 1 or 2. . Press the ↓ key to move to the next field.

Model 4040 VIPER Analyzer
Sensor Information

Eng ID:
Tach Chan: Tach Type:
Tach Pos (FLA): :00
Full Scale Vibration:

Sensor Type	Ch	Desc	Pos	Targ
<input type="text" value="GV ONBOARD"/>	<input type="text" value="A"/>	<input type="text" value=""/>	<input type="text" value="12"/>	<input type="text" value="0.100"/>

- 11.9.2 In the **Tach Chan:** field, use the \Rightarrow key to select the tach channel you wish to use. This must be the tach channel, 1, 2, 3, or 4, where you connect the tach input cable for this engine. Press the \Downarrow key to move to the next field.
- 11.9.3 In the **Tach Type:** field, use the \Rightarrow key to select the type of tachometer you are using. If using the EVM tach output, a Lasetach or Phototach, select Optical. Press the \Downarrow key to move to the next field.
- 11.9.4 In the **Tach Pos (FLA):** (tachometer position as viewed from forward looking aft), use the \Rightarrow key to select a clock position where the tach probe is located on the engine. Press the \Downarrow key to move to the next field.
- 11.9.5 In the **Full Scale Vibration:** field, use the \Rightarrow key to select the highest amplitude you reasonably expect to experience for this balance job. Amplitude of 5 mm/sec is sufficient for the BR710. Press the \Downarrow key to move to the next field.
- 11.9.6 In the **Sensor Type** column, use the \Rightarrow key to select a sensor from those sensors programmed into your analyzer. If using the GV's engine installed sensor, select the GV Onboard sensor as programmed in paragraph 10 of this document. Press the \Downarrow key to move to the next field.
- 11.9.7 In the **Cha** field, use the \Rightarrow key to select the channel you will connect the incoming vibration signal to, A, B, C, or D. Press the \Downarrow key to move to the next field.
- 11.9.8 In the **Desc** field, use the keypad to enter an optional description of the channel identified sensor such as #1 or L. Press the \Downarrow key to move to the next field.
- 11.9.9 In the **Pos** (position) field, use the \Rightarrow key to select the approximate clock position of the vibration sensor on the engine as viewed from forward looking aft into the intake. If you are not sure of the position, select "UNK" for unknown. The analyzer will compensate for the unknown position and locate it automatically with one additional engine run. Press the \Downarrow key to move to the next field.
- 11.9.10 In the **Targ** (target amplitude) field, use the keypad to input the amplitude you wish to achieve as a maximum acceptable using this setup. When all fields are complete, press [ENTER] to accept. The screen below will be displayed asking "Store this new setup?" Press the [F1] "Yes" key to save or the [F5] "No" key to return to the setup.

Model 4040 VIPER Analyzer				
Model 4040 VIPER Analyzer				
Store this new setup?				
Yes				No

- 11.10 After the setup is stored you may turn the analyzer off or proceed to the balance procedure. If you continue with the balance, the customer information screen below will be displayed. The information on this screen is optional and need not be filled in to continue with the job, however; this information will assist you in your record keeping efforts and greatly reduce the effort in recalling the job later from the analyzers memory or for the AvTrend database. Use the keypad to enter the Name, Aircraft Registration, and total aircraft time. If you have entered other names in the Name field previously, you may press the [F1] key and select from a list containing those stored names. When all fields are complete, press [ENTER] to accept and continue.

Model 4040 VIPER Analyzer				
Customer Information				
Enter the following optional Customer information.				
Name: CONTINENTAL EXPRESS				
A/C Registration: N123CE				
A/C Total Time: 1289				
Press ENTER to continue				
Names				

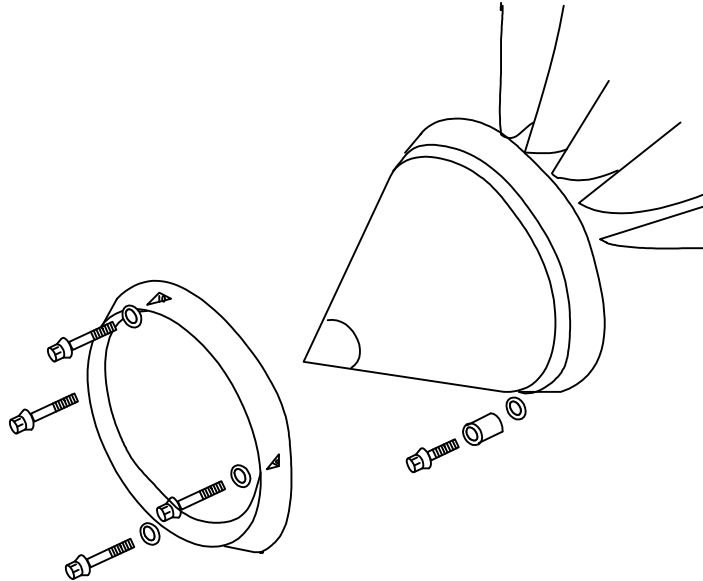
- 11.11 If you elected to Select Balance Speeds in the Job (see item 11.6.11 above) the “Define Fan/Turbine Balance RPM” banner, shown here, will be displayed. use the ⇒ key to select the number of balance speeds for this job. You may choose up to nine speeds. If you have completed a survey for this engine and know the balance speeds you will use, enter those speeds in the “N% RPM” column. Press the ↓ key to move to the next field.

- 11.11.1 In the **Entered PRM Relative to Peak:** field, use the ⇌ key to toggle the answer field to Yes or No as appropriate indicating whether or not the speeds are relative to the peak vibration of a survey. This is normally the case unless the engine manufacturer specifies the balance speeds without reference to any survey information. Press the ↓ key to move to the next field.
- 11.11.2 In the **Peak Speed:** field, enter the speed of the highest peak vibration of the survey. You may enter either a %RPM or the actual RPM. The analyzer will make the distinction. Press the ↓ key to move to the next field.
- 11.11.3 The **Spd** column will contain a number of rows relative to the number of balance speeds you specified. Immediately to the right of those numbers, in the **N%RPM** column, use the keypad to enter the balance speeds. If you wish to conduct a Fan Vibration Survey at this point to determine the balance speeds, press the [F1] “Survey” key and follow the directions on screen. When all fields are complete as necessary, press [ENTER] to accept and continue.
- 11.12 The Define Fan / Turbine Balance ICFs banner screen will be displayed. In the **All Speeds Use the Same ICF:** field, use the ⇌ key to toggle the answer field to Yes or No as appropriate. If you have individual coefficient influences for each speed, answer No, otherwise answer Yes. Press the ↓ key to move to the next field.

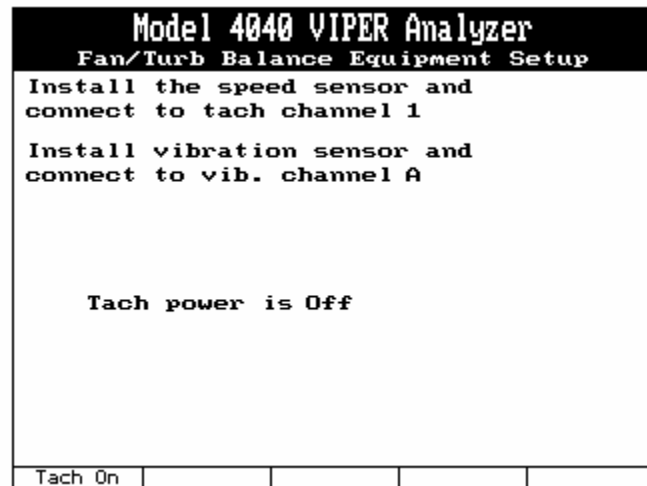
Model 4040 VIPER Analyzer				
Define Fan/Turbine Balance ICFs				
Plane ID: 1				
All Speeds Use the Same ICF: <input checked="" type="checkbox"/> Yes				
Spd Sensor 1				
g/IPS Deg				
1	90.91	150		

- 11.12.1 In the **g/IPS** column, use the keypad to enter the influence in grams per IPS. If you do not know the influence, leave it at zero. The analyzer will require one extra run to automatically calculate an influence for the engine. Press the ↓ key to move to the next field.
- 11.12.2 In the **Deg** field, use the keypad to enter the phase lag, if known. If you do not know the phase lag, leave this field at zero. The analyzer will calculate the phase lag automatically during the job. Press [ENTER] to accept your settings and proceed.
- 11.13 The Fan / Turb Balance Equipment Setup screen will be displayed. Follow the on screen instructions for installing and attaching sensors and cables. Notice that there is a message near the center of the screen reading “Tach power is off”. This indicates the tachometer circuit is currently not powered for alignment of the Lasetach. If you are

ready to align the Lasetach, press the [F1] “Tach On” key to power the laser and proceed to the LASER ALIGNMENT section at the end of this document. When the laser alignment is complete, return to this point and continue.

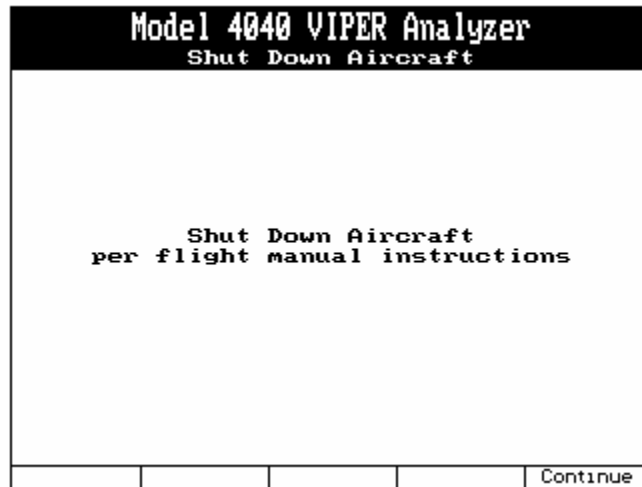


- 11.14 If the laser alignment is complete, press [ENTER] to continue. The power indication for the tach may be left in either the on or off position when exiting this screen.



- 11.15 The Start Aircraft banner screen will be displayed. The Run number is indicated at the top left of the screen followed by the information message “Remove all trim weights.” Insure all previously installed trim balance weights have been removed. Start the engine(s) and watch for the Current RPM indication on the analyzer screen. When an indication of RPM is noted, allow the engine to warm up to normal operating temperature then accelerate the engine until the Current RPM and the Desired PRM on screen match as closely as possible. The Difference indication will show how many RPM difference there is between the Current and the Desired RPM. When the speeds

- 11.17 The Shutdown Aircraft message will be displayed. Press the [F5] “Continue” key to acknowledge and proceed with a normal engine shutdown procedure.



- 11.18 The Review Prior Run(s) Data will be displayed for your review of the data collected up to this point. You may view data from all runs by scrolling through the available run data using the ← and → keys. Optionally you may use the [F1] and [F2] keys to Retake one or all data as required. When you are satisfied with the review, press [ENTER] to continue.

The screenshot shows a terminal window with a black header bar containing the text "Model 4040 VIPER Analyzer" and "Review Prior Run(s) Data". The main area of the screen displays a table of data for Run 1. The table has columns for Spd, Sensor 1, Rpm, Vib, and Deg. The data is as follows:

Run 1	Spd	Sensor 1	Rpm	Vib	Deg
1	13746	0.36	290		
2	13572	0.29	293		
3	13224	0.30	295		

Below the table, the text "Use <> to select run" is displayed. At the bottom, there are buttons for "RetakeOne" and "RetakeAll".

- 11.19 The Fan / Turb Suggested / Installed Wts screen will be displayed. Notice the first line of text in the screen shows the Run number and the message “Remove Old Wts, Inst. New Wts.” Remove all previously installed trim weights for the previous run and install the weights in the “Suggested” column in the hole numbers indicated to their immediate left. The right side of the screen reflects what you actually installed. Be sure the

information in the Hole/Bld and Installed column are correct before exiting this screen. If you install the exact suggested weight, you need only press the [ENTER] key to exit this screen with that information. If you installed different weights or installed weights in different holes than those suggested, use the arrow key to navigate the matrix and indicate your exact installation. This is very important in that the analyzer will use this information to calculate an influence for all subsequent runs. Notice the the function keys at the bottom of the screen are labeled for the options of “Inst=Sugg” (install the suggested weights in the suggested holes), “Inst=None” (Install None or no weights), “Sel Pla/W” (select a different Plane or weight set), and “Quit Job” When all fields are complete, press [ENTER] to accept and continue.

Model 4040 VIPER Analyzer			
Fan/Turb Suggested/Installed Wts			
Run 1 Remove Old Wts, Inst. New Wts			
Name: Plane 1, 23071354-X			
Hole/Bld	Suggested	Hole/Bld	Installed
6	-4	6	-4
5	-5	5	-5
4	-5	4	-5
3	-5	3	-5
2	-1	2	-1
1	NILL	1	NILL
1	NILL	1	NILL
1	NILL	1	NILL
1	NILL	1	NILL
1	NILL	1	NILL
1	NILL	1	NILL
Total: Sugg = 29.536 @ 261			
Total: Inst = 29.601 @ 261			
Inst=Sugg	Inst=None	Sel Pla/W	Quit Job

- 11.19 The Start Aircraft banner screen will be displayed for the next sequential run as indicated in the upper left portion of the screen. From this point, the sequence of events from paragraph 11.15 through 11.18 repeat until the fan vibration is reduced to an acceptable level. Normally this goal will be attained in one to three runs.

Model 4040 VIPER Analyzer			
Start Aircraft			
Run 2			
Start engine(s) per flight manual			
Current RPM: NO TACH			
Desired RPM: 13746			
Difference :			
When speed is stable at desired speed, press ENTER to continue.			

LASER ALIGNMENT

1. Rotate the fan until the reflective tape on the spinner is positioned at the 9:00 position for number 1 (left engine) or 3:00 for the number 2 (right engine). Clock position is from the Front of the engine, looking aft into the intake.
2. Ensure the Lasetach is securely mounted and connected as described in Equipment Setup. Also check to make sure the Lasetach is securely mounted to the Swivel Head of the Lasetach Mount. (See figure 3 below). If it is loose, tighten by turning the Lasetach clockwise on the mounting stud while holding the Swivel head with the other hand.
3. Remove the plastic aperture cap from the Lasetach.
4. Turn the Laser **ON/OFF** switch on top of the Lasetach to the **ON** position.
5. The **BEAM ON** indicator (red) light adjacent to the Laser **ON/OFF** switch should now be illuminated.
6. Place the open palm of your hand in front of the aperture. The laser beam should be visible on your palm.

WARNING

Do not look into the aperture of the Lasetach. Avoid direct eye exposure. Eye damage may occur due to direct exposure to laser radiation.

7. Loosen the Locking Handle of the Lasetach mount (see figure below) so that the Lasetach swivels with a slight friction. Using the “gunsight” method, sight along the side of the Lasetach using one hand while holding the Locking Handle with the other. If you have trouble acquiring the laser beam visually, you may use a free hand to sight on. No injury will occur as a result of the laser being projected on your skin. You may also choose to have someone hold a sheet of white bond paper near the target for easier acquisition. When the laser beam strikes the tape, it will be very visible. When the laser is on target, center the beam on the length of the tape and immediately tighten the Locking handle by turning it clockwise. Release both hands and recheck the alignment.
8. The laser should now be approximately in the center of the two-inch span of the tape. If minor adjustments are necessary, loosen the Locking Handle only **SLIGHTLY**. Make adjustments as necessary and re-tighten.
9. When satisfied with the laser position, rotate the fan several times. When the tape passes through the laser position, the **GATE** (green) light on the Lasetach should turn on as the tape enters the beam and off as it exits. If this test is successful, return to the cockpit and select the opposite Tach. Repeat steps **1.** through **9.** above for the second Lasetach. When complete, return to the cockpit and continue with the Equipment Setup section of this document.

