



Application Note

Application Note Number	A-HIUH12-2020E-MR
Revision	1
Function	Main Rotor Track and Balance
Airframe	Hiller UH-12
Engine	N/A
E-Setup Number	A-HIUH12-2020E-MR.asf
ACES Systems Analyzer	Model 2020 w/Main Rotor Enhanced
Firmware Version	2.00 or greater
Procedure	N/A

Introduction

This outline covers the required equipment, equipment installation, analyzer setup, data acquisition, and solution process for using the ACES' 2020 ProBalancer to perform main rotor track and balance on the Hiller UH-12 helicopter. General instructions for the use of the Model 2020 ProBalancer can be found in user manual #2020OM-01. All adjustments to the aircraft are to be performed IAW the Hiller Maintenance Manual.

A. Required Equipment

The following ACES Systems' equipment is required.

Item	Quantity	Description	Part Number
1.	1	Model 2020 ProBalancer	10-100-2020
2.	1	Optical Tracker Model 540-2	75-900-0542
3.	2	Sensor, Vibration, 991D-1	69-100-0075
4.	1	Cable, Sensor, 991D-1, 50'	10-320-0163
5.	1	Cable, Sensor, 991D-1, 25'	10-320-0162
6.	1	Cable, Phototach	10-320-0126
7.	1	Phototach	10-100-1773
8.	1	Phototach Mount, Hiller UH-12	22-430-0143
9.	1	Mount, Sensor, ¼	22-430-0035
10.	1	Mount, Sensor, 5/16	22-430-0036

Miscellaneous Equipment

Tape or tie wraps to secure cables to airframe.

B. Equipment Installation

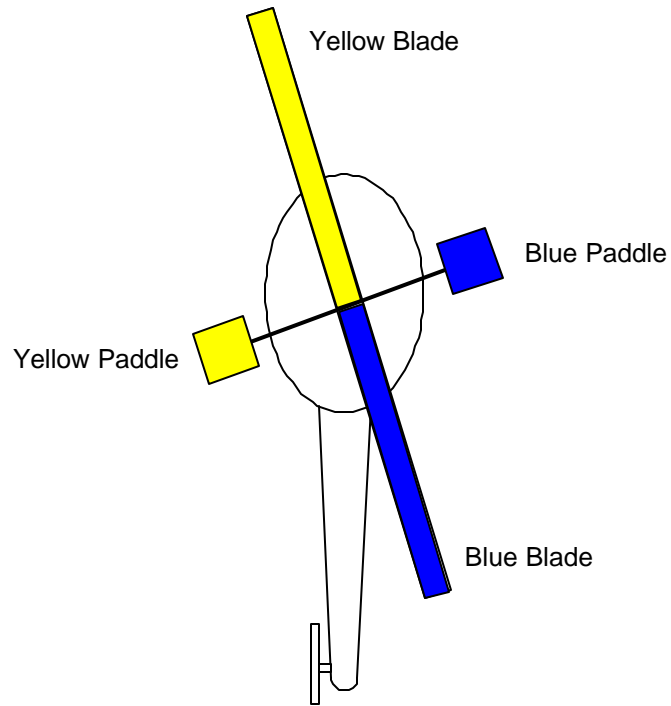
1. Install phototach mount (P/N 22-430-0143) on the right side of the “wishbone”. Rotate the mount towards the nose of the aircraft until forward portion of the mount rests on the “wishbone” crossmember. Tighten mount.
2. Install phototach (P/N 10-100-1773) into bracket. Install the plastic nut onto the phototach and tighten.
3. Rotate the main rotor until the yellow blade is at the 11:30 position. Install reflective tape on the rotating mast inline with the phototach.

Note

When phototach and reflective tape are aligned, the blade over the nose of the aircraft is the Yellow Blade.

4. Connect phototach cable (P/N 10-320-0126) to phototach and route into cabin area. Secure cable with tape or adel clamps. Connect cable to Tach Channel 1 on analyzer.
5. Remove nut from stud at the top of the transmission. The nut to be removed is at the right rear of the bolt circle. Mount 991D-1 sensor (P/N 69-100-0075) and bracket (P/N 22-430-0036) to the left-hand side of the transmission. The connector must point to the 9:00 position. Connect sensor cable (P/N 10-320-0163) to the sensor and route to the analyzer. Connect the cable to channel B of the 2020 analyzer.
6. Mount 991D-1 sensor (P/N 69-100-0075) and bracket (P/N 22-430-0035) in the forward cockpit area on the left-hand side of the center console. Connector must face down. Connect sensor cable (P/N 10-320-0162) to the sensor and route to the analyzer. Connect the cable to channel A of the 2020 analyzer.
7. Connect the Optical Tracker (P/N 75-900-0542) to the Aux./Comm port on the 2020 analyzer.

Equipment Installation Diagram



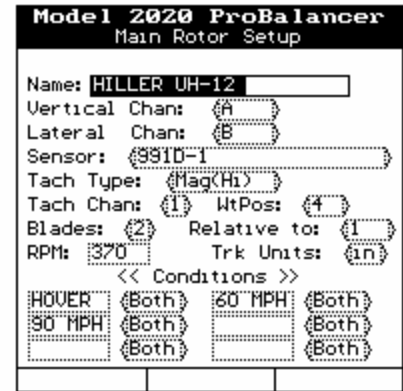
Yellow Blade is forward when the phototach and tape are aligned

Hiller UH-12

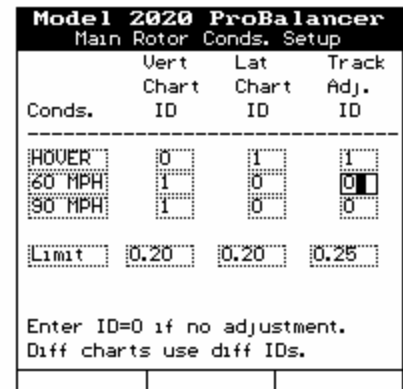


C. Analyzer Set Up

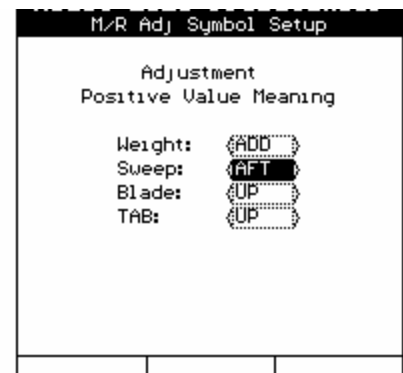
1. Turn the analyzer “ON”
2. Enter a new setup as follows; from the “Main Menu” select “Main Rotor Track and Balance” and press **[Enter]**. From the “Main Rotor Tack and Balance” menu, select **[Manage Setups]** and press **[Enter]**. From the ‘Manage Setups’ menu, select **[Edit]** and press **[Enter]**. From the “Edit Screen” press the **[New]** button.
3. The “Main Rotor Setup” screen now appears. Enter the main rotor job setup as shown. When completed press **[Enter]**.



4. The “Main Rotor Conditions” screen will determine the charts to be used when calculating corrections for a given measurement. Chart “ID’s” of similar measurements with the same number will average the readings together for use in solutions. The “limit” field under each measurement type will set the point at which the analyzer will determine whether corrections are needed. Enter the information exactly as it appears in the appropriate fields. When completed, press **[Enter]**.



5. The “M/R Adjustment Symbol Setup” screen is displayed next. The function of this screen is to



determine the direction of movement for a + adjustment. Enter the values as shown. When complete press **[Enter]**.

- The first main rotor chart to define will be the “Vertical”: 60-80MPH chart. This chart will determine the Tab adjustments to perform for vertical vibration reduction. The unit of adjustment is DEG., “Degrees”. Enter the information exactly as it appears in the appropriate fields. When completed press **[Enter]**.

```

Model 2020 ProBalancer
Main Rotor Chart Setup
Name: Vert: 60 MPH-80 MPH
Chart Type: (Regular)
Sweep Only: (No)
Adj. Unit: DEG
Adj./IPS: 6.00
Bld/Pos      Adj @      Bld/Pos
-----
YELLOW      1 : 30
BLUE        7 : 30

Bld/Pos: in CW or CCW order
+Adj = WtAdd/SwAft/BldUp/TabUp
Help
    
```

- “Lateral”: Hover chart. This chart will determine the Blade Tip weight and Paddle weight or the Blade Tip weight and Sweep adjustments to perform for lateral vibration reduction. Choose the desired adjustment types and enter the information as shown. When completed press **[Enter]**.

```

Model 2020 ProBalancer
Main Rotor Chart Setup
Name: Lat: HOVER
Chart Type: (Irregular)
Sweep Only: (No)

Bld/Pos Unit  Adj   IPS  Adj @
-----
YELTIP: G    50.00 1.00 3 : 0
BLUSWP: FLT  2.00  1.00 6 : 0
BLUTIP: G    50.00 1.00 9 : 0
YELSWP: FLT  2.00  1.00 12 : 0

+Adj = WtAdd/SwAft/BldUp/TabUp
Help
    
```

```

Model 2020 ProBalancer
Tracking Influence Setup

Conds      AdjName Unit  Adj./in
-----
HOVER      PCL  FIT  3.00

+Adj = WtAdd/SwAft/BldUp/TabUp
    
```

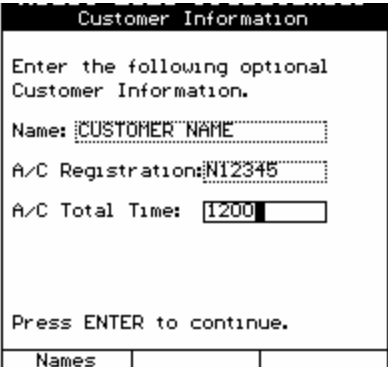
- Next, the “Tracking Influence Setup” screen for Hover will appear. This chart will determine the amount of pitch change adjustment required to improve track splits at hover. The “Adj./in.” sensitivity tells the balancer the amount of PCL adjustment required to equal one

inch of movement at the blade tip. Enter the information exactly as it appears in the appropriate fields. When complete, press **[Enter]**

8. Setup complete, press **[Enter]**, and then **[Backup]**, select “Start Job”, press **[Enter]** and then select the Hiller UH-12 Main Rotor Setup that was just created.

D. Data Acquisition

1. “Customer Information” screen. It is recommended to complete this screen so that customer information will appear on printout assisting in identification of the job when it is stored in the analyzer memory. When finished press **[Enter]**.



Customer Information

Enter the following optional
Customer Information.

Name: CUSTOMER NAME

A/C Registrations: N12345

A/C Total Time: 1200

Press ENTER to continue.

Names		

2. “Tracking Selections” screen. Allows the user to select tracking device for this particular job. Select Tracker or Strobe and press **[Enter]**.

Model 2020 ProBalancer		
Tracking Selections		
Track Device:	(Tracker)	
- For Optical Tracking Only		
Number of Rotations:	50	
Inches To Blade Tip:	120	

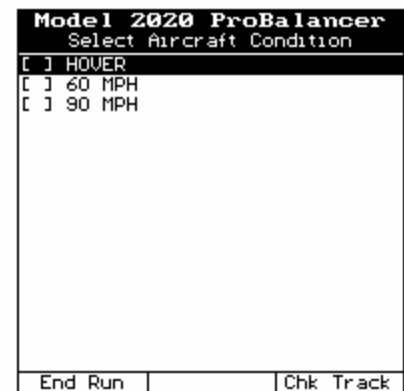
3. “Main Rotor Equipment Setup”. Information screen that prompts the user to verify equipment installation has been performed in accordance with channel selections that were specified when building the setup. Press **[Enter]**.

Model 2020 ProBalancer		
Main Rotor Equipment Setup		
Install the speed sensor and connect to TACH Channel 1		
Install vertical vibration sensor to vibration channel A		
Install lateral vibration sensor to vibration channel B		
Tach power is off		
Tach On		

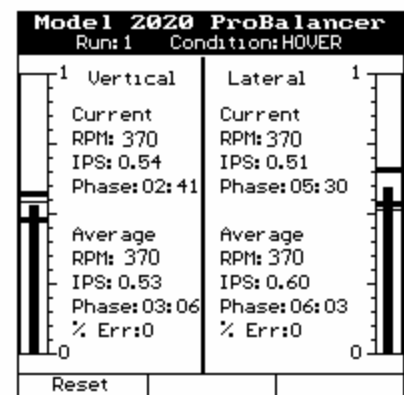
4. “Start Aircraft” screen. This screen allows the user to view the current main rotor rpm. When the aircraft has been started press **[Enter]**.

Model 2020 ProBalancer		
Start Aircraft		
Runs:	1	
Start aircraft per flight manual.		
Rotor Speed:	370	
After speed is greater than 50, press ENTER to continue.		

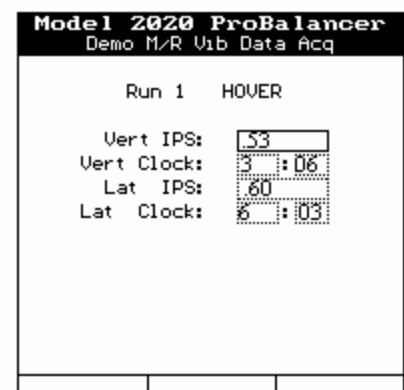
5. “Select Aircraft Condition” screen. Displays the ground and flight regimes that are specified in the setup. Select Ground and press **[Enter]**.



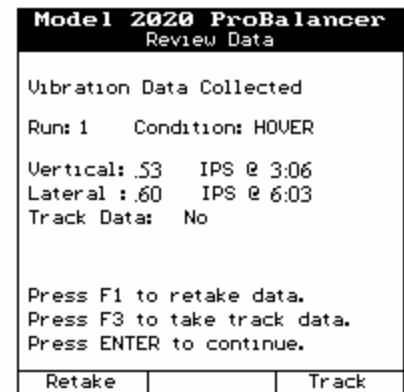
6. “Acquiring Vibration Data”. This screen is displayed during the vibration acquisition. When stable vibration readings are observed, press **[Enter]**.



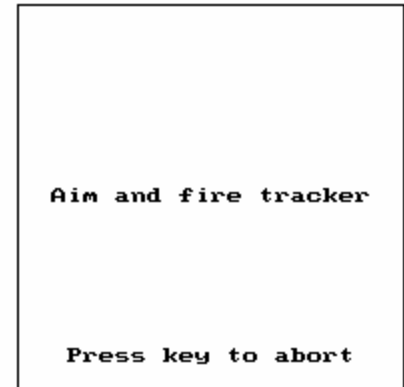
7. “Review Data”. This screen allows the user to view the vibration readings that were acquired during the regime. Press **[Enter]** to continue.



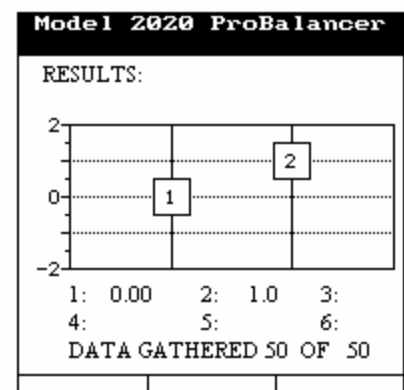
8. “Review Data”. This screen allows the user to view the vibration readings that were acquired during the regime. Press **[Enter]** to continue or **[F-3]** to acquire Track data.



9. The “Track Screen” will appear prompting you to aim and fire the tracker. Aim the tracker at the tip of the rotor disk at the 12:00 position. Move tracker up and down until green LED’s are illuminated. Press trigger one time and release, continue to hold tracker with green LED’s illuminated. The amber LED will pulsate during the acquisition. When tracker acquisition is complete the amber LED will extinguish.



10. The track data will now appear on the screen. The track split will be shown. If the number of packets recorded is less than 75% of the total, press **[Enter]** and then **[F-1]** to retake the track reading. After review press **[Enter]** to continue.



11. The “Review Data” screen will reappear showing that the track data has been taken and recorded, press [Enter] to continue.

Model 2020 ProBalancer		
Review Data		
Vibration Data Collected		
Run: 1	Condition: HOVER	
Vertical: .53	IPS @ 3:06	
Lateral : .60	IPS @ 6:03	
Track Data: YES		
Press F1 to retake data.		
Press F3 to take track data.		
Press ENTER to continue.		
Retake		Track

Note

At any time during a flight if the vibration levels are found to be too severe to continue, the user has the option to end-run and solve for the vibration data acquired to that point.

12. Repeat sequence through all flight regimes. After all data is acquired press the “Adjust” [F-2] button, shut down the aircraft and review solution options.

Model 2020 ProBalancer		
Select Aircraft Condition		
[x] HOVER		
[x] 60 MPH		
[x] 90 MPH		
End Run	Adjust	Cbk Track
M/R Sugg. and Inst. Adj		
Run 1		
Name: Vert: 60 MPH-90 MPH, DEG		
Bld/Pos	Suggested	Installed
YELLOW	4.24	4.24
BLUE	0.00	0.00
+Adj = WtAdd/SwAft/BldUp/TabUp		
Inst=Sugg	Inst=None	Quit Job

13. The analyzer will present all of the gathered. It is possible adjustments that would adversely affecting the rotor system as called to start the engine and con

Model 2020 ProBalancer		
Shutdown Aircraft		
Shutdown aircraft per flight manual instructions.		
Press ENTER to continue.		
M/R Sugg. and Inst. Adj		
Run 1		
Name: Lat: Hover, G		
Bld/Pos	Suggested	Installed
VELTIP	0.00	0.00
BLUPAD	90.00	90.00
BLUTIP	0.00	0.00
VELPAD	0.00	0.00
+Adj = WtAdd/SwAft/BldUp/TabUp		
Inst=Sugg	Inst=None	Quit Job

Note

It is important to remember that when installing or removing weights and recording their positions that the influence used for the next run will be updated by the result from the previous run's solution, therefore be as accurate as possible when recording adjustments made regardless whether the recommended solution is implemented. The only entries on this screen should reflect the actual solution implemented.



Application Note

Hiller UH-12

Main Rotor Track and Balance

Part Number: a-hiuh12-2020e-mr

AppNote Number: 11-200-0098

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