Application Note

Application Note Number	A-SIH60-2020E-MR
Revision	0
Function	Main Rotor Track and Balance
Airframe	Sikorsky H-60
Engine	N/A
E-Setup Number	A-SIH60-2020E-MR.asf
ACES Systems Analyzer	2020E with enhanced Main Rotor software.
Firmware Version	2.0 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 Model 2020 to perform a main rotor track and balance on the H-60 helicopter using the Pushrod Method for tracking and balancing. General instructions for the use of the Model 2020 can be found in user manual #2020OM-01. All adjustments to the aircraft are to be performed IAW the H-60 Maintenance Manual.

A. Required Equipment

The following ACES Systems' equipment is required.

Item	Quantity	Description	Part Number
1.	1	Model 2020 Analyzer	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, 25'	10-320-0162
5.	1	Cable, Sensor, 991D, 50'	10-320-0163
6.	1	Mount, Vibe Sensor, 5/16" "L"	22-430-0036
7.	1	Mount, Vibe Sensor, .250" "L"	22-430-0035
8.	1	Magnetic Pickup	75-900-0187
9.	1	Cable, Magnetic Pickup 25'	10-320-0052

Miscellaneous Equipment

Tape or tie wraps to secure cables to airframe.

B. Equipment Installation

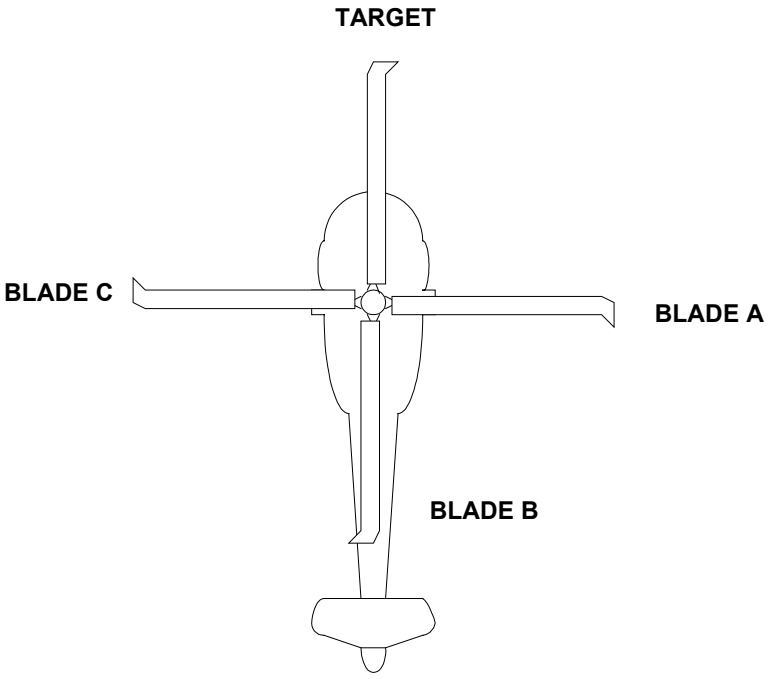
1. The magnetic pickup bracket is permanently installed on stationary swashplate. Remove upper jam nut from magnetic pickup (P/N 75-900-0187). and install magnetic pickup into magnetic pickup bracket. Turn main rotor until the magnetic pickup and interrupter align. The blade over the nose of the aircraft is the **Target Blade.**
2. Adjust the gap between the magnetic pickup and the interrupter to .022 - .024 in. Tighten upper jam nut and safety wire.
3. Connect magnetic pickup cable (P/N 10-320-0052) to pickup and route through drip pan and into the cabin area. Secure cable with tape or adel clamps. Connect cable to Tach Channel 1 on analyzer.

Caution

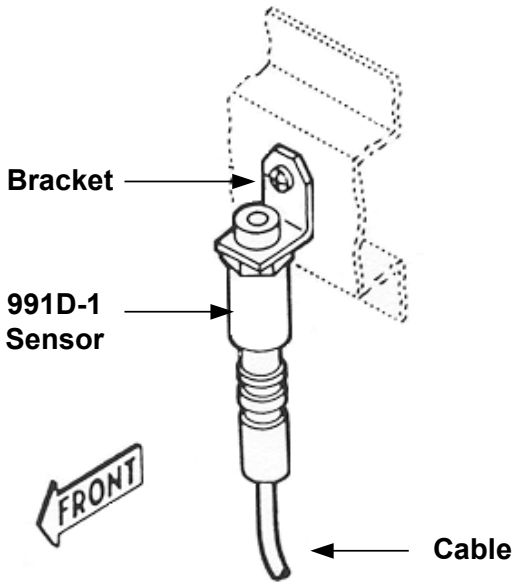
Secure the cable as not to interfere with helicopter moving parts. Cable must have sufficient slack to permit full movement of swashplate.

4. Mount 991D-1 sensor (P/N 69-100-0075) and bracket (P/N 22-430-0035) to station 293 behind the pilots station. Connector must face **DOWN.** Connect sensor cable (P/N 10-320-0163) to the sensor and route to the analyzer. Connect the cable to channel A of the 2020 analyzer.
5. Mount 991D-1 sensor (P/N 69-100-0075) and bracket (P/N 22-430-0036) to station 293 behind the copilots station. 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 B of the 2020 analyzer.
6. Connect the Optical Tracker (P/N 75-900-0542) to the Aux./Comm port on the 2020 analyzer.

Equipment Installation Diagram

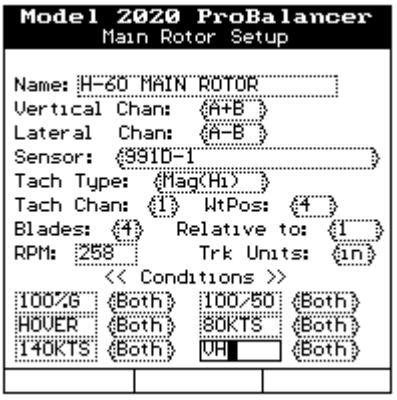


Target Blade is forward when interrupter and magnetic pickup are aligned

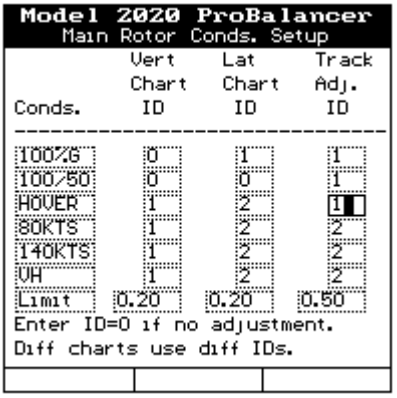


C. Analyzer Set Up

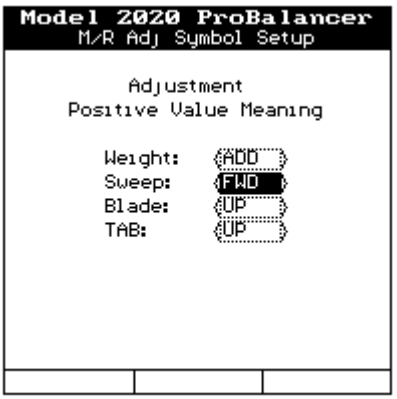
1. Turn the analyzer "ON"
2. Enter a new setup as follows; from the "Main Menu" select "Main Rotor Track and Balance" and press **[Enter].** From the "Main Rotor Tack and Balance" menu, select **[Manage Setups]** and press **[Enter]**. From the 'Manage Setups" menu, select **[Edit]** and press **[Enter].** From the "Edit Screen" press the **[New]** button.
3. The "Main Rotor Setup" screen now appears. Enter the main rotor job setup as shown. The conditions are 100% Ground, 100% ground with 50% Torque, Hover, 80 KTS, 140KTS, and VH. When completed press **[Enter].**



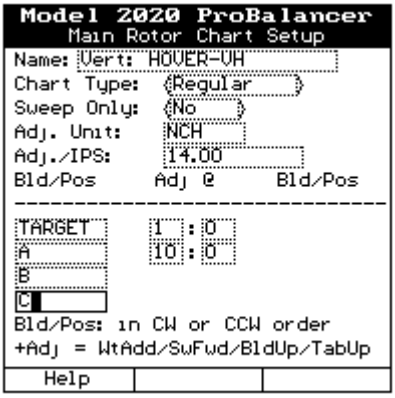
4. The "Main Rotor Conditions" screen will determine the charts to be used when calculating corrections for a given measurement. Chart "ID's" of similar measurements with the same number will average the readings together for use in solutions. The "limit" field under each measurement type will set the 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].**



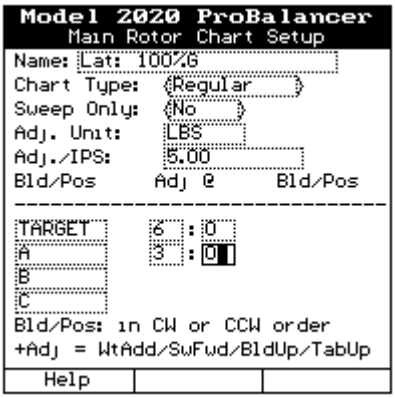
5. The "M/R Adjustment Symbol Setup" screen is displayed next. The function of this screen is to determine the direction of movement for a + adjustment. Enter the values as shown. When complete press **[Enter].**



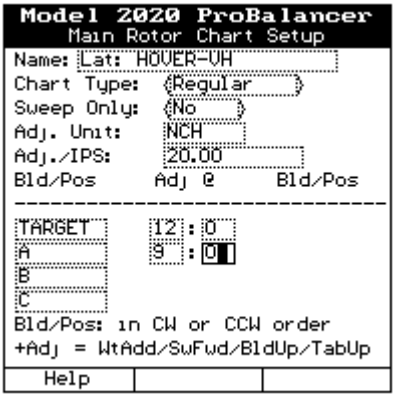
6. The first main rotor chart to define will be the "Vertical": Hover-VH chart. This chart will determine the PCL adjustments to perform for in-flight vertical vibration reduction based on the A+B vibration readings. The unit of adjustment is NCH, "Notches" of the PCL. Enter the information exactly as it appears in the appropriate fields. When completed press **[Enter].**



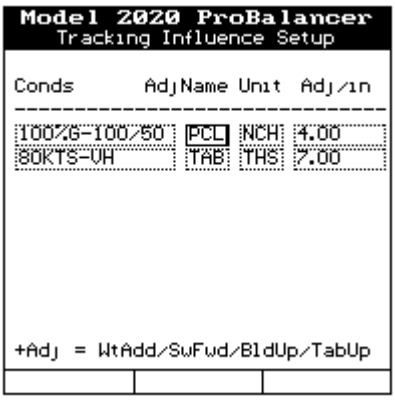
7. The next main rotor chart to define will be the "Lateral": 100% Ground chart. This chart will determine the Weight adjustments to perform for ground lateral vibration reduction. Enter the information exactly as it appears in the appropriate fields. When completed press **[Enter].**



7. The next main rotor chart to define will be the "Lateral": Hover-VH chart. This chart will determine the PCL adjustments to perform for in-flight vertical vibration reduction based on the A-B vibration readings. The unit of adjustment is NCH, "Notches" of the PCL. Enter the information exactly as it appears in the appropriate fields. When completed press **[Enter].**



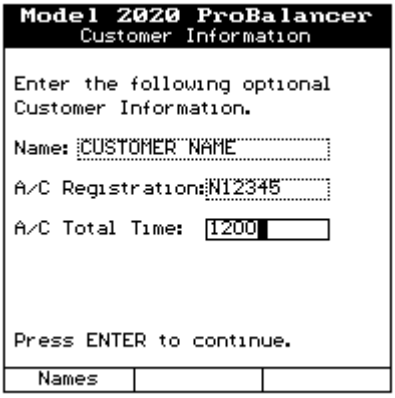
8. Last, the "Tracking Influence Setup" screen will appear. This chart will determine the amount of pitch change and tab adjustment required to improve track splits at ground and in-flight. The "Adj./in." sensitivity tells the balancer the amount of adjustment required to equal one inch of movement at the blade tip. The PCL: adjustments are in notches and the Tab adjustments are in .001 in. Enter the information exactly as it appears in the appropriate fields. When complete, press **[Enter]**



9. Setup complete, press **[Backup]**, select "Start Job", press **[Enter]** and then select the H-60 Main Rotor Setup that was just created.

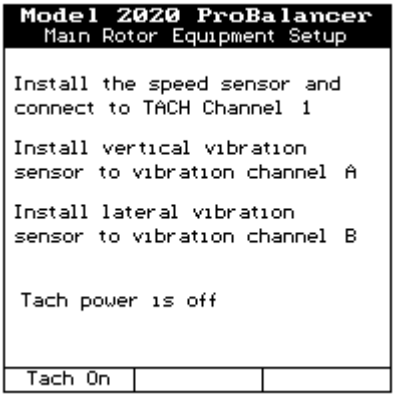
D. Data Acquisition

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].**

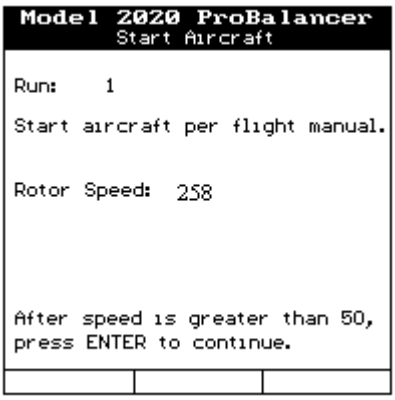


2. "Tracking Selections" screen. Allows the user to select tracking devise for this particular job. Select Tracker or Strobe and press **[Enter].**

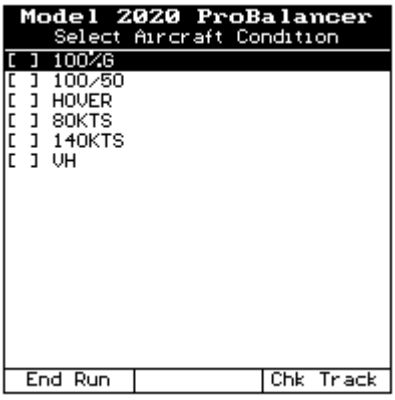
3. "Main Rotor Equipment Setup". Information screen that prompts the user to verify equipment installation has been performed in accordance with channel selections that were specified when building the setup. Press **[Enter].**



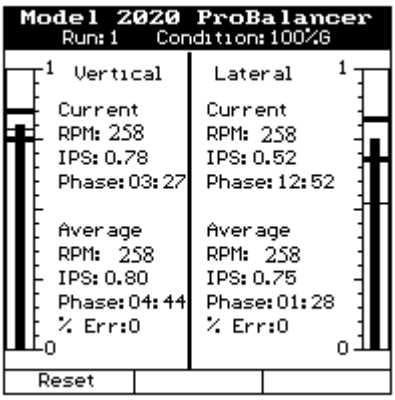
4. "Start Aircraft" screen. This screen allows the user to view the current main rotor rpm. When the aircraft has been started press **[Enter].**



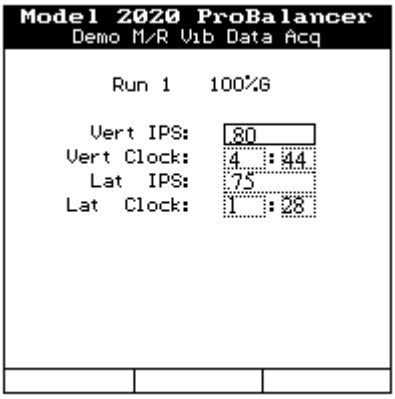
5. "Select Aircraft Condition" screen. Displays the ground and flight regimes that are specified in the setup. Select Ground and press **[Enter].**



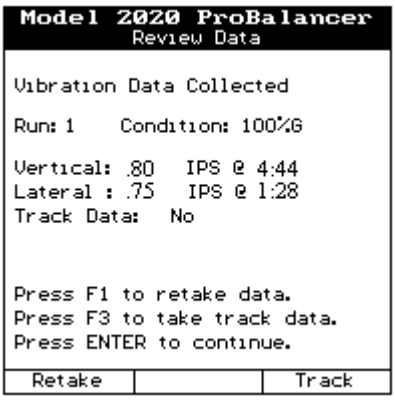
6. Acquiring Vibration Data. This screen is displayed during the vibration acquisition. When stable vibration readings are observed, press **[Enter].**



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

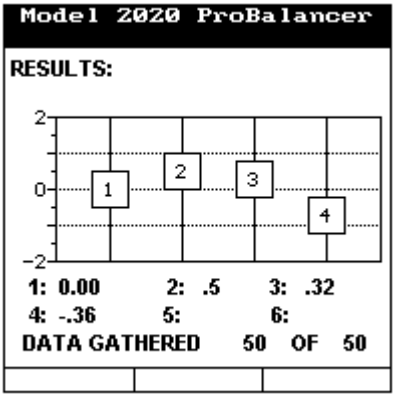


8. "Review Data". This screen allows the user to view the vibration readings that were acquired during the regime. Press **[Enter]** to continue or **[F-3]** to acquire Track data.

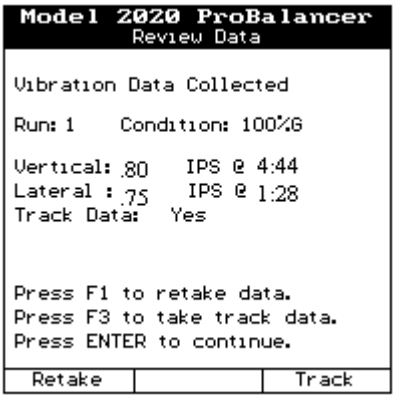


9. The "Track Screen" will appear prompting you to aim and fire the tracker. Aim the tracker at the tip of the rotor disk at the 12:00 position. Move tracker up and down until green LED's are illuminated. Press trigger one time and release, continue to hold tracker with green LED's illuminated. The amber 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.



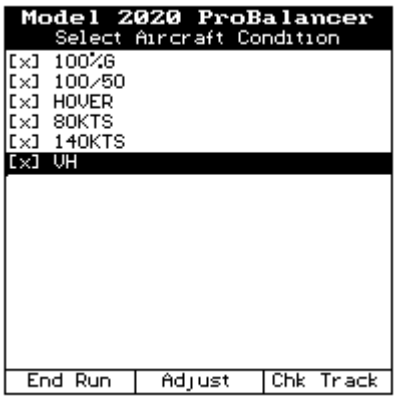
11. The "Review Data" screen will reappear, press **[Enter]** to continue.

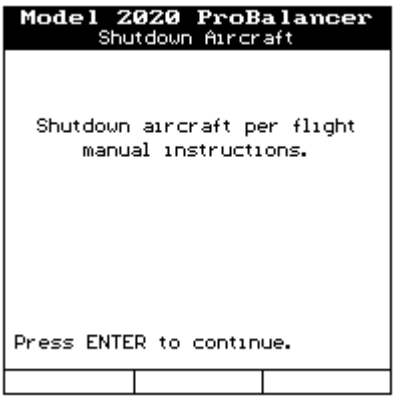


Note

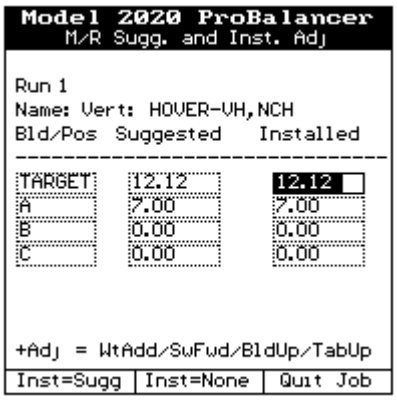
At any time during a flight if the vibration levels are found to be too severe to continue, the user has the option to end run and solve for the vibration data acquired to that point.

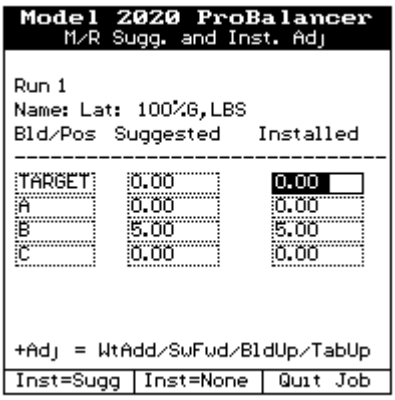
12. Repeat sequence through all flight regimes. After all data is acquired press the "Adjust" **[F-2]** button, shut down the aircraft and review solution options.

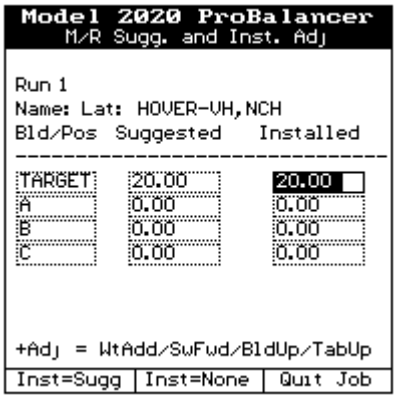


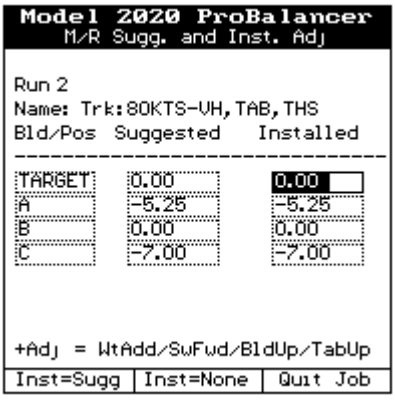


13. The analyzer will present all of the solutions possible from the data gathered. It is possible for the analyzer to give two adjustments that would adversely affect the other. The user is ultimately responsible for determining which adjustments to implement and which to discard. Use the attached flow chart to aid in the decision making process. Make the desired adjustments to the rotor system as called for by analyzer and press **[Enter].**
The user will now be prompted to start the engine and continue with run #2



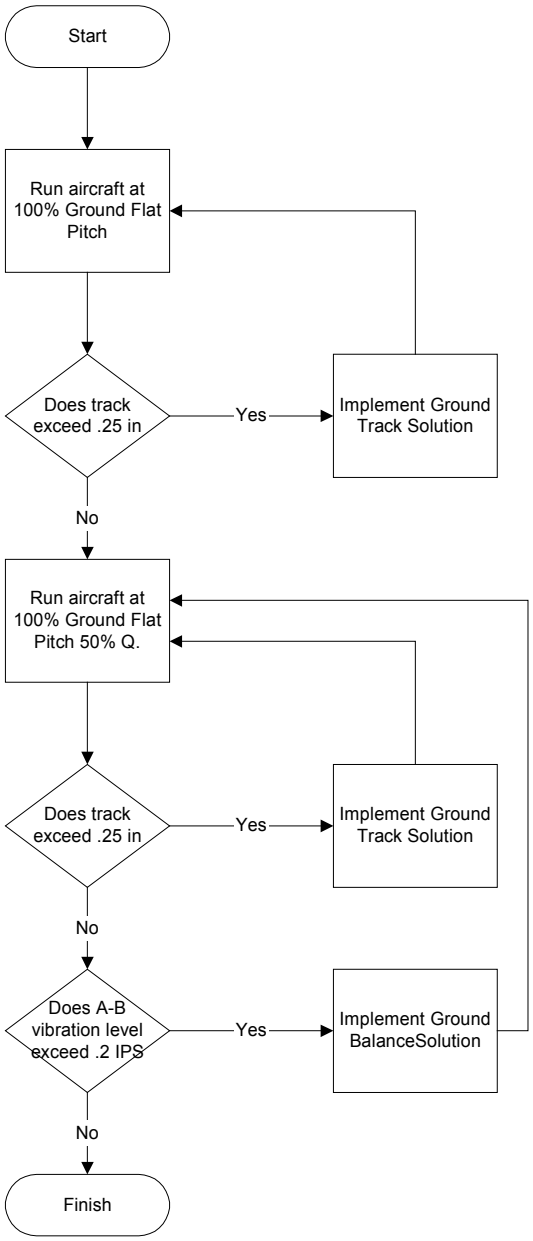




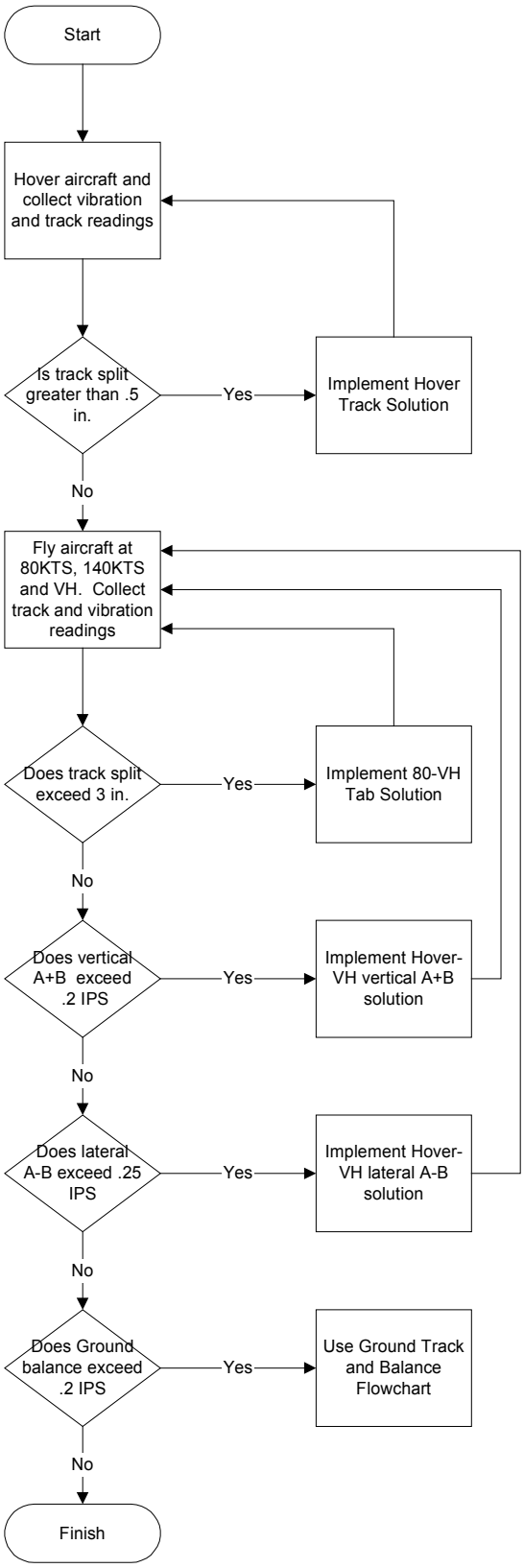


Note

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.



Ground Track and Balance Flowchart



Inflight Track and Balance Flowchart

Application Note

Sikorsky H-60

Main Rotor Track and Balance

Part Number: 11-200-0087

AppNote Number: A-sih60-2020e-mr