

**HELITUNE RT-6  
AND STAT MedEvac  
CASE STUDY**



**HELITUNE**  
A **CMTG** COMPANY

# SITUATION



**18** STAT MedEvac  
UNITS ACROSS  
FOUR STATES



**23**  
AIRCRAFT

STAT MedEvac are a HEMS service provider. They have **18 STAT MedEvac units** providing services across the US states of Pennsylvania, New York, Maryland and Ohio.

STAT MedEvac operate a fleet of **23** aircraft made up of predominantly EC135 and **four** BK117 C2.

Aircraft are maintained primarily at Allegheny County Airport as well as at satellite units.

# SITUATION

MET WITH  
HELITUNE IN  
**2022**

**2 X**  
RT-6  
SYSTEMS

In 2022, STAT MedEvac met with Helitune at H.A.I. This led to a practical demonstration of the RT-6 system, providing evidence of the system's effectiveness.

STAT MedEvac's main area of focus for RT&B process improvement was the BK117 C2 tail rotor, along with both aircrafts' main rotor systems.

Following a successful demonstration, it was clear Helitune RT- six would make tasks more efficient. **STAT MedEvac purchased two RT-6 systems with the EC135 and BK117 C2 Application Kits.**



# OUR AIMS



Analyse the observed differences between using the Helitune RT-6 system over a six month period, compared to the system STAT MedEvac were previously using for RT&B.



Identify the differences in metrics for ground runs and flights taken.



Identify the differences in sortie times, from the start of ground data recording to the completion of the final flight data recording.

# OUR AIMS



Identify the number of sets of rotor adjustments made as a result of the difference in engineering time taken.



Identify the overall impact for all the above metrics and discuss the impact of these differences.



Identify how and why the RT-6 provides that difference.

# EC135 MAIN ROTOR TRACK AND BALANCE

LEGACY RTB KIT:  
HOW MANY RUNS / FLIGHTS?



STAT MedEvac estimate that with their previous track and balance system the average EC135 main rotor would take on average of:

4 GROUND RUNS

3 HOVERS

3 FORWARD FLIGHTS

This would indicate that a typical track and balance procedure would need an average of seven sets of adjustments between 10 engine starts, four of which are ground runs, three 'hover only' flights and three 'full flight' regimes.

# EC135 MAIN ROTOR TRACK AND BALANCE

HELITUNE RT-6:  
HOW MANY RUNS / FLIGHTS?



Following data analysis, the average amount of ground runs and flights required using the Helitune RT-6 calculated over 17 individual RTB activities carried out on 15 different aircraft over six months.

The mean averages for the Helitune RT-6 system are:



This would indicate an average of three sets of adjustments between four engine starts.

# EC135 MAIN ROTOR RT&B



Legacy RTB kit would take over double the time as Helitune. STAT MedEvac had to take a track picture by itself then take vertical and lateral readings separately.

(It is assumed that the legacy kit takes 2.5 times longer).

EQUIPMENT TYPE	GROUND RUN (MINS)	FULL FLIGHT (MINS)	AMOUNT OF RUNS / FLIGHTS
<b>LEGACY RTB KIT</b>	12.5 MINUTES	25 MINUTES	4 GROUND RUNS 6 FLIGHTS
<b>HELITUNE RT - 6</b>	5 MINUTES	10 MINUTES	2 GROUND RUNS 2 FLIGHTS

# EC135 MAIN ROTOR RT&B



OPERATION	DETAIL	TIME SAVING DATA
2 x GROUND RUNS 4 x RTB FLIGHTS	2 x FULL GROUND RUNS SAVED 2 x FULL FLIGHTS SAVED	2 x 12.5 MINS 4 x 25 MINS
2 x GROUND RUNS 2 x FLIGHT TIMES	REDUCED RUNNING TIME REDUCED FLIGHT TIME	2 x 7.5 MINS 2 x 15 MINS

TOTAL TIME SAVED

# 2 HOURS 50 MINS

# OPERATING COST OF EC135

**\$750**

**AIRCRAFT PER HOUR**

**\$84**

*(\$2.1 per gallon)*

Fuel at a combined Flight / Ground Run  
burn rate of 40 US Gallons per hour

**\$834**

**TOTAL HOURLY COST**

**AVERAGE COST PER HOUR OF  
RTB COMBINING GROUND RUNS  
AND FLIGHTS**



# EC135 MAIN ROTOR TRACK AND BALANCE AVERAGE APPROX SAVING PER RT&B



- 6 engine starts saved on average per RTB
- 2 hours and 50 minutes / running time saved per RTB
- 2 ground runs saved per RTB
- 4 flights saved per RTB
- 4 adjustments saved per RTB
- 2 hours and 50 minutes at a cost of \$834 per hour

**\$2363** saved per RTB on average

# EC135 MAIN ROTOR RT&B RT-6 HEADLINE FLEET DATA (6 months)



Data was collected over six months, over 17 RTB activities on 15 different aircraft. Here are the mean averages and estimated time / effort taken using the legacy RTB kit:

- 102** engine cycles saved
- 48** flying hours saved
- 34** ground runs saved
- 68** RTB flights saved
- 68** adjustments saved  
*20 mins per adjustment – 23 engineering manhours*

**\$40,171** in aircraft hours and fuel cost

# EC135 TAIL ROTOR BALANCE



COMPARED TO THE LEGACY RTB SYSTEM THE RT-6 PERFORMED EQUALLY, EXCEPT FOR THE AMOUNT OF TIME TO PROCESS AND DISPLAY DATA.

for a simple tail rotor radial balance with a single type weight adjustment, this is as expected.



# BK117 C2 MAIN ROTOR TRACK AND BALANCE

**LEGACY RTB KIT:  
HOW MANY RUNS / FLIGHTS?**

**4** GROUND  
RUNS

**6** HOVERS

**4** FORWARD  
FLIGHTS

STAT MedEvac estimate that with their previous track and balance system the average BK117 main rotor would take on average:

This would indicate that a typical track and balance procedure would need **an average of 10 sets of adjustments between 14 engine starts**, four of which were ground runs, six were 'hover only' flights and four would have been 'full flight' regimes.

# BK117 C2 MAIN ROTOR TRACK AND BALANCE

HELITUNE RT-6:  
HOW MANY RUNS / FLIGHTS?

Following data analysis, the average amount of ground runs and flights required using the Helitune RT-6 calculated over two individual RTB activities carried out on two different aircraft.

The mean averages for the Helitune RT-6 system are:



This would indicate **an average of four sets of adjustments between five engine starts.**

# BK117 C2 MAIN ROTOR RT&B



Legacy RTB kit would take over double the amount of time as Helitune. STAT MedEvac had to take a track picture by itself, then capture vertical and lateral readings separately.

It is assumed that the legacy kit takes 2.5 times longer.

EQUIPMENT TYPE	GROUND RUN (MINS)	FULL FLIGHT (MINS)	AMOUNT OF RUNS / FLIGHTS
<b>LEGACY RTB KIT</b>	12.5 MINUTES	25 MINUTES	4 GROUND RUNS 10 FLIGHTS
<b>HELITUNE RT-6</b>	5 MINUTES RUNNING	10 MINUTES FLIGHT / RUNNING	2 GROUND RUNS 3 FLIGHTS

# BK117 C2 MAIN ROTOR RT&B



OPERATION	DETAIL	TIME SAVING DATA
2 x GROUND RUNS 7 x RTB FLIGHTS	FULL GROUND RUNS SAVED FULL FLIGHTS SAVED	2 x 12.5 MINS 7 x 25 MINS
2 x GROUND RUNS 2 x FLIGHT TIMES	REDUCED RUNNING TIME REDUCED FLIGHT TIME	2 x 7.5 MINS 3 x 15 MINS

TOTAL TIME SAVED

**4 HOURS  
20 MINS**

# OPERATING COST OF BK117 C2

**\$1480**

**AIRCRAFT PER  
HOUR**

**\$94.5**

*(\$2.1 per gallon )*  
Fuel at a combined Flight / Ground  
Run burn rate of 45 US Gallons per  
hour

**\$1574.50**

**TOTAL HOURLY  
COST**

**AVERAGE COST PER HOUR OF  
RTB COMBINING GROUND RUNS  
AND FLIGHTS**

# BK117 C2 MAIN ROTOR TRACK AND BALANCE AVERAGE APPROX SAVING PER RT&B



- 9 engine starts saved on average per RTB
- 4 hours and 20 minutes flight / running time saved per RTB
- 2 ground runs saved per RTB
- 7 flights saved per RTB
- 8 adjustments saved per RTB

**\$6,822** saved per RTB on average

# BK117 C2 MAIN ROTOR RT&B RT-6 HEADLINE DATA



Data was collected over two RTB activities on two different aircraft. Here are the mean averages and estimated time / effort taken using the legacy RTB kit:

**18** engine cycles saved

**8hr 40m** flying / running time saved

**4** ground runs saved


**14** RTB flights saved

**16** adjustments saved  
*20 mins per adjustment – five engineering manhours*

**\$13,635** in overall operating costs

# BK117 C2 TAIL ROTOR TRACK AND BALANCE

LEGACY RTB KIT:  
HOW MANY RUNS / FLIGHTS?



STAT MedEvac estimate that with their previous track and balance system the average BK117 tail rotor would take on average:

12-15

#### GROUND RUNS

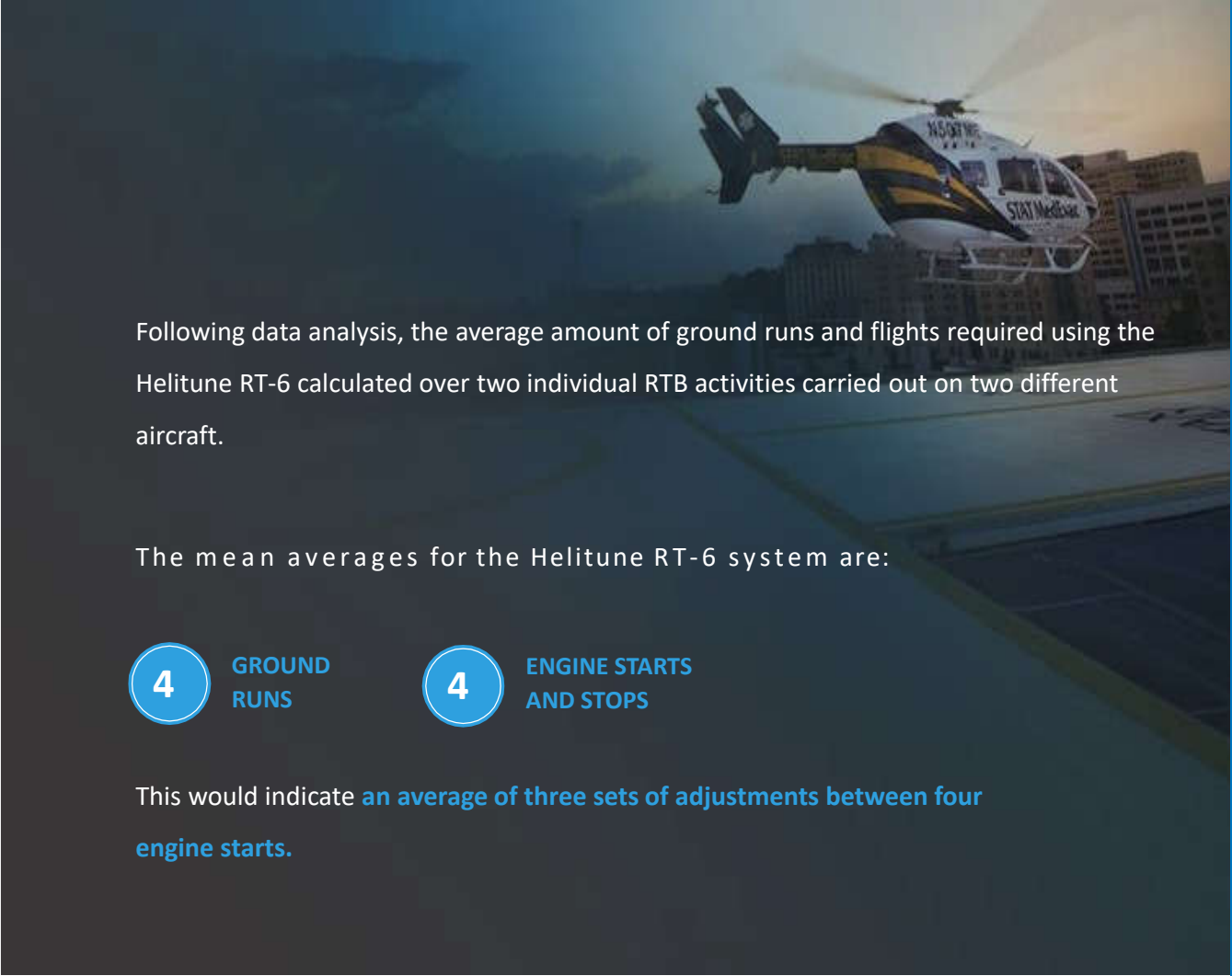
*(sometimes over  
20 times)*

This would indicate that a typical track and balance procedure would need **around 11 - 14 adjustments. These would have been implemented between 11-15, all of which would have been ground runs only.**

We have used 13 as the average number of runs for an approximate comparison to the RT-6 system.

# BK117 C2 TAIL ROTOR BALANCE

## HELITUNE RT-6: HOW MANY RUNS / FLIGHTS?



Following data analysis, the average amount of ground runs and flights required using the Helitune RT-6 calculated over two individual RTB activities carried out on two different aircraft.

The mean averages for the Helitune RT-6 system are:

4 GROUND  
RUNS

4 ENGINE STARTS  
AND STOPS

This would indicate **an average of three sets of adjustments between four engine starts.**

# BK117 C2 TAIL ROTOR BALANCE



On average, legacy RTB kit would take over double the amount of time as Helitune to record data.

It is assumed that the legacy kit takes 2.5 times longer.

EQUIPMENT TYPE	GROUND RUN (MINS)	AMOUNT OF RUNS / FLIGHTS
LEGACY RTB KIT	12.5 MINUTES RUNNING	12 GROUND RUNS
HELITUNE RT-6	5 MINUTES RUNNING	4 GROUND RUNS



# BK117 C2 TAIL ROTOR BALANCE



OPERATION	DETAIL	TIME SAVING DATA
8 x GROUND RUNS	FULL GROUND RUNS SAVED	<b>8 x 12.5 MINS</b>
4 x GROUND RUNS	REDUCED RUNNING TIME	<b>8 x 12.5 MINS</b>

TOTAL TIME SAVED

**2 HOURS  
10 MINS**

# OPERATING COST OF BK117 C2 TAIL



**AVERAGE COST PER HOUR OF  
TAIL BALANCING GROUND  
RUNS**

**\$1480**  
**AIRCRAFT PER  
HOUR**

**\$42**  
*(\$2.1 per gallon)*  
Fuel at a combined Flight / Ground  
Run burn rate of 20 US Gallons per  
hour

**\$1522**  
**TOTAL HOURLY  
COST**

# BK117 C2 TAIL ROTOR BALANCE



## RT-6 VS. LEGACY RTB EQUIPMENT

- 8 engine starts saved on average per tail balance
- 2 hours and 10 minutes running time saved per tail balance
- 8 ground runs saved per tail balance
- 7 adjustments saved per tail balance

**\$3226.50** saved per tail balance on average

# BK117 C2 TAIL ROTOR BALANCE RT-6 HEADLINE DATA



Data was collected over two tail balancing activities on two different aircraft, over six months. Here are the mean averages and estimated time / effort taken using the legacy RTB kit.

- 16** engine cycles saved
- 4hr 20m** running time saved
- 16** ground runs saved
- 16** adjustments saved  
*20 mins per adjustment – 5.5 engineering manhours*

**\$6453** in aircraft operating costs

# HEADLINE DATA



Over a six month period, the STAT MedEvac Fleet was reviewed. The following data for the BK117 and EC135 main rotors and BK117-C2 tail rotors was collected:

**33 technician manhours**

approximate time savings total

**98 fewer adjustments**

between runs or flights

**98 cycles/starts/stops**

starts / stops / cycles

**59 less aircraft hours**

combined running and flying hours

**\$53,445**

approximate  
financial cost  
savings total

# IMPACT OF THE DATA OBSERVED



## REDUCED COST

Financial cost savings impact needs no explanation. In the six months analysed the cost associated with tracking and balancing has been **reduced by approximately \$53,440**, when compared to the previous balancing system used.

## TIME ON TASK

Reducing the technician manhours on tasks increases overall productivity, enabling the task to be completed much faster. This further contributes to aircraft availability.

## LESS ADJUSTMENTS

Less breaks between less flights means a tail or main rotor is likely to be completed with one pilot and team of technicians in a single continuous activity. This reduces handovers and maintains task continuity.

# IMPACT OF THE DATA OBSERVED



## LESS CYCLES, LESS STARTS AND STOPS, LESS OPERATING HOURS

Less impact on fatigue and finite life, of cycle sensitive components and, hours sensitive components.

## LESS STARTS AND CONTINUAL SHORT FLIGHTS AND RUNS

Reduces the likelihood of a fault occurring with non RTB related systems, incurring further maintenance burdens.

## LESS TIME FLYING IN AN AIRCRAFT

with higher than desired vibration levels, whilst under an RTB test , further reducing the risk of induced secondary faults and crew fatigue.

# OVERALL IMPACT OF THE DATA OBSERVED



LESS DOWN  
TIME



AVAILABILITY  
IMPROVED



LOWER COST  
OF RTB



RAPID RETURN  
TO SERVICE



MOST IMPORTANT IMPACT

# EVERY HOUR COULD BE THE GOLDEN HOUR



# HOW IT WORKS IN PRACTICE?



Evidence based insights into Helitune RT-6 functionality utilising the **'Minimum Flight Routine Algorithm'** referred to as **MFR**



# EXAMPLE OF AN EC135 MAIN ROTOR RTB

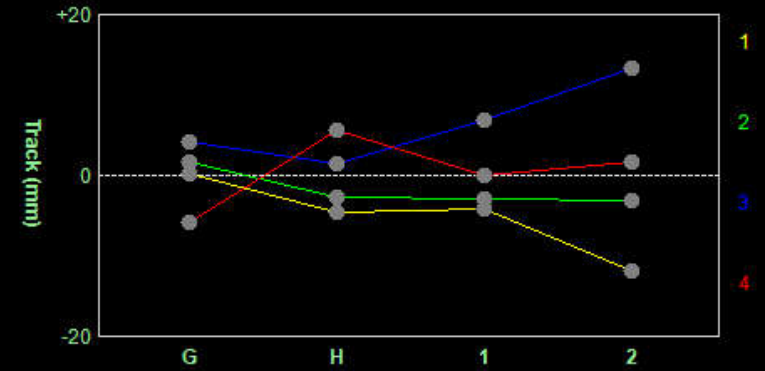
RUN ONE 'FULL FLIGHT'



**Lateral** Part: Main  
Scale 0.5 ips



**Vertical**  
Scale 0.5 ips

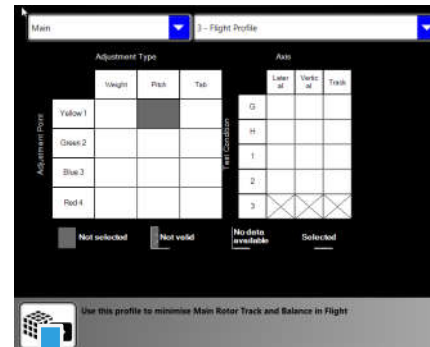


Condition	Lat		Vrt		Track Split
	ips	phase	ips	phase	
G	0.268	289.1	0.093	100.4	9.9
H	0.177	279.8	0.191	128.4	10.2
1	0.209	252.2	0.224	171.6	11.2
2	0.241	254.4	0.183	22.8	25.2
3					

- Out of limits for lateral and vertical in all conditions except for ground condition.
- Solution must keep Ground in limits but resolve the hover and forward flight speed balances, keeping the track below 40mm.
- Combined weight, pitch and tab can be employed by the MFR algorithm to achieve this.

# EXAMPLE OF AN EC135 MAIN ROTOR RTB

FIRST SOLUTION REQUESTED



Adjustment Type	Point	Change	Total
Weight	Blue 3	-64.000 minus	+87.000
Weight	Red 4	+165.000 plus	+249.000
Pitch	Green 2	+0.500 longer	+0.500
Pitch	Blue 3	-0.250 shorter	-0.250
Pitch	Red 4	-0.250 shorter	-0.250
Tab	Green 2	-0.050 Up	+4.950
Tab	Blue 3	-0.150 Up	+4.850
Tab	Red 4	+0.250 Down	+5.250

# EXAMPLE OF AN EC135 MAIN ROTOR RTB

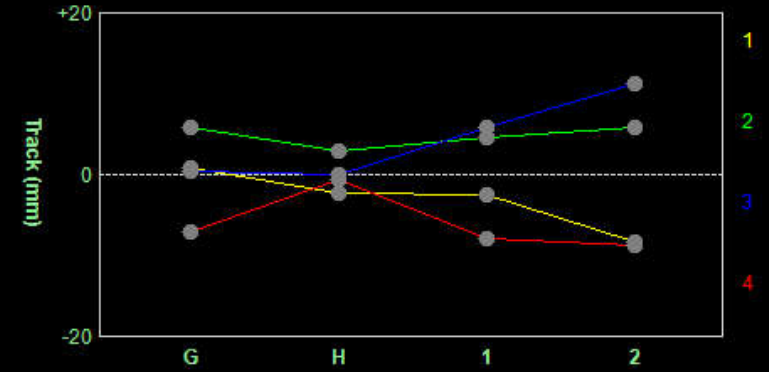
RUN TWO  
'FULL FLIGHT'



**Lateral** Part: Main  
Scale 0.25 i



**Vertical**  
Scale 0.25 i

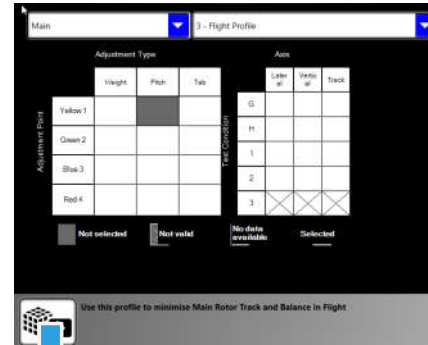


Condition	Lat		Vrt		Track Split
	ips	phase	ips	phase	
G	0.099	61.7	0.039	160.8	12.9
H	0.068	35.8	0.102	287.4	5.2
1	0.051	66.9	0.121	355.0	13.6
2	0.070	124.7	0.127	232.8	20.1
3					

- Result of applying the MFR algorithm solution.
- All but the vertical forward flight is now in limits. (LIMIT < 0.12 IPS).
- Hover lateral is between 0.1 IPS and 0.06 IPS, and is deemed acceptable.

# EXAMPLE OF AN EC135 MAIN ROTOR RTB

FIRST SOLUTION REQUESTED



Adjustment Type	Point	Change	Total
Weight	Blue 3	+2.000 plus	+89.000
Weight	Red 4	+1.000 plus	+250.000
Pitch	Green 2	-0.500 shorter	+0.000
Pitch	Blue 3	-0.250 shorter	-0.500
Pitch	Red 4	-0.250 shorter	-0.500
Tab	Yellow 1	+0.050 Down	+5.050
Tab	Blue 3	+0.200 Down	+5.050
Tab	Red 4	-0.450 Up	+4.800

# EXAMPLE OF AN EC135 MAIN ROTOR RTB

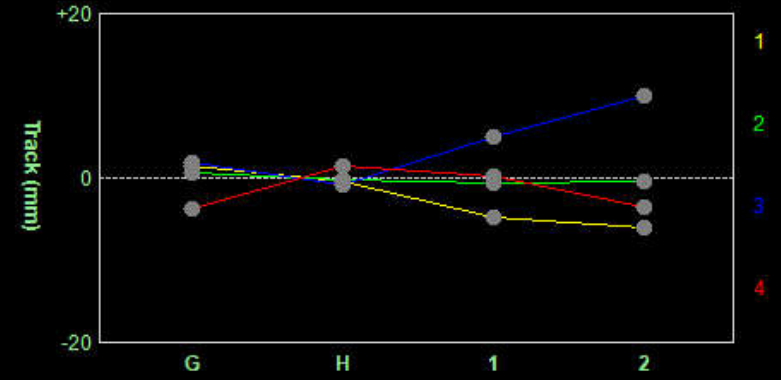
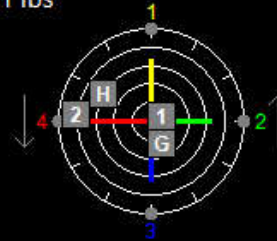
RUN THREE  
'FINAL FLIGHT'



**Lateral** Part: Main  
Scale 0.1 ips



**Vertical**  
Scale 0.1 ips



Condition	Lat		Vrt		Track Split
	ips	phase	ips	phase	
<b>G</b>	<b>0.042</b>	<b>27.3</b>	<b>0.027</b>	<b>153.3</b>	<b>5.6</b>
<b>H</b>	<b>0.041</b>	<b>346.1</b>	<b>0.059</b>	<b>300.8</b>	<b>2.3</b>
<b>1</b>	<b>0.024</b>	<b>245.9</b>	<b>0.014</b>	<b>65.0</b>	<b>9.9</b>
<b>2</b>	<b>0.050</b>	<b>203.9</b>	<b>0.082</b>	<b>275.0</b>	<b>16.2</b>
<b>3</b>					

## RESULTS

Main Rotor In Limits for all required parameters with two sets of adjustments between three short flights.

# BK117 C2 TAIL ROTOR BALANCE

RUN ONE 'FULL FLIGHT'



- The BK117 C2 tail rotor can be a difficult tail rotor to balance.
- This is possibly down to a level of unpredictability between the different rotor installations on different machines.
- Helitune RT-6 uses two axes for balancing the rotor (Radial and Axial).
- Helitune RT-6 has a manually activated calibration function which can be activated after the effects of the first adjustment have been measured in the second tail recording.
- Providing a two axes solution provides better results when tail radial vibration is over 0.3 IPS.

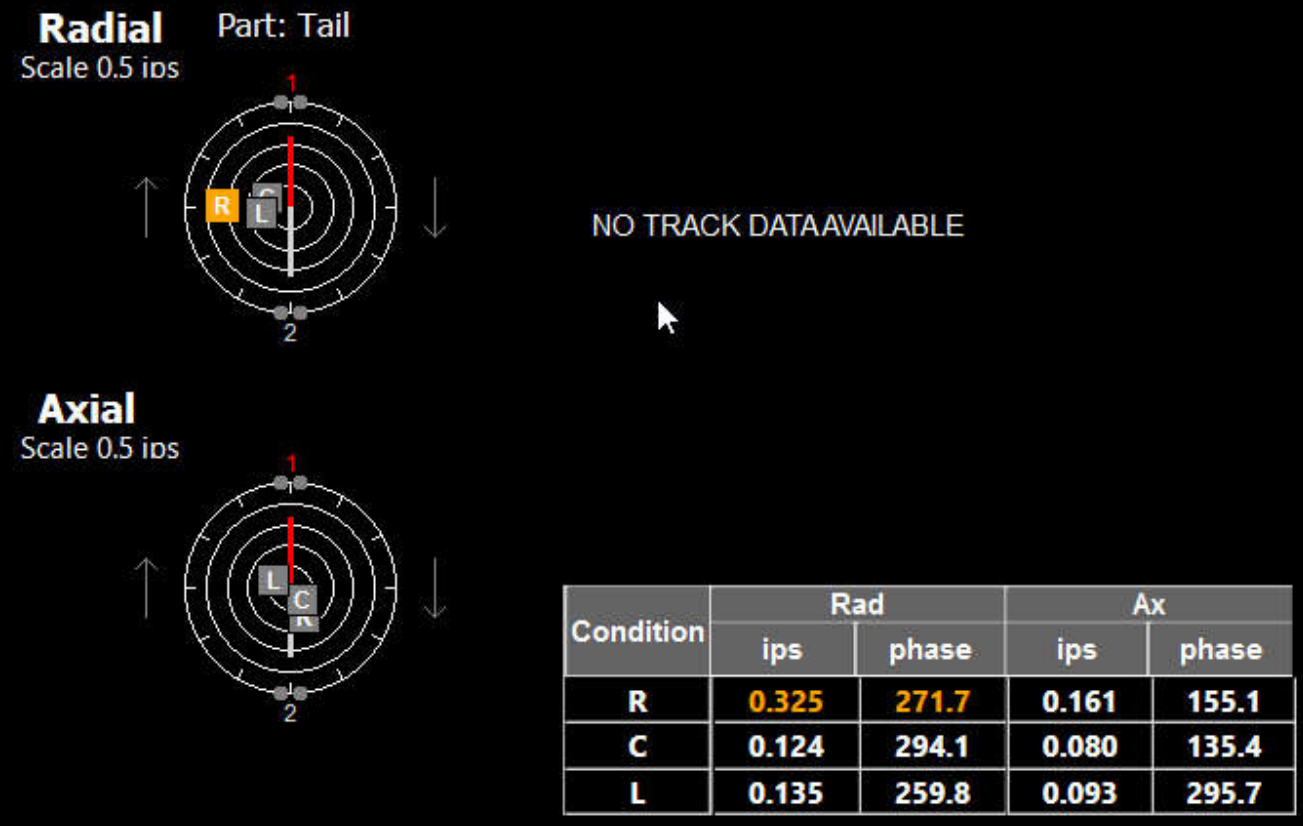


1 - Radial Only

2 - Radial & Axial

# BK117 C2 TAIL ROTOR BALANCE

## RUN ONE



The initial ground run shows the rotor to be out of limits.

R – Is for Right Pedal FWD C – Is for Pedals Centered L – Is for Left

Pedal FWD

# BK117 C2 TAIL ROTOR

FIRST SOLUTION REQUESTED



Tail 2 - Radial & Axial

Adjustment Point	Weight	Axis		
		Radial	Axial	Track
Bolt 1				
Bolt 2		R		X
Bolt 3		C		X
Bolt 4		L		X

Not selected   
  Not valid   
  No data available   
  Selected

Use this profile to establish a Tail Rotor Balance including Axial on the Ground

Adjustment Type	Point	Change	Total
Weight	Bolt 2	+8.500 plus	+8.500
Weight	Bolt 3	+8.900 plus	+10.400
Weight	Bolt 4	-0.600 minus	+0.000

**Weight (grams)**  
 '+' : plus  
 '-' : minus

# BK117 C2 TAIL ROTOR

RUN 2



**Radial** Part: Tail  
Scale 0.5 ips

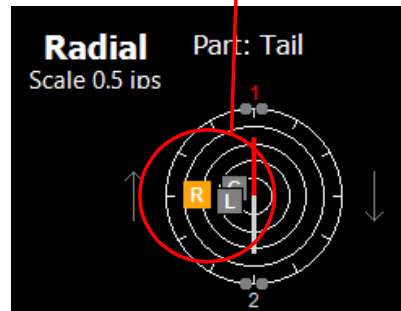


NO TRACK DATA AVAILABLE

**Axial**  
Scale 0.5 ips



Condition	Rad		Ax	
	ips	phase	ips	phase
R	0.083	221.9	0.084	20.8
C	0.225	51.3	0.110	351.1
L	0.415	72.9	0.270	80.5



The adjustment appears to be too large, while the balance points have moved too far.

# BK117 C2 TAIL ROTOR



Tail [▼] 2 - Radial & Axial [▼]

Adjustment Point	Adjustment Type	Test Condition	Axis		
	Weight		Radial	Axial	Track
Bolt 1		R			X
Bolt 2		C			X
Bolt 3		L			X
Bolt 4					

Legend: [Grey] Not selected, [White] Not valid, [Black] No data available, [White] Selected

Use this profile to establish a Tail Rotor Balance including Axial on the Ground

[Helicopter icon]

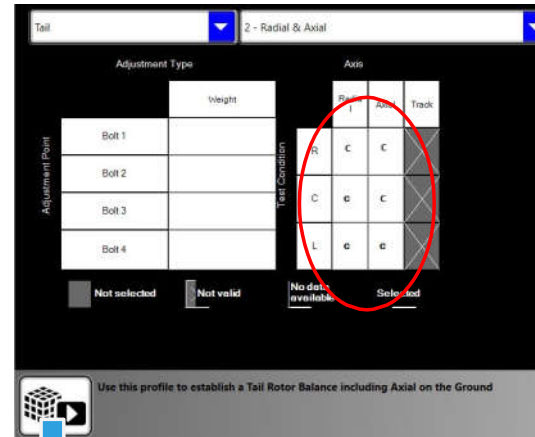


In the solution screen during the second adjustment, a calibration function can be accessed.

# BK117 C2 TAIL ROTOR

## ADJUSTMENT TWO

CALIBRATED FROM RESPONSE TO ADJUSTMENT ONE



Adjustment Type	Point	Change	Total
Weight	Bolt 2	- 3.500 c	+5.500
Weight	Bolt 3	- 3.900 c	+ 6.500

**Weight (grams)**  
 '+' : plus  
 '-' : minus

# BK117 C2 TAIL ROTOR

RUN THREE AFTER A CALIBRATED ADJUSTMENT

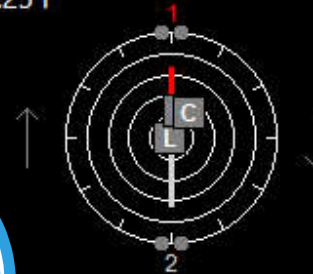


**Radial** Part: Tail  
Scale 0.25 i



NO TRACK DATA AVAILABLE

**Axial**  
Scale 0.25 i



Condition	Rad		Ax	
	ips	phase	ips	phase
R	0.124	237.5	0.072	15.4
C	0.112	51.2	0.076	33.4
L	0.092	341.5	0.005	261.1

- The response of the rotor weight adjustment was calibrated.
- The second adjustment removed some of the weight initially prescribed based on the first adjustment which uses averaged BK117 C2 sensitivity data.
- The result is a balanced tail rotor in three Runs.

# SUMMARY



MAIN ROTORS ARE RESOLVED QUICKLY USING ALL AVAILABLE ADJUSTMENTS FOR ALL CONDITIONS AND PARAMETERS REQUIRED.



TAIL ROTORS THAT DO NOT RESPOND AS EXPECTED, CAN BE RESOLVED QUICKLY AND EFFECTIVELY USING THE MANUAL CALIBRATION FUNCTION.



ANY QUESTIONS?



**HELITUNE**

A **CMTG** COMPANY