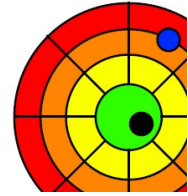




Advanced training

Dynamic balancing of autogyro rotors

Using the Smart Avionics PB4 dynamic balancer



Program:

Day 1 :

Part 1 – Introduction

- Basics of imbalance, C of G & centrifugal force.
- Elementary demonstration of a rotating imbalance on a gyro mast.
- Accelerometers and Tachometers
- Simplified presentation of how a dynamic balancer works and phase lag.
- Balancer output data, IPS and phase angle.
- The « Polar Chart » and « Move Lines ».
- Use of traditional paper Polar Charts.

Part 2 - PB4 setup for single axis balancing

- Step by step PB4 screenshots showing setup (participants using their own PB4 if available).
- Installation of accelerometer and tacho on a Gyro (supplied by participants).
- Flight capturing points (if flight not possible a worked example on the computer).
- Balancing using a typical paper polar Chart.

Part 3 - Balancing rotors that do not respond to pre-established move lines.

- Step by step PB4 screenshots showing how to develop paperless bespoke polar charts with span and chord move lines for an individual rotor
- A worked example or further flight testing according to progress
- Using PB4 software to create proposed adjustment solutions to balance problems.

Part 4 - Balancing rotors that do not respond to the single accelerometer method.

- Introduction to the « two axis » approach using two accelerometers, possible with the Smart Avionics dual accelerometer modules.

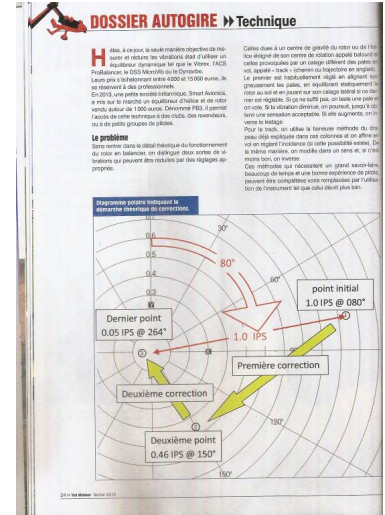
Day 2 :

Part 5 - In flight tracking

- Development of a “multi move line” approach to detect and correct “tracking” dynamically in flight at full rotor rpm.
- Tracking and balance of a gyro (requires numerous 8 to 10 short flights in gyro supplied by participants).
- If flying not possible, 3 worked examples step by step on screen.

Part 6 - Vibration frequency analysis

- Explanation of frequency spectrum.
- Examples showing other sources of gyro vibration.



Formateur : Mike Goodrich / Jérôme Prompsy

Public : Technicians responsible for design or maintenance of autogyros.

Objective: to allow trainee to balance and track 2 blade autogyros using the PB4 (or 3) balancer.

Number de participants : de 4 à 8 max

Teaching method: classroom presentations and hands on installation of PB4 hardware on an autogyro with measurement flights (weather permitting).

Training materials: booklet of print

Tarif : 500 € per trainee (min 4 trainees) + travel

Site : classroom at/near an airfield

Date : to be decided

Duration : 2 days (2 x 7 hours)

Necessary conditions: weather with no rain and limited turbulence, allowing short flights, operational runway. An operational autogyro, with an available pilot for test flights. A closed room with power, a screen and projector for computer presentations (PowerPoint).

**Basic Training : The keys to decision making****The main causes of Autogyro vibration**

Understanding the main causes of autogyro vibration and the limits of dynamic balancing.

Program:

- Elementary explanation of imbalance and using a dynamic balancer.
- Reading the "Polar Chart" and judging levels of acceptable vibrations.
- Reading the "Frequency spectrum" and recognising important values.
- Discussion "The current state of autogyro vibrations".

Formateur : Mike Goodrich / Jérôme Prompsy

Public : Owners and pilots of autogyros (and helicopters).

Objective: To understand the different vibration sources to allow owner/pilots to decide and supervise the balancing of their autogyro.

Number of participants : 5 minimum, no max.

Teaching method: PowerPoint presentation.

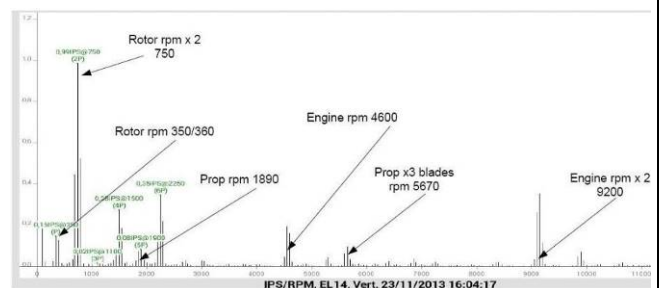
Training materials: document (4 pages)

Site: classroom

Date: to be decided.

Duration: 1 hour.

Tarif : 50 € per trainee + travel expenses



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We do not represent or sell any make of autogyro or equipment

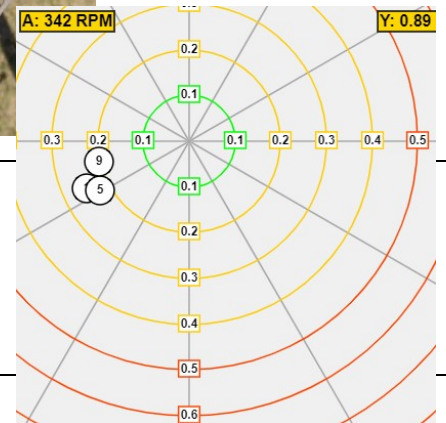
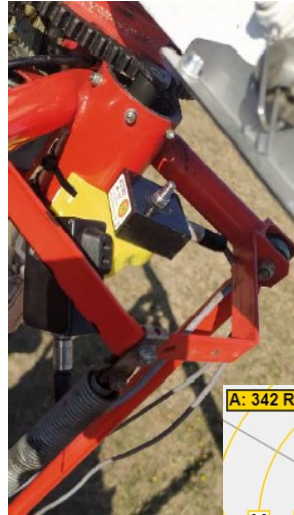


Autogyro Vibration Analysis

Measurement and analysis of the vibration condition of an autogyro using the Smart Avionics PB4 dynamic balancer. Installation of PB4 accelerometers and tachometer on customer's autogyro.

Printout of a simplified vibration diagnostic report for this autogyro, including :

- 1/rev (~350 RPM) vibration characteristics (polar chart).
- Frequency spectrum (vibration levels at different frequencies), allowing the possible identification of other sources of vibration (prop, carb balance etc).
- Possible recommendations of follow up actions in the event that some vibrations are outside acceptable levels.



Note :

- The customer is responsible for a short flight (usually an extended circuit) recording the vibration data.
- The diagnostic report can be useful as a support for an eventual sale of an autogyro.

Tarif : 100€ per autogyro + travel expenses.

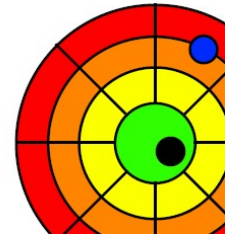
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Dynamic balancing of an Autogyro

Using the Smart Avionics PB4 dynamic balancer by adjustments to the rotor blade weight, chordwise shift and blade pitch to reduce the synchronous (1/rev) vibration to an acceptable level.



Notes :

- depending upon autogyro type, certain adjustments may be impossible due lack of design features or special tools and/or parts allowing these adjustments.
- Work outside of rotor balancing (such as prop balancing, prop blade pitch adjustment, carburettor balancing, worn bearings/rod ends and other parts needing replacement) are not included in the balancing work scope.
- The customer is responsible for all flights (usually up to 8 extended circuits) recording the vibration data.
- The number of autogyros that can be balanced in one session is extremely variable :
 - It would be very difficult to balancer more than 3 or 4 gyros in one day and it is highly probable that an extra day would be required and should be planned for.
 - In the event that more than 4 gyros were included in the planning, Vayavolo would send 2 operators.



Operator : Jérôme Prompsy and/or Mike Goodrich

Public : owners and authorised autogyro pilots

Number of autogyros : minimum 1, if possible a group is preferred.

Site: airfield

Date : to be decided

Duration: 1 day (8 heures),
to be adjusted according to the number and conditions.

Conditions nécessaires : weather with no rain and limited turbulence, allowing short flights, operational runway. An operational autogyro, with an available pilot for test flights.

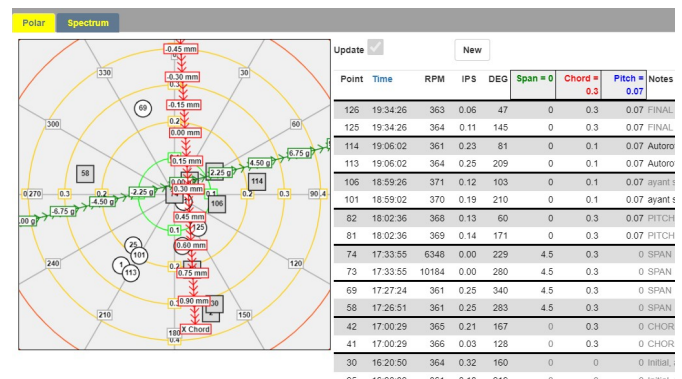
Notes :

It is the owner (or his pilot) that will carry out all flights. This can be up to 10 extended circuits.

Tarif :

240€ per autogyro,

(or 80€ per working hour if the intervention is limited (<2H)
or includes work outside balancing scope (eg prop balance and/or pitch change....)



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Remote support (internet/telephone) for PB3/4 users

For experienced PB3/4 users who experience specific difficulties.
Or for non-trained users in remote locations

Intervenant : Jérôme Prompsy or Mike Goodrich

Public : technician balancing a rotor with the PB3/4, who has mechanical and computing experience/skills.

Site : Internet (email, Video conference, telephone)

Delivery/Availability : Case by case.

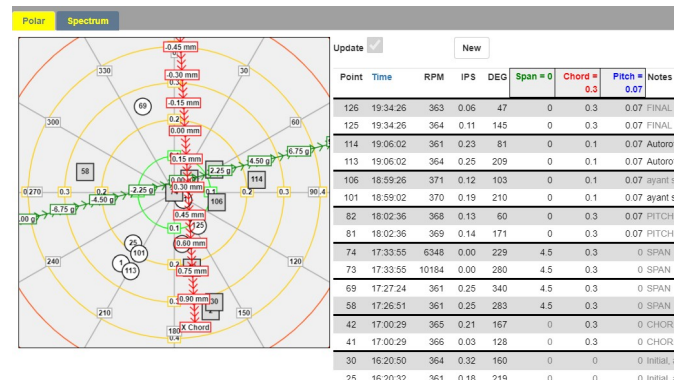
(discussions to be agreed depending upon availability)

Method : The technician in charge of the balancing installs the equipment on the gyro and performs the PB3/4 setup and data gathering flights and transmits the files by email.

Tarif : 100€ per hour. Each hour started is billable. Vayavolo to send regular accounts of time consumed.

For PB3/4 trained and/or experienced technicians PB4, this support is usually to clarify some setup or procedure, **1 hour per rotor** is usually sufficient.

For an untrained PB3/4 novice, the remote support can include a complete training session or just help on specific details. Our experience suggests that **3 to 5 hours of remote support for a gyro** should be sufficient depending upon the initial competence of the technician.



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