Subject: [c-a] Crankshaft loads and P-factor
Date: Wed, 11 Aug 1999 20:27:24 -0400
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To: canard-aviators@canard.com

[The Canard Aviators's Mailing list]

Dear canardians,

Reading my vacation bunch of canardises (french word) on this forum, I found together the discussion on P-factor, and the discussion on 2 versus 3 blades for cranckshaft loads. As I am an engineer in helicopter rotor design, It is striking to me than both subjects have much in common.

Yes, pushers have as much P-factor as any prop-airplane, though I still need to see a taildragger-pusher, for which P-factor would be evident at take-off.

When the airplane (pusher or not) flies at angle of attack, the blade going downwards is advancing, while the one going upwards is retreating, making a change in blade's angle of attack during each revolution.

For a 2-bladed prop, the sum of these two dynamic one-per-rev forces doesn't create a steady moment, as often believed, but rather a 2-per-rev flapping moment.

Just think that twice a revolution, blades are at 12 and 6 hours (no difference, no moment), then at 3and 9 hours (max difference and moment).

For this reason, 2-bladed helicopters always have a teetering rotor. If not, shaft would brake in fatigue immediately.

With 3 blades or more, the summation makes the total moment steady: There is only crankshaft bending, no pulse. Math demo belongs to sine*sine=....

It makes a big difference for the engine and airplane vibration, but not a big for cranck fatigue, however.

Flying helicopters is as much fun as an EZ...

Friendly   Bruno GUIMBAL (20-years french VEZ)