Prototyping….

Rapid prototyping and concurrent design.

We are seeing design software becoming CAM software.

Types of prototypes..

Aesthetic models – full size – a visual communication

Proof of concept models – mechanical principal testing

Environmental testing -40 to +50 degree

Complete beta versions – hovercraft

Learning from your mistakes is good, but learning from someone else's mistakes is better!

Document control! Version control.

1. The Prototype for Initial Exploration
2. The Prototype to Choose the Appropriate Direction
3. The prototype to attract funding
4. The Prototype To Garner Feedback
5. The Prototype To Define Patents
6. The Prototype To Facilitate Manufacturing

Why prototype?

Its all about money!

Production runs are expensive! So get it right in prototype.

R&D claims – first two 'prototypes' can be sold as fully working craft.

It's FUN! We learn!

2D, Virtual reality and Augmented reality just don't cut it

Prototyping guides.

Design for adjustment -

Design for assembly –

Design for disassembly

Design to replicate production

Choose your battles… do you need to prototype everything?

Common Prototype problems.

It's expensive! But its expensive not to!

Aesthetics…. Looks better on the screen.

Tolerances… welcome to the real world. Parts don't fit. How do you achieve high tolerance on a 3D printed part?... you don't

Prototype doesn't work properly

Wear

Strength

Mass + weight + inertia + momentum… welcome to the real world.

Time. Time equals money. The longer the prototype takes the further away the profits are.

I cannot assemble it!... but it fits together on the screen!

Material selection…Timber is dynamic – changes shape and size based on humidity.

“Rapid prototyping tools give us an exciting level of freedom. With enough effort, you can build an entire product without waiting on a single engineer. Finally!

Unfortunately, reality sets in when you’re halfway through the prototype. Every change creates a ripple effect that touches two dozen unrelated screens and breaks a handful of others.

The goal of rapid prototyping is to gain feedback that guides the final design. So the prototype is just a means to an end. You can toss it once you’ve learned what you needed to.

So avoid the temptation to prototype the full product unless you want to tackle all the day-to-day hassles associated with actually managing the product.

Instead, spin up specific prototypes as your team needs them. Limiting the scope of each prototype frees you to do what’s best at the time, without worrying about ongoing maintenance.”

CASE STUDY. Propeller blades

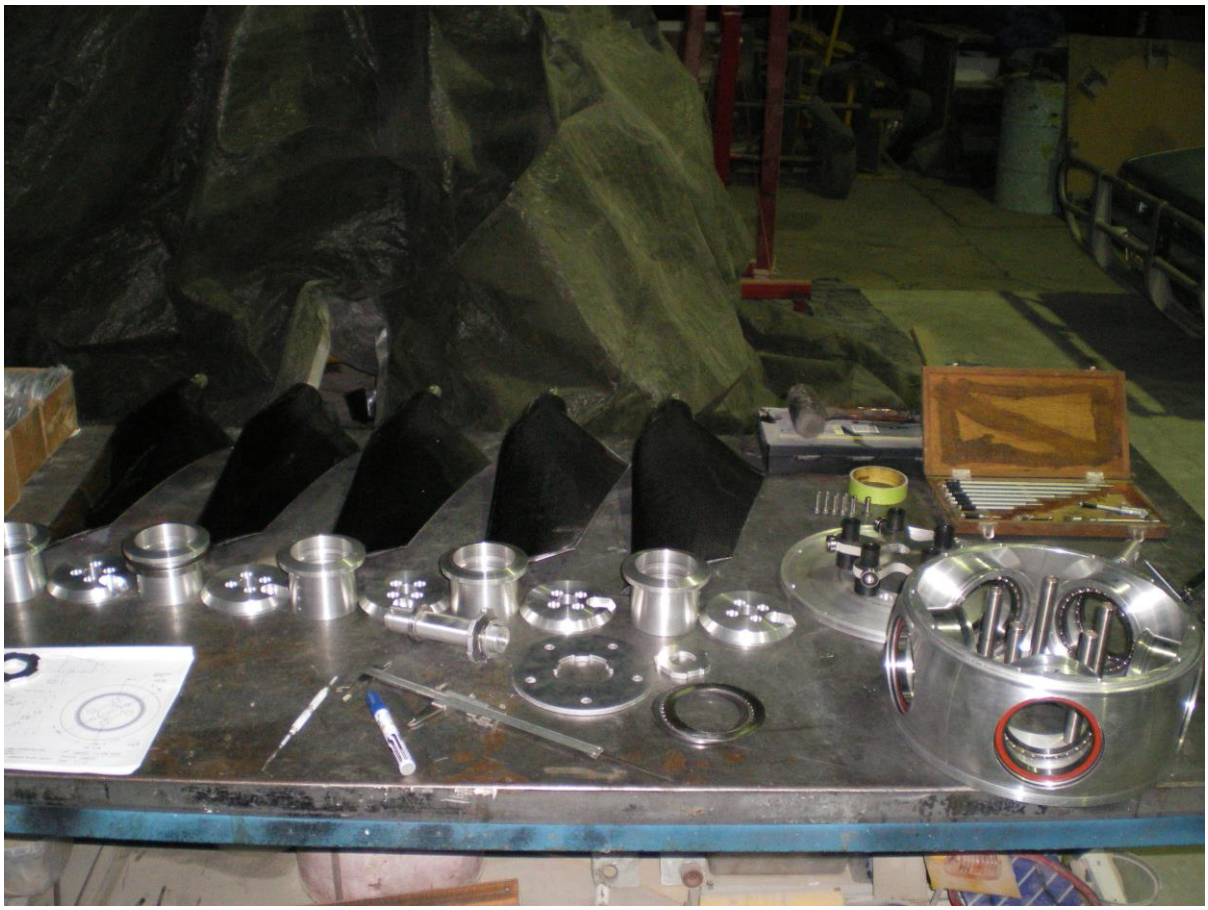
This is a good example as it simply MUST be tested insitu. No amount of CAD simulation can replicate real world conditions.

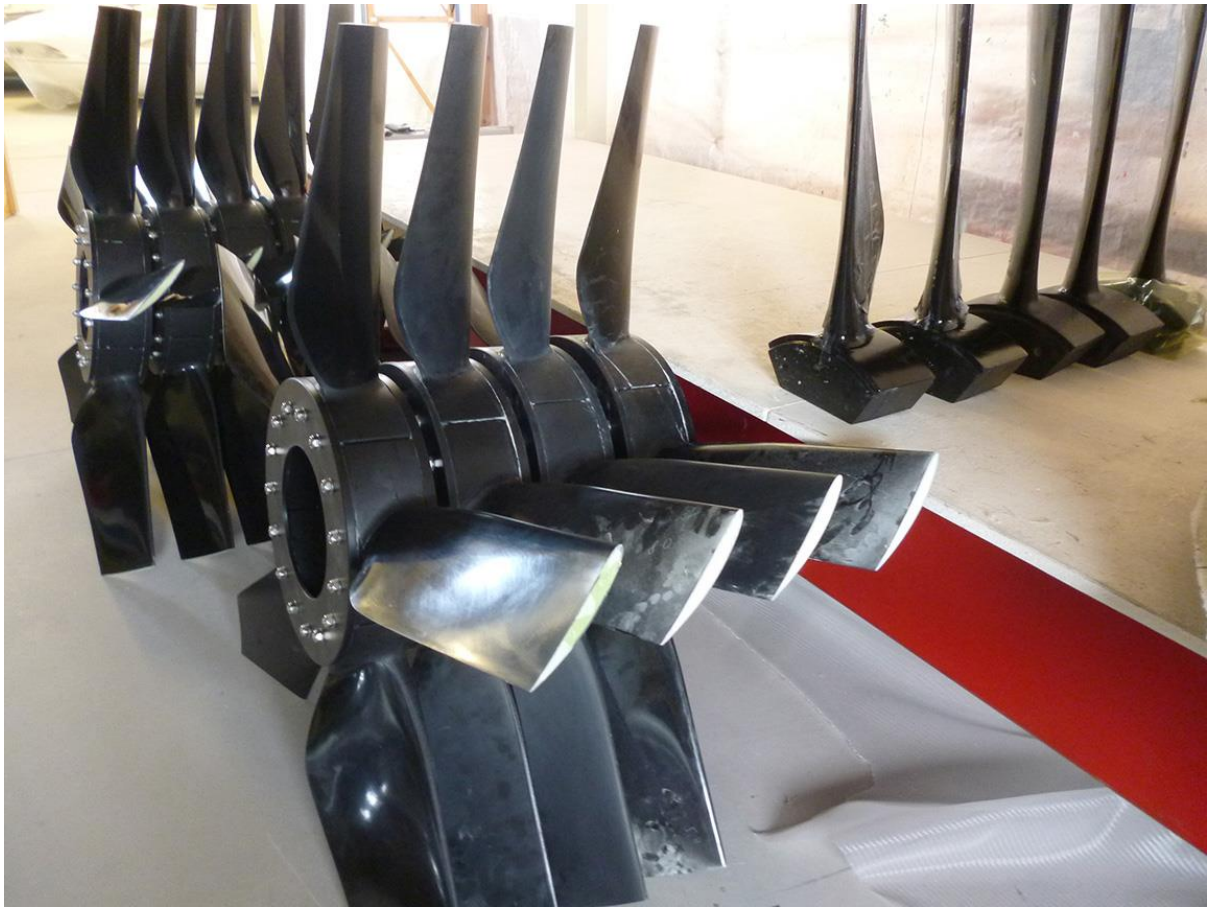
Testing for…

- Performance – pure physical thrust, aerodynamic waste
- Adjustability
- Wear
- Moments of inertia… does it gyroscope the craft?
- Noise
- Manufacturability – reject factors
- Maintainability – in field service
- Assembility
- Cost
- QA & certification.

Design brief – get the cost down!

Early craft had an IFA – inflight adjustable propeller… these were very expensive. (image exploded IFA prop)



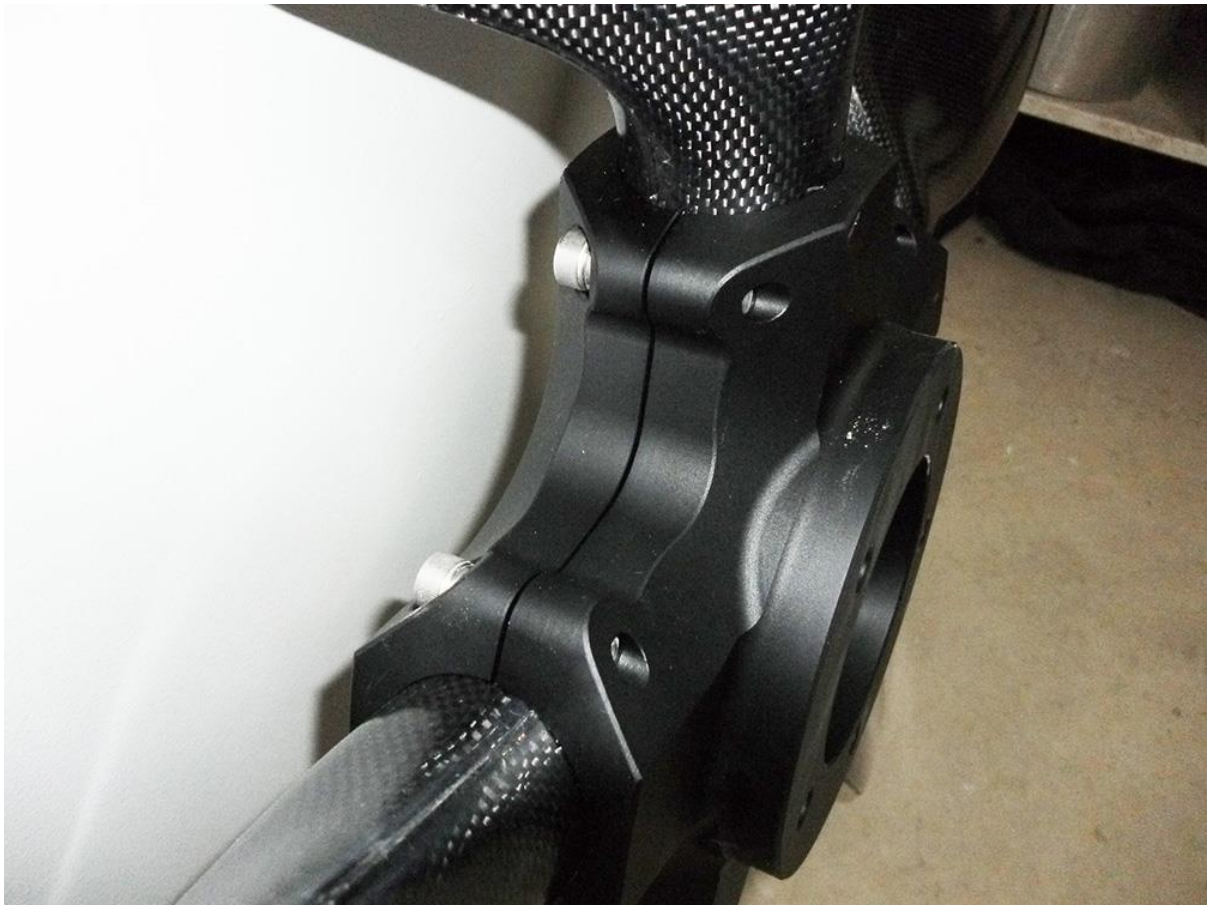


We went back to a static blade design designed to meet the exact specs of the craft. (image)

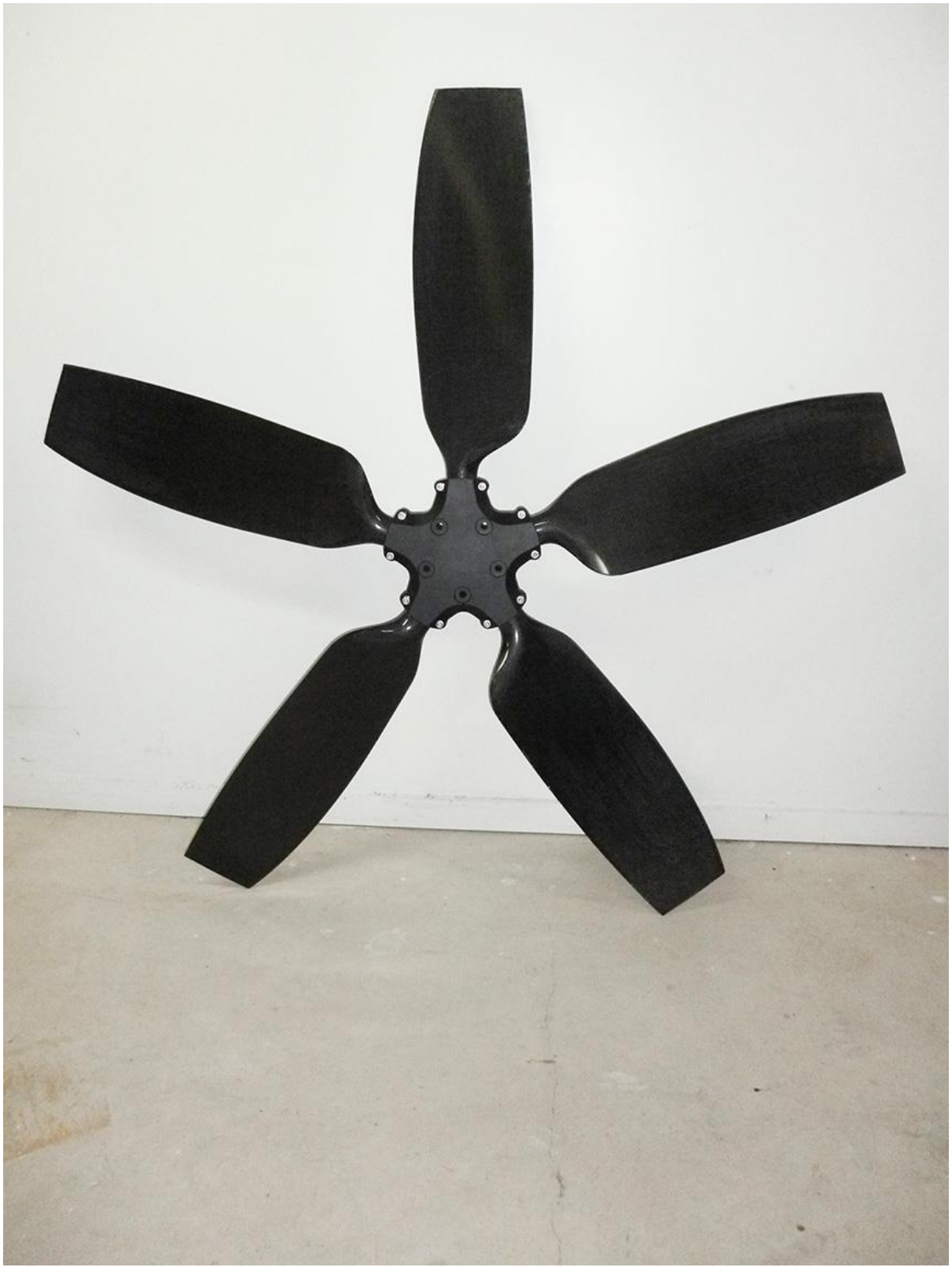
It worked ok… but was not good enough.

So we changed the pitch – to amount its screws through the air in one revolution – we had two separate pitches.

We made 2 separate wooden blade assembly propellers from Meranti on the CNC to bolt on to craft in Thailand.



One pitch angle is confirmed we could proceed… BUT then we changed to adjustable, so we needed a new hub design. This were CNC machined Aluminium. (image)



New blade design (image)