Project in a Box:

Fan or Turbine Efficiency

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1 Synopsis

This project is aimed at learning of the importance of blade efficiency for generating or using electricity and for the conservation of the environment.

It is also important for turbine fans in aeroplanes and steam turbines.

It may be used for individual or for team learning.

It is based upon a Design Council finalist project from a school pupil aged 17 and who is now a Member of the IET.

Suitable for pupils aged 12-16.

2 Teachers' Guide

2.1 Guide

The original project made the fan using an aluminium disc, a saw, pliers, and a protractor used to set the angles, mounting it onto the motor. See the Artwork section.

The motor was mounted on a boat made from off-cut wood.

The boat was mounted in a deep tray and at the end of the tray was mounted a wheel.

String was attached to the boat, over the pulley, and weights attached to counter the thrust of the fan.

The power needed to just stop and just start the boat pulling against the weight was measured at different blade angles and also with different weights.

For each angle and weight combination, the average power (average of just start and just stop) was used - why? (To adjust for the viscosity of the water and friction in the pulley system.)

This was plotted: average power v weight (= thrust of the fan).

Conclusions were drawn and project was documented.

Sections were:

- summary,
- project objective,
- method,
- results,
- results graphs,
- conclusions.

The summary for the Managing Director, who has little time available, should be, of course, only half a page and at the front of the detailed project report.

However - your pupils should decide the method.

2.2 Materials

Pupils are provided with:

- aluminium disc, may be pre-cut, see artwork section,
- 12v motor,
- off-cut wood,
- construction kit, e.g. Meccano (steel or plastic), with pulley-wheels and spars for the pulley assembly and motor support assembly, alternatively they can be made from wood,
- saw for both wood, plastic and steel,
- ammeter and voltmeter or power-meter,
- string or cotton,
- lipped tray,
- plastic cup,
- clamps (e.g. to hold the pulley assembly to the tray or bench),
- miscellaneous screws, nuts, bolts, eye-screws, etc.,
- 12v batteries (e.g. car battery).

3 Pupil Guide

The blade angle of a fan or turbine greatly affects its efficiency. High efficiency is vital for generating or using electricity and for minimising environmental impact.

Your Managing Director has asked you to make recommendations.

You have a 10cm diameter disc of aluminium, a 3v DC electric motor, a voltmeter and an ammeter.

You also have whatever tools and materials you can find in the home and a car battery.

You should measure the power needed by the fan at different blade angles to pull against a known force.

Plot these on a graph.

Draw conclusions.

Write up the project with a summary for your Managing Director.

Sections could be:

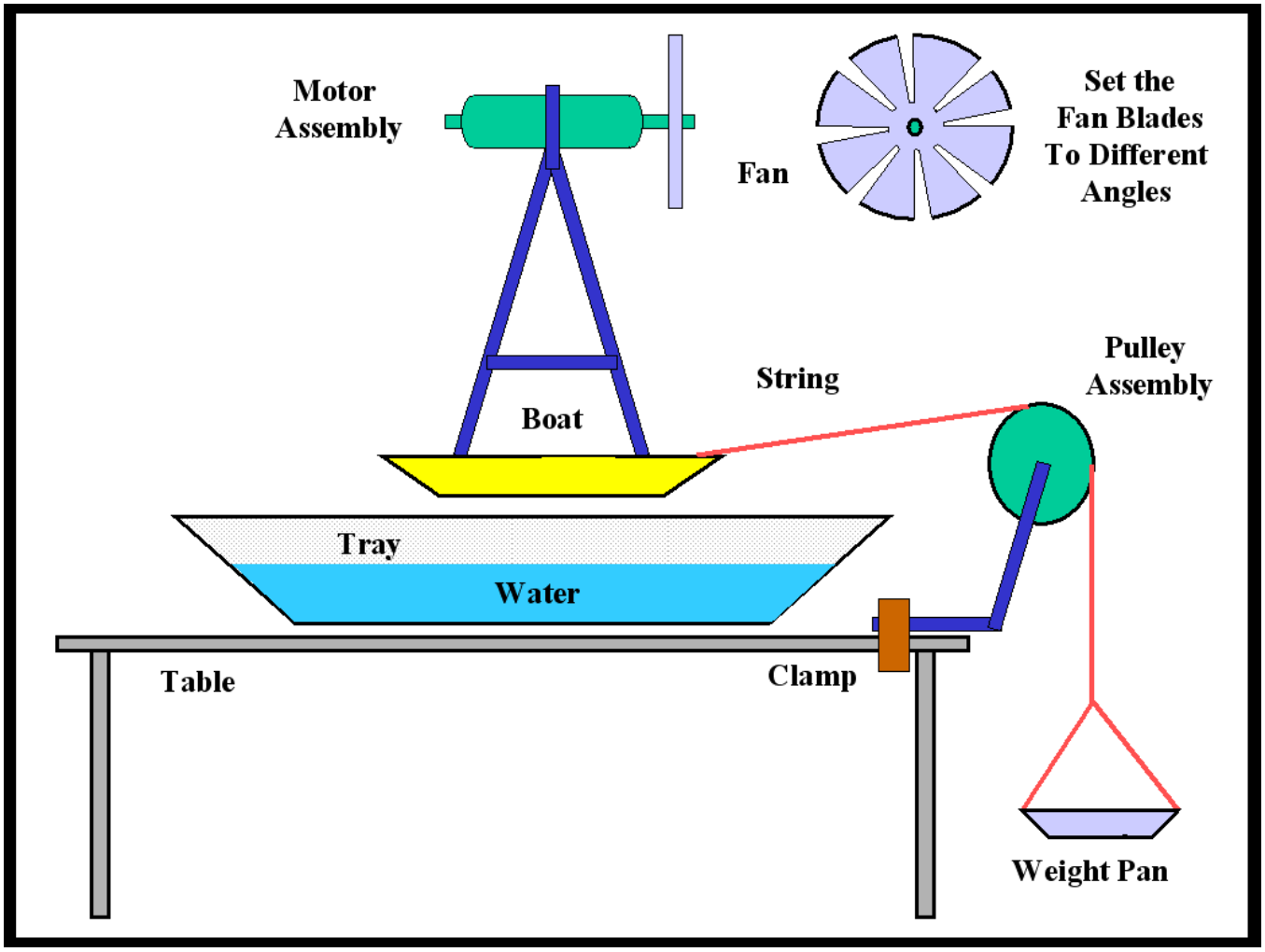
- summary,
- project objective,
- method,
- results,
- results graphs,
- conclusions.

The summary for the Managing Director, who has little time available, should be, of course, only half a page and at the front of the detailed project report.

How could the project be improved?

4. Artwork

Click on the picture to display on your computer for projection onto a screen.



5. Health and Safety Risk Analysis

Standard Classroom Health and Safety Risk Analysis.

plus:

Hazard	Risk	Preventive Measures	Score if over 10 additional measures are required		
		Severity: 1=no loss of time, 2=absence not serious, 3=absent, doctor seen, 4=hospitalised, 5=death **Likelihood:** 1=unlikely, 2=very rare, 3=rare, 4=probable, 5=certain	**Severity**	**Likelihood**	**S x L**
Hand Tools	Cuts, etc.	Supervised training of pupils to use the hand tools. Close surveillance of pupils	4	1	4

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