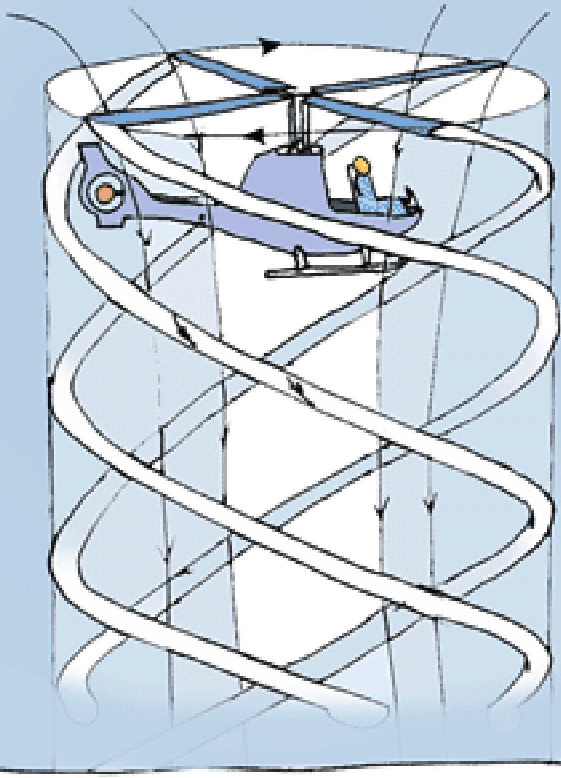
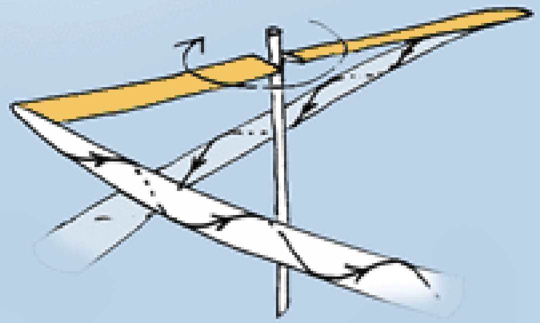
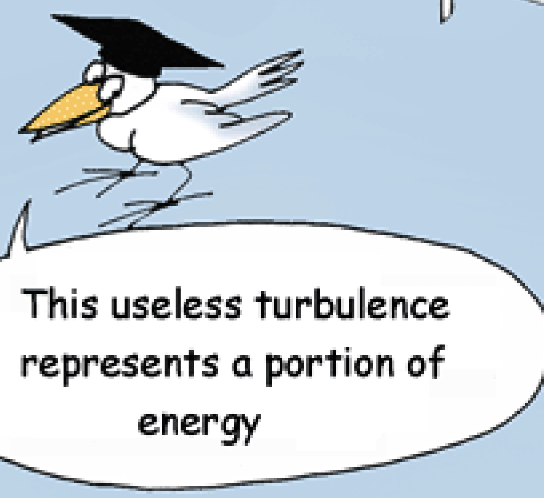
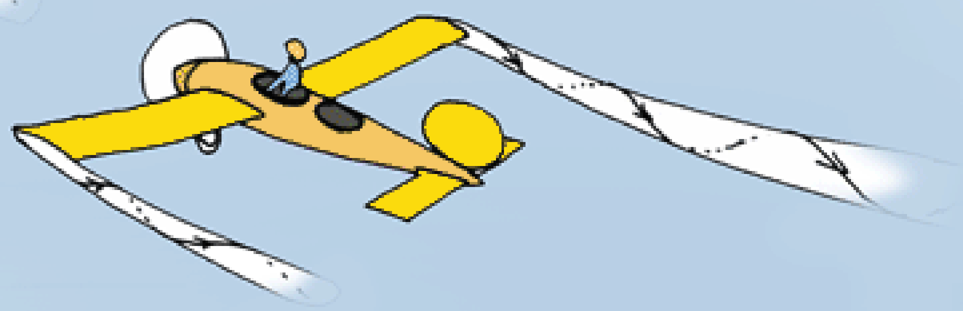
TRANSITION





The blades of a helicopter are very elongated wings which leave **tip vortices** in their wake.

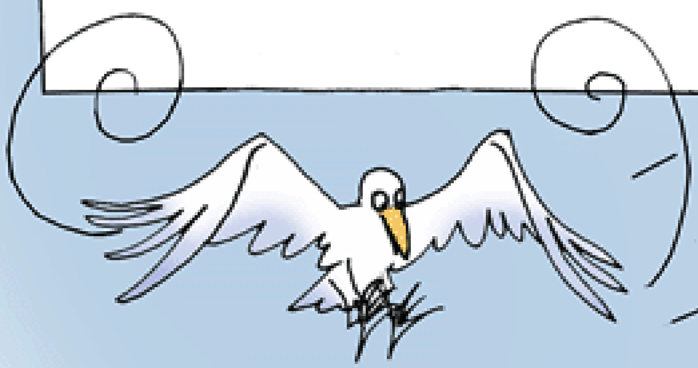




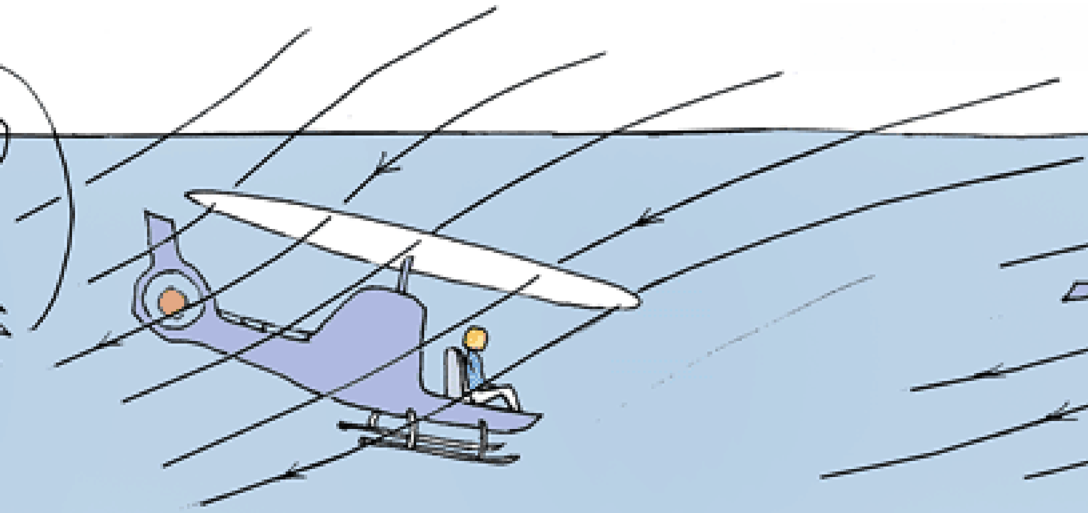
These vortices are created at the blade's extremity which causes water vapour condensation (condensation drag) at high altitude.

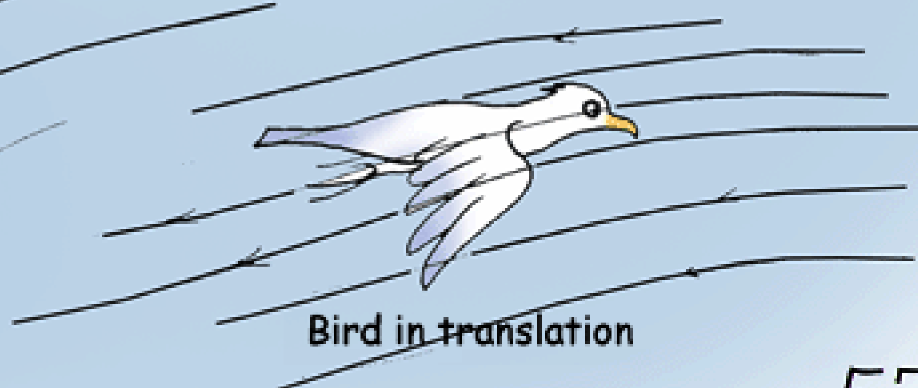
When the helicopter goes into transition the speed of flow is completely modified. The vortices lose their importance and, because of that, the machine can maintain lift with a reduced amount of energy.

The Management

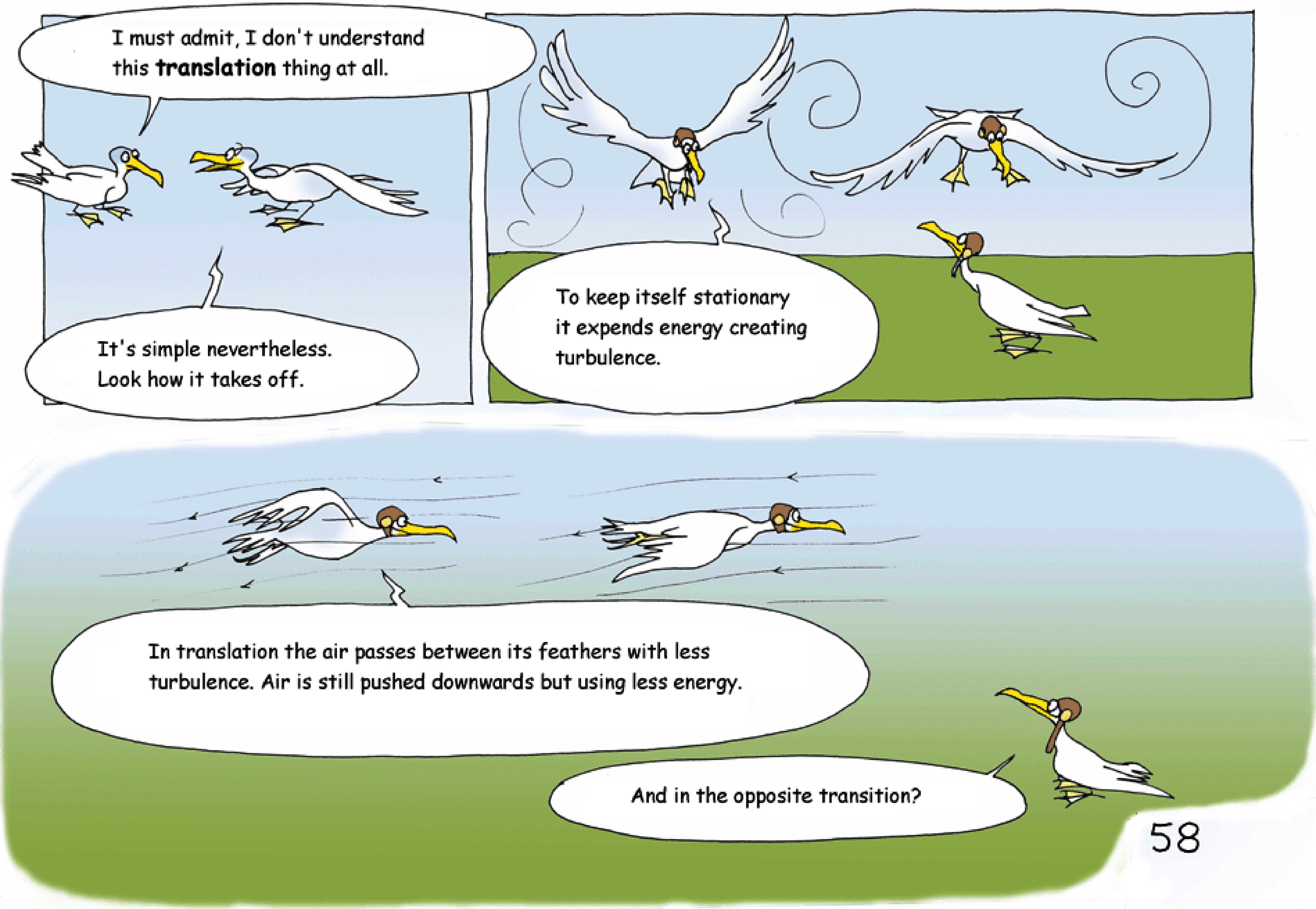


Bird in stationary flight
strong turbulence

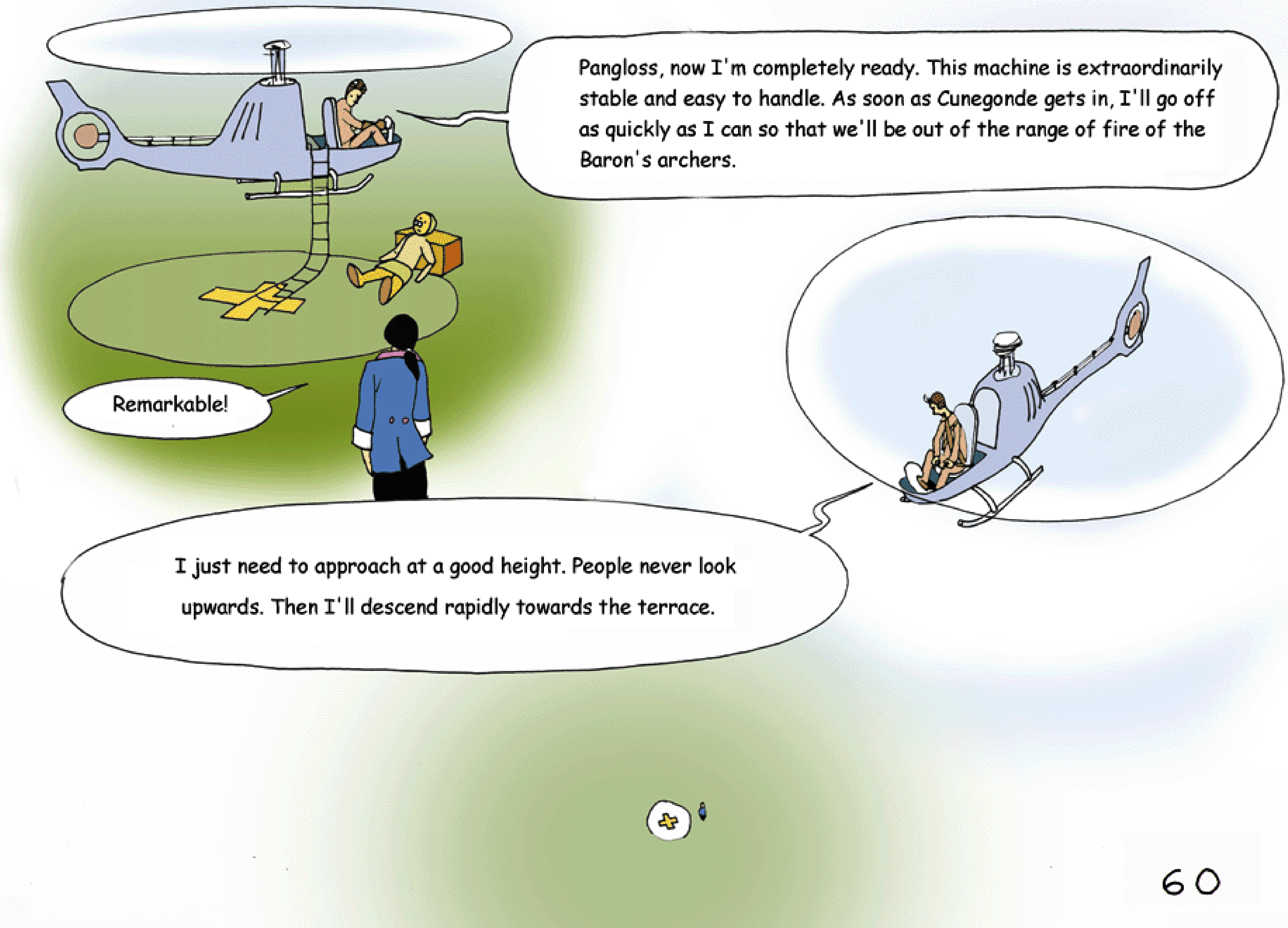


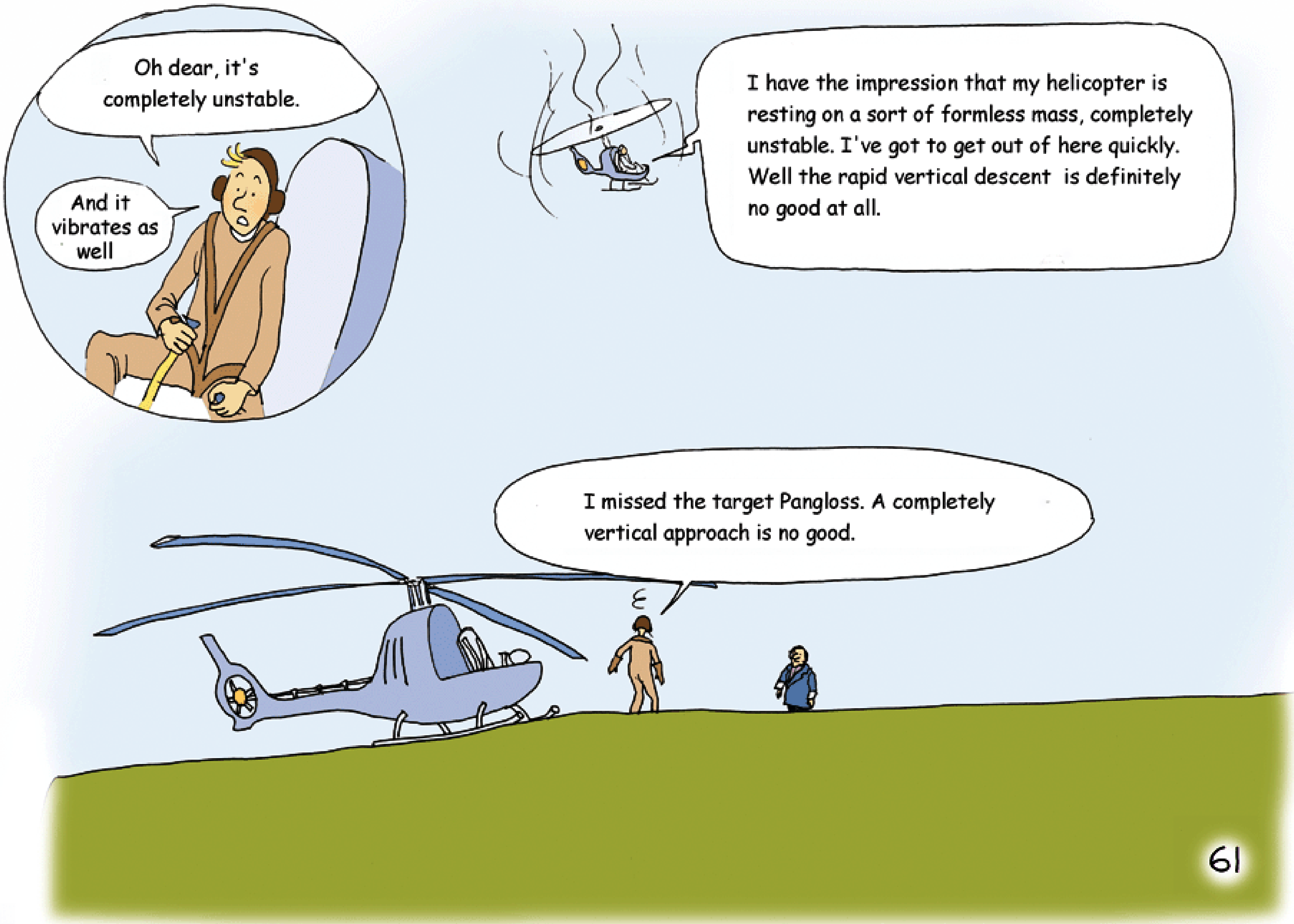


Bird in translation

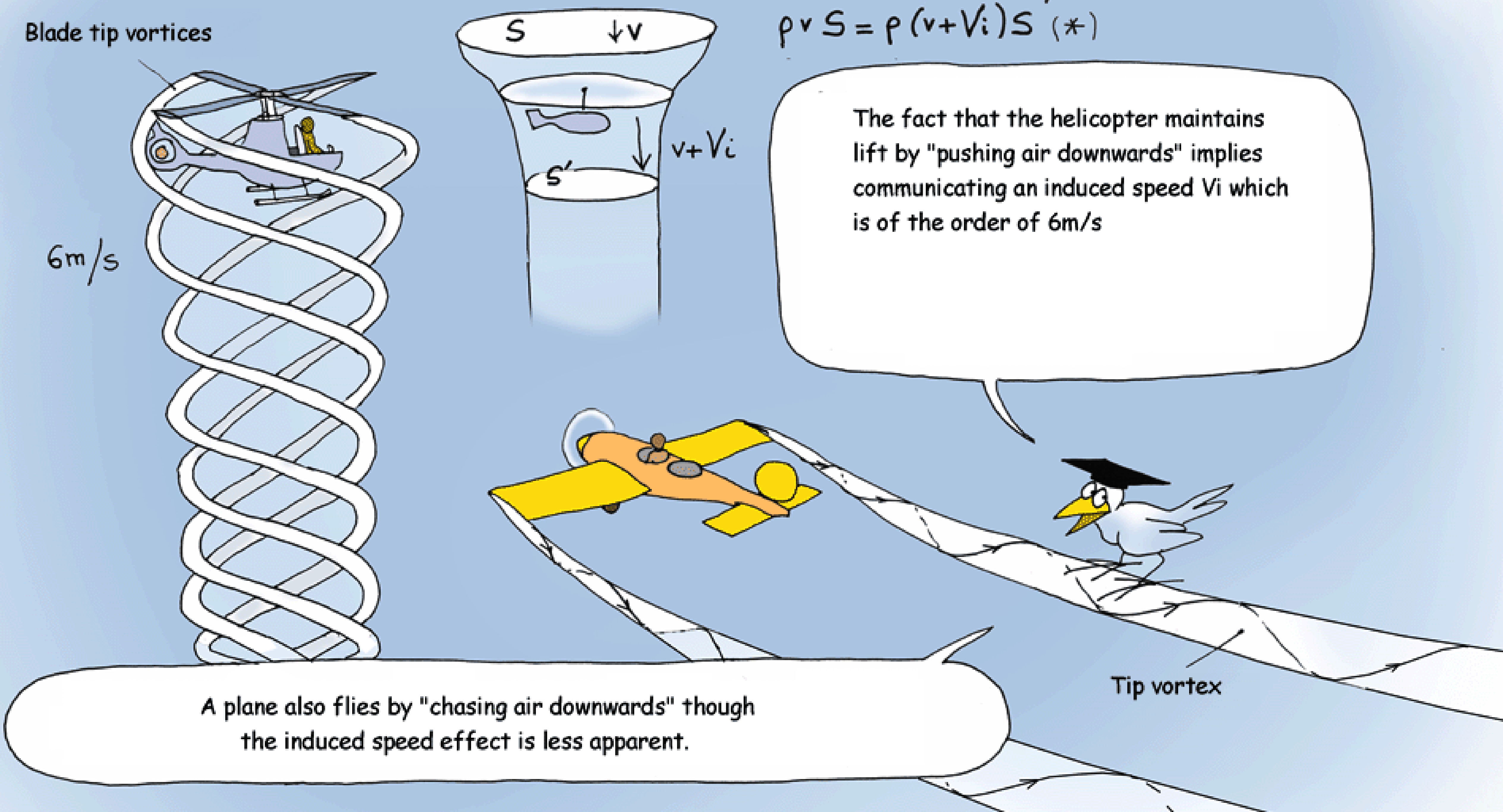

I must admit, I don't understand this **translation** thing at all.
It's simple nevertheless. Look how it takes off.
To keep itself stationary it expends energy creating turbulence.
In translation the air passes between its feathers with less turbulence. Air is still pushed downwards but using less energy.
And in the opposite transition?


It isn't hard. Look down there, there's something interesting, a fish.
You rear up to slow your speed and immobilize yourself in the air.
And there you get back to a stationary flight regime by creating strong turbulence, therefore using more energy.

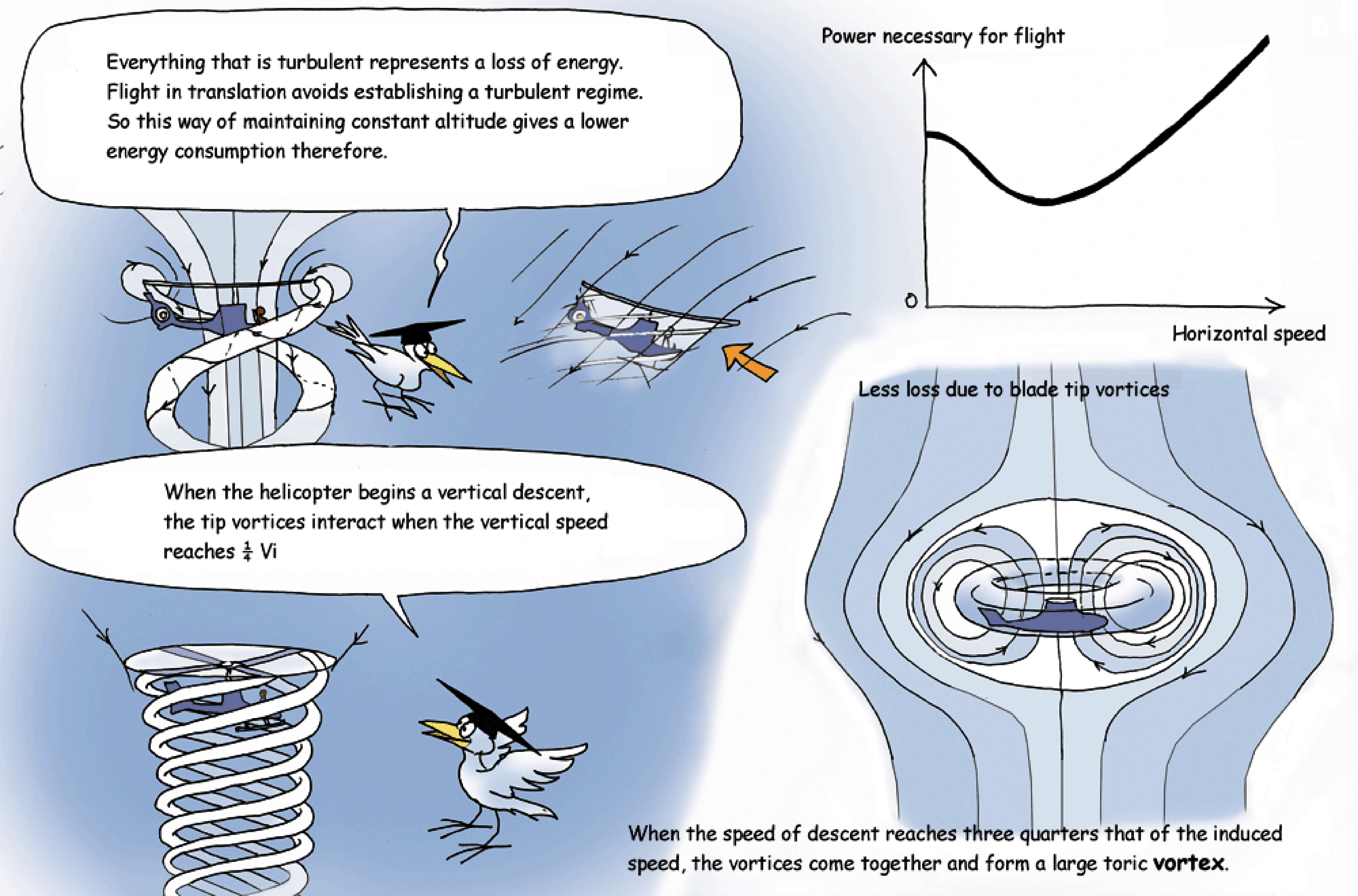

Pangloss, now I'm completely ready. This machine is extraordinarily stable and easy to handle. As soon as Cunegonde gets in, I'll go off as quickly as I can so that we'll be out of the range of fire of the Baron's archers.
Remarkable!
I just need to approach at a good height. People never look upwards. Then I'll descend rapidly towards the terrace.

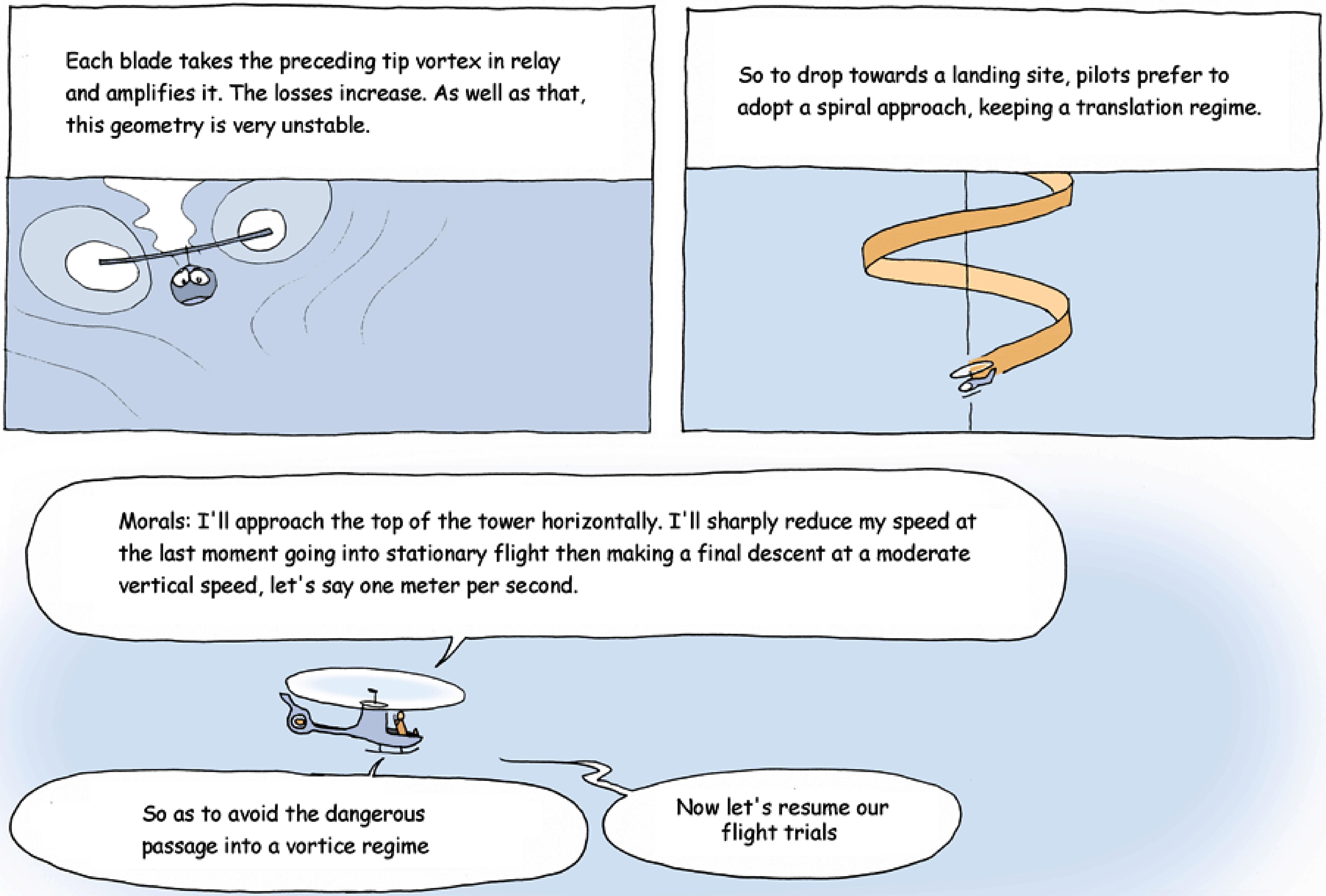

Oh dear, it's completely unstable.
And it vibrates as well
I have the impression that my helicopter is resting on a sort of formless mass, completely unstable. I've got to get out of here quickly. Well the rapid vertical descent is definitely no good at all.
I missed the target Pangloss. A completely vertical approach is no good.

INDUCED SPEED

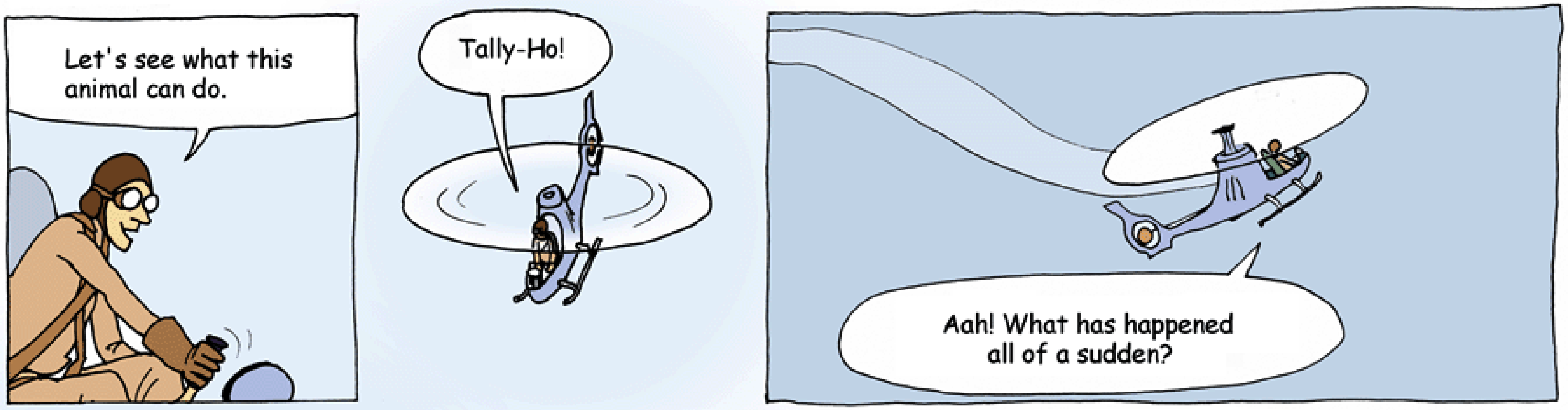


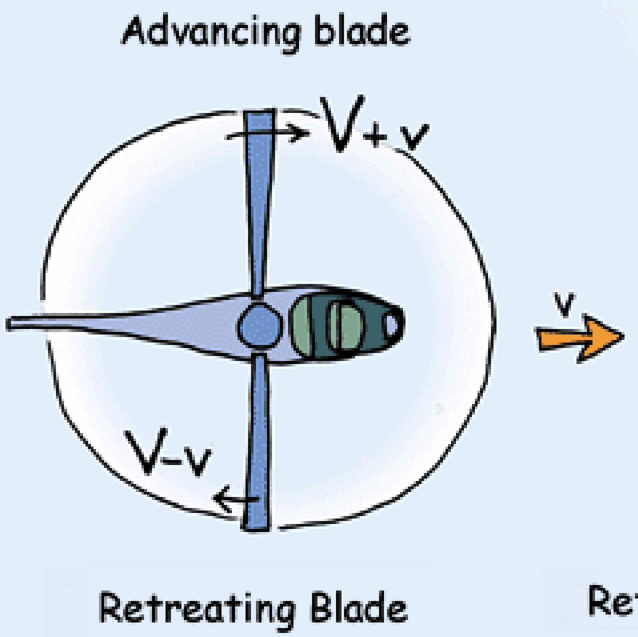
(*) This relation expresses the conservation of the airflow of a constant volume mass ρ
The requires that the section S' be smaller than the section S


Everything that is turbulent represents a loss of energy. Flight in translation avoids establishing a turbulent regime. So this way of maintaining constant altitude gives a lower energy consumption therefore.
Power necessary for flight
0
Horizontal speed
Less loss due to blade tip vortices
When the helicopter begins a vertical descent, the tip vortices interact when the vertical speed reaches ¾ Vi
When the speed of descent reaches three quarters that of the induced speed, the vortices come together and form a large toric **vortex**.

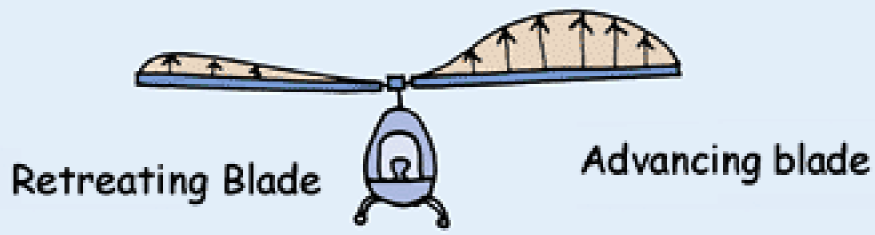

Each blade takes the preceding tip vortex in relay and amplifies it. The losses increase. As well as that, this geometry is very unstable.
So to drop towards a landing site, pilots prefer to adopt a spiral approach, keeping a translation regime.
Morals: I'll approach the top of the tower horizontally. I'll sharply reduce my speed at the last moment going into stationary flight then making a final descent at a moderate vertical speed, let's say one meter per second.
So as to avoid the dangerous passage into a vortice regime
Now let's resume our flight trials

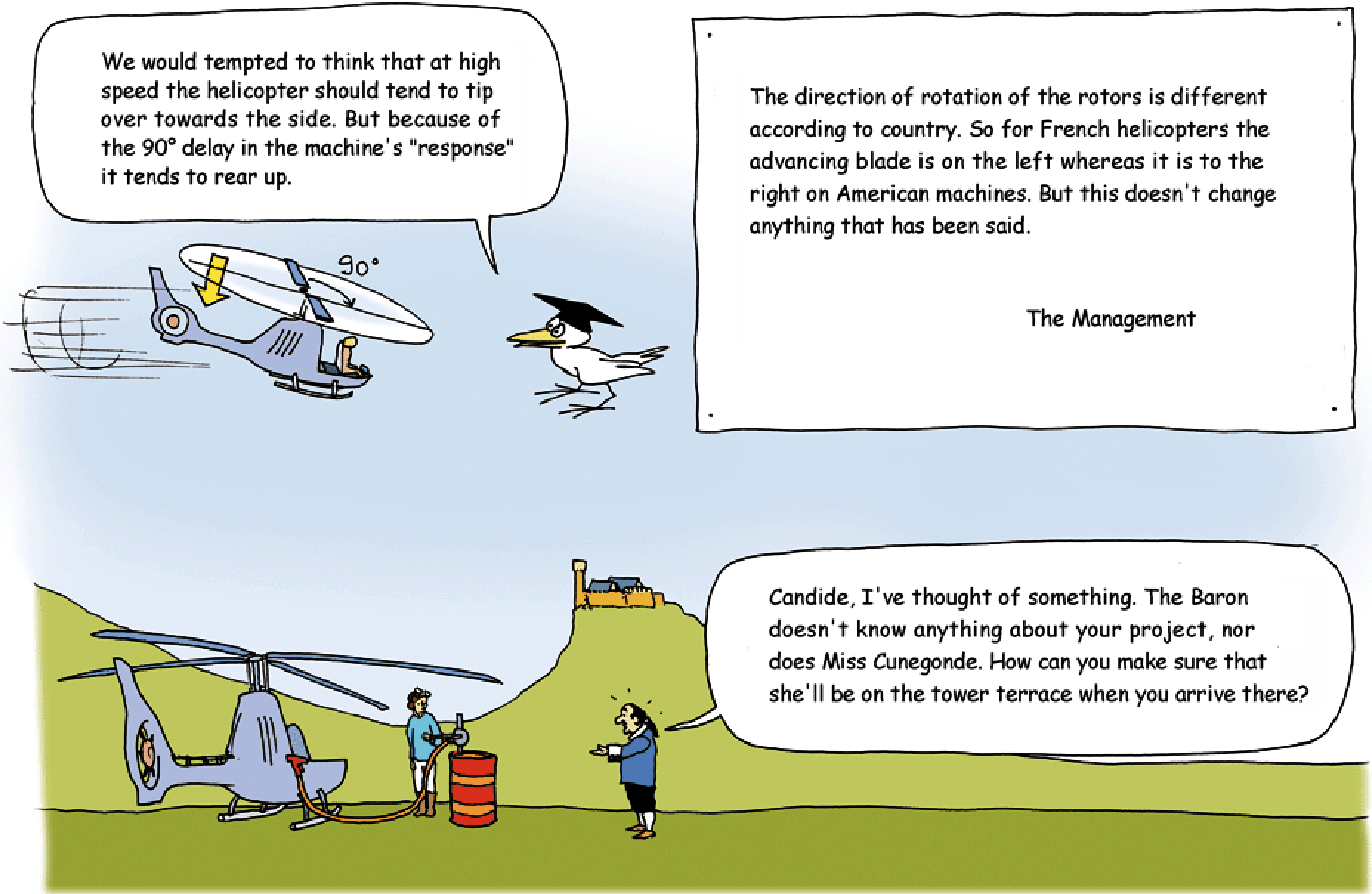
Loss of lift on the retreating blade





Either V, the speed at the tip of the blade or v, the helicopters flying speed, the relative wind applied on the advancing blade is V + v. That of the receding blade is V- v. So the pressure forces exerted on the two blades are very different.




We would tempted to think that at high speed the helicopter should tend to tip over towards the side. But because of the 90° delay in the machine's "response" it tends to rear up.
90°
The direction of rotation of the rotors is different according to country. So for French helicopters the advancing blade is on the left whereas it is to the right on American machines. But this doesn't change anything that has been said.
The Management
Candide, I've thought of something. The Baron doesn't know anything about your project, nor does Miss Cunegonde. How can you make sure that she'll be on the tower terrace when you arrive there?