FLYING SAUCERS R&D THE COANDA EFFECT

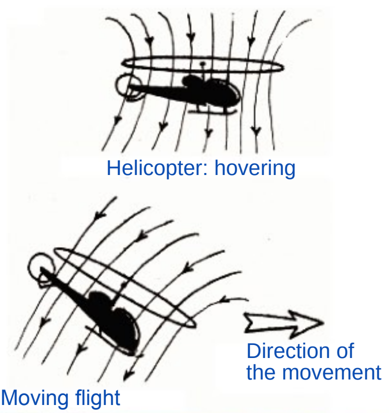
With today's technical know-how, we can make a flying saucer. They already fly quickly and silently in some laboratories. But they are waiting for a revolutionary engine which does not exist yet. Here is the project schedule of the saucer 1974, written and drawn by a fluid mechanics specialist.

Fling saucers, like the storks, came back. They are sighted here and there. Cameramen from the French ORTF even recentlly filmed one of them, planing above the hills. Do they really exist, do they come from another part of the universe, travelling along light rays, or do they use some famous "black holes" to curtail their trip?

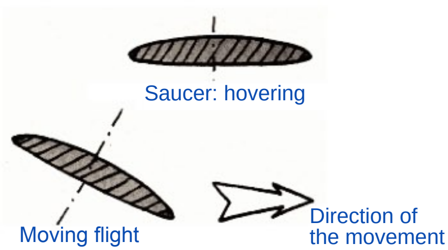
We won't try to discuss this question here. Now let's suppose that these lenticular UFOs are material objects, and not electric or optical phenomena. The fact that they move without any noise at very high speed, often in the lower atmosphere, involves problems of aerodynamics we will evoke.

1 HOVERING OR SLOW MOVEMENT

In many observations, UFOs and helicopters share the same behavior:



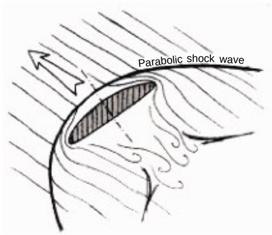
The helicopter levitates and moves trough the atmosphere because it sends downwards



the ambiant air from top, thanks to its rotor. So if we adopt an aerodynamic solution for the UFO (other than electromagnetic or antigravitational phenomena) it seems logical that it works the same way. We will examine further how this can be considered.

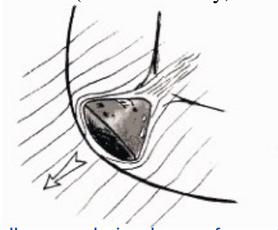
2 FAST AND NOISELESS

Here is the crux of the problem. If a lenticular body moves in the air at supersonic speed, a "detached" shock wave appears, is the same way the shock wave occurs upstream Apollo capsule in phase of re-entry.



Lenticular aerodyne
at supersonic speed

The air is strongly heated by recompression immediately behind the shock wave, even becoming luminous. This is why re-entry space capsules (like Mercury, Gemini or



Apollo capsule in phase of re-entry

Apollo) have a thick heat shield protecting the passengers and the equipment from the intense heat flow consecutive to this heating.

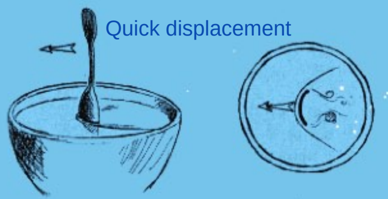
3 A LITTLE WORD ABOUT SHOCK WAVES

Take a teaspoon and half soak it in a liquid, like a coffee in its cup. Move the spoon very slowly in this direction:

Slow displacement

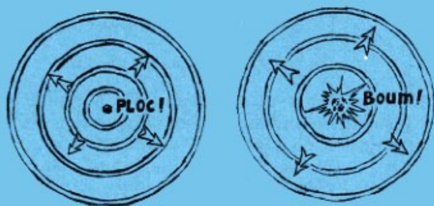
No ripple appears on the liquid surface. If the liquid is a white coffee, at most you will see the turbulent wake induced downstream by displacement of the spoon.

Now move the spoon quicker. It makes a wave, a wavelet which is, mathematically speaking, the faithful analogue of a shock wave in a gas. The increase of pressure and



Quick displacement

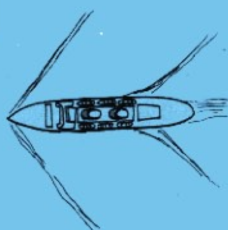
temperature is now replaced by an increase of the water height. Thus the spoon moves at a "supersonic" speed in the white coffee. But then, in this hydraulic analogy, what is the speed of "sound"? It is simply the propagation velocity of the wrinkles on the water surface, ripples caused for example by the fall of a small object in the liquid.



White coffee
speed of "sound":
a few cm/s

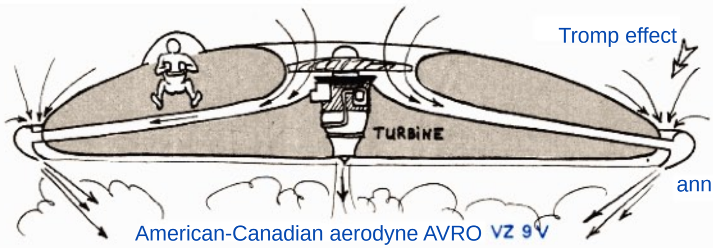
Atmospheric air
speed of sound:
340 m/s

The bow wave of a boat is also a hydraulic analogy of a shock wave.



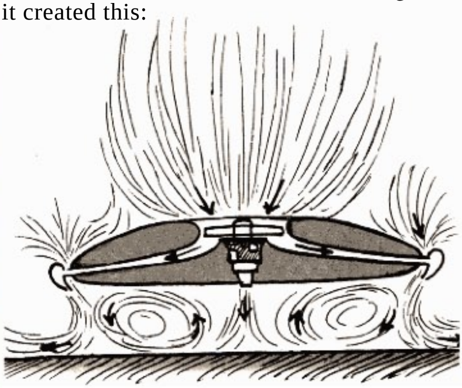
4 PRINCETON BY THE SIXTIES

At that time, in the greatest secrecy, very serious people built and tested... saucers. By the end of summer 1961, I was able to see some installations at the James Forrestal Center, Princeton University, New Jersey. I could see very closely the famous American-Canadian saucer Avro VZ-9V, presented by a photograph in this article. This experimental device was equipped with a gas turbine and according to its designers, had to to reach very high altitude and fly at 550 km/s at least. I observed it thoroughly (I even sat down inside...) thus I can now explain how it worked:



American-Canadian aerodyne AVRO VZ 9V

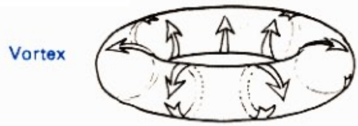
Air was aspired from above into a giant fan. A part of this air went into the engine's combustion chambers, and the other into an annular tube girdling the machine. The geometry of this tube had been designed to allow a powerful lower pressure on top of the disc, by tromp effect. But the tests were disappointing. The disc irregularly moved at 65 km/h above the concrete of the research center, and was reconverted out as a ground effect machine. At one meter above the ground, it created this:



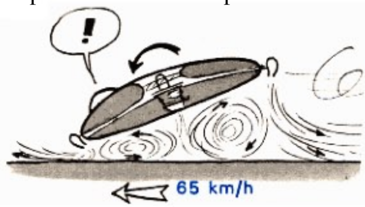
AVRO VZ 9V aerodyne.
Air flow near the ground

and a lot of dust...

As indicated on the picture, a "vortex" (as aerodynamicists call it, i.e. a mass of air whirling on itself) was forming under the disc. This vortex had a toric form and was confined by the curtain-like air jet:



While moving, the disc was very unstable. The curtain-like air jet became deformed, and the very important vortex escaped outside:

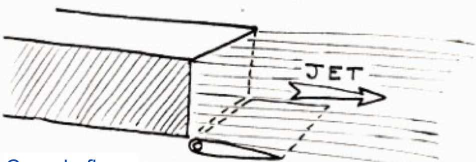


The saucer nosedived and the pilot had the unpleasant feeling to have sat down on a half inflated tire tube. The project was cancelled. However, this device had been designed to be more than a ground effect machine such as an overcraft. Scientists believed the air jet would manage to create a strong lower pressure on top of the disc, and that the saucer would easily fly. But it was not the good solution.

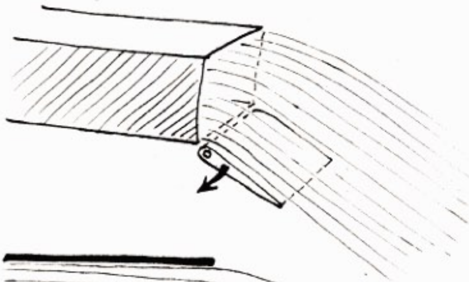
5 COANDA, THE SAUCER MAN

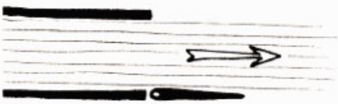
Henri Coanda, a Roumanian man working in France, was an impossible man.

Historians of aviation speak of him with caution (only when they speak of him). This great man had a mania: to always be about forty years ahead of his time. At the Paris show in 1910, he demonstrated... a jet aircaft. All was already there: the turbine, the compressor, the combustion chamber. But it was... too early. In 1930, he was studying the effect which bears his name, and from which we will talk about.

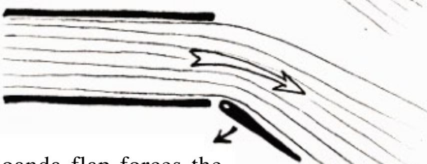


Coanda flap



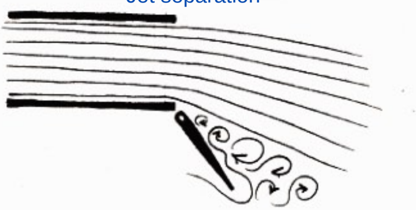


Coanda effect



The steering of the Coanda flap forces the jet to deflect, and a strong lower pressure appears on its internal side.

Jet separation



Strong swirling zone

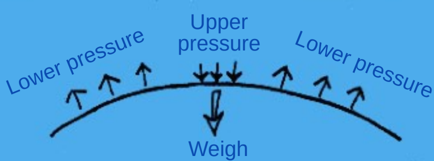
When the air jet is thick, about forty degrees swing can be achieved, at maximum. Beyond that, the jet "takes off" and refuses to follow the flap.

6 WHAT IS THE COANDA EFFECT?

It can be illustrated with a simple experiment: take half of a paper sheet. Place it under your hand like this:

Put your mouth at the arrow, between your index and your middle fingers, and blow

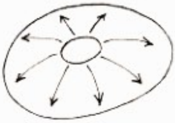
strongly. The sheet, instead of being expelled, will stick to your hand by Coanda effect.



Low pressure thanks to flow deflection is powerful enough to overcome the sheet weight.

7 RADIAL FLOW

Consider now a radial Coanda air flow (also called "conical"):

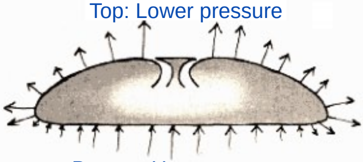


Coanda effect with flow of revolution

The annular slit is thin, the upstream pressure is high (about ten bars). Because of Coanda effect, the gas is ejected along the curved foil of the saucer, which is a first cause of lower pressure. But this flow is also radial, so it undergoes a strong expansion: this is a second cause of lifting lower pressure.

High pressure
Thin slit

Top: Lower pressure

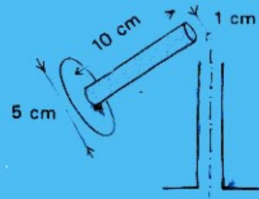


Bottom: Upper pressure

If the ejection speed at slit is high enough (relatively to the speed of sound in the ambient air) an amazing thing occurs, which I could formerly note with an experiment: the air jet does not take off from the hull and it perfectly circumvents the disc.

8 RADIAL FLOW PARADOX

Another experiment, very easy, will enable you to understand the originality of this flow. Take some strong paper and paperboard, and make this object:



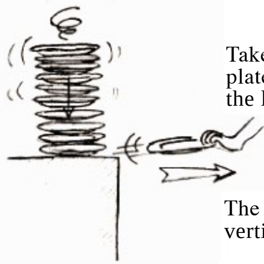
All things considered, it is just a tube, supplemented by a disc. Put the disc against a light flat object. A small matchbox for

Reality is quite different.

What really occurs

This remind us the analogy with the flow through the helicopter's rotor (see preceding pages). This explains the similarity of flight behaviour.

It can be justified rather intuitively.
Pose a pile of plates near the edge of a table, and pull the one below.
This occurs.



Take a new pile of plates and this time pull the lowest one quickly.

The pile goes down vertically.

Thus, when the air jet is very fast, molecules near it are brutally grabbed, and the global flow is like how I draw it above.

9 THE SAUCER FLIES

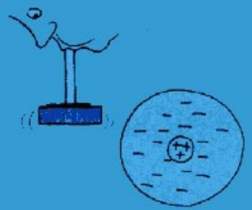
But the flow along the saucer wall will continue to astonish us.

Let's see the effect induced by the thin air jet on the ambient air. At first we could think this will occur:

Air flow induced by a thin air jet

What we would expect

example, and blow strongly. You raise the box, by blowing on it!



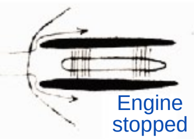
The lower pressure upon the discs's periphery is powerful enough to overcome the overpressure on the middle. A lifting system known as the "fix-tromp" had been patented by a man called Bertin. A metal tube with an air intake, receiving 6 to 7 kg high pressure, makes it possible to raise a mass weighing 4 to 5 kg.

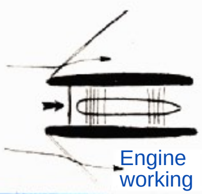
10 THE UFO'S SECRECY?

Our saucer works, it even flies very well. Like Coanda, but thirty years later, I made these discs fly in lab, trailing behind them the tube which brought their compressed air. And the saucer grabbed the smoke of my pipe or eat the imprudent's tie.

Can this aspiration induced by the air jet be powerful enough to act on the shock wave, in the case of a supersonic flight?

When a jet engine travels inside a gas flow at supersonic speed, a detached shock wave occurs, as on any bulky obstacle:





If the turbojet now starts, the turbine sucks the air in front of it. If the aspiration is strong enough, the wave is even swallowed by the engine.

It will be the same for the saucer. The interaction with the air jet stream could even make the wave disappear. Thus a lack of sonic boom noted by witnesses.

Seeking attenuation of this wave, or even its disapearance, is logical. An aircaft flying at supersonic speed consumes half its power creating this wave system. The other half is devoted to overcome skin friction. Same thing for the boat which let its useless wake on the sea. So the lenticular disc seems finally the best solution to cruise at supersonic or hypersonic speeds. This argument militates in favour of flying saucers, because obviously the witenesses can not had thought about all this logical step.

The saucer has a negative drag... It levitates and is propelled by brewing the air from top to bottom, like a swimmer in the water. The solution is very interesting because it reduces heating effects, since the saucer is isolated from the ambient air by the air jet. Definitely, these saucers have to exist apart from the imagination of those which observed them...

The saucer is unstable, like the helicopter, and naturally swivel on its back. But it can be controlled by changing the lift at some point of its surface. Small flaps, or "spoilers", will be devoted to this purpose:

THE SAUCERS TOMORROW?

The most difficult problem to resolve is the engine. Current axial or centrifugal turbochargers offer insufficient compression ratios to allow the ejection speed needed. A pressure about 10 kg with a strong flow rate have to come from the compressor. Who will invent this revolutionary engine? Coanda died, his ideas remain. It does him justice to make them known to the public.

MYLOS ■
(JEAN-PIERRE PETIT)