

1

00:00:00,000 --> 00:00:11,000

Music

2

00:00:11,000 --> 00:00:18,000

There is nothing wrong with your television set. Do not attempt to adjust the picture.

3

00:00:18,000 --> 00:00:23,000

For the next hour you must suspend your disbelief.

4

00:00:23,000 --> 00:00:27,000

Suppose an alien spacecraft has crashed in the desert.

5

00:00:27,000 --> 00:00:31,000

We recovered it. Our job?

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00:00:31,000 --> 00:00:37,000

Figure out how it works. Reverse engineer the technology.

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00:00:37,000 --> 00:00:45,000

With the help of leading physicists, astronomers and engineers, we'll decipher UFO technology.

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00:00:46,000 --> 00:00:52,000

Inertia cancelers, anti-gravity devices and wormhole excavators,

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00:00:52,000 --> 00:01:00,000

and maybe in the process, discover the secrets of the universe through alien engineering.

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00:01:05,000 --> 00:01:12,000

What you are about to participate in is an exercise in imagination. Prepare yourself.

11

00:01:12,000 --> 00:01:17,000

This is an alien spaceship that crashed in the desert some years ago.

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00:01:17,000 --> 00:01:24,000

We've been given the task of decoding the technology and figuring out how it runs.

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00:01:26,000 --> 00:01:31,000

We've assembled a team of some of the smartest and most imaginative researchers,

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00:01:31,000 --> 00:01:35,000

physicists, engineers and astronomers as advisors.

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00:01:36,000 --> 00:01:41,000

Step by step, our experts will take us on a technical tour of this ship,

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00:01:41,000 --> 00:01:47,000

from its controls to its aerodynamics to its propulsion.

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00:01:49,000 --> 00:01:56,000

We'll learn how it travels through space and how it maneuvers in the air.

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00:01:59,000 --> 00:02:03,000

This task won't be easy, but it will be rewarding.

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00:02:03,000 --> 00:02:08,000

Alien technology is centuries, millennia ahead of ours.

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00:02:08,000 --> 00:02:13,000

When speaking about flying saucers and UFOs, people are going to laugh behind your back,

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00:02:13,000 --> 00:02:15,000

and there goes your career.

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00:02:15,000 --> 00:02:19,000

My attitude is we have to have an open mind.

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00:02:19,000 --> 00:02:27,000

Open your mind to the possibility that a civilization could exist that is a million years ahead of us.

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00:02:28,000 --> 00:02:39,000

I say, find me a law of physics that prevents contact between civilizations that are a million years ahead of us.

25

00:02:42,000 --> 00:02:46,000

No need to convince us, we have the proof.

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00:02:47,000 --> 00:02:51,000

This ship is like a cheat sheet for advanced physics.

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00:02:51,000 --> 00:02:57,000

Let's start with the basics, the shape and flight characteristics of the ship.

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00:02:58,000 --> 00:03:01,000

Our aliens built a saucer.

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00:03:01,000 --> 00:03:05,000

Are there any aerodynamic advantages to this shape?

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00:03:06,000 --> 00:03:09,000

There were plenty of other options.

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00:03:10,000 --> 00:03:17,000

Examining records of UFO sightings over the last 50 years, it's obvious there's more than one design.

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00:03:17,000 --> 00:03:23,000

When you start researching UFO sightings, you quickly realize that there's many commonalities throughout the cases

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00:03:23,000 --> 00:03:27,000

that kind of stay true throughout all the different reports.

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00:03:27,000 --> 00:03:34,000

The number one thing is we think of UFO, we think of a flying saucer, the disk shape, usually metallic, glistens in the sunlight,

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00:03:34,000 --> 00:03:37,000

and that's really probably the most prevalent.

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00:03:38,000 --> 00:03:41,000

Secondly, you have the cigar-shaped UFOs.

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00:03:42,000 --> 00:03:47,000

Then one of the other popular types of sightings are the lights in the sky.

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00:03:47,000 --> 00:03:51,000

The glowing orbs sometimes going very slow, sometimes seem going very fast.

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00:03:52,000 --> 00:03:57,000

A triangle or boomerang is another commonly reported shape.

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00:04:00,000 --> 00:04:07,000

Since aliens may come from all over the galaxy, it makes sense that they would have different makes and models,

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00:04:07,000 --> 00:04:09,000

just like we do with our aircraft.

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00:04:10,000 --> 00:04:13,000

Each has its own purpose and handling characteristics.

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00:04:14,000 --> 00:04:20,000

When you think of a light plane, the wings generally have blunt leading edges,

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00:04:20,000 --> 00:04:25,000

but the minute you get into higher speeds, then the wings have to have sharp leading edges.

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00:04:26,000 --> 00:04:31,000

When you get into hypersonic speeds, there may be no wings at all.

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00:04:31,000 --> 00:04:39,000

The hypersonic vehicle that NASA is testing now essentially is a flying slab.

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00:04:41,000 --> 00:04:46,000

Shape does affect the aerodynamics of objects flying in our atmosphere.

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00:04:47,000 --> 00:04:55,000

When you think about a conventional airplane, generally the forces that act on it are lift,

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00:04:56,000 --> 00:05:01,000

and that's generally done by some surface, we call it a wing.

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00:05:02,000 --> 00:05:05,000

Now acting against lift is drag.

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00:05:05,000 --> 00:05:13,000

That is the mere fact of the air moving over a surface and tends to impede it.

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00:05:13,000 --> 00:05:21,000

That of course has to be overcome by some kind of forward propulsion or thrust that counteracts drag.

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00:05:22,000 --> 00:05:30,000

Few of the reported sightings mention wings, tails, jets or propellers,

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00:05:30,000 --> 00:05:35,000

but an object lacking these essentials could still stay aloft.

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00:05:35,000 --> 00:05:42,000

There's a saying, with enough propulsion you can fly a brick and that's true.

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00:05:43,000 --> 00:05:50,000

With enough propulsion, a craft can even make it into space.

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00:05:50,000 --> 00:05:58,000

Like our rockets, the cigar shaped UFOs would be good for drilling through our thick atmosphere.

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00:06:00,000 --> 00:06:07,000

When looking at reported UFO shapes, the boomerang or triangle is one of the best, aerodynamically speaking.

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00:06:08,000 --> 00:06:15,000

We even have our own boomerang shaped aircraft such as the B2 stealth bomber.

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00:06:15,000 --> 00:06:19,000

It's known as a flying wing design.

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00:06:19,000 --> 00:06:26,000

The flying wing is a beautiful shape, at least through subsonic flight, because it's all wing and it's all efficient.

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00:06:26,000 --> 00:06:33,000

The minute you start putting engines hanging out, the minute you put a fuselage,

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00:06:33,000 --> 00:06:38,000

the minute you put a tail, a rudder and elevators, you're adding drag.

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00:06:38,000 --> 00:06:41,000

Flying wing doesn't have that.

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00:06:41,000 --> 00:06:47,000

The boomerang shaped flying wing dates back to the early half of the 20th century.

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00:06:47,000 --> 00:06:54,000

Northrop Aircraft Company even developed a long range bomber using this shape during World War II.

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00:06:55,000 --> 00:07:09,000

Coincidentally, the sighting that started the UFO phenomenon also describes boomerang shaped objects.

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00:07:09,000 --> 00:07:33,000

On June 24, 1947, Kenneth Arnold, a recreational pilot, was flying in his single-engine Cessna in the Cascade Mountain Range of Washington State when a flash caught his attention.

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00:07:33,000 --> 00:07:42,000

He claimed to see several metallic objects flying in a loose V-formation and moving at a terrific speed in his words.

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00:07:42,000 --> 00:07:56,000

Interviewed by both the news media and the FBI, Arnold ushered in the modern era of the unidentified flying object when he described his object flying like saucers skipping across the water.

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00:07:56,000 --> 00:08:00,000

However, he didn't say they looked like saucers.

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00:08:00,000 --> 00:08:09,000

Arnold later made some sort of a sketch for someone to describe the shape, and it turned out it wasn't exactly a saucer, but the term is stuck.

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00:08:09,000 --> 00:08:17,000

Comparing Arnold's sketch with a stealth aircraft from the U.S. Air Force reveals some similarities.

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00:08:17,000 --> 00:08:26,000

Maybe those aliens who build triangular spaceships are also concerned about drag when flying in our Earth's atmosphere.

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00:08:27,000 --> 00:08:32,000

Of course, in the vacuum of space, drag is not an issue.

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00:08:32,000 --> 00:08:42,000

Looking at other commonly reported shapes of UFOs, we realize our aliens don't seem to care about drag in our atmosphere at all.

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00:08:42,000 --> 00:08:46,000

If they did, they wouldn't build flying saucers.

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00:08:46,000 --> 00:08:54,000

Saucers just aren't that stable or easy to control, at least for us humans.

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00:08:54,000 --> 00:09:03,000

It doesn't have any particular control surfaces like the fins or the flaps on a conventional airplane for changing direction, either climbing or turning.

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00:09:03,000 --> 00:09:09,000

So it's really hard to see why this would be a particularly advantageous shape for flying inside any kind of atmosphere.

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00:09:13,000 --> 00:09:18,000

People have dabbled in making flying saucers, and in fact they've shown that it can be done.

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00:09:18,000 --> 00:09:27,000

Generally, their saucer shape, they have a big fan in the center, and they take off and they fly, and it's a good show.

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00:09:27,000 --> 00:09:32,000

But it's a lousy airplane. It's a very inefficient lifting surface.

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00:09:32,000 --> 00:09:40,000

And they're getting most of their lift from the fan that is blowing air down, more like a helicopter.

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00:09:40,000 --> 00:09:48,000

If you were grading for efficiency, it would be at the bottom of the scale as far as a lifting device is concerned.

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00:09:48,000 --> 00:09:54,000

So why would the aliens build such aerodynamically inefficient craft?

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00:09:54,000 --> 00:10:03,000

The truth is, they could build any shape of ship and it would still fly, thanks to its super strong propulsion system.

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00:10:03,000 --> 00:10:15,000

And it seems to me that when you think about what's been reported, their propulsion systems must be so powerful that it really doesn't matter what shape they are.

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00:10:17,000 --> 00:10:21,000

We'll explore our alien ship's propulsion later.

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00:10:21,000 --> 00:10:29,000

But for now, let's keep this in mind. On this ship, aerodynamics are almost obsolete.

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00:10:30,000 --> 00:10:37,000

Maybe our aliens selected the flying saucer model for no other reason than it looks cool.

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00:10:37,000 --> 00:10:47,000

If their propulsion system is as strong as we think, how do the aliens on board survive the forces of abrupt changes in speed,

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00:10:47,000 --> 00:10:52,000

violent forces that would rip a human being apart?

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00:10:52,000 --> 00:11:01,000

In other words, somewhere on this ship, there's an inertia canceler. We'll send in our team to find it.

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00:11:12,000 --> 00:11:18,000

Our alien ship is immune to the effects of drag within Earth's atmosphere.

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00:11:19,000 --> 00:11:30,000

But even more significantly, it's immune to the effects of inertia, the universal property of matter that causes a body at rest to stay at rest,

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00:11:30,000 --> 00:11:34,000

and a body in motion to stay in motion.

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00:11:34,000 --> 00:11:47,000

Our alien spaceship has an inertia canceler, a sort of high-tech seat belt that keeps everything inside our fast-moving ship from going through the windshield.

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00:11:48,000 --> 00:11:56,000

By examining UFO reports, our experts can better comprehend this piece of alien equipment.

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00:11:58,000 --> 00:12:06,000

Sometimes you hear reports of this UFO or craft or ship or however they want to describe it, moving hundreds, if not thousands of miles an hour,

101

00:12:06,000 --> 00:12:10,000

streaking across the sky, sometimes doing a right-angle move or going up and down,

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00:12:10,000 --> 00:12:14,000

and something we obviously have not achieved yet as a human race.

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00:12:15,000 --> 00:12:22,000

We offer the following straight from the UFO files of the United States Air Force for your edification.

104

00:12:22,000 --> 00:12:30,000

December 6, 1952, in the last minutes before dawn, a B-29 bomber conducts a training mission over the Gulf of Mexico.

105

00:12:30,000 --> 00:12:35,000

Suddenly, an object appears on radar heading straight toward the bomber.

106

00:12:36,000 --> 00:12:45,000

Captain, bogey inbound, moving at 3,800. No, 4,200 knots, sir, over.

107

00:12:45,000 --> 00:12:49,000

That's nearly 5,000 miles per hour.

108

00:12:49,000 --> 00:12:51,000

She's coming in, three o'clock, sir, over.

109

00:12:51,000 --> 00:12:56,000

A crewman jumps to the right blister window to see a blue-white light streak by.

110

00:12:56,000 --> 00:13:00,000

Then four more blips appear on the scope.

111

00:13:00,000 --> 00:13:06,000

We got another one, sir, coming in. Sir, at this range, you should have visual, over.

112

00:13:06,000 --> 00:13:11,000

They too screen by at more than 5,000 miles per hour.

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00:13:11,000 --> 00:13:12,000

What was that?

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00:13:12,000 --> 00:13:17,000

Then one of the objects breaks away and starts following the plane.

115

00:13:18,000 --> 00:13:36,000

Minutes later, the radar operator sees all the blips fly toward and merge with a much larger radar blip that suggests a large flying craft.

116

00:13:36,000 --> 00:13:43,000

This large mothership then tears off at more than 9,000 miles per hour.

117

00:13:44,000 --> 00:13:59,000

Our aircraft then and now can't come close to that speed, and even if they could, it would kill us to be going that fast and suddenly stop or turn.

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00:13:59,000 --> 00:14:22,000

The acceleration forces generated by performing such maneuvers would rip an aircraft's structure and its occupants apart.

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00:14:22,000 --> 00:14:32,000

Any time that you slow down, speed up or turn, a force is involved, and if it's very severe, then the force has to be very severe.

120

00:14:32,000 --> 00:14:59,000

That's because of inertia. Once again, the property of matter that causes a body at rest to stay at rest, and a body in motion to stay in motion at the same speed and in the same direction unless acted upon by an outside force.

121

00:15:02,000 --> 00:15:10,000

That's why when you're in that car and you slow down, you're lurching forward because your body wants to keep moving forward even though the car is not.

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00:15:11,000 --> 00:15:33,000

If the spaceship is traveling 5,000 miles per hour and abruptly stops, the craft might come to a halt. But the alien pilots continue moving forward due to inertia. In other words...

123

00:15:33,000 --> 00:15:38,000

If they're built anything like us, they become wet smears on the inside surface of the spacecraft.

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00:15:43,000 --> 00:15:59,000

That's why the inertia canceler is a must. To understand how this might work, we can look at the research garnered by over 100 years of flight testing right here on Earth.

125

00:16:04,000 --> 00:16:20,000

Acceleration forces are measured in units of gravitational acceleration, or G forces. A single G is the pole downward Earth has on our bodies when we're at sea level.

126

00:16:21,000 --> 00:16:28,000

Jet fighter and stunt pilots pull elevated Gs up to 9 during certain maneuvers.

127

00:16:29,000 --> 00:16:37,000

Pulling back on the stick generates positive Gs. This gives a person the sensation of being several times heavier.

128

00:16:38,000 --> 00:16:52,000

Diving, or abruptly stopping, produces negative Gs and a feeling of weightlessness, like a roller coaster going down the first large drop.

129

00:16:54,000 --> 00:17:02,000

But pulling serious Gs isn't like riding an amusement park attraction. In fact, it can be deadly.

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00:17:03,000 --> 00:17:17,000

Here at LaMoure California's Naval Air Station, pilots take a ride in the human centrifuge to see just how many positive Gs the human body can withstand.

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00:17:18,000 --> 00:17:19,000

Ok, go ahead.

132

00:17:19,000 --> 00:17:22,000

You should start to feel the gradual onset of Gs now.

133

00:17:23,000 --> 00:17:30,000

The centrifuge we have here, the gondola itself travels at about 65 or 70 miles an hour, which doesn't seem like it's all that fast.

134

00:17:30,000 --> 00:17:39,000

But as it rotates on that arm, it produces some very significant G forces. As much as 15 Gs, although we are human limited to 9 Gs.

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00:17:40,000 --> 00:17:48,000

The goal of our training here is to educate pilots in aircrew what it feels like to pull Gs under controlled laboratory situation.

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00:17:48,000 --> 00:17:51,000

We will often take them right to the edge of Glock.

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00:17:52,000 --> 00:18:00,000

Glock is the technical term for gravity-induced loss of consciousness caused by blood draining from the brain.

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00:18:01,000 --> 00:18:09,000

Testing helps pilots to know what the onset of Glock feels like and therefore how to avoid it later when they're actually flying.

139

00:18:11,000 --> 00:18:21,000

Unchecked, Glock can cause pilots to black out. Eventually, they will die, either from lack of oxygen or from crashing their aircraft.

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00:18:22,000 --> 00:18:30,000

What happens is at certain points, the blood literally cannot pump around your whole body. The forces are so great that the blood gets pushed to your legs.

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00:18:30,000 --> 00:18:40,000

So 10 Gs, a very hardy astronaut could survive. Beyond that, literally parts of your body get pushed apart, get crushed, literally by the G forces.

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00:18:41,000 --> 00:19:00,000

The human body is even more sensitive to pulling negative Gs. We know much about the way negative Gs affect the human body because of the work of men like Dr. John Stapp.

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00:19:01,000 --> 00:19:14,000

Stapp worked for the Air Force as his own guinea pig, climbing into rocket sleds and shooting himself down a long track, only to be instantly stumped.

144

00:19:15,000 --> 00:19:18,000

This generated tremendous negative Gs.

145

00:19:19,000 --> 00:19:32,000

On one run in 1954, Stapp reached a speed of 632 miles an hour before slamming to a stop in less than two seconds.

146

00:19:33,000 --> 00:19:48,000

He survived, but suffered a complete redout, bursting the capillaries in his eyes due to the force of more than 40 Gs.

147

00:19:49,000 --> 00:20:08,000

Stapp's experiments made everything from ejection seats to car safety belts safer. However dramatic, these tests don't come close to producing the kind of Gs a ride in a UFO would.

148

00:20:09,000 --> 00:20:24,000

Let's say a flying saucer were traveling at the speed of sound and made a right angle turn in a tenth of a second. The acceleration felt would be about 300 Gs, which would really be enough probably to tear everything apart, any material we know of and everything inside it.

149

00:20:24,000 --> 00:20:37,000

But that maneuver is nothing for a UFO. Some radar reports indicate an object going from rest to 9,000 miles per hour almost instantaneously.

150

00:20:38,000 --> 00:20:50,000

The G forces that you'd experience if you did that would be literally thousands of times the force of gravity. And that would be far greater than you'd experience, say, if you were in a jet plane that lost power and crashed on the ground.

151

00:20:52,000 --> 00:21:03,000

Our ship has an inertia canceler because simply flooring the ship's gas pedal creates more G forces than crashing a plane. So how does it work?

152

00:21:04,000 --> 00:21:18,000

There'd have to be something within the craft that would counter these G forces. One possible way, at least in principle, is to actually manipulate the force of gravity itself.

153

00:21:18,000 --> 00:21:27,000

For example, if I could produce a gravitational field in front of me within the spacecraft that was pulling me forward at the same force that I was being pushed back into the seat.

154

00:21:27,000 --> 00:21:34,000

A gravitational force field. This must be exactly how the alien inertia canceler works.

155

00:21:34,000 --> 00:21:47,000

You would presumably have to be able to turn it on and off in some easily controlled way and very quickly because if you're going to make a very quick change in your state of motion, you have to be able to deal with it quickly.

156

00:21:48,000 --> 00:22:02,000

These aliens have shown us humans the way to overcome inertia. Maybe someday we'll use this knowledge to eliminate the need for, among other things, safety belts and airbags.

157

00:22:03,000 --> 00:22:22,000

Now that we've figured out what the inertia canceler does, our next goal is deciphering the propulsion system. Our experts believe it's either a force field generator or an anti-gravity drive. Our scientists are reverse engineering one right now.

158

00:22:23,000 --> 00:22:41,000

Beyond their shock value, close encounters with UFOs can reveal secrets about how alien spacecraft actually function. Perhaps even clues about their propulsion systems.

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00:22:41,000 --> 00:22:48,000

What you are about to see is a dramatization, a composite of similar encounters.

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00:22:48,000 --> 00:23:01,000

Two men are heading off for a weekend camping trip. They're also headed for a shock.

161

00:23:01,000 --> 00:23:10,000

In many cases there's been sightings where a UFO would come out of the sky or hover over a car or come down behind a tree line or something like that.

162

00:23:10,000 --> 00:23:14,000

The first thing I'd do is I'd quit my job.

163

00:23:14,000 --> 00:23:26,000

Sometimes even turning off a car engine, making the lights flicker. But how they actually can do that is really kind of a question mark.

164

00:23:26,000 --> 00:23:28,000

I can't believe we were out of gas.

165

00:23:28,000 --> 00:23:33,000

We didn't run out of gas. Something else must be wrong.

166

00:23:34,000 --> 00:23:44,000

There are certain characteristics that are reported again and again regardless of the shape of the craft. One would have to do with silence.

167

00:23:44,000 --> 00:23:53,000

It could be a very, very large craft, hovering nearby overhead, and the witness reports that it makes absolutely no sound.

168

00:23:53,000 --> 00:23:56,000

Oh, we'll just cut through here to get back to the highway.

169

00:23:56,000 --> 00:24:01,000

Look, if you didn't think it was such a good idea, you should have said something at the time.

170

00:24:03,000 --> 00:24:05,000

Something wrong with the camera.

171

00:24:16,000 --> 00:24:18,000

What is that?

172

00:24:20,000 --> 00:24:22,000

What the heck is that?

173

00:24:22,000 --> 00:24:24,000

Bob, Bob, what is that?

174

00:24:24,000 --> 00:24:42,000

Like what you've just seen, our alien ship can hover silently. Also, the energy produced from its propulsion system interferes with electronics.

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00:24:42,000 --> 00:24:50,000

The ship uses either an anti-gravity drive or a force field generator for its propulsion system.

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00:24:51,000 --> 00:24:57,000

Our engineers are trying to determine which one of these devices the ship uses.

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00:24:57,000 --> 00:25:13,000

Perhaps the aliens have discovered a way of silently turning off gravity. Somewhere on this ship might be an anti-gravity drive that negates the natural pull objects like the Earth have on other objects.

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00:25:13,000 --> 00:25:27,000

But what is gravity? For this, we'll need to go to the blackboard. There are four known forces, electromagnetism, the strong and the weak nuclear forces, and gravity.

179

00:25:27,000 --> 00:25:36,000

Gravity is the most enigmatic. Ironically, it's the one we're most familiar with, and the weakest of the four.

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00:25:36,000 --> 00:25:45,000

If you say you don't really understand gravity very well, you're in good company, because I think not even the best physicists really understand gravity yet.

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00:25:47,000 --> 00:25:58,000

$E = mc^2$, in which energy is per equal to mass, multiplied with the square of the velocity of light, shown.

182

00:25:58,000 --> 00:26:08,000

Albert Einstein, while a young patent clerk, revolutionized our understanding of how the universe works with his special and general theories of relativity.

183

00:26:11,000 --> 00:26:19,000

In general relativity, Einstein said gravity is the result of the curvature of space caused by energy and mass.

184

00:26:21,000 --> 00:26:26,000

Gravity is our experience of that curvature, produced by the mass of the Earth.

185

00:26:28,000 --> 00:26:31,000

Could this device be an anti-gravity drive?

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00:26:34,000 --> 00:26:44,000

We humans are striving to create our own anti-gravity drives. So far, none has succeeded, and most physicists will tell you it's impossible.

187

00:26:45,000 --> 00:26:53,000

Right now, I'd have to say we just don't know. So far, gravity is something that acts on us, and we don't act on gravity.

188

00:26:54,000 --> 00:26:59,000

Just because we aren't manipulating gravity yet doesn't mean the aliens aren't.

189

00:27:00,000 --> 00:27:05,000

But an anti-gravity drive isn't the only way for the aliens to skirt gravity.

190

00:27:06,000 --> 00:27:10,000

A force field generator could allow the saucer to overpower gravity.

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00:27:11,000 --> 00:27:19,000

If it doesn't manipulate gravity, maybe it uses one of the other four known forces for propulsion and levitation.

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00:27:20,000 --> 00:27:25,000

Perhaps the exotic force that holds photos to your fridge.

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00:27:27,000 --> 00:27:33,000

At every point in space surrounding a magnet, there is a force field called the magnetic field.

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00:27:34,000 --> 00:27:38,000

All permanent magnets have a north and south pole.

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00:27:41,000 --> 00:27:46,000

Opposite poles are attractive to each other, and their force fields pull them together.

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00:27:47,000 --> 00:27:55,000

Identical poles repel, and this force will, within certain parameters, overcome gravity.

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00:27:58,000 --> 00:28:03,000

Electrons moving through a coil of wire also produce a magnetic field.

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00:28:04,000 --> 00:28:10,000

So if you want to make a very powerful magnet, you do what many of us have done in second grade, which is you make a coil of wire,

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00:28:10,000 --> 00:28:18,000

and then you put electrical current through it and you prove that it's an electromagnet by having it attract a nail or some other steel object to it.

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00:28:22,000 --> 00:28:26,000

We're using electromagnets for propulsion right now.

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00:28:29,000 --> 00:28:35,000

A maglev train uses opposing electromagnets to levitate the train and propel it down the track.

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00:28:36,000 --> 00:28:44,000

While the maglev train relies on two sets of magnets to perform its trick, some materials need only one magnetic field to perform the same stunt.

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00:28:47,000 --> 00:28:53,000

This is a hockey puck, if you will, of yttrium barium copper oxide.

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00:28:54,000 --> 00:28:59,000

This is one of the high temperature superconductors that was discovered about 20 years ago.

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00:29:00,000 --> 00:29:08,000

If we put it in liquid nitrogen to cool it down, then it becomes superconducting and its properties change dramatically.

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00:29:09,000 --> 00:29:21,000

When this gets cold enough, it becomes a superconductor, and it then will levitate above this track that's made up of neodymium iron boron magnets.

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00:29:22,000 --> 00:29:30,000

The supercooled superconductor is perfectly diamagnetic. It expels the magnetic field.

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00:29:32,000 --> 00:29:38,000

It's being pushed up against gravity as it's trying to expel the magnetic field out of itself.

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00:29:40,000 --> 00:29:48,000

Another way that you can use magnetic fields to counteract the forces of gravity is through levitating anything that contains water, for example.

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00:29:48,000 --> 00:29:57,000

Because water is diamagnetic and it wants to repel magnetic fields, so it really wants to get out of the magnetic field.

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00:29:58,000 --> 00:30:03,000

Even living things can be diamagnetic, such as a frog.

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00:30:03,000 --> 00:30:21,000

If you put something that has water in it, and of course our bodies are mostly water, a frog's body is mostly water, you can put that in a magnetic field gradient.

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00:30:22,000 --> 00:30:31,000

So it's a strong field here, it's a weaker field there, it's the weakest field up here, and that water-containing object is going to want to drift up to the weaker magnetic fields.

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00:30:31,000 --> 00:30:40,000

So by configuring your experiment right, you can get that frog to levitate, in principle, you can get a human being to levitate, because we contain so much water.

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00:30:44,000 --> 00:30:52,000

Could this be the way they get the saucer to levitate? Is the saucer made of some super diamagnetic material?

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00:30:53,000 --> 00:31:03,000

In principle, magnetic fields could be used to propel a ship through the air, and it's natural enough that when we look at the story of unidentified flying objects to think about magnetic fields,

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00:31:04,000 --> 00:31:15,000

the levitation experiment with the frog works because there's a big magnet that's positioned right beneath the frog, and that's how we can make the magnetic force be equal to an opposite the gravitational force.

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00:31:16,000 --> 00:31:28,000

If UFOs were using magnetic levitation, we would not only notice the UFO, we would notice the big magnet that they're lugging around underneath the flying saucer, so I don't think that would be what they would be using.

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00:31:30,000 --> 00:31:41,000

The alien ship doesn't hover above a big magnet. However, the Earth itself generates a magnetic field, that's why compass needles point north.

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00:31:41,000 --> 00:31:48,000

Maybe the alien ship uses the natural magnetic field of Earth for propulsion within our atmosphere.

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00:31:49,000 --> 00:31:58,000

But the Earth's magnetic field is very weak. We're a few Nobel prizes away from levitating a ship using a force field generator.

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00:31:59,000 --> 00:32:17,000

But remember, either an electromagnetic repulsive force field generator or an anti-gravity drive could meet the challenges of gravity the aliens face, and the anti-gravity drive is what this alien ship has under the hood after all.

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00:32:18,000 --> 00:32:33,000

The alien anti-gravity drive manipulates Earth's gravity, reversing it against itself and focusing it to prop up our ship on a gravity wave. It can go in any direction it wants.

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00:32:34,000 --> 00:32:47,000

Now that we've learned that this ship can match the acrobatic maneuvers of the most amazing UFO reports, we'll turn our attention to the drives that allow it to travel across the universe.

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00:32:48,000 --> 00:33:08,000

Our alien spaceship uses an exotic form of space travel to cross the galaxies, because conventional rocket-powered space travel just won't cut it. Space is just too big, way too big.

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00:33:08,000 --> 00:33:25,000

Take a look at our solar system. If our solar system were about, let's say, a foot long, here's the Sun and here's the orbit of Pluto. And you were to ask, well, where are the nearby stars? The nearby stars would be miles away.

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00:33:26,000 --> 00:33:34,000

After our sun, the closest star is in the Alpha Centauri system, more than four light years away.

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00:33:35,000 --> 00:33:48,000

That means that even if the alien ship could travel at light speed, a mind-boggling 186,000 miles per second, it would still take over four years to get to Alpha Centauri from here.

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00:33:49,000 --> 00:34:00,000

And even if we went, there probably isn't anyone to meet. Scientists optimistically estimate the nearest habitable planet at 45 light years away.

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00:34:02,000 --> 00:34:11,000

Clearly, they're using unconventional methods. Besides, covering such vast distances would require a lot of rocket fuel.

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00:34:12,000 --> 00:34:20,000

All that fuel adds weight, of course. Consider how long it would take the aliens if they were using conventional rockets.

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00:34:24,000 --> 00:34:35,000

Our Voyager missions that explore Jupiter and Saturn are the fastest man-made objects traveling 10 miles per second. Pretty fast, but that's still not fast enough.

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00:34:36,000 --> 00:34:50,000

If the ancient Greeks, at the time of Homer, had launched a space mission to the nearest stars and it traveled as fast as Voyager, the fastest space probe that humans have ever launched.

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00:34:51,000 --> 00:35:02,000

And if they launched it 5,000 years ago, it would still be another 70,000 years before it would get to the nearest star. It wouldn't even be 1% of the way there.

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00:35:03,000 --> 00:35:11,000

This ship is engineered to travel at the speed of light, or even faster. And that's not possible using conventional methods.

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00:35:12,000 --> 00:35:22,000

To do that, the aliens would have to break some laws of physics. Because Albert Einstein won't allow them to go that fast the old-fashioned way.

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00:35:23,000 --> 00:35:36,000

In the early 20th century, Albert Einstein offered a radical new way to understand the universe with his special and general theories of relativity.

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00:35:37,000 --> 00:35:48,000

Einstein theorized that time is relative throughout space. It's gooey and flexible.

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00:35:49,000 --> 00:35:58,000

One of the strange side effects of traveling close to the speed of light is something known as time dilation.

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00:35:58,000 --> 00:36:09,000

According to Einstein, the closer you get to the speed of light, the more the clocks on your ship slow down. So time to you passes more slowly.

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00:36:10,000 --> 00:36:18,000

So if you have somebody approaching the speed of light, say 80 or 90% of the speed of light, time for them is passing very, very slowly.

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00:36:19,000 --> 00:36:31,000

If a rocket blasted off from Earth on a round-trip mission to Alpha Centauri, traveling close to the speed of light, years would have elapsed here on Earth before the mission returned.

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00:36:32,000 --> 00:36:42,000

But on the spaceship, only a few weeks would have elapsed. The crew would have aged only a few weeks, and the in-flight recorder would have indicated a short journey.

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00:36:43,000 --> 00:36:49,000

It's not science fiction. It's really true. We can test this in undergraduate physics laboratories around the world every single day, and it works.

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00:36:50,000 --> 00:36:56,000

It's really true that clocks do slow down relative to an observer watching someone as they travel near the speed of light.

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00:36:57,000 --> 00:37:04,000

Now this is in principle, of course, great, but it's also a problem if some spacecraft does a return voyage and it takes five years for it to do.

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00:37:05,000 --> 00:37:08,000

And 50,000 years later, it arrives back at its home base.

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00:37:13,000 --> 00:37:24,000

But Einstein predicts an even bigger problem. Our ship can only go so fast before it runs into

Einstein, the ultimate galactic traffic cop.

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00:37:25,000 --> 00:37:37,000

Einstein says there is a universal speed limit. It's not possible to travel faster than the speed of light, because at that speed the laws of physics fundamentally alter mass.

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00:37:38,000 --> 00:37:43,000

As objects speed up to get closer and closer to the speed of light, they get more massive.

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00:37:45,000 --> 00:37:56,000

If I take a single atom and I want to accelerate it to half the speed of light using conventional rocket fuel, the amount of fuel required will be greater than the mass of the entire visible universe.

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00:37:58,000 --> 00:38:02,000

Our spacecraft being made of atoms would have the same problem.

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00:38:03,000 --> 00:38:14,000

The closer the alien ship gets to the speed of light, the more massive it becomes, until ultimately, according to Einstein, it becomes infinitely massive.

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00:38:16,000 --> 00:38:27,000

This is part of the mind-boggling relationship between energy and mass that Einstein grasped a century ago and the rest of the world has been grappling with ever since.

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00:38:28,000 --> 00:38:42,000

It would seem that this is all a roadblock stopping our aliens from traveling the galaxies, but it's really not, because our aliens have found a loophole in Einstein's general theory of relativity.

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00:38:44,000 --> 00:38:53,000

Well, actually, it's not so much a loophole as it is a wormhole. There may be a detour around the speed of light.

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00:38:58,000 --> 00:39:06,000

Our team is busy analyzing the exterior of our alien ship, even as we struggle with how the gears and inner workings function.

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00:39:07,000 --> 00:39:15,000

But our technicians have made a major discovery. They've tapped into what we would call the ship's computer guidance system.

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00:39:16,000 --> 00:39:18,000

It appears there's a map of the universe.

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00:39:21,000 --> 00:39:23,000

This could be a real breakthrough.

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00:39:28,000 --> 00:39:36,000

Contrary to what we all learned in sixth grade, the shortest distance between two points isn't necessarily a straight line.

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00:39:38,000 --> 00:39:46,000

To begin to understand what the aliens are doing, we have to again consult with Einstein about his theories on gravity.

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00:39:47,000 --> 00:39:59,000

Einstein saw mass and space, matter and space, as connected in the sense that you could explain gravity by saying that mass distorts space, that it exerts some force on it.

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00:40:00,000 --> 00:40:08,000

Space is curved in the vicinity of matter and that the planets follow the shortest path on the curved surface of space.

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00:40:09,000 --> 00:40:13,000

So massive objects bend space itself.

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00:40:17,000 --> 00:40:29,000

Proof of this bizarre theory, which secured Einstein's place among the gods of physics, came from two British astronomers on expedition during a solar eclipse in 1919.

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00:40:30,000 --> 00:40:34,000

The scientists took photographs of the sun during the eclipse.

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00:40:35,000 --> 00:40:41,000

Within the darkness as the moon shields the sun, stars near the sun are visible.

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00:40:42,000 --> 00:40:47,000

But Einstein believed that sun stars behind the sun would also be visible.

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00:40:49,000 --> 00:40:58,000

He predicted their light would be curved by the sun's immense gravity around the sun, and therefore would be visible to us beyond its edge.

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00:40:59,000 --> 00:41:11,000

He actually calculated by what amount it would curve, and in 1919 British astronomers went to see a solar eclipse and verified precisely that his prediction was correct, and Einstein became a household name overnight.

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00:41:12,000 --> 00:41:20,000

Since gravity bends space, maybe aliens utilize that phenomenon to jet across the galaxy.

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00:41:22,000 --> 00:41:25,000

This device appears to be a warp drive.

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00:41:26,000 --> 00:41:39,000

If you could manipulate space, you could expand space behind you and contract it in front of you, and you could build what you might call a warp drive, if you wish, which in some sense is warping space by manipulating it in front and behind you.

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00:41:39,000 --> 00:41:44,000

And in so doing travel from one place to another, apparently, faster than the speed of light.

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00:41:45,000 --> 00:41:55,000

By constricting space time in front of the craft while expanding space time behind, the alien ship could propel along like a bullet exiting a rifle.

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00:41:56,000 --> 00:42:09,000

And even better, the clocks inside would run at the same rate as the clocks outside. This is probably one of the most surprising and puzzling things, but it would live in a pocket of ordinary space which wouldn't feel the relativistic effects of its huge velocity.

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00:42:10,000 --> 00:42:18,000

Because our engineers successfully hacked into the alien computer system, we are learning a lot more about the function of the ship.

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00:42:20,000 --> 00:42:35,000

Next to the warp drive is an even more sophisticated device. It too allows for faster than light travel, relatively speaking, a wormhole generator, capable of folding space itself.

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00:42:36,000 --> 00:42:49,000

Think of Alice's looking glass. The looking glass was in some sense a shortcut, a subway system, a tunnel to the fabric of space and time. That is a wormhole.

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00:42:50,000 --> 00:43:01,000

Let's imagine a map of the Earth. Mark A represents New York City. Mark B represents Paris. If we fold the map, they're actually not very far away.

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00:43:01,000 --> 00:43:09,000

Now all we need to do is punch a hole through the map to connect both cities. Voila, the opening is like a wormhole.

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00:43:10,000 --> 00:43:26,000

In 1935, Einstein came out with the first paper on wormholes. We call them Einstein-Rosenbridges. We don't really call them wormholes, but these Einstein-Rosenbridges really do take you from one

stage to another, a gateway.

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00:43:27,000 --> 00:43:34,000

Einstein's theory allowed for the possibility of wormholes. Quantum physics suggests that they may occur spontaneously.

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00:43:35,000 --> 00:43:47,000

Einstein's equations we now know are littered with wormholes. It's impossible to look at Einstein's equations without finding a wormhole here or there. They're everywhere. The problem is, how stable are they?

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00:43:48,000 --> 00:44:01,000

Luckily, the wormhole generator also has a stabilizer. That means the aliens can prop open a wormhole and keep it open until the ship passes through. Problem solved.

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00:44:04,000 --> 00:44:16,000

Understanding this alien ship has been a real challenge. We've had to push our knowledge of physics and quantum mechanics to its limit in order to comprehend what our alien visitors have achieved.

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00:44:17,000 --> 00:44:29,000

But we've been able to figure out quite a bit. Like how it defies gravity and inertia. And how it can sidestep the speed of light across the universe.

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00:44:34,000 --> 00:44:51,000

The next challenge is turning this insight into our own real machines that can travel through space and time. To meet the aliens on their turf, not as students or subjects, but as equals.