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Space Odyssey: Voyage to the Planets

By Joe Ahearne

(MISSION CONTROL) Pegasus, proceed with checklist for trans-Venus injection.

(YVAN) Copy that.

(NARRATOR) It is our destiny to explore the far frontiers of space.

Last century we took the first steps to the moon.

Imagine we were ready to take the next giant leap.

This is the story of a manned voyage to the planets.

Humanity's greatest challenge and ultimate adventure.

(MISSION CONTROL) Event timer countdown.

Five, four, three, two, one.

(NARRATOR) This eight-billion-mile tour of our solar system

is based on science fact, not fiction.

Using data from over 40 years of unmanned probes and human space flight, it is a vision of how technology could take us on a search for the origins of our own planet and signs of extraterrestrial life.

No single nation could take on a project this vast.

A manned mission to the planets is a global endeavour,

but the dreams of billions lie in the hands of just five astronauts.

They represent a wide range of disciplines - engineering, medicine, geology and aeronautics.

These five are scientists as well as astronauts and they've been training for this mission most of their adult lives.

The mission will begin with Venus.

It's our nearest neighbour, but nothing like Earth.

Venus is the most hostile planet in the solar system.

Two of the crew will attempt to land on its burning surface.

Huge electrostatic storms, winds of over 200 miles an hour.

Clouds of hydrochloric acid, sulphuric acid.

It gets so hot on the surface, it never rains.

(TOM) They'll be flying into hell.
Venus is permanently covered with cloud, so
they will be the first humans to see the surface.
Venus is covered in lava plains
and it's comparatively recent.
The thing is we've never seen any eruptions
so...what's going on?
No ordinary spacesuit can withstand the soaring
temperatures and crushing pressures.
This titanium suit has been tested
in a blast furnace.
On Venus, it will only function for about one hour.
(YVAN) It's a bit like going to Rome and
getting only two seconds in the Sistine Chapel.
When I get down there,
I won't have time for big speeches.
I'll have to leave that to politicians.
I'm going there to pick up rocks.
They will be out of Earth's gravity
and their muscles will be weakened.
Grigorev will need all his strength
once he's on the surface.
On Venus, the gravity's like Earth's
so it'll come as quite a shock.
We've got an exercise regime on the way there
to help, but the suit weighs 100 kilos.
(BLEEPING)
The crew will pursue their mission objective.
the search for any signs of life
even in the acid storms of Venus.
There's a thin layer about 45 kilometres up.
The temperatures and pressures there are just
low enough for microbes to live off the sulphur.
No one thought they'd find life
in the hot sulphur springs here on Earth.
If life is tough enough to make it there,
why not Venus?
(MISSION CONTROL) We have lift-off.
(NARRATOR) This is Pegasus,
one mile of nuclear-powered spacecraft,
home for the next six years,
an oasis of life in the vacuum of space.
Everyone understands the risks. There's
no guarantee any of them will make it home.

(MISSION CONTROL)

You have a go for trans-Venus injection.
Godspeed, Pegasus.

(NARRATOR) The five astronauts
rely on thousands back on Earth.
The tip of the iceberg - Mission Control.
This nerve centre is vital
to the success and survival of the crew.
Flight Director is in overall control.
Flight Dynamics Officer, or FiDO,
handles all manoeuvres.
Flight Surgeon assesses crew health
and the risks
as the astronauts perform experiments
designed by the Science Director.
All Mission Control advice is relayed
to Pegasus through Capcom.

Pegasus, you are go...

Six weeks from Earth
and Pegasus is in Venus orbit,
ready to send the lander Orpheus
into the inferno.

(TOM) Fantastic sight, Larry.

You ought to be here, man.

(LARRY) I'm eating my heart out, Tom.

(TOM) Pegasus standing by
for Orpheus pad on descent.

(MAN) Surface temperatures can melt lead
and pressures could crush a submarine.
The lander's designed to last for two hours.

(TOM) Orpheus bay is open.

You have to treat Venus like a bank job.
Get in, do your experiments fast and get out.
- You have the parameters for the descent, over.
- Coming up.

Grigorev and Lessard will be the first humans
on Venus, but not the first visitors from Earth.
The Soviets landed eight probes on Venus from
the '60s up until the '80s - the Venera series.
They withstood the heat and pressure
long enough
to transmit our first pictures back
from another planet.
The last one touched down in 1982, Venera 14.

The Russians are keen to find out what's left.
(YVAN) My grandfather worked on Venera 14.
For him, it was a complete disaster.
The camera ejected its lens cap and it landed
exactly where the soil sample was due to go in.
It blocked it, so they got one wonderful picture
before the camera insides melted,
but they couldn't touch the surface.
(ZO) Auto-sense sequencer up.
We're ready for release.
(CAPCOM) Orpheus, go front dock.
(NINA) I see a good set.
They're out at five metres per second.
(TOM) APU's looking good.
(NINA) Altitude is nominal.
(CAPCOM) Looking good, Orpheus.
(NINA) They'll be hitting the atmosphere
in one minute.
(JOHN) Max G due in 10 seconds.
(NINA) Loss of signal in 5.
25,000 kilometres per hour.
Heat shield 1,800 centigrade.
Switching to Venus com sat 4.
(TOM) Orpheus Pegasus.
Orpheus Pegasus, over.
Orpheus Pegasus.
Orpheus Pegasus, over.
- FiD0, when are you expecting tracking?
- Two minutes ago, Flight.
Orpheus Pegasus.
Orpheus Pegasus.
- Is the high gain antenna on?
- (CRACKLY TRANSMISSION FROM ORPHEUS)
(CHEERING)
(BABBLE OF VOICES)
Successful flight chute deployed.
Post-guidance systems are good.
Wind speeds are up, Orpheus.
You are drifting west.
Thin margin. Compensating east.
Been told there's flashes.
- Yeah, roger that. We saw that one from here.
- Higher sulphur than expected.
Something could've erupted.

Hey, I can see the surface.
I can see it's beneath us -
exactly like the radar images.
Three metres minus half.
Forward one, down half.
- How's the cabin pressure?
- Pressure's good.
(ZO) Abort override off.
(TOM) Looks good. You got a stay for Venus.
(ZO) Orpheus has arrived in HadesI
(CHEERING)
(THUNDER)
(THUNDER)
(TOM) We have visual on Venera 14.
(NINA) Radar's giving 236 metres.
(JOHN) Looks further. Unbelievable distortion.
(CRACKLING THUNDER)
(ZO) Lost the camera.
- It's imploded under the pressure.
- Did we get his first step? Any words?
(YVAN) Looking at the surface camera on one.
(YVAN) Are you getting this, Orpheus?
It's like a dull day in Moscow down here.
Strange flat light everywhere. Orange.
(ZO) Beautiful. Don't stop.
(YVAN) I can't tell where the sun is.
There are no shadows.
- (THUNDER)
- (CAPCOM) Pegasus Control.
We are enjoying the show, but be advised,
you're four minutes behind the timeline.
- (NINA) Seismic sensors are recording activity.
- It's just Yvan's footsteps.
His heart rate is higher than the simulations.
He will have to take it more slowly.
There may not be time for all the experiments.
(YVAN) OK... (GASPS FOR BREATH)
Seismic sensor network is set.
- (THUNDER)
- This is a grim place.
It's difficult to judge distance.
And the atmosphere is so dense,
it's like walking through water.
(EXPLOSION)

(TOM) Orpheus Pegasus, tell him to forget the camera. He's gotta move on.

Orpheus, do you copy?

Got a warning light. We're trying to get a visual on that. Got a computer shutdown.

Yvan, you're behind. Suggest you move on.

(ZO) I've got one or two issues in here, too. Let's not overstay our welcome.

(YVAN GASPS) Yes, some welcome.

OK...let's see if Venera's done any better.

(TOM) Orpheus, it's time to pace himself.

That's a 450-metre round trip.

Must be at least 50 metres.

It's difficult to see through this heat haze...

but it looks like she's still in one piece.

Just past the 28-minute mark. Suit temperature is higher than planned. Heart rate is still up. Some surface corrosion. I can see a little dust.

(THUNDER)

- (YVAN PANTS) It's a little bit pitted.

- Do we have any commonality...

(YVAN) The Russian robot, she's beaten Venus.

(GASPS FOR BREATH)

Robots may be tougher than us...

but we don't make the same mistakes.

(ZO) Recommend we drop

the second weather experiment.

John's in agreement, so roger that.

(ZO) Call that a wrap on Venera, Yvan.

Just rapid return to Orpheus.

All right.

(YVAN BREATHES HEAVILY)

It's uphill back to Orpheus and his heart rate's already too high. He needs a breather.

- The gravity's killing him. He needs a break.

- Forget it, John, he's gotta keep moving.

- I've got an update on your ascent pattern.

- He's suffering from overheating.

- He's four minutes over-budget.

- Let's work out exactly what it is she's venting.

- Ascent pattern coming up.

- (YVAN GASPS)

My air has almost run out.

- Cabin temperature 22 degrees, up 4.

- (TOM) Zo, prepare for launch.
- (WOMAN) Heart rate 186.
- Downloading a diagnostic routine.
Suit temperature 32 degrees.
- (ZO) Yvan, we've got to go. Just lost...
- (BEEPING)
(ZO) No, it's back.
- Cabin pressure holding.
- (NINA) What is the weather doing?
- Nina?
- We've just lost camera 3.
(ZO) He's inside.
(NINA) Super coolers are off.
(JOHN) Temperature falling. 150 degrees...
- ...70 degrees...20 degrees...
- (YVAN) Can we turn the air-con off?
(ZO) Contact for pressure.
Abort stage set and move onto ascent.
- Ready for launch.
- (KLAXON BLARES)
(KLAXON BLARES)
- Lift-off.
- (YVAN SPEAKS RUSSIAN)
One minute till max cue.
(ZO) We're gonna pitch and yaw now.
(ZO) OK, she's all yours.
(TOM) Five metres and closing.
Two metres.
- (YVAN) Still in one piece?
- Pegasus is doing fine, Yvan. Welcome home.
(NARRATOR) Having survived
the hellhole that is Venus,
the crew of Pegasus has experienced
at first hand
a grim warning for our own planet.
(JOHN) You can really see that haze layer.
(TOM) Hard to believe
it could ever have been like Earth.
When people ignore greenhouse gases here,
they should look at Venus.
The carbon dioxide there - from volcanoes, not
pollution - created a runaway greenhouse effect
that sent temperatures soaring
over 400 centigrade.

Mars window is open, reactor temperature nominal, cryogenics of 36 psi.

Pre-combustion chamber at pressure.

All systems are go.

Capcom, give the go-ahead for the burn.

(TOM) Event timer countdown

to trans-Mars injection.

Five, four, three, two, one.

We have ignition.

(NARRATOR) Throughout human history, one planet has gripped our imagination more than any other.

The one place in our solar system most likely to support life.

Mars.

Hi. Pegasus commander Tom Kirby here.

Halfway to Mars

and time for our regular Q and A.

This week's topic

is our interplanetary home Pegasus.

We've got the email address on the screen, so keep those questions coming.

OK, first question is. How big is Pegasus?

Well...you could fit in twelve football fields end to end, so pretty big.

Why do you have a Frisbee stuck on the end of your spaceship?

We call that the disk

and that's our main shield against the sun and the planetary atmospheres we sometimes have to fly through to slow ourselves down.

It's also where our nuclear engines are so, all in all, a very important Frisbee.

Some questions about the instrument panels here in the cockpit. Why don't we take a look?

Looks impressive, huh?

Well, I'll let you in on a little secret.

(WHISPERS) Most of these are duplicates in case of short-outs, but don't tell anybody because we think it makes us look cool

(LAUGHTER)

- Let's go downstairs and see some sights.

- (MUSIC)

Kill that music, John!

OK, here we are in the crew area.

What about those Venus samples, Nina?

Any little green men yet?

No, not yet, but I have found

some interesting chemicals

that might have been left by living organisms.

I'll keep you posted, OK?

John, we got a lot of questions

about the water. Is everything recycled?

Yes, viewers, I've been drinking his urine

for the last six months!

- Mmm!

- (MUSIC) # All the crazies

Try to space me and I don't know...

(TOM) Zero G is a lot of fun,

but too much of it's very bad for your health.

These rotating modules

provide us with some gravity

to help keep us in shape.

This is 0.5G, to be precise,

which is half Earth gravity,

and here we have Zo Lessard making up

for the time she spends in zero G

by exercising three hours a day.

- Let's take a look in Zo's sleeping module.

- No, Tom!

Oh, my Lord, someone's broken in!

It's not just a mission to the planets.

We're exploring the human body.

No one knows how it'll respond to six years

in space - physically, psychologically.

It's new territory.

(TOM) Six years is a long time if you consider

time more important than what you do with it.

(NINA) I have spent more time with these guys

than anyone. We're more a family than a crew.

I don't see it as giving up anything. I just

won the lottery. It's you lot I feel sorry for.

(NARRATOR) More probes have been sent here

than any other planet, but Mars has a jinx.

Over half of them failed.

Pegasus Control, you can tell Nina

she has a go for EVA.

(FLIGHT) She should be out on the arm by now.

What was her heart rate when she left Pegasus?

(NARRATOR) Before sending a lander to Mars, Pegasus needs to refuel.

(NINA) I have a visual on the fuel port.

You can slow the arm now.

(TOM) You got it.

(TOM) 10 metres.

(NARRATOR) Carrying enough fuel for the whole tour would be impossible, so giant tanks of hydrogen have been placed at strategic locations along the route.

(TOM) One or two notches left should do it.

(NINA) OK, right...straight forward... one metre and closing.

It may look effortless, but it takes a lot out of you, doing an EVA.

We have to keep a close eye on it.

It's not exciting, it's hard work.

I keep looking down and expecting to see Earth.

It's a fantastic-looking planet.

John, I can see our landing site crystal clear.

(TOM) I don't see any X function at all.

(NINA) Coming up on three metres.

- It's doing fine.

- (YVAN) Looking good, Aries.

(NARRATOR) Three astronauts will pilot the lander Aries in a descent with its own particular dangers. Instead of a hundred times the atmosphere of Earth, on Mars it's 100th, which presents its own unique set of problems when you wanna try and land.

There's not a whole lot to slow you down.

(DISTORTED, GARBLED VOICES)

(TOM) How ya doin' back there?

Everyone still with us?

(JOHN) 10 metres...down at two.

(TOM) Lost visual on the ground.

There's a lot of dust.

(TOM) All right, I got it.

Stand by for touchdown.

Three metres, down at one.

One metre.

- Contact.

- (CHEERING)

(TOM) Pressure on. Check yours.

- (JOHN) Pressure integrity check.

- 500 pep gauge to 4.0 on the forward dumbbell.

And she's opened and latched.

The hatch is open...and Kirby is on the porch.

(TOM) We stand at the edge of a new frontier
and we vow that we shall not see it governed
by a hostile flag of conquest...

..but by a banner of freedom and peace.

My footprints are crisp

and the dust clings to my boots.

Wind's picking up.

Dust is increasing at your 10 o'clock position.

(TOM) The sky's a kind of butterscotch colour.

(NINA) There's dust devil activity.

- Which way is it heading?

- I don't know.

- (TOM) Guess I'll stay here, then.

- Pegasus, we've got a problem.

(NINA) Scrub the EVA.

(ZO) Get Tom inside.

(TOM) Seal the hatch, John.

Will you look at that!

(HOWLING WIND)

(INAUDIBLE TRANSMISSION FROM NINA)

(NINA) Are you OK?

(TOM) Say again, Aries.

You sound a little breathless in there.

- (NINA) Are you OK?

- Think so.

(ZO) Control want Tom inside now.

I don't care how you break it to him.

- That's what I call a Martian welcome!

- Want to run through a few suit checks?

(TOM) I think that's a good idea. Why not?

(JOHN) It's not as tough as it looks.

Martian dust is easily sucked up

into a dust devil.

Luckily, the Martian atmosphere

is a pale imitation of ours.

Pressures rarely climb above 100th of Earth's.

Although it may look like a whirlwind,
it's a breeze.

(TOM) I could get used to this.

(NINA) Eight weeks will be over before we know it.

(NARRATOR) The astronauts set up camp
close to Valles Marineris,
a vast canyon which could unlock
the mystery to life on Mars.

(MAN) Geologists are going crazy
over those sulphate salts.

Valles Marineris is basically a vast tear
in the Martian crust. It's over 4,000km long.
It runs so far round the planet that one end
is in daylight while the other is in dark.

(Z0) There's a big temperature difference
between the day and the night,
so strong winds surge up through the canyon
from the west, which brings up a lot of dust.
That could be a problem. Nobody wants
to work in zero visibility next to a 7km drop.

(NARRATOR) This is where they hope
to achieve their mission objective.
Not just evidence of life, but maybe life itself.

(NINA) There's evidence water once flowed
on Mars. Most of it's long gone.
But in the lowest parts, it might still be there
a metre below the surface.

On Earth, everywhere we find liquid water,
we find life.

This is MEP-14. It's our drilling robot.
It gets to the floor of Marineris by balloon.
A HydroSensor at this end sniffs out the water,
then a drilling probe this end
goes in for the sample.

Then another balloon brings it back up
on the surface with evidence of life on Mars.

(JOHN) Two feet. This is definitely better.
It's more controllable.

I'm gonna patent this. The Mars bunny hop!

(NINA) John, give it a rest!

I'm trying to do a presentation here.
Big day today. We're conducting a robot descent
the seven vertical kilometres down to the floor
of Valles Marineris to search for liquid water.

Charlie here has volunteered.
Ah, here's our ride.
Someone order a cab?
(NINA) Shall we dust off first?
(JOHN) Yes, let's not mess up this vehicle.
- No names, Kirby!
- We're on a dusty planet, guys!
(NARRATOR) Dust devils are harmless,
but global storms have wrecked
previous robotic missions.
Pegasus will be keeping a close eye
on the surface.
- You're very quiet back there.
- (NINA) Oh, John!
(POP MUSIC PLAYS)
- (NINA) Take it easy, John.
- (POP MUSIC CONTINUES)
(JOHN) I think I see the edge.
(TOM) Famous last words!
- Let's park up here. We can walk the rest.
- Keep the handbrakes on.
(TOM) Yeah, yeah, yeah.
- God!
- (JOHN) Yep.
(NINA) Look at those layers.
Millions of years of Martian history.
(JOHN) Makes the Grand Canyon
look like a scratch.
(TOM) How do you read, Pegasus?
(YVAN) Loud and clear. Pictures are great.
Zo's going a nice shade of green up here.
Tell her, if it's any consolation,
we're gonna name these cliffs after her.
She says that makes all the difference!
- Tell 'em to get back to work!
- Did you read that?
4,000 kilometres long, seven kilometres deep.
It's a geological heaven and I'm not going!
But, still, I don't think there'll be any clouds.
I'll have a ringside seat.
(TOM) Ready for descent.
(ZO) Copy that, Tom...
(NARRATOR) 150 million miles away,
Mission Control monitors

another serious health hazard - the sun.
We have a solar weather warning. Hazard class.
We should get them under cover.
Capcom, tell them there's a solar flare
heading their way...
(NARRATOR) Solar flares
send storms of charged particles
blasting across the solar system.
Unlike Earth, Mars has no magnetic field
to deflect the lethal radiation.
It'll take 10 minutes for the warning
to reach the astronauts
and another 90 minutes
before they can reach shelter.
(TOM) Beautiful day, isn't it?
(JOHN) Roger that.
(CAPCOM) You have a solar flare heading your
way. ETA four minutes behind this message.
- (ALARM BLEEPS)
- Affect immediate evacuation of the cockpit.
Tell Tom to abort the EVA. Get back to Aries.
Surgeon wants dosimeter readings
before the solar storm reaches you.
- That's two minutes behind this message.
- (ALARM BLEEPS)
(NINA) Can't this heap go any faster?
(JOHN) 25 hours. Radiation levels are falling.
- Won't be much longer.
- (GEIGER COUNTER CRACKLES)
(JOHN) Looks just the same out there.
You wouldn't think it was lethal.
(GEIGER COUNTER CRACKLES)
Nothing.
- I've never felt more awake in my life.
- (GEIGER COUNTER CRACKLES)
(NINA) Good luck, Charlie.
(NARRATOR) Once the solar storm passes,
the astronauts pick up where they left off
at the cliffs of Valles Marineris.
(NINA) Wind speed 9.5 metres per second.
080 degrees.
(NARRATOR) It will take six hours for their robot
Charlie to reach the floor of the canyon.
(NINA) Altitude 6520, down at 12.

(JOHN) Looks like
he's drifting up the alluvial fans.
(NINA) Confirm lateral drift.
(TOM) OK, John enough pictures already.
Let's get some rocks.
I wish I could see Mars without a visor
in front of my face. I wish I could...just taste it.
From what I understand, John, what
you'd taste is your saliva boiling on your tongue.
OK, I've got another...
(NINA) We're getting some false positives here.
Our second bore hole is dry. Moving on.
..fine-grained, fairly solid...
(NINA) Drilling bore hole number three.
(JOHN) Probably dust. Perfect kidney-shaped
crystals. I wish I could get the dust off it.
(TOM) Distinct metallic lustre,
millimetre-sized crystals...
(ZO) Aries Pegasus.
(TOM) Reading you. Go ahead.
(ZO) Storm brewing in the western end
of Marineris heading east.
- How big?
- Most of it's still on the night side.
I think it's a canyon storm, not a global event,
but it's got potential to reach you.
OK, roger that.
- (BLEEPING)
- (NINA) Charlie's drinking!
(BLEEPING)
(JOHN) Water on the third bore hole.
- (ZO) What's your status?
- We did it!
We're just wrapping things up.
- How long till we get it back?
- Four hours. Anchors released.
(JOHN) Do we wait?
(NINA) We might not get another chance.
(TOM) That is a big storm.
Look, the wind's blowing Charlie off course.
(JOHN) This planet is jinxed.
(NINA) What are we standing here for?
(ZO) You shouldn't be travelling
when this hits you.

This isn't a dust devil, it's a storm.
It'll wreck your guidance systems.
Copy that. We have a visual on Charlie.
(ZO) It's well over 10 metres per second
advancing east.
- We're collecting the water sample from Charlie.
- Gotcha!
(ZO) It's obscuring our view.
Expect some com interference.
Aries Pegasus, what's your position?
(TOM) Just parked up.
You should've let me drive!
(NINA) Can't see a thing. Where's the ladder?
(ZO) Hope you enjoyed the ride.
The forecast says you are grounded.
(YVAN) This is your local weather forecast for
the next two days, and it's dust and more dust.
Count yourselves lucky it wasn't a global storm.
You'd be stuck inside until spring.
(TOM) What a mess.
(LLOYD) People say
why not do the whole mission with robots?
Without people to wipe their solar panels,
those robots would be dead.
They're great for certain tasks,
but you can't program initiative.
They don't respond to that glint
on the horizon or subtle change in rock colour.
You can't beat eyes, a hand and a hammer.
(JOHN) OK, this is cricket now.
(TOM) Season one in the Martian league.
Hang on, hang on!
- Oh, come on!
- OK, bring it on!
I call this my Martian curve ball.
(GRUNTS) Pretty good!
- What do you call that, huh? Home run!
- Wow!
(YVAN) No need for any gyro conversation.
You're cleared for take-off.
(NARRATOR) Of all the planets, Mars is
the most likely to support a human colony,
but without a magnetic field, they'll have to find
another way of protecting against solar flares.

(ZO) Radar gives 90 metres.

(TOM) Stand by for pitch and yaw.

Over to you, Zo,

(ZO) One metre and closing.

Soft dock and...hard dock.

(NARRATOR) Mankind's first tour
of the inner solar system is complete.

Now the crew of Pegasus prepare to journey on
towards Jupiter and the outer solar system.

The fastest route is to fly by the sun
and use its enormous gravity
to accelerate them to 300 kilometres per second.
We're not doing this fly-by just to pick up speed.
It's a unique opportunity.

We'll be analysing a star closer than ever before.
It's one of the last unexplored regions
of the solar system.

From Earth, we can only see the surface,
the photosphere.

Pegasus will pass through
the outer atmosphere, the corona.

- We'll get our first samples from a star.

- (JOHN) Readings follow. Tom has 230...

(NARRATOR) During the solar fly-by, Pegasus
needs extra protection, her own magnetic field,
to repel the sun's lethal high-energy particles,
but nothing can protect the crew
if they encounter the awesome power
of a solar flare this close to the sun.

What about these flares?

Even at solar minimum, we're bound to get some.
The magnetic shield won't help us against that.

- How about if the field generator fails?

- If that fails, it's a loss of crew.

We've looked into every aspect
of energy management on this...

(NARRATOR) It's not just during the fly-by
they have to worry about solar radiation.
It's a constant risk once they leave
the protection of Earth's magnetic field.

(JOHN) Over the course of the mission, we get
the equivalent of eight chest x-rays a day.
These dosimeters will change colour
if our own personal levels get too high.

These bubble tubes let us know how much radiation is passing through the cabin here. A bubble forms each time a charged particle hits the gel. Some radiation will get through. We minimise the effects with special dietary supplements. (CAPCOM) We have the descent path through from Santa Claus at the North Pole and he's... Hi, Claire. I've been taking another look at our cumulative doses. Looks like some of the radiation got through the shield and into the flight deck. I've increased my supplements and taken blood samples for analysis. I'd love to hear your view. (MAN) Merry Christmas, Pegasus. I hope Santa gives you everything you ask for. Control out. (NARRATOR) Pegasus will pass the sun's closest planet, but there will be no landing on Mercury. It's not lack of interest. There's a big metallic core and a mysterious magnetic field. Its surface temperature goes from around 420 degrees centigrade to minus 170 at night. So even that close to the sun, there could be ice at the poles, but if we landed there we'd lose so much speed, it'd put another year on the mission, so next time. Generating a magnetic field powerful enough to shield them against the sun, even at a distance of five millions miles, means diverting power from all non-essential systems. Centrifuge is offline. 0.5G. 0.3G. Zero G.

- What was the final word on the air-con?
- Sorry, we gotta power it down.

(TOM) OK, let's batten down the hatches.
(YVAN) Swing round to the negative X axis.
(NARRATOR) As Pegasus nears the point of closest approach, she rotates 180 degrees and uses her disk as extra protection.
(TOM) Coming up on 40 degrees.
(YVAN) Shadow in 10 seconds.
(NARRATOR) Of all the bodies

Pegasus will encounter,
none are more important than the sun.
All life depends on it.
(TOM) We have totality.
Magnetic field is going up.
- Aurora Pegasalis.
- (JOHN) Our very own northern lights.
(FLIGHT) OK, this was the last call to abort
the fly-by. Let's have your assessments.
We have the final report in -
flare activity's expected to remain low
with less than 1% chance of proton events
at the closest approach.
Flight, all systems are nominal.
Shield temperature is 2,300 degrees.
(SIZZLING)
God said, ''Let there be light.''
Good luck, guys.
It's been a pleasure working with you.
(CONTINUOUS STATIC)
(LLOYD) They're in the outer atmosphere
of the sun.
I'm not hearing them any more, Flight.
Surgeon?
Still getting a strong bio-sensory read-out.
(BLEEPING)
Flight, space assets and ground stations
are reporting flare activity.
- Which quadrant?
- Checking.
Do they have a class yet?
Predicting...S1 class.
Quadrant?
That's...
..west. Confirmed.
Might disrupt our com a little, that's all.
(MAN) Due to re-acquire signal in three hours.
(CONTINUOUS STATIC)
(STATIC WITH TOM'S VOICE)
(LOUD STATIC
WITH TOM'S VOICE UNDERNEATH)
Trajectory confirmed. Flight, we need
mid-course corrections for Jupiter.
But it's acceptable.

(STATIC CONTINUES)

(TOM) Our dosimeters are mostly in the green.
John Pearson's edged into the amber.
Cameras had a tough time
and seven computers shut down.
Even with the hatches down, it felt a little
too close for comfort in here...but what a sight!
We saw rivers of plasma
beneath the photosphere.
We got an outstanding view
of the magnetic loop fields. It was incredible.
We also detected some sun quakes,
I guess triggered by that flare to the west.
We're glad to have missed
that little piece of weather!

(YVAN) Magnetic field generator offline.
Centrifuges online. 0.2.
0.5...full G.

The sun has accelerated Pegasus towards
Jupiter, the biggest planet in the solar system,
seven months and 470 million miles away.

(ALL) # Happy birthday to you
Happy birthday to you
Happy birthday, dear John
Happy birthday to you

(CHEERING)

I thought it was just a shaving rash,
but it's been around for, what, two weeks.
Eczema.

Before reaching Jupiter, Pegasus has
to run the gauntlet of the Asteroid Belt -
over a million rocks,
some the size of small moons.
Most are uncharted
and any one of them could end the mission.

(KLAXON BLARES)

55 minutes.

- Do we need a correction?
- Yvan's running the numbers.
- What did Control say?
- We'll know in 38 minutes.
- How big is it?
- 224 billion tons.

It's gonna pass within one kilometre.

- Sounds like a course correction.
- Let's see what Control say.
Closest approach is 10km.
That's a completely reliable figure.
- Why the discrepancy?
- The alarm initiated after two locks on the target.
Not enough for a reliable projection. We based
ours on more data than they've got up there.
They get a fantastic fly-by
and we can steal some more science.
Consider the psychological effects
of throwing a close fly-by at them.
- They've done this a thousand times in sims!
- We need to get back to them, Flight.
Tell them to maintain course.
Pegasus Control, we've got a 'no trajectory
change' on that alarm. Repeat 'no change'.
We've got a 'no trajectory change'
on that alarm. Repeat 'no...'
(RHYTHMIC BLEEPING)
(NINA) Got it.
(JOHN) It's a binary.
(Z0) How close is it gonna pass?
(YVAN) Main body, 4km long...
- How close? Yvan?
- One kilometre.
- (YVAN SPEAKS RUSSIAN)
- Who says 10km, then?
- They've got more data.
- They're not staring at it in the face!
- Have we got time to run another simulation?
- (TOM) No!
- Aren't we gonna discuss this?
- We just did.
(BLEEPING INTENSIFIES)
(RAPID BLEEPS)
(RAPID BLEEPS)
- (BLEEPING INTENSIFIES)
- Here they come.
(YVAN) Better go out and check the paintwork!
(JOHN) Are we insured?
(Z0) Let's switch the com off for half an hour.
Let THEM sweat!
- (WOMAN) 15 kilometres...5 kilometres!

- (HUSHED GASPS)

I'll be damned. 920 metres.

- Would that be a completely reliable figure (?)

- (SHOCKED MURMURS)

Thank you for the fly-by. We got a good view.

- Incroyable!

- It was a C type binary.

We've named the twins Hubris and Catastrophe.

Let's hope they never head YOUR way.

(NINA) Airlock door is open.

(NARRATOR) This far from the sun,

the solar panels on Pegasus

become useless and need to be jettisoned.

One has jammed

and the crew will have to release it manually.

- (TOM) I've got a visual on you, Nina.

- It's so nice to stretch my legs!

- I was starting to feel like a sardine.

- We need to check for meteorite damage.

(YVAN) Hey, it's dark out here.

- Bloody tools!

- (NINA) Let me help. It's probably the battery.

Stand by.

(YVAN) I've got some meteorite impact

from our transit through the Asteroid Belt.

- (NINA) This is the last retention pin.

- Release.

(NINA) I feel like

we're pulling the wings off a butterfly.

(YVAN) Dead weight. They've done their job.

(ZO) We are 22 million miles from Jupiter.

She's visible with the naked eye.

You can see cloud bands,

but her magnetic field is way bigger.

Yvan, how big is Jupiter's magnetic field?

It's the largest object in the solar system. Bigger

than the sun. Stretches all the way to Saturn.

Why is it so dangerous?

Any charged particles that get trapped

in a magnetic field like that

get accelerated to lethal speeds.

Someone wants to know,

is it true you can hear Jupiter?

Yeah, it gives out radio waves.

(RHYTHMIC WHOOSHING)

Jupiter FM.

Music while you cook.

(WHOOSHING)

(VOLUME INCREASES)

(JOHN PANTING)

(BREATHLESS PANTING)

The radiation isn't as strong as the sun's,
but they'll be exposed a lot longer
so they'll need their magnetic shield again.

(INTERVIEWER) Could you expand on that?

How dangerous is it?

I'll feel a lot better

when they're on their way to Saturn.

(NARRATOR) Pegasus is approaching Jupiter
at 80km per second.

To begin the slowdown into orbit, she turns
her disk to Jupiter and fires her main engines.

To complete the brake, Pegasus
will crash into Jupiter's upper atmosphere,
using friction to slow down.

(TOM) We have ignition.

The G forces during this manoeuvre represent
the greatest physical stress for the astronauts
and formed the most critical part of their training.

(JOHN) G suits to inflate.

Slowing down to Jupiter orbit is
the most stress we'll get in the whole six years.
We've got a bet going for who passes out last.

(HIGH-PITCHED WHIRRING)

How you doing?

(JOHN) Tom's been disqualified.

He's taught himself this little trick.

He can faint with his eyes open.

It took us a while to work out how he took 15Gs.

Pegasus, you're due to enter Jovian atmosphere
in two minutes.

Looking at a maximum of 8G. Good luck, guys.

(TOM) 0.5G.

1G.

2G.

(YVAN) Going into free-flow position.

That's a continuing flow.

- (COUGHS)

- Still rising.

4G.

Pressure rising.

This isn't right!

(TOM) 7G.

8G.

- 9GI

- That's impossible!

We're losing the shields.