**SOLAR ORBITER - A MISSION TO THE SUN**

**A ROLL VT**

**Suggested webcopy:** The Solar Orbiter spacecraft is undergoing important pre-launch tests at the IABG National Space Centre in Germany. This joint ESA and NASA mission will study the Sun. But first the spacecraft must pass vibration, acoustic and shock tests before heading to Cape Canaveral for launch, in 2020. This will ensure the spacecraft can withstand the stresses of lift off and the extreme environments it will encounter while in orbit around the Sun – from the coldness of space 150 million km away – to temperatures up to 500ºC reached when it will be a mere 46 million km away, closer than Mercury. An international collaboration, the spacecraft was built and is being tested by Airbus. This film contains interviews with César García, ESA Solar Orbiter Project Manager, and Ian Walters, Solar Orbiter Project Manager at Airbus Defence and Space.

TAPE STARTS: 10:00:00

VT STARTS: 10:00:10

10:00:10

[EXTERIOR AND INTERRIOR SHOTS IABG, GERMANY]

At the IABG national space Centre near Munich in Germany, the Solar Orbiter spacecraft undergoes crucial tests for its mission to observe our nearest star.

10:00:26

[SOLAR SYSTEM ANIMATION, CREDIT: ESA]

The Sun is an essential part of our Solar System, providing the Earth with heat, light and life.

10:00:34

[SOLAR ORBITER, CÉSAR GARCÍA AND IAN WALTERS SET UP SHOTS, IABG CLEAN ROOM, MUNICH]

But before Solar Orbiter gets to study the Sun’s features, activity, solar wind, electric and magnetic fields, engineers must be certain it can withstand the stresses of launch.

10:00:46:08

[INSET CLIP: CÉSAR GARCÍA

SOLAR ORBITER PROJECT MANAGER, ESA]

*“What we do in these vibration tests, we put them on a table which is very well lubricated with oil and we use some, what we call voice coil actuators which is basically very powerful loudspeakers and we do a vibration movement of the spacecraft, longitudinally and then laterally and what we try to see is the resonant frequencies of the spacecraft. This spacecraft behaves like a bell and then once you hit on the bell then it has certain natural frequencies so what we’re now trying to measure is what are the natural frequencies of the spacecraft and then in some cases that when we are exciting the spacecraft at those natural frequencies that nothing breaks loose.”*

10:01:32

[SOLAR ORBITER GVS AND CLOSE UPS]

An international collaboration, the spacecraft was built and is being tested by Airbus. After the vibration tests, which can shake the craft up to 500 times per second, are the higher frequency acoustic tests. Then, in April, shock tests for when the spacecraft deploys its solar arrays, antennas or instrument boom. After the vibration tests, which can shake the craft up to 120 times per second, are the higher frequency acoustic tests. Then shock tests, for when the spacecraft deploys its solar arrays, antennas or instrument boom. The high gain antenna - used to receive telecommands and send data and images back to Earth - will use just one kilowatt of power, much less than a dishwasher. And the heat shields at the top of the spacecraft - which required specially made blankets - will protect the normal operating temperature of 30 degrees Celsius *inside* from much hotter conditions *outside*.

10:02:20:05

[INSERT CLIP: IAN WALTERS

SOLAR ORBITER PROJECT MANAGER, AIRBUS DEFENCE AND SPACE, UK]

*“We’re in an orbit which is about 160 days long. We go very close to the Sun about 42 million kms from the Sun. It doesn’t sound close but it’s actually much closer than we are from the Earth and at that distance we will see power from the Sun about 12-13 times hotter than what we see here on Earth. That means that temperatures get very hot, over 500 degrees Centigrade. But because we’re in long elliptical orbit, we’ll also go out really quite far away from the Sun. So we’ll actually get very cold as well so we will see this thermal cycling every 160 days, we’ll go hot and cold, hot and cold, and we’ll do about 20 of those orbits for the complete mission of Solar Orbiter.”*

10:02:59

[ANIMATION SOLAR ORBITER, CREDIT: ESA]

Solar Orbiter will also be up to 180 million kilometres away from the Sun. This allows it to make both in situ and remote measurements at different distances with some of its ten instruments.

10:03:14

[NITROGEN GAS TANKS AND PROTECTIVE COVER OVER SOLAR ORBITER]

To keep these instruments clean and to protect them from humidity, dry nitrogen gas is pumped through them 24 hours a day - a process that will happen all the way up to the Atlas V launch vehicle lift off. The joint ESA and NASA mission will launch from Cape Canaveral in early 2020. And these next few months are vital to ensure that Solar Orbiter is ready for the spotlight.

10:03:41:20

[ESA STING - ENDS]

**10:03:41:21**

**BR\_001**

**SOLAR ORBITER - A MISSION TO THE SUN**

# **A-Roll without logo and titles – audio split**

**10:07:23:18**

**BR\_002**

**CÉSAR GARCÍA**

**SOLAR ORBITER PROJECT MANAGER, ESA**

**[ENGLISH]**

“What we do in these vibration tests, we put them on a table which is very well lubricated with oil and we use some, what we call voice coil actuators which is basically very powerful loudspeakers and we do a vibration movement of the spacecraft, longitudinally and then laterally and what we try to see is the resonant frequencies of the spacecraft. The spacecraft behaves like a bell and then once you hit on the bell then it sounds at its natural frequencies so what we’re now trying to measure is what are the natural frequencies of the spacecraft and then in some cases that when we are exciting the spacecraft at those natural frequencies that nothing breaks loose.”

“We are getting at a distance of Venus to the Sun and that means that many things could get much warmer than they could actually be able to operate here on the ground. For that we have a heat shield which will be will be protecting most of the spacecraft from the solar radiation but that’s not the only challenge. Also the challenge is that we are also going far away from the Sun so things are getting colder. While we get very far away from the Sun, like twice the distance from the Sun to the Earth, and this is about 300 million kms, we have to be able to communicate with the spacecraft and receive the data from the spacecraft. Of course the scientists want to take fantastic photos of the Sun and that means many megabytes and still we have transmit those megabytes down to ground.”

“I think one of the key features about Solar Orbiter is the top side, what you can see on the top side of the spacecraft is the heat shield, and the heat shields insulate the main body of the spacecraft from the very substantial radiation. Solar Orbiter will see about twelve times more solar radiation than any other spacecraft orbiting the Earth. So on top of the spacecraft you can see the heat shields. The heat shield is two layers of many other smaller layers and it separates the close to five, five hundred and twenty celsius that will be on top of the heat shields from the normal operating temperatures of the spacecraft which is about 30 Celsius. Then one of other key features of Solar Orbiter is the Huygens antenna, that’s like a satellite dish which is on the side of spacecraft and this one is essential to send data to the earth and also to receive tele-commands form the Earth. Also from this view you can see the solar array. Solar Orbiter does not have a particularly large solar array because the power demand is only about 1 KW and 1KW is much less than a dishwasher at home. So our solar arrays are not particularly large. When they are deployed from side to side the spacecraft will be 70 metres.”

“We are going to get very close to the Sun. We are going also to be of the ecliptic plane so we are going to be able to observe higher latitudes and also the poles of the Sun. And we are going to take two types of measurements. We are going to take *in situ* measurements, we are going to actually take particles coming from the Sun, what we call the solar wind. We are going to be able to see on the spot, what is the magnetic fields and the electric fields and the directions and all kinds of charged particles. And on top of that we going to do remote observations of the Sun. We are going to look at Sun features, corona features and heliospheric features. And we will be able to correlate. At the same time we are going to measure what happens *in situ*, what happens around the spacecraft and what’s happening in the Sun or around the Sun and that’s what makes Solar Orbiter unique.”

**10:11:36:01**

**BR\_003**

**CÉSAR GARCÍA**

**SOLAR ORBITER PROJECT MANAGER, ESA**

**[SPANISH]**

An explanation of the Solar Orbiter mission.

The tests that are being done on the spacecraft before launch.

**10:14:02:09**

**BR\_004**

**IAN WALTERS**

**AIRBUS DEFENCE AND SPACE, UK**

**[ENGLISH]**

“We’re building a spacecraft which has a very low magnetic signature, that means it almost has no mag materials at all so we have to build it out of materials which are not magnetic. We have make sure, take special precautions so don’t accidentally magnetise so people working near spacecraft must make sure no that they have no magnetic fields, no mobile phones or nothing like that and at end we will test that just to make sure that it really has no magnetic signature.”

“We’re in an orbit which is about 160 days long. We go very close to the Sun, about 42 million kms from the Sun. It doesn’t sound close but it’s actually much closer than we are from the Earth and at that distance we will see power from the Sun about 12-13 times hotter than what we see here on Earth. That means the temperatures get very hot, over 500 degrees Centigrade but because we’re in long elliptical orbit, we’ll also go out really quite far away from the Sun so we’ll actually get very cold as well so we will see this thermal cycling every 160 days we’ll go hot and cold, hot and cold, and we’ll do about 20 of those orbits for the complete mission of Solar Orbiter.”

**“**Of course one of other special things we have to do for this mission is to keep the instruments clean at all times and one of ways that we do that is to put a dry nitrogen gas through the instruments and that has take place 24 hours day, 365 days a year. We find that we’re not allowed to stop purging for more than 30 minutes so we also need very special equipment that can monitor if there have been any interruptions of the purge gas and that’s all got telemetry or information backed via mobile phone back to our operators so if they know there’s been an interruption they can rush in and fix the problem. So it’s really quite an interesting challenging design just to keep the nitrogen gas flowing to the instruments at all times, even all the way up to the launch vehicle.”

**10:16:06:06**

**BR\_005**

**Solar Orbiter clean room GVs**

**IABG national space centre**

**Ottobrunn, near Munich, Germany**

Wide shot and tracking shot of the Solar Orbiter spacecraft in the IABG clean room, plus a protective cover being lowered onto the spacecraft.

**10:21:50:03**

**BR\_006**

**Solar Orbiter close ups**

**IABG national space centre**

**Ottobrunn, near Munich, Germany**

Close ups of spacecraft thrusters, solar array, heat shield, silver thing (?) instrument, instrument boom and protective covering, nitrogen gas tanks

**10:27:04:06**

**BR\_007**

**CÉSAR GARCÍA and IAN WALTERS set up shots**

**IABG national space centre**

**Ottobrunn, near Munich, Germany**

Set up shots of César García and Ian Walters by the Solar Orbiter spacecraft.

**10:31:41:20**

[ESA STING - ENDS]