

Prime Minister's speech in Poland on the Russian invasion of Ukraine: 1 March 2022

I'm back here in Poland again. It's always good to be here but I'm afraid I'm here in the background of an unfolding European tragedy, when Poland is in the frontline.

Two weeks ago, when I met Mateusz and the Polish government, we agreed that our countries would stand shoulder to shoulder in what we predicted jointly would be a coming crisis.

And as indeed we have stood shoulder to shoulder so many times in the last hundred years, that crisis is now upon us.

It is now 126 hours since Vladimir Putin decided to launch a war of aggression on our continent, tearing up every principle of civilised behaviour between states.

He has hurled his war machine on the people of Ukraine, a fellow Slavic country; he has bombarded civilian targets and fired rockets at blocks of flats.

He is responsible for hundreds of civilian casualties, including growing numbers of children and for also of course the deaths of many Russian and Ukrainian soldiers.

We must accept the grim reality that Putin will continue to tighten the vice and if you go by sheer size and firepower of Vladimir Putin's war machine. The odds have always been heavily against Ukraine's armed forces.

But one thing is already clear and one prediction – that both Mateusz and I made – is being proved right.

This invasion of a free and sovereign country is not only a tragedy, but it is a colossal mistake. Putin has lied to his people and to his troops about how this conflict would go, and he has now been caught out in that lie.

They have not been welcomed to Ukraine, as he prophesied. Their tanks have not been cheered in the streets or garlanded with flowers.

Instead, Ukrainians have mounted an astonishing and tenacious resistance, which has snarled up Putin's advance on Kyiv and Kharkiv and delayed his whole invasion plan.

Putin has totally miscalculated the nature of this conflict and the nature of the people of Ukraine.

With every hour, the passionate desire of the people of Ukraine to defend

their country has become more apparent and millions of people around the world have been stirred and moved by their courage.

The reality is that whatever happens in the coming days or weeks, the Ukrainian people have shown already that their spirit will not be broken, and they will not be subdued.

I have spoken almost every day to President Volodymyr Zelenskyy and when I think of the dangers and pressures he must be facing, the physical dangers he must be facing,

I marvel at his coolness under fire, his bravery and his invincible good humour. I think he is mobilising the world against the horror of what is happening.

And as I said in Munich 10 days ago, Russia will not be able to subjugate the second largest country in Europe, encompassing nearly a quarter of a million square miles.

Putin's war machine will not succeed in holding down Ukraine. Even to hold down a part of that giant country, with the constant threat of reprisals and guerrilla attacks, would be militarily exhausting and economically ruinous for the Russian occupiers.

And so, it is already clear from the facts that we have right now, that Putin will ultimately fail in Ukraine and Putin must fail in Ukraine.

And so, the best thing both for Russia and Ukraine, and for the world is for this misbegotten venture to be halted and reversed as fast as possible.

And with every day and every hour that goes by that amazing Ukrainian resistance is helping to solidify and unite the rest of the world and if anything, western unity, and determination is growing stronger.

Dozens of nations have rejected the easy option of sitting on the side lines, or adopting a policy of calculated indifference, and instead, they have chosen instead to take a stand, consciously risking retaliation from the Kremlin.

They understand the stakes:

They know that if Putin succeeds in trampling Ukraine, his imperial ambitions would not end at that country's borders.

They know that the outcome would be a world where aggression has triumphed, where might is right and extreme violence pays off and no nation would be safe.

And they know that Putin's aim is to overthrow the post-Cold War order and destroy the vision of a Europe whole and free.

The draft treaty he published in December would once again impose a Russian veto on the foreign and defence policies of a dozen or more nations at the

heart of our continent, including Poland, and that is something the UK and our allies could never accept.

And it is because of the implications of what is happening in Ukraine as well as the sheer horror that the UK has worked side-by-side with the European Union and the United States to devise the biggest package of sanctions ever imposed on Russia and one of the biggest packages of sanctions of all time.

And I'm grateful for the determination of President Biden and President Ursula von der Leyen. Our efforts have intensified to the point where the rouble virtually collapsed yesterday, even though Russia's central bank doubled its interest rates.

Now we will do more with our friends to exclude Russian banks from the SWIFT system, freeze their assets and restrict trade, and we will go further in our efforts to sanction those who are close to the Putin regime.

We are now taking further steps to whip aside the veil of anonymity and freeze their assets.

But I must emphasise that we are not motivated by any hostility towards the Russia or Russians: quite the reverse.

All our hearts ache for the Russian soldiers sent to die in this futile venture: we all grieve with their parents.

Only a few weeks ago, four weeks ago, I visited St Sophia's cathedral in Kyiv, which has survived every invader since Yaroslav the Wise built its granite walls nearly a thousand years ago, it's modelled on Hagia Sophia in Constantinople which was then the capital of Christendom.

How tragic, how incredible, how inexplicable, that the cradle of Slavic civilisation and Eastern Orthodoxy, should now be within range of Russian guns.

As I speak, a column of tanks and armoured vehicles 25 miles long is grinding south towards the golden domes of this ancient European capital – a city of nearly 3 million innocent people who have done nothing to deserve the carnage that Putin is unleashing on their country.

No wonder the Kremlin-controlled media refuses to tell the Russian people that their soldiers are attacking Kyiv.

No wonder that they spin a tissue of lies and claim that Russia is merely conducting a "special operation in the Donbas".

Russia is a great country and civilisation, and we will never forget her sacrifice in the struggle against fascism, side by side with ourselves.

We must emphasise every day that it is Putin's regime which is exacting from its own people an unacceptable cost for an unnecessary war – a war of choice – that should end as soon as possible.

And to ensure that Putin's venture in Ukraine fails we must get over that key point, that this is not Russia's war, not the Russian people's war, this is Putin's war and that has been increasingly obvious from everything he has said and written in the last year.

The UK, our government, first considered sending weapons to our Ukrainian friends because we read Putin's semi-mystical essay on the future of Ukraine, amounting to a manifesto for imperial expansion.

That's why in January we sent 2,000 anti-tank missiles, and now more than 25 nations are prepared to send defensive lethal aid, in support of the principle of a country's right to protect itself.

I thank Chancellor Scholz of Germany for his speech which I believe was of world historical significance. We should recognise the gravity of Germany's latest decisions, which have arisen from Putin's aggression.

When I spoke to President Biden and fellow leaders last night, we focused on the humanitarian emergency that is now beginning.

Putin's invasion has already forced hundreds of thousands of people to flee their homes and we must prepare for an even larger outflow, perhaps numbered in the millions.

Poland has already welcomed many thousands of refugees with compassion and practical help, and the UK will provide up to £220 million of emergency and humanitarian aid for Ukraine and I have placed 1,000 troops on stand-by to help the humanitarian response in neighbouring countries, including in Poland.

Many people in Britain will of course want to help Ukrainian refugees. So, we will make it easier for Ukrainians already living in the UK to bring their relatives to our country, and though the numbers are hard to calculate they could be more than 200,000.

And if the worst happens, and President Zelenskyy's government is no longer able to function in Kyiv, we must prepare to support them whatever happens in the weeks ahead.

And we should recognise that this crisis will impose costs on ourselves and our electorates, that sanctions have consequences for us as well as for Russia, and no step is free of risk.

And whatever the difficulties ahead, and they may be considerable, this is now the moment for Europe to do something that is long overdue, and this is to finally wean ourselves off of Russian oil and gas and in the long term to reduce our reliance on fossil fuels from any source at all.

All of us must proceed with wisdom, care, and moderation: we have a duty to ensure that this crisis does not spread any further.

But if we are to have any chance of ending this nightmare, then Putin must understand that his savagery will be met with unrelenting economic pressure

and that the west will be united in supporting Ukraine and that we are ready for a prolonged crisis.

I have no doubt that if the West can maintain the extraordinary unity we have shown so far, if we can press ahead with the strategy we have set out – of international economic, humanitarian, and diplomatic assistance to Ukraine, along with defensive weapons – then Putin’s venture will ultimately fail.

The path ahead will require patience and resolve, and we must be rational in our response – and recognise that Russia is capable both of misunderstanding and misrepresenting what we say.

And I will not waver in my conviction that, however long it takes, a sovereign and independent Ukraine will emerge once again, because Putin has stubbed his toe and tripped on a giant and immovable fact:

Which is no matter how many troops and tanks he sends, the Ukrainians desire to live in freedom in an independent country – which something that Poles will immediately understand – and in this desire the UK will always give them our wholehearted support.

And in the face of that fact and the unquenchable and manifest will of the Ukrainians to resist and in the face of this gathering tragedy, I say to Vladimir Putin and his regime, that there is only one way out of this morass and that is to stop the tanks, to turn back the tanks on their way to Kyiv, turn them round and take the path of peace.

Thank you all very much.

[Home Secretary says ‘Enough’ to violence against women and girls](#)

The campaign includes television adverts, billboards, social media and radio advertising and will highlight different forms of violence against women and girls and the simple acts that anyone can take to challenge perpetrators of abuse. Forms of violence against women and girls represented include street harassment, coercive control, unwanted touching, workplace harassment, revenge-porn and cyber-flashing.

The campaign was informed by the unprecedented 180,000 responses to the Call for Evidence last year. This multi-year campaign will also include communications to educate young people about healthy relationships and consent, and ensure victims can recognise abuse and seek support.

[View a YouTube video about the ‘Enough’ campaign to tackle violence against women and girls](#)

It has been developed with an advisory group comprising over 30 voluntary sector organisations, survivors and academics who have given their expert insight. The latest findings in behavioural science have also been used, including the role of peers and wider society in influencing people's actions, and the importance of providing simple, clear options to overcome the barriers people can have to challenging abuse.

Alongside advertising, a [new website provides more information on the steps people can take to safely challenge violence against women and girls](#), guidance for victims of these crimes and advice for perpetrators who recognise their behaviour needs to change.

It comes as the Home Secretary, National Police Chiefs' Council and College of Policing (HMICFRS) confirm that they are accepting and implementing all of the recommendations made by HMICFRS in their violence against women and girls inspection. The inspection, commissioned by the Home Secretary last year, recommends:

- appointing a full-time VAWG national policing lead to co-ordinate and improve the national policing response – which the Home Office supported, and DCC Maggie Blyth is now in post
- adding VAWG to the strategic policing requirement placing it on the same strategic footing as terrorism, serious organised crime and child sexual abuse
- new guidance to police forces on how to treat victims and to establish a single national survey on victim satisfaction
- ensuring that progress is closely monitored, including violence against women and girls as a priority for the ministerially chaired Crime and Policing Performance Board
- taking action to make sure different agencies, including the police, health and education, are working together effectively to tackle violence against women and girls, including considering whether any new duties should be introduced. The government recently made it clear in the Police, Crime, Sentencing and Courts Bill that local areas can consider domestic abuse and sexual offences for the purposes of the new serious violence duty.

Home Secretary Priti Patel said:

For too long, the responsibility of keeping safe has been placed on the shoulders of women and girls. This campaign says enough, and recognises it is on all of us to demand major societal change. Everyone has a stake in this.

Our new campaign shows that everyone can play a role in challenging abuse and making our country a safer place. By accepting all of the recommendations in the HMICFRS report I commissioned last year, the government and the police are doubling down to support victims and survivors and punish perpetrators.

The Home Secretary also commissioned a two-phase independent inquiry, chaired by Dame Eilsh Angiolini QC, to investigate and scrutinise the robustness of vetting practices, professional standards and discipline, and workplace behaviour within the police.

Deputy Chief Constable Maggie Blyth said:

The last year has seen some tragic and shocking incidences of violence against women and girls. There have been abhorrent examples of abuse or misogyny by police officers.

We have a good plan for change in policing to better protect women and girls from violence and root out misogyny in our own ranks. Experts in the VAWG sector have helped shape it and all forces are implementing it. I will review progress to ensure we are delivering as well as enabling others to scrutinise our progress.

The government's decision to make tackling violence against women and girls a strategic policing requirement reinforces the commitment already made by police chiefs to prioritise making women and girls safer.

CEO of Karma Nirvana Natasha Rattu said:

We welcome the launch of 'Enough', which the Karma Nirvana team and survivor ambassadors contributed to. The campaign is an important step and sends a powerful message that violence against women and girls cannot go on, and everyone has a role to play to stop it. We are pleased to see the Home Office launch a communications campaign that raises awareness of the abuse women and girls can face on a daily basis, challenges perpetrators and empowers others to know how to safely intervene if they witness unacceptable abuse.

Chief Executive at Women's Aid Farah Nazeer said:

Violence against women and girls is a spectrum, running from the everyday misogyny that is so prevalent, many people don't even notice it, right through to horrifically violent crimes and murder. Campaigns like this by the Home Office are an important tool to raise awareness of sexist actions and language that have been tolerated for too long and normalise the treatment of women as objects. Women's Aid will continue to keep working for the safety of women – until we no longer walk home in fear, whether it is the journey or the destination that holds the greatest danger – but we can't do it alone. It's also not enough that women must initiate and highlight the urgency of these conversations. We need 'allyship' to help bring about structural change.

Jo Todd, CEO of Respect said:

For too long the responsibility has been on women to keep themselves safe. If we are going to tackle violence against women and girls we must hold those who use abuse to account. This involves providing meaningful opportunities for change and robust action for those who continue to abuse. We hope this campaign will challenge those using abuse to take responsibility and enable communities to feel more confident speaking out. Violence against women and girls must not be tolerated in our society, we will not stop until women and children are safe.

Jayne Butler, CEO of Rape Crisis said:

Campaigns such as these are incredibly important for raising awareness not only on the prevalence of violence against women and girls but also of the types of harmful behaviours that are too often minimised and ignored. All too often the onus is put on women and girls to keep themselves safe or mitigate for male violence, so it's encouraging to see a campaign that shifts that responsibility, highlighting the different types of abuse and the importance of bystander intervention.

Payzee Mahmood, Child Marriage Survivor and IKWRO Campaigner, said:

I'm behind this strong campaign which importantly shows that everyone has a role to play in taking action to end violence against women and girls and ensuring that every woman and girl gets the support they need.

Andrea Simon, Director of the End Violence Against Women Coalition (EVAW), said:

We welcome this campaign to tackle male violence against women and girls. We can't end this abuse without addressing the unacceptable attitudes and behaviours that minimise and normalise it.

The End Violence Against Women Coalition has called for a public campaign since 2018, and it is clear that this type of campaign must be long-term, properly funded and shaped by specialist organisations including those led by and for Black and 'minoritised' women.

It's really important to engage men and boys in this conversation, because violence against women and girls is everyone's business and we should all be able to take action and hold each other

accountable.

Preventing violence is always better than solely responding after the harm has been done. We need to see more investment in prevention so that as a society, we can continue to have these difficult but necessary conversations and build.

The communications campaign advisory group includes:

- Business Disability Forum
 - Dr Sarah Steele, Cambridge University
 - Professor Catherine Donovan, Durham University
 - Office of the Domestic Abuse Commissioner
 - Drive
 - Dr Kelly Johnson, Durham University
 - Professor Nicole Westmarland, Durham University
 - Dr Stephen Burrell, Durham University
 - End Violence Against Women Coalition
 - Everyone's Invited
 - FORWARD
 - Galop
 - Dr Helen Mott, expert on ending violence against women
 - Nimco Ali OBE , Independent government advisor on tackling VAWG
 - Iranian Kurdish Women's Rights Organisation
 - Karma Nirvana
 - Laura Bates
 - Dr Fiona Vera-Grey, London Metropolitan University
 - Professor Purna Sen, London Metropolitan University
 - Mental Health First Aid
 - DCC Maggie Blyth, National Police lead for Violence Against Women and Girls
 - Our Streets Now
 - Plan International UK
 - Rape Crisis
 - ReBuild Britain
 - Refuge
 - Respect
 - Revenge Porn Helpline
 - SafeLives
 - Dr Shola Apena Rogers, University of Birmingham
 - SignHealth
 - Suzy Lamplugh Trust
 - Office of the Victim's Commissioner
 - Welsh Women's Aid
 - White Ribbon UK
 - Women's Aid
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[PM meeting with Prime Minister Mateusz Morawiecki of Poland: 1 March 2022](#)

Press release

The Prime Minister met Polish Prime Minister Mateusz Morawiecki in Poland today.



The Prime Minister met Polish Prime Minister Mateusz Morawiecki in Poland today.

He told Prime Minister Morawiecki that this is a key moment for the Ukrainian resistance and we must be ready to increase and intensify sanctions.

The Prime Minister praised Poland for being on the front line of humanitarian efforts.

They discussed the talks between Ukraine and Russia and the long-term disinformation that had misled Russian troops. The leaders welcomed EU and Germany's support for defence and humanitarian efforts.

Published 1 March 2022

[Latest data reinforces the safety of COVID-19 vaccinations in pregnant women](#)

The latest data from UKHSA shows that vaccinated women who gave birth between January and October 2021 had a very similar low risk of stillbirth, low

birthweight and premature birth compared to women who were not vaccinated in pregnancy.

Previous studies have shown the risk of being severely ill with coronavirus (COVID-19) is higher for unvaccinated women. Out of 235 [pregnant women who were admitted to intensive care with COVID-19](#) between January and September 2021, none had received 2 doses of vaccine.

The latest analysis shows that women who had received at least one dose of COVID-19 vaccine during their pregnancy and gave birth between April and October 2021 were more likely to give birth without any of the reported adverse outcomes than women who had not been vaccinated in pregnancy (92.9% compared with 91.6%). This difference was more apparent in those aged 30 years and older.

The stillbirth rate for vaccinated women who gave birth was approximately 3.6 per 1,000, a similar rate for women who were not vaccinated in pregnancy (3.9 per 1,000).

The proportion of vaccinated women giving birth to babies with low birthweight (5.01%) was lower than the proportion for women who were not vaccinated in pregnancy (5.33%).

The proportion of premature births was 5.97% for vaccinated women, similar to the 5.88% in women who were not vaccinated in pregnancy.

Vaccine coverage has been increasing overall – in August 2021, 22.5% of women giving birth had received at least one dose of vaccine. This increased to 32.1% of women who gave birth in September, and 41.3% in October 2021, almost doubling in 2 months. Of women who gave birth in October 2021, 29.4% had received 2 doses of the vaccine.

Despite the marked increase in coverage in recent months, women of black ethnicity and women living in the most deprived areas in England were least likely to have been vaccinated in pregnancy. A total of 13.3% of pregnant black women and 18.3% of pregnant women living in more deprived areas of England had a first dose of a COVID-19 vaccine by time of delivery – up from 5.5% and 7.8% respectively in the last published statistics in November.

However, just 6.8% of pregnant black women and only 10.2% of pregnant women living in more deprived areas of England had 2 doses, compared with 23.4% of white women and 34.8% living in less deprived areas.

Dr Gayatri Amirthalingam, Consultant Epidemiologist at UKHSA, said:

There is growing evidence indicating that if you are pregnant, you are at increased risk of serious illness from COVID-19, especially in late pregnancy.

We know that the COVID-19 vaccines used in the UK are highly effective at protecting against hospitalisation and our ongoing monitoring of the vaccine programme continues to provide reassuring

evidence on the safety of COVID-19 vaccines in pregnant women.

I would urge all pregnant women to come forward and get their vaccine without delay. This is the best way to protect you and your baby.

Professor Lucy Chappell, Chief Scientific Adviser at the Department of Health and Social Care and a consultant obstetrician, said:

It's really promising to see the number of pregnant women who were vaccinated at time of birth almost doubling in just 2 months and should be hugely reassuring for other women thinking about getting the jab.

The data also show that outcomes for babies continue to be reassuringly similar for vaccinated pregnant women compared to unvaccinated pregnant women.

The vaccines are the best possible way for a pregnant women to protect herself and her baby – we urge pregnant women to get their vaccine, whether it's their first dose, second dose, or booster, as soon as you can.

Dr Alison Cave, MHRA Chief Safety Officer, said:

The latest data from the UKHSA support the findings of our own rigorous and ongoing safety monitoring of the COVID-19 vaccines in pregnancy – that these vaccines are safe and that there is no increased risk of pregnancy complications. There is no evidence to suggest that COVID-19 vaccines affect fertility and the vaccines can be taken at any time in pregnancy.

COVID-19 infections can be very severe in pregnancy, particularly if women get infected in the third trimester of pregnancy or if they have underlying medical problems. This can lead to increased rates of stillbirth as well as complications for the mother.

Our advice remains that the benefits of vaccination against COVID-19 and flu outweigh the risks for those who are pregnant. We encourage all pregnant women to take up the COVID-19 and flu vaccines as soon as possible to boost immunity and protect themselves, their baby and others from further infection.

Dr Mary Ross-Davie, Director for Professional Midwifery at the Royal College Of Midwives, said:

All the evidence is showing that having the vaccine is safe for you and your baby and is the best way to protect you both against this

potentially serious, and deadly, virus. Hundreds of thousands of pregnant women across the USA, the UK and elsewhere have had the vaccine with no harms to them or their baby reported.

I urge pregnant women who have not yet been jabbed to go to trusted sources for their information about the vaccination such as the RCM or NHS websites, midwives and doctors, and not to be influenced by the mass of incorrect misinformation swirling around the internet and social media.

It is also particularly important that we work to increase levels of vaccination in pregnant women in communities where the uptake is low. A concerted effort is needed to engage with these women, and to support them with advice and information about the vaccine, about its safety and about its benefits.

Dr Edward Morris, President of the Royal College of Obstetricians and Gynaecologists, said:

It is encouraging to see the number of women who gave birth in October 2021 who had received the COVID-19 vaccine has nearly doubled from previous figures from August 2021.

We hope that this increase in uptake will reassure and encourage other pregnant women who have not yet been vaccinated to come forward for their first, second or booster doses.

We know that pregnant women are more vulnerable of becoming seriously ill with COVID-19, which can lead to an increased risk of giving birth prematurely, and stillbirth. We have high-quality evidence that the COVID-19 vaccine is the best way to protect both pregnant women and their babies against COVID-19.

We remain concerned that those living in the most deprived areas of England and women of black ethnicity were the least likely to be vaccinated before giving birth, and we continue to advocate for concerted efforts to support these women to feel more confident about having the vaccine.

Funding for next generation of space science missions

The UK has been at the heart of international space science missions, including the once-in-a-generation James Webb Space Telescope, which launched

in December; Solar Orbiter, a mission to study the Sun and its effects on the solar system; and the BepiColombo mission to Mercury.

The new funding aims to encourage collaboration between industry and academia and boost technology that will support the future exploration of the universe through space-based astronomy, cosmology, solar system science and astrophysics.

Led by organisations across Scotland, Northern Ireland and England, the projects include using tiny, digitally controlled mirrors, smaller than the width of a human hair, to counteract the movements of space telescopes and get sharper images. If successful, the UK-led technology could be used as a basis for instruments on future space missions.

Another will develop a space-based atomic clock small enough to fit inside a cubesat the size of a microwave. Tests of fundamental physics, such as quantum mechanics and general relativity, rely on extremely precise time measurement. An ultra-accurate atomic clock that can fit into a tiny satellite could help revolutionise space-based physics experiments, as well as deep-space navigation for planetary science and exploration missions.

Science Minister George Freeman said:

The UK's space and satellite technology sector is already worth over £16 billion and growing fast. As well as our ground-breaking leadership on projects like the James Webb Telescope and Solar Orbiter missions, our UK Space Agency is supporting hundreds of SMEs developing cutting edge technology.

From miniature atomic clocks and tiny digitally-controlled mirrors that help channel light into moving spacecraft, to new space weather detectors to help warn of devastating solar storms, these new projects will ensure the UK continues to grow as a global science superpower.

The Technology for Space Science call is a joint initiative between the UK Space Agency's National Space Technology Programme and the Science and Technology Facilities Council (STFC), part of UK Research and Innovation. A total of £455,000 has gone to the 10 projects across the UK.

In addition to national funding, the UK is a major contributor to the European Space Agency's Science Programme, investing approximately £94 million per year, giving UK companies opportunities to bid for high value contracts and access to European suppliers and customers, and allowing UK researchers to collaborate with European and international partners on pioneering space science missions that would be too large and ambitious for one country alone.

The [National Space Strategy](#) outlines the long-term plans to grow the UK space sector and make Britain a science and technology superpower, including building on manufacturing and technology capacity, catalysing investment and

working internationally.

Rb-TP: A Rubidium atomic clock for tests of fundamental physics

Lead: TwinParadox Ltd, London

Funding: £36,500

Optical atomic clocks in space will be able to make orders-of-magnitude improvements to tests of Quantum Mechanics and General Relativity. They also open up new fields such as Gravitational Wave observatories, extreme-VLBI astronomy, and have the potential to revolutionise deep-space navigation for planetary science and exploration missions.

Warm rubidium vapour optical clocks are an excellent candidate for a space optical clock, achieving stabilities of parts in 10^{15} at one hour – better than any existing space clock. This project will perform the necessary precursor design for an ultra-compact Rb-TP clock in a small, low-cost format, suitable for a CubeSat demonstration.

Miniaturisation of high-precision radio receivers for cosmological observations of the Dark Ages from cost-effective space platforms on Moon's orbit

Lead: University of Cambridge

Partner: STFC RAL Space

Funding: £50,000

Low frequency radio cosmology aims at studying the mysterious early Universe (Dark Ages and Cosmic Dawn). The observational endeavour is an extreme instrumental challenge, where a cosmological signal needs to be extracted from much brighter ($\sim 100,000$ times) noise signals originated in the sky, on Earth and in the radio telescope itself. Ground-based experiments face challenges like human-made interference and distortions introduced by Earth's ionosphere. This project will build a prototype miniature receiver for radio cosmology observations from the quietest location in the solar system: Far-side of Moon's orbit. This could be installed in a cost-effective CubeSat platform enabling an iterative experimental approach without the contaminating factors.

A technology roadmap for astrophysical X-ray interferometry

Lead: University of Leicester

Partner: Open University

Funding: £50,000

The highest resolution images of the X-ray sky have to-date been taken by the Chandra X-ray observatory, a remarkable telescope that has revolutionised our

view of high energy processes in astrophysics. But telescopes of this type appear to be reaching a practical limiting resolution. A radical new approach to X-ray imaging is needed to drive future advances in X-ray astronomy. This proposal will create a technology roadmap aiming to deliver the tools that astronomers need for new scientific observations – from imaging exoplanets passing in front of nearby stars to resolving the event horizon of a black hole.

Feasibility Study of a Moon-enabled Sun Occultation Mission

Lead: Surrey Space Centre, University of Surrey

Funding: £50,000

According to the Royal Academy of Engineering's most recent assessment of space weather, better modelling and observations of the inner heliosphere represent a "crucial step in understanding all aspects of solar activities". These include catastrophic events such as solar flares and corona mass ejections that can wreak havoc on power grids and space-based technologies. This project wants to explore the feasibility of a spacecraft mission aimed at collecting more frequent and higher-quality measurements of the inner Sun corona via Moon-enabled total solar eclipses in space. Candidate spacecraft trajectories will be researched in the chaotic dynamics of the Sun-Earth-Moon system and used to inform the preliminary design of a UK-led small satellite platform.

Integral Field Units: the next generation of space-based solar instrumentation

Lead: Queen's University Belfast

Funding: £50,000

Placing high-powered telescopes in space offers an unrivalled viewpoint of celestial objects, including our nearest star, the Sun. Unfortunately, the spacecraft mechanics necessary to maintain stable orbits often introduce unwanted jitter in the telescope pointing, which can result in blurring of the acquired images. This project will investigate the suitability of digitally controlled small-scale mirrors, which are smaller than the width of a human hair, to reduce the impact of spacecraft jitter by allowing the re-pointing of incoming light at very high rates (exceeding thousands of times each second). Understanding the suitability of micromirrors for spaceflight will pave the way for future UK-led instrumentation suites in the decades to come.

GaiaNIR:UK – capacity building and feasibility study for next generation astrometry

Lead: Institute of Astronomy, University of Cambridge

Partners: Durham University, University College London's Mullard Space Science Laboratory and the UK Astronomical Technology Centre and Leonardo UK

Ltd

Funding: £47,000

The focus of the study is to conduct initial feasibility studies related to the development of a future near-infrared astrometry space mission in the context of the ESA Voyage 2050 programme, building on UK strengths in science, data and IR detector technologies. Observing in the infrared would allow the study of regions hidden in the optical due to dust, for instance the central regions of the Milky Way, and thus allow a detailed understanding of our galaxy's ecosystem and formation history.

Ultrasonically assisted augers

Lead: University of Glasgow

Funding: £50,000

Exploring the subsurface of another planet may require us to drill below the ground, but low gravity might make it difficult to create the forces and torques required to operate a rotating drill string. However, ultrasonic vibration – small, high frequency movements – are known to fluidise soil-like materials. This project will determine if this fluidisation phenomenon can be applied to a drilling auger, which would reduce the force and torque that would need to be applied and allow us to explore the terrain using smaller, and therefore faster and cheaper, planetary landers.

Improved control loop for a miniaturised space weather magnetometer

Lead: Imperial College London

Funding: £36,500

Imperial College is leading a project to improve the performance of miniaturised magnetic field detectors that are deployed on nano-satellites to detect space weather disturbances coming from the Sun. These disturbances can cause serious environmental interference on the ground such as shutting down power grids. The project involves development of a new type of electronics control that is compatible with the most sensitive magneto-resistive sensors, solid state miniature sensors that are more commonly use in navigation and vehicle detection applications.

Using Multivariate Statistical Analysis to fit spectroscopy data from remote and in situ analysis of planetary surfaces: A proof-of-concept assessment

Lead: The Open University

Funding: £40,500

One of the most powerful tools that scientists use for the remote exploration

of planetary bodies is reflectance spectroscopy. When light from the Sun is reflected back from the surface of a planetary body, its spectrum (or pattern of wavelengths) is changed in ways that depend on the composition and roughness of the surface. Spectra are interpreted by comparison with known rocks and minerals – but it is not an exact procedure. The team is developing mathematical techniques that can speed up and make more accurate the interpretation of planetary spectra. This will help future exploration of space and recognition of potential in situ resources.

Optical Coatings by the ContinUous Processing of Large ARea Parts using Plasma Electrolytic Oxidation (“OCULAR”)

Lead: Keronite International Ltd, Haverhill, Suffolk

Funding: £44,000

Black surface treatments are needed for optical instruments and solar shielding to withstand the extreme conditions found in space, but very few surface treatment technologies meet these requirements. Keronite’s proprietary plasma electrolytic oxidation (PEO) process involves creating a ceramic oxide layer on the surface of metals, which offers exceptional properties for space applications.

To cater for an increased demand for coating large components, including the next generation of space telescopes, the OCULAR approach envisages an innovative continuous coating process whereby only a section of a part is coated at any given time while rotating the part to ensure full coverage. This will be a globally unique capability that will put UK space technology at the forefront of the future development for large space parts requiring functional optical coatings.