# INTRODUCTION FOR TEACHERS

'Apollo 13', released by Universal Pictures, is a space drama starring Tom Hanks, Kevin Bacon, Gary Sinise, Bill Paxton and Ed Harris. It follows the extraordinary story of the Apollo 13 space mission, which intended to place astronauts on the Moon for the third time, but instead became famous as the first deep-space emergency. Oxygen tanks on the spacecraft blew up 200,000 miles from Earth, and the three astronauts on board had to use their Lunar Module as a makeshift lifeboat; the fact that they survived the journey home was a miracle of resilience and human resourcefulness, and forms the main drama of the film.

This study guide is not aimed at a film studies audience, and only touches on the Apollo 13 mission in a very broad context. It is aimed primarily at teachers of General Studies at A' level, and provides resource material in three main areas. First, it looks at the ways that space has always excited the human imagination, and shows how space travel can be seen as a development of great explorations on Earth. Second, it focuses on the Apollo Programme and the race for the Moon, explaining how this race was born out of Cold War rivalries. Third, it looks at the future of space travel in the light of the Challenger space shuttle disaster.

A viewing of 'Apollo 13' will provide a springboard for discussion in all these areas, and should be seen as a teaching resource working in parallel with this guide.

# A PRESIDENT'S PROMISE

"I believe this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the moon and returning him safely to Earth. No single space project in this period will be so impressive to mankind, or more important for the long-range exploration of space, and none will be more difficult or expensive to accomplish."

On the 25th of May 1961, John F. Kennedy, the newly-elected President of the United States, delivered the most daring and audacious speech of his short presidential career. He threw out a challenge to America's rocket scientists. In exchange for enough cash to fund an intensive space programme, they must achieve the unbelievable: a return flight to the moon . . .

His speech continued: "We shall send to the moon, two hundred and forty thousand miles away from the control station in Houston, a giant rocket more than three hundred feet tall, capable of standing heat and stresses several times greater than have ever been experienced, made of new alloys, some of which have not been invented, fitted together with a precision better than the finest watch, carrying all the equipment

needed for propulsion, guidance, food and survival, on an untried mission, to an unknown destination…

And as we set sail, we ask God's blessing on this, the most hazardous and dangerous adventure on which man has ever embarked.."

In the event Kennedy's promise - that America would make a moon landing "before this decade is out" was met just months within the deadline. But on the 21st of July 1969, the dream was accomplished: Neil Armstrong and "Buzz" Aldrin, two of the three astronauts piloting Apollo 11, actually walked on the surface of the moon. They spent three hours loping about, enjoying the moon's curiously weak gravity; they collected a few moon rocks, and they sunk an American flag into the moon-dust as proof of their visit (although with a live TV audience of millions watching their every move, this latter formality was hardly necessary). Then they piloted their lunar module 'Eagle' back to the command module, steered by the third astronaut Michael Collins, and all three then returned to Earth to heroes' welcomes and a place in the history books.

In the film 'Apollo 13', Jim Lovell (played by Tom Hanks) talks of Neil Armstrong in the same breath as Christopher Columbus, who supposedly first 'discovered' America, and the Wright Brothers, pioneers in human flight. And the cornparison is accurate; the feats accomplished by the Apollo missions rank on a par with the very greatest of human achievements.

This study guide aims to provide background information on the Apollo missions. It hopes to stimulate discussion on a variety of topics, but the central question remains constant throughout: why, in May 1961, did President Kennedy make such a extraordinary promise? Why send a man to the moon?

## SPACE AND THE HUMAN IMAGINATION

From the earliest days of human existence, men and women have searched for meaning in the mysteries of space. Even our most primitive ancestors noticed patterns in the movement of the Sun, the Moon and the stars, and in describing these patterns they turned the sky into a vast tapestry of myth and folklore. For the Ancient Greeks, the Sun's daily passage across the sky was explained as the journey of a god, Apollo, riding a fiery chariot. For the Egyptians, the waning of the Moon was a monthly re-enactment of the dismemberment of the god Osiris, chopped into fourteen pieces by his enemy Typhon. Even today we call the major planets in our solar system by the names by which they were worshipped in the days of Ancient Rome: Mars, God of War; Venus, Goddess of Love; Neptune, God of the Oceans, and so on

As human beings gained more scientific understanding, they learnt to distinguish

between fanciful and real connections linking life on Earth and activity in the heavens. The hardest realisations have been comparatively recent. It is only five hundred years, for instance, since we discovered that the Earth revolved around the Sun, and not vice versa, a discovery which rocked civilisation to its foundations, in that it quietly destroyed the notion that the universe and everything in it centred on man.

Since then our true insignificance has become painfully apparent. We have learnt, for instance, that the Sun - the most marvellous object in our solar system - is simply an ordinary star, and that an infinite number of other solar systems exist just like ours.

The Moon, equally, has been revealed as a rather dull and uninspiring place. Once it seemed magical, responsible for everything from fits of lunacy to the successful growth of plants. But science lays it bare: the Moon is simply a natural satellite of bare rock, travelling around the Earth at a distance of about a quarter of a million miles, trapped by our gravity into an endless and never-changing orbit. It is lifeless, with neither water nor atmosphere, and its surface is pitted with craters. Described like that it seems an unlikely place to want to visit.

## DISCUSSION POINTS 1 - MYTHS AND LEGENDS OF THE STARS

- In groups, picture yourselves as members of a primitive society living many thousands of years ago, with little understanding of the universe or of man's place within it. How would you have made sense of the Sun, the Moon and the stars? Try and create for yourselves stories that might help 'explain' the activity of the celestial bodies' above you.

- Now gather as much information as you can on real myths and legends that relate to the Sun, the Moon and the stars. Try and find material from as many different cultures as possible. Do any common ideas seem to emerge from these legends? And how do you respond to them? Do these legends seem absurd to you, or are they in some sense understandable?

- Think in particular of the Moon, and the way the Moon affects life on Earth. At night, it dimly reflects the light of the Sun. Its weak gravitational pull controls the ebb and flow of our tides. And the twenty-eight day lunar cycle has a clear influence on many natural phenomena here on Earth. So it's clearly wrong to dismiss every 'heavenly influence' as superstitious. But does that justify the horoscopes devoured by millions of newspaper readers every day? Where do you think the balance should lie between science and superstition?

Curiously, the more humans discovered about the universe, the more fascinated we became. Learning the moon is simply a lump of rock did nothing to kill that fascination.

In fact, our imagination has been more stimulated by the idea of space in the last hundred years than ever before.

But maybe that's not so surprising. After all, what a scientific understanding of space showed was that the planets - the Moon, Mars and so on - were physical entities, on predetermined orbits, a certain distance away from Earth. Suddenly it was apparent that these planets were potential destinations. Rather than worshipping the sky, or standing in awe of it, we could view it as a map of places we might one day actually visit.

Seen like that, space travel is a simple development of transport improvements that were started centuries ago. From the invention of the wheel, to the steam train, the internal combustion engine, the aeroplane, from century to century man has travelled further and further with increasing ease. Now we think nothing of flying across the Atlantic in a day, when for our rural ancestors the thought of even visiting the nearest town was remarkable.

And of course as soon as the means of travel is invented, the will to travel soon follows. That's true even if the means of travel are still barely tested. Every great expedition in the history of human exploration has been coupled with risk. The ships used by Christopher Columbus to sail the Atlantic were so primitive they would fill a modern sailor with dread. And for every once-obscure destination that humans have visited - the polar ice-caps, the source of the Nile, the summit of Everest, the western frontier of America, there were deaths along the way as pioneers beat out the trail.

Space is just the latest in a long line of risky destinations. All we needed was to understand the route, and to build a vehicle fit enough for the journey .

## DISCUSSION POINTS 2 - 'SPACE, THE FINAL FRONTIER'

- What makes human beings so determined to explore the unknown? Do you think we are simply following a natural urge, or are our reasons more cynical - do we believe we have something to gain from exploration?

- Make a list of great explorers, and the destinations they visited. Try to make sure this list is not simply from a Western perspective (we sometimes tend to see exploration as a process of 'us' discovering 'them'). Now, using your list of destinations, try to analyse what benefits discovering these places brought the explorers and the generations that followed them. Think in terms of trade and emigration, for instance . . . What other benefits can you spot? And are there occasions when, at least for some people, the results of exploration were actually harmful?

- In the American TV and film series ‘Star Trek’, space is famously referred to as ‘the Final Frontier’. What do you understand by this phrase?

- Find out all you can about the American colonisation of the ‘Wild West’ in the mid- to late 19th Century. This is a story crucial to any understanding of America today. In the 20th Century the story has been immortalised in countless ‘Westerns’, movies glorifying the tough spirit of the American cowboy Can you see any parallels between the drive to colonise the West, and the drive to explore space? Do you think American history may have led the American people to pursue the exploration of space with an increased enthusiasm?

The growing fascination with the idea of space travel in the last hundred years has been mirrored in the growth of the science fiction industry. Space travel and science fiction appear inescapably linked. It is hard to think of fictional accounts of the future that don’t take for granted the idea that we will be able to travel to other worlds.

In fact, fictional accounts of space travel have a long history. The first account of a journey to the Moon was written in the 2nd Century AD by the Greek satirist Lucian of Samosata. In his ‘True History’, he describes how his heroes, travelling through the Straits of Gibraltar, are hurled into the air by a waterspout and thrown onto the Moon. In this version the Moon is a turbulent world inhabited by warring armies.

But the true father of science fiction was Jules Verne, whose ‘From the Earth to the Moon’ (1865) and ‘A Trip Round the Moon’ (1870) planted most of the ingredients of the genre we know today. In fact, his accounts were most remarkable for the amazing accuracy of his predictions. He describes *a* rocket launched from Cape Canaveral in Florida, at a speed of 25,000 miles an hour, eventually splashing down in the Atlantic Ocean and rescued by a warship. One hundred years before the Apollo missions he’d got the launch site, speed and mode of recovery spot on.

It’s in the 20th Century, though, that science fiction has really taken off. And studying the way science fiction writers paint the future is *a* good way of analysing just how far we have come. It gives us a yardstick by which to judge our achievements.

## DISCUSSION POINTS 3 - SCIENCE FICTION

- Working in groups, try to list as many fictional accounts of space travel as possible. Include feature films. comic strips, TV series, books. And try to include science fiction from the 1940s, ‘50s and ‘60s: characters like Dan Dare, ‘pilot of the future’, whose antics now seem rather old-fashioned.

- What are the common ingredients of space travel, as seen through the eyes of the creators of science fiction? How do people travel in space? What devices exist to make space travel easy (what, for instance, do you understand by the phrase ‘hyperspace’?) And why, in science fiction, do people travel? Where are they going? Who are they visiting? What sort of society exists out there? Is it hostile? Are humans in a position of strength, or are we simply one of many races in a rich and varied galaxy?

- What can people do in science fiction that we can’t do today? Are we progressing well, or simply in the early stages of space technology?

- Do you think we will ever achieve the sort of inter-planetary civilisations described in science fiction? Should we wish to?

So far, this study guide has answered the question ‘Why send a man to the moon?’ by looking at the human imagination, and our extraordinary drive to explore the unknown. We send a man to the Moon, so the argument goes, because the Moon exists and we’ve never been there before. It’s like the mountaineer, asked why he should want to climb Everest, who replies simply, “because it’s there.“ And this is certainly a valid answer to the question.

But it’s not the only answer. The next section of this study guide will look in greater detail at the political climate from 1945 to 1969, and show that President Kennedy, in promising the Moon, had very Earthly concerns in mind…

## SECTION TWO - SPACE AND THE COLD WAR

On 20th April 1961, one month before promising Americans would land on the Moon, President Kennedy wrote a memorandum to his Vice-President, Lyndon B. Johnson. In it, he asked:

“Do we have a chance of beating the Soviets by putting a laboratory in space, or by a trip to the Moon, or by a rocket to go to the moon and back with a man? Is there any other space program which promises dramatic results in which we could win?”

What does this memorandum tell us of President Kennedy’s real motives for achieving success in space?

To answer this question more fully, we need to understand the rivalry that existed between the United States and the Soviet Union from the 1940s to the 1960s. The two nations dominated the world stage, and yet were ideological opposites. Each used the other as ‘bogey-man’, exaggerating the perceived threat to justify arms sales and hard-talking diplomacy. On many occasions the threat became very real, and on reflection it

seems extraordinary that the two sides never openly met each other in battle. This remarkable stand-off has become known as the ‘Cold War’.

Nowhere was the ‘Cold War’ fought harder than in outer space. The ‘Space Race’ was high profile and dramatic, and the leaders of both America and the Soviet Union were quick to exploit its propaganda potential. The Space Race was like a shop-window for scientific advancement, and to be seen to lead the way was to advertise your country’s technical superiority.

Just as importantly, advances in space technology had a vital military function. The rockets developed to power spacecraft into orbit could just as well be used to deliver nuclear warheads to their target. Inter Continental Ballistic Missiles, as they came to be known, were developed by space scientists as part of the space programme, although their function had nothing to do with space exploration. Equally, objects in orbit round the Earth (satellites) can be used as spy devices to gather sensitive information. In the 1 980s the role of military satellites developed further, as potential defence stations which could, in theory, detect and eliminate l.C.B.M.s within seconds of their launch.

On the next few pages you will find a table listing the key events of the Cold War (Column 1), the key events of the American Space Programme (Column 2), and the key events of the Soviet Space Programme (Column 3), for the years 1939 to 1969. Study the table, and then, working in groups, tackle the following points for discussion:

## DISCUSSION POINTS 4 - SPACE AND THE COLD WAR

- To what extent did Project Apollo - the American Moon landing programme - depend on the Cold War? Why? Do you suppose Project Apollo would ever have left the ground had the Cold War never taken place?

- From the information given in the table, at what points between /945 and /969 was the Cold War at its most intense? And at what points did tensions seem to relax? Do these fluctuations seem to affect either space programme in any way?

- Does it surprise you that the Apollo missions, founded at a time of such hostility between America and the Soviet Union, reached their peak at a time of détente?

- Think about relations between the super-powers today Do you think we are likely to see many developments in space technology in the near future? Why?

| **DEVELOPMENT OF THE COLD WAR** | | |
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| 1939-45: The Second World War. America and the Soviet Union are allies in the fight against Germany. The 'common cause' disguises their ideological differences. | Rocket design, vital to any subsequent venture into space, is pioneered under the supervision of the German Army at Peenemunde on the Baltic coast. The project's technical director is Werber von Braun. By the end of 1943, his full scale ballistic missiles enter mass production as the V2, Hitler's revenge weapon. Armed with one-ton warheads, 1200 of them are fired at London, killing more than 2500 people. Had these weapons been available sooner, they would most probably have won Germany the war. | |
| | **AMERICAN SPACE PROGRAMME** | **SOVIET SPACE PROGRAMME** |
| 1945: The War ends. Nazi-occupied Europe is liberated. The allied powers – America, the Soviet Union, France and Britain – preside over the ruins. In Eastern Europe the Soviets create puppet states closely monitored by Moscow. America explodes atomic bombs at Hiroshima and Nagasaki, to end the war with Japan but also to impress the Soviets. | Werner Von Braun and 120 of the best German rocket scientists surrender to the Americans. Under Operation 'Paperclip', the Nazi party affiliation and SS membership of many of these scientists were erased from their biographies to avoid future PR problems. | The Soviets capture V2 missiles, equipment and 6000 German scientists and rocket engineers. They set to work immediately launching captured V2 rockets and refining robot technology. |
| 1946: Winston Churchill warns that an 'iron curtain' has divided Europe between the Soviet and American spheres of influence. | The Americans develop a testing ground at White Sands in New Mexico, to build missiles for the US Army. | |
| 1948: barbed wire separates the two halves of Europe. In the West, America helps reconstruction with an injection of cash – the Marshall Plan. In the East, the Communist dominated zone, American aid is rejected. The Soviets blockade Berlin. | | |

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| 1949: The Soviets explode their first atomic bomb. In America, Senator Joe McCarthy starts his campaign to root out anything 'un-American'; anti-Communist witch-hunts sweep the country. | | Stalin, the Soviet leader, calls for the development of a rocket large enough to attack America armed with a nuclear warhead. Sergei Korolyev and his team of rocket scientists set to work. |
| The 1950s. The arms race intensifies. The Americans detonate the first H-bomb in 1952. The Soviets follow suit in 1953. | Werner Von Braun tests second generation V2 rockets at Cape Canaveral in Florida, believing that these 'Redstone' rockets will eventually be capable of launching a satellite into orbit. | |
| 1955: The creation of the Warsaw Pact, the military alliance of East European nations under Soviet guidance. | American President Eisenhower calls for a US satellite to be launched within two years. | The Soviets announce plans for the launch of a satellite. |
| 1956: The people of Communist-controlled Hungary rise up against the Soviets, and call for American help. Help never arrives, because the Americans have realised that the cost of conflict in the nuclear age would be too great to contemplate. Soviet tanks roll into Hungary and crush the uprising. | | |

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| 1957: The launch of Sputnik 1 proves to America the superiority of Soviet scientists. And the implications of Inter-Continental Ballistic Missiles are worryingly clear: from now on, nuclear devastation can be launched from great distances – bombs no longer need to be dropped from a plane, as happened at Hiroshima. | America fails in attempts to fire Inter-Continental Ballistic Missiles, and to launch satellites. An American general glumly concludes: "we got the wrong Germans…" | The Soviets amaze the world. On the 21st of August, they launch the world's first Inter-Continental Ballistic Missile, the SS6. Then, on October 4th, they launch Sputnik 1, the world's first artificial satellite. One month later, Sputnik 2 is launched carrying a dog, Laika. Laika survives 10 days in orbit before dying of a lack of oxygen. |
| 1958/8: The Cold War thaws slightly. US President Eisenhower welcomes Soviet Premier Nikita Khrushchev on a tour of America. But the truce does not last long. | Werner Von Braun successfully launches Explorer 1, the first American satellite. In June 1958, NASA (the National Aeronautics and Space Administration) announces Project Mercury, the programme for a manned flight into space. | 'Luna 2', a Soviet unmanned spaceprobe, becomes the first man-made object to hit the moon. 'Luna 3' takes the first photographs of the Moon's 'dark side'. |
| May 1960: A Soviet missile shoots down an American spy plane in Soviet airspace. | | |
| 1961: Kennedy takes office determined to toughen up policy against the Soviets. The stand-off in Berlin reaches a head with the building of the Berlin Wall. | Soviet success in space leads Werner Von Braun to remark that if the Americans ever get to the moon, they'll have to check in through Soviet customs first. Yet just six weeks later Kennedy makes his historic speech promising a return trip to the moon 'before the decade is out.' | Cosmonaut Yuri Gagarin becomes the first man in space, completing a full orbit of the Earth on 12th April 1961. Soviet superiority in space seems unbeatable, and Soviet scientists are scornful of Kennedy's ambitions. |

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| 1962: The Cuban Missile Crisis; the Cold War's climax. A US spy plane spots Soviet ships moving missiles to Communist Cuba, just 100 miles off the US coast. Kennedy blockades Cuba. Nuclear war seems imminent. The Soviets back off. | John Glenn becomes the first American to orbit the Earth. | In Vostok 6, Valentina Tereshkova becomes the first woman in space (June 1963). |
| 1965: Kennedy's successor, Lyndon B. Johnson, sends American troops to fight the Communist forces of North Vietnam. The war ends with a Communist victory eight years later. | From 1965 to 1968 NASA slowly overtakes the Soviets in the race for the Moon. Project Mercury is followed by Project Gemini, which develops spacecraft large enough for two or three astronauts, and practices docking procedures. By 1966 the gigantic Saturn V rockets used in the Apollo launches are ready for tests. | The Soviets meanwhile develop the Voskhod Programme – its aim more ambitious than simply a flight to the moon. They were investigating the possibility of manned space stations orbiting the earth, from which Moon trips could be made on a frequent basis. From Voshod 2, Cosmanaut Alexei Leonov performs the first space walk. |
| 1968: Students protest against the war in Vietnam. America is clearly no longer a nation united against the 'Communist threat.' | The three American astronauts of Apollo 8 pilot a spacecraft into orbit around the Moon and return to Earth. Project Apollo celebrates its first outstanding success. | |
| 1969: The first Strategic Arms Limitation talks are held between Moscow and Washington, to limit the colossal spending both Americans and Soviets had been pushing into defence. Although the Cold War would continue until the fall of the Berlin Wall in 1989, the superpowers were at last finding ways to preserve the fragile peace. | 21st July 1969: Apollo 11. Neil Armstrong and "Buzz" Aldrin walk on the Moon | |

# SECTION THREE - ‘NO BUCKS FOR MOON ROCKS’

‘No Bucks for Moon Rocks’ was one of the slogans used by protesters in the 1960s campaigning against the space programme. Their argument was simple: it cost too much, and it achieved too little.

Given the sheer majesty of Project Apollo - given its significance in the history of human civilisation - it’s sad to think that such achievement should be belittled. But the protesters had a point. The cost of the space race, simply in financial terms, was enormous. The bill to send a man to the Moon was an estimated £24 billion dollars. As ever, there were plenty of Earthly problems that the money could have helped fix: the perennial problems of unemployment, poor housing and food supply, in America and elsewhere.

And then there was the human cost. In fact, given the immensely risky adventure undertaken by the American and Soviet space programmes, it’s amazing that more lives weren’t lost. But accidents did occur, and every fatality tested the public’s conscience.

On January 27th, 1967, three astronauts of the Apollo programme lost their lives preparing for a full rehearsal of lift off procedures. Virgil Grissom, a veteran of Mercury and Gemini, Edward White, the first American to walk in space, and Roger Chaffee, an enthusiastic rookie astronaut, had just taken their seats inside the command module when a fire broke out; in the pure oxygen of the capsule, the fire became an instant inferno.

On April 23rd, 1967, Cosmonaut Komarov, flying Soyuz 1, died when the parachute on his re-entry capsule failed to open.

On April 14th 1970, an oxygen tank on Apollo 13 blew up 200,000 miles from Earth. The three astronauts aboard survived by using their Lunar Module as a lifeboat, but the drama, watched by millions the world over, brought home the terrible risk of space travel.

On 29th June, 1971 the three-man crew of the Soviet spacecraft Soyuz 11 died in re-entry when a faulty valve allowed air to escape rapidly from their descent module.

On 28th January 1986, the US space shuttle Challenger blew up 73 seconds from lift-off. The rubber valves in the rocket boosters had failed due to the frozen conditions in the build-up to the launch. All seven astronauts on hoard died.

The list keeps growing, and will continue to grow for as long as we think the risk

worthwhile. So what has space travel really taught us, to compensate for such disasters? A scientist would say we've learnt a great deal. We've learnt about the composition of the Moon, of Mars, of Venus, and these details have given us clues about the origins of our universe. We've been able to approach and photograph the further reaches of our solar system. We've been able to conduct experiments in weightlessness and other space related phenomena. But for the lay-person, the benefits of space travel are less easy to comprehend. Satellites have opened up possibilities in communications, relaying telephone and TV signals, and they help with the forecasting of the weather. But that, sad to say, is about it. So have the risks proved worthwhile?

### DISCUSSION POINT 5 - THE VALUE OF SPACE TRAVEL

Imagine a new proposal has come before the US Congress, asking for millions of dollars to fund a new space programme. Debate the proposal in two groups, half in support of the motion, half opposing. Who puts forward the best case?

## SECTION FOUR - NASA: THE FUTURE

NASA has taken great strides forwards since the days of Apollo. Its most significant recent achievement was the space shuttle, a spaceship able to land safely after re-entry into the Earth's atmosphere, and then be re-launched again. The shuttle's importance is obvious; space travel will never be a realistic proposition if the majority of the spacecraft is jettisoned during the journey. In the Apollo missions, the Saturn launch rockets, the Lunar Module and the Service Module were all jettisoned along the way; and only the tiny capsule of the Command Module actually splashed down after re-entry. This is a little like driving to the shops in a car and returning only with the driving seat, then rebuilding a new car for every successive journey.

But the space shuttle programme, for all its initial success, suffered terribly from the after-shock of the Challenger disaster. It became bogged down in bureaucracy and over-cautiousness, and costs have spiralled.

But NASA's greatest problem today is one of lack of direction. The mood is summed up by Dr Thomas O. Paine, who was Deputy Administrator at NASA in 1969 at the height of the Apollo Programme:

"Remember the way Kennedy put it when he selected Apollo? What he said was it is absolutely essential that this nation lead in the exploration of space. That we be the pre-eminent power able to navigate the new ocean of space, and, therefore, that we go

to the Moon in this decade. OK, we're leading in space, he was absolutely right. That demonstrated to the Soviets and the rest of the world; not only were we leading in space, but obviously all the technologies required to do it. That was the objective. Now, what do you do with this tool you have created? And there we weren't so smart. We didn't know."

Consider the following newspaper articles, all of which were printed in the past two years:

I: "The future of the 'Freedom' space station project is hanging in the balance. Freedom has already suffered four cost-cutting exercises since the heady days of the Reagan era, when investment in space research was equated with patriotism. So the latest proposals for an even cheaper version of Freedom are seen as a cut too tar by many former supporters. Washington's lawmakers argue that the space station's design has been pared back so much since it was first proposed in 1984 that it will accomplish little useful science, and many believe the money would be better spent on more down-to-earth research. The strength of their opposition became clear when the space station escaped cancellation in the US House of Representatives by a single vote..." [*New Scientist*, itlth July 993]

2: "It was no coincidence that the space shuttle Challenger burst away from Cape Canaveral on the very day, January 28th 1986, that President Reagan was due to make his Stale of the Union address to the nation. For NASA, hitting the January 28th deadline was supremely important. The agency had promised an operational, cost-effective spacecraft and, by heck, it was going to deliver. But it badly needed the publicity that the President's speech would provide, for all was not well. Challenger was the third, not the first, shuttle to take off in uncertain weather conditions, and NASA scientists were working 12-hour clays to keep pace with the hectic timetable and ward off criticism that the shuttle was a costly, unreliable fantasy..." [*The Independent*, reviewing an account of the Challenger disaster, 14th April 1994]

3: "An unmanned mission to the Moon was announced by the American space agency, NASA, yesterday. The mission, scheduled for 1997, will cost £40 million. At today's prices, the Apollo programme that put man on the Moon in 1969, would have cost £80 billion." *IThe Daily Telegraph*, 2nd March 1995]

4: "The space shuttle Endeavour took off yesterday with seven astronauts aboard for the longest shuttle flight planned by the American space agency, NASA. The 151/2-day voyage will investigate ultra-violet light streaming from stars and quasars near the edge of the universe. "See you back on Earth", astronaut Tamara Jernigan said before boarding." [*The Daily Telegraph*, 3rd March 1995]

5: "Washington. The space agency has begun a competition within the aerospace

industry to design and build a new family of reusable rockets that would eventually replace the space shuttle and other satellite launchers. The new generation of rockets would be owned and operated by private industry. The government and other customers would pay to use them when they needed to launch satellites or other cargoes. 'This concept represents a real transition to the next phase of space flight,' said John Logsdon, director of George Washington University's Space Policy Institute. 'It's certainly the next step beyond the shuttle for routine and affordable access to space'. " [*The International Herald Tribune*, 13th March 1995]

6: "Unlike NASA, a private company would be highly motivated to cut unnecessary costs - meaning the loss of thousands of jobs on the shuttle programme. But Newt Gingrich, the powerful right-wing Speaker of the House of Representatives, is already trying to force the issue. 'The shuttle should be contracted out,' he said, 'If you look at the private airline model of efficiency, and then you look at the way we currently design space products, it is irrational and it stops us getting into space.' [*New Scientist*, 25th March 1995]

7: "Goldin [the man who has run NASA since 1992] is adamant that a human presence in space is necessary to prepare for a crewed mission to Mars early next century. The first step is the international space station lAIpha] which will be in orbit and almost completed by 2000. "The purpose of the station is to figure out how people can live and work together in space. It's a cultural issue as well as a technological one...

Eventually new technologies will make crewed missions to other planets much easier. "We have plenty of time to get to Mars," says a confident Goldin. The previous NASA administration had wanted to start in 1989 and launch in 2004. But Goldin maintains that this was always unrealistic. He prefers to wait until the technology arrives that will allow NASA scientists to plan and launch over a shorter timescale. The next feasible launch date occurs in 2018. He says NASA will not need to start planning until 2010." [*New Scientist*, 24 June 1995]

## DISCUSSION POINTS 6 NASA: THE FUTURE

- Using these newspaper articles as source material, do you believe the American space programme has an optimistic or a pessimistic future?

- In Paragraph 1, "Washington's lawmakers" are quoted as wishing to push finding towards more "down-to-earth" research. What do you think they mean by this? What do you think their attitude would be towards the sort of research hinted at in Paragraph 4?

- Does the cost of the mission announced in Paragraph 3 seem large or small? Why

is this significant?

- What is the significance of NASA hosting a competition for the design of a new spacecraft (Paragraph 5)? Do you think they hosted competitions in the heady days of the Apollo Project?

- What is the significance of NASA co-operating with private industry (Paragraphs 5 and 6)? Do you think this step will help or damage the space programme?

- Do you believe space flight will ever become a cheap and easy means of transport? What are the technical and social problems we have yet to overcome to make this dream a reality?

- Find out about the planned ‘Alpha’ international space station which has superseded the planned American space station ‘Freedom’. What ‘earthly’ considerations do you think may be shaping this project in addition to its scientific and exploratory objectives?