USA and the Wider World
The Moon Landing 1969
Reasons for the Space Race

• USA and USSR involved in a ‘Cold War’
• USA and USSR involved in the ‘Arms Race’ (including Nuclear Missiles)
• Technology developed in Space Race could be used in Arms Race (rockets to carry missiles, computers, satellites for communication and spying etc...)
• Technology developed in Space Race could have applications in industry
• Propaganda (both USA and USSR wanted to show they had superior ideology, political and economic system, education system, superior scientific and technological research)
Victories for Russia in Space Race

- 1957 Sputnik-1\textsuperscript{st} satellite into space
- 1957 Sputnik II (with Laika the dog-nicknamed ‘Muttnik’)
- 1960 unmanned spacecraft ‘lands’ on the moon
- Yuri Gagarin becomes the 1\textsuperscript{st} man in space 1961 and to orbit the Earth in Vostok I
- 1964 Valentina Tereshkova becomes the 1\textsuperscript{st} woman in space and to orbit the Earth in Vostok 6
- 1965 Alexei Leonov 1\textsuperscript{st} spacewalk for 12 minutes in Voskhod 2
Sputnik I
SOVIET FIRES NEW SATELLITE, CARRYING DOG; HALF-TON SPHERE IS REPORTED 900 MILES UP

Zhukov Ousted From Party Jobs; Konev Condemns Him
Yuri Gagarin
Valentina Tereshkova
The USA and the Space Race in the 1950s and early 1960s

- 1958 President Eisenhower sets up NASA
- 1958 1\textsuperscript{st} US satellite launched (Explorer)
- 1961 JFK pledges that USA would put man on the moon before the end of the decade
- 1961 Alan Shephard becomes the 1\textsuperscript{st} American in space (Mercury Project)
- 1962 John Glenn orbits the Earth 3 times (Freedom or Friendship??? 7)
- 1964 unmanned Ranger 7 sends back photos before crashing into the moon
- US spending about $5billion a year in 1960s on its space program
- Americans also sent monkeys and chimpanzees into space
Animals in Space

• November 3 1957 USSR launch a dog called ‘Laika’ into space in Sputnik II (nicknamed ‘Muttnik’ by the Americans)
• Laika died 2 days into flight due to heat and stress
• Dec 13 1958 US launched a test rocket with a squirrel monkey called ‘Gordo’ aboard [Jupiter project]
• Gordo died when his rocket plunged into the Atlantic Ocean after 15 minute flight
• August 1960 Russians sent 2 dogs ‘Belka’ and ‘Strelka’ into space for a day on Sputnik 5
• January 31 1961 US send a chimpanzee called ‘Ham’ into orbit [Mercury Project]
• Ham safely returned to Earth (died in 1983)
Russian Space Exploration in the 1960s

- Gagarin 1st man in Space 1961
- Fell behind US in early 1960s (USSR investing less money than USA in their Space Program)
- 1964 Kruschev’s successors less enthusiastic about Space Program
- Russians facing technical problems developing a craft able to land men on the moon
- 1967 Russian cosmonaut Colonel Komanov died in crash returning to Earth (Soyuz)
- Russians start sending unmanned craft into space
The Gemini Project

- 10 manned missions to space between 1963 and 1966
- Space Walks
- ‘Soft Landings’ on the moon by unmanned spacecraft
- Photographs taken of possible landing sites on the moon
- Gemini 8 tested docking of 2 spacecraft in space
TIME

RACE FOR THE MOON
Landing on the moon, the Apollo Program
Apollo Missions 1 to 10

- Apollo Project aimed to land astronauts on the moon
- 10 missions between ???? And ????
- Apollo 1: 3 astronauts died in fire while testing the command module (on Earth)
- Apollo 4, 5, 6: test of booster rockets/lunar module (unmanned missions)
- Apollo 7: 1st manned rocket-3 astronauts killed?????
- Apollo 8: 1st manned orbit of the moon
- Apollo 9: tested docking the lunar and command modules
- Apollo 10: tested lunar module (flew to 5km from moon and then rejoined the command module)
- 1965 Werner Von Braun developed the Saturn V rocket to bring modules to the moon
Problems with landing on the moon

• Building a rocket to bring spacecraft out of the Earth’s atmosphere
• Getting a spacecraft to the moon (250,000 miles from the Earth) [384,000 km]
• Designing a spacecraft that could keep astronauts alive for the length of the journey to the moon and back (life-support systems)
• Getting spacecrafts to dock in space
• Designing a lunar module to land on the moon and return astronauts to the command module
• Designing spacecraft and spacesuits that could cope with high and low temperatures (on moon temperature ranged from -162°C to +121°C)
The crew of Apollo 11

- Neil Armstrong (Commander of the mission)
- Edwin ‘Buzz’ Aldrin (Pilot of the Lunar Module)
- Michael Collins (Pilot of the Command Module)
The Apollo 11 spacecraft
Components of the Apollo 11 Spacecraft

• 3 booster Rockets [Saturn V] (to get the Service, Command, and Lunar Modules out of earth’s atmosphere and into the moon’s orbit)

• Lunar Module [the Eagle] (to land on the moon: had scientific instruments and ladder)

• Command Module [Columbia] (to orbit the moon and return to earth)

• Service Module (rockets to help Command Module return to earth)
Diagram showing the Command Module and the Service Module
Command Module attached to Service Module
Command Module
Lunar Module
APOLLO CSM & LM COMPARISON

CSM

LM
The Command/Service Modules and the Lunar Module before docking
Model showing the Lunar Module after docking with the Command/Service Modules
MOON AT EARTH LANDING

ENTRY & LANDING

CM/SM SEPARATION

EARTH ORBIT

TRANSLUNAR INJECTION

TRANPOSITION & DOCKING

MOON AT EARTH LAUNCH

TRANSEARTH INJECTION

MIDCOURSE CORRECTIONS

DESCENT, ASCENT & RENDEZVOUS

LUNAR ORBIT INSERTION

APOLLO LUNAR MISSION
The launch

• 400,000 people involved in preparations for Apollo 11 mission
• Apollo 11 launched from Kennedy Space Center in Florida on 16 July 1969
• Launch watched by millions around the world on TV
Travelling to the moon

- Images of astronauts and of their view from the spacecraft were broadcast live on TV
- Astronauts ate freeze dried food (peaches, bacon strips, coffee, orange juice, beef stew, chicken, salmon)
- Travelled at speed of 25,000 mph
- Astronauts began their orbit of the moon on 19 July
Landing on the moon

- Lunar module (with 2 astronauts) landed on the moon on 20 July
- Landing site was in the ‘Sea of Tranquillity’
- Moon landing watched live on TV by about 600 million people
- Astronauts wore protective space suits with air supply because moon does not have an atmosphere and has a lower gravity than the Earth
- Armstrong the 1st man to set foot on the moon
- ‘One small step for [a] man, one giant leap for mankind’
Work on the moon, artefacts, experiments etc...

- Astronauts spent 20 hours on the moon
- Collected rock samples
- Conducted scientific experiments
- Planted an American flag on the surface of the moon
- Put a plaque marking the event on the moon
Returning to the Earth

• On 22 July the Lunar Module took off from the moon and docked with the Command/Service Module

• Command Module begins return journey to Earth
Begin Earth Return

CM-SM Separation

Skip Entry Interface

Skip Exit Interface

Entry Interface

Atmospheric Entry

Skip Entry

Drogues Separate Prior to Extracting Mains

Drogue Parachute Deployment

Parachute Descent

Main Parachute Deployment

Final Descent

Heatshield Separation

Rocket Ignition

Airbag Inflation

Touchdown

Touchdown

Splash down
Landing on Earth

• On 24 July Splash down of the Command Module in the Pacific Ocean
• Parachutes used to slow it down
• USS Hornet warship collects astronauts
Welcome and Quarantine

• 3 astronauts placed in a quarantine chamber for 21 days (in case they were carrying viruses or bacteria from the moon)

• Welcomed by President Nixon
Speeches/parades etc...

• 13 August astronauts emerged of quarantine to cheering crowds
• Parades held in US cities to honour the astronauts
• Official State Dinner in Los Angeles to celebrate Apollo 11 with members of Congress, 44 Governors, The Chief Justice and 83 foreign ambassadors
• Astronauts presented with ‘Presidential Medal of Freedom’ by President Nixon and Vice President Spiro T. Agnew
• Astronauts embark on 45 day ‘Giant Leap’ tour of 25 countries (met many world leaders including Elizabeth II and the Pope)
World Reaction to Moon Landing

- Astronauts visited 24 countries in 45 days
- Massive media coverage of the story in many countries
- Many countries issued commemorative stamps and coins
- Moon landing story played down by Russia
- Moon landing story ignored by China, North Vietnam and North Korea
Man lands on the moon with perfect touchdown

It looks like a collection of about every kind of rock, Armstrong says

Nixon says feat will stand through the centuries

Senator Edward Kennedy faces death crash charges
THE FIRST FOOTSTEP

Man's first footstep on the moon — a reconstruction of the historic moment.

Human footsteps crunch noiselessly on lunar soil — never to be erased for perhaps a million years.

One of two brave men gazes at this alien world through gold visors with almost unbelieving eyes. No wind, no rain, no sounds shatter the eerie silence. They are there!

Since time flowed, man has gazed at the moon and wondered. Neil Armstrong and Edwin Aldrin today are the first to touch it.

And as TV screens glow 210,000 miles away, the watching earth pauses in its moment of destiny...

More moon colour on centre and back pages
Appollo Missions 12-17

- 12 Crew collected soil and rock samples
- 13 Crew forced to turn back after oxygen tank exploded
- 14 Alan Shephard plays golf on the moon
- 15 1st mission with Lunar ‘Rover’ vehicle (3 days on moon)
- 16 1st landing in lunar highlands
- 17 Final Apollo lunar mission, first night launch, only mission with a professional geologist.
The end of the Appollo Program

• Aim of landing on the moon had been achieved
• Moon Landing program had cost USA $27billion
• So after 1972 NASA switched focus to other aspects of space exploration
Space exploration in the 1970s

• In 1970s USA sent unmanned flights to Jupiter, Mars, Mercury, Venus (and in the 1980s to Saturn)

• In 1973 USA launched the SKYLAB space station to conduct experiments
The Shuttle Program

- Shuttle was to be a re-usable spacecraft
- 1977 Enterprise tested
- 1981 Columbia became 1\(^{st}\) shuttle to fly in space
- 1986 Challenger exploded shortly after launch (7 killed)
- 2003 Columbia exploded on re-entry (7 killed)
Challenger Explosion
Columbia Crew
Space exploration and the Arms Race

• USA and USSR both developed spy satellites
• Computers and technology developed in space programs could have military applications also
Scientific and technological research done as part of space exploration programs have had applications in other areas also

- Telecommunications technology (TV, telephone) and weather information now use satellites
- Hole in the ozone layer confirmed by photos and experiments done in space
- Research done in the space exploration program has also helped in the development of medical technology: e.g. tiny cameras, hearing aids, voice controlled technology (e.g. Wheelchairs), insulating material used in fuel tanks was adapted for use in hospital beds to help prevent bed sores
- Cushioning and ventilation in sports footwear
- Silicon chips used in cars, computers washing machines etc...
- [Some people argue that these technological advances would have been achieved anyway and perhaps more cheaply than as spin-offs of space exploration programmes]
Conspiracy theories
Reasons conspiracy theorists give for saying the moon landing was faked.

• Flag should not fluttering as there is no breeze on the moon.
• This is explained by the fact that astronauts had to twist the poles to get them into the ground and this had a rippling effect on the flag.
• Shadows point in different directions (they explain this by the lights in a film studio)
• This can be explained by the uneven surface of the moon.
• No stars visible in the photographs of the astronauts on the moon.
• This can be explained by the fact that during the lunar day it is too bright to see the stars.
Moon Landing Conspiracy Theories and movies

• In the 1978 film ‘Capricorn One’ NASA attempt to fake a landing on Mars

• In the 1971 James Bond movie ‘Diamonds Are Forever’ there is a sequence where astronauts are being trained on a ‘moon like’ set. Bond steals what looks like a moon buggy from the model set and uses it to escape from the compound

• These movies may have fuelled conspiracy theories about the moon landing being faked in a movie studio.
The lives of the crew of Apollo 11 after the moon landing

- Neil Armstrong became a university professor and chairman of a computer company but rarely spoke publicly about his experiences as part of Apollo 11
- Edwin ‘Buzz’ Aldrin had a nervous breakdown, recovered from it and became a university professor
- Michael Collins wrote a book about his experience and became a business executive
Contextualisation questions

• Why was there a ‘Space Race’ between the USA and the USSR?
• Why did the Space Race develop and why is it generally considered that the USA won?
• To what extent did the Cold War influence US policy on space exploration?
• What major advances in space exploration had the US made before July 1969?
• Why was the moon landing such a major achievement for the United States?
• How and why did the Americans succeed in landing on the moon in 1969?
• How was it possible for the USA to achieve the moon landing in 1969?
• What was the significance of the moon landing of July 1969?
• What impact did the Apollo 11 moon landing have on the Cold War between the USA and the USSR?
• Was it worth spending between 25 to 40 billion dollars on the moon landing project?
• To what extent can the moon landing in 1969 be seen both as a major advance in technology and a statement of American foreign policy?