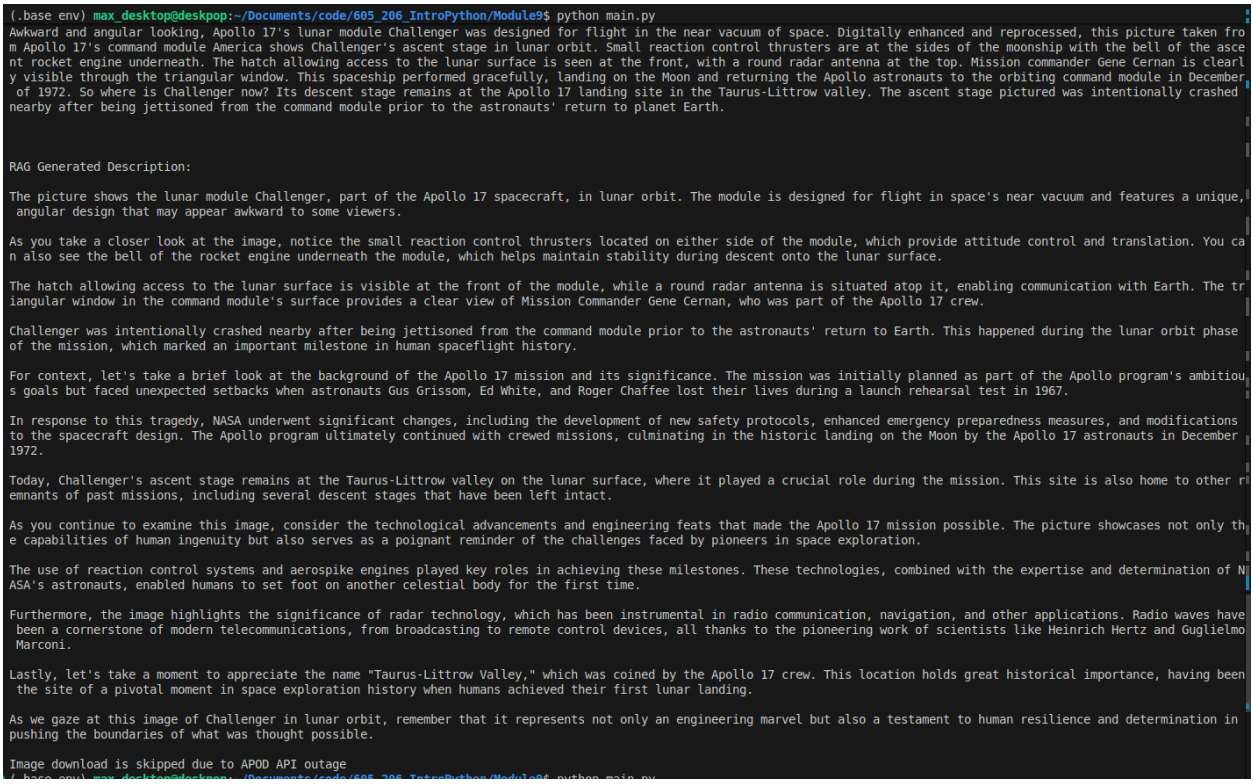
main.py

Terminal output



results.txt

505_206_IntroPython > Module9 > results.txt

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Original APOD Image Information:

Awkward and angular looking, Apollo 17's lunar module Challenger was designed for flight in the near vacuum of space. Digitally enhanced and reprocessed, this picture taken from Apollo 17's command module America shows Challenger's ascent stage in lunar orbit. Small reaction control thrusters are at the sides of the moonship with the bell of the ascent rocket engine underneath. The hatch allowing access to the lunar surface is seen at the front, with a round radar antenna at the top. Mission commander Gene Cernan is clearly visible through the triangular window. This spaceship performed gracefully, landing on the Moon and returning the Apollo astronauts to the orbiting command module in December of 1972. So where is Challenger now? Its descent stage remains at the Apollo 17 landing site in the Taurus-Littrow valley. The ascent stage pictured was intentionally crashed nearby after being jettisoned from the command module prior to the astronauts' return to planet Earth.

Additional Search Terms:
• 'Apollo 17'
• 'Lunar Module'
• 'Challenger'
• 'Reaction Control Thrusters'
• 'Ascent Stage'
• 'Bell of Rocket Engine'
• 'Radar Antenna'
• 'Lunar Surface Access Hatch'
• 'Taurus-Littrow Valley'

Searching Wikipedia for ''Apollo_17''...
Summary of 'Apollo 17': Apollo 1, initially designated AS-204, was planned to be the first crewed mission of the Apollo program, the American undertaking to land the first man on the Moon. It was planned to launch on February 21, 1967, as the first low Earth orbital test of the Apollo command and service module. The mission never flew; a cabin fire during a launch rehearsal test at Cape Kennedy Air Force Station Launch Complex 34 on January 27 killed all three crew members—Command Pilot Gus Grissom, Senior Pilot Ed White, and Pilot Roger B. Chaffee—and destroyed the command module (CM). The name Apollo 1, chosen by the crew, was made official by NASA in their honor after the fire.
Immediately after the fire, NASA convened an Accident Review Board to determine the cause of the fire, and both chambers of the United States Congress conducted their own committee inquiries to oversee NASA's investigation. The ignition source of the fire was determined to be electrical, and the fire spread rapidly due to combustible nylon material and the high-pressure pure oxygen cabin atmosphere. Rescue was prevented by the plug door hatch, which could not be opened against the internal pressure of the cabin. Because the rocket was unfueled, the test had not been considered hazardous, and emergency preparedness for it was poor.
During the Congressional investigation, Senator Walter Mondale publicly revealed a NASA internal document citing problems with prime Apollo contractor North American Aviation, which became known as the Phillips Report. This disclosure embarrassed NASA Administrator James E. Webb, who was unaware of the document's existence, and attracted controversy to the Apollo program. Despite congressional displeasure at NASA's lack of openness, both congressional committees ruled that the issues raised in the report had no bearing on the accident.
Crewed Apollo flights were suspended for twenty months while the command module's hazards were
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20  Crewed Apollo flights were suspended for twenty months while the command module's hazards were
    addressed. However, the development and uncrewed testing of the lunar module (LM) and Saturn V rocket
    continued. The Saturn IB launch vehicle for Apollo 1, AS-204, was used for the first LM test flight,
    Apollo 5. The first successful crewed Apollo mission was flown by Apollo 1's backup crew on Apollo 7
    in October 1968.
21  Searching Wikipedia for ''Lunar_Module''...
22  Summary of 'Apollo Lunar Module': The Apollo Lunar Module (LM ), originally designated the Lunar
    Excursion Module (LEM), was the lunar lander spacecraft that was flown between lunar orbit and the
    Moon's surface during the United States' Apollo program. It was the first crewed spacecraft to
    operate exclusively in space, and remains the only crewed vehicle to land anywhere beyond Earth.
23  Structurally and aerodynamically incapable of flight through Earth's atmosphere, the two-stage Lunar
    Module was ferried to lunar orbit attached to the Apollo command and service module (CSM), about
    twice its mass. Its crew of two flew the Lunar Module from lunar orbit to the Moon's surface. During
    takeoff, the spent descent stage was used as a launch pad for the ascent stage which then flew back
    to the command module, after which it was also discarded.
24  Overseen by Grumman, the LM's development was plagued with problems that delayed its first uncrewed
    flight by about ten months and its first crewed flight by about three months. Regardless, the LM
    became the most reliable component of the Apollo–Saturn space vehicle.  The total cost of the LM for
    development and the units produced was $21.65 billion in 2016 dollars, adjusting from a nominal total
    of $2.29 billion using the NASA New Start Inflation Indices.
25  Ten Lunar Modules were launched into space. Of these, six were landed by humans on the Moon from 1969
    to 1972. The first two flown were tests in low Earth orbit: Apollo 5, without a crew; and Apollo 9
    with a crew.  A third test flight in low lunar orbit was Apollo 10, a dress rehearsal for the first
    landing, conducted on Apollo 11. The Apollo 13 Lunar Module functioned as a lifeboat to provide life
    support and propulsion to keep the crew alive for the trip home, when their CSM was disabled by an
    oxygen tank explosion en route to the Moon.
26  The six landed descent stages remain at their landing sites; their corresponding ascent stages
    crashed into the Moon following use. One ascent stage (Apollo 10's Snoopy) was discarded in a
    heliocentric orbit after its descent stage was discarded in lunar orbit. The other three LMs were
    destroyed during controlled re-entry in the Earth's atmosphere: the four stages of Apollo 5 and
    Apollo 9 each re-entered separately, while Apollo 13's Aquarius re-entered as a unit.
27
28  Searching Wikipedia for ''Challenger''...
29  An issue occurred retrieving information for 'Challenger'
30  Searching Wikipedia for ''Reaction_Control_Thrusters''...
31  Summary of 'Reaction control system': A reaction control system (RCS) is a spacecraft system that
    uses thrusters to provide attitude control and translation. Alternatively, reaction wheels can be
    used for attitude control, rather than RCS. Use of diverted engine thrust to provide stable attitude
    control of a short-or-vertical takeoff and landing aircraft below conventional winged flight speeds,
    such as with the Harrier "jump jet", may also be referred to as a reaction control system.
32  Reaction control systems are capable of providing small amounts of thrust in any desired direction or
    combination of directions. An RCS is also capable of providing torque to allow control of rotation
    (roll, pitch, and yaw).
33  Reaction control systems often use combinations of large and small (vernier) thrusters, to allow
    different levels of response.
34  Searching Wikipedia for ''Ascent_Stage''...
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    Apollo 9 each re-entered separately, while Apollo 13's Aquarius re-entered as a unit.
40
41  Searching Wikipedia for ''Bell_of_Rocket_Engine''...
42  Summary of 'Aerospike engine': The aerospike engine is a type of rocket engine that maintains its
    aerodynamic efficiency across a wide range of altitudes. It belongs to the class of altitude
    compensating nozzle engines. Aerospike engines were proposed for many single-stage-to-orbit (SSTO)
    designs. They were a contender for the Space Shuttle main engine. However, as of 2023 no such engine
    was in commercial production, although some large-scale aerospikes were in testing phases.
43  The term aerospike was originally used for a truncated plug nozzle with a rough conical taper and
    some gas injection, forming an "air spike" to help make up for the absence of the plug tail. However,
    a full-length plug nozzle may also be called an aerospike.
44  Searching Wikipedia for ''Radar_Antenna''...
45  Summary of 'Radar': Radio is the technology of communicating using radio waves. Radio waves are
    electromagnetic waves of frequency between 3 hertz (Hz) and 300 gigahertz (GHz). They are generated
    by an electronic device called a transmitter connected to an antenna which radiates the waves. They
    can be received by other antennas connected to a radio receiver; this is the fundamental principle of
    radio communication. In addition to communication, radio is used for radar, radio navigation, remote
    control, remote sensing, and other applications.
46  In radio communication, used in radio and television broadcasting, cell phones, two-way radios,
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46  In radio communication, used in radio and television broadcasting, cell phones, two-way radios,
    wireless networking, and satellite communication, among numerous other uses, radio waves are used to
    carry information across space from a transmitter to a receiver, by modulating the radio signal
    (impressing an information signal on the radio wave by varying some aspect of the wave) in the
    transmitter. In radar, used to locate and track objects like aircraft, ships, spacecraft and
    missiles, a beam of radio waves emitted by a radar transmitter reflects off the target object, and
    the reflected waves reveal the object's location to a receiver that is typically colocated with the
    transmitter. In radio navigation systems such as GPS and VOR, a mobile navigation instrument receives
    radio signals from multiple navigational radio beacons whose position is known, and by precisely
    measuring the arrival time of the radio waves the receiver can calculate its position on Earth. In
    wireless radio remote control devices like drones, garage door openers, and keyless entry systems,
    radio signals transmitted from a controller device control the actions of a remote device.
47  The existence of radio waves was first proven by German physicist Heinrich Hertz on 11 November 1886.
    In the mid-1890s, building on techniques physicists were using to study electromagnetic waves,
    Italian physicist Guglielmo Marconi developed the first apparatus for long-distance radio
    communication, sending a wireless Morse Code message to a recipient over a kilometer away in 1895,
    and the first transatlantic signal on 12 December 1901.  The first commercial radio broadcast was
    transmitted on 2 November 1920, when the live returns of the 1920 United States presidential election
    were broadcast by Westinghouse Electric and Manufacturing Company in Pittsburgh, under the call sign
    KDKA.
48  The emission of radio waves is regulated by law, coordinated by the International Telecommunication
    Union (ITU), which allocates frequency bands in the radio spectrum for various uses.
49
50  Searching Wikipedia for ''Lunar_Surface_Access_Hatch''...
51  Summary of 'Altair (spacecraft)': The Altair spacecraft, previously known as the Lunar Surface Access
    Module or LSAM, was the planned lander spacecraft component of NASA's cancelled Constellation
    program. Astronauts would have used the spacecraft for landings on the Moon, which was intended to
    begin around 2019. The Altair spacecraft was planned to be used both for lunar sortie and lunar
    outpost missions.
52  On February 1, 2010, U.S. President Barack Obama announced a proposal to cancel the Constellation
    program (except the Orion spacecraft), to be replaced with a re-scoped program, effective with the U.
    S. 2011 fiscal year budget.
53  Searching Wikipedia for ''Taurus-Littrow_Valley''...
54  Summary of 'Taurus–Littrow': Taurus–Littrow is a lunar valley located on the near side at the
    coordinates 20.0°N 31.0°E / 20.0; 31.0. It served as the landing site for the American Apollo 17
    mission in December 1972, the last crewed mission to the Moon. The valley is located on the
    southeastern edge of Mare Serenitatis along a ring of mountains formed between 3.8 and 3.9 billion
    years ago when a large object impacted the Moon, forming the Serenitatis basin and pushing rock
    outward and upward.
55  Taurus–Littrow is located in the Taurus mountain range and south of Littrow crater, features from
    which the valley received its name. The valley's name, coined by the Apollo 17 crew, was approved by
    the International Astronomical Union in 1973.
56  Data collected during Apollo 17 indicate that the valley is composed primarily of feldspar-rich
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Data collected during Apollo 17 indicate that the valley is composed primarily of feldspar-rich breccia in the large massifs surrounding the valley and basalt underlying the valley floor, covered by an unconsolidated layer of mixed material formed by various geologic events. Taurus–Littrow was selected as the Apollo 17 landing site with the objectives of sampling highland material and young volcanic material at the same location.

RAG Generated Description:

The picture shows the lunar module Challenger, part of the Apollo 17 spacecraft, in lunar orbit. The module is designed for flight in space's near vacuum and features a unique, angular design that may appear awkward to some viewers.

As you take a closer look at the image, notice the small reaction control thrusters located on either side of the module, which provide attitude control and translation. You can also see the bell of the rocket engine underneath the module, which helps maintain stability during descent onto the lunar surface.

The hatch allowing access to the lunar surface is visible at the front of the module, while a round radar antenna is situated atop it, enabling communication with Earth. The triangular window in the command module's surface provides a clear view of Mission Commander Gene Cernan, who was part of the Apollo 17 crew.

Challenger was intentionally crashed nearby after being jettisoned from the command module prior to the astronauts' return to Earth. This happened during the lunar orbit phase of the mission, which marked an important milestone in human spaceflight history.

For context, let's take a brief look at the background of the Apollo 17 mission and its significance. The mission was initially planned as part of the Apollo program's ambitious goals but faced unexpected setbacks when astronauts Gus Grissom, Ed White, and Roger Chaffee lost their lives during a launch rehearsal test in 1967.

In response to this tragedy, NASA underwent significant changes, including the development of new safety protocols, enhanced emergency preparedness measures, and modifications to the spacecraft design. The Apollo program ultimately continued with crewed missions, culminating in the historic landing on the Moon by the Apollo 17 astronauts in December 1972.

Today, Challenger's ascent stage remains at the Taurus-Littrow valley on the lunar surface, where it played a crucial role during the mission. This site is also home to other remnants of past missions, including several descent stages that have been left intact.

As you continue to examine this image, consider the technological advancements and engineering feats that made the Apollo 17 mission possible. The picture showcases not only the capabilities of human ingenuity but also serves as a poignant reminder of the challenges faced by pioneers in space exploration.

The use of reaction control systems and aerospike engines played key roles in achieving these milestones. These technologies, combined with the expertise and determination of NASA's astronauts,

The use of reaction control systems and aerospike engines played key roles in achieving these milestones. These technologies, combined with the expertise and determination of NASA's astronauts, enabled humans to set foot on another celestial body for the first time.

Furthermore, the image highlights the significance of radar technology, which has been instrumental in radio communication, navigation, and other applications. Radio waves have been a cornerstone of modern telecommunications, from broadcasting to remote control devices, all thanks to the pioneering work of scientists like Heinrich Hertz and Guglielmo Marconi.

Lastly, let's take a moment to appreciate the name "Taurus-Littrow Valley," which was coined by the Apollo 17 crew. This location holds great historical importance, having been the site of a pivotal moment in space exploration history when humans achieved their first lunar landing.

As we gaze at this image of Challenger in lunar orbit, remember that it represents not only an engineering marvel but also a testament to human resilience and determination in pushing the boundaries of what was thought possible.

Link to this photo:
Image download is skipped due to APOD API outage