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Apollo 17:
down in the valley

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Y THE TIME OF DEPARTURE from the Moon on December

14, the final Apollo mission looked like becoming the
most undramatic operationally but the most reward-
ing scientifically. These points tend to support the public attitude that Moon exploration has become routine, but also illustrate the achievement of perfecting a system expanded well beyond its original requirements. Each mission has had its own particular significant feature and Apollo 17 seems to have gained its notoriety through the astronauts' sleep, or excess of it—perhaps fitting for a journey to the edge of the Sea of Serenity.
The departure from Earth orbit at 0846 GMT on Decem-ber 7 was 2hr 32min behind schedule, but with a slight gain on the 2hr 40min launch delay. The delay was caused by low fuel-tank pressure in the S.IVB which resulted in a break-off in countdown 30sec before lift-off. The late launch necessitated a slightly early lunar-trajectory injection burn to compensate for the Earth's rotation.
The first 5hr of the mission appeared the most ominous because of the recurring squeal of the main defect-alarm signal, until it was decided that the alarm was itself defective. At the end of this period the fault appeared to cure itself. The crew were also treated to a sparkling snow-storm effect outside the cabin, and this was concluded to be paint particles flaking off the S.IVB stage.
The transposition and docking presented Apollo 17 with no difficulties, but one of the 12 locking catches failed to secure properly. Mission controllers were not, however, unduly concerned about this and, to prevent any risk of it affecting the remaining docking operations, mission commander Eugene Cernan was later to push it fully open again.
The first course correction, after 6hr, was a lsec burn of the main engine which was also accurate enough to become the last. From there on the the saga of Apollo 17 became a human one. Cernan began complaining of gastric pains and, although these continued for half the flight, he maintained that they were not severe enough to affect his performance. Lunar module pilot Harrison (Jack) Schmitt had a headache.

Throughout the Apollo programme Nasa has encouraged the use of sleeping pills to ensure that the astronauts, tense, apprehensive and cramped, still had enough rest. The Apollo 17 astronauts were no exception but, following the second night, they overslept despite strenuous attempts to wake them.
One crew member is required to wear earphones so that the sleeping crew can be alerted or woken up. Ron Evans, the command module pilot, was on watch that night. Mission controllers allowed an extra lOmin sleep before transmitting stentorian music across 200,000 miles of space and into a pair of earphones, where it played unheeded. Repeat performances at higher volume, accompanied by

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voice calls, were in vain. Discordant klaxons, sirens and spacecraft alarms were added to the orchestration and the astronauts' pulse rates never flickered.
Mission control was not unduly concerned. "We're just going to keep sending a wake-up call every lOmin and eventually we may get these sleepyheads awake." The tiny capsule, reverberating with the cacophony, sped on through space for another l^hr before Evans awoke to find warn-ing lights overheating with the exertion. "How are you up there?" inquired capsule communicator Gordon Fullerton. "We're asleep," replied Cernan.
The situation arose largely because the volume control on Evans's headset had accidentally been switched too low. All three crewmen, however, had slept unusually heavily and considerably longer than any previous US astronauts. They continued to complain of drowsiness for several hours afterwards.
At 1936 GMT on December 10 communication was lost as the spacecraft swung round behind the Moon. Recovery of contact 23min later was slightly delayed by a brief fault in the ground receiving equipment. Cernan reported that the 6-5min burn of the main engine, exactly back on the original schedule at 1948 GMT, had been perfect. The burn had reduced the speed by 2,032 m.p.h. to orbital velocity of 3,751 m.p.h. The spacecraft was now in an elliptical orbit ranging from 58 miles, 94km to 196 miles, 316km above the surface. At 2014 GMT, as Apollo 17 made its first pass across the front of the Moon, the S.IVB crashed into the surface about 230 miles behind them and some 200 miles from the Apollo 14 site, producing a crater about 130ft in diameter.

Following the second time round the back of the Moon Schmitt reported seeing a brief flash of light on the darkened surface. Scientists were unable to distinguish any associated vibrations, particularly as the Moon was still reverberating from the S.IVB impact.
Preparations for landing were marred only by a report of a minor fault detected by mission control. A pressure-triggered switch controlling a heater in one of the hydrogen tanks for the fuel cells was operating too rapidly. The fault was rapidly corrected.

New approach to landing

A new descent procedure was adopted for this landing. On the third time round the main engine was fired again for descent-orbit insertion. The 23sec burn, shorter than that of Apollo 16, produced an orbit of 15-5 miles X 68 miles, 25km X 109km. The Apollo 16 perilune (lowest point) was about 10 miles.

The change was introduced in response to the problem with the Apollo 16 guidance system. The lower perilune was considered too critical in the event of a guidance fault or slightly inaccurate engine burn. The higher perilune also allows re-acquisition of signal some 3min earlier.
This operation required major adjustments to the whole landing pattern. On the 12th orbit, after separation from the lunar module Challenger, the command module America fired itself normally back up to an. orbit of 62 miles X 81 miles, 100km X 130km. Five minutes later the reaction-control system on Challenger was fired for 27sec to lower its perilune to 8 miles, 12 • 9km.
The side benefits included a small saving of fuel for the CSM, while the RCS burn reduced Challenger's weight by about 401b, permitting a possible 3-5see extra hover time over the landing site. This procedure also moved the perilune about 10° west of landing site, whereas the Apollo 16 perilune had been about 16° east of the site. The result was that the descent burn began while Challenger, heading westward, was still descending.
The Apollo 17 lunar module touched down heavily a few seconds late at 1955 GMT on December 11, with one leg about a third of the way into a small crater. Mission control was more concerned about the heavy landing. Cernan responded: "You said shut down and I shut down and we dropped, didn't we?"
The landing site is in the middle of a valley about eight miles wide bounded by hills to the north, south, and east,