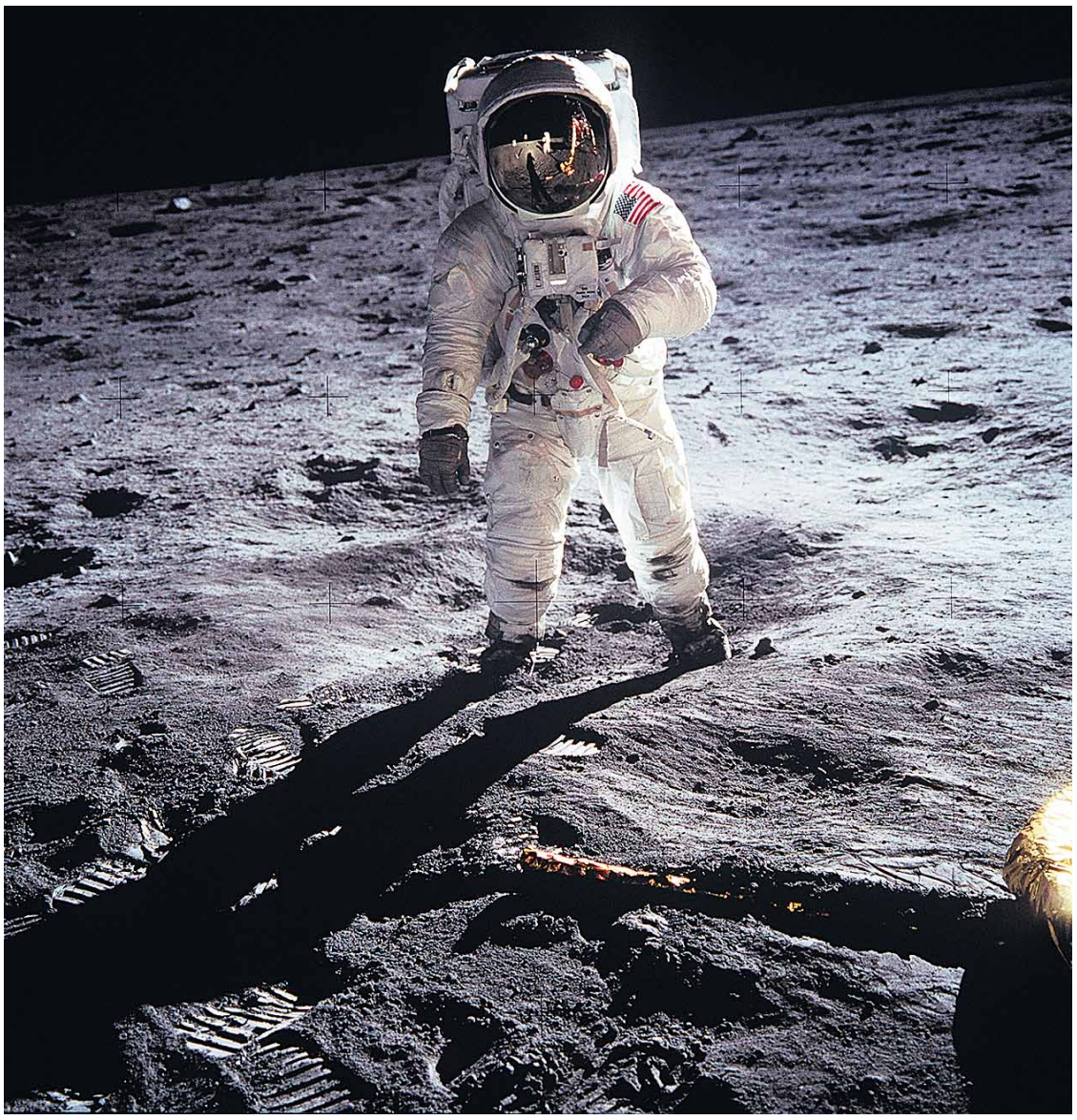
MOON SOUVENIR EDITION

EVENT HORIZON

ISBN 978-0-9806922-2-8 THURSDAY, 20 MAY, 2010 50 CENTS

BEYOND WHAT LIES BEYOND

By **MARK FEARY**



COURTESY NASA

20 JULY 1969 Astronaut Edwin E Aldrin Jr, lunar module pilot, walks on the surface of the Moon near the leg of the Lunar Module 'Eagle' during the Apollo 11 extravehicular activity

VISUAL PERCEPTION is the enabler of what we comprehend, yet possibly also its major inhibitor, insofar as we inherently trust and believe in what we visually see at the expense of what we cannot. It is perhaps of little wonder that for a significant part of humankind's existence the horizon was an end point in itself, representing as was determinedly believed, the outer parameter of our existence, the edge of the Earth, literally being the end of the flat plane upon which life existed.

The Soviet Space Program initiated a gargantuan shift in humankind's quest to extend the parameters of our habitation. Their pioneering early missions thrust into space the first intercontinental missile, satellite, animal, and then in 1961, much to the ire of the United States, the first human. These crucial developments laid the foundation for the ensuing 'space race' which would lead the USA through the National Aeronautics and Space Administration or NASA as it is more commonly known, to successfully land a manned mission on the Moon. These well-documented missions consolidated the foundation upon which broader perspectives of our existence have developed, as the science fiction of yesterday began to shape the reality of our future.

It could be suggested that in the subsequent decades following humankind's trajectory into space, we have become largely apathetic of these possibilities. Confoundingly, as we have extended our reach into space modern astrophysics has advanced thought on the actual size of the environment within which our solar system exists. Indeed, even as various probes extend into space, research indicates that the universe is in a sustained and continual process of expansion. With this we are getting incrementally further and further away from ascertaining the actual parameters of our wider environment.

Cosmonaut Major Yuri Gagarin was the first human to enter space in the Soviet vessel Vostok 1 on 12 April 1961. In response to what was undeniably a significant victory for the Soviets, the government of the United States responded by extending the racetrack. On 25 May 1961, then President John F Kennedy announced his support for the Apollo program as part of a special address to a joint session of Congress, stating 'I believe that 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 the Earth. No single space project in this period will be more impressive to mankind, or more important in the long-range exploration of space; and none will be so difficult or expensive to accomplish'[1].

With these ambitious words, Kennedy had set a new goal for extending the frontier of human existence, if only for reasons of not wishing to be left behind, on Earth, or indeed in the past. Astonishingly, and ahead of what seemed a highly improbable deadline, the goal of putting an American, as opposed to any other nationality, on the Moon became a reality. Yet in those interim years between 1961 and 1969 many aspects of American society had shifted dramatically and irreversibly. Kennedy was an arbiter of change, and sought to lead his country on that platform, yet his desire to implement such a sweeping and ambitious challenge seemed like an impossible time accelerant for the NASA scientists and technicians.

The statistical analysis of Apollo 11's mission being a success was by no means assured prior to the launch, with Neil Armstrong even remarking afterward as 'having been somewhat surprised at the fact that we were able to make a successful touchdown'[2]. There was certainly no denying the incredible dangers of the mission. In his official letter to the government and people of the USA, then Australian Prime Minister John Gorton stated, 'May the high courage and technical genius which made this achievement possible be so used in the future that mankind will live in a universe in which peace, self expression, and the chance of dangerous adventure are available to all'[3]. It seems almost ludicrous that a modern day world leader would actively promote the pursuit of danger as one of the top three wishes for humankind. It sounds quite 'Enid Blyton' in retrospect.

Given the obvious dangers of the mission, it is perhaps of little surprise that the office of then President Richard Nixon, had pre-prepared a contingency speech ominously titled *In the event of moon disaster*. Within this address, President Nixon would not speak of the mission as a failure of America within the politically vital 'space race'. Were it to be a victory, it would be one for America, were it to be a loss, it would be a loss for all humankind. The event of the deaths of astronauts Aldrin and Armstrong would be spoken of as being in pursuit of 'humankind's most noble goal: the search for truth and understanding'[4]. Their goal was not merely to step on the Moon's surface, in the name of scientific research, but to seek an infinitely more philosophical end.

President Nixon delivered an infinitely more casual, upbeat and brief telephone call to the astronauts of

Continued on Page 2

Beyond What Lies Beyond

Continued from Page 1

Apollo 11. This phone call took place on 20 July 1969 to astronauts Aldrin and Armstrong while they were on the Moon's surface in an extraordinary telecommunications feat via a phone-to-Moon link as President Nixon sat in the White House.

The success of Apollo 11 came at a period of time within the USA, and indeed internationally, that was notable for turbulent social upheaval, with all manner of social and civil structures being confronted and challenged. Space was symbolic of the future, a future that no longer seemed so distant and abstract from a world that was both booming and crumbling apart at the same time. With many nations being acutely aware of the inherent tensions and differences to even their closest neighbouring countries and the internal structures of these countries being in turn called into question, surely the world was becoming too small. With the prospect of peace on Earth seeming all but impossible, could there be somewhere else we could start over?

Apollo 11's mission to the Moon was by no means a failure. It ignited hope and encouraged new positions of perspective. The failure was later and would be far more gradual. It is the failure within our imagination to no longer consider space a possibility. The world is slowly recognising its significant environmental impact and is now desperately seeking to hinder climatic instability while reticent to curb immediate and potential economic growth. As if to reinforce the back to the wall nature of this predicament, most of the world has resigned itself to the fact that space travel and exploring new frontiers are no closer than they were in 1969.

In a statement delivered on 20 April 2010 at John F Kennedy Space Centre in Florida entitled *Remarks by the President on Space Exploration in the 21st Century*, President Barack Obama announced some significant shifts which acknowledge a certain lack of bling within the existing NASA space program. Speaking in relation to the goal of another manned return to the Moon's surface, Obama states 'I just have to say bluntly here: We've been there before. Buzz has been there. There's a lot more of space to explore, and a lot more to learn when we do'[5].

These comments reflect a certain impatience at a lack of substantial progress in the 40 years since the lunar module Eagle successfully touched down. We seem so distant from the days following 20 July 1969 when new and ambitious objectives for the NASA program were being elaborated. In the days following the Eagle's landing, an associate administrator of NASA, Dr John Naugle speculated 'America may have men living on the Moon more or less permanently by 1979. They would live much as man lives today on the Antarctic'[6]. Even in the days preceding the landing, Vice President Spiro Agnew announced that Mars would be the next major US celestial goal with Dr Wernher von Braun, then director of the Marshall Space Flight Center claiming that the USA could land a man on Mars by 1982[7].

What happened? Why are we still here?

* * *

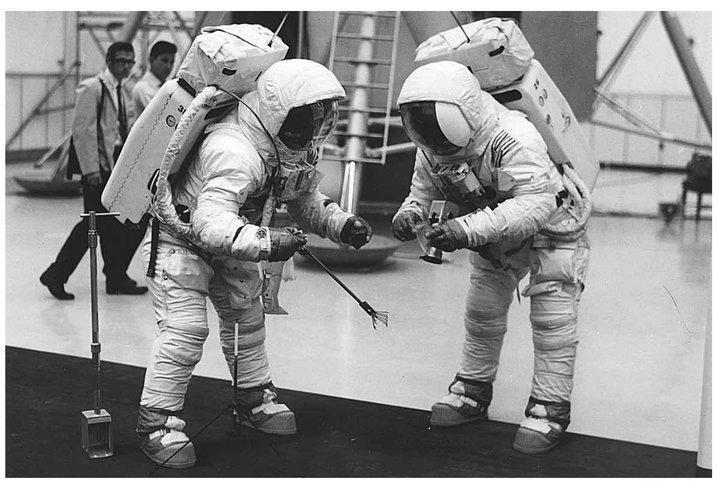
Marco Fusinato's work, a selection from the wider *sun series* (2002) alludes to the pursuit of photographic impossibilities, or more specifically, improbabilities. Astronomical photography has long since been the visual documentation, or proof of what exists beyond what we can see with the naked eye. Far less solicited are direct images of the Sun, confronting the almost mythologised retina burn, and the various technical barriers affecting light levels. While the Sun may feature within the background of numerous images, it is barely the main focus, preferably working well behind the scenes, with its effect rather than actual appearance being, more favourable. *Sun series* seems pursuant of a futile objective while eliciting a devotion to document a phenomenon experienced largely universally on a daily basis. These individual suns demonstrate a consistency of experience not experienced. They exist as documents proving certain events happened, events which we were privy to, yet undoubtedly failed to capture, as something consistently taken for granted, by and large, just out of view.

Nick Mangan's *Friday 13th 2009 (image of the sun five days after Black Saturday)* (2009) provides an evocative counterpoint to Fusinato's *sun series*. Looking directly at the Sun is generally only possible when there are refracting elements within the hemisphere say, for example, light cloud cover or the refraction of the Sun as it sets upon the horizon. This is also true of smoke as the mournful events of Black Saturday, to which the title refers, may solemnly recall. If Fusinato captures something universal and repetitive within his work then Mangan offers something localised and for all of our hopes and fears, never again to be repeated. *Friday 13th 2009* indicates just how significantly our vision shifts due to local environmental conditions, as true for Australia during bush fires, as it was recently for Northern Europe during the recent eruption of Eyjafjallajökull. This work reflects on the moment at which things begin to unravel, as do many of Mangan's works.

Damiano Bertoli's expansive *Continuous Moment: Classical Gas* (2001–2010) fully absorbs the wall upon which it is presented, enveloping it as if to annul it. The physical structure of the wall recedes as the horizon upon it expands. The horizon grid has become ubiquitous within much of Bertoli's work as a reference to the utopic philosophies of the anti-architectural practice of Superstudio. The Florence-based architectural idealists proposed the grid in the mid-1960s as a means to question the necessity of structures and hierarchies of society as determined and reinforced through its architecture. Bertoli's employment of the grid is certainly part homage, but more importantly, it is the enduring and cynical reminder of the failure of such radical utopias. The grid alludes to utopia while reinforcing its absence. *Continuous Moment: Classical Gas* directs the grid toward a new frontier, perhaps the Moon, perhaps beyond. It is an unstructured structure upon an as yet uninhabited terrain. It is a structure of a society that exists without parameters and restrictions. It is a terrain of physical expanse and infinite possibilities, alas undiscovered and unachieved.

COURTESY NASA

18 APRIL 1970 Astronaut James A Lovell Jr, A US Navy captain and Apollo 13 mission commander, salutes the U.S. flag during ceremonies with President Richard M Nixon at Hickam Air Force Base, Hawaii



COURTESY NASA

18 JUNE 1969 Apollo 11 prime crew simulates Moon activity

Pierre Huyghe's video work *One Million Kingdoms* (2001) mimics the starkness of anachronous technologies, with an aesthetic clunkiness embedding it within a specific retrospective vision of the future. Annlee is a desperate, turn of the twentieth century wanderer through a post-optimistic terrain, more forlorn and apathetic than excitable pioneer. Annlee's journey is through a fluctuating landscape determined by the narrator's intonation, which merges Armstrong's iconic reportage from the Moon's surface with Jules Verne's novel of 1864 *Journey to the Centre of the Earth*. She is at once the orator of her exploration and subservient to its directives. Within this work, Huyghe suggests 'Annlee is expressing the consequences of what we do. She is walking in the consequence of what she is planning and what she is saying'[8]. *One Million Kingdoms* is a montage of scenarios that interweaves what we believe to be true with what we know to be fiction, blurring the distinctions between seemingly incongruent events to a degree that the factuality of every aspect needs be reconsidered.

Similarly, Matthew Shannon's work traverses the intersection of fact and fiction, investigating scientific research made erroneously rather than misleadingly. *Untitled Dust* (2010) examines source information used historically to chart the wider expanse of our universe. Scientific research has long since suggested that solar systems, like our own, may revolve around many untold stars located in the wider universe. Many theories are developed through complex physics before they can be proven with empirical data using the available technologies of the time. It would appear that certain solar systems were chartered around particles of dust which had contaminated the processing stages of the astro-photographs being analysed by scientists. With *Untitled Dust* Shannon extracts all of the stellar components of these source images to reveal a solar system of fantasy, integrated for a time at least, within the galactic view widely presented as fact by the scientific experts.

Mathieu Briand's work responds to some of the canons of space exploration—not NASA or their Soviet counterparts—but rather Stanley Kubrick and Philip K Dick. These cultural producers are two of the most influential guides exploring what space, a seemingly limitless space, may actually entail. In their idiosyncratic ways both Kubrick and Dick explored the notion of space, physically in terms of its potential terrains and gravitations, but more strikingly in terms of its potential psychological affects depicting collective fears of boundlessness. More broadly, space represented technology's impact on our future—as untested tools within an untested environment and its possibility of being our last chance. *La vallée des Alpes* (2007–2010) from the extended *Ubiq: A Mental Odyssey* project embeds itself within the continuum of these historic narratives that have significantly shaped a popular vision of the future. Briand's *La vallée des Alpes* creates a fiction in two interrelated parts, the first of which is instantly definable as fiction, while the secondary part operates in defiance of this fiction, operating as if to suspend what we know to be illusionary.

Mabel Juli's work *Garnkinny Ngarrangkarni* (2008) belongs less to a scientific impulsion to explain than to a cultural custom of belief. To want to hope is altogether different than to want to know, it is the desire to understand the *everything* within a context that does not require proof of all of the *somethings*. Within many indigenous cultures the night sky represents both a terraqueous map and a wider heaven. *Garnkiny Ngarrangkarni*, or Moon Dreaming as it translates, is a recurring theme within Juli's practice as a way of connecting with country and culture. Her work is significant within the canon of Aboriginal painting in that it engages with dreaming through a highly personal interpretation, as opposed to collective accomplishment. Her works feature highly pared back iconography drawn from the dreamings, made all the more vivid through the starkness of the background. Through this process of minimalisation, Juli creates an intimate involvement between the icons—frequently related to the Moon, the stars and the land—and the viewer. This intimacy allows a direct and powerful contemplation of the work and the dramatic and often taboo narratives upon which they reflect.

Anouk de Clercq's work addresses the calculated trajectory of satellites and space vessels with respect to preparing communicative strategies in the event that one of these vessels should encounter intelligent life or other life forms. *Oops wrong planet* (2009), as its title suggests, indicates a kind of randomness in terms of discovering new data. It exists at a point where abstract and complicated theories collide with laborious empirical research. The work nods aesthetically to historical footage gathered from the Moon's surface in the late 1960s as a vessel orbits an unknown astral mass. It is a familiar voyage of discovery, with the anticipation of finding something, indeed anything, which indicates the existence of new life or even the possibility of a life-supporting frontier. *Oops wrong planet* does not render such missions as futile, but acknowledges the trial and error dilemma of such exploration, albeit with an emphasis on the latter.

* * *

Perhaps the pursuit of space exploration is a wider metaphor for human existence; it is about a questioning of purpose, of limitations and of mortality. The idea of space is a sublime utopia that exists as a possibility, yet also as an incomprehensible void. Perhaps the search for space as frontier is about enabling us to contextualise our existence on Earth. If humans could land on the Moon then certainly there could be further possibilities beyond Earth, a different world, a different existence, and even a different matter. Is this not how various religions have anticipated what happens after we die? What if space is not only expanding, as Hubble's expansion law contests, but infinite? Our picture then would be like a jigsaw puzzle, yet with no edges and a limitless amount of pieces to attempt to configure.

Possibly. But it is with such possibility that the limitlessness of space holds an eternal pull, it is something that we can only vaguely comprehend, and as such, it remains an arena of hope that exists beyond the constraints of an increasingly hopeless world. ■

NOTES

1 www.jfklibrary.org/Historical+Resources/Archives/Reference+Desk/Speeches/JFK/Urgent+National+Needs+Page+4.htm

2 NASA press conference, 16 July 1999—Kennedy Space Center, http://history.nasa.gov/ap11ann/presconf.htm

3 *Message from Australia* signed by Prime Minister John Gorton in July 1969

4 *In the event of moon disaster*, a Presidential note written by President Richard Nixon's speechwriter William Safire, 18 July 2010. Held in the US National Archives

5 *Remarks by the President on Space Exploration in the 21st Century*, John F Kennedy Space Centre, Florida, 15 April 2010

6 AAP, 'A Moon colony by 1979, predicts space expert', *The Age*, Melbourne, 22 July 1969

7 Roy Macartney, 'Next target: a man on Mars by 1982', *The Age*, Melbourne, 21 July 1969

8 Pierre Huyghe cited in Kevin Bouchard '*Pierre Huyghe: One Million + Kingdoms*' www.artlies.org/article.php?id=25&issue=43&s=0

COURTESY NASA

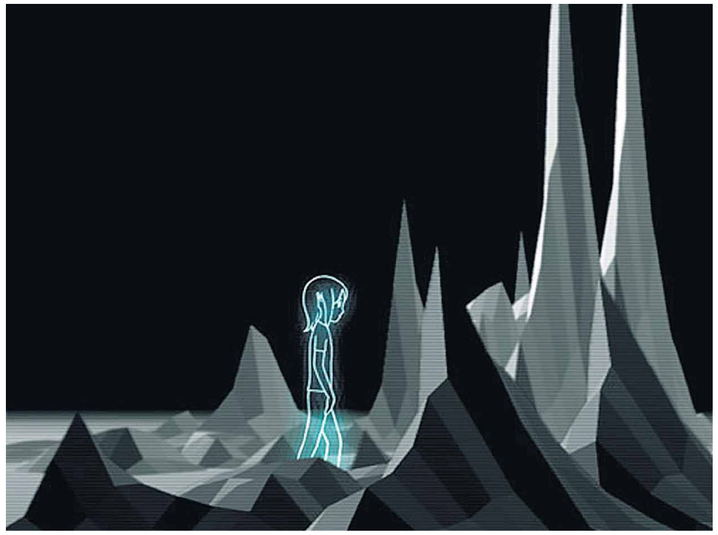
Neil Armstrong (right) with Ken Mattingly during a geology field trip to Iceland in 1967

COURTESY NASA

One of the first steps taken on the Moon, this is an image of Buzz Aldrin's bootprint from the Apollo 11 mission

PHOTOGRAPH BRYNJAR GAUTI AP

Footprints in volcanic ash covering the ground near Myrdalssandur, about 130 miles east of the Reykjavík, the Icelandic capital



PIERRE HUYGHE *One Million Kingdoms* 2001 (video still), courtesy of Colección Musac, Museo de Arte Contemporáneo de Castilla y León, Spain

PIERRE HUYGHE'S SCIENCE FICTIONS

By **AMELIA DOUGLAS**

In the mid-1990s, Pierre Huyghe began scripting a scenario for a project based on Jules Verne's *Journey to the Centre of the Earth* (1865). Verne's novel recounts the journey of Professor Lidenbrock and his nephew Axel through Iceland, toward an extinct crater, across a sunless sea and into the innermost recesses of the Earth. In navigating this treacherous subterranean realm, Lidenbrock and Axel re-trace the steps taken by an ancient explorer, guided by the markings and signals left during his journey long ago. Although Verne never travelled to Iceland, he familiarised himself with the territory via written descriptions and artistic impressions in scientific journals and periodicals of the time. The contract from Verne's French publisher records the services and employment conditions for geologists and librarians, who were to provide Verne with the data needed to validate his fictional landscape.[1] Verne's continuous provision of meteorological and geographical detail in the novel was then for the most part an accurate record of the Icelandic environs, albeit couched in a fantastical frame. The crater into which Verne's characters descend, for example, is still known as the Snæfellsjökull volcano, located south west of Reykjavík in the Snæfellsjökull National Park.

A century after the publication of Verne's book, this site again proved catalytic for the production of science fiction. In preparation for their mission to the Moon, Neil Armstrong and Buzz Aldrin trained at a NASA base in northern Iceland, not far from the site of Verne's fiction. It was here on that same desert of cooled Icelandic lava that the first photographs of a space-suited Neil Armstrong, bounding across a lunar-like landscape, were captured. Verne's account of the conquest of the Earth's interior was refashioned as a projection of extra-terrestrial activity. When the footage from Apollo 11 was broadcast back to Earth on 20 July 1969, its choreography had already been mapped out. The aesthetic of history was determined by 'fictional' parameters.

This extraordinary spin cycle of science and fiction proved irresistible to Pierre Huyghe, who began thinking of Verne's novel as a 'guide', a kind of discursive map, for the planning of his project in Iceland. As Huyghe has explained, 'You have two places, two places of supposition. One from this scientific novel of the 19th century, a fiction, which is about going inside, and then there's this other hypothesis made by NASA, which is about going outside. So it's a place where two suppositions overlap.'[2] Although this work was never realised, the scenario re-emerged in Huyghe's digital animation *One Million Kingdoms* (2001).

The film opens on a barren landscape, a bleak, digital composition rendered in basic grey scale. The outline of Annlee, sketched in blue neon, wanders through this terrain. As she walks, a voiceover is activated. Written by Huyghe, the text includes sections of Verne's *Journey to the Centre of the Earth* recounted in the voice of Neil Armstrong, digitally synthesised from the original Apollo 11 broadcast. The vocal intonation conjures visual shifts in the landscape. Mountains and valleys are registered sonically and graphically, rising and falling as sound waves. Ground is generated at the moment of speaking. When the utterance falters, so does the terrain, but Annlee moves without hesitation in this fragile space. The map of her journey becomes equivalent to the time of its production. Labour and document coincide.

Although this kind of equivalence between work and object impacts across the entire field of exploration (including that of contemporary art), it is an equivalence that would have been equally familiar to Verne and his contemporaries during the late 1800s. Verne's science fictional accounts, like Huyghe's, move within the orbit of others. His characters base their pilgrimages on information unearthed from elsewhere. The figure of the artist here appears cloaked in the guise of an adventurer, on course to chart what is perhaps one of the last great remaining frontiers of the known universe: time. We are left with a peculiar sensation of anti-gravity. Scripts are prised loose from their historical moorings to speak in place of another. 'On the Moon', we are told, 'there is nothing but dust. The conquest of space, which was a dream until now … had become an illusion. And we are arriving in 1865, at the beginning of chapter 17. It's from here that we should end up in the centre of the Earth. I had not yet looked down into the bottomless pit which I was about to plunge into. The fascination of the void took hold of me … There is nothing so attractive as the abyss. Nothing, with the possible exception of the state of weightlessness.'[3] ■

NOTES

1 Michel de Certeau, 'Writing the Sea: Jules Verne', in *Heterologies: Discourse on the Other*, translated by Brian Massumi, Minneapolis: University of Minnesota Press, 1986, p. 137.

2 Pierre Huyghe, conversation with the author, New York, 2005.

3 Pierre Huyghe, *One Million Kingdoms* 2001, Digi-Beta video, 5.1, sound, 6'.

COURTESY NASA

THE INFORMATION PARADOX FOR BLACK HOLES

By **STEPHEN HAWKING**

From a lecture delivered Wednesday 21 July 2004 on the occasion of *GR17: 17th International Conference on General Relativity and Gravitation*,18–23 July 2004, Dublin, Ireland.

Transcript courtesy of John Baez, www.math.ucr.edu/home/baez/week207.html

CAN YOU HEAR ME?

I want to report that I think I have solved a major problem in theoretical physics that has been around since I discovered that black holes radiate thermally, thirty years ago. The question is, is information lost in black hole evaporation? If it is, the evolution is not unitary, and pure quantum states, decay into mixed states.

I'm grateful to my graduate student Christophe Galfard for help in preparing this talk.

The black hole information paradox started in 1967, when Werner Israel showed that the Schwarzschild metric, was the only static vacuum black hole solution. This was then generalized to the no hair theorem: the only stationary rotating black hole solutions of the Einstein-Maxwell equations are the Kerr-Newman metrics. The no hair theorem implied that all information about the collapsing body was lost from the outside region apart from three conserved quantities: the mass, the angular momentum, and the electric charge.

This loss of information wasn't a problem in the classical theory. A classical black hole would last forever, and the information could be thought of as preserved inside it, but just not very accessible. However, the situation changed when I discovered that quantum effects would cause a black hole to radiate at a steady rate. At least in the approximation I was using, the radiation from the black hole would be completely thermal, and would carry no information. So what would happen to all that information locked inside a black hole, that evaporated away, and disappeared completely? It seemed the only way the information could come out would be if the radiation was not exactly thermal, but had subtle correlations. No one has found a mechanism to produce correlations, but most physicists believe one must exist. If information were lost in black holes, pure quantum states would decay into mixed states, and quantum gravity wouldn't be unitary.

I first raised the question of information loss in '75, and the argument continued for years, without any resolution either way. Finally, it was claimed that the issue was settled in favour of conservation of information, by AdS/CFT. AdS/CFT is a conjectured duality between supergravity in anti-deSitter space and a conformal field theory on the boundary of anti-deSitter space at infinity. Since the conformal field theory is manifestly unitary, the argument is that supergravity must be information preserving. Any information that falls in a black hole in anti-deSitter space, must come out again. But it still wasn't clear how information could get out of a black hole. It is this question I will address.

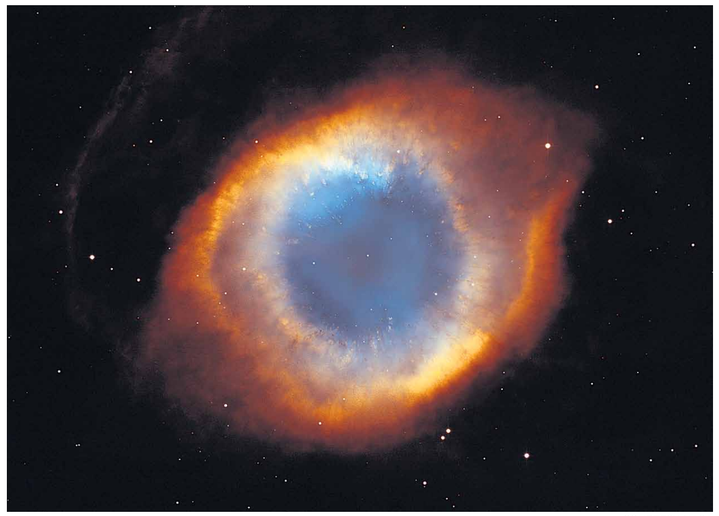
Black hole formation and evaporation can be thought of as a scattering process. One sends in particles and radiation from infinity, and measures what comes back out to infinity. All measurements are made at infinity, where fields are weak, and one never probes the strong field region in the middle. So one can't be sure a black hole forms, no matter how certain it might be in classical theory. I shall show that this possibility allows information to be preserved and to be returned to infinity.

I adopt the Euclidean approach, the only sane way to do quantum gravity non-perturbatively. In this, the time evolution of an initial state is given by a path integral over all positive definite metrics that go between two surfaces that are a distance T apart at infinity. One then Wick rotates the time interval T to the Lorentzian.

The path integral is taken over metrics of all possible topologies that fit in between the surfaces. There is the trivial topology: the initial surface cross the time interval. Then there are the nontrivial topologies: all the other possible topologies. The trivial topology can be foliated by a family of surfaces of constant time. The path integral over all metrics with trivial topology, can be treated canonically by time slicing. In other words, the time evolution (including gravity) will be generated by a Hamiltonian. This will give a unitary mapping from the initial surface to the final.

COURTESY NASA

WHOLE EARTH This image from Apollo 17, and others like it, captured whole hemispheres of water, land and weather. This photo was the first view of the south polar ice cap



COURTESY NASA

NGC 7293: THE HELIX NEBULA This image of the Helix Nebula shows a fine web of filaments, like the spokes of a bicycle, embedded in the colorful red and blue gas ring around this dying star. The Helix Nebula is one of the nearest planetary nebulae to Earth, only 650 light years away

The nontrivial topologies cannot be foliated by a family of surfaces of constant time. There will be a fixed point in any time evolution vector field on a nontrivial topology. A fixed point in the Euclidean regime corresponds to a horizon in the Lorentzian. A small change in the state on the initial surface would propagate as a linear wave on the background of each metric in the path integral. If the background contained a horizon, the wave would fall through it, and would decay exponentially at late time outside the horizon. For example, correlation functions decay exponentially in black hole metrics. This means the path integral over all topologically nontrivial metrics will be independent of the state on the initial surface. It will not add to the amplitude to go from initial state to final that comes from the path integral over all topologically trivial metrics. So the mapping from initial to final states, given by the path integral over all metrics, will be unitary.

One might question the use in this argument, of the concept of a quantum state for the gravitational field on an initial or final space-like surface. This would be a functional of the geometries of space-like surfaces, which is not something that can be measured in weak fields near infinity. One can measure the weak gravitational fields on a time-like tube around the system, but the caps at top and bottom, go through the interior of the system, where the fields may be strong.

One way of getting rid of the difficulties of caps would be to join the final surface back to the initial surface, and integrate over all spatial geometries of the join. If this was an identification under a Lorentzian time interval T at infinity, it would introduce closed time-like curves. But if the interval at infinity is the Euclidean distance, beta, the path integral gives the partition function for gravity at temperature $1/\beta$.

The partition function of a system is the trace over all states, weighted with $e^{-\beta H}$. One can then integrate β along a contour parallel to the imaginary axis with the factor $e^{-\beta E}$. This projects out the states with energy E_0. In a gravitational collapse and evaporation, one is interested in states of definite energy, rather than states of definite temperature.

There is an infrared problem with this idea for asymptotically flat space. The Euclidean path integral with period β is the partition function for space at temperature 1/beta. The partition function is infinite because the volume of space is infinite. This infrared problem can be solved by a small negative cosmological constant. It will not affect the evaporation of a small black hole, but it will change infinity to anti-deSitter space, and make the thermal partition function finite.

The boundary at infinity is then a torus, S^1 cross S^2. The trivial topology, periodically identified anti-deSitter space, fills in the torus, but so also do nontrivial topologies, the best known of which is Schwarzschild anti-deSitter. Providing that the temperature is small compared to the Hawking-Page temperature, the path integral over all topologically trivial metrics represents self-gravitating radiation in asymptotically anti-deSitter space. The path integral over all metrics of Schwarzschild AdS topology represents a black hole and thermal radiation in asymptotically anti-deSitter.

The boundary at infinity has topology S^1 cross S^2. The simplest topology that fits inside that boundary is the trivial topology, S^1 cross D^3, the three-disk. The next simplest topology, and the first nontrivial topology, is S^2 cross D^2. This is the topology of the Schwarzschild anti-deSitter metric. There are other possible topologies that fit inside the boundary, but these two are the important cases: topologically trivial metrics and the black hole. The black hole is eternal. It cannot become topologically trivial at late times.

In view of this, one can understand why information is preserved in topologically trivial metrics, but exponentially decays in topologically nontrivial metrics. A final state of empty space without a black hole would be topologically trivial, and be foliated by surfaces of constant time. These would form a 3-cycle modulo the boundary at infinity. Any global symmetry would lead to conserved global charges on that 3-cycle. These would prevent correlation functions from decaying exponentially in topologically trivial metrics. Indeed, one can regard the unitary Hamiltonian evolution of a topologically trivial metric as the conservation of information through a 3-cycle.

On the other hand, a nontrivial topology, like a black hole, will not have a final 3-cycle. It will not therefore have any conserved quantity that will prevent correlation functions from exponentially decaying. One is thus led to the remarkable result that late time amplitudes of the path integral over a topologically nontrivial metric, are independent of the initial state. This was noticed by Maldacena in the case of asymptotically anti-deSitter in 3D, and interpreted as implying that information is lost in the BTZ black hole metric. Maldacena was able to show that topologically trivial metrics have correlation functions that do not decay, and have amplitudes of the right order to be compatible with a unitary evolution. Maldacena did not realize, however that it follows from a canonical treatment that the evolution of a topologically trivial metric, will be unitary.

So in the end, everyone was right, in a way. Information is lost in topologically nontrivial metrics, like the eternal black hole. On the other hand, information is preserved in topologically trivial metrics. The confusion and paradox arose because people thought classically, in terms of a single topology for spacetime. It was either R^4, or a black hole. But the Feynman sum over histories allows it to be both at once. One cannot tell which topology contributed the observation, any more than one can tell which slit the electron went through, in the two slits experiment. All that observation at infinity can determine is that there is a unitary mapping from initial states to final, and that information is not lost.

My work with Hartle showed the radiation could be thought of as tunnelling out from inside the black hole. It was therefore not unreasonable to suppose that it could carry information out of the black hole. This explains how a black hole can form, and then give out the information about what is inside it, while remaining topologically trivial. There is no baby universe branching off, as I once thought. The information remains firmly in our universe. I'm sorry to disappoint science fiction fans, but if information is preserved, there is no possibility of using black holes to travel to other universes. If you jump into a black hole, your mass-energy will be returned to our universe, but in a mangled form, which contains the information about what you were like, but in an unrecognisable state.

There is a problem describing what happens, because strictly speaking the only observables in quantum gravity are the values of the field at infinity. One cannot define the field at some point in the middle, because there is quantum uncertainty in where the measurement is done. However, in cases in which there are a large number, N, of light matter fields, coupled to gravity, one can neglect the gravitational fluctuations, because they are only one among N quantum loops. One can then do the path integral over all matter fields, in a given metric, to obtain the effective action, which will be a functional of the metric.

One can add the classical Einstein-Hilbert action of the metric to this quantum effective action of the matter fields. If one integrated this combined action over all metrics, one would obtain the full quantum theory. However, the semi-classical approximation is to represent the integral over metrics by its saddle point. This will obey the Einstein equations, where the source is the expectation value of the energy momentum tensor, of the matter fields in their vacuum state.

The only way to calculate the effective action of the matter fields, used to be perturbation theory. This is not likely to work in the case of gravitational collapse. However, fortunately we now have a non-perturbative method in AdS/CFT. The Maldacena conjecture says that the effective action of a CFT on a background metric is equal to the supergravity effective action of anti-deSitter space with that background metric at infinity. In the large N limit, the supergravity effective action is just the classical action. Thus the calculation of the quantum effective action of the matter fields is equivalent to solving the classical Einstein equations.

The action of an anti-deSitter-like space with a boundary at infinity would be infinite, so one has to regularize. One introduces subtractions that depend only on the metric of the boundary. The first counter-term is proportional to the volume of the boundary. The second counter-term is proportional to the Einstein-Hilbert action of the boundary. There is a third counter-term, but it is not covariantly defined. One now adds the Einstein-Hilbert action of the boundary and looks for a saddle point of the total action. This will involve solving the coupled four- and five-dimensional Einstein equations. It will probably have to be done numerically.

In this talk, I have argued that quantum gravity is unitary, and information is preserved in black hole formation and evaporation. I assume the evolution is given by a Euclidean path integral over metrics of all topologies. The integral over topologically trivial metrics can be done by dividing the time interval into thin slices and using a linear interpolation to the metric in each slice. The integral over each slice will be unitary, and so the whole path integral will be unitary.

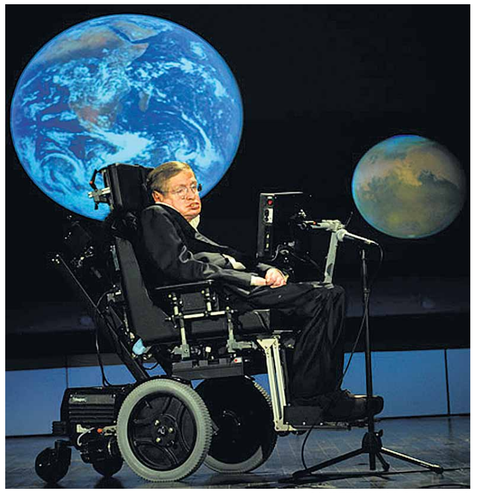
On the other hand, the path integral over topologically nontrivial metrics, will lose information, and will be asymptotically independent of its initial conditions. Thus the total path integral will be unitary, and quantum mechanics is safe.

It is great to solve a problem that has been troubling me for nearly 30 years, even though the answer is less exciting than the alternative I suggested. This result is not all negative however, because it indicates that a black hole evaporates, while remaining topologically trivial. However, the large N solution is likely to be a black hole that shrinks to zero. This is what I suggested in 1975.

In 1997, Kip Thorne and I bet John Preskill that information was lost in black holes. The loser or losers of the bet are to provide the winner or winners with an encyclopaedia of their own choice, from which information can be recovered with ease. I'm now ready to concede the bet, but Kip Thorne isn't convinced just yet. I will give John Preskill the encyclopaedia he has requested. John is all-American, so naturally he wants an encyclopaedia of baseball. I had great difficulty in finding one over here, so I offered him an encyclopedia of cricket, as an alternative, but John wouldn't be persuaded of the superiority of cricket. Fortunately, my assistant, Andrew Dunn, persuaded the publishers Sportclassic Books to fly a copy of *Total Baseball: The Ultimate Baseball Encyclopedia* to Dublin. I will give John the encyclopaedia now. If Kip agrees to concede the bet later, he can pay me back. ■

COURTESY NASA

16 JULY 1969 This view from the Apollo 11 spacecraft shows the Earth rising above the Moon's horizon. The lunar terrain pictured is in the area of Smyth's Sea on the nearside



COURTESY NASA/PAUL ALERS

21 APRIL 2008 Professor Stephen Hawking speaks about 'Why We Should Go into Space' for the NASA Lecture Series

To: H.R. Haldeman

From: Bill Safire July 18, 1969.

IN EVENT OF MOON DISASTER

Fate has ordained that the men who went to the moon to explore in peace will stay on the moon to rest in peace.

These brave men, Neil Armstrong and Edwin Aldrin, know that there is no hope for their recovery. But they also know that there is hope for mankind in their sacrifice.

These two men are laying down their lives in mankind's most noble goal: the search for truth and understanding.

They will be mourned by their families and friends; they will be mourned by their nation; they will be mourned by the people of the world; they will be mourned by a Mother Earth that dared send two of her sons into the unknown.

In their exploration, they stirred the people of the world to feel as one; in their sacrifice, they bind more tightly the brotherhood of man.

In ancient days, men looked at stars and saw their heroes in the constellations. In modern times, we do much the same, but our heroes are epic men of flesh and blood.

-2-

Others will folllow, and surely find their way home. Man's search will not be denied. But these men were the first, and they will remain the foremost in our hearts.

For every human being who looks up at the moon in the nights to come will know that there is some corner of another world that is forever mankind.

PRIOR TO THE PRESIDENT'S STATEMENT:

The President should telephone each of the widows-to-be.

AFTER THE PRESIDENT'S STATEMENT, AT THE POINT WHEN NASA ENDS COMMUNICATION WITH THE MEN:

A clergyman should adopt the same procedure as a burial at sea, commending their souls to "the deepest of the deep," concluding with the Lord's Prayer.

IN THE EVENT OF MOON DISASTER This is the full text of a contingency speech prepared before Apollo 11 successfully landed on the Moon. This speech was prepared on 18 July 1969 by President Richard Nixon's then speechwriter, William Safire, to be used in the event of a disaster that would maroon the astronauts on the Moon

Memo courtesy of http://www.thesmokinggun.com/archive/0808051apollo1.html

ARTISTS' BIOGRAPHIES

List of Works

EVENT HORIZON

DAMIANO BERTOLI
Continuous Moment:
Classical Gas 2001–2010
Mixed media
Dimensions variable
Courtesy of the artist, Milani Gallery, Brisbane and Neon Parc, Melbourne

MATHIEU BRIAND
UBÏQ: a Mental Odyssey
Chapter I—A Space Perspective
(La vallée des Alpes) 2007–2010
Mixed media
Dimensions variable
Courtesy of the artist

ANOUK DE CLERCQ
Oops wrong planet 2009
Animated video and audio track
8 minutes
Courtesy of the artist and Portapak, Brussels

MARCO FUSINATO
Photographs #01
(sun series)—06.03.02 2002
Type C print
126 × 176 cm
Photographs #02
(sun series)—31.03.02 2002
Type C print
126 × 176 cm
Photographs #04
(sun series)—05.05.02 2002
Type C print
126 × 176 cm
Photographs #07
(sun series)—21.05.02 2002
Type C print
126 × 176 cm
Photographs #08
(sun series)—30.05.02 2002
Type C print
126 × 176 cm
Photographs #10
(sun series)—06.06.02 2002
Type C print
126 × 176 cm
All works in edition of 5
All works courtesy of the artist and Anna Schwartz Gallery, Melbourne

PIERRE HUYGHE
One Million Kingdoms 2001
Animated video and audio track
7 minutes
Colección Musac Museo de Arte Contemporáneo de Castilla y León, Spain

MABEL JULI
Garnkinny Ngarrangkarni 2008
Natural ochres on canvas
120 × 180 cm
Courtesy of the artist and Gallery Gabrielle Pizzi, Melbourne

NICK MANGAN
Friday 13th 2009 (image of the sun five days after black Saturday) 2009
Unique digital print on photographic paper
70 × 103 cm
Courtesy of the artist and Sutton Gallery, Melbourne

NASA
Various images
Courtesy of NASA and Melbourne Planetarium

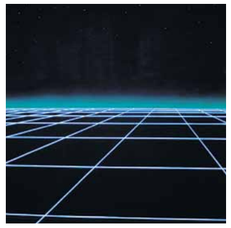
MATTHEW SHANNON
Untitled Dust 2010
Mixed media
Dimensions variable
Courtesy of the artist

ANOUK DE CLERCQ

Born in Ghent, Belgium 1971. Lives and works in Brussels, Belgium.

Recent selected solo exhibitions include *Oops, wrong planet*, Museum Dr. Guislain, Ghent, Belgium, 2009; *Seven Screens*, Osram Art Projects, Munich, Germany, 2008; *Seven Screens*, Dhondt-Dhaenens, Deurle, Belgium, 2008; *Echo*, Museum Dhondt-Dhaenens, Deurle, Belgium, 2007; *Log*, SAFN, Reykjavik, Iceland, 2006; *Anouk De Clercq*, Netwerk Galerij, Aalst, Belgium, 2005; *Picture this*, Museum Dhondt-Dhaenens, Deurle, Belgium, 2005; *Log 2000-2004*, *Audioframes*, Kortrijk, Belgium, 2004; *Les Hivernales*, Montreal, Canada, 2002; *Anouk De Clercq*, Matrix Art Project, Brussels, Belgium, 2002; *Sonar*, Looking Glass, Brussels, Belgium, 2002.

Recent selected group exhibitions include *Chefs d'oeuvre?*, Faux Mouvement Centre d'Art Contemporain, Metz, France, 2010; *The Fluxus Gallery*, Museum of Image and Sound, Sao Paolo, Brazil, 2010; *Fantastic Illusions*, MOCA, Shanghai, China, 2009; *Correspondence*, LUX 28, London, UK, 2008; *Digital Art from Belgium*, Telic Arts Exchange, Los Angeles, USA, 2007; *Artes Digitales*, Buda Kunstencentrum, Kortrijk, Belgium, 2007; *Discovering Slowness*, National Centre of Photography, St-Petersburg, Russia, 2007; *(In)visible sounds*, Montevideo, Amsterdam, The Netherlands, 2007; *Snapshot*, Tijdelijk Museum Amsterdam, The Netherlands, 2007; *Conjonctions*, Espace Piano Nobile, Geneva, Switzerland, 2007; *The Leading Thread*, Centro de Arte Caja de Burgos, Burgos, Spain, 2007; *Presentation of the integration of a work of art,* Netwerk, Aalst, Belgium, 2007; *Borderline*, Beijing, China, 2006; *Contour*, 2nd Biennial for Videoart, Mechelen, Belgium, 2005; *Bevreemdende verkenningen*, Sint-Lukasgalerij, Brussels, Belgium, 2005; *Mov*, Concertgebouw, Bruges, Belgium, 2004; *Wunderland Unframed*, Stedelijk Museum Bureau, Amsterdam, The Netherlands, 2004; *Oogst/Harvest/Récolte,* Caermersklooster, Ghent, Belgium, 2004; *Feel the Young*, Z33, Hasselt, Belgium, 2004; *Undercurrent*, Platform Garanti Contemporary Art Centre, Istanbul, Turkey, 2004; *The Alps*, Netwerk Galerij, Aalst, Belgium, 2004; *Essential Emptiness*, Beursschouwburg, Brussels, Belgium, 2004; *Prix Jeune Peinture Belge 2003*, BOZAR, Brussels, Belgium, 2003; *Overload and Organization*, Boston Centre for the Arts, Boston, USA, 2003; *Anouk De Clercq & Dany Deprez*, Cultuurcentrum Strombeek, Brussels, Belgium, 2003; *Wav*, Concertgebouw, Bruges, Belgium, 2003; *Secret Gardens*, Tacktoren, Kortrijk, Belgium, 2002; *Anouk De Clercq & Sean Kerr*, Moving Image Centre, Auckland, New Zealand, 2001.



DAMIANO BERTOLI

Born in Melbourne, Australia 1969. Lives and works in Melbourne, Australia.

Selected recent solo exhibitions include *Continuous Moment: Bad Infinity*, The Narrows, Melbourne, 2009; *Continuous Moment: I'm Ok, You're Ok*, Contemporary Art Centre of South Australia, Adelaide; *Continuous Moment*, Geelong Art Gallery, Geelong, 2008; *Goodbye Surfing, Hello God!,* Neon Parc, Melbourne, 2007; *Continuous Moment: Hot August Knife*, MOP Projects, Sydney, 2006; *Continuous Moment: Hot August Knife*, Ocular Lab, Melbourne, 2005; *Continuous Moment*, Gertrude Contemporary Art Spaces, Melbourne, 2003; *Frightened of this Thing that I've Become*, 1st Floor, Melbourne, 2002; *Lagrange*, Studio 12, Gertrude Contemporary Art Spaces, Melbourne, 2000.

Selected recent group exhibitions include *The Gift*, ICAN, Sydney, 2009; *Expandex*, Tin Sheds Gallery, Sydney, 2009; *+/-*, Switchback Gallery, Monash Centre for Art & Design, Churchill, 2009; *True Crime – Murder and Misdemeanour in Australian Art*, Geelong Art Gallery, Geelong, 2009; *Lo Sguardo Di Giano*, American Academy, Rome, Italy, 2009; *LOOP '09*, Hotel De Las Ramblas, Barcelona, Spain, 2009; *ART LA*, Barker Hangar, Santa Monica, USA, 2009; *Structural Decline*, Melbourne Art Fair, Melbourne, 2008; *West Space East*, Plastique Kinetic Worms, Singapore, 2007; *NEW07*, Australian Centre for Contemporary Art, Melbourne, 2007; *Relentless Optimism*, The Carlton Hotel & Studios, Melbourne, 2007; *One God, No Masters*, Hamish McKay Gallery, Wellington, New Zealand, 2006; *Motion Pictures*, Perth Institute of Contemporary Art, 2006; *Endgame: Late–Capitalist Realism*, VCA Margaret Lawrence Gallery, Melbourne, 2006; *Adventures with Form and Space: Balnaves Sculpture Project*, Art Gallery of New South Wales, Sydney, 2006; *Trinity Nine*, Trinity College, University of Melbourne, 2006; *Silenzi, Palazzo dei Prigione*, Venice, Italy, 2006; *Short Ride in a Fast Machine*, Gertrude Contemporary Art Spaces, Melbourne, 2005; *National Sculpture Prize*, National Gallery of Australia, Canberra, 2005; *Quiet Collision*, Viafarini & C/O, Milan, Italy, 2004; *2004–Australian Culture Now*, National Gallery of Victoria, Melbourne, 2004; *Papercuts*, Monash University Gallery, Melbourne, 2004; *This Was the Future…Australian Sculpture of the 1950's, 60's, 70's + Today,* Heide Museum of Modern Art, Melbourne, 2004; *PARK4DTV*, Amsterdam, The Netherlands, 2002; *Mutable Spaces*, Metro Arts, Brisbane, 2002; *Office of Utopic Procedures*, West Space, Melbourne, 2001; *Blink*, Australian Centre for Contemporary Art, Melbourne, 2001.

Damiano Bertoli is represented by Milani Gallery, Brisbane and Neon Parc, Melbourne.

MABEL JULI

Born in Five Mile, Western Australia c. 1934. Lives and works in Warmun Community (Turkey Creek) Western Australia. Juli is of the Gija language group.

Recent solo exhibitions include *The Great Mabel Juli*, Short St. Gallery at Mary Place Gallery, Sydney, 2007; Gabrielle Pizzi Gallery, Melbourne, 2006; Kaliman Gallery, Sydney, 2004; Gabrielle Pizzi Gallery, Melbourne, 2002.

Recent selected group exhibitions include *The Women of Warmun: Ten years on*, Gadfly Gallery, Perth, 2008; *Ngarrangkarni & Bible Stories*, Alcaston Gallery, Melbourne, 2007; *Greetings from Turkey Creek*, Mary Place Gallery, Sydney, 2007; *Warmun Artists in New York*, Ralph Pucci Gallery, New York, USA, 2007; *Country in mind: five contemporary Aboriginal artists*, The Ian Potter Museum of Art, Melbourne, 2006; *Patrick Mung Mung & Mabel Juli*, Gabrielle Pizzi Gallery, Melbourne, 2006; *Gija: Across the Border*, Raft Artspace, Darwin, 2005; *Warmun Women's Show*, Alcaston Gallery, Melbourne, 2005; *Die inneren & die äußeren Dinge*, Stadtgalerie Bamberg, Germany, 2004; *True Stories: Art of the East Kimberley*, Art Gallery of New South Wales, Sydney, 2003; *Love Your Work*, Fremantle Arts Centre, Perth, 2002; *Die Kraft & das Licht*, Neuer Kunstverein Aschaffenburg, Germany, 2002; *Kult(o)urnacht–Aboriginal Art,* Galerie Baehr, Speyer, Germany, 2002; *Das Verborgene im Sichtbaren (the Unseen in Scene)*, Stadtische Galerie Wolfsburg, Germany, 2001; *Beyond Wings*, Flinders University Art Museum, Adelaide, 2001; *Kunst der Aborigines*, Leverkusen & Dormagen, Germany, 2000; *BlickDicht*, Adelhausermuseum, Freiburg, Germany, 2000; *Traumpfade–Zeitgenossische Malerei Australischer, Aborigines*, Stadtische Galerie, Traunstein, Germany, 2000; *Telstra National Aboriginal & Torres Strait Islander Art Award Exhibition*, Darwin, 2000.

Mabel Juli is represented by Warmun Art Centre, Western Australia and Gadfly Gallery, Perth.

MARCO FUSINATO

Born in Melbourne, Australia 1964. Lives and works in Melbourne, Australia.

Selected recent solo exhibitions include *Double Infinitives*, Anna Schwartz Gallery, Melbourne, 2009; *Mass Black Implosion*, Sarah Cottier Gallery, Sydney, 2008; *Mass Black Implosion (for Anestis Logothetis)*, Hamish McKay Gallery, Wellington, New Zealand, 2008; *A Dozen Roses*, Hamish McKay Gallery, Wellington, New Zealand, 2007; *The Approaching of the Disco Void- Repeated and other works*, Anna Schwartz Gallery, Melbourne, 2006; *Mutlu Çerkez / Marco Fusinato*, Art Gallery of New South Wales, Sydney, 2005; *Photographs: sun series*, Centre for Contemporary Photography, Melbourne, 2005; *La classe operaia va in paradiso and other possible meanings*, Starkwhite, Auckland, New Zealand, 2005; *Avalon (Mutlu Çerkez, Marco Fusinato, Callum Morton)*, Artspace, Sydney, 2005; *AND (Mutlu Çerkez AND Marco Fusinato)*, Gertrude Contemporary Art Spaces, Melbourne, 2003; *____/03:00/4SP/_ _:_ _* The Studio, Sydney Opera House, Sydney (performance), 2001; *TM/MF (Thurston Moore/Marco Fusinato)*, Australian Centre for Contemporary Art, Melbourne, 2000; *+/+/+/+-*, Artspace, Sydney, 2000; *Solver (Marco Fusinato/ John Nixon)*, Base progetti per l'arte, Florence, Italy, 2000; *Piece for PS*, PS Gallery, Amsterdam, The Netherlands, 2000.

Recent selected group exhibitions include *Towards a Cinema of Pure Means*, The Physics Room, Christchurch, New Zealand, 2010; *Sonic Youth etc.: Sensational Fix*, Kunsthalle Düsseldorf, Germany, The Museum of Malmo, Sweden, 2009; *Still Vast Reserves*, Magazzino Arte Moderna, Rome, Italy, 2009; *Photographer Unknown*, Monash University Museum of Art, Melbourne, 2009; *NEW09*, Australian Centre for Contemporary Art, Melbourne, 2009; *PS 1999-2009*, PS Amsterdam / Kunstruimte09 Groningen, The Netherlands, 2009; *Sonic Youth etc.: Sensational Fix*, Life, St. Nazaire, France; *21:100:100*, Gertrude Contemporary Art Spaces, Melbourne, 2008; *Propositions and Game Plans*, Melbourne International Arts Festival, Melbourne, 2007; *Underplayed: A Mix-Tape of Music-based Videos*, Yerba Buena Center for the Arts, San Francisco, USA, 2006*; The Unquiet World*, Australian Centre for Contemporary Art, Melbourne, 2006; *2 Step*, Kunstnernes Hus, Oslo, Norway, 2006; *Sensational: Sight and Sound Installations*, Auckland Art Gallery, New Zealand, 2005*; Quiet Collision*, Viafarini and C/O Contemporary Art Space, Milan, Italy, 2003; *Extended play: art re-mixing music*, Govett Brewster Art Gallery, New Plymouth, New Zealand, 2003; *PS 1997-2003*, Raid Projects, Los Angeles, USA, 2003; *Veze / Connections, contemporary artists from Australia*, Hdlu, Zagreb Croatia and Mestna Gallery, Lubljana Slovenia, 2002; *2 Step*, CCNOA, Brussels, Belgium, 2002; *Art>Music Rock/Pop/Techno*, Museum of Contemporary Art, Sydney, 2001.

Marco Fusinato is represented by Anna Schwartz Gallery, Melbourne; Sarah Cottier Gallery, Sydney; and Hamish McKay Gallery, Wellington.

MATHIEU BRIAND

Born in Marseille, France 1972. Lives and works in Paris, France.

Recent selected solo exhibitions include *Bâtons de Légendes*, Galerie Nathalie Seroussi/galerie carlier|gebauer, Berlin, Germany, 2010; *Bad Trip*, galerieofmarseille, Marseille, France, 2009; *In memorial of Albert Hofmann 1906–2008*, ANNE+, Ivry-sur-Seine, France, 1999; *The Spiral AKA SYS*11*, Turbine Hall, Tate Modern, London, UK, 2007; *UBÏQ: A Mental Odyssey*, Galerie Maisonneuve, Paris, France, 2007; *UBÏQ: A Mental Odyssey–Landing on the Valley of the Alps–another interpretation*, Martos Gallery, New York, USA, 2007; *UBÏQ: un Monde Flottant*, Fondation Claude Verdan, Lausanne, Switzerland, 2007; *UBÏQ: A Mental Odyssey*, DF2 Gallery, Los Angeles, USA, 2007; *UBÏQ: A Mental Odyssey: Chapter VI*, Art Unlimited, Art 38 Basel, Galerie Maisonneuve, Switzerland, 2007; *UBÏQ: A Mental Odyssey*, Red Cat Theatre, Los Angeles, USA, 2006; *Derrière le Monde Flottant*, MAC, Lyon, France, 2004; *Le Monde Flottant* , Palais de Tokyo, Paris, France, 2003; *SYS*017. ReE.06/PiG-EqN\5*8*, Ateliers d'artistes de la ville de Marseille, France, 2001.

Recent selected group exhibitions include *Incarnational Aesthetics*, New York Center for Arts and Media Studies, New York, USA, 2009; *Les enfants terribles*, Fundación / Colección Jumex, México, 2009; *Volta5*–galerieofmarseille, Basel, Switzerland, 2009; *Les mondes disparus*, Centre d'art Bastille, Grenoble, France, 2008; *Maternités cosmiques*, TEA, Santa Cruz de Tenerife, Spain, 2008; *In Memoriam Albert Hofmann*, Museo Laberinto de Artes y Ciencias, San Luis Potosi, Mexico City, Mexico, 2008; *Three Degrees, with Bill Albertini and Curtis Mitchell*, Martos Gallery, New York, USA, 2007; *La Tentation de l'espace*, Espace Louis Vuitton, Paris, France, 2007; *Sensorium: Embodied Experience*, MIT List Visual Arts Center, Boston, USA, 2007; *Roger Pailhas, l'art d'une vie*, MAC, Marseille, France, 2006; *Dual Realities, 4th Seoul International Media Art Biennale*, Seoul, South Korea, 2006; *La Force de l'Art, Entre les lignes*, Grand Palais, Paris, France, 2006; *Singuliers*, Guangdong Museum of Art, China, 2005; *Emergency Biennale*: *Chechnya*, Palais de Tokyo, Paris, France, 2005; *Reactivity*, ICC, Tokyo, Japan, 2004; *Digiscape*, Seoul, South Korea, 2004; *Digital Sublime*, MOCA Tapei, Taiwan, 2004; *Artists in Town*, Maktab Anbar, Damas, Syria, 2003; *Darat Al Funun*, Amman, Jordan, 2003; *Our mutual friend*, Bloomberg Space, London, UK, 2003; *Uneasyspace,* SiteSantafe, Santa Fe, USA, 2003; *Sonic-Process*, Macba, Barcelona, Spain, 2002; Centre Georges Pompidou, Paris, France, 2002; *Egofugal, 7 Istanbul Bienal*, Istanbul, Turkey, 2001; *Connivence,* 6th Biennale de Lyon, France, 2001; *Vision machine*, Musée des Beaux Arts, Nantes, France, 2000; *Less Aesthetics More Ethics*, 7th International Architecture Exhibition, Venice, Italy, 2000; *Au-délà du spectacle*, Centre Pompidou, Paris, France, 2000; *Let's Entertain*, Walker Art Centre-Minneapolis, MAC Miami, USA and Kunstmuseum Wolfsburg, Germany, 2000; *Version 2000*, Centre pour l'image contemporaine, Genève, Switzerland, 2000; *BIG TORINO 2000 Biennale Arte Emergente*, Turin, Italy, 2000.

MATTHEW SHANNON

Born in Perth, Australia 1982. Lives and works in Melbourne, Australia.

Recent selected solo exhibitions include *17.04.10–15.05.10,* Conical, Melbourne, 2010; *Infinity of Wind Muskets*, The Physics Room, Christchurch, New Zealand, 2009; *Movement of the Still Image,* Rearview, Melbourne, 2009; *The Persistent Presence of the Endless,* West Space, Melbourne, 2009; *Infinity of Wind Muskets,* Gertrude Contemporary Art Spaces, Melbourne, 2008; *Untitled,* Seventh Gallery, Melbourne, 2008; *pirtyaD,* TCB art inc, Melbourne, 2008.

Recent selected group exhibitions include *The Nothing,* Chalkhorse Gallery, Sydney and West Space, Melbourne, 2010; *The Hypnotism Show*, Kadist Foundation, Paris, France and Kunstverein, Amsterdam, The Netherlands, 2009; *Gertrude Studios 2009*, Gertrude Contemporary Art Spaces, Melbourne, 2009; *Edge of the Line*, Utopian Slumps, Melbourne, 2009; *Blue Sunshine,* TCB art inc, Melbourne, 2009; *Gertrude Studios 2008*, Gertrude Contemporary Art Spaces, Melbourne, 2008; *Electromagnetic Imaginary,* Spectrum Gallery, Perth, 2008; *Shine on you crazy diamond,* Platform, Melbourne, 2008; *Electro-magnetic Imaginary,* Area Gallery, Melbourne, 2007; *Wittgenstein's Discotheque,* George Patton Gallery, Melbourne, 2007; *The Paper Show*, Perth Institute of Contemporary Art, 2007; *Pleasantries,* Alliance Française de Melbourne, 2006; *Entropy,* Victoria Park Gallery, Melbourne, 2006.

NICK MANGAN

Born in Geelong, Australia 1979. Lives and works in Melbourne, Australia.

Selected recent solo exhibitions include *Between a Rock and a Hard Place*, Art Gallery of New South Wales, Sydney, 2009; *Comparative material,* Projects@230 Young Street Fitzroy/ Sutton Gallery, Melbourne, 2007; *The mutant message*, Sutton Gallery, Melbourne, 2006; *The Colony,* Gertrude Contemporary Art Spaces, Melbourne, 2005; *In the crux of matter,* Sutton Gallery, Melbourne, 2003; *The Obolus,* Studio 12, Gertrude Contemporary Art Spaces, Melbourne, 2002; *OBTX4Plastralwallmold*, Penthouse and Pavement Gallery, Melbourne, 2000; *OBTX wallmold,* White Wall project, Building 12 RMIT University, Melbourne, 2000.

Selected recent group exhibitions include *Before and After Science: 2010 Adelaide Biennial of Australian Art*, Art Gallery of South Australia, Adelaide, 2010; *Voids A Retrospective*, Centre Pompidou, Paris, France, 2009; *Lost & Found: An Archeology of the Present*, TarraWarra Biennial, Victoria, 2008; *Before Lucky Number Seven*, SITE Santa Fe International Biennial, Santa Fe, USA, 2008; *Revolving Doors, an exhibition in memory of Blair Trethowan*, Uplands Gallery, Melbourne, 2008; *Master Humphrey's Clock*, The Shadow Cabinet, de Appel Arts Centre, Amsterdam, The Netherlands, 2008; *super natural,* The Physics Room, Christchurch, New Zealand, 2006; *Adventures with Form in Space, The Fourth Balnaves Foundation Sculpture Project,* Art Gallery of New South Wales, Sydney. 2006; *Uncanny Nature,* Australian Centre for Contemporary Art, Melbourne, 2006; *Molecular History of Everything*, Australian Centre for Contemporary Art, Melbourne, 2004; *2004: Australian Culture Now,* National Gallery of Victoria, Melbourne, 2004; *Primavera,* Museum of Contemporary Art, Sydney, 2004; *Work in progress*, Spacement, Melbourne, 2004; *vécu*, Conical, Melbourne, 2003; *Compendium,* Platform, Melbourne, 2003; *In the Making*, 1st Floor, Melbourne, 2002; *Carbon Copy and Giant Molecules*, Penthouse and Pavement, Melbourne, 2002; *Pure Negativity*, West Space, Melbourne, 2002; *Mutable Spaces*, Metro Arts, Brisbane, 2002; *Only the Lonely,* Block Gallery, Sydney, 2002; *Why do Birds Suddenly Appear,* Boutwell Draper Gallery, Sydney, 2002; Gertrude Contemporary Art Space Studio Artists, Melbourne, 2001.

Nick Mangan is represented by Sutton Gallery, Melbourne

PIERRE HUYGHE

Born Paris, France 1962. Lives and works in Paris, France.

Selected recent solo exhibitions include *Live–Show as Exhibition*, Reykjavik Art Museum, Iceland, 2007; *Celebration Park*, MUSAC, Castillia y León, Spain, 2007; *Celebration Park,* Tate Modern, London, UK; *Celebration Park*, Arc/Musée d'art Moderne de la Ville de Paris, France, 2006; *This is Not a Time for Dreaming*, Marian Goodman Gallery, New York, USA, 2006; *A Journey that Wasn't,* Wollman Ice Rink, Central Park, Public Art Fund, New York, USA, 2005; *Streamside Day*, Moderna Museet, Stockholm, Sweden, 2005; *Streamside Day*, Irish Museum of Modern Art, Dublin, Ireland, 2005; *Huyghe + Corbusier : The Carpenter Center Project*, Carpenter Center, Fogg Art Museum, Harvard University, Cambridge, USA, 2004; *Streamside Day*, Galerie Marian Goodman, Paris, France, 2004; Castello di Rivoli Museo d'Arte Contemporanea, Rivoli, Italy, 2004; *One Million Kingdoms, Les Grandes Ensembles*, Modern Art Museum of Fort Worth, Texas, USA, 2004; *In the Belly of an Architect* Portikus, Frankfurt am Main, Germany, 2004; *Streamside Day Celebration*, Fishkill, New York and Dia Center for the Arts, New York, USA, 2003; *Hugo Boss Prize 2002 Exhibition*, Solomon R. Guggenheim Museum, New York, USA, 2003; *A Smile Without a Cat* (with Philippe Parreno) Miami, USA, 2002; *L'Expédition Scintillante, a Musical*, Kunsthaus Bregenz, Austria, 2002; *Le Château de Turing*, Pavillon Français, 49th Biennale di Venezia, Venice, Italy, 2001; *Interludes*, Stedelijk Van Abbe Museum, Eindhoven, The Netherlands, 2001; *Even More Real than You*, Marian Goodman Gallery, New York, USA, 2001, Tramway, Glasgow, Scotland, 2000, Musée d'art contemporain, Montréal, Canada, 2000, Kunstverein, Hamburg, Germany, 2000; and Galerie Shipper & Krome, Berlin, Germany, 2000; *The Third Memory*, Centre Pompidou, Paris, France, 2000; *No Ghost Just a Shell, Two Minutes Out of Time*, Galerie Marian Goodman, Paris, France, 2000; and Kunsthalle, Zürich, Switzerland, 2000.

Selected group exhibitions include *Il Tempo del Postino*, Theater Basel, Art 40 Basel, Basel, Switzerland, 2009; *Sydney Biennale: Revolutions: Forms that Turn*, Australia, 2008; *Art Focus 5, International Biennial of Contemporary Art*, Jerusalem, Israel, 2008; 52nd Biennale di Venezia, Venice, Italy, 2007; *Experiencing Duration*, Biennale de Lyon, France, 2005; *Gwangju Biemnale 2004: A Grain of Dust, A Drop of Water*, South Korea, 2004; *It Happened Tomorrow*, Biennale de Lyon, France, 2004; *Moving Pictures*, Guggenheim Museum, Bilbao, Spain, 2003; *Utopia Station*, Biennale di Venezia, Venice, Italy, 2003; *Documenta 11*, Kassel, Germany, 2002; *Moving Pictures*, Solomon R. Guggenheim Museum, New York, USA, 2002; *No Ghost just a Shell*, Kunsthalle, Zürich, Switzerland, 2002; *In Many Ways the Exhibition Already Happened*, ICA, London, UK, 2001; *International Istanbul Biennale*, Turkey, 2001; *Yokohama 2001: International Triennial of Contemporary Art*, Japan, 2001.

Pierre Huyghe is represented by Marian Goodman Gallery, Paris and New York.

AFTERWORD

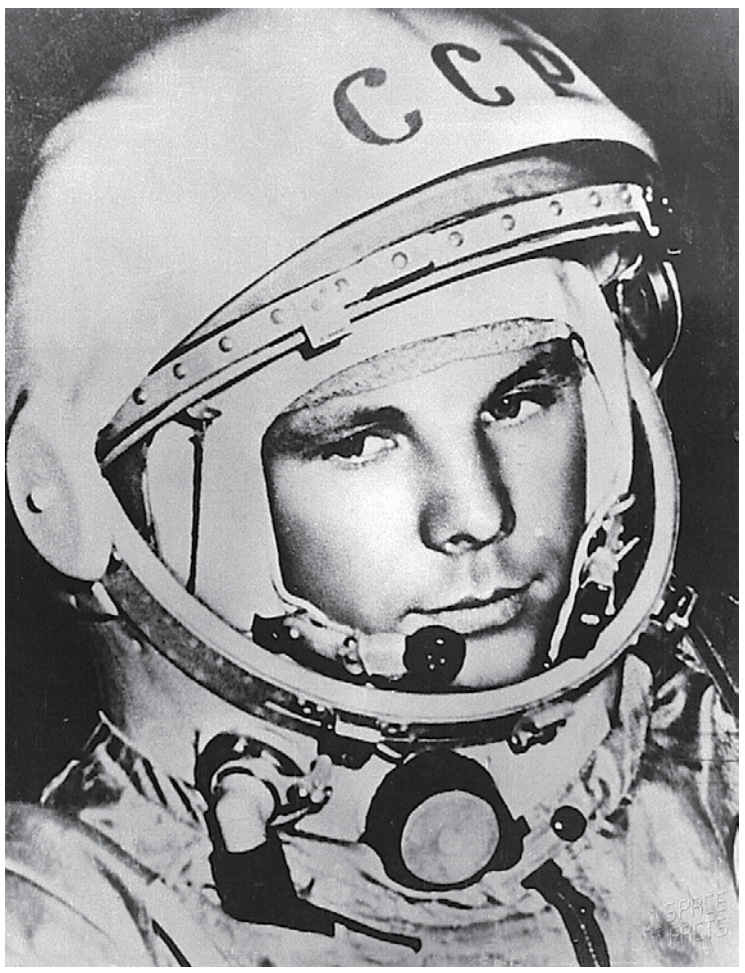
By **NAOMI CASS**

Event horizon sweeps into Centre for Contemporary Photography inviting us to consider the horizon line in photography and other forms of representation. Drawing upon a broad range of local and international work, curator Mark Feary expands the horizon of this media specific gallery and by implication questions the fixed position of the viewer. *Event Horizon* considers art and science as intersecting forms of representation, where photography and literature shape public understanding of science (imagining that which cannot be seen) and conversely, events in science shape the visual enquiry of contemporary art.

I would like to thank the exhibiting artists, in particular visiting artist, Mathieu Briand who made his work on site at CCP as well as giving an artist talk. Lenders to *Event Horizon* are acknowledged for their confidence in the project, including the artists and their representatives; MUSAC: Museo de Arte Contemporáneo de Castilla y León, Spain, for the loan of Pierre Huyghe's work and Melbourne Planetarium for the loan of a splendid selection of NASA images.

Critical funding for this exhibition has been granted by Cultures France, and the *Event Horizon* catalogue has been produced through support from the Besen Family Foundation: we are most grateful to both organisations.

I acknowledge Amelia Douglas for her fine essay on Pierre Huyghe and Rebecca Chew, CCP General Manager for raising support to produce this catalogue. Tracey Hubert, CCP Designer, is to be acknowledged for working closely with Mark Feary in convincingly re-imagining the feel of the Moon landing as it hit the streets in 1969 for the *Event Horizon* publication.



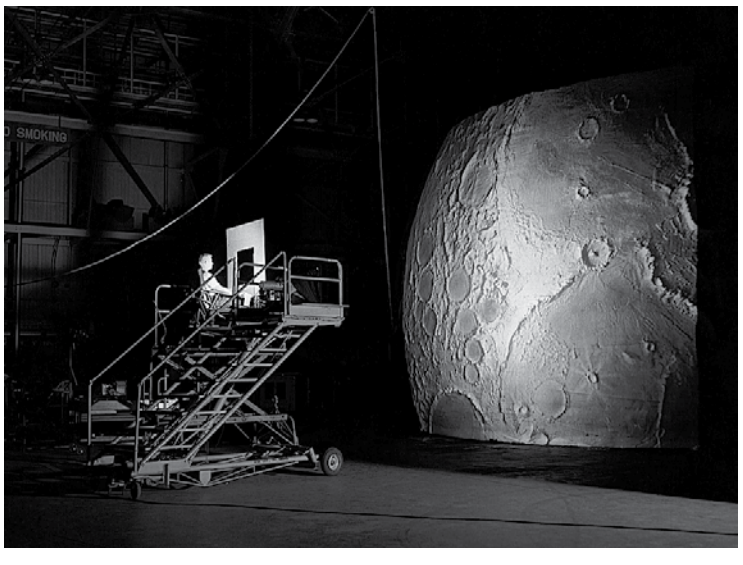
COURTESY SOVIET SPACE PROGRAM

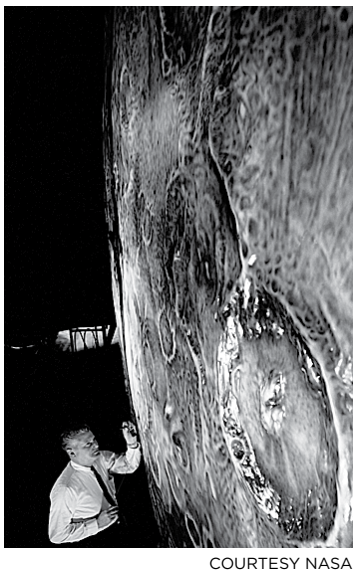
1961 Cosmonaut Major Yuri Gagarin—the first human in space

I thank two eminent scientists Dr David Malin and Professor Jeremy Mould for stepping beyond their horizons and into the art gallery to give lectures in public programs associated with *Event Horizon*.

Finally I would like to thank Stephen Hawking, who has fed so many imaginations, not least of which CCP's stellar curator, Comrade Mark Feary. ■

NAOMI CASS
Director
Centre for Contemporary Photography





COURTESY NASA

LEFT: Test subject sitting at the controls. Project LOLA or Lunar Orbit and Landing Approach was a simulator built at Langley to study problems related to landing on the lunar surface

RIGHT: Artists used paintbrushes and airbrushes to recreate the lunar surface on each of the four models comprising the LOLA simulator

ccp.
centre for contemporary photography

Centre for Contemporary Photography
404 George Street,
Fitzroy, Victoria 3065
Australia
T +61 3 9417 1549
E info@ccp.org.au
W www.ccp.org.au

Acknowledgements

EVENT HORIZON

Event Horizon would not have been possible were it not from the dedication and determination of the artists, writers and speakers involved in the project.

Centre for Contemporary Photography would also like to acknowledge the invaluable assistance of: Anna Schwartz Gallery; John Baez; Ruth Bain; Martin Bush, Melbourne Planetarium; Sylvie Christophe, Cultural and Cooperation Attaché—French Embassy in Australia; Cultures France; Amelia Douglas; Koré Escobar, Helena Lopez & Agustín Pérez Rubio, MUSAC: Museo de Arte Contemporáneo de Castilla y León; Gallery Gabrielle Pizzi; Mark Galea; Alice Gibbons; Stephen Hawking; IAS—International Art Services; Marie Logie; David Malin; Marian Goodman Gallery; Milani Gallery; Jeremy Mould; David Murray; NASA; Neon Parc; Auguste Orts; Portapak; Sophie Robnard; Sofitel Melbourne On Collins; Grant Smith; Sutton Gallery; Tint Design and Warmun Art.

CCP gratefully acknowledges the support from the Besen Family Foundation to produce a suite of catalogues in 2010. ■

Supporters

Cultures France

Besen Family Foundation

ias Fine Art Logistics

Melbourne Planetarium Scienceworks

Sofitel Luxury Hotels

tintdesign

First published for the exhibition *Event Horizon*, 21 May–18 July 2010

ISBN 978-0-9806922-2-8

ARTS VICTORIA
Australian Government Victoria The Place to Be THE VISUAL ARTS AND CRAFT STRATEGY
Australian Government Australia Council for the Arts

Centre for Contemporary Photography is supported by the Victorian Government through Arts Victoria and is assisted by the Australian Government through the Australia Council, its arts funding and advisory body. Centre for Contemporary Photography is supported by the Visual Arts and Craft Strategy, an initiative of the Australian, state and territory governments. CCP is a member of CAOs Contemporary Arts Organisations of Australia.