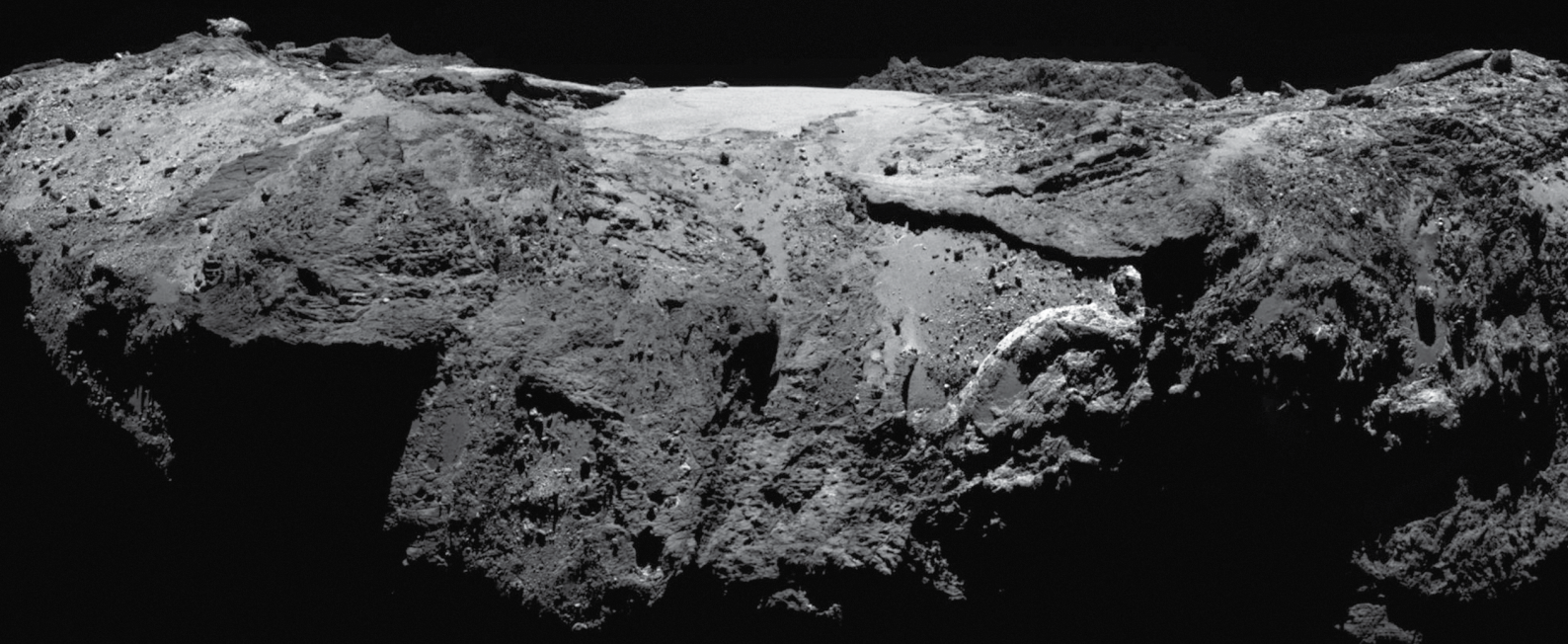


Rosetta

special



Exclusive behind-the-scenes look at the outreach
surrounding ESA's iconic *Rosetta* mission

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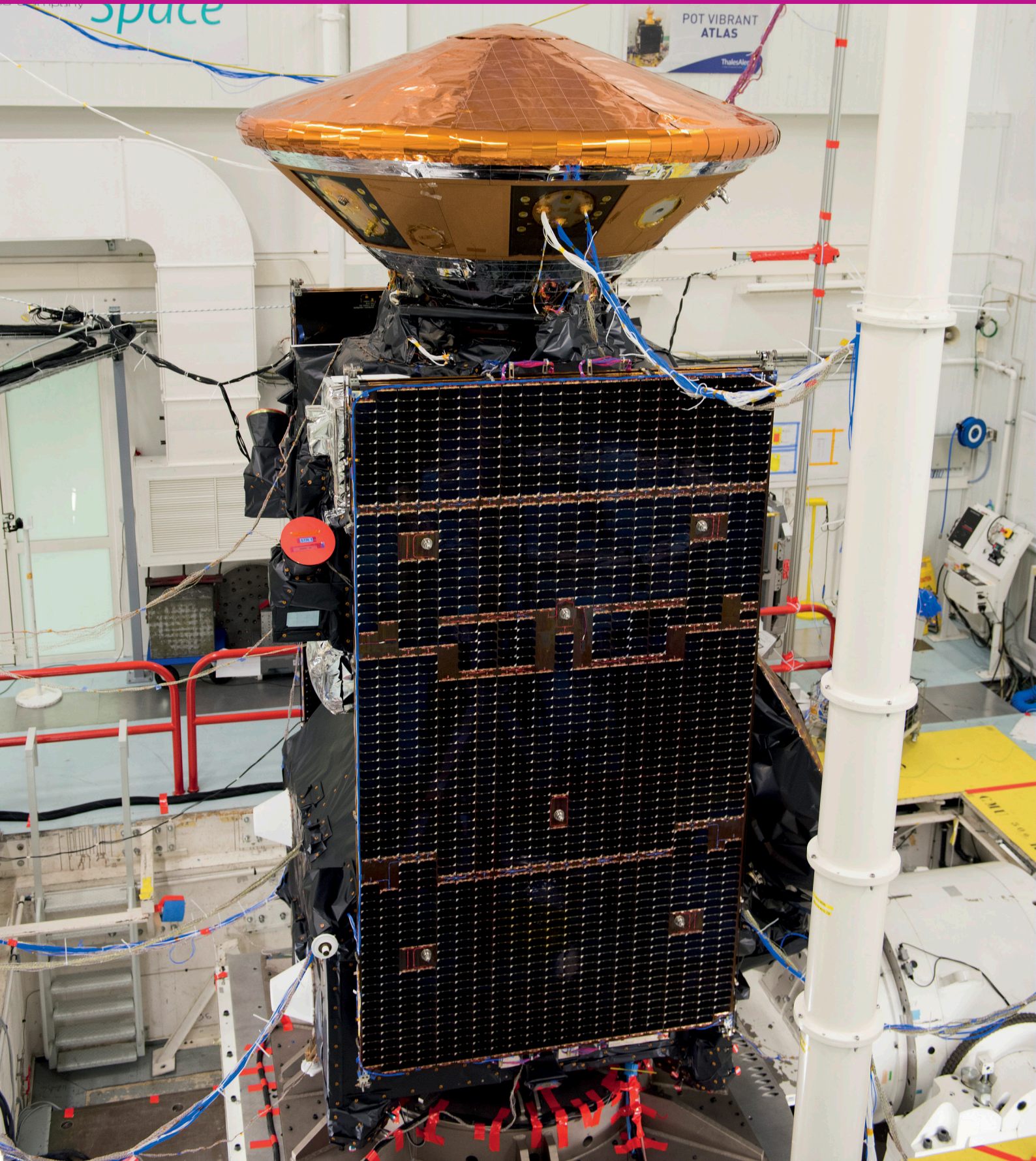
The first of two ExoMars missions will be launched in March 2016. ExoMars, a joint endeavour between the European Space Agency and Russia's Roscosmos space agency, comprises two missions.

The *Trace Gas Orbiter (TGO)* and *Schiaparelli* (both pictured here) make up the 2016 mission, while the second mission, planned for launch in 2018, will combine a rover and a surface science platform. Both missions will be launched on Russian Proton rockets from Baikonur.

TGO will take a detailed inventory of Mars's atmospheric gases. The origin of methane is of special interest — its presence implies an active, current source, and the *TGO* will help to determine whether it stems from a geological or biological source. *Schiaparelli* will demonstrate a range of technologies to enable a controlled landing on Mars in preparation for future missions. The *TGO* will also serve as a data relay for the 2018 mission, which comprises a European rover and a stationary Russian surface science platform. The rover will be the first mission to combine the capability of moving across the surface with the ability to drill down to two metres below the surface, in order to retrieve and analyse samples using the Pasteur payload of sophisticated instruments.

ExoMars is set to open a new era for Europe: moving from remote observation to surface and subsurface exploration of Mars.

Credit: ESA-S.Corvaja





Editorial

It is with great pride that I, alongside the rest of the editorial team, present this issue of *CAPjournal*, dedicated to the communication and outreach that surround the *Rosetta* mission.

For Europe, and indeed beyond, *Rosetta* represents the largest spaceflight event of the decade and it was not luck that the world was watching as it all unfolded. In the United Kingdom, where I am based, it was impossible to miss. You could find news and messages of support for the mission in papers, on television, swathed across the internet and even on a dedicated postmark. I found myself bombarded with questions from friends and family who had never before shown much interest in space about what was happening, what would come next and, perhaps most heart-warming of all, what else there was to know about ESA — an organisation that some of them had not previously known to exist.

In this issue the creators of the communications storm that surrounded and stoked *Rosetta*'s success share their experience of the process and lay out before us the Good, the Great and the downright Ugly of baring all for the public. It is a campaign that exposed the risks, the failures and the unknowns of a pioneering mission to the eyes of the world and, in making itself vulnerable, *Rosetta*'s story became not only known, but embraced and adored the world over. You will also find here critiques and reviews of the mission's communications — outsider perspectives on what was, at times, a controversial approach.

It is always a pleasure to edit this journal and this issue was no exception. I hope you gain as much from reading the articles as I did: I think we can all learn something from the diverse and widely collaborative work that was done to support this historic mission.

In addition to the content of this issue, *CAPjournal* has yet more reason to celebrate as, at the end of last year, both the International Astronomical Union (IAU) and the European Southern Observatory (ESO) confirmed their commitment to the journal. We have many more issues, and a very bright future, ahead of us and it is time to think about how that future might look. It has always been our aim to keep the astronomy outreach community deeply embedded in this journal's evolution and production so if you have any suggestions for improvements or changes to the journal please do get in touch. In the meantime, we encourage you to continue coming together as practitioners and theoreticians to share your learning, innovation and ideas through the journal.

Many thanks once again for your interest in *CAPjournal*, and happy reading,

Georgia Bladon
Editor-in-Chief of CAPjournal

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Beyond the acknowledgements included in individual papers in this special edition, the European Space Agency (ESA) communication team would like to thank everyone involved in the Rosetta mission communication campaign: it was a huge collaborative effort. These include ESA's partner agencies and institutions around Europe and the world; the many external media partners, broadcasters, companies, and individuals who helped build and spread the word; our colleagues from across ESA communications; and the scientists and engineers inside and outside ESA who have worked on the Rosetta mission over many decades, who helped us release accurate and timely information. In particular, we would like to thank our ESA colleagues Matt Taylor, Fred Jansen, Gerhard Schwehm, Patrick Martin, Andrea Accomazzo, Sylvain Lodiot, and Paolo Ferri for their enormous support.

Cover: On the cover of this issue is an image of Comet 67P/Churyumov-Gerasimenko taken with the Optical, Spectroscopic, and Infrared Remote Imaging System (OSIRIS), a dual camera imaging system aboard the *Rosetta* orbiter operating in the visible, near-infrared and near-ultraviolet wavelength ranges. OSIRIS was built by a consortium led by the Max-Planck-Institut für Sonnensystemforschung, Göttingen, Germany. Credit: ESA/Rosetta/MPS for OSIRIS Team MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDA

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- Research & Applications
- Column
- Review

Explained in 60 Seconds: Why Visit a Comet?

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Keywords

Space exploration, Solar System formation, comets, Rosetta

Blazing across the night sky, comets have captured people's imaginations for centuries. Once considered harbingers of doom, we now know them to be priceless treasure troves of dust and ice with the secrets of the early Solar System locked within.

The Solar System was a chaotic place 4.6 billion years ago, but from tiny dust and ice particles to colliding boulders and swirling gas, the planets eventually took shape. Comets, the leftover detritus in this planetary construction yard, were banished to the cold outer reaches of the Solar System. But, as the planets slowly settled into the orbits we see today, huge gravitational perturbations sent showers of comets through our cosmic neighbourhood, slamming into

planets and moons, and leaving impact scars that are visible on their rocky surfaces even today.

As well as bringing destruction, comets are thought to have ferried some of the key ingredients that are needed for life as we know it on Earth; perhaps even complex organic molecules and water.

While today our corner of the Universe is, fortunately, a lot quieter, these frozen time capsules are still occasionally jolted into new orbits that slingshot them closer to the Sun. Many meet a fiery death and others are flung clear of the Solar System, but some become trapped in elliptical orbits that see them returning time and time again.

As they approach the Sun, the increasing heat slowly warms their surfaces, turning ice into vapour and dragging out dust to form the beautiful tails seen from Earth. Occasionally, unpredictable and dramatic outbursts reveal material from within the comet's interior, opening a window onto the processes that drove the evolution of the early Solar System.

By investigating a comet up close — from orbit and from its surface — and living with it for two years, the *Rosetta* mission is giving us an unprecedented opportunity to study the behaviour of these once mysterious worlds, and to better understand the role that they may have played in our origin.

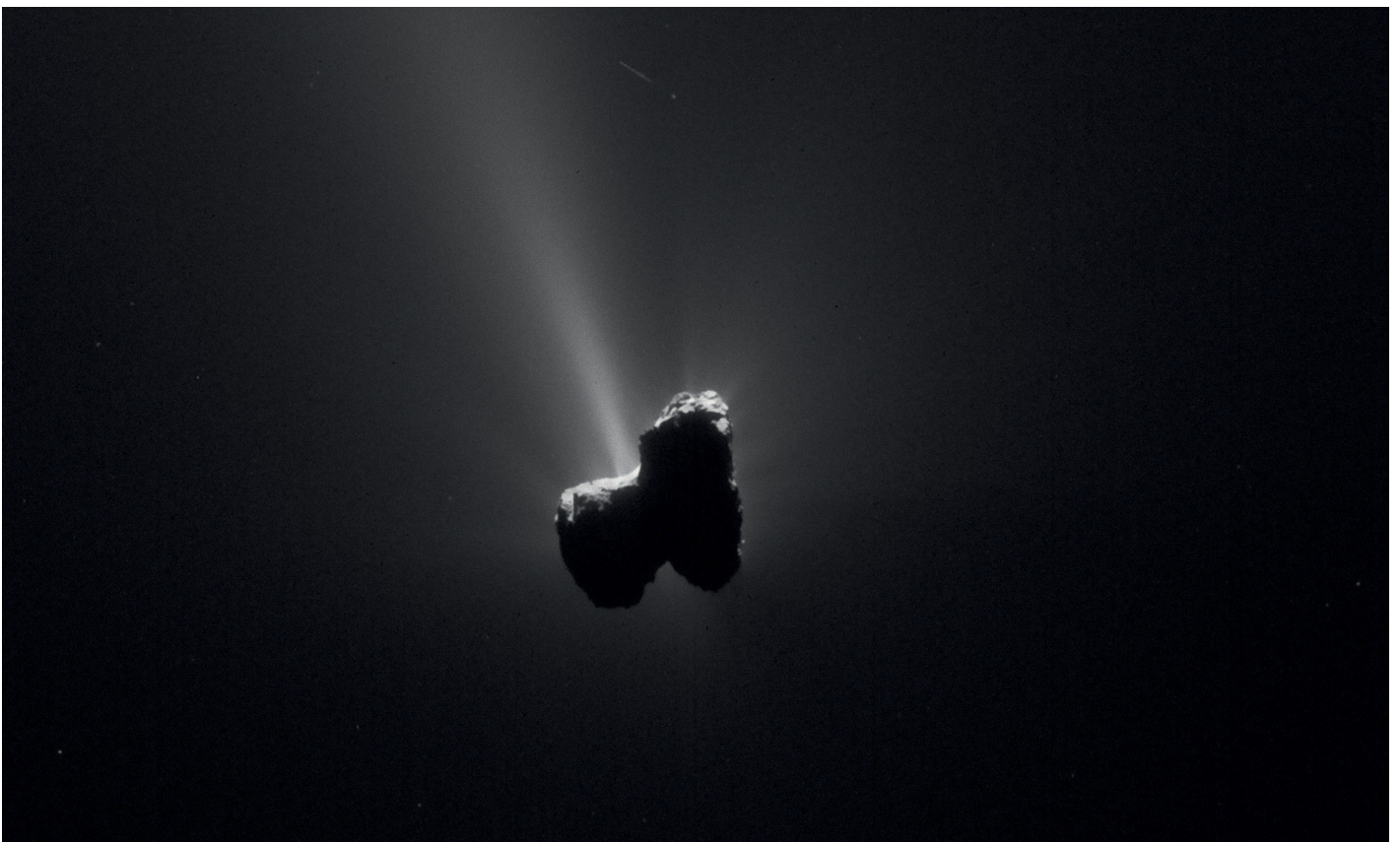


Figure 1. Comet 67P/Churyumov-Gerasimenko pictured by ESA's navigation camera, NavCam, on 11 September 2015. Rosetta was 319 kilometres from the centre of the comet at this time. Credit: ESA/Rosetta/NavCam – CC BY-SA IGO 3.0

The Strategy and Implementation of the *Rosetta* Communication Campaign

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Science communication strategy,
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The communication campaign for *Rosetta* has been the biggest success in the history of European Space Agency outreach, resulting in global awareness for the agency. The mission itself is an extraordinary operational and scientific success, but communicating only the operational and scientific firsts would likely not have brought the *Rosetta* orbiter and *Philae* lander to the attention of so many people, and would not have made the mission part of people's lives across the globe.

The additional impact brought to the mission through the communication campaign was based on a strategic approach focusing on: real-time release of information with maximum transparency; direct real-time access for media and social media; adding a human dimension to the story; and communicating the risks openly in order to manage expectations.

In this article we describe our overall strategy, illustrate its implementation, and provide the framework for subsequent articles in this journal highlighting specific aspects of the campaign in more detail.

Introduction

Does a space science mission designed to accomplish a series of historical firsts need a communication strategy? Should the achievements not speak for themselves and draw everybody automatically to the news? Is content no longer king, making its way into the public domain without assistance? In today's world, with its noisy societal communication and fierce competition for attention, this is not a given. It was evident from the beginning that even *Rosetta*'s historic achievements would need a comprehensive, strategic approach to communication in order to be made as widely visible as possible.

The strategy

The formal European Space Agency (ESA) *Rosetta* communication plan states:

The purpose of the communication campaign is to raise awareness, understanding, and support by providing information and opportunities to engage.

More specifically and following Edward L. Bernays' influential 1947 essay *The Engi-*

neering of Consent (Bernays, 1947)¹ the scope of the *Rosetta* communication campaign was designed to adapt to today's societal communication reality, in order to share the mission with as many people as possible.

There is no doubt that *Rosetta* lends itself very well to communication. The adventure of comet exploration allowed people to experience an unknown world, touched with an element of risk, as this had never been attempted before. The mission's over-arching scientific themes concerning the origins of the Solar System, and potentially the origins of the water and life on Earth, along with a series of world firsts including rendezvousing with, escorting, and landing on a comet, provided ideal stepping stones to build up and nourish excitement through all of 2014.

The overall strategic approach was based on the following assumptions and key ideas:

- Given the poor signal-to-noise ratio in today's societal communication, we needed to make sure that the key events, namely the wake-up from hibernation, rendezvous, and landing, were

well above the threshold by highlighting the huge challenges and risks associated with each step.

- Although communication from Earth with the spacecraft could take anywhere between 12 and 45 minutes one way during this phase of the mission, and image processing might take more than a day, we had to stay as real time as possible in communicating. Both successes and potential failures had to be relayed near-live to provide everyone with a ring-side seat.
- Going live had the potential to foster understanding, support, trust and engagement. The aim was to treat people with the greatest transparency, so that they would know, simultaneously with us in the mission control room, what was going on hundreds of millions of kilometres away.
- Communicating the considerable risks of failure had to be properly managed, hoping for the best and being prepared for the worst.
- A global impact would only be achieved by cooperating closely with ESA's partner national space agencies, research institutes, and space industries, and only if they were in a position to implement their own targeted campaigns —



Figure 1. Rosetta communication teams, with some of the landing day programme participants, on 12 November 2014. Credit: ESA/J. Mai

in full coordination with ESA — to reach national audiences.

- Global coverage would only happen if (social) media had real-time, direct access to all information and could turn this into real-time coverage.

Additional valuable engagement could be achieved if we succeeded in making this mission part of people's daily lives, perhaps by assigning *Rosetta* and *Philae* anthropomorphic personalities, embarking on an exciting exploration mission deserving empathy.

ESA scientific missions have often been in the global spotlight before, for example with the *Huygens* landing on Titan², the discovery of Martian methane through *Mars Express*³, and *Planck*'s images of the cosmic microwave background, the left-over light from the Big Bang⁴. However, the *Rosetta* communication campaign required not only building up, but also maintaining, engagement and attention for a whole year and beyond, and on a global scale; a challenge that ESA had not had to master before.

Cooperation and coordination

While ESA's missions are designed and funded on the basis of their scientific and technological goals, as well as the application of their data, its 22 member states and partners also expect visibility through

communication, especially in their national contexts. Thus, while *Rosetta* is an ESA-led mission and ESA is a genuine global brand, it was important to ensure that *Rosetta* was present in each of the member states too. Hence it was essential to put in place an effective mechanism to coordinate and cooperate on communication and outreach.

In reality, the resulting *modus operandi* in the ESA context is usually a mixture of cooperation and competition. To ensure that cooperation prevailed over competition on this occasion, all *Rosetta* communication activities were coordinated, with the main vector being a weekly teleconference starting in late 2013, involving as many partners as possible from ESA member states and from the USA, including national space agencies and individual research institutes involved in the mission⁵.

The aim of these meetings was to exchange information; share communication material and products; agree on publication timelines, press conferences and their line-ups; balance visibility amongst partners; and above all, to ensure a coordinated release of the same information at the same time in order to maximise the impact of the *Rosetta* communications in all member states, the USA, and beyond.

By circulating draft texts, images, and animations in advance of publication, all partners were in a position to adapt this

information to fit their national and cultural environments, and to add their specific angles. Press conferences and media events were broadcast live over the internet and on satellite. This allowed partners to build local or national events around them, making those events attractive to their own communities.

The coordination teleconference also evolved into a forum to launch and develop new activities. For example, the competition to name the landing site of *Philae* was planned and executed jointly by Agenzia Spaziale Italiana (ASI), Centre national d'études spatiales (CNES), Deutsches Zentrum für Luft- und Raumfahrt (DLR) and ESA. The group also discussed shortcomings and ways to improve matters. The trust built up over the course of 2014 proved vital in resolving occasional conflicts of interest to the benefit of the common goal of communicating the mission as effectively as possible. The weekly teleconferences became a strong tool of collaboration for the *Rosetta* communication campaign and its roll out.

Trust was also key in the relationship between the ESA communication team and people directly involved in the mission itself: the science working team, the mission operations team, the science operations team, and the mission management team.

One would assume — as most of the people involved were working for the same organisation, namely ESA — that trust is a given. However, in reality, it takes time to build trust and it relies on positive common experiences while working together. For example, in the lead-up to the moment when *Rosetta* would wake from its 31-month hibernation in January 2014, the decision to kick off *Rosetta* communications with a Wake Up, Rosetta! competition was met with some scepticism. For those who had in mind mainly, or rather only, science, technology and spacecraft operations — the traditional inherent communication content of any space mission — it was not evident that a virtual shouting campaign was really suited to a Solar System exploration mission.

The ice was broken when it became clear that the daily, seemingly banal experience of waking up had indeed resonated with the general public, leading to many elaborate video contributions to the Wake Up, Rosetta! competition and even more hits and likes on ESA web pages. After *Rosetta* came out of hibernation on 20 January 2014, communication was seen as an intrinsic part of the mission.

Communicating risk

The Wake Up, Rosetta! campaign was designed to bring awareness to a critical point in the mission's timeline. On 20 January 2014, after 31 months in deep-space hibernation, *Rosetta*'s computer was supposed to start reactivating the spacecraft at 11:00 Central European Time (CET) spacecraft time, bring it out of a stabilising spin, establish its attitude, then send a signal to Earth with an arrival time during a window starting at 18:30 CET. If all went well, contact would be signalled via a spike in an otherwise flat line on control monitors at the European Space Operations Centre (ESOC) in Darmstadt, Germany.

Deliberately hibernating a spacecraft and having it wake itself autonomously more than two and half years later was unprecedented in the history of spaceflight and not without risk, even if the chances of a micrometeoroid impact or onboard system failure during that time were deemed to be low. In the absence of any contact with *Rosetta* for so long, the tension was high.

Mission managers were initially opposed to the plan to broadcast the wake-up event live, preferring to do it behind closed doors, then issue a press release the next day announcing either success or failure. From the communication perspective, however, it was clear that a live event could bring a great deal of engagement if successful, and avoid any accusations of concealing problems if not. Either way, it provided the perfect opportunity to open ESA up to the world.

At 18:30 CET, the clock started to tick and the conversations began to get quieter throughout ESOC. Mission operations personnel were watching the screens in the main control room, while senior management from ESA and partner agencies sat in the front row of the conference room, hoping, like everybody else watching around the world, to see the imminent wake-up signal. Everything was broadcast live via satellite and the internet while the minutes passed without any news from *Rosetta*.

By 19:00 CET, the number of TV and still cameras focused on the front row had increased dramatically. It had been decided that if no signal was received by 19:30 CET, an announcement would be made, calling off the media activities for the night, while still giving *Rosetta* more time to make contact. At 19:18 CET, just as Paolo Ferri, head of ESA's mission operations department, was about to leave the main control room to go and make that announcement, the wake-up spike appeared on the monitors and was broadcast around the world, followed by great relief and joy.

The full 48 minutes of hope and nail-biting worries had been carried live on TV and the internet, and the reward was enormous. Half a million people had watched ESA's online feed and they immediately appreciated their ringside seat and direct real-time link to the mission, even in a moment when things were not going quite as expected. Transparency is key when it comes to communicating risk: this is known from the textbooks, but proved to be true throughout the delayed wake-up.

Wake-up day also set the scene for the rest of 2014, with a number of major documentary companies including Discovery Channel, Arte and National Geographic beginning their filming ahead of releases around the landing in November.

There were also risks associated with the next key step after wake-up, the series of ten thruster burns to bring the spacecraft to its rendezvous point 100 kilometres from Comet 67P/Churyumov–Gerasimenko on 6 August 2014⁶. Although different, as there could have been chances to try again if the rendezvous was missed first time, the key to communicating the risk — even if difficult to quantify — was to be as transparent as possible and to stress the fact that when exploring new avenues one needs to expect the unexpected⁷. All ten manoeuvres were announced beforehand, illustrated in animations, and the associated risks highlighted. As with the wake-up, the day of final rendezvous was broadcast live from the ESOC main control room to share the moment in real time. Despite this being the crossing of a more or less arbitrary line in space, the event was widely followed.

For the landing of *Philae* on 12 November 2014, much more was at stake. Even though substantial effort had been put into emphasising that *Rosetta* itself was already successfully operating at the comet and would deliver the great majority of the scientific results, it was clear that the general public and media were nevertheless going to identify *Philae*'s landing as the crux of the mission. A failure of the landing could have jeopardised the public's perception of the mission and damaged the ESA brand⁸. Thus, even more intense advance communication efforts were needed to highlight and explain the risks associated with the landing, and how *Philae* fit into the wider mission. Two major communication activities were implemented to prepare for landing in this regard.

During the press conference held at ESA Headquarters in Paris on 15 September 2014 to announce the selected landing site, all mission and scientific experts

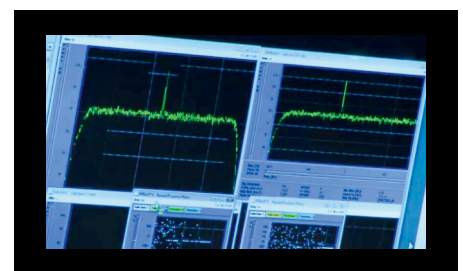


Figure 2. This is the signal that brought a nerve-racking 48-minute wait for *Rosetta* to wake up to an end. Credit: ESA

stressed the risks associated with landing. *Philae* would descend to the surface on a ballistic trajectory, with no manoeuvring capabilities to avoid dangerous terrain, and given the unexpectedly rough nature of the comet — covered with craters, cliffs, slopes and boulder fields — even the best possible landing site would be hazardous.

A more innovative approach to communicating this risk involved the short science fiction film *Ambition* (McCaughrean, 2016). Initially conceived as a way to communicate the key scientific aims of *Rosetta* to non-traditional audiences including film lovers, gamers and internet surfers, it also played a key role in framing the risk. A core message of the film was that we humans are ambitious, we explore, we take risks, and we learn from our mistakes. Released two weeks prior to the landing of *Philae*, it added a human dimension, setting expectations, and emphasising that the risks of the landing and its inherent potential to fail had the positive connotation that one has to be daring to explore and achieve ambitious goals.

The message that attempting a landing would be bold and risky was clearly received, and no doubt contributed to the intense worldwide interest on landing day: would *Philae* make it? Although the landing did indeed not go according to plan, with

Philae failing to secure itself to the surface, bouncing and flying across the comet for a further two hours, it was perceived very positively by the public. *Philae* was able to deliver images of its final landing site and perform a first run of scientific experiments before shutting down due to lack of sunlight, and was ultimately seen as a great success by the majority of commentators and viewers. Correspondingly, no harm was done to the image of *Rosetta* or ESA; quite the opposite, in fact⁹.

(Social) media relations

Since the landing of ESA's *Huygens* probe on Titan in 2005, there has been a massive shift in news consumption away from print and towards video, mobile and social media. This clearly had to be taken into account when preparing and rolling out the *Rosetta* communication campaign.

While print is in decline, television is still of major importance and remains at a high and stable level. But even established newscasters such as the BBC, CNN and Al Jazeera are competing for a global English-speaking audience alongside the websites of newspapers such as *The Guardian* and *The New York Times*, and newer, purely online players such as Huffington Post, Slate, and BuzzFeed.

Simultaneously, social media — especially Facebook and Twitter, but also WhatsApp, SnapChat, Instagram, Tumblr, and so on — have been experiencing a rapid rise in audience and reach, and with this a new dynamic in the ways that audiences share news and interact directly with newsmakers has been born.

These changes have been accompanied by some degree of demographic division: younger people up to 35 years of age prefer to get their news online and via social media, while those older than 45 prefer TV and online (Reuters, 2015). In terms of delivery, there is a clear trend towards the use of smartphones and tablets, albeit without yet renouncing the desktop or the TV set. Using several platforms to follow news seems to be the norm.

This sets the scene for anyone who would like to be heard and to participate in societal communication today. It is essential to produce news oneself in formats suitable for social media and mobile devices, preferably in video form, and to provide journalists and social media multipliers with direct access to the events as they unfold and the facilities to dispatch their broadcasts or stories rapidly to their audiences.

Although social media have been used throughout the mission, these wider



Figure 3. François Hollande, President of France, views 3D images during the comet landing event. Credit: CNES/PIRAUD Hervé

lessons were particularly important during the implementation of communication for the main mission events of wake-up, rendezvous and landing.

At each event, we witnessed a growing interest and participation by conventional and social media outlets. Recognising that the landing was going to be the most publicly significant event, we set up a permanent press centre at ESOC. Operations started two days in advance of landing, with journalists and social media producers informed about the status of the mission and preparations for the big day, along with interview opportunities with key participants.

Landing day itself saw a fully-fledged stage programme at ESOC featuring scientists and engineers explaining the challenges of the landing, progress and the status quo. The programme started early in the morning, as *Philae* was deployed from *Rosetta*, and continued through the day, as the first touchdown took place, and into night, when the world was informed of *Philae*'s final landing.

The programme also included live links to the Lander Control Center at DLR in Cologne, and the Lander Science Operations and Navigation Center at CNES in Toulouse. Media were present at both sites.

The programme was streamed live by ESA¹⁰ to the internet, where it was watched by ten million people, and made available via satellite to the world's broadcasters and their much larger audiences. The live broadcast was used by many European institutes and space agencies as a core part of their own events: one significant example was the CNES-organised event held at the Cité des Sciences in Paris in the presence of François Hollande, the French President.

At ESOC, there was a huge media presence, including a large number of satellite broadcast trucks. Approximately 360 media representatives were present and 1400 interviews were conducted onsite or remotely via TV, radio, or online channels on landing day alone. Both numbers are unprecedented in the history of ESA.

With regards to social media, a special emphasis was put on Twitter. According

to the Reuters Institute *Digital New Report* for 2015, Twitter is seen much more as an active destination for news by an audience that is deeply interested in the latest developments, compared with Facebook, for example (Reuters, 2015). Accordingly, ESA's various Twitter accounts, not least the account representing the *Rosetta* spacecraft, which was tweeting in the first person (Baldwin et al., 2016), became the primary lead in for real-time social media news engagement.

During landing day, a special cooperation agreement was established between ESA and Twitter Germany, with a Twitter curator onsite at ESOC to help ensure that the news of the landing was quickly picked up across their audience. As a result, the landing became the top trending topic globally on the day, as heads of state, representatives of global brands, and a very wide section of the public engaged heavily with ESA via Twitter, leading to a jump in follower growth for the @ESA_Rosetta account during the week of landing from 90 000 to 284 000¹¹.

This also extended to a crossover media campaign, with selected tweets appearing embedded in the ESA TV live broadcast, and combined with ESA's channels on Flickr, Instagram, Facebook, Google+ Hangouts, and YouTube, the mission's social media activities played a very significant role in spreading the landing day news around the world.

Making the mission personally relevant

While content is still king, in the modern era of social, video, and mobile channels, it also needs to be of personal relevance. The big philosophical questions posed by *Rosetta* can seem less pressing and rather remote compared to the problems of daily life, and yet the connection can be made, as they can be linked to the human condition.

Thematically, the search for an understanding of the formation of the Solar System and for the origins of water and life are among the big scientific questions that *Rosetta* is engaged in. The challenge for communications is to find ways for people to connect to those main themes, and for people to identify and sympathise with



Figure 4. Promotional poster for the film *Ambition*. Credit: ESA/Platige Image

them. A key way of achieving this was to place the human dimension of the mission in the foreground.

An obvious method for humanising the story was to emphasise the people who were making the mission happen whenever possible, ensuring that they were seen presenting *Rosetta* on video and during the live events. Mission scientists, operators, engineers, and managers were featured intensively in ESA TV broadcasts and videos, external TV interviews, documentaries, and online channels such as Google hangouts. They were briefed not only to talk about the facts, but also to describe what their work on the mission meant to them personally.

During the live events, this approach gave people a connection behind the scenes. They were able to witness scientists and engineers nervously sitting through the nail-biting minutes when *Rosetta* woke up late from 31 months of hibernation, and the flight director's tears of relief once the touchdown had successfully taken place after decades of work.

Several key individuals involved in the mission, including the flight director and the project scientist, became well known in their own right in the media and across social networks. They became the faces of

Rosetta, real people who the public could relate to because they showed their emotions and the human aspect of their work.

Beyond this direct link to people working on the mission, we also developed two competitions designed to highlight specific emotions and provide opportunities for the public to empathise with the mission and the spacecraft (O’Flaherty et al., 2016). Both focused on common experiences, linking the adventures of *Rosetta* and *Philae* to routines of daily life (Berger, 2013), in the hope that while going through them, people would also think about *Rosetta*.

The first competition had the goal of getting the public to (virtually) help wake the spacecraft from hibernation¹². Waking up or waking up another person happen daily for almost everyone on Earth: it is a routine we all share. The competition asked people to submit videos with their wake-up message to *Rosetta*, and the resulting creativity, positive online feedback, and sharing via the #WakeUpRosetta hashtag started quite a buzz on social media. The quality of the videos submitted suggested that some people had already made *Rosetta* part of their household and maybe even their wake-up routine¹³.

The other routine experience that we tapped into was the feeling of impatience to arrive when on the last leg of a journey. The *Rosetta*, are we there yet? competition¹⁴ linked the imminent arrival of *Rosetta* at its target comet in August 2014 to the holiday season in the northern hemisphere at that time. Again the creative quality was very high and showed that certain core groups of people were well engaged¹⁵.

Our short science fiction film *Ambition* was also a very important vehicle to highlight the human dimension (McCaughrean, 2016). Starting from the title itself, the film was aimed at singling out one of human-kind’s primary drivers when it comes to accepting risk as we reach out in our exploration of the Universe. It also provided a bridge spanning from the dream that *Rosetta* was 30 years ago to the reality it achieved in 2014 and still further to a possible far future. A future where people return to the big questions of the possible origins of water and life on the Earth, gives both an intellectual and emotional rationale as to why *Rosetta* is an important mission for everyone.

Made in secret, promoted virally via a fake Hollywood-style trailer, and launched just two weeks before the comet landing, *Ambition* succeeded in grabbing public and media attention, with more than 1.5 million views by landing day, and over 3 million to date. That the film was actually about a real space mission came as a positive surprise to many, and ESA was congratulated for thinking outside the box and pushing science communication to new levels.

Another essential step in fully exploiting the human dimension within the communication of the mission was the creation of anthropomorphic personalities for the two robotic protagonists, with *Rosetta* and *Philae* embarking on an extraordinary adventure of comet exploration together (Mignone et al., 2016).

While this first-person anthropomorphic approach has been used to promote other space missions, including NASA’s Mars rover *Curiosity*¹⁶ and JAXA’s asteroid probe *Hayabusa*¹⁷, we were able to develop a wider and more engaging approach with *Rosetta* and *Philae*, not least because the two spacecraft were able to interact.

While it was decided from the beginning that they would communicate in first person via Twitter, their much-loved visual appearance as cartoons came as a by-product of the promotion of the Wake Up, Rosetta! competition.

The two representations turned out to be complementary. While Twitter allowed for immediate real-time dialogue between the two spacecraft and between the spacecraft and their followers on Earth, the cartoons made it possible to access the full palette of human emotions by showing the shared experiences of an older sister and a younger brother on an exciting, but hazardous, adventure.

The Twitter dialogue, even though largely scripted in advance, provided instantaneous engagement with the mission as it unfolded in real time, including unforeseen events, such as the unexpected landing conditions in November 2014 or the revival of *Philae* in June 2015. By comparison, the cartoons provided the bigger picture and helped to put past events into context, to manage expectations and to share the scientific findings of the mission.

As a result of this combined anthropomorphic approach, both *Rosetta* and *Philae* have been adopted empathetically by many, adults and children alike, and there have been many occasions when strong emotions have been stirred up by the pair, not least at the moment when *Philae*’s battery dwindled after three days on the comet. People continue to ask for more episodes of the cartoons, probably the greatest compliment one could hope for.

Conclusion

Even a mission like *Rosetta*, which is already communication-friendly by its very nature, can gain enormously through a concerted, strategic communication campaign spanning a wide range of approaches and audiences, bringing global visibility and widespread public engagement.

By stressing the human dimension, personalising the two protagonist spacecraft, telling the comet exploration adventure in compelling visual ways, and allowing the public and media to have a real-time ring-side seat for engagement and interaction, the *Rosetta* communication campaign helped create the fertile ground out of which arose huge awareness of and interest in the mission around the world.

Notes

See also Edward L. Bernays 1965, *Biography of an Idea: Memoirs of Public Relations Counsel*, (London: Simon & Schuster)

¹ More on *Huygens* and Titan: http://www.esa.int/Our_Activities/Space_Science/Cassini-Huygens

² The discovery of Martian methane through *Mars Express*: http://www.esa.int/Our_Activities/Space_Science/Mars_Express/Mars_methane_and_mysteries

³ More on *Planck* and the images of the cosmic microwave background: http://www.esa.int/Our_Activities/Space_Science/Planck

⁴ Regular participants of the weekly coordination teleconferences were: ASI, CNES, DLR, UK Space Agency, Swedish National Space Board, Istituto Nazionale di Astrofisica, Max Planck Institute für Sonnenforschung, NASA/JPL, TU Braunschweig, Centre National de la Recherche Scientifique, University of Uppsala, Finnish Meteorological Institute, Swedish Institute of Space Physics,

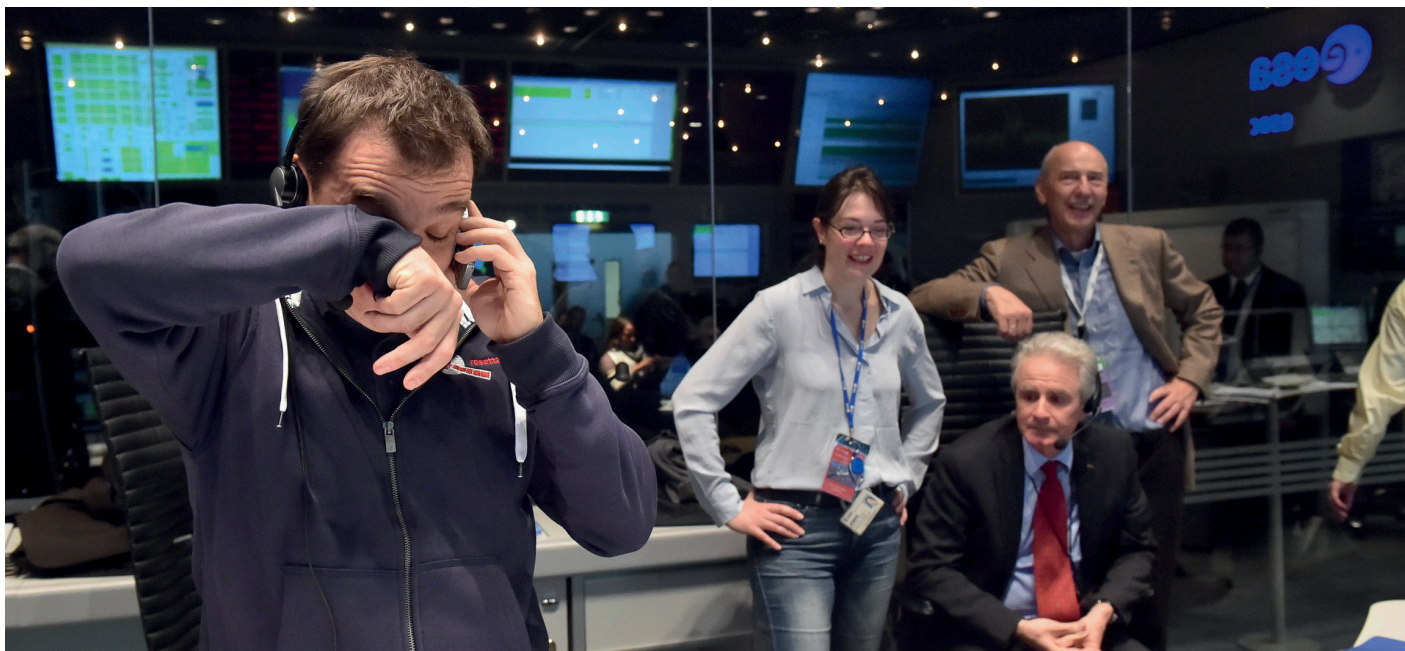


Figure 5. Rosetta Flight Director, with colleagues, in the mission control room after the successful landing. Credit: ESA/J. Mai

- Observatoire de Paris, Norwegian Space Centre, Institut für Weltraumforschung.
- ⁵ The approach to the rendezvous was presented in a continuous photo stream stemming from the Navigation Camera on *Rosetta*. The fact that the higher resolution images from the OSIRIS science camera could not be used for communication purposes during this time met with some criticism on social media channels. Since December 2015, OSIRIS has provided a regular image stream of recently acquired images.
- ⁶ Another example of an unexpected discovery came when the shape of Comet 67P/Churyumov–Gerasimenko was resolved and it was anything but spherical, resembling much more a duck with a body, a neck and a head.
- ⁷ ESA had already experienced what it means to recover from negative publicity in the case of the failed landing of *Beagle-2*, a UK-led lander carried by *Mars Express*, in December 2003, where it took almost two years to demonstrate the scientific success of *Mars Express*.
- ⁸ Landing day also saw the unfolding of a significant online and broader media debate about an inappropriate shirt worn by a key member of the *Rosetta* team and seen widely on television. While clearly an important and sensitive issue, the cultural and political implications have already been discussed in detail by many commentators, and further analysis is beyond the scope of the current overview article.
- ⁹ The platform livestream.com was used to enable livestreaming of the event.

- ¹⁰ During landing day, @ESA_Rosetta gained 156 000 followers, @Philae2014 278 000 and @esa 50 000.
- ¹¹ More on the Wake Up, Rosetta! campaign can be found here: http://www.esa.int/Our_Activities/Space_Science/Rosetta/Wake_up_Rosetta
- ¹² Examples of the Wake Up, Rosetta! messages created by the public can be found here: http://www.esa.int/Our_Activities/Space_Science/Rosetta/The_competition_winners_who_helped_us_wake_up_Rosetta
- ¹³ More information on the Rosetta, are we there yet? competition can be found here: http://www.esa.int/Our_Activities/Space_Science/Rosetta/Rosetta_are_we_there_yet
- ¹⁴ The Rosetta, are we there yet? winners can be found here: <http://blogs.esa.int/rosetta/2014/08/28/rosettaarewethereyet-winners-announced/>
- ¹⁵ More on NASA's Mars rover *Curiosity*: <http://mars.nasa.gov/msl/>
- ¹⁶ More on JAXA's asteroid probe *Hayabusa*: http://global.jaxa.jp/projects/sat/muses_c/

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How a Cartoon Series Helped the Public Care about *Rosetta* and *Philae*

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Once upon a time... is a series of short cartoons¹ that have been developed as part of the European Space Agency’s communication campaign to raise awareness about the *Rosetta* mission. The series features two anthropomorphic characters depicting the *Rosetta* orbiter and *Philae* lander, introducing the mission story, goals and milestones with a fairy-tale flair. This article explores the development of the cartoon series and the level of engagement it generated, as well as presenting various issues that were encountered using this approach. We also examine how different audiences responded to our decision to anthropomorphise the spacecraft.

Introduction

In late 2013, the European Space Agency’s (ESA) team of science communicators devised a number of outreach activities to engage the general public in the *Rosetta* mission, which was about to reach three milestones the following year: waking up from hibernation, and both rendezvousing with and landing on Comet 67P/Churyumov–Gerasimenko (Comet 67P/C-G). However, the spacecraft was launched in 2004, and had been in hibernation — meaning no contact with Earth — for almost three years, and it is fair to say that by 2013, it was known, but only to a specialised audience of space science professionals and enthusiasts.

Several activities were specifically designed to highlight *Rosetta*’s expected exit from hibernation on 20 January 2014. The purpose of these activities, aimed at different target groups, was to (re)kindle curiosity about a mission that was largely unknown to most audiences, but that had potential for great public interest and appeal.

The activities included press briefings, the launch of new social-media channels dedicated to *Rosetta*, and a series of short videos to be distributed on the

internet before the spacecraft came out of hibernation (Bauer et al., 2016). The four short videos were commissioned from the cross-media company Design & Data GmbH (D&D). They were intended to promote a Wake Up, Rosetta! campaign, run by ESA, in which members of the public were invited to take part in a competition by creating wake-up videos and sending them to ESA, symbolically helping to wake the spacecraft. The top prizes included an invitation to the comet-landing event in November (O’Flaherty et al., 2016).

One of the four short films used imagery related to alarm clocks, while a further two involved asking people on the streets of European cities to send a wake-up message to *Rosetta*, and what they normally did after waking up. These were both straightforward and direct. The fourth film played off the idea that some of the mission themes — the long adventure, the goal of unlocking the mysteries of comets and, most importantly, the spacecraft being asleep at the time and the imminent wake-up in January — resonated with the fairy-tale narrative of *Sleeping Beauty*. It was decided that the fourth video in the set should be a feel-good, family-friendly short film describing *Rosetta*’s journey and highlights so far, and giving a taste of the

exciting highlights to come, using the fairy-tale narrative as a base. The hope was that the video would help to build a degree of human empathy between the public and *Rosetta*.

The team originally envisioned a combination of illustrations and original footage from the mission presented in the style of a storybook, which would be released shortly before the winter holiday in advance of the spacecraft’s wake-up call in January. The aim was to engage a wide public, but particularly school-age children.

The ESA team drafted the initial storyline for the *Once upon a time...* video and then worked with the creative team at D&D on further development. D&D suggested producing the video as a fully-fledged cartoon, embracing the benefits of visual storytelling to make the mission more accessible. They built on the original ESA storyline to demonstrate this concept, creating a first script for the video. In the process of drawing the shapes of the *Rosetta* and *Philae* probes to represent a simplified, but distinctly recognisable version of each spacecraft, the two characters took shape, and anthropomorphic features — such as arms, a mouth and eyes — were added.



Figure 1. The first cartoon concept proposed in late 2013. Credit: Design & Data

The first concept illustrations developed by D&D were promising and the ESA team bought into the vision, agreeing to use a cartoon video to promote *Rosetta*'s wake-up competition alongside the three other clips produced by D&D.

Cartoons and personification of spacecraft

The cartoon, presenting *Rosetta* and *Philae* as two brave, cheerful explorers on a fun and pioneering journey across the Solar System, was released on 20 December 2013. In a little over two minutes, it described the mission's launch, the planetary and asteroid flybys, and the long cruise up to the point when the spacecraft, far from the energy of the Sun, fell asleep. In true fairy-tale style, the video ended with *Rosetta*'s anticipated wake-up and an enticing "To be continued..." message.

The video, with a narration originally only in English, was published on ESA's websites and YouTube channel, and promoted with ESA's social media channels, as well as via the *Rosetta* mission Twitter and Facebook accounts (Baldwin et al., 2016). It proved quite successful, registering over 49 000 views on YouTube in the six weeks following its release.

Although there are precedents from other outreach campaigns for personified space probes, landers, and even fundamental particles, this was the first time that such an approach had been taken for ESA's main tier of communication². Nevertheless, after the release of this first cartoon, we received

very enthusiastic messages from many members of the public who appreciated the clear content and fresh style delivered by the animation.

Building on the saga

The positive response to the introduction of the characters led to additional cartoon episodes and a continuation of the narrative as mission events unfolded and the overall *Rosetta* communication campaign developed during 2014.

The collaboration between ESA and D&D continued. For each episode, the ESA team started by writing the script and outlining a rough storyboard, after which the D&D team created a draft animation (with a placeholder narration) on which the ESA team commented and suggested edits. This lengthy review process was necessary to ensure that the content of the cartoons was not only visually and audibly engaging, but also factually correct in terms of accurately representing the course of events, as well as the scientific and engineering aspects of the mission. Based on the feedback provided the D&D team would then produce the fully animated version of the episode, recording the narration with a voice actor and including a music track. After final iterations to check that every detail was correct, the ESA team would publish the episode and promote it on ESA's online channels.

Ahead of *Rosetta* arriving at the comet in the summer of 2014 the cartoons were used to create a trailer to promote the

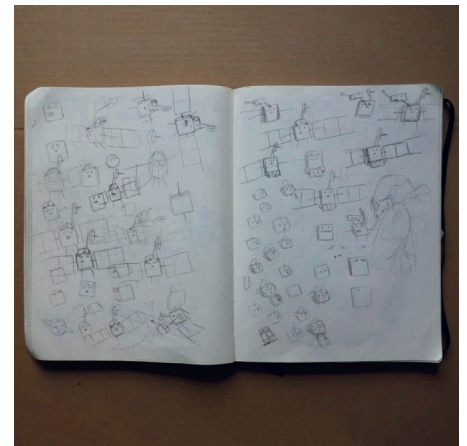


Figure 2. Early sketches showing the development of the *Rosetta* and *Philae* cartoon characters. Credit: Carlo Palazzari

Rosetta, are we there yet? competition conveying the feeling of being on a long journey and the excitement of reaching one's destination (O'Flaherty et al., 2016). Following this a second full episode was released. Longer and more involved, this episode covered the events that followed the successful wake-up, including taking first images of the comet, planning rendezvous manoeuvres, dreaming of future scientific investigations, and, finally, the arrival. In both videos, the personalities of the spacecraft characters were further developed, with *Rosetta* pictured as a calm, reliable pilot and *Philae* as a curious passenger, impatient to arrive at the comet.

The third full episode was released just a week before rendezvous on 6 August 2014. At that time, the ESA team had also been investigating another of the mission themes: the role of comets in the history of science³. The team had considered including some highlights from this fascinating story in the arrival episode, but realised that this subject deserved its own episode — this became *Fabulous Fables and Tales of Tails*.

It was imagined as a story that the *Rosetta* and *Philae* characters may have read on their journey, narrated by a grandfather figure represented by ESA's *Giotto* spacecraft which, in 1986, was the first spacecraft to make close-up observations of a comet. In this four-minute-long episode, *Giotto* and a handful of probes from other space agencies were also anthropomorphised, as *Giotto* recounted stories about their various cometary missions. The episode also featured human characters from the history

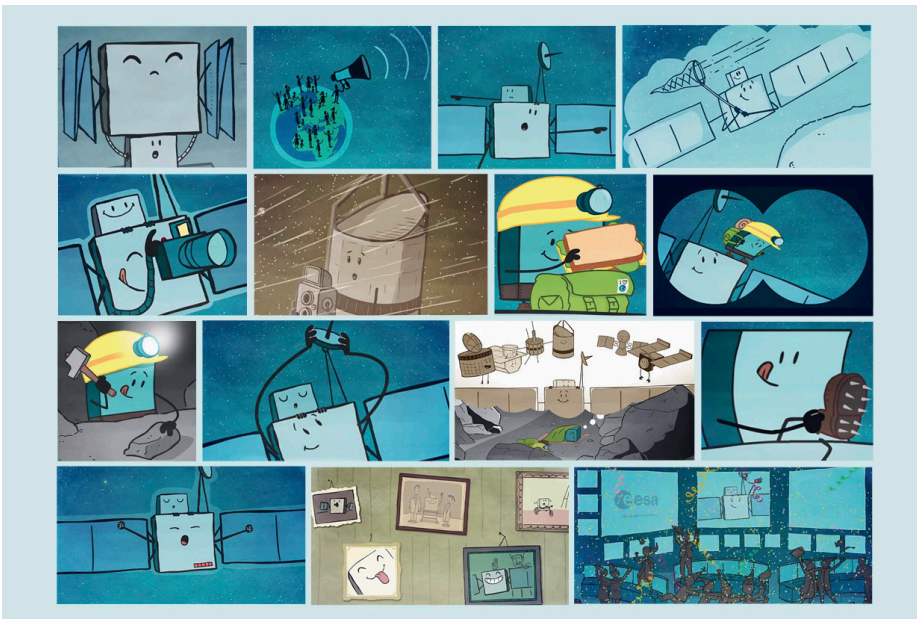


Figure 3. Selected scenes and characters from the cartoon. First row: Rosetta and Philae during launch; people on Earth shouting “Wake Up, Rosetta!”; Rosetta and Philae finding directions in space; Rosetta catching comet dust. Second row: Rosetta taking a photo; Grandfather Giotto taking a photo; Philae and his sandwich; Rosetta and Philae ready for comet landing. Third row: Philae studying the comet surface; Rosetta adjusting her antenna after wake-up (Philae still sleeping); Philae sleeping on the comet, dreaming of Rosetta, Giotto and previous comet chasers from other space agencies; Philae wearing his landing gear. Fourth row: Rosetta falling asleep; baby pictures of Rosetta and Philae; mission controllers at ESA celebrating after Rosetta’s wake-up. Credit: ESA

of science, including ancient Chinese and Greek scientists, as well as astronomers from more recent times, such as Tycho Brahe and Edmond Halley.

Communicating risk and managing expectations

The fourth major episode in the series was released one week before the historic comet landing on 12 November 2014, describing *Rosetta*’s scientific activities during the first months at the comet, the selection of *Philae*’s landing site, and the preparation for sending *Philae* to the comet’s surface. The science experiments were represented through metaphors (Arcand et al., 2014), for example, tasting water from the comet’s atmosphere and collecting dust particles with a vacuum cleaner. *Philae*’s equipment was also portrayed in a similar way, including a helmet, headlamp, camera, compass, pickaxe and snow boots. In addition, we decided to add a sandwich to *Philae*’s backpack, to indicate that the lander would need an independent source of energy to operate on the comet’s surface.

While these visual storytelling elements provided us with a helpful tool to commu-

nicate the various operational and scientific aspects involved in the landing in a charming yet accurate way, a long-standing concern with this approach came fully into focus during and after the production of this episode. The real probe *Philae* was about to be sent on a risky, one-way journey that would ultimately end in it dying on the surface of the comet. But having turned both *Rosetta* and *Philae* into lovable anthropomorphic characters, how could we represent that risk in a truthful and yet sensitive way?

This aspect became even more relevant in the wake of the unplanned nature of the actual landing events. After *Philae* touched down at the originally planned landing site, it was unable to secure itself to the surface and then rebounded, travelled above the surface for over two hours in a number of bounces, before finally coming to rest over a kilometre from the initial touchdown point. In a strange coincidence, a scene in the fourth episode showed *Philae* daydreaming of the landing, including repeated bounces off the comet surface. This was included to help manage expectation of the risks of landing in a general sense, but was by no means a premonition of what was to come!

Beyond that, *Philae* had landed in an unexpectedly dark location where there was insufficient sunlight to charge the probe’s secondary batteries. After almost three days of successful scientific operations, *Philae* exhausted its non-rechargeable primary battery, fell into hibernation, and lost contact with *Rosetta*. Addressing these non-nominal outcomes and the premature demise of *Philae* in terms of its anthropomorphic incarnation became the key challenge involved in the production of the fifth cartoon episode, ahead of its release in early 2015. We could not just say that *Philae* had “died”.

In fact, the anthropomorphic approach helped us by making it possible to present *Philae*’s risky and difficult tasks, as well as the unexpected chain of events, in terms of common feelings: fear, surprise, commitment, and even humour. The issue of the lander going into hibernation was communicated by explicitly drawing attention to *Philae*’s battery level dropping on an indicator familiar from mobile phones (a visual metaphor that had also been used in the very first episode to describe *Rosetta*’s hibernation) and stating that he had fallen asleep on the comet’s surface, rather than having died. This was reinforced by showing him dreaming about the plaudits he might expect from the other comet missions as previously anthropomorphised in the *Fabulous Fables and Tales of Tails* episode, and also of possibly waking up again later in the mission.

This approach appeared to go down well with the cartoon audience, with a lot of sympathy expressed for the anthropomorphic *Philae*, as well as hope that he would awake from his slumber. When *Philae* did indeed wake up again and make contact with *Rosetta* on 13 June 2015, a cartoon still image prepared in advance became the main visual element for communicating this momentous news worldwide. This wake-up image was featured prominently online, as well as by traditional media.

The sixth and latest full episode in the series to date was published in November 2015, and mentioned *Philae*’s wake-up in June, the difficulties in establishing communications between orbiter and lander, and reaching perihelion — the comet’s closest point to the Sun along its orbit — in August 2015. But the principal focus of the episode



Figure 4. An Italian newspaper's report on Philae's wake-up in June 2015, including the tweet from @ESA_Rosetta featuring the cartoon.
Source: La Stampa, Italiana Editrice S.p.A.

was on *Rosetta's* activities during the first year at the comet, drawing attention back to the orbiter and its extensive set of scientific experiments. Once again, the experiments and their results were represented through a series of visual metaphors.

Narrative, aesthetic and cross-media choices

As the personalities of the *Rosetta* and *Philae* cartoon characters developed, a number of other issues emerged.

From the outset, we did not wish to associate any stereotypical gender characteristics to the characters: both were intrepid explorers undertaking a risky adventure together. We nevertheless did choose to use he/she pronouns to help viewers, especially children, engage with and follow the single-voiced narration.

We decided that *Rosetta* would be a female character, most obviously because the name is a common female name in many languages. But that immediately brought with it the strong message that *Rosetta*, a bold explorer on a pioneering mission to study the origins of the Solar System, was a representation of the many great women working in science and engineering. Even before the cartoons first appeared we had been encouraged by some leading women in the fields of astrophysics and space science to present *Rosetta* as a positive female role model, and the anthropomorphised version made that eminently possible.

Then, simply for balance, *Philae* was identified as a male character. However, to treat the two characters equally and to avoid both a stereotyped nurturing connotation for *Rosetta* and possible emotional escalation around the time of landing, we decided that *Rosetta* would not be a mother to a son *Philae*, but that the two probes would be described as siblings⁴. In the history episode, *Giotto* took the role of their grandfather, while the more recent NASA missions, *Deep Impact* and *Stardust*, were regarded as cousins.

Regarding the animation style, the D&D team opted for a two-dimensional rather than three-dimensional animation. Aesthetically, the appeal of a simple, reduced representation of the spacecraft was chosen instead of an overly detailed one. The images appear as watercolours drawn on rugged paper, with a range of blue hues suggesting a dreamy environment in outer space. At times, the texture of the paper was left visible in the video, some of the coloured areas appear not to be completely filled, and features like contour lines were deliberately left rough. This approach was chosen to convey the feeling of an almost handmade product, although of course production time and budget constraints also played a role.

Within this graphical context the spacecraft themselves were drawn in a very simplified form, rather than in any kind of more life-like representation, in part to avoid getting anywhere close to the well-known Uncanny Valley concept⁵, and also to appeal to a broad range of viewers across different target groups and cultures. One exception to this highly stylised approach was that in later episodes, as the mission and its imagery gained wider recognition, we decided to include real images of Comet 67P/C-G in selected scenes of the cartoon, interspersed with artistic representations.

Similar considerations were taken into account in the choice of the voice actor for the narration. Among those auditioned we searched for a warm, fairy-tale feel so that the narration would resemble that of a grandparent telling a story to the family. The final choice of an American voice actor also ensured wider engagement with worldwide audiences, used to the voices of Hollywood actors.

The music used in the films, under the supervision of executive music producer Rolf Maier-Bode, accompanies the journey of *Rosetta* and *Philae* in the classical storytelling model of the Hero's Journey⁶. A predominantly relaxed, orchestral sound was used, in contrast to a more dramatic style commonly identified with space and science fiction. Various repeated themes were used across the arc of the cartoons⁷, and only limited sound effects were employed, to avoid distracting from the narration.

Although initially the narration was only in English, a clear demand for additional languages arose once the cartoons became popular, especially for younger audiences in non-native English-speaking countries. Subsequently, each episode has now been released in five major European languages, namely English, French, German, Italian, and Spanish, each with its own dedicated narrator.

Beyond the films themselves, the ESA team also exploited the crossover between the

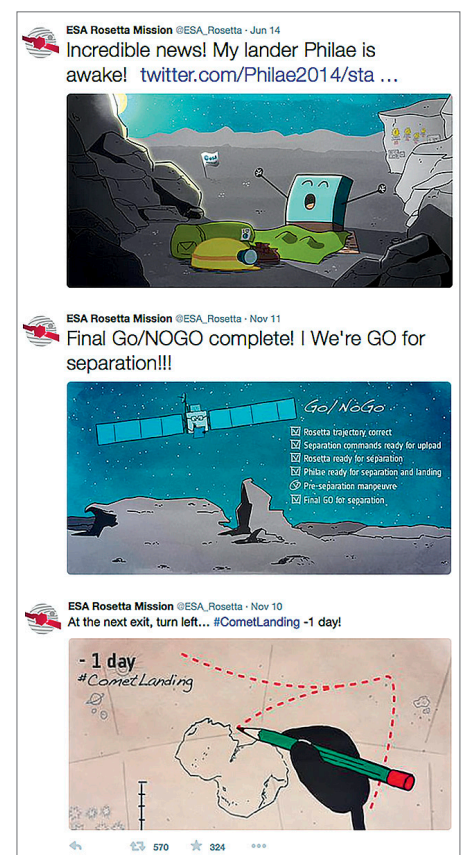


Figure 5. Examples of cartoon scenes used in the tweets from @ESA_Rosetta. Credit: ESA

anthropomorphic spacecraft depicted in the cartoon series and the characters of *Rosetta* and *Philae* that were taking shape in the interactions between the first-person @ESA_Rosetta and @Philae2014 Twitter accounts, which often engaged in friendly conversations about their journey and adventures together⁸. Particularly in the weeks leading up to landing, tweets were often accompanied by images from the cartoon series in order to further reinforce the connection between the fictional spacecraft characters and the mission's human followers (Baldwin et al., 2016).

Current status of the cartoon series

To date, six episodes have been released, plus a brief trailer for the *Rosetta*, are we there yet? competition. In addition, a compilation of scenes drawn from various episodes (but also including some brief new elements) was shown on screens throughout Schiphol Airport in Amsterdam without narration for several months at the end of 2015.

To date, the total viewing numbers for all the videos combined is more than 1.8 million⁹; for the full six episodes, the average viewership thus far is about 280 000, and the most-watched episode — featuring the preparations for landing on the comet — had reached over 900 000 views by the end of 2015.

At the time of writing, we intend to continue the cartoon series throughout the mission's operational lifetime. A number of episodes are envisaged in 2016 emphasising the main scientific discoveries of the mission, and leading up to the final planned controlled impact of *Rosetta* on Comet 67P/C-G at the end of September 2016. We then plan to complete the series with a final long compilation, integrating all episodes with small edits to ensure a good flow, covering the entire history of *Rosetta* and *Philae*'s mission.

Analysis

All the elements described above resulted in the cartoon series making a significant contribution to personalising the mission and connecting with audiences, with the result that many members of the public made it clear that they empathised with the

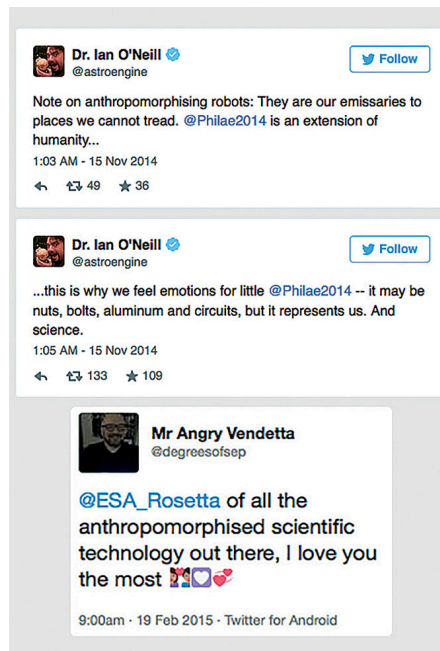


Figure 6. Examples of Twitter messages about the anthropomorphic cartoon characters. Source: Twitter

two spacecraft and cared for their wellbeing. This was mainly evident in the social media sphere, especially on Twitter and Facebook, where many users have commented on the successes achieved and challenges faced by the spacecraft in personal terms, often expressed using very human emotions. Many adopted the cartoon characters as their own avatars and many thousands have shared them with their own contacts.

It is very unlikely that many people (apart perhaps from the very youngest children) actually thought that *Rosetta* and *Philae* were anything other than unintelligent robots mostly controlled from Earth. However, the willingness to suspend disbelief and engage with anthropomorphised machines, animals, and completely fictional characters is a very common human characteristic exploited in a wide range of storytelling arenas, and it is clear that we tapped into this with the combined cartoon and first-person approach. People identify with *Rosetta* and *Philae* because they are, in some sense, our representatives in the very human desire to explore the Universe.

The empathy perhaps peaked on the night of 14 November 2014, in the final few hours before *Philae*'s primary battery ran out, and as the two spacecraft conversed back and forth via Twitter. People



Figure 7. An example of Rosetta-themed Christmas decorations in December 2014. Source: Twitter

following the live tweets from the two mission control rooms in Darmstadt (ESA) and Cologne (Deutsches Zentrum für Luft- und Raumfahrt, DLR) shared intense and quite probably genuine emotions of tension, sadness, but also joy and pride at *Philae*'s achievements (Baldwin et al., 2016). There was also a very positive emotional reaction when the lander made contact with the orbiter again in June and July 2015.

Beyond ESA's own communications output, the personified cartoon characters and first-person tweets were also very widely used in stories about the mission by news outlets worldwide, and the overall anthropomorphic approach we have taken to *Rosetta* and *Philae* has been discussed and analysed in articles, blogs, podcasts, and mainstream media¹⁰.

Outside of the 2D confines of the online films, the cartoon characters lent themselves to a variety of physical spin-off products. Stickers featuring scenes from the cartoon episodes were produced and distributed during public events, and a cut-out-and-make 3D paper model¹¹ of the two main characters was made available online for the *Rosetta*, are we there yet? competition in 2014. The characters were also featured on a series of products for purchase, including T-shirts, sweatshirts, and a soft toy: these have all proven very popular¹².



Figure 8. The planetarium team at the Techmania Science Center in Plzeň, Czech Republic, wearing Rosetta and Philae cartoon T-shirts in front of the spacecraft scale model. Source: Facebook

Members of the public also created their own versions of the cartoon representations of *Rosetta*, *Philae*, and the comet — ranging from baked goods to masquerade costumes and nail art — sharing many photos of their creations on social media channels. In December 2014, shortly after the landing, we were surprised by the number of Christmas decorations inspired by the mission themes that were spontaneously posted on Facebook and Twitter.

Based on comments received on ESA's websites and social media platforms, the public response to the anthropomorphised spacecraft has been very positive overall. As a simple quantitative metric, the average like-to-dislike ratio of the cartoon episodes on YouTube is a hundred to one.

Overall, there was very little criticism of the approach, but that which did arise was mostly limited to tech-savvy space enthusiasts who deemed cartoons to be childish and did not appreciate the level of simplification adopted in the narrative. However, this ignores the fact that cartoons were just one of several facets of the broad *Rosetta* and *Philae* communication campaign run by ESA and its partner institutions. This campaign included a huge variety of products to appeal to and engage many different audiences, including images and data from the various instruments; news and updates about the technical and scientific aspects of the mission; in-depth articles; video material; interviews with mission experts and even a short science fiction

film (McCaughrean, 2016). All of these outputs were accompanied by an extensive social media presence. It is clear that no single approach can engage all possible audiences and we have clearly seen that many people appreciate receiving information in a variety of forms: many amateur and expert space enthusiasts were just as taken with the cartoons as they were with technical details.

In the same vein and as an added and perhaps unexpected bonus, the anthropomorphised *Rosetta* and *Philae* have also been very well received within the scientific community. Many scientists and engineers involved with the mission have reported that they use the cartoon material extensively when giving public talks, especially in schools. Some *Rosetta* scientists have been sighted wearing cartoon-themed clothing at conferences, and plenty of scientists and engineers worldwide, covering many different disciplines, commented positively on the cartoons and adopted *Rosetta* and *Philae* avatars for their social media presence.

Finally, in further external validation, the cartoon series has featured a few times among the many prizes that the mission and its communication campaign have been awarded over the past year. These include the Fast Forward Science Award from Wissenschaft im Dialog and the Stifterverband für die Deutsche Wissenschaft in Germany in December 2014, and the New Media (non-interactive)

Selected internet comments on the cartoons and the anthropomorphic representation of *Rosetta* and *Philae* posted on ESA's public channels:

Awesome cartoon. We love it. We need more [of] this so space-related science gets attention from our kids

I saw all the videos about Rosetta and Philae, and they are really amazing, full of humility and educational content, and the animation is simply inspiring

Cheers! I totally loved those cartoons — made me fall in love with the mission and its adorable protagonists!

Do you know when the next cartoon is scheduled for release? I have a class of 14 year olds who want to see Philae's adventures on the surface

prize at the EuroPAWS Science TV & New Media Festival, held in Lisbon in November 2015. The cartoons were also shortlisted in the European Excellence Awards, honouring outstanding achievements in the field of public relations and communication in Europe, and for the Deutscher Preis für Onlinekommunikation in Germany.

These qualitative observations suggest that the medium of visual storytelling can be used to develop a clear and engaging narrative to communicate complex technical and scientific topics, and that a careful use of anthropomorphic characters in the dissemination of space science missions has the potential to be widely appreciated by a variety of audiences. With *Rosetta* and *Philae*, this has worked extremely well, and it seems likely that their anthropomorphic avatars will live on in the public sphere long after the mission itself is over.

Acknowledgements

This work describes one aspect of the communication campaign devised by the European Space Agency (ESA) and its partner institutions to promote the *Rosetta* mission, which was made possible by the work and collaboration of a great number of people at ESA's various establishments and in external partner agencies and institutions. In particular, we wish to thank Ruth McAvinia for collaborating on the genesis of the cartoon and Karin Ranero Celius for running the @Philae2014 Twitter account for DLR.

Notes

- ¹ Links to all episodes of ESA's *Once upon a time...* cartoon series can be found here: <http://sci.esa.int/rosetta/53593-outreach-resources/#once-upon-a-time>
- ² There are already precedents for a personified approach to public communication of space science. Several spacecraft, most notably NASA's *Phoenix* and *Curiosity* landers on Mars, have first-person Twitter accounts (Vertesi, 2010) and the ESA science communication team had already decided that *Rosetta* would also adopt a first-person voice before making the cartoons. Other examples include an illustrated booklet (in Japanese) written in 2010 which told the story of JAXA's asteroid sample-return mission *Hayabusa*, featuring anthropomorphic spacecraft and planets (<http://www.isas.jaxa.jp/j/enterp/missions/hayabusa/fun/adv/index.shtml>); the Istituto Nazionale di Fisica Nucleare animated video (in Italian) called *Nino il Neutrino*, produced in 2008, featuring anthropomorphic particles flying through space and explaining fundamental physics concepts (<https://youtu.be/mSQ3w3lcVSM>); and in 2003, ESA's development of the anthropomorphic Paxi character, an alien exploring outer space, for its ESA Kids education website (<http://www.esa.int/esaKIDSen/>).
- ³ A history of comets is available here: <http://sci.esa.int/rosetta/54198-harbingers-of-doom-windy-exhalations-or-icy-wanderers/>
- ⁴ Interestingly, members of the public who mention the characters of *Rosetta* and *Philae* on the ESA social media channels have referred to them in different ways: from siblings to mother and child, and even, in some cases, as lovers.
- ⁵ The Uncanny Valley is a concept that has been researched in the field of aesthetics and was first identified by Japanese roboticist Masahiro Mori as *Bukimi no Tani Genshō* (不気味の谷現象) in 1970. The term itself first appeared in the 1978 book *Robots: Fact, Fiction, and Prediction*, by art critic and curator Jasia Reichardt. The idea is that consumers of animated movies and games can develop an antipathy towards avatars that aim (but ultimately fail) to get as close as possible to human-like characteristics. Instead, there seems to be a preference towards a certain degree of abstraction in slightly unrealistic anthropomorphic figures.
- ⁶ The Hero's Journey (or monomyth) is a universal pattern that has been used by storytellers around the world for millennia. It involves a heroic character who goes out on an adventure, faces and overcomes challenges and crises, and returns after a

major change or transformation. Joseph Campbell first described it in his 1949 book *The Hero with a Thousand Faces*.

- ⁷ An example of a repeated theme used in the animation's score is the simple fifth interval in the melody at the beginning of the first episode, resembling a fanfare. This was chosen to match the first scene of the episode, showing a rocket launching into the sky — an iconic image for space exploration. The overall motif was chosen to remain wary and emotional, to convey the sense of uncertainty in the mission's future at the time of launch; for this reason the fifth interval was played in a delicate way. To fit with the fairy-tale style of the drawings and narration, the bold, adventurous fifth interval from the first scene was eventually matched to an overall charming, rather gentle melody.
- ⁸ The ESA science communication team manages the @ESA_Rosetta Twitter account, while the @Philae2014 account is managed by the DLR. Many of the conversations between the two accounts were co-scripted in advance.
- ⁹ The view counts are cumulative across ESA's website and YouTube channel (including all five languages). The videos have been republished by many independent online channels and translated into other languages, but these viewing numbers are not included here.
- ¹⁰ Examples of news outlets using the cartoon characters in their reporting include *Washington Post* articles by Rachel Feltman on *Rosetta* and *Philae* communications (<https://www.washingtonpost.com/news/speaking-of-science/wp/2014/11/15/why-we-all-fell-in-love-with-rosettas-philae-lander/>); a *Flow South Africa* blog post by Stuart Buchanan on the social media strategy used for *Rosetta* (<http://www.flowsa.com/blog/entry/cometlanding-a-social-media-strategy-thats-out-of-this-world/>) and *The Cosmic Shed* podcast on the *Rosetta* communication campaign (<http://thecosmicshed.podbean.com/e/bonus-episode-ambition/>).
- ¹¹ The *Rosetta* and *Philae* paper model is available here: <http://esamultimedia.esa.int/docs/rosetta/RosettaModel.pdf>
- ¹² The *Rosetta* online shop managed by D&D is here: <http://www.rosettashop.eu/>

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Biographies

Claudia Mignone has a degree in astronomy, a PhD in cosmology and a passion for telling stories about space, science and the Universe. She has been working as a science writer for the European Space Agency since 2010. Claudia is co-manager of the *Rosetta* blog and *Rosetta* Mission Facebook pages, and provides support for @ESA_Rosetta.

Emily Baldwin has a PhD in planetary science and is space science editor for the European Space Agency's web portal, www.esa.int. She is the primary voice of the @ESA_Rosetta Twitter and rosettamission Instagram accounts, and co-manager of the *Rosetta* blog and *Rosetta* Mission Facebook pages.

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Sebastian Marcu is the Chief Executive Officer of Design & Data GmbH, a specialised cross-media agency that provides digital visual communications solutions for the space sector and science. He has over 15 years of experience as a content marketing and PR strategy expert.

Carlo Palazzari is a graphics designer at Design & Data GmbH who specialises in animations, screen design and illustrations. He created the look and feel of the *Rosetta* and *Philae* cartoon characters, as well as the overall screen design.

Behind the Scenes of the Discovery Channel's *Rosetta* Mission Documentary Special

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Keywords

Broadcast, Discovery Channel,
television series

On the evening of 12 November 2014, the Discovery Channel documentary *Landing on a Comet: Rosetta Mission* was broadcast around the world. This was the culmination of months of preparation and behind-the-scenes filming. Shelley Ayres, the producer, director and writer of the one-hour special recounts how this came about and reflects on her experience.

Introduction

The 12 November 2014 was a monumental day for space science and exploration. The *Rosetta* mission successfully landed *Philae* on Comet 67P/Churyumov–Gerasimenko, an achievement that resonated around the world.

Just about everyone took notice, from scientists to school children, and the European Space Agency (ESA) was thrust onto a world stage by international media who had earlier tested the waters of this story in August 2014 when *Rosetta* managed to slide into orbit about a comet. Not by any standards an easy task. As the prospect of landing on a comet stirred curiosity *Rosetta* and *Philae* made headlines and the story unravelled before our eyes. Ejection, descent, landing, bouncing and a lost lander. Compelling imagery, like a news feed, trickled in every few hours.

For our team — the Discovery Channel crew covering this event as a cap to months of coverage — we could not have asked for a more exciting and interesting day. The coverage from 12 November made our story, built from the past many months, all the more relevant, compelling and of course, watchable. Our one-hour documentary special, *Landing on a Comet: Rosetta Mission* was to be a great success¹.

Starting a story

Having done smaller features on ESA missions and having completed a space documentary special in the past, I had expectations of what was needed to bring this story together, but there is always a mix of excitement and trepidation when embarking on a new and large-scale project. And there are always challenges to overcome.

In this case location was one of the biggest challenges. I am based in Canada, while the mission, the scientists and engineers, are based all over Europe, largely in Germany. So the first step was getting there. One of the first things we did, in May 2014, was to arrange a visit to Darmstadt, Germany, where we could meet the press team at the European Space Operations Centre (ESOC) and interview some of the key players on the mission, including engineers, flight teams and scientists working on *Rosetta*. It was during this trip that we covered our first mission moment — a trajectory correction manoeuvre.

This was our opportunity to survey our story, our characters and the team at ESA who would be so instrumental in providing ongoing access through the year. From a practical perspective it was also good to understand the locations and what that would mean for filming, both now and later when hundreds of media representatives would come to tell the *Rosetta* mission story in November.

Our footprint was small, just my cameraman and director of photography Mark Foerster and myself. This was a calculated decision as our goal was to truly get to know the story and the people behind this mission. After all, many people had dedicated their careers, years and years of hard work, to get to this final year.

We not only visited ESOC but also ESA's European Space Research and Technology Centre (ESTEC) in Noordwijk, the Netherlands, and the Deutsches Zentrum für Luft- und Raumfahrt (DLR) in Cologne, Germany. It was an exercise to navigate locations, and press contacts in each location. I am very grateful that



Figure 1. The Discovery Channel documentary *Landing on a Comet: Rosetta Mission* was broadcast on 12 November 2014, on the day that *Philae* landed on 67P/Churyumov–Gerasimenko. Credit: Discovery Channel



Figure 2. Some of the many outdoor broadcast units that were hosted at the European Space Operations Centre in Darmstadt, Germany, as media channels reported live and recorded news reports about the historic comet landing. Credit: Discovery Channel

everyone spoke perfect English and tolerated my poor French.

Every site visit was a success, with each contact playing a valuable part in getting us what we needed on site, but even more so afterward when I needed to ask for help finding visuals, animations, early mission photos or documents.

Building on a story

The rendezvous event on 6 August 2014 proved to be a great dress rehearsal for November and we covered it very differently from other news teams; we had time and our scope was broader. This was a day to simply follow and to allow our characters, and their story, to come to life.



Figure 3. Mark McCaughrean, Senior Science Advisor at the European Space Agency, being interviewed by Shelley Ayres for the Discovery Channel documentary about Rosetta. Credit: Discovery Channel

We used this visit to bring some creative shooting to the story. Explaining a trajectory manoeuvre is tricky, and although animations do a good job, we found an outdoor Olympic-sized pool in Darmstadt and some amazing swimmers, which helped us with an analogy. Sam Gulkis, the principal investigator of the Microwave Instrument for the Rosetta Orbiter (MIRO), joined us for the shoot to talk about water on the comet.

In terms of things that worked for our production, I want to draw attention to a small example. The day after the rendezvous we had arranged to shoot at the Max-Planck-Institut für Sonnensystemforschung (MPS) in Göttingen, Germany. While we did not have a firm scene planned, we knew we wanted to follow the Optical, Spectroscopic, and Infrared Remote Imaging System (OSIRIS) team — the people responsible for the science camera on *Rosetta* — at a very key time, unravelling imagery they had waited years to see. The team, ESA and MPS were trusting in allowing us to do this, and as a result we captured something that was in the moment and felt very real. I applaud ESA and MPS for allowing us that access and understanding that we would stand by our agreement to hold that footage until our broadcast. This is something many press offices are reluctant to do.

In contrast, one of the biggest obstacles was just making sure I stayed informed and very close to the story and mission when I was writing and editing in Toronto. This required a lot of talking and emailing with the press teams, following our leads as they tweeted or as reports appeared on ESA's website and in the news. Multiple sources, various agencies, a collection of press offices and summer months filled with distractions all added to the challenges, but in the end, it was worth it.

A very human highlight

Something that was critical in the storytelling of the mission and one of the greatest things that ESA, Centre national d'études spatiales (CNES) and the participating scientists allowed, was access to the landing decision meetings in Toulouse, where the site for *Philae's* landing was to be chosen. This took a lot of arranging and at times did not look feasible, but in the end an agreement was reached and it was

truly an opportunity for us, and the other documentary teams, to document the difficult decision this mission needed to make.

It was a long two-day meeting, over two weekends. It was not very visual; no one climbed a mountain or jumped out of a plane, but the stakes were high and this was real science and true emotion. After the special aired, we received many viewer comments about this coverage. Viewers loved being able to see this side of the process, and how hard the scientists were working to make an incredibly difficult decision.

Ultimately, it was and continues to be the willingness of scientists and engineers to engage with us and share their stories, which help me, and ultimately our viewers, to understand what this mission means to them. I thank the press offices that enabled us to access these individuals and their stories.

Conclusion

There are different ways to tell stories, especially about space missions. There are visual ideas that will push us to try new things, frame interviews, new angles, backgrounds, animations. There are editorial decisions about writing, stakes, and drama. In the end it is always the emotion that wins out, and it is the emotion that this mission carries with it that makes it so compelling. I was, and still am, very fortunate to be the one on the ground, learning, telling and sharing the story.

Notes

¹ The documentary can be viewed here: <http://review.bellmedia.ca/view/170700914> (For personal review; non-commercial, non broadcast, nor online embed use.)

Biography

Shelley Ayres is a director, producer and writer working with the Discovery Channel in Canada. She works in a variety of factual genres including science, technology and space. Shelley produced the *Landing on a Comet: Rosetta Mission* documentary. Her most recent production is *Direct from Pluto: First Encounter*.

Ambition: A Risky Adventure in Science Communication

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Keywords

Science fiction,
science communication

This article explores how the European Space Agency made a short science fiction film about the *Rosetta* mission to engage audiences in the core scientific and philosophical questions of the mission, and to manage expectations regarding the risky landing of *Philae* on the surface of Comet 67P/Churyumov–Gerasimenko.

Beginnings: From 7 Minutes of Terror to the Rosetta story

Early in the morning on 6 August 2012, I was at the European Space Agency's (ESA) European Space Operations Centre (ESOC) in Darmstadt, Germany, taking part in a media event covering the landing of NASA's *Curiosity* rover on Mars. As we watched the live feed from California, the tension was high. We all knew that the novel "skycrane" approach was risky and that the whole mission depended on it.

One of the reasons that everyone at ESOC, and around the world, was on the edge of their seats was because of a film made by NASA called *7 Minutes of Terror*, which illustrated *Curiosity*'s journey down through the Martian atmosphere and onto the surface¹. The film showed mission engineers talking about each key step, interspersed with high-end computer graphics, sound and music, showing in dramatic fashion how the descent was supposed to unfold.

7 Minutes of Terror painted the mission as bold, risky, and perhaps even a little crazy, but it certainly grabbed people's attention. It encouraged viewers to watch the mission unfold and see if everything would work and made them feel involved in the adventure. The film was a huge success, as was the *Curiosity* landing.

We knew then that the ante had been upped, and that we would have to try and reach the same level of engagement with our communication work at ESA. The most immediate challenge was going to be *Rosetta*, which was due to arrive at Comet 67P/Churyumov–Gerasimenko (Comet 67P/C-G) exactly two years later, and then to attempt to put its lander, *Philae*, onto the surface of the comet only months after that.

Rosetta was going to be big. It was going to break new ground as the first-ever mission to rendezvous with, escort, and land on a comet, and this was going to be an adventure that people could follow in almost real-time. Scientifically, the mission promised new insights into the origin of the Solar System and perhaps even life on Earth. It had the potential to become a major highlight in space exploration.

Rosetta definitely deserved the *7 Minutes of Terror* treatment, but it wasn't that simple. The event most likely to engage the widest public was going to be the landing of *Philae*, but in contrast to *Curiosity*'s high-speed clattering descent through the atmosphere towards Mars, *Philae* was going to take hours to descend sedately to the comet's surface and would do so in complete silence. We couldn't make a film called *7 Hours of Nervous Tension*.

However, we had also noted that NASA's film talked exclusively about the "what", namely the technical difficulties and checkpoints in getting *Curiosity* onto Mars. It didn't talk about the "why". Why was undertaking such a risky endeavour worthwhile? What was the scientific rationale behind such a mission? Beyond the complex technology and the risks associated with it, why should people care about the mission?

So, right from the outset, we knew that anything we did had to be different. As well as illustrating the mission, it had to talk about what we were hoping to achieve with *Rosetta*, what it would mean scientifically and perhaps even philosophically to people and what it could teach us about ourselves. We wanted people to care about *Rosetta* in a deeper way.

Fast forward to mid-2013, when the planning for *Rosetta*'s big year began in earnest. We knew we had a series of milestones in 2014 that we could build the communication campaign around. The wake-up from hibernation on 20 January, rendezvous with 67P/C-G on 6 August, and then the landing of *Philae* in mid-November. There were many things that needed doing, as described elsewhere in this special edition of *CAPJournal*, but we had decided that a core part of the campaign was to be a film, a few minutes of top-drawer video that would capture attention across a wide audience, something we tentatively called *The Rosetta Story*.

We sold this idea internally and garnered the necessary funding to go ahead, but soon afterwards we began to wonder whether a straightforward film about the mission would be worthwhile. After all, we would also be making a series of classical technical animations to illustrate the mission, while others would be making documentaries much better than we could. What could this film bring on top of that?

Enter science fiction: The birth of Ambition

After a great deal of thought about the role this new film would play, the light went on. Rather than a literal telling of *Rosetta*'s story, perhaps we could talk about the scientific, technical, and philosophical aspects of the mission within a fictional framework. By creating an interesting story, we might hope to draw in new audiences otherwise reluctant to engage with a real space mission. To do this justice, we knew we couldn't do it ourselves. We needed to work with talented people in the film industry who could develop a compelling short



Figure 1. A selection of scenes from the short science fiction film *Ambition*. Credit: Platige Image

narrative inspired by *Rosetta*, and then produce an outstanding audiovisual experience around it. They would also need to understand our wishes and constraints, both scientifically and in terms of communication by an international space agency.

We asked two companies for bids, and while both had excellent storytelling skills and technical credentials, ultimately we decided to go with Platige Image, based in Warsaw, Poland².

Platige make award-winning short films and commercials, including the stunning and later BAFTA-winning trailers for the BBC's coverage of the 2014 Winter Olympics in Sochi, Russia³. They also have scientists involved in the team both at the helm of the company and in Jan Pomierny, our main interface throughout. Jan is an astronomer and science communicator through the New Space Foundation, which he co-founded, who has also worked with the Universe Awareness project and as an

organiser of the International Astronomical Union CAP conference in Poland in 2013.

Jan's involvement as film and campaign producer, managing the overall Platige effort from within its creative department (PLTG R130, now called Fish Ladder), was critical to us. Beyond producing an amazing film, we needed to work with people who could grasp the science and technology, and who could see the bigger picture of what we were aiming to achieve. They also needed to be sensitive to the potential pitfalls surrounding a civilian space agency getting into the science fiction game. We were very lucky to be assigned Platige's star director Tomek Bagínski, who was nominated for an Oscar in 2002 for his short film *The Cathedral*⁴. Tomek had also directed the BBC Sochi Olympics trailer and that dark, dramatic piece with its brilliant visuals, voiceover, and driving music seemed a perfect fit for us as a starting reference.

With the team on board we started to discuss possible storylines. One was a heist movie, in which someone broke into a giant museum and stole the centrepiece, a kilometre-wide comet, an icy treasure chest. We then focused on the idea of turning science fiction into science fact, to show how *Rosetta* was going to do something hitherto thought of as impossible, mad, crazy. Refining things, we came around to telling a story set in the deep future, looking back at *Rosetta* as a pivotal moment in space exploration and the understanding of our own origins.

Platige came up with the perfect name for the film: *Ambition*. This encapsulates the extraordinary goals of the entire *Rosetta* mission in a single positive word, but also implicitly refers to the risks associated with rendezvousing with a comet for the first time and then being so bold as to deploy a lander to its surface⁵.



Figure 2. Photographs taken during the filming of *Ambition* on location in Iceland. Credit: Mark McCaughrean

By this time, it had become clear to us that the film needed to communicate the mission in a variety of different ways. It needed to entertain and engage through superb visual storytelling, imagery, and music; it needed to explore the broad scientific and philosophical aims of the mission; and it also needed to help manage expectations.

It was clear that the widest moment of public engagement with the mission would be on the day when *Philae* was sent to the surface of Comet 67P/C-G. However, much like with NASA's *Curiosity* rover, everyone close to the mission knew that successfully landing *Philae* was going to be highly challenging, and it was important to communicate that risk in a positive way. It is for this reason that you don't see *Philae* landing in *Ambition* and the actors don't actually say whether or not the landing was successful. From their perspective in the far future the most important thing was to have tried, and even in the worst case, learning from failures has much to contribute to future success.

One important difference from *Curiosity* that needed to be communicated was that in order to deploy *Philae* in the first place, the wider *Rosetta* mission would already necessarily have to be a success, both operationally and scientifically. That is, the whole mission was not riding on *Philae*.

Another key element in our developing *Ambition* strategy was to do it undercover. Whereas a more conventional "*Rosetta*

story" film could perhaps be done out in the open, we realised that to maximise the impact of an out-of-the-box science fiction film, we needed to surprise an unsuspecting public.

To ensure external secrecy, we also needed to keep the number of people in the know inside ESA and Platige Image to a minimum. Inside ESA, even most of the communication team responsible for the rest of the great *Rosetta* campaign were only vaguely aware of the mysterious project until near the end. Similarly, at Platige, the work was done behind closed doors on a strictly need-to-know basis. A very small number of people at Platige and at ESA worked as one team to bring the whole concept together.

A byproduct of this secrecy was that it would perhaps help shield the essential vision of the film from being blunted by committee and management decisions inside ESA. While this was obviously a risky approach in the event that the film failed, we nevertheless felt that the chance of coming up with something amazing made it worth taking.

Making progress: Planning the strategy and casting the actors

A perfect opportunity to release the film from under this deep secrecy had presented itself in early 2014, just days before *Rosetta* woke up from hibernation. Rhidian

Davis at the British Film Institute (BFI) in London was organising a science fiction film festival called *Days of Fear and Wonder* for later in the year, and had been talking to various people about how to mix science fiction and real science. Via UK-based science communicators, Marek Kukula and Anita Heward, he had heard about *Rosetta* and asked if we could explore working together, perhaps by livestreaming the *Philae* landing from ESOC to the BFI.

When we requested that he instead help us to premiere a science fiction film during his festival, Rhidian quickly overcame his initial surprise and became an enthusiastic supporter of the concept. He arranged meetings with BFI senior management and by the summer, helped by the fact that *Rosetta* was already making big news, they had agreed to host the premiere at their prominent theatre in London.

Our aim was to hold the premiere a few weeks before the *Philae* landing, preceded a few weeks before that by the release of a brief teaser trailer online. The teaser trailer would not mention ESA or *Rosetta* at all, but by featuring a well-known actor, we could hope to bring attention to the pending premiere, allowing us to invite film and culture journalists without them knowing that the film had anything to do with us.

To achieve this though, we needed that actor. Early versions of the story involved just one, but we had iterated towards a master and apprentice scenario for obvious dramaturgical reasons, so in fact we needed two actors. The idea was to cast the master first with a well-known actor, and then look for an upcoming younger actor for the apprentice.

By this time producer Anna Różalska had brought her film-world experience in to co-produce the film with Jan⁶. Anna used her link to Gail Stevens Casting to make contact with a series of well-known actors with the lead role in mind. The list included both male and female actors, and we had decided that whoever we managed to land for the master, the apprentice should have the opposite gender.

Availability at very short notice and willingness to work on something quite out-of-the-ordinary were key, and we were hugely lucky to get Aidan Gillen on-board⁷. Aidan has a long career in film and TV, and has

also done a few things just for the sake of impressing his kids, including appearing in Christopher Nolan's 2012 Batman film *The Dark Knight Rises*. This is one of the reasons that he agreed to do *Ambition*, along with the promise of a flight on ESA's zero-g plane. Aidan is perhaps most well-known as Petyr "Littlefinger" Baelish in HBO's fantasy drama, *Game of Thrones*, which has had huge success in recent years. His fame in the role is such that when my then 14-year old daughter found out that he was going to star in *Ambition* her reaction was, "Him? I hate him!". She was referring to Littlefinger, not Aidan, of course, but I knew we were onto something good if we had an actor who could provoke such a reaction.

Almost immediately after casting Aidan we landed Aisling Franciosi in the other part⁸. At the time, she was an upcoming young actor known for her roles in *Quirke* and *The Fall*, as well as appearing on the red carpet at Cannes for her part in the Ken Loach film, *Jimmy's Hall*. She was perfect for the key role of the apprentice.

Filming: The move to Iceland

With the actors on-board, and after a lot of iteration between Platige and ESA on the script and storyboard, as well sorting out the contractual issues, the time came for the principal shoot. The story needed a barren, desolate location that could serve as an alien planet, whether real or virtual, on which the protagonists could practice their planet-making and to which they could bring life-giving water.

An excellent location had been found in the form of an open-cast mine in Poland: dark, dusty, and with a wide horizon suitable for subsequent visual effects work. However, less than two weeks before the shoot, Greenpeace heard that permission had been sought to film at this location and were concerned about the possibility of mine tailings being kicked up, endangering people nearby.

A new location needed to be found at very short notice and Iceland was picked. Although rather more remote and hard to get to from Warsaw, Iceland offers fantastic other-worldly volcanic landscapes and has a very active film industry. Indeed, the year before, key scenes for Christopher Nolan's film *Interstellar* had been shot there



Figure 3. Left hand side: *Ambition* director, Tomek Baginski, being interviewed at the film premiere in London. Top right: Panel discussion during the *Ambition* premiere with, from left to right: Aisling Franciosi, Rhidian Davis, Tomek Baginski, Mark McCaughrean, and Alastair Reynolds. Bottom right: Mark McCaughrean during his presentation at the premiere of the *Ambition* film. Credit: Andy Dohnoe

and, even though it had not been released as we were making *Ambition*, the need to compete with *Interstellar* was often joked about.

In mid-July 2014, we decamped to Reykjavik, Iceland. The live shoot took place at a location on the Reykjanes peninsula, roughly fifty kilometres southwest of Reykjavik, not too far from the famous Blue Lagoon geothermal spa⁹. It lasted just two days, but took full advantage of the very long daylight available in midsummer close to the Arctic Circle. The weather was rather typical of Iceland: mixed. It was fairly cold and rained for some of the second day. The rain is not visible in the final film, which is fortunate given that it is supposed to take place on a dry, barren planet with no water. Similarly, even though the landscape was predominantly volcanic, there were a few small patches of grasses and even some flowers, which had to be edited out during post-production.

There was a combined crew of roughly fifty people, including the team from Platige and local Icelanders, with the actors emerging briefly from huge padded overcoats for each take. The film had been fully storyboarded with animatics and the script rehearsed with the actors in advance in Reykjavik. Tweaks were made continuously

throughout the shoot with the help of writer Afolabi Kutu. Opportunities were also taken to film interviews with the actors as part of a foreseen promotional campaign called *My Ambition*. Finally, as well as conventional shots, a helicam was used for overhead scenes involving stand-ins, although ultimately, those were all dropped in favour of visual effects.

After the short, but very intense, shoot many of the crew stayed on for a few days holiday in Iceland, while knowing that a huge amount of work was still ahead for many.

Bringing it together: Visual effects, music and a trailer

The key visual effects work continued back in Warsaw throughout the shoot and after, right up to the very last minute. The film clearly had to look stunning, with visuals at the highest standard, to avoid criticism by audiences used to blockbuster Hollywood computer-generated imagery (CGI) and visual effects (VFX).

We wanted a core sequence in the middle of the film to capture the real *Rosetta*, *Philae*, and Comet 67P/C-G in a stunning way, without the actors, and without voice-



Figure 4. Visual effects were added to the location shots to produce the stunning final film. Credit: Platige Image

over. The aim was to have a short piece that could be used by broadcasters to capture the essence of *Rosetta* at the time of landing and after, and that meant it had to be accurate. This meant that Platige had to develop their own very detailed model and render of the two spacecraft, but also of Comet 67P/C-G which, until August 2014, had never been seen close up. As a result, a huge amount of expert modelling and rendering work needed to be done by Jakub Knapik, VFX supervisor at Platige, and his team in Warsaw based on a limited set of available comet images, in the same very short time window in which the whole film was being assembled and edited.

The level of work required and the timeframe in which it needed to be achieved led to some fairly fraught moments. At ESA, we were anxious to see at least a very brief excerpt of the final product, to convince ourselves that things were going in the right direction. We were not accustomed to the flow of this kind of film-making, where the superstructure of the film was being assembled in terms of the edited live shoot, with simple animatics inserted to show where VFX would later appear, and the final composition, grading, and sound only coming together at the very last minute. A significant number of iterations on the VFX were also needed to convince ourselves that core scientific elements would not be misrepresented.

Another critical element was the soundtrack. A whole range of ideas were battled between us, including using existing songs, but in the end the award-winning film composer Atanas Valkov was engaged to compose an original score for *Ambition*,

creating a superb combination of otherworldly mystery and drama¹⁰. Atanas later produced and released a full album of music based on the themes used in the film, along with other tracks inspired by space exploration.

At the same time as the final film was being worked on ahead of the premiere, now set for 24 October 2014 at the BFI, we needed the work on the teaser trailer¹¹. The aim was to reach our intended audience and suggest the prospect of a new science fiction film, but without giving away that it involved ESA and *Rosetta*. In a one-minute trailer, we couldn't use significant parts of the final film, partly because it wasn't finished, but mainly because it would potentially give too much away: the film itself is only just under seven minutes long, after all.

The decision was made to go with a series of stock clips representing the origins and evolution on Earth, starting from primitive life and ending with rockets and astronauts in space. A kind of extended version of the well-known opening credits to CBS's sitcom *The Big Bang Theory*, with dramatic music by Atanas, some overlaid text to set the scene, and a reveal showing Aidan surrounded by flying rocks asking the question, "What is the key to life on Earth?"

A couple of Easter eggs were included to see if anyone could make the connection to *Rosetta* and ESA: in the final frames at the end of Aidan's sequence, two rocks fly past each other and very briefly line up to make the shape of Comet 67P/C-G, and the astronaut shown waving from outside the International Space Station was Christer

Fuglesang, an ESA astronaut sporting a Swedish flag. Slightly disappointingly, no one figured it out.

Nevertheless, when the trailer was released on a dedicated website and YouTube channel run by Platige, it racked up over 400 000 views online and stirred considerable interest in the science fiction, film, and entertainment communities, as well as among Aidan's fans, as hoped. One positive review in Gizmodo said, "It's not *Interstellar*, but now I want to see it just the same".

Importantly, the positive reception made it possible to invite journalists spanning film, science fiction, gaming and technology, to the premiere of *Ambition*. There was still no connection to ESA, and Platige and the BFI worked with Aimée Anderson and her team at DDA PR in London to promote the event.

The existence of *Ambition* had, however, now been revealed to a rather surprised wider *Rosetta* communication team. Their involvement was now crucial, as the full weight of ESA's online and social media machinery would be needed to promote the film once it was released.

The premiere: Surprises and reactions

The *Rosetta* team came together with Platige and DDA in London on 24 October for the premiere at the BFI. Also present were the project scientist, Matt Taylor, science fiction author and former ESA astronomer, Alastair Reynolds, and actor, Aisling Franciosi. While the film, culture, and technology journalists were in the dark, a small number of science journalists had also been invited "in the know". The total audience was around a hundred.

The aim was to keep the whole involvement of *Rosetta* and ESA secret until the moment Aisling says in the film "Are you talking about the *Rosetta* mission?", a reveal that would end months of closely guarded undercover work.

In the event, things didn't quite work out that way. After the teaser trailer was shown, *Ambition* itself was introduced by the moderator, saying that it was "an innovative collaboration between ESA and Platige



Figure 5. Panels from the original storyboard for the *Ambition* film. Credit: Michał Murawski/Platige Image

Image, around the *Rosetta* mission”, and thus giving the game away a few minutes too early.

However, while those of us sitting in the front row of the theatre shook our heads in disbelief, the rest of the audience were still clearly surprised, and the big reveal in the outside world had not been spoiled.

After the film was shown, members of the ESA team removed jackets to reveal *Rosetta* polo shirts and logos, and a series of short presentations were given to describe the real *Rosetta* mission, its overall goals, its status, the link between science and science fiction, and where *Ambition* fitted in. We then had a panel session with Rhidian, Tomek, Aisling and Alastair, to talk about the film and to take questions from the audience. The interest was clear, and discussions continued well into the reception that followed.

Immediately after it was shown at the BFI, the film was released online via both the *Ambition* website and via various YouTube accounts, with promotion via *Rosetta* and ESA social media. The impact was immediate and the viewing numbers rose rapidly as people began talking about this completely unexpected representation of the mission and its goals, and of course, about *Rosetta* itself.

The reception was almost universally positive and a large number of online articles, blog posts, and reviews appeared in the days and weeks up to the *Philae* landing. Many praised the boldness we had shown

in taking a very unconventional approach to promoting *Rosetta*, but many also took the core themes of the film to embark on their own discussions of what it means to be ambitious and to take risks in pursuit of universal questions such as the origin of life.

It is important to note that a wider campaign had been developed around *Ambition* in order to help direct the film’s audience to *Rosetta*. This included a number of short films collectively titled *The Science of Ambition*, interspersing brief clips from *Ambition* with interviews from ESA staff involved in *Rosetta*, to give some additional scientific and engineering background to the key concepts introduced in the film. These were released online to further enhance the links between the science fiction and the real science.

A *Making of Ambition* film, several brief interview clips on a theme called *My Ambition*, posters by the acclaimed artist Grzegorz “Gabz” Domaradzki, and concept art were also released¹². Together, these added to the idea that *Ambition* was not just a seven-minute trailer to the *Philae* landing, but an integral part of the overall *Rosetta* communication campaign^{13 14 15 16}.

In the days that followed, we were relieved that the response from within ESA and the professional space community was also very positive. We had feared that our colleagues might think we were dumbing down a real scientific mission by associating it with science fiction. But, perhaps unsurprisingly, many people in the space

business are also fans of science fiction and like to dream about what might lie beyond the immediate projects they’re working on now. Many ESA employees made a point of saying how pleased they were we had taken a brave, creative, step in communication, and this was emphasised over the same weekend when *Ambition* took over the entire ESA entry webpage, with the normal website behind.

Recognition has also come from the film-making and communication communities. *Ambition* has been nominated for a number of awards by a number of organisations, including the prestigious Visual Effects Society, the Geekies, and the European Science TV & News Media Awards, and won the animago Best Visualisation award in 2015¹⁷.

Also, as hoped, the central sequence of the film showing the real *Rosetta* and *Philae* around Comet 67P/C-G was widely adopted as a definitive representation of the actual mission and extensively used in news and other media broadcasts.

Aftermath: The impact and legacy of *Ambition*

By the time of the *Philae* landing event three weeks later, *Ambition* had been watched more than a million times, and at the time of writing (February 2016), the total number of views over YouTube, ESA’s own website, and a number of large secondary outlets including Vimeo and Google+ exceeds 3.1 million. On the ESA YouTube channel, the film has had 1.3 million views alone, and the thumbs-up to thumbs-down balance is 99% positive.

Widening the analysis, it is worth making a brief comparison between *Ambition* and the series of anthropomorphic cartoons made about *Rosetta* and *Philae* described elsewhere in this issue (Mignone et al., 2016). The two are clearly complementary in terms of the way they deliver their messages to their rather different initial target audiences, with *Ambition* taking a relatively oblique, conceptual approach, and the cartoons being much more literal.

Ambition was always intended to be more of an “event film” linked to a specific time, to raise interest in the run-up to *Philae*’s



Figure 6. Concept drawings for the opening scene of *Ambition*. Credit: Platige Image

landing, as well as to help mitigate the risk associated with it. It was a film “for the moment”. By contrast, the cartoons have been developed and issued in a series over time to relate the unfolding story of the mission from before hibernation exit, through rendezvous, landing, and to the present.

Through the cuddly appearance of *Rosetta* and *Philae* and the link to their first-person Twitter accounts (Baldwin et al., 2016), the cartoons have developed a more affectionate following than the perhaps colder *Ambition*. On the other hand, the latter stimulates rather more reflective and philosophical thoughts than the cuteness effect triggered by the cartoons. Both, however, have been successful in reaching out to wide audiences well beyond the traditional space fanclub, as was the intention of the entire *Rosetta* campaign (Bauer et al., 2016).

Does *Ambition* herald a new approach to science communication for space missions and beyond? In the widest sense, yes. In much the same way as *Ambition* talks about the challenges, risks, and potential huge gains from thinking boldly and taking risks in space exploration, it also provides a meta-illustration of how innovative thinking in science communication can open doors to new, wider audiences.

More specifically, it is not obvious that *Ambition*'s central science fiction trope

would necessarily be adaptable to other projects. One crucial point about *Ambition* is that when it was released in October 2014, *Rosetta* had already achieved its main goal of rendezvousing with and flying around a comet. Thus any accusations that *Ambition* was indulging in pure fantasy could be immediately rebuffed by the fact that we were really doing this. Using science fiction to sell a project that still lies in the future could be much riskier in that regard, as the project itself could become tarred with the sometimes pejorative meaning of “oh, it's all just science fiction”.

A major lesson learnt from *Ambition* was the importance of identifying and working with people who felt passionate about the project, and who were able to bring world-class storytelling and technical skills and experience to it. This was obviously centred on the highly dedicated team at Platige Image, but involved people from many other areas who also bought fully into the idea, everyone thrilled to be working on something linked to a real space adventure.

Equally, a tight, constant interaction between the creative side and the scientific and technical aspects was essential. This ensured that the film was not only exciting and engaging, but that it conveyed accurate, meaningful messages about *Rosetta*, which is, after all, a real mission doing real science. The interaction was very intense, involving many emails, discussions, and face-to-face meetings, and there were cer-

tainly moments of creative tension, but the final product is surely better as a result of this very close collaboration between science and art.

Ultimately, it is perhaps impossible to disentangle the importance of the various aspects of the *Rosetta* communication campaign. Indeed, it is very likely that it was the combination and interplay between all parts of the campaign with the amazing and thrilling mission itself that helped bring worldwide attention to it. But *Ambition* was probably the single most original part of the campaign and at least in retrospect, a risk very definitely worth taking.

Acknowledgements

Making *Ambition* was a remarkable endeavour, bringing together many creative, passionate, and dedicated people, some mentioned in this article and all listed in the credits to the film. Special thanks though go to Markus Bauer, my co-conspirator at ESA, who helped dream up the project and ensured that we got it done, and Jan Pomierny at Fish Ladder/Platige Image, without whom it simply never would have happened.

Notes

¹ NASA's *Mars Curiosity* film *7 Minutes of Terror*: https://www.youtube.com/watch?v=Ki_Af_o9Q9s

- ² Platige Image webpage: <http://www.platige.com>
- ³ Platige Image Winter Olympics 2014 trailer for the BBC: <https://www.youtube.com/watch?v=4b9Ji7DvsjU>
- ⁴ IMDB page for Tomek Bagiński: <http://www.imdb.com/name/nm1313617/>
- ⁵ Platige Image Behance gallery for *Ambition*: <https://www.behance.net/gallery/21398975/AMBITION>
- ⁶ IMDB page for Anna Różalska: <http://www.imdb.com/name/nm3837777/>
- ⁷ IMDB page for Aidan Gillen: <http://www.imdb.com/name/nm0318821/>
- ⁸ IMDB page for Aisling Franciosi: <http://www.imdb.com/name/nm4957233/>
- ⁹ Flickr page with *Ambition* Iceland location shoot photos: <https://www.flickr.com/photos/markmccaughrean/sets/72157647105202934>
- ¹⁰ Atanas Valkov's *Ambition* soundtrack: <http://www.atanasvalkov.com/2014/12/ambition-soundtrack-premiere-15-01-2015/>
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- ¹⁴ ESA Space in Videos page for *Ambition*: http://www.esa.int/spaceinvideos/Videos/2014/10/Ambition_the_film
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- ¹⁶ Vimeo page for *Ambition*: <https://vimeo.com/109903713>
- ¹⁷ Links to various nominations and awards for *Ambition*:
<https://www.visualeffectssociety.com/post/ves-awards-nominations-announced>
<http://www.thegeekieawards.com/ambition/>
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Biography

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Image: ESO's VLT observing the supermassive black hole at the centre of the Milky Way, using an artificial laser star to help un-twinkle the stars orbiting the black hole. Credit: Y. Beletsky

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Directed by: Lars Lindberg Christensen

Art direction, Production design: Luis Calçada | Producer: Luis Calçada

Written by: Georgia Bladon & Lars Lindberg Christensen | 3D animations and graphics: Luis Calçada & Martin Kornmesser

Gas cloud simulation: ESO/S. Gillessen/MPE/Marc Schartmann | Editing: Luis Calçada | Narration: Sara Mendes da Costa

Soundtrack & sound effects: Sacred Site by Michael Stearns | Executive producer: Lars Lindberg Christensen

Footage and photos: ESO, Stéphane Guisard (eso.org/~sguisard), Nick Risinger (skysurvey.org) & Serge Brunier

“Hello, World!” Harnessing Social Media for the Rosetta Mission

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The European Space Agency’s comet-chasing *Rosetta* mission was launched in 2004, before social media became a popular tool for mainstream communication. As it reached its destination ten years later, new audiences were reached and inspired by this once-in-a-lifetime event by harnessing a range of outlets for communicating the key messages. These included traditional online platforms, such as news websites, blogs, and Livestream, as well as Twitter, Facebook, Instagram, Flickr, YouTube, Google+ and SoundCloud. In this article, we outline the role social media channels played in making *Rosetta* one of the European Space Agency’s biggest communication and public engagement successes.

Introduction

*Rosetta*¹ is the first European Space Agency (ESA) mission for which social media were employed as an intrinsic aspect of the communication strategy. Several *Rosetta*-specific social media accounts — @ESA_Rosetta on Twitter, the Rosetta Mission Facebook page, and the rosettamission Instagram account — were developed during 2013 and 2014, and were used alongside the traditional reporting line of the main ESA website, the Rosetta blog, and live press events, to build awareness of the mission. By coordinating these mission-specific accounts with ESA’s existing social media channels (which include Flickr, YouTube, Google+, Twitter, and Facebook), Deutsches Zentrum für Luft- und Raumfahrt’s (DLR) English-language @Philae2014 Twitter account, and through the support of ESA’s country desks and *Rosetta*’s partner agency accounts information could be shared in a number of European languages, ensuring

a wide reach across Europe and the world². Each channel played a well-defined role in terms of the audience it reached and the content it delivered.

Rosetta blog

The Rosetta blog³ acts as a bridge between classic social media and the traditional reporting line of the corporate ESA Portal⁴ and in-depth Science and Technology⁵ websites — the home of ESA’s press releases and news stories. The blog was initially set up in 2008 ahead of *Rosetta*’s flyby of asteroid Šteins and followed the mission up until hibernation in June 2011, before being re-launched in late 2013, during the preparations for the Wake Up, Rosetta! activities.

In the months following *Rosetta*’s wake-up in January 2014, the spacecraft was prepared for studying Comet 67P/Churyumov–Gerasimenko (Comet 67P/C-G) and the

mission operations teams and instrument teams contributed to blog posts in order to introduce the spacecraft’s science payload. With eleven experiments on the orbiter and ten on the lander, this process enabled us to lay the groundwork for the science that would be carried out later in the mission and to explain why it was important, while also allowing us to build working relationships with the various mission teams. The blog was also an important channel for explaining what the mission operations experts were doing, as *Rosetta* carried out a number of “operations-intensive” activities leading up to arrival at the comet.

A range of other topics were also presented on the blog to provide context to the mission and to appeal to different audiences: these included a brief history of comet observations, the story of Comet 67P/C-G’s discovery, Earth-based observations of the comet, and the evolution of artist’s impressions of the comet.



Figure 1. Example of the “Hello, World!” tweet being acknowledged in traditional media.

On the final approach to Comet 67P/C-G between May and August 2014, the blog was used to report the ten braking manoeuvres needed for the spacecraft to be placed in the same orbit as the comet and rendezvous with it. As the comet images became clearer and more defined, the blog acted as the main repository for image releases, including the regular CometWatch series, which features images from *Rosetta*'s navigation camera and still continues today.

The blog was also used for live reporting during the key events of wake-up, arrival, and landing, alongside audio-visual live-streaming.

During the week of the comet landing in November 2014, the blog was one of the primary public information channels and operated almost 24 hours a day over a five-day period. After the landing of *Philae* on 12 November, the blog continued to cover its activities right up until the primary battery was exhausted overnight on 14–15 November. This last important event was not livestreamed and the blog was one of the only channels available to officially follow the final hours *Philae*'s operations on the surface of the comet, alongside the Twitter accounts of @ESA_Rosetta, @Philae2014, @esaoperations, and three external social media reporters who worked alongside the ESA team that evening⁶. The 1.39 million views of the Rosetta blog on 12 November, and a total of 5.5 million views throughout the month of November, are the highest counts ever achieved on an ESA blog for any topic to date.

As of December 2015, over 530 posts have been published (since late 2013) and the blog receives between about 3000 and 20 000 visits daily, with each post generating anything from tens to hundreds of

comments. By enabling a comment function, the blog allows the editors to have a dialogue with readers, as well as allowing readers to have conversations amongst themselves. That said, it must be noted that many individual discussions are dominated by a recurring group of 10 to 20 extremely active commenters. Often questions that arise in the comment section are the trigger for new blog posts to satisfy frequently asked questions. Blog users have left many positive comments regarding the level of technical details communicated on this platform.

As a testament to the authority of the blog as a source of information about the mission, many online and print-media journalists writing stories reference the blog for additional technical details that may not be included in ESA's more general web articles or press releases, or to illustrate their articles with the most recent CometWatch image. Furthermore, the mission scientists and operators have cited the blog as the first place they look for updates on aspects of the mission that are outside their own areas of expertise, and several have engaged directly through the comment section, answering questions and providing additional details for the readers.

@ESA_Rosetta on Twitter

The use of the Twitter handle @ESA_Rosetta is the first time that ESA has created a first-person Twitter account for a spacecraft, following as realistically as possible the actions of the real *Rosetta* spacecraft, and translating technical information into updates of 140 characters or less. The key moment for the account was the wake-up of the spacecraft on 20 January 2014 following more than two and a half years of

hibernation. In all the press material leading to the wake-up, the account was promoted as being the first official way to find out whether the spacecraft was awake; until this moment the account was deliberately dormant, mimicking the sleeping spacecraft.

During the lead-up to 20 January, the day that *Rosetta* was programmed to wake up, a social media campaign was run asking people to shout — virtually — at the @ESA_Rosetta Twitter account, using the hashtag #WakeUpRosetta. This chance to participate clearly appealed to Twitter audiences as it trended for several minutes in Europe on the day, with peaks in the number of tweets at 11:00 (CET) — the programmed wake-up time on the spacecraft's on-board clock — and eight hours later between 18:30 and 19:30 (CET) — the window during which the signal was expected.

When *Rosetta* woke up, a simple but familiar message of “Hello, World!” was tweeted, not just in English, but in the 23 languages of ESA's member and cooperating states. This allowed followers to engage by re-tweeting in their own native language, raising awareness across Europe. The use of multilingual tweets was also a strategy repeated for the arrival in August, where “Hello, Comet!” was tweeted in different languages, along with a “post-card” — the arrival image of the comet.

On the day that *Rosetta* woke up, the @ESA_Rosetta account grew very significantly by around 37 000 followers, with nearly 45 000 following the account by the end of January 2014. The use of the Twitter account to announce the wake-up was reported widely in online news and crossed over into traditional news and TV media channels, which set the stage for the channel for the year ahead (see Figure 1).

During the year, the personalities of @ESA_Rosetta and @Philae2014 (a first-person account for the lander managed by DLR, the lead agency for *Philae*) developed as they followed events in real time and as their adventures were recounted through the cartoon series. The tone of the conversations was of two friends on a great adventure. The accounts tweeted each other regularly, especially in the lead-up to and during the events of comet landing.

While the Twitter accounts play an important role in sharing content from other



Figure 2. A sample of the messages of congratulations for the comet landing sent from high-profile Twitter account holders.

platforms, making general status updates and sharing new images and science results, the first-person approach crucially makes it possible for the spacecraft to describe how they are feeling. Often a tweet will be accompanied by an image from the cartoon series to express how they might be feeling during tense or exciting moments. By sharing human traits and emotions, a direct connection is made with human followers (Mignone et al., 2016; Vertesi, 2010; Gomez, 2014). By contrast, other ESA Twitter accounts — notably, @esaoperations and @esascience — continued tweeting throughout the mission with non-personified content and factual updates or scientific context, to ensure that they were strongly differentiated from the human voices of the spacecraft and lander Twitter accounts. It is interesting to note that the non-personified accounts

also increased their follower count at the key *Rosetta* milestones, indicating that a complete level of engagement via Twitter benefits from both styles.

In addition to the 24-hour reporting line of the blog during the activities surrounding the comet landing during the week of 10–15 November 2014, information was also shared in real time via the @ESA_Rosetta and @Philae2014 accounts. They were closely coordinated to maintain the conversational dialogue, with a number of tweets around key moments agreed in advance. During comet landing day @ESA_Rosetta and @Philae2014 gained 156 000 and 287 000 new followers respectively.

On landing day itself, farewell images taken by the two spacecraft of each other shortly after separation were returned to Earth and presented in a press briefing. In parallel, the images were exchanged online through tweets by the two spacecraft, a highlight of the seven hours between separation and landing. Messages of support during the descent and congratulations following touchdown were received from around the world and from high-profile Twitter accounts including those of actors, politicians, heads of state, astronauts, international brands and TV personalities (see Figure 2).

Twitter had officially partnered with ESA to give priority within their network on landing day, acknowledging the historic importance of the *Rosetta* mission. Twitter provided several services including access to special promotion channels, target group promotions, video channels, and a curator service, all of which contributed to the wide reach. This included the presence of Twitter staff at ESA’s mission control centre at the European Space Operations Centre (ESOC) where the main activities were occurring. The hashtag #cometlanding was used throughout, with peak volumes of tweets recorded around the times of separation and landing. At touchdown the hashtag was the number one worldwide trending topic.

Soon after landing it became apparent that the lander was not secure and had bounced. It arrived at its final location on the comet two hours after the first touchdown. The first images from this location were again shared by @Philae2014 and

@ESA_Rosetta in parallel with a press briefing on 13 November and operational updates provided as the events unfolded. The illumination conditions at the location meant that *Philae* would not be able to charge its solar-powered secondary batteries and was destined to enter hibernation after completing its first set of primary battery-powered science experiments.

The unexpected nature of the landing meant that no formal live broadcasts had been scheduled for this hibernation event, and so the final Twitter conversation between @ESA_Rosetta and @Philae2014 was created almost in real time as we received new information regarding the operational status of *Philae* — this was in stark contrast with conversations around other key moments, which had been drafted well in advance. This spontaneous, unscripted coverage was only possible thanks to mission operators allowing members of the ESA communication team to work with them at the European Space Operations Centre (ESOC), including the human handler of @ESA_Rosetta, and with DLR’s team at the Lander Control Center in Cologne, where the account holder of @Philae2014 was based. The twitter account operators were in continuous Skype contact to discuss how to evolve and conclude the conversation.

The exchanges between the two accounts during *Philae*’s final hours and minutes of operations in particular touched the hearts of our followers. Apart from status updates reported on the blog and shared to the Facebook page, Twitter was the only other way to follow the events that unfolded on that night as they happened. It also provided the ideal platform for followers to express and share their emotions, likely contributing to the high level of engagement.

In the same way that @ESA_Rosetta had remained dormant while the spacecraft was in hibernation @Philae2014 did not tweet again until mission operators received a signal from the lander in June 2015. Although reliable communication between the two spacecraft was not restored at this time — prohibiting the Twitter spacecraft from continuing their conversations — the @ESA_Rosetta account (along with the Facebook page) continues to be asked for status updates on *Philae*, a testament to the popularity of the two characters.

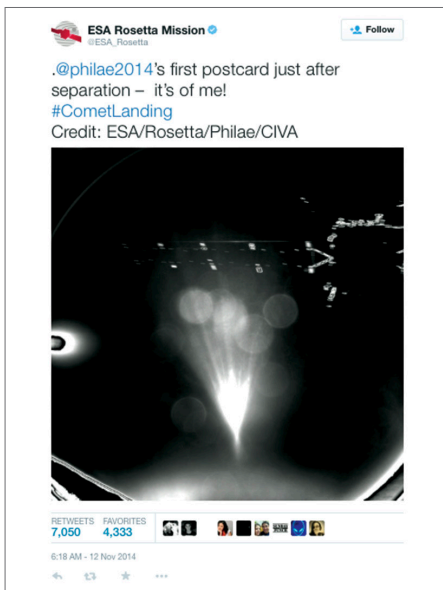


Figure 3. Shortly after they were downloaded from the spacecraft on 12 November 2014 farewell images of the parting spacecraft were shared on Twitter in parallel with live press briefings.

Rosetta Mission Facebook

The Rosetta Mission Facebook page⁷ was launched on 10 December 2013, on the occasion of the first official media briefing ahead of the wake-up of *Rosetta* and to provide the central point for the Wake Up, Rosetta! video competition (O'Flaherty et al., 2016). The competition was implemented using the Woobox tool embedded in the Facebook environment, making it possible for the public to submit entries easily; the same approach was also used for the Rosetta, are we there yet? photo contest which ran from July to August 2014⁸.

More generally, the Facebook page is not a primary channel and is not news driven, but is used by the communication team to share content from other platforms, in particular new images, videos, and blog posts, as well as links to local *Rosetta* events. Followers of the Facebook page spontaneously share their *Rosetta*-related photos and experiences on the page, for example, photos of themselves or family members wearing *Rosetta* T-shirts or showing what they have done with their paper models of the spacecraft provided for the Rosetta, are we there yet? contest in July 2014. The most popular activity was the unprompted use of the models to decorate Christmas trees in December 2014.

Facebook, along with Twitter, is also a popular choice for people sharing their photos of comet-shaped potatoes and other foodstuffs and their *Rosetta*-inspired artwork or baking, showing just how widely the mission has infiltrated everyday life and become a household name.

Rosettamission Instagram

The rosettamission Instagram account⁹ was set up in late 2013, but was not actively used until the launch of the Rosetta, are we there yet? contest in July and August 2014 when it was used as an additional entry point to the competition. The platform is now used to share the latest images of the comet and has over 23 000 subscribers, attracting a different demographic to the more formal news-driven platforms.

Using ESA's existing social media channels

The *Rosetta* mission social media channels are supported by ESA's own social media channels across Flickr, YouTube, Google+, Twitter, Facebook, Livestream and SoundCloud¹⁰. To capitalise on the reach of existing ESA channels such as YouTube and Flickr, playlists and photo-sets were created, rather than starting new accounts from scratch.

Google+

ESA's Google+ channel has been used to share content and to host Google+ Hangouts since late 2013. A total of five *Rosetta*-specific hangouts were hosted in 2014 and 2015 to present specific aspects of the mission, allowing members of the public to meet the faces behind the mission and to have a dialogue with them through live question and answer sessions.

Hangouts also offer an informal alternative to a traditional press briefing, attracting a more general audience. For example, during the last day of the comet landing activities, and due to the unexpected nature of events, a hangout was conducted live from ESOC in place of a traditional live-streamed press briefing. This had not been foreseen, with the entire hangout planned on the day in the few hours before being broadcast. It was watched live by 13 000

viewers and has since attracted over 380 000 views (by comparison, the hangouts held earlier in the year attracted several hundred live viewers). Google+ also shared the hangout on their page. As of December 2015 the full set of hangouts has collectively attracted nearly half a million replays on ESA's YouTube channel.

YouTube

ESA's YouTube channel is used to share video replays of events, scientific and technical animations, and other unique video content, such as the short science fiction film, *Ambition* (McCaughrean, 2016), the *Rosetta & Philae* cartoon series (Mignone et al., 2016), and new musical pieces by Vangelis composed especially for the comet landing¹¹. These are organised into a number of *Rosetta*-related playlists for ease of access.

The overall ESA YouTube account attracted 3.5 million views during comet landing week, a dramatic increase from the 167 000 views on 6 August, the date of the comet rendezvous. As of October 2015, 8.7 million views have been made on *Rosetta*-related videos, 27% of the total number on the channel.

Flickr

ESA's Flickr account attracted 16.8 million views on landing day, accounting for 15% of all views since the platform was established in 2004. The all-time top-ten viewed images on the channel remain the top ten navigation camera (NavCam) images released on 11 November. Flickr also featured *Rosetta* images in its well-known weekly blog. For comparison, ESA's Flickr channel gained 2.9 million views on 6 August, when the first high-resolution images of Comet 67P/C-G were released, while average daily views at other times are around 50 000.

SoundCloud

The esaoperations SoundCloud account was used to share a handful of authentic sounds from *Rosetta*, including correct pronunciation of the name of the comet and landing site¹². In particular, an audio track, *The Singing Comet*¹³, a sonification

of magnetic field data created by the *Rosetta* RPC–MAG instrument team, was posted on this account on 11 November, the day before landing. Perhaps because it added a new layer to the immersive experience of being at the comet with *Rosetta*, this piece became a worldwide sensation, widely shared on various social media channels and used by many news outlets worldwide in their reports, with almost six million listens on SoundCloud.

Livestream

Livestream was used to deliver live coverage at wake-up, arrival, and during comet landing week, and to reach a wide general audience. For example, 10 million people watched the live webcasts from ESOC during the period 11–13 November 2014, with 74% of the views occurring on landing day. According to Livestream it was the single biggest event in the history of the company. In comparison, 500 000 people had watched each of the live webcasts during the one-day events on the occasion of the 20 January 2014 wake-up and 6 August 2014 arrival at the comet.

Other ESA Twitter and Facebook accounts

The ESA Facebook account, the Twitter accounts @ESA, @esaoperations and @esascience, the Twitter accounts of ESA’s major country desks and various accounts of ESA’s astronauts and of the *Rosetta* mission partners, all played a key role in helping to provide and share *Rosetta*-related content to different audiences and in different languages. They all experienced a boost in followers around the key mission milestones, and especially during comet landing.

Reflection

The use of a variety of social media platforms to target different audiences with specific content in a coordinated way has made it possible for us to bring a personal touch to the mission and to share its more human aspects alongside the more scientific and technical information, allowing our audiences to be a part of every step of the adventure. This approach not only raised awareness of *Rosetta*, but also led many

people to discover ESA and its much wider array of missions and activities for the first time.

A cross-media approach ensured that the social media activities were featured in more traditional media output from ESA, including our TV channels and traditional press releases. Similarly, conventional outside media including TV and newspapers frequently referred to and used aspects of the social media materials in their coverage.

In particular, the first-person Twitter accounts of *Rosetta* and *Philae*, in combination with the anthropomorphic cartoons, were used as part of a carefully orchestrated social media plan throughout the year. This attracted significant attention from traditional media, where it was lauded as an effective way of allowing people to engage with the mission, further enhancing its visibility. In particular, the conversations between @ESA_Rosetta and @Philae2014 were featured in many online and traditional media reports of the comet landing events.

Another measure of the extraordinary impact of the *Rosetta* mission can be seen in the fact that it featured in the 2014 highlight summaries of many social media channels: it was in Google’s *A Year in Search*, Twitter’s *Moments*, and Facebook’s *Year in Review*. Google also celebrated the successful touchdown in the form of a Google Doodle released on landing day, created in a formal partnership with ESA. Google also featured the comet landing in their New Year’s Eve 2014 Google Doodle, this time without prior contact with ESA. This recognition by some of the biggest online and social media channels is testament to

the wide reach of the mission, publicised by our activities on social media.

A key part of the success of the overall communication achieved around *Rosetta* can be attributed to the degree of trust that has developed between the mission teams and the communication team since the latter half of 2013, and this applies fully to the social media aspects. Working together, we have demonstrated the possibility and immense value of achieving global impact by providing live feeds and real-time social media reporting, even for — and perhaps especially for — high-risk events when the successful outcome of an activity is not certain. Exposing risk and vulnerability is part of human nature, and whatever the outcome, the emotional experience can be related to, be it tension, stress or the anxiety of an unknown situation, or the jubilation and joy of shared success for an achievement. This required the communication team to work alongside the mission operators to manage expectations in the build-up to key moments and also to be present during those key moments to ensure that the most accurate information could be provided directly, and translated immediately and effectively into social media updates (see Figure 4).

During the demanding periods of 24-hour coverage it was also necessary to share roles and responsibilities within the communication team to maintain the numerous social media accounts in shifts, having draft tweets and blog posts that could be adapted as required as each mission milestone was met (or not). With the communication team onsite with the sources of the information, robust information and



Figure 4. The lead author of this paper (lower left) was present in the control room and able to receive direct confirmation of *Rosetta*’s wake-up, in order to send the “Hello, World!” tweet immediately. Credit: ESA/J. Mai

→ ROSETTA SOCIAL MEDIA INSIGHTS 2014



ESA Flickr 16.8m views 12 November	ESA Livestream 10m live views 12-13 November	ESA YouTube 14.5k new subscribers 18.3k likes 4.2k comments 8.9k shares 3.5m channel views 11-17 November
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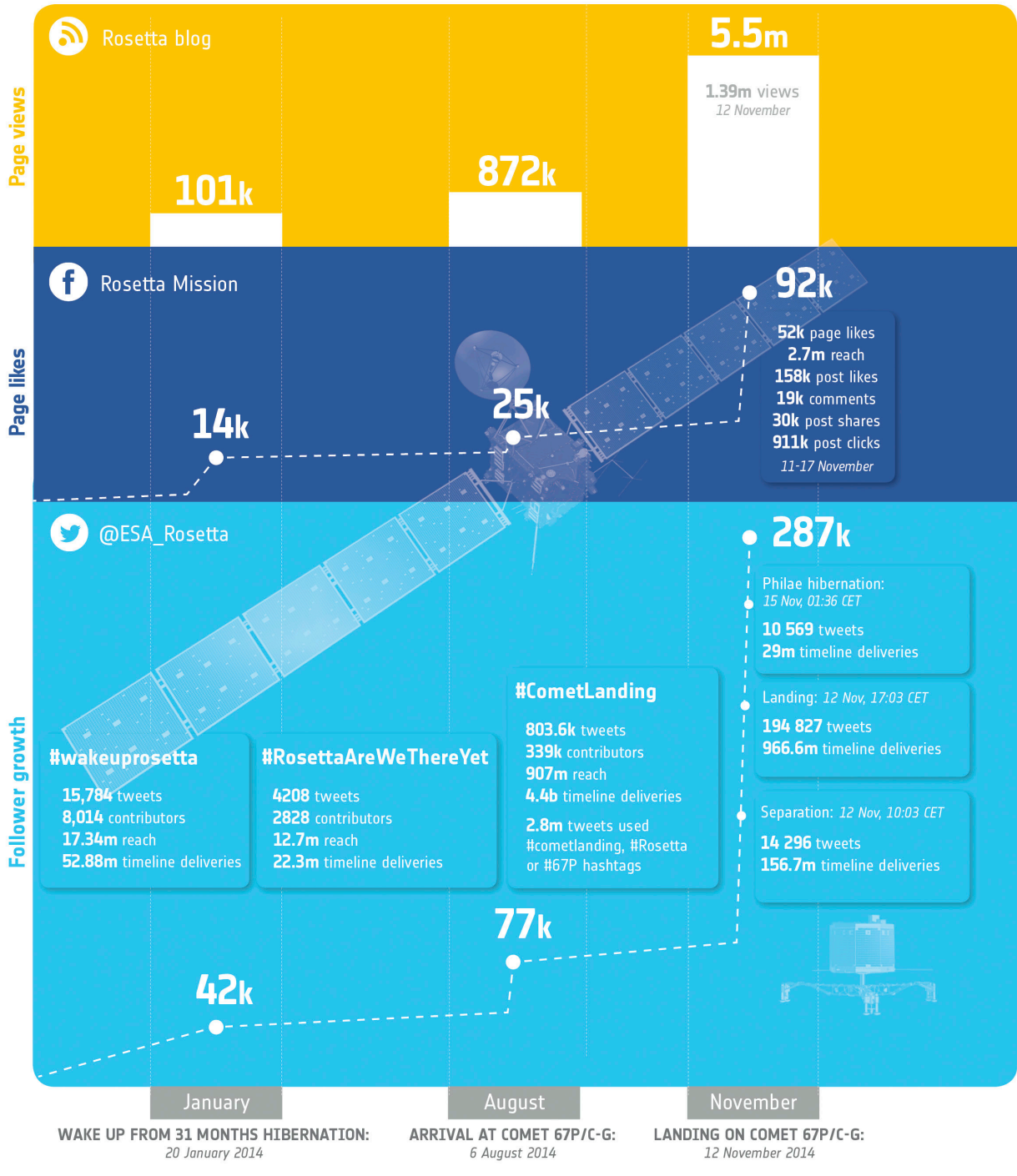


Figure 5. Graphic showing ESA social media insights from wake-up (January 2014) to comet landing (November 2014). Credit: ESA

approvals for sudden new material could easily be sought if and when the plan deviated from that which was originally foreseen.

The *Rosetta* mission accounts continue to attract new followers today (see Figure 5), keen to find the latest news, see the latest images, and follow the adventure as *Rosetta* continues its scientific mission at Comet 67P/C-G. Social media will remain a vital part of the mission right up until its end in September 2016, and the lessons learnt from the *Rosetta* social media campaigns will be of relevance to future ESA missions and other scientific communication campaigns.

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ics, and science ground segment teams at ESA's European Space Research and Technology Centre (ESTEC), European Space Operations Centre (ESOC) and European Space Astronomy Centre (ESAC) respectively, for their support, information, and engagement with our outreach campaigns.

Notes

- ¹ *Rosetta* is an ESA mission with contributions from its member states and NASA. *Rosetta*'s *Philae* lander is provided by a consortium led by DLR, MPS, CNES, and ASI.
- ² ESA country desks are responsible for communication on all ESA programmes and activities in local national languages.
- ³ The *Rosetta* blog: <http://blogs.esa.int/rosetta>
- ⁴ The ESA Portal: <http://www.esa.int>
- ⁵ The ESA Science and Technology site: <http://sci.esa.int>
- ⁶ Emily Lakdawalla (@elakdawalla), Chris Lintott (@chrislintott) and Steven Young (@stevenyoungsfm) joined some of the ESA communicators to report as *Philae* completed science operations on the comet. See: <http://blogs.esa.int/rosetta/2015/11/17/remiscing-about-the-week-of-comet-landing/>
- ⁷ *Rosetta* Mission Facebook page: <https://www.facebook.com/RosettaMission/>

- ⁸ More information about Woobox can be found at: <http://woobox.com>
- ⁹ Rosettamission Instagram account: <https://www.instagram.com/rosettamission>
- ¹⁰ A full list of ESA's social media channels can be found here: http://www.esa.int/ESA/Connect_with_us
- ¹¹ Three pieces composed by Vangelis for *Rosetta* are available on YouTube: *Arrival* (<https://youtu.be/FJrUnzLsmZk>); *Philae's Journey* (<https://www.youtube.com/watch?v=W8bVOGN9jSg>); and *Rosetta's Waltz* (<https://www.youtube.com/watch?v=PUpSVxoCcik>)
- ¹² The esaoperations SoundCloud account: <https://soundcloud.com/esaops>
- ¹³ *The Singing Comet* can be heard on SoundCloud: <https://soundcloud.com/esaops/a-singing-comet>

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Biographies

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Using Competitions to Engage the Public: Lessons Learnt from *Rosetta*

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The year 2014 was an historic and challenging time for the *Rosetta* mission. On 20 January the spacecraft awoke from a 957-day hibernation; by August, it had arrived at Comet 67P/Churyumov–Gerasimenko; and in November, the lander *Philae* was deployed to the comet’s surface. These milestones were communicated by traditional outreach channels — on websites and via press events — as well as through the extensive use of social media. To provide an opportunity for the public to participate actively in these milestones, the European Space Agency and its partners ran three competitions. In this article we outline how these competitions provided a means for the public to engage with what was to become one of the most exciting space science missions in decades.

Introduction

As 2014 approached, one of the biggest challenges facing *Rosetta* science communicators was how to awaken interest in the mission, which had been launched almost ten years before, and how to generate sustained engagement with the broadest possible audience in a relatively short time. The adopted approach is outlined in an accompanying article (Bauer et al., 2016).

An important aspect of the communication plan was to offer as many opportunities as was feasible for the public to engage with the mission. We provided behind-the-scenes access via live streamed events with opportunities for questions from anyone via social media channels (Baldwin et al., 2016), Google+ Hangouts hosted by the European Space Agency (ESA) with mission experts, and independently produced documentaries in which the

crews were allowed to film closed meetings (Ayres, 2016). But we wanted to go further and create channels for people to directly share their excitement and interest in the mission — with us and with each other. This was the starting point for introducing competitions.

Competition 1: Wake Up, Rosetta!

As *Rosetta* approached the end of the hibernation period, ESA produced a number of short videos in order to signal the wake-up event on 20 January 2014, and the public were invited to play their part by sending in short video clips showing them “waking up” the spacecraft¹.

The videos were then to be rated by public vote. The two top prizes were trips to the European Space Operations Centre (ESOC) in Germany to be present when *Philae* landed on the comet on

12 November 2014², while the top ten winners would receive gift bags and have their videos beamed into space via ESA’s tracking station network, Estrack³.

This competition was announced on 10 December 2013 and ran using Facebook, Twitter, Vine and Instagram for submitting competition entries; using YouTube for promoting the competition and individual entries; and via Facebook (with a WooBox plug-in⁴) for the public voting, which closed on 24 January 2014. WooBox was chosen because it integrated very well with Facebook, Twitter and Instagram which were the platforms that we expected to use and had a fully fleshed out campaign module that matched our competition plans.

The number of entries — just over 200 — was somewhat lower than we had anticipated. On reflection, this was probably because we had expected participants to make



Figure 1. Winners of the top prize of the Rosetta competitions — a trip to the European Space Operations Centre to be present on the day that Philae landed on Comet 67P/Churyumov-Gerasimenko. From left to right: Alexandre Broust (winner of the Name Site J! competition), Elisabetta Bonora (winner of the Rosetta, are we there yet? competition), Józef Dobrowolski (winner of the Wake Up, Rosetta! competition), and Emanuele Andreola (winner of the Rosetta, are we there yet? competition). In the front is Dimitris Grillis (winner of the Wake Up, Rosetta! competition). Credit: ESA/C. Carreau

simple, short videos, for example, using their smartphone camera, whereas most of the submissions involved far more elaborate and imaginative “wake-up videos”, incorporating music, animation, dancing, acting and filming in various locations.

In fact, the quality of the submissions far exceeded our expectations⁵. It was immediately obvious that many participants in this competition were taking part not just because of the very attractive top two prizes, but also as their way of connecting with the mission. This provided a means for them to share, in a creative and personal way, their excitement about *Rosetta*. Perhaps surprisingly, a non-negligible percentage (about 7%) of entries came from people who knew they were ineligible for the top prize because of restrictions on residency (ESA was only able to pay to fly people to Germany from ESA member states, ESA cooperating states, EU member states and the USA), but who participated nonetheless.

It was not just us as organisers who were impressed with the videos: the public voted enthusiastically, with more than 75 000 votes in total cast for the videos. The top two winners⁶ of the trip to ESOC were student Dimitris Grillis, accompanied by physics teacher Koskos Spyros and representing the Ellinogermaniki Agogi Primary School in Greece, and Józef Dobrowolski from Poland.

Competition 2: Rosetta, are we there yet?

Rosetta was due arrive at its destination, Comet 67P/Churyumov-Gerasimenko, on 6 August 2014, during Europe’s summer holiday season, and this naturally led to the idea of a second competition, this time based on the theme of completing a journey and reaching a destination. One common expression heard or uttered by anyone who has been on a long journey is: “Are we there yet?” And so the next competition was born⁷.

Announced on 9 July 2014, the competition invited participants to submit photographs that captured the “Are we there yet?” feeling. Two props were made available to download, print and include in the photo: a cut-out-and-make *Rosetta* and *Philae* model based on the cartoon characters designed as part of the mission communication, and a certificate to fill in with a destination (Mignone et al., 2016). Participants were also encouraged to draw inspiration from *Rosetta* mission themes, such as photographing comet-like landscapes, or by incorporating the themes of water and life.

Facebook, Twitter, and Instagram were the primary channels used for submission and voting, and the top prize was again a trip to ESOC to be present on the landing day. Weekly spot prizes were awarded to keep the competition in the public eye

and to encourage people to participate, as well as providing more opportunities to win something.

Compared to the Wake Up, Rosetta! competition, a similar number of entries were received, and somewhat fewer votes — around 22 000 by the time the competition closed on 21 August. Although the number of participants was lower than we expected, especially as the required task seemed simpler than that of the first competition, the quality of many of the entries was very high, with participants going to extraordinary lengths (and places) to produce imaginative and evocative photographs.

Some photographs showed people sharing their interest in *Rosetta* with family and friends, colleagues and students. Models of the spacecraft in various shapes and sizes were built, including many of the cut-out-and-build one that we provided, and brought to new destinations. The destination certificate was also widely used and was printed out, completed, and featured in many pictures. Participants spanned a broad range of ages and interests, with some people involved in the space business and others stating that this was the first time that they had felt captivated by a space mission. About 10% of participants could not win the top prize because of the residency requirement, but they still submitted pictures.



Figure 2. The most popular names proposed by participants in the Name Site J! competition. *Agilkia* is the name chosen by the jury for the site where *Philae* touched down on 12 November 2014. The lander bounced and eventually came to rest at a site which was later given the name *Abydos*, the second choice of the jury. Credit: ESA

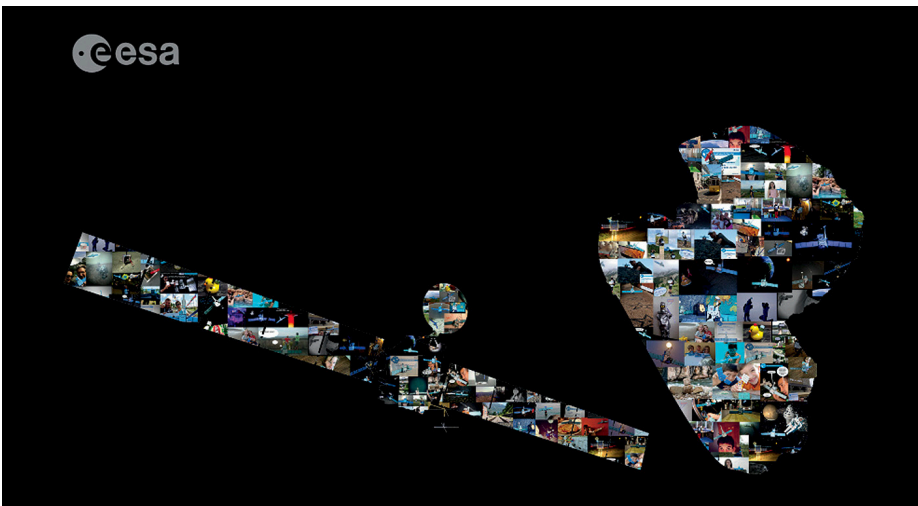


Figure 3. This mosaic, in the shape of the *Rosetta* spacecraft and Comet 67P/Churyumov–Gerasimenko, is made from images submitted by participants in the *Rosetta, are we there yet?* competition. Credit: ESA

In the end, the two top prizes, selected by a combination of public vote and a jury, were given to Elisabetta Bonora and Emanuele Andreola, both from Italy⁸.

Competition 3: Name site J!

On 15 October 2014, ESA announced the selection of *Philae*'s landing site. Chosen from a set of ten initial candidates, the location was known at that time as Site J⁹.

Even before the landing site had been selected, there had been discussion

amongst the partners involved in *Rosetta* and *Philae* about how to name this area. Because the surface of a comet can evolve as it travels closer to the Sun, International Astronomical Union rules do not apply when it comes to naming surface features, so there were no boundary conditions.

The core *Philae* partners — ESA, Deutsches Zentrum für Luft- und Raumfahrt (DLR), Centre national d'études spatiale (CNES), and the Agenzia Spaziale Italiana (ASI), supported by all other *Rosetta* partners, including NASA — agreed to run a competition, inviting the public to propose a

name for the landing site. The main condition was that the name could not be that of a person, living or dead. These would then be considered and a choice made by a jury comprising members of the *Philae* Lander Steering Committee.

Given the need to pick the name before landing, the Name Site J! competition was launched on 16 October and ran until 22 October, again with a top prize of a trip to ESOC for landing day. To ensure that as many people as possible could participate, a simple web form was used. No social media accounts were required although the competition was still heavily promoted on our, and our partners', social media channels. In addition, entries could be made in any European language.

The competition attracted proposals from more than 8000 people spanning 135 countries with almost 14% not eligible to win the top prize because of the residency requirements. To accompany the proposed name of the landing site, participants were asked to provide a short justification for their proposed name. Many used this opportunity to express their delight in having an opportunity to participate in the mission by means of the competition.

A shortlist of 30 names was drawn up by the organisers and provided to the *Philae* Lander Steering Committee who chose *Agilkia* as the name for the landing site¹⁰. More than 150 people had proposed this name and of these, Alexandre Brouste from France was selected to be at ESOC for landing day.

Although *Philae* touched down at *Agilkia* the lander then bounced and eventually landed at a site now known as *Abydos* — the second choice of the steering committee.

Lessons learnt

As each competition ran its course, we were confronted with aspects that we had not anticipated. Each one yielded lessons that were folded into the next.

When entries started to arrive for the Wake Up, *Rosetta!* competition, we soon realised that participants were being far more creative than we had anticipated, perhaps resulting in fewer entries than hoped.

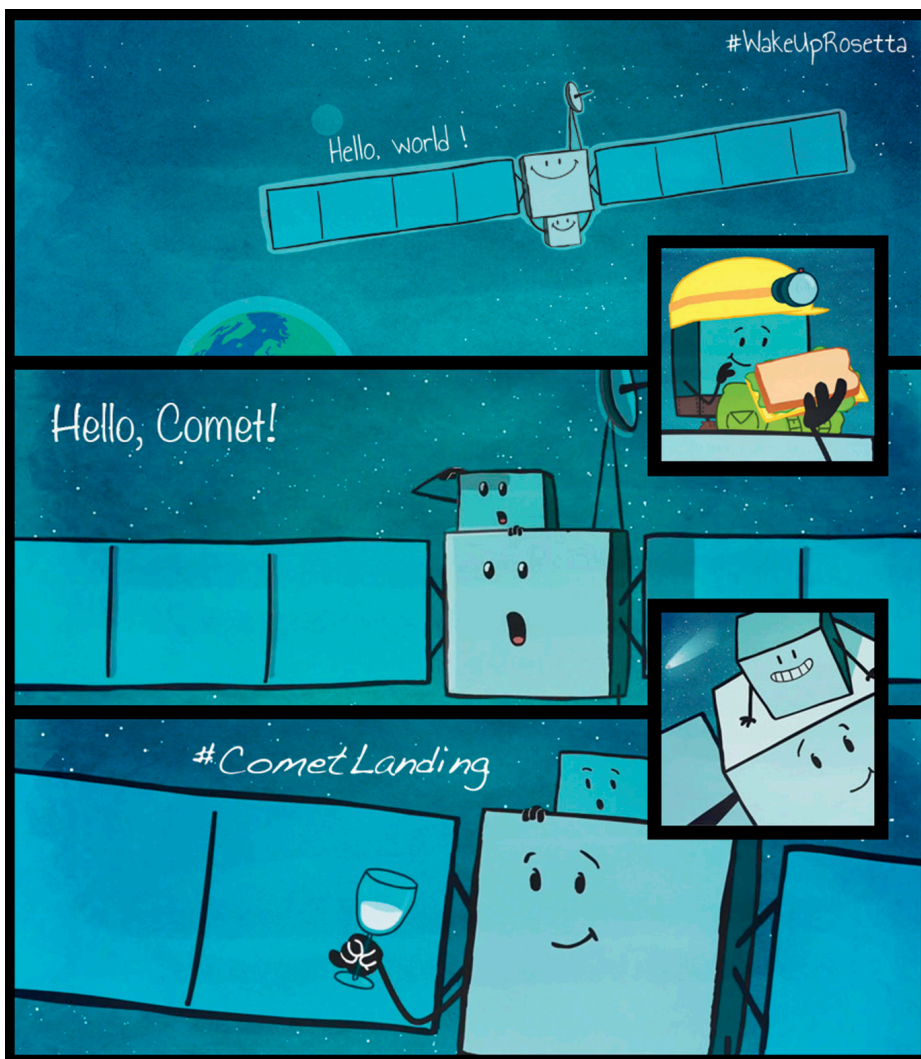


Figure 4. Rosetta-themed images, to use on Facebook, Twitter, and as wallpapers on laptops, tablets and smartphones, were made to share with people who participated in the Rosetta competitions. Credit: ESA

For the subsequent competitions, we tried to provide unambiguous guidelines and clearer examples of what we expected to see.

Similarly, we had thought that people would submit individual entries, but many were submitted by groups, and we had to adapt the rules to account for this.

Lessons were also learnt about voting formats. Public voting has the advantage of being transparent and allowing people to have their say in what is considered to be a winning submission, but there are some aspects that should be carefully considered before deciding to opt for this method of choosing a winner. While monitoring the voting for the Wake Up, Rosetta! competition, we realised that some of the participants were undertaking lobby-

ing and promotion campaigns to gather votes for their entries. While this was not against the written rules, we felt that it was against the spirit of the competition. Thus for the Rosetta, are we there yet? competition, we adopted a selection process that relied on public voting for one of the two winning places and a jury vote for the other. Unusual voting patterns were also noted in this competition.

The dialogue that is possible using social media channels was crucial in managing expectations and in providing direct and rapid feedback in the few instances when there were issues. For example, on one occasion, we had to temporarily suspend voting while irregularities were investigated and on another, there was a problem with the submission mechanism. By communicating this immediately and

openly via social media, we avoided any major negative feedback. That said, it was also good that our competition rules included a clause indicating that rules might be updated or modified, if that was considered necessary.

Did the competitions engage the public?

What do we mean by engagement in the context of science communication? Most often, engagement refers to a two-way process, involving interaction and dialogue between communicators and audience. Did the *Rosetta* competitions facilitate this?

At the end of 2013, we had only planned for one competition — Wake Up, Rosetta! — as part of the process of stirring interest in the mission. We had no real metric for success in mind, apart from the qualitative raising of interest in the mission through direct participation, rather than purely passive.

However, following the highly creative participation in the first competition, the Rosetta, are we there yet? and Name Site J! competitions arose naturally in the developing landscape of dramatically increased interest in the whole mission and particularly in the attempt to deploy a lander to the surface in November 2014.

The periodic competitions also provided focal points for the public to participate in the main mission milestones of 2014: they provided a channel for the public to connect with the mission team, with other enthusiastic supporters, and vice versa.

The abundant and mostly enthusiastic comments that participants included with their entries, in follow-up email messages to the organisers, or in posts on social media channels, clearly demonstrated engagement. People explicitly stated that they were happy to have a means of contributing to the mission and of doing something to show how much such a mission meant to them.

At a more detailed level, the content of the photo and video competitions reflected strong personal involvement from individuals and groups. People organised activities with friends, family, colleagues, and students to create their entries for

the photo and video competitions. They became interested in *Rosetta* together, which further enhanced the engagement and the discourse.

Also, the presence of the competition winners at ESOC on landing day allowed them to act as avatars of the wider public, representing them at an event that was otherwise confined to mission participants, VIPs, and media.

Finally, for those of us involved in the competitions, the direct connection it gave us to people who were following the mission was hugely motivating and instructive.

Acknowledgements

The Wake Up, Rosetta! and Rosetta, are we there yet? competitions were run by ESA alone, while the Name Site J! competition was run jointly by ESA, DLR, CNES and ASI. All competitions were supported and promoted by *Rosetta* partner agencies and institutes. We gratefully acknowledge the contributions of all our colleagues who helped in preparing and running the competition infrastructures, promoted the

competitions, assisted with selection of winners, and organised the prizes and their distribution.

Notes

- ¹ More information on the Wake Up, Rosetta! competition here: http://www.esa.int/Our_Activities/Space_Science/Rosetta/Wake_up_Rosetta/
- ² See this blog article about the Wake Up, Rosetta! winners: <http://blogs.esa.int/rosetta/2014/11/12/competition-winners-at-esoc/>
- ³ See this blog article about the Wake Up, Rosetta! runners up: <http://blogs.esa.int/rosetta/2014/05/08/a-light-speed-voyage-to-the-distant-future/>
- ⁴ WooBox allows users to manage online voting and can be hosted on Facebook: <https://woobox.com/>
- ⁵ Video entries for the Wake Up, Rosetta! competition can be seen here: <https://www.youtube.com/playlist?list=PLbyvawxScNbuKC6e4LxqZJq6t51WmZ9mt>
- ⁶ News item about the success of the Wake Up, Rosetta! competition: http://www.esa.int/Our_Activities/Space_Science/Rosetta/The_competition_winners_who_helped_us_wake_up_Rosetta

- ⁷ More information on the Rosetta, are we there yet? competition: http://www.esa.int/Our_Activities/Space_Science/Rosetta/Rosetta_are_we_there_yet
- ⁸ Information on the Wake Up, Rosetta! winners of the Rosetta, are we there yet? competition: http://www.esa.int/Our_Activities/Space_Science/Rosetta/Rosetta_arrival_competition_winners
- ⁹ Information on the naming *Rosetta's* landing site competition: http://www.esa.int/Our_Activities/Space_Science/Rosetta/Name_Rosetta_mission_s_landing_site
- ¹⁰ Announcement of the new name for *Rosetta's* landing site: http://www.esa.int/Our_Activities/Space_Science/Rosetta/Farewell_J_hello_Agilkia

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Biographies

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Emily Baldwin has a PhD in planetary science and is space science editor for the European Space Agency's web portal, www.esa.int. She is the primary voice of the @ESA_Rosetta Twitter and rosettamission Instagram accounts, and co-manager of the Rosetta blog and Rosetta Mission Facebook pages.

Claudia Mignone has a degree in astronomy, a PhD in cosmology and a passion for telling stories about space, science and the Universe. She has been working as a science writer for the European Space Agency since 2010. Claudia is co-manager of the Rosetta blog and Rosetta Mission Facebook pages, and provides support for @ESA_Rosetta.

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Live Blogging Science News: The *Rosetta* Mission

Stuart Clark

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Keywords

Blogging, *The Guardian*, press,
 live blogging

When one of the world's most popular online news websites decides to cover a space science event live, you know that something big is brewing. Stuart Clark reports on how live blogging can be used for science reporting and how an idea that was triggered by his observations during the *Rosetta* flyby of the asteroid Lutetia and the landing of the *Curiosity* rover on Mars led to him live blogging two of *Rosetta*'s most memorable occasions for *The Guardian* newspaper.

Introduction

I knew the *Philae* landing would be popular but I had no idea it would be *that* popular. I was in Darmstadt, at the European Space Operations Centre (ESOC), working for *The Guardian*¹. I had expected a few hundred thousand online readers — a highly respectable number and the kind of figures that would class the story a success. Instead what I got was well over a million, and a one-day job that turned into a four-day mission to keep a fascinated public informed. The eyes of the world were on *Philae*.

I was there to live blog the event. *The Guardian*'s website² was making increasing use of live blogs to provide instant, rolling coverage of fast-moving news events. Sports matches too had proved to be highly popular for the live-blog team and I had become convinced that live blogging could be made to work for a science mission.

An idea is born

My epiphany happened during the landing of NASA's *Curiosity* rover on Mars in 2012³. Like so many other people I had been glued to the NASA webstream, but the thing that opened my eyes was the social media chatter, specifically on Twitter. People from all walks of life and countries were talking about the landing and sharing their interest in space exploration. Few were experts, most were simply caught up in the moment and many had questions about what was going on. I saw immediately that a live blog that provided analysis as well as coverage could provide what these people wanted.

Rosetta was the obvious choice. I had been working as the ESA website's senior editor for space science when *Rosetta* had made its flyby of the asteroid, Lutetia, in 2010. I had witnessed the tension and excitement of waiting for the spacecraft to make contact with Earth and that gave me an idea.

Not that long after the flyby, *Rosetta* had been placed into hibernation for about three years. There was palpable anxiety surrounding the wake-up; not because anyone thought that corners had been cut, but simply because space is a hostile environment, which can trigger unpredictable events.

Deciding to embrace the risk of public failure — a strategy that paid off hugely for the agency — ESA organised a wake-up press event at ESOC, Darmstadt⁴; a kind of vigil to wait for the signal. This was a great way to test a science live-blog. *The Guardian* agreed to the experiment and that it could run as part of their science blog network, where I contribute the astronomy blog *Across the Universe*⁵.

Live blogging *Rosetta*'s wake-up

I was allowed access to the ESA in-house briefings the day before the wake-up and, thanks to some very supportive staff, was made comfortable with a secure internet connection (and triple redundant options!) on the day itself.

With a live blog, the key is keeping it lively and varied. We can pull in tweets or other postings from social media; embed videos and webstreams; and also provide our own commentary. These include snatches of interviews and pictures taken on the day.

For this event, the tension of the day was a big draw. Viewers steadily ramped up during the day until there were around 50 000 readers watching and waiting for the wake-up itself. Not bad considering that *Rosetta* was a specialist mission in those days, and not the mainstream superstar it was soon to become.

From wake-up to landing

Following on from the success of live blogging the wake-up it was a no-brainer that I would live blog the landing⁶. This meant running articles, features and news in the months and weeks leading up to the event that would raise awareness. The steady stream of revelations that came out of the mission — such as the shape of the comet, the choice of landing site and the honest discussions about the difficulty of landing — all helped to engage the public, to make them root for the lander and to feel part of the mission.

On landing day itself, 12 November 2014, I was in the press centre when it opened at 6 am. There were a number of reasons for this early start. Firstly, the newspaper wanted the live blog to start as soon as possible. Secondly, there were only a limited number of tables in the press centre and I could not imagine trying to blog from a chair. Thirdly, I had arrived the day before to prepare and had watched the go/no-go decision overnight on the webstream from the hotel — being too excited to sleep — and it was obvious something was not quite right with *Philae*.

It was not long before the press were being told about the problems with the landing thruster. The beauty of the live blog was

that this could go out straight away, as a simple statement of fact, as could the news that the landing attempt was going ahead anyway⁷. I did not have to frame a full story around the news, which would have attracted an inevitable and undesirable “Philae in trouble” headline. Instead, I could just throw the news into the rolling coverage of all the other things that were taking place, as part of a positive story, rather than a negative blast of news.

Getting the news about the thruster at the stage we did was an early indicator of something that I think the agency should be extremely proud of, and which made my job, and that of the other journalists covering this event, so much easier. It was the level of contact that we had with the scientists and engineers, both during official briefings and informal ones that happened because an expert happened to be in the press room. There was a world-class level of professionalism on display in the way the experts would answer our questions honestly and openly — even when things started to move away from the plan — and in the willingness of the outreach professionals to seek out the people or information to get us the answers we needed. This kind of cooperation is essential to the success of live blogging a mission in this way.

Impact

As the day unfolded the unexpected bounce and eventual awkward landing all just added to the story. It is also true that anthropomorphising *Philae* and *Rosetta* through YouTube cartoons and their first-person Twitter feeds in the run-up to this day was masterful. It would not work for every mission, but here it was a charm (Mignone et al., 2016).

I realised the story was big when the live blog was given the most prominent spot on *The Guardian's* front page. It rapidly became the most read story on the website and stayed that way all day. Well over a million readers joined us to follow the drama — the kind of online readership usually reserved, in the UK at least, for general election coverage.

Perhaps predictably my mobile rang me to wakefulness the next morning. It was my editor wanting to do the whole thing again. In total, I ran the live blog for three days.



Figure 1. Press room on the Rosetta landing day. Credit: ESA/J. Carreau

Day two was just as busy and well-read as day one. On day three the dip started, but still it was in the top ten most-read stories on *The Guardian* that day. In all, around 3.4 million unique readers read some or all of the *Philae* coverage.

Conclusion

It was a week like no other I have experienced. I was working from 6 am until late into the evening, but I was in a very special place, somewhere that millions of readers were also wanting to be. I remember thinking at the time that I doubt that I will cover a story as big or as magical again.

Philae was an *Apollo* moment, and I feel privileged to have been able to share it with so many other people. It was also proof that the appetite for astronomy is out there and that live blogging can offer the public a fast-paced and responsive account for science with just as much success as for breaking news in any other field.

Acknowledgements

Thank you to Jocelyne Landeau-Constantin, Karen O’Flaherty, Daniel Scuka, Erica Rolfe and Markus Bauer for their fantastic support.

Notes

- ¹ *The Guardian* is a British daily newspaper.
- ² *The Guardian* website (<http://www.theguardian.com>) is one of the world’s most popular English-language news websites, ranking in

the top three along with *The New York Times* and the *Daily Mail*.

- ³ Relive the *Curiosity* landing: <https://www.youtube.com/watch?v=LAL4F61WC-Y>
- ⁴ The wake-up press event can be viewed online here: <https://www.youtube.com/watch?v=AmdZRw-0AZI> and here: <https://www.youtube.com/watch?v=kxQbt7xTnE8>
- ⁵ *The Guardian's Across the Universe* blog is online here: <https://www.theguardian.com/science/across-the-universe>
- ⁶ The first day’s live blog can be found here: <https://www.theguardian.com/science/across-the-universe/live/2014/nov/12/rosetta-comet-landing-live-blog>
- ⁷ The problems with the lander’s thruster were posted here: <https://www.theguardian.com/science/across-the-universe/live/2014/nov/12/rosetta-comet-landing-live-blog#block-54630104e4b0c6f7ffe34b4f>

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Biography

Stuart Clark is a best-selling author, script-writer and widely read astronomy journalist. His working life is devoted to translating the complex world of astronomy, space research and physics into comprehensible language for the general public, whether it be via novels, radio documentaries, news reports, in-depth magazine articles or public talks. Stuart writes the *Across the Universe* blog in *The Guardian*, and is a consultant and regular contributor to *New Scientist*. His most recent book is *The Unknown Universe: what we don't know about time and space*.

An Historic Encounter: Reviewing the Outreach around ESA's *Rosetta* Mission

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Keywords

Rosetta, Philae, OSIRIS, NavCam, ESA, DLR, communication strategy

The *Rosetta* mission is a milestone in terms of science and public outreach. The European Space Agency and the Deutsches Zentrum für Luft- und Raumfahrt in particular did a marvellous job of sparking global public interest, driven by various events throughout the mission. In contrast, the actions of the Max Planck Society research group in charge of the high resolution Optical, Spectroscopic, and Infrared Remote Imaging System¹ were, in my opinion, the cause of some concern and bring to light an important debate in the relationship between outreach and science. This article seeks to review the outreach that surrounded the *Rosetta* mission and to highlight both the best practice that made it a success and the bad practice that set some aspects behind.²

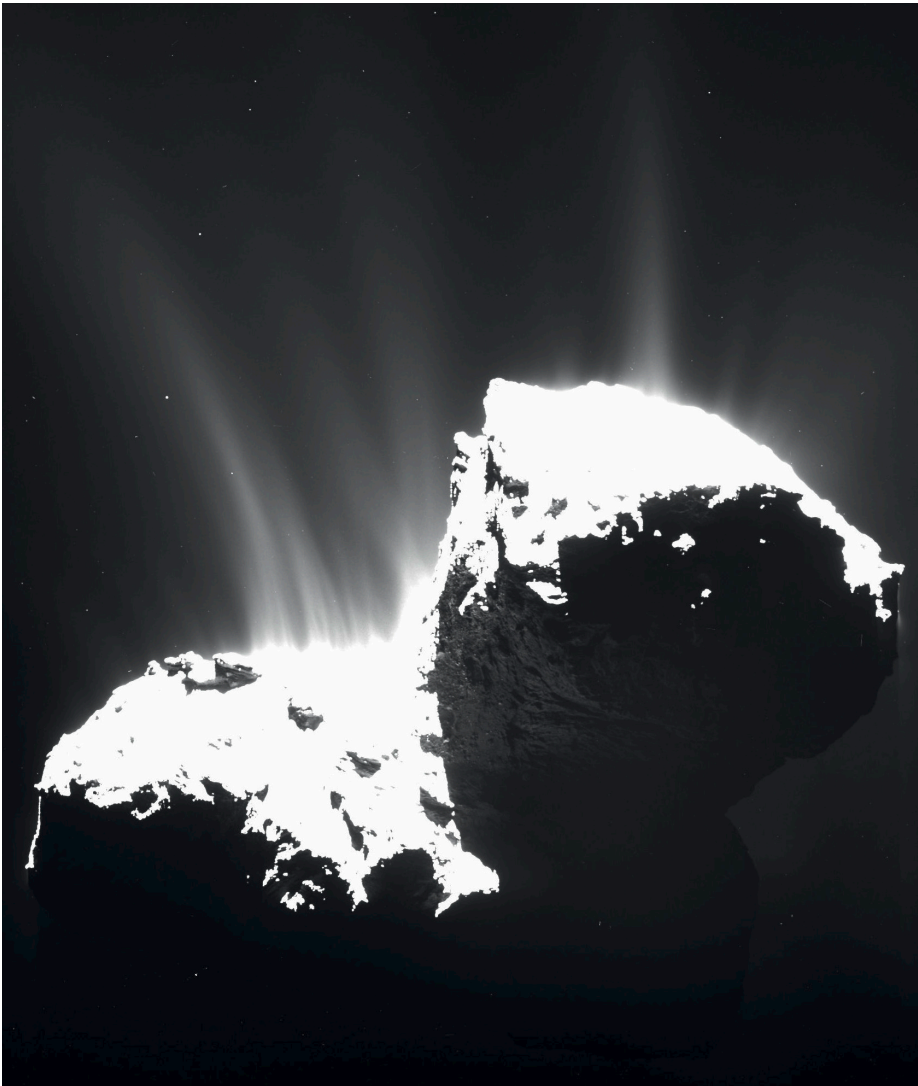


Figure 1. The comet is very active, as seen in this rare OSIRIS image from November 2014.
Credit: ESA/Rosetta/MPS for OSIRIS Team MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDA

The mission: Europe's Moon landing

What a mission! Launched in 2004, *Rosetta* has kept us busy for more than a decade as it has made its way to the outer Solar System. After a year-long hibernation *Rosetta* woke on 20 January 2014 and approached Comet 67P/Churyumov-Gerasimenko. As the comet began to dominate *Rosetta*'s field of view it was anxiously observed by both scientists and the general public. On 6 August 2014 *Rosetta* finally arrived at the comet. Three months later the *Philae* lander was released from the orbiter and touched down on the surface of the comet's nucleus after seven tense hours. *Rosetta* is still orbiting the comet now, giving more and more insights into the changes taking place as it moves through the Solar System. The orbiter itself will touch down on the surface of the comet in around September 2016 and might stay there until the comet disintegrates in a couple of thousand years.

This mission really is a drama. It is a story about a very long and complicated journey to uncover fundamental scientific questions about the origins of the Solar System and life on Earth. The billion-euro spacecraft was sent from Earth to a remote snowball and has managed not only to catch up with it, but to transmit breathtaking views and exciting data. Moreover, it did so without any possibility for a pitstop. In the end, we were met with a moving finale. *Rosetta*, an historic European mission, has had an almost comparable impact for the

European space agencies as the *Apollo* landing on the Moon had for NASA.

This is true not only because of the great scientific achievements of the mission, but also because of how this mission was, and is being communicated. The European Space Agency (ESA) and the Deutsches Zentrum für Luft- und Raumfahrt (DLR) where the Philae control centre is based, did, and are still doing, a marvellous job, and I say that as someone who is not at all reluctant to give critical feedback to scientists or outreach officers, when it is appropriate to do so. *Rosetta* was a real feat in terms of the communication of European space flight activities.

First of all, scientists and communicators realised that this mission would connect to a very broad audience, and even reach out to people who do not usually relate to scientific issues or read the science sections in newspapers or websites. This realisation is not always easy to come by. Very often scientists — and sometimes even outreach professionals — miss an opportunity to engage the public with what could be very popular events. Alternatively scientists can be reluctant to communicate when the public wants to get the news. At ESA and the DLR they avoided these problems; the outreach and communication teams teamed up with the scientists, and the scientists themselves wanted to cooperate in a timely fashion, and not weeks, months or even years later.

Science and outreach in parallel

The communication teams from ESA and the DLR worked almost perfectly in parallel — on the science and for the public. I really admire — a term a journalist uses very rarely — Stephan Ulamec, *Philae* lander manager at DLR, and his team for their openness with media contacts. The team wanted to talk about this mission, even when the technical workload for them was almost unbearable and when they were having a hard time with their spacecraft. The very moment when we wanted to know everything that there was to know about the mission was probably also the most critical moment in their careers. Nevertheless, they were enthusiastic about communicating and answered many questions with patience and endurance.



Figure 2. Neil Armstrong was the first man on the Moon. Stephan Ulamec is the first man to land a robot on a comet. In terms of communication, he is even better than Neil. Credit: DLR/ESA/A. Morellon

The overall communication strategy was very well chosen. It was driven by the events taking place at any one time and followed closely the various acts of the scientific drama. This may sound like an obvious way of doing things but, until a few years ago, strategies like this often went awry. This was not because outreach departments were less savvy about Twitter and Facebook, but more often because scientists and project managers did not understand the importance of communicating at the right time. Many outreach departments have faced, and still do, strong constraints from mission management.

Here are two examples.

Christmas 2003. We all waited for the signal from *Beagle-2* — the UK-led Mars lander — to land on the surface of the red planet. At the same time, *Mars Express*, the orbiter, was shot into a stable orbit. All this excitement, and yet it took almost a month before the general public saw the first picture from the high-resolution camera on board *Mars Express*. The image popped up on the internet without any context or any supporting special presentation event, to find a public fed up with waiting for Europe's first Mars image. An official event with high-level representatives from the agency and politics followed four days later. Even worse, whilst we waited for the ESA data to emerge, NASA landed the first of its two Mars exploration rovers, with surface pictures from the *Spirit* rover shown in real time. Something that was virtually unimaginable for European missions.

Next, in 2005, I attended the orbit insertion event for *Venus Express* at the European Space Operations Centre (ESOC). Whilst eagerly awaiting the crucial telemetry signal to arrive so that I could report on the mission for the morning news shows of various radio stations, I was met with a long and boring speech by a high-level representative of the DLR. The press were informed much later that the spacecraft had performed a perfect orbit insertion. Worst case communication!

Rosetta festival

In 2014 the story was completely different. The *Rosetta* festival, as I used to call it, started in January. The spacecraft was about to end its hibernation phase, during which there had been no contact with Earth. *Rosetta*'s wake-up was celebrated with a big media event at ESOC, where representatives from ESA and various national space agencies, scientists, engineers and media from all around the world gathered in the same room to wait for the first data link to *Rosetta* in more than two years. After nail-biting minutes of uncertainty the carrier signal popped up on the screen. The audience burst into applause, accompanied by cheering and hugging. Nobody who was on site or witnessed the livestream, will ever forget this historic moment. *Rosetta*'s wake-up ranked as a top news item in all the major news outlets throughout Europe and even worldwide; from television, to radio, newspapers and, of course, through all kinds of online media.

In the following months, the first pictures were published, showing the strange, duck-shaped comet nucleus. ESA and the DLR communicated through blogs, social media and classical press conferences. Finally, the spacecraft arrived at the comet. Again, folks gathered at ESOC in Darmstadt to follow the final manoeuvre that would put the spacecraft in the right position next to the comet. Of course, it is impossible to allow hundreds of journalists into the control room, but there was live coverage of all the important steps shown by ESA television, with experts explaining what was going to happen and making themselves available for interviews in the press area.

***Philae* has landed!**

One of the highlights of my career — and I have been in the job for more than two decades — followed the landing of *Philae*. There were two major events. At the bigger event at ESOC in Darmstadt, more than a thousand journalists from all over the world covered the historic landing on the comet. At the *Philae* control centre on the DLR premises in Cologne a few hundred journalists assembled to be even closer to the action than in Darmstadt. There was such a high demand from the media that ESA and the DLR set up an application procedure for journalist access to one of these events. That is very unusual for spaceflight events, but it is a wonderful problem to have. It proves that the landing on the comet was as appealing to the media as a big sports event or a high-level international meeting of politicians.

Again, the news was communicated in nearly real time. Once the flight teams got the data, it took only seconds or minutes at most, to present it to the public. I know experts hate to do instant science, to comment on new and unexpected data, but they did so very well. Unfortunately, *Philae* landed in a position that left its solar panels with insufficient illumination. So, it fell asleep sixty hours after touch-down. But the public and press were so well connected with the mission that *Philae* was back in the headlines — even those of tabloid newspapers — roughly half a year later, when it got more sunlight and was able to have at least some communication with the *Rosetta* orbiter. People across Europe, and the world, were crossing their

fingers for the *Philae* team to re-establish the science programme on the icy surface. What a reward for the scientists! Their work was not done in some remote ivory tower, but was made immediately relevant to many interested people who had no professional connection to science.

On the day of the *Philae* landing an interesting incident occurred. A British physicist appeared at a press conference wearing a shirt plastered with depictions of semi-naked women. I do not wish to comment on the appropriateness of this, or on the fashion sense of this individual, but what I can comment on is the extensive protest and debate that it caused on social media. Without dwelling on the content of the debate the event proves, if nothing else, that the *Rosetta* mission was followed intensely by the public at large.

OSIRIS, the unknown camera

So far, so good. But there was one major let-down for me in the outreach from the *Rosetta* mission — the public saw very few images from the Optical, Spectroscopic, and Infrared Remote Imaging System (OSIRIS). This instrument was built under the leadership of the Max-Planck-Institut für Sonnensystemforschung (MPS) in Göttingen, Germany. It is a masterpiece, one that the taxpayer paid for, but there was a perceived reluctance to allow public and press access to the camera's images. This issue was highlighted for me in August 2015 when, to my great disappointment, I saw OSIRIS images presented at the General Assembly of the International Astronomical Union that had never been shared with the public.

It is likely that the Max Planck scientists wanted to keep the data from public view in order to write scientific papers that could be published in peer-reviewed journals such as *Nature* or *Science*. These journals usually require data and pictures that have not been shown before, and this puts scientists in a difficult position. But, in my opinion, it is not good practice for this to be considered more important than sharing the data with the people who paid for it.

This example raises an important and difficult debate in outreach. Are there in fact any instances where a competing researcher has used press jpeg-pictures to write a

paper before the involved scientists themselves? I am not personally aware of any, although I would be interested to hear from anyone who is. In my view, the perceived danger of the theft of scientific research is exaggerated and to my mind, unless there is a real risk to the research outcomes, it should not be an excuse to withhold the best pictures from the public. The OSIRIS team, and other teams who have taken the opposing view, are rarely criticised for this behaviour, because many journalists, and indeed the public, just do not realise that there are more high-resolution pictures to be had.

Show us the comet, please!

Most images from the comet are taken by the navigation camera (NavCam) on the *Rosetta* spacecraft, which is run by ESA. The ESA team likes to share the images on very short timescales to maintain the momentum in public interest. We really have to thank the engineers for having built such marvellous navigation cameras. My concern is that if ESA and DLR had done as other agencies and science institutes have done, and put caution ahead of sharing data, then we could have ended up with just a handful of images released in a timely fashion from this iconic mission. If we had to wait until the data had been analysed and papers prepared, when would the first surface pictures have been published? In November 2014? Christmas? Spring 2015?

The principal investigators of instruments flying on European satellites are in a very strong position. In many cases, they virtually own the data. They decide whether specific data are used for public outreach and when. Is it right, given the great deal of money spent on space that the scientists responsible for the projects are the only ones to decide how much the public should get to see of it? There are different views on this across both the science and outreach communities, mine being that the public should get what they have paid for and see the images as they come. Thankfully though there are instances like *Rosetta* where parties work together and we end up with successful missions shared in real-time with the public. But, had OSIRIS been the only camera I am not sure we could say the same.

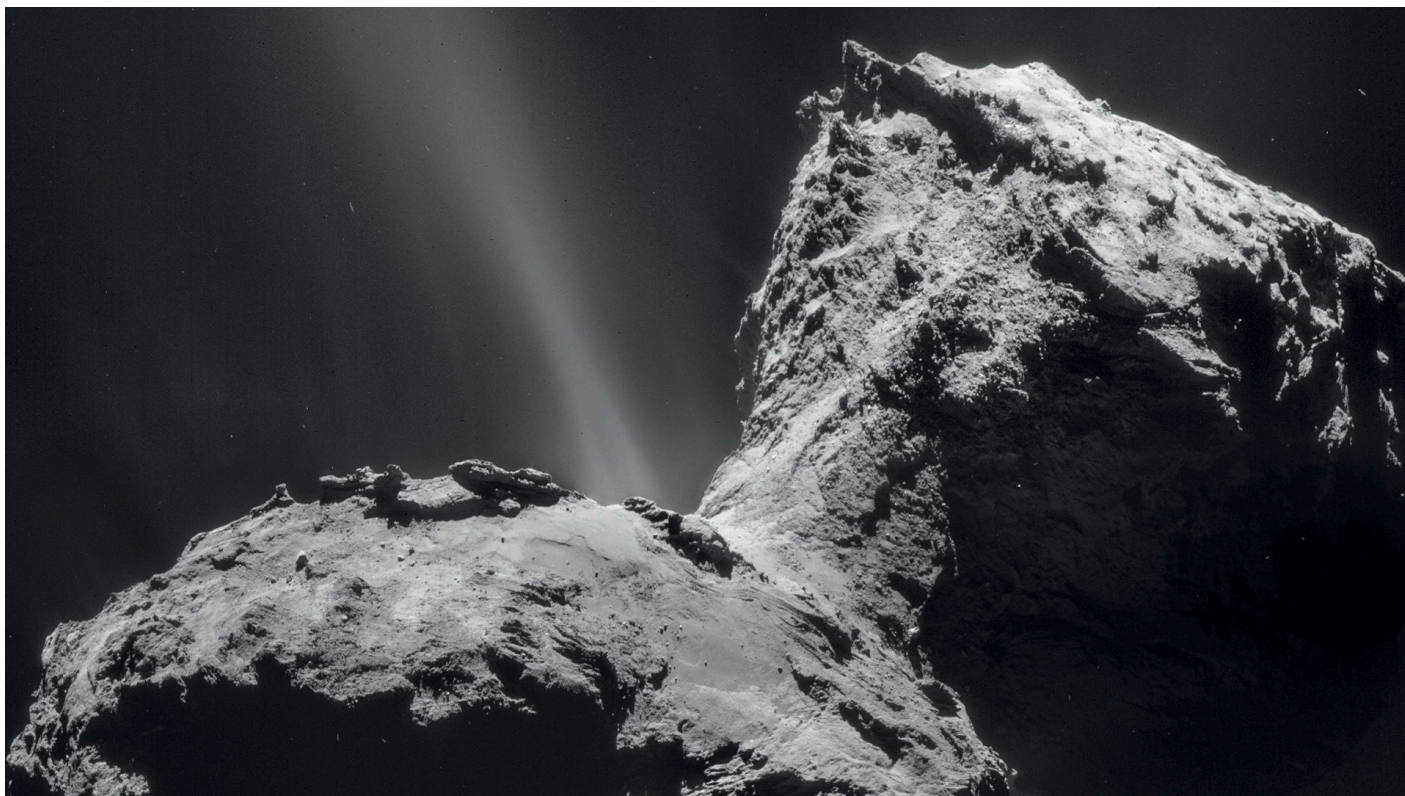


Figure 3. Thank you NavCam. A typical view of the comet as seen by the navigation camera on the Rosetta spacecraft. Credit: ESA/Rosetta/NavCam – CC BY-SA IGO 3.0

Although compromises have to be made to make data public instantly, it is in the scientists' interest as much as the public's to make their science public. If science does not matter to the public, the public will lose interest in it and in the long term this might lead to a decrease in funding. While this might pose a severe problem for research that is important, but unappealing to the public, it presents a great opportunity for spaceflight activities. They are easy to communicate, especially if they have a strong connection to fundamental astronomical questions. Space missions fire the imagination, they have the appeal of extreme conditions and extreme numbers and they produce beautiful images that almost everybody will be fascinated by.

Cassini, the perfect example

The team of *Cassini*, the spacecraft in orbit around Saturn for more than a decade now, has an imaging diary. We get to see new views of the planet and its rings and moons on an almost daily basis. Why is there no imaging diary of the *Rosetta* mission, with the great views from OSIRIS? Such a tool would help to foster the public interest in the mission even more. Despite this, and

especially as far as the outreach teams at ESA and the DLR are concerned, there is no need to complain. Maybe the OSIRIS team will catch up in the future and realise that it is missing a huge opportunity.

Conclusion

By training, I am an astrophysicist who is used to dealing with objects that are billions of light-years away, so until a few years ago I considered comets to be more or less irrelevant dirt in space. They were nice to have, but not really important. Now, I have to say, this wonderfully designed, built and flown spacecraft has changed my view completely. I owe to it a few of the best moments of my professional life and the outreach campaign that supported it has no doubt brought the same realisation to professionals and members of the public around the world.

To finish, I have an anecdote to share, which for me highlights the success of the *Rosetta* communication story. When I arrived in Seattle in January 2015 I was asked by the immigration officer why I was visiting the USA. I answered that I was attending the annual meeting of

the American Astronomical Society. He replied, "Oh, great. For sure you will discuss the landing of this spacecraft from Europe on the comet. I enjoyed that!" I was astonished. Not only did this officer know about the mission, he knew that it was a European one. Well done, ESA!

Notes

- ¹ Images from OSIRIS are now available at <http://www.esa.int/spaceinimages/Missions/Rosetta>
- ² Article received 30 October 2015 and all content correct at that time.

Biography

Dirk Lorenzen trained as an astrophysicist at Hamburg University, Germany. After graduating he joined German Public Radio, and for more than 20 years has covered astronomy and space flight for various radio stations. Lorenzen has also authored several books. Since the International Year of Astronomy 2009 Lorenzen has also written the daily space column *Sternzeit*, a very popular 100-second programme on the radio station Deutschlandfunk.

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