Impossible Journey

BY JOE FORDHAM

In the 1960s, opponents of the United States space program cited the mythological character of Icarus, who stole his father's wax-and-feather wings and soared too close to the sun, as a symbol of hubris. The 'space race,' critics maintained, was a reckless reaction to the launch of the Soviet Union satellite, Sputnik 1. But President Kennedy's 1962 speech, which challenged Americans to place an astronaut on the moon by the decade's end, went on to inspire an unprecedented feat of courage and engineering hutzpah.

Historian James Hansen's 654-page biography, *First Man: The Life of Neil Armstrong*, traced the journey to the moon from the perspective of Neil Alden Armstrong, a young aviator from Ohio who fulfilled Kennedy's challenge. The story captured the imagination of filmmaker Damien Chazelle, director of 2016's *La La Land*. "Having grown up with the moon landing in the rear view," said Chazelle, "it felt like an event that later generations take for granted. People don't ask too many questions about what it might have meant, and what it took to accomplish. I became fascinated with the idea of trying to tackle this huge event of global significance, but from an intimate, subjective point of view. I wanted to look at the years leading up to the moon landing, to show step-by-step

how that became a reality, and I wanted to locate that almost exclusively from the perspective of Neil Armstrong, his wife and his family, to show what that cost them."

Screenwriter Josh Singer focused on eight critical years leading to NASA's Apollo 11 moonshot, manned by commander Armstrong (Ryan Gosling), lunar module pilot Buzz Aldrin (Corey Stoll) and command module pilot Mike Collins (Lukas Haas). The narrative charted personal details in the lives of Armstrong and his wife Janet (Claire Foy), including the death of their infant daughter Karen (Lucy Stafford), Neil's training with the X-15 rocket-powered jet, the Gemini 8 Earth-orbit rendezvous, and his eventual, historic landing on the moon's Sea of Tranquility, July 20, 1969.

Chazelle laid out shooting plans in an animatic reel that he compiled with film editor Tom Cross. "We had a script and a breakdown from the studio," recalled visual effects producer Kevin Elam. "As we got into budgeting, Damien came in with his animatic. He had storyboarded almost every sequence that involved visual effects, and cut that to music. And he handed out a 300-page document describing how he was going to make the movie. He was extraordinarily well prepared."

NASA offered its assistance with archival reference and location facilities. "We had complete access," commented production designer Nathan Crowley. "We were allowed access to the astronaut's homes in El Lago, Florida. We filmed the crawler that carried the Saturn V rocket to its launch pad, and we shot in the vehicle assembly building. I wanted to film at Mission Control in Houston, but it was about to start historic renovations, and getting all the consoles and projection screens running was difficult, so we decided to build that. It was similar to what I'd done with Christopher Nolan on *Dunkirk*

— this was an event/documentary-style story, so we filmed as much as possible for real, and built the rest."

The brief for visual effects, too, had parallels with Nolan's *Dunkirk* and *Interstellar*, combining authentic locations with many in-camera effects. DNEG visual effects producer Michelle Eisenreich and visual effects supervisor Paul Lambert oversaw work at DNEG's studios in Vancouver and Mumbai, working with visual effects editor Ryan Chavez and in-house digital artists John Weckworth and Joseph DiValerio. The documentary aesthetic influenced shot design. "Most of the space program footage we'd seen had been shaky, slow-motion and archival," remarked Paul Lambert. "What we ended up doing, in particular for the Apollo 11 launch, was to take pieces of documentary footage and give it a good cleanup. We removed grain and artifacts, did stabilization and sometimes compressed frames to create the best possible image. NASA had multiple cameras on their Apollo launches to capture engineering details of the Saturn V. We repurposed that by placing restored footage in the center of frame, and then extended either side using CG. At the core of those scenes, we retained the original material, including footage that had never been seen before — high-speed, slow-motion, shot on obsolete 70-millimeter NASA military stock. That was inspiring, and it was unlike any visual effects I've worked on before."

The large-format material emerged during the production's hunt through NASA resources. "James Bilbrey at NASA's Marshall Space Center television division emailed us that he had access to 70mm footage," recalled Kevin Elam. "No one was quite sure what

was on it, because they had no way to view it. You can imagine our excitement. I called Christy's Editorial in L.A., had them ship over some 70mm rewinds and a lightbox, and flew out to Alabama. We pulled 18 cans of material, and I was floored to see labels: 'Camera original, 1969, Apollo 11 launch.' We were holding history in our hands. As we rolled through the reels, we discovered a lot of full-frame closeups, shot with a long lens, of the Saturn V in flight. We found footage of the Apollo 14 launch that I knew Damien would love. But there was no way to view it except on the lightbox."

The military grade Kodak Ektachrome 70mm reversal stock revealed a sprocket pitch incompatible with modern film scanning techniques. "We did two parallel paths of research," said Elam. "John Nicolard, vice president of digital production at FotoKem, found a gate for the stock on a Rank Cintel telecine machine at White Sands Missile Range. At the same time, David Keighley, president and chief quality officer at IMAX, recommended a prototype scanner in London as a possible way to transfer the footage. The bigger issue for NASA was how to save the footage because, as we were opening the cans, we could see the stock was starting to deteriorate with mold and vinegar decay."

While FotoKem used the White Sands film gate for telecine-quality reference, FilmLight Ltd. in London digitized approximately 20 minutes of footage using a sprocket-less film scanner — the ArcLight — Mark II of a prototype developed for the Centre National du Cinéma in Paris. "We built the first ArcLight to scan the CNC's very large archive of historic material, including footage by the Lumière brothers from the founding days of cinema," explained FilmLight senior engineer Chris Hall. "CNC commissioned us to make a unique machine that could scan any format. That's why it was useful for the NASA footage. No

matter the film gate or the number of sprockets — or lack of sprockets — it could load and scan the footage through a gateless system. The film passed continuously through a line-array, where the scanner looked at sprockets and generated frames stable to the image. It used a very high-resolution 9K camera, so it had good stability, and we could scan the film from edge to edge, including the sprockets if we needed those as registration points. In this case, we had quite a lot of material, so we scanned only the image area, creating 7Kx7K frames, each around 50 megapixels. It was a slow process and took a couple of weeks because the ArcLight only has a black and white camera. We had to scan the footage three times to get red, green and blue, and then put them together."

The ArcLight scans — with ultra-crisp contrast and high dynamic range — set a baseline for photographic realism that Chazelle and cinematographer Linus Sandgren selected for the production. "The film formats were themed through the film," explained Michelle Eisenreich. "Any time action was set inside of a cockpit or a craft, it was 16mm. Out in the regular world, it was 35mm. And when the astronauts stepped onto the moon, it became full 70mm IMAX."

Re-creations of events emulated period photographic choices. "Damien did not want to do camera moves that were not possible back in the day," noted Paul Lambert. "A lot of space scenes, we shot craft-mounted. We had the occasional 'God-shot' to clarify what was happening, but most of the time the camera was attached to the craft, or emulated footage that was derived from what was photographed during the Gemini and Apollo launches. On Gemini 8, there was even less archival material, so we decided not to reveal