TITANIC · FX Review

Editors Note: The review that follows is a critical look at the visual effects of TITANIC, and is not intended to be an all-inclusive, behind the scenes report of the making of the film's effects. In as many cases as possible, firms and techniques involved with some sequences will be mentioned. For a complete look at the making of the visual effects, [see Cinefex 72 (Dec. 1997), or American Cinematographer Dec. 1997] for no less than seven articles on the cinematography and effects of TITANIC.

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The most anticipated visual effects film of 1997 was certainly *Titanic*. With hundreds of people working countless months on the picture, the visual effects crews used just about every single technique known to man to produce the fantastic images to James Cameron's film. Paradoxically, the film is a cautionary tale about reliance upon technology; the visual effects teams used both traditional and high-tech methods to create the film's illusions.

Although there are occasions of inconsistencies, *Titanic*'s visual effects are stunning. There are shots of jaw-dropping beauty, others where audiences stare in fascination, and others where they will think that there is no trickery involved. That, of course, is the true measure of success for any visual effects film that attempts to recreate reality.

I highly doubt that audience members who paid money to see *Titanic* actually believed the filmmakers created a full size, working ship, sailed it around the ocean, only to sink it in one glorious take, with dozens of cameras rolling. But narrative, Hollywood filmmaking is about the suspension of disbelief, allowing the audience to become so involved with the film's content as to be obvlivious to the techniques involved. The cinematography, editing, and visual effects are not the stars, but mechanisms to allow the story to progress, and *Titanic* achieves this unlike few films ever have.

Under The Sea

The film opens with the Mir submersibles descending upon the camera. As the camera tilts down, the subs fade into the darkness of the sea, eerily reminiscent of shots from Cameron's earlier work, *The Abyss*. The

exploration sequences of the sunken Titanic contain a collage of miniature photography, and actual Titanic footage photographed by Cameron himself during a series of deep sea dives. The big challenge for this sequence was to cut between real-life Titanic shots and miniature shots without the audience ever realizing it, and the filmmakers succeeded. While the miniature shots shot by Digital Domain have slightly smoother camera moves than the real footage, the two sets are nearly indistinguishable. Careful additions of particles visible in the subs lights add to the realistic look of the shots. Even through significant camera moves, the particles appear to have depth, giving the dry-for-wet miniature footage a deep, documentary look.

To further add realistic cues of scale to the sub footage, CG fish were animated and composited into a couple shots. For one, Banned from the Ranch added a CG fish that swims behind the tub in Rose's stateroom. The lighting on that fish was particulary interesting, since in uncharacteristic restraint, the fish wasn't the focus of the shot, and was actually hidden in shadow for most of the shot. This kind of subtlety and lack of 'look at me!' effects appear throughout the film.

Above the water, a computer simulation of the ship's demise is displayed for Rose, documenting Titanic's last hours. The Digital Domain CG animation of the ship sinking was composited into the television by Banned From the Ranch, as the animation was not available for live, on-set playback. The burn-in effect
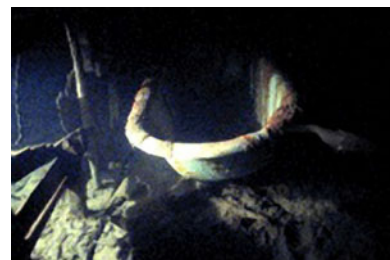
[top] The Mir subs approach the camera within the darkness of the ocean. Miniatures were shot dry-for-wet by Digital Domain, composited by Banned from the Ranch.

[bottom] Banned from the Ranch added CG fish to some underwater wreck shots.

is transparent to the viewer. The demonstration, utilizing the complex Lightwave CG model created by DD's NT group, is quite a show within itself. Its purposefully low resolution model still moved with grace; particularly interesting was the depiction of panels being ripped off the ship as the bow descended to the bottom of the ocean.

As Rose begins her story, the camera moves behind her to a video screen, depicting the sunken ship, with the video camera moving left to right across her bow. In one of the magnificent Digital Domain transitions, the bow magically transforms into the Titanic bow of 1912, while docked at Southampton. The shot continues across the bow to reveal waving passengers on board, and hundreds of extras scattered around the dock. The transformation is stunning, providing a majestic entrance for one of the film's main characters, the ship itself.

"GOODBYE! WE'LL MISS YOU!"

For many wide shots of the Titanic, the passengers are actually computer generated models. The digital extras and stuntpeople for *Titanic* were animated via a complex combination of motion capture, freehand animation, and 'roto capture', where animators keyframed CG models using footage of actors performing an action as reference. The position of the decks had to be meticulously tracked in 3D and massaged in 2D, so the CG passengers would actually appear to be standing on the decks and leaning on the railings throughout complicated camera moves.
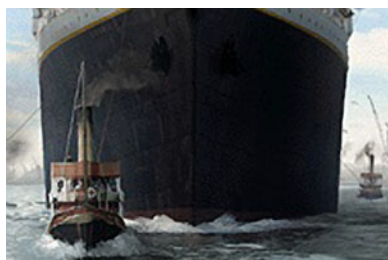
This technique was used many times throughout *Titanic* by Digital Domain— combining motion control photography of a model miniature ship, with motion-capture CG extras lining the decks of the ship. In nearly every case, the camera is moving in dramatic,

swooping moves, and at no point do the CG people 'slide' or jiggle across the decks.

The fact that the passengers actually seem to be aboard the great craft is a marvelous complement to the compositing/rotoscoping team, since various pieces of the miniature would have to be rotoed if

a CG person would appear behind it—the best example would be the ship's railings. Even though matte passes were shot of the miniature's railings, it must still have been a massive task. The compositing prowess continues for shots of Jack and Fabrizio, and Jack and Rose on the very tip of the bow, where full-scale motion control footage was composited into

the miniature shots. For those, the railings and posts that appear in front of the characters had to be meticulously isolated, even during shots of a number of seconds in length.

The Southampton sequence features a great deal of footage from the first unit shoot, which took place in Fox's Studios Baja in Mexico, where a nearly full scale Titanic was built. This allowed Cameron to freely move his camera in dozens of wide shots, without the need for tracking and compositing a miniature or CG ship. Much like the underwater sequences, his desire was to cut between this 'real' ship, and the composited CG/miniature ships without the audience ever realizing the trickery, and that was accomplished.

The Southampton dock shots feature hundreds of

[left] Digital Domain composited real wake elements with their digital water (created with Arete software), CG smoke, model tugs and the 1/20 scale Titanic, which measured over forty feet long.

[above] One of Digital Domain's stunning launch shots. The passengers on the ship are actually computer generated models. The shot below is a detail of the previous shot.

cheering crowds on the docks, sometimes realized as composited greenscreen footage of a small group cheering. For moving camera shots, the greenscreen clumps of extras were animated in 2 and a half-D: the 2D pieces of crowd would be arranged in 3D space for sweeping camera moves. This trickery is seamless and invisible. Digital matte paintings fill the edges of the screen, depicting various cranes and buildings around the dock. In a particularly cool image, the camera cranes around Jack Dawson waving, "We'll miss you!" Visible the background, sometimes covered by his hand, is an enormous crane, actually a digital addition. It is effects shots like this that almost subliminally take the viewer into the world of the characters.

The greenscreen composites in the tavern sequence where Jack wins his ticket on board Titanic were executed with real flair; even with some complicated camera moves and smoke, the background seemed to be in the distance, although the background element seemed a bit contrasty.
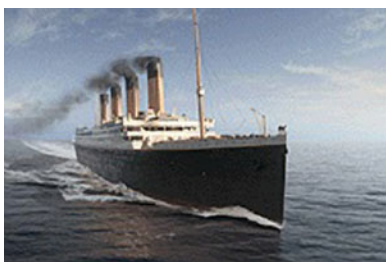
The Journey Begins

For most of the at-sea shots of the ship, Digital Domain photographed their 1/20 scale model, and even as the camera swoops close to the decks, the miniature holds up. Depth of field remained realistic, and the detail of the hull and decks looked very sharp. Digital water, combined with practical water elements seemed real, even when the breakwater in front of Titanic and tugboats nearly fill the frame. One of my favorite shots of the sequence is an epic, wide shot of a tiny sailboat being engulfed by Titanic's enormous shadow.

A subsequent helicopter shot of Titanic, with the ship extremely small in frame with a its smoke trail behind it, features the full CG ship. Its hull is mysteriously brownish gray in this shot, and the smoke trails didn't seem to have the dissipation attributes normally seen with smokestack trails.

As the engines rev up, the camera takes us down

to the Titanic engine room. Only very few people will ever realize that nearly the entire sequence is nothing but visual effects—clever combinations of a miniature engine room created by Tony Meininger of Brazil Design, and a different miniature (1/3 scale) engine room (actually a real-life engine room) contained greenscreen-photographed people moving around its walkways. The camera arcs all over the place, and all the elements match—the workers don't slip and slide even in the most active of shots. Later in the film, as the engine room is told to reverse engines, the camera is wild, with the operator running down 'corridors' and climbing 'ladders'. Compositing was also consistent, with the color values of the greenscreen elements matching their surroundings. The engine room sequences were part of VIFX's work for the film.

Two of the film's signature helicopter flybys then appear, both handled by DD. The first is a modest flyby of the ship, with the 'helicopter' approaching the starboard side of the ship, ending its shot on Captain Smith on the bridge. The second shot begins on a tight two-shot of Jack and Fabrizio on the tip of the ship. The camera surrounds them, then travels up and backward throughout the entire length of the ship, traveling over the smokestacks, across the stern, and ending up at nearly the water's level. The two shots both utilized a miniature ship, and with the exception of the Jack/Fabrizio elements, which were live-action greenscreen elements, every passenger and crewmember depicted walking the decks of the ship were CG characters. The Jack and Fabrizio elements were shot with a complicated real time motion control system, with the actors and key lights fastened to a rotating platform. With the kind of perspective shifts associated with these flybys, using real actors against a greenscreen would have proven unruly and

[left] Jack and Fabrizio peer down the edge of the bow. (Digital Domain)

[above] One of the film's signature images of Titanic sailing the seas. (Digital Domain)

nearly impossible for the passengers on deck. After 3D tracking data of the ship's decks was determined, the 3D characters could be placed throughout the ship, and 'directed' by the animators just as human actors would be directed by the director.

The appearance of digital extras is not visible within *Titanic*. There's nothing in the film to give the illusion away. This is a tribute to not only the performance/animation editors, but, more importantly, to the 3D trackers at DD who pinpointed the exact 3D space that the miniature decks, stairways and ladders existed in.

The second flyby, although technically astounding (especially considering the camera move around Jack/Fabrizio, and their eventual morph to CG characters), does a disservice to previous and subsequent realistic camera moves throughout *Titanic*. Every shot of the ship besides this one could conceivably had been captured through actual helicopter, crane or some kind of photography. We've all seen countless cruise line commercials, where the camera triumphantly swirls around the decks of the ship revealing the majesty of a huge craft. This shot, however, could never had been photographed by a real camera, due to the perilous nature of the camera's path. The camera twirls backwards away from the bow, and rises mere inches above one of Titanic's funnels. Since no helicopter would dare move its camera so close to the funnel in real life, the illusion of the shot is broken. The 'camera of God' syndrome of visual effects filmmaking is not new—just look at 1995's remarkable *Apollo 13*; during the launch sequence, the camera rotates and dives through the gantry posts as the rocket blasts off.

Between the two flybys, a number of extraordinary shots appear. DD's remarkable camera moves

[above] Hammerhead Productions created CG dolphins for some shots in the film.

continue as the view swoops over Jack's head, to view the breakwater against Titanic's hull. Dolphins appear, swimming and jumping alongside the ship—Hammerhead Productions not only composited real-life dolphin footage into the shot, but created CG dolphins for closeups of the animals. An over the shoulder dolly shot of Captain Smith and Officer Murdoch standing on the bridge reveals the extreme bow and forcastle in a very convincing shot—the actors, shot against greenscreen, comped in front of the 1/6 scale forecastle, with digital water and motion-capture CG crewmembers.

For other daylight exterior Titanic shots, actors were filmed on the decks of the Titanic set, with numerous digital sky replacements to enhance the scene, or remove visible remnants of land. In many cases, the camera swoops over the deck, first revealing Titanic's hull, the water, than cranes over the deck to characters having a discussion. One particular set extension shot accomplished by DD (usually using the Lightwave CG version of Titanic) is absolutely perfect—the camera begins starboard side aft, then flies over the railing to see some third class children kicking a ball on deck. The wake, water, interaction of the water on the hull... everything matched, not just in terms 3D tracking, but in scale, depth of field, contrast and color. Another terrific crane move from the hull to the decks takes place later in the film, as Rose and Mr. Andrews, the ship's designer, are walking on the port side of the ship, discussing the lifeboat situation. Once again, the water, hull and deck all seem in synch, and the illusion is not at all visible.

As night falls, the sky replacements take on different significance—clearly visible starfields and the ever present horizon line. Nearly every single evening sky in the film contains these elements. The stars become a distraction in many shots; their brightness is overwhelming at times. As the camera pans left or right or moves up and down, the tracking of the stars was consistent throughout the film, but the stars seem to gain intensity in order to visibly blur and streak across the frame as the camera moves. The starfields, themselves, are a bit weak, in that there only seemed to be two levels of intensity—bright and

very bright. The distribution of stars was too uniform to be believed, as well.

Rose On The Edge

The long sequence of Rose attempting suicide contains dozens of greenscreen composites, many completed under difficult conditions. For one thing, Rose's dress was of a semi-transparent, flowing fabric, which can be hellish on greenscreen matte extractions. Also, it seemed clear that there was some excessive spill and exposure problems on a couple of shots, namely a few directly facing Rose, where black levels seemed off and the actress had a greenish tint. A nagging light above the actors heads appeared to be completely digitally reconstructed in wide shots, as well. These instances aside, there are some wonderful composites completed by CIS Hollywood in the sequence, including some invisible shots of Rose dangling off the edge of the ship. Completely invisible is CIS' work on the wake—actual wake elements were shot off a twin-propeller ship, and since Titanic was a three prop ship, various digital manipulations were made to give the impression of a three prop wake. The camera is

seemingly always moving during this sequence, especially in the dramatic 'helicopter' shot that begins the sequence. Just one of many complicated shots appears as a crewmember comes across Jack and Rose, looks down then up, turns toward the camera and yells, "Fetch the master-at-arms!" The camera is flying all over the place, and the horizon line and stars always seemed naturally within the frame.

"I'm Flying!"

Jack returns to the very front of the ship, as Rose joins him, only to be taught how to fly in a gorgeous 'magic hour' sequence. With the setting sun in front of them, orange-red hues engulf the ship and the actors. The camera swirls around them from a hundred feet away, rotating almost 90 degrees behind them. Like the previous Digital Domain Jack/Fabrizio shots, the actors were shot motion control on a greenscreen stage, with the camera motion translated from the 1/20 scale miniature Titanic photography. As with the previous shots, they are locked into place at the tip of the ship, and rotoscoping of the railings was smooth

and unnoticeable. As with the other bow-to-stern shots, Digital Domain's digital smoke elements eminating from the funnels seem very realistic. Unfortunately annoying is the near-exact same camera path traveled twice in the short sequence, with the camera moving up and to the left, rotating clockwise around the bow—as well as the lack of motion blur on the water in the background, especially near the end of the shot.
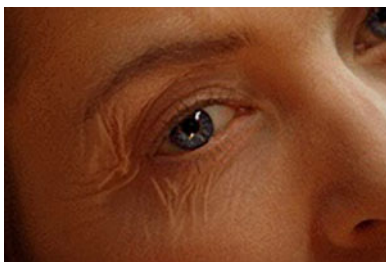
Probably the most dazzling of all the transitions of the film appears as the last sweeping shot slows its pace, while rust and debris magically appear along the railings. Slowly the warm orange colors are transformed into cold blues, the water disappears, and finally the couple disappear. The camera

pulls back to reveal the true nature of the shot—a video screen depicting the sunken wreck, as viewed by Old Rose. This DD transition does exactly what visual effects should always do— play a part in telling the story. The purpose of the shot is to not only to transition from the past to the present, but to remind the audience of the

impending danger, loss and horror that is to come—both temporal and emotional transitions. The design of the shot, as well as the execution, allow this sequence to shine as a classic, one that will be remembered for its technical brilliance and its emotional impact.

A quicker transition takes us back to the past, as the sunken mantlepiece and fireplace of Rose's sitting room smoothly transforms into the 1912 version, as Jack and Rose enter the room. Hammerhead took the miniature passes of the sunken mantlepiece, as well as the live-action footage, and massaged the elements until it created the smooth transition.
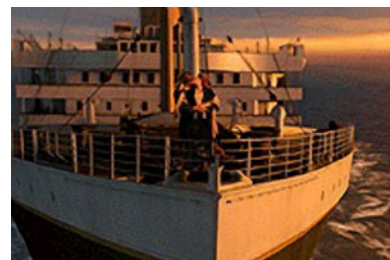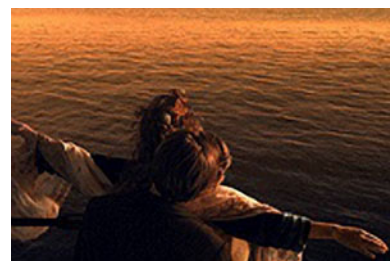
[above] Jack teaches Rose how to fly. For wide shots, the actors were shot motion control against a greenscreen, composited against CG water and the 1/20 scale miniature. The top image is a simple greenscreen element, composited against digitally generated water. (Digital Domain, both shots)

As soon as we were brought into the past, the audience is shuffled into the present via another complicated Digital Domain transition, where the camera dollys in tight on Rose's eye, only to be transformed into old Rose's eye. The drawbacks of the shot are that the young Rose camera move is incredibly smooth, which was a little jarring following the frenetic shots of Jack drawing on his paper—and that young Rose is *completely* still, whereas she has been squirming and adjusting herself throughout the scene. During the zoom in on young Rose's face, also, the edges of the frame slightly strobe. Besides this, the morph is impeccable, with the subtle change in lighting, eye shape and the surrounding tissue transforming.

The finest evening at-sea shot takes place as the camera, situated at water level and travelling parallel to the ship, tilts up from the reflection of the ship's lights in the water, to the ship itself. Following this is a terrific multi-axis crane move outside the ship, revealing the water, hull, and a porthole with Jack peering outside.

At this point in the film the style of the visual effects change dramatically; whereas the first half of the film depicts the ship in all its beauty, the iceberg collision and sinking sequences depict the ship with deep strokes of nightmarish imagery.

"Iceberg, Right Ahead!"

The iceberg approach shots, taken from the POV of the Titanic's bridge, composited by Digital Domain and Light Matters, are absolutely chilling. The miniature iceberg element, eerily lit by the Titanic's own light fixtures, is shrouded in shadow, looming as a massive monster in these shots. The best of them all is a hurried, over the shoulder handheld shot of an officer running to the bridge's deck to take a look at the oncoming iceberg. The iceberg scrapes against the side of the ship, right near Jack and Rose, where the miniature iceberg was augmented by DD with CG chunks of ice in a dazzling tilt down, then up shot of the 'berg passing the characters.

Because the live-action shoot took place in Mexico, and not in icy waters in the Atlantic, breath vapor was not visible, and for over 100 shots, VIFX composited practical cold breath elements shot against black into first unit photography. At no point do the digital breath elements call attention to themselves, or reveal themselves as illusion.

Women And Children First

At this point, Cameron cuts directly between the full scale Titanic set, with the miniature Titanic models for shots of the ship sinking—featured in the sinking shots were the 1/20 scale full ship, a 1/6 scale forecastle, and the 1/8 scale stern section. The latter two models, plus a 1/4 scale stern, were built by Don Pennington, Inc. The 1/8 scale stern was predominately utllized in the sinking and splitting of the back half of the ship. A number of full scale shots also feature plenty of invisible wire, rig and light removals.

The 1/20 scale ship, along with digital water and starfield, is triumphantly seen in a dazzling DD tilt down from a flare element, showing the extreme bow of the ship slowly decending into the water. Shots that totally look like full scale elements are actually miniatures shot dry with digital water and reflections added by DD.

A seemingly innocent shot of the very front tip of the shot is actually the 1/6 scale miniature sinking into the water, with digital water extensions and CG lifeboats in the background. In another very clean DD

[left] Young Rose becomes Old Rose in this complicated morph, completed by Digital Domain using Avid's Elastic Reality.

composite, Captain Smith takes a look at the sinking forecastle, in a very realistic over the shoulder shot of Smith wearily looking at his ship from the bridge.

The full CG ship makes another cameo in another flare shot. With the camera seemingly hundreds of feet in the air, and the ship tilted about 10 degrees, a signal flare bursts and dies out, leaving a glimmering reflection on the water. This shot is eerie and disturbing, and conveys a great deal to the audience—the shot underlines desperate nature of the situtation, the complete isolation and forebodes the doom of the ship.

ILM contributed some fine, unplanned composites to show the entire full size ship tilted into the water. As the full size set could only be tilted by splitting it in half, two pieces of first unit footage each depicting the halves of the ship were composited by ILM to give the impression of the full ship sinking into the water. These extremely complicated 2D composites are extremely clean and unnoticeable—a remarkable feat, in that the footage was never intended to be spliced together.

Inside the Doomed Ship

Visual effects for *Titanic* do not exclusively occur with the camera outside the ship; plenty take place within the ship, as well. A miniature corridor is flooded with water as the camera pulls backwards at a tremendous rate. ILM was tasked to paint out larger clumps of water, clumps with large specular highlights that would have shown the true scale of the miniature set/water, and to digitally paint in smaller balls of water. The shot was also tilted, with missing pieces of the shot painted by ILM. Quarter scale interiors of first class decks, built and shot by DD, are destroyed as the ship splits in half in a neat series of shots.

In a particularly interesting shot, Jack and Rose run toward the camera, evading a huge blast of water. Because of the danger of the stunt, stuntmen ran through the shot with the blast of water behind them.

The actors then ran through the set without the water, and it was up to POP Film to digitally remove DiCaprio and Winslet's faces and paste them onto the stuntmen's face. Early in the shot, strobing and sliding of Winslet's face is clearly noticeable, and her forehead throughout the first half of the shot seems quite expansive. The shot is enormously ambitious due to the light flashes and overcranked camera; defying conventional wisdom, the shot actually gets more convincing as the actors get closer to the camera.

The action outside gets grim as the ship tilts to 30 degrees, funnel cables snap into the water, causing boats to flip over. The cable snaps are probably one of the most noticeable effects shots in the film, with the animated wires looking out of place, and moving with little or no motion blur. Exceptionally cool is the over the shoulder shot of Hockley looking at the forward funnel collapsing into the water. The miniature funnel, one of numerous Pennington models, was shot by 4-Ward, and really holds up well. As it splashes into the water, uncharacteristic water elements appear in a lower frame rate than 24fps in the composite.

As the ship's generator gives out and the Titanic's lights go dark, nearly every shot afterwards is some kind of composite, be it starfield and horizon additions, or Digital Domain set extensions, or flat out miniature ship/digital water/digital stuntmen shots.

The ship buckles under the pressure and splits midway between the third and fourth funnel. The 1/6 scale miniature was photographed interacting with water for many of these final shots, which turned out to be a very good idea, since digital water elements or 100% composited splash elements would have not worked

[left] In this wonderful over the shoulder shot, Smith assesses the damage. The camera dollys, swoops left then right, and it all matches. A flare's light burst illuminates both the Smith and miniature element, further welding the elements together. (Digital Domain)

[above] A frame of POP Film's ambitious face replacement shot.

as well. Even with the frenetic movement of the two halves of the ship splitting in half, digital stuntpeople seem to actually exist within the miniature's space.

EVERY MAN FOR HIMSELF

Freaked out passengers begin to jump off the ship, taking hundred foot falls into the freezing water, or taking longer trips down by bouncing off of railings. There are several memorable shots involving the
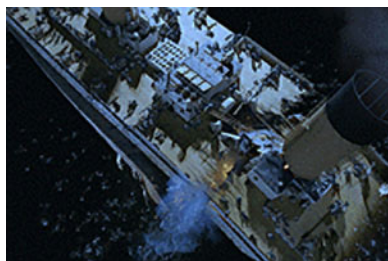

digital stuntmen—two particularly terrific DD shots are taken from water level, with the camera bouncing up and down with the water. As a poor soul jumps from hundreds of feet in the air, the camera tilts down to follow him—and to mimic real-life photography of someone falling hundreds of feet, the camera overcompensates and actually tilts down more than necessary even after the person splashes in the water, then bounces back up to water level. These shots that mimic real photographic tendencies are the best of the bunch. And I don't think anyone will ever forget the shot of the soul who jumped off the stern, only to hit a propeller and flip over and over before splashing into the water. While the man flips over and over, his clothes realistically swing around him in the stunning shot.


While the handheld shots at water level work the best, there are a couple of shots of the props rising out of the water whose compositions are too good to be true. No less than two very similar shots of the ship's propellers rising out of the water have the camera perfectly perpendicular to the back of the ship, with the three props filling the screen in symmetry. The shots, which feature rescue boats and swimming people in the foreground, are also locked down. Put these elements together, and the spontaneity of the sequence is lost. While many of the water elements dripping off the ship and streaming down the hull look very realistic and properly scaled, a few streams of goofy, strobing globs of water fall straight off the props.
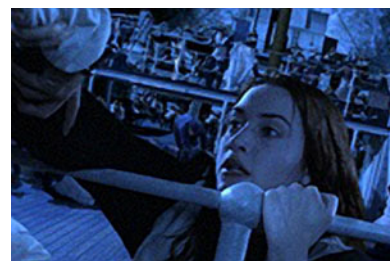
There are plenty of DD's lifeboat POV shots that are incredible, one in particular is a rack focus from the sinking ship to Bruce Ismay, sitting in a lifeboat protected from the tragedy. The best shots are those

whose camera is not locked down, giving the footage a documentary-style feel. The constant presence of swimming people and people panicking on the decks of the ship not only reminds the viewer of the scale of the situation, but also gives the shots an added dose of reality—previous maritime disaster films relegate their shots to miniatures interacting with real water elements, usually overcranked to compensate, with no human beings to be found on deck.
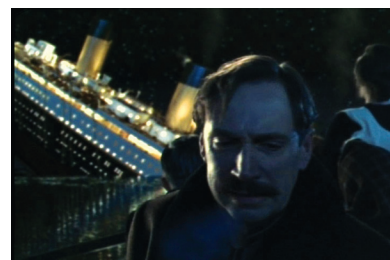
As the stern dives into the ocean, DD's digital stunts abound, countless wire removals were made, and set

[left top, center] The 1/6 scale model Titanic was shot in water at high speed to realistically integrate the ship with the sea. Computer generated passengers flee on deck. [Digital Domain, both shots]

[left bottom[One of DD's complicated propeller shots, involving miniatures, digital and practical water, and greenscreen shot foreground elements.

[right top] Rose clinging to the railiing in one of DD's set extension shots. A greenscreen was placed near the bottom of the vertical poop deck set, which was digitally removed and replaced with the ship sinking into the sea.

[right bottom] A rack focus from the sinking ship to Ismay as he turns towards the camera.

extensions and composited water elements were all used to give the scene a great deal of believability and depth.
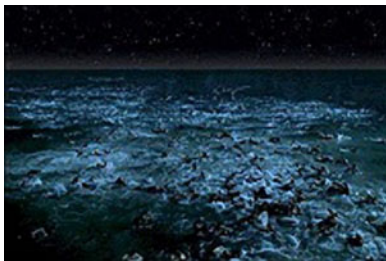
When the ship finally goes into the sea, with Jack and Rose clutching its railings, the gurgling bubbles it leaves on the surface look a little bit out of scale, even with the 1/4 scale miniature of the stern that was used for the ship's final moments. Some frightening underwater composites show the first few moments under the sea for Jack and Rose.

Once Rose reaches the surface, she looks around for Jack, calling his name, as the camera pulls back up and out to reveal hundreds of panicking swimmers. This shot is extraordinary, in that it was pieced together by POP Film using footage of a small group of swimmers and cloning them. POP Film also produced a later shot of the rescue boats panning their flashlights over countless hundreds of dead, frozen bodies in the water.

As Rose and Jack give their final goodbyes, countless starfields are composited around them, sometimes with the actors shot against greenscreen, others shot against black. The tightest, closest shots featuring VIFX's composited breath appear here, as both Jack and Rose fill the frame, their breath taking up sometimes half the frame, and still looking realistic.

RESCUE

Through a series of dissolves, we see the early morning rescue of the Carpathia, in a lovely matte shot provided by Matte World Digital, with rescue boats in the foreground, and the Carpathia and icebergs populating the background. The smoke billowing from the Carpathia and iceberg elements give the scene realistic touches, but it would have

been nice to see a little more camera movement in that shot, to lessen the appearance of the 2D elements. A quick couple of shots reveal DD's miniature Statue of Liberty, composited by Digiscope, gleaming over Rose's shoulder as she's standing in the rain on the deck of Carpathia, shots that work quite well.

The film's final image is also the film's longest effects shot, with the camera zooming through the decks of the sunken ship, then magically revealing the ship in its most beautiful state, with Rose meeting Jack one more time on the grand staircase. The DD shot is a wonder—not necessary are the countless concerns over realism for this shot, since it is part of Rose's dream anyway (or her death, or the journey of the diamond, depending on your interpretation of the film). The transition between the wreck and the finished decks is subtle, starting with the lights beaming through the windows, and then the decks and walls changing color and texture. Since the wreck model had to be altered before the camera could whip through the deck, 2D trickery was used to keep the shot moving, as it transitions to a pristine model, and finally with the live-action footage. It is an incredible ride through space and time.

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There are probably dozens of shots of the film's 600+ effects shots that will never be noticed—interior CG water, CG props, countless wire removals, rig, light, prop and character erasures, miniature interior sets, even body part erasures—all of which add to the rich visual tapestry created by director Cameron. The visual effects of *Titanic* are like no other film's; not only are they some of the finest, most original shots ever made, but they work *with* the story instead of being straightforward eye candy.

The style of *Titanic*'s visual effects will inexorably and rightfully be credited to Cameron, who has crafted his film with effects to propel his characters and to drive the narrative. He is one of a select few Hollywood directors who can not only write for visual effects, but who has the faith in the industry to create never-before seen imagery previously limited to his imagination. With Robert Zemeckis and George Lucas, Cameron is a grand storyteller whose palette always includes a healthy batch of innovative effects, and for that, moviegoers (and the industry, itself) should be thankful.

[top] The camera pulls back from a closeup of Rose to reveal hundreds of freezing, panicking people in the water in this complicated POP Film composite.

[bottom] Matte World Digtial provided the daybreak shot of the Carpathia coming to the rescue of the Titanic survivors.

for more information about Carey Villegas, visit

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