



The Avengers represents the culmination of phase one of The Marvel Cinematic Universe: a film franchise that combines superhero characters from earlier motion pictures with other figures from the Marvel comic books in an ensemble piece. Thus, *Iron Man*, *The Incredible Hulk*, *Thor*, and *Captain America: The First Avenger* combat evil side-by-side with the relatively new kids on the block, *Black Widow*, and *Hawkeye*.

From a storytelling perspective, the biggest challenge of the project was achieving an engaging and entertaining balance between such varied characters and their wildly differing superhero abilities. This challenge permeated much of the effects work, striving to visually showcase each unique character in a manner that wouldn't either dominate or adversely diminish any of the others.

The film's 2000+ shot count and relatively short post-production period also necessitated sharing the FX work associated with several of the key characters and environments/sets between multiple facilities. In particular, ILM, with supervisor Jeff White at the helm, and WETA Digital, guided by supervisor Guy Williams, shared many Iron Man and Thor duties. Accompanying them on the overall project were Digital Domain, Cantina Creative, Evil Eye Pictures, Fuel VFX, Hydraulx, Legacy FX, Luma Pictures, Scanline VFX, and Trixter. The Third Floor handled the extensive previs and postvis of the FX sequences, while production SPFX Supervisor Dan Sudick and his team generated the all of the practical and floor FX.



Digital Superheroes

High-resolution digital doubles were created early in the production for all the principal human (and Asgardian) characters, suspecting that many of the desired acrobatic leaps, impacts and any flying shots would simply not be achievable with any form of stunts or practical rigging approaches.

The 2 Iron Man suits were a combination of a practical upper 'football' suit, used for close up, helmetless dialogue, and a fully digital suit for the full body, closed-helmet flying and action shots.

Hulk would prove to be the most challenging digital creation in this film. Key to this process was casting Mark Ruffalo, an actor who the fans would accept as the Hulk's human counterpart, Bruce Banner. The trick was then to imbue digital Hulk with as many of Mark's individual quirks and

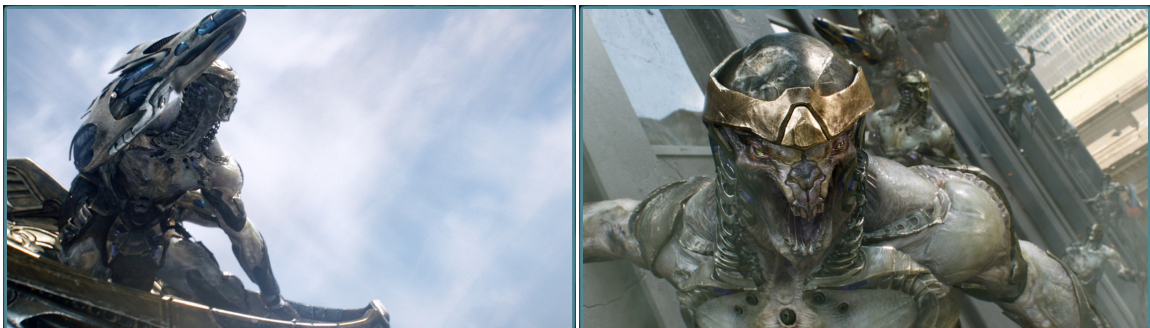
idiosyncrasies as possible, without losing track of the comic book rage monster that everybody loved. Only then would Hulk feel like a truly grounded, multi-dimensional character.

As soon as the basic Hulk design was approved during pre-production, Mark was put through all manner of texture shoots and face and body motion capture sessions to gather as much information as possible for incorporating into the finished Hulk. Similarly, it was crucial that every Hulk moment in the finished film was at least based on some of initial performance from Mark, even if combined extreme key frame animation, or other motion capture data.



Alien Invasion

The climax of the movie features the Avengers fending off an alien invasion from another dimension. Animation of the alien foot soldiers was based upon the on-set performances of stunt players in motion capture suits, which was then further refined with movement characteristics of other animals, such as birds or reptiles, to create a non-human feel.



New York, NY

Tony Stark's new skyscraper apartment, and the final climactic alien battle are set in the heart of New York, in and around Grand Central Station at the eternally busy junction of Park Ave and 42nd Street. Shooting in New York was 3 days only, and ultimately, the New York sequences were primarily created from a combination of a Cleveland location shoot, New Mexico stage work, and a huge digital environment, generated from an extensive stills shoot of the actual New York locations.

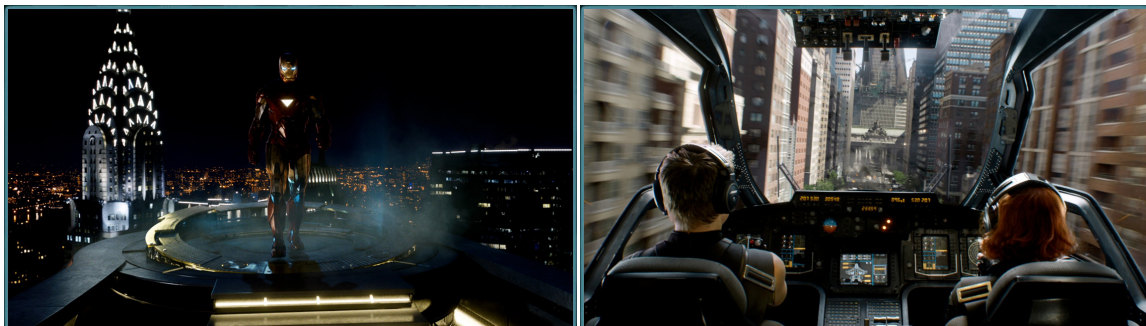
A short section of a downtown Cleveland street doubled as iconic 42nd Street, and was used to stage shots of civilians reacting to the alien invasion. Both ends were extended with digital NY architecture, practical abandoned vehicles, and additional debris/damage. On the street itself, SPFX-rigged cars and pyro were timed to explode in time with strafing runs from (digital) alien attack ships.

Above 42nd Street, The Avengers fight against invading alien foot soldiers on the elevated viaduct that connects Park Avenue to Grand Central. All of the viaduct material was filmed on a 300' long practical viaduct set, at ground level on a 360° green screen stage, and surrounded with a digital version of Park Ave, and Grand Central.

Shots depicting Iron Man and others flying between buildings relied upon a fully digital version of New York, intermixed with the occasional (higher) helicopter plate. Creating this digital environment from stills photography was the only possible solution given the inability to fly helicopters below a 500' ceiling, and the relative lack of flexibility of cable-suspended camera systems.

Stills coverage of the key locations were systematically shot over a series of several weeks using multiple camera teams, capturing architecture from various key angles, and under varying lighting conditions. Cameras were located on building rooftops, balconies, pointed out of windows, mounted on condor cranes, and just about everywhere else conceivable. After projecting captured imagery onto building geometry, these basic digital buildings and streets were then populated with all manner of digital dressing – vehicles, street furniture, debris, damage, fleeing civilians, and so on.

Stark Tower itself was realized as a fully digital construction, replacing the existing MetLife Building that stands above Grand Central, and incorporating a practical penthouse apartment set and balcony built on a blue screen stage.





Helicarrier & Quinjet

The Avengers introduces two iconic S.H.I.E.L.D. vehicles - the Helicarrier, a giant aircraft carrier, powered by a series of huge ducted fans, and the Quinjet, a formidable swing-wing jet.

All that was practically built of the Helicarrier exterior was a small section of painted runway at an Albuquerque airport, replete with two real Alpha fighter jets used as dressing. Similarly, the Quinjet was built as a practical interior set with only the exterior surface of the cockpit finished. Everything else seen in the picture had to be extended or added digitally.

