Following a competition process in early 2014, we were awarded the role of Main Contractor to deliver the UK Pavilion in Milan. Once appointed, we were invited to help select the winning design, a bee-hive inspired structure by Nottingham artist Wolfgang Buttress. Buttress’s design addressed the Expo’s theme “Feeding the Planet, Energy for Life” by drawing attention to the important role of the honey bee, the long and narrow Expo plot lending itself to the meandering narrative of his design which followed the bee’s journey through the British landscape.

The pavilion site was divided into a series of zones including a swarm wall, orchard and wild flower meadow, culminating with the dynamic Hive structure. With a relatively small and restricted construction site, a timeline of just twelve months and the Hive alone comprising 169,300 individual components; this was an extremely complex project, but one which played to our strengths and experience.
Journey to the Hive

Visitors to the Pavilion begin their journey at the ticket office, before walking through an orchard to a swarm wall where digital content is shown on over a hundred screens. They then continue through the site, walking through a raised wildflower meadow allowing an unusual bees-eye perspective of the planting as they approach the Hive structure.

The raised meadow was created by laying tonnes of topsoil on top of staging decks raised on scaffold legs. This approach reduced the total volume of material that had to be transported to site while still fulfilling the eye-level criteria so important to the visitor experience. Both the orchards and meadow used native planting in order to faithfully replicate a small piece of the British countryside in the heart of the Expo site, adding further to the authentic and immersive experience.

The paths through the meadow follow a geometric route, referencing the hexagonal cells of the Hive. Cor-ten steel was selected for the retaining walls of the paths as well as the external walls of the hospitality block, the panels gradually weathering to a beautifully rich rusty hue. A series of 2.3 metre high wooden louvres were manufactured in our wood workshops. These were stained and finished with graphics before being installed along the site perimeter, behind rows of native lavender bushes.
In the Workshop: creative manufacture

Designed as the sculptural centrepiece of the UK Pavilion, the 17 metre high Hive was fabricated from aluminium and was one of the most complex and intricate things we have ever been commissioned to create.

For us, the process of making involved over 4,500 CAD hours to develop workshop drawings before machining, finishing and packaging each component in specific batches, each item etched with its own reference number. These numbers related to specific positions within the complex warren of hexagonal cells that comprise the Hive structure, ensuring our crew could complete the on-site construction in good time.

The manufacturing processes kept our machine shop occupied for more than 16 hours a day for five months with each component being made in such a way that it could be bolted together on-site and built up layer-by-layer as a kit of parts. With such a massive number of individual components and with subtle variations between batches, project workflow was rigorously controlled.
On site: The Hive Rises

Work on site began in November 2014 with groundworks that entailed the removal of 300 tonnes of water and replacing this with 200 tonnes of aggregate. This was followed by the erection of steelwork for the hospitality block, an area providing accommodation for conferences and one-off events, control rooms and a kitchen.

The complete Hive structure weighs approximately 50 tonnes and rests on a concrete pad foundation. Eighteen steel columns of approximately 5m (CHS 139.7mm x 5mm) are bolted to this pad and support a 10.8 metre steel ring beam. The design is driven by structural performance. Whilst the aesthetic and form is critical in communicating the notion that this is a beehive, the chords and rods of the structure have each been optimised through careful parametric analysis to ensure that the Hive is not only decorative but also structurally sound and bears its own weight. This means that the sculpture is effectively a giant truss.

The Hive was assembled piece by piece, our twelve-strong team gradually building up the 169,300 individual components in 32 horizontal layers. Each layer consists of rods and cords of differing length, forming a cuboid structure with an internal spherical void nine metres in diameter. The precision of our workshops and the carefully sequenced deliveries to site paid dividends with a straightforward assembly process, the first layers being completed in January 2015 and the last, just three months later.
Inside the Void

The void allows the visitor to enter the very core of the Hive where audio and LED lighting hum and pulsate in direct response to a beehive in the UK. Entering via the terrace area, a glass floor gives visitors an unimpeded 360 degree view of the hexagonal structure that surrounds them, also providing a unique perspective from which to experience the swarm simulation.

Light sources within the Hive simulate activity captured via accelerometers located within beehives in Nottingham. To deliver this we created an entirely bespoke solution, a custom high power LED light source and control system. We designed, prototyped, refined and manufactured one thousand four-colour (RGBW) ‘pixels’ bright enough to be seen in daylight. The array of pixels defined the spherical void within the 14m cube, the lattice design making the effects visible from inside and out.

We also worked on the lighting infrastructure and control, developing the custom software that enabled each of the thousand lights to be controlled individually and/or collectively and requiring the manufacture of circuit boards, diffusers, housings and heatsinks. Using real time 3D visualisations of the many lighting effects saved a great deal of time once on site.

The UK Pavilion project drew on our engineering and construction capabilities, along with our experience of delivering large scale creative installations. Being commissioned to deliver the entire project afforded us a high level of control enabling us to deliver a beautiful yet complex pavilion, on time and on budget.