The story of Metahaven begins with a site and a vision of the future, imagining a scalable modular nanoclimate system. The ultimate vision of Metahaven at Fly Ranch embraces natural energy, community, safety and higher purpose.

Set into the earth, structurally partnering with Earth’s thermal insulative density 6 meters underground for macro resilient moderation of the Fly Ranch site’s annual extremes to carve out a niche nanoclimate capable of supporting sustainable agriculture, shelter and creative human activities. As a holistic contextual engagement, Metahaven engages all 5 key design goals of the LAGI challenge, supporting:

* + Shelter & Communal Event Space
	+ Power
	+ Water
	+ Food
	+ Zero-waste/Regeneration.

Metahaven’s comprehensive environmental program will include the following technologies:

* + Solar harvesting
	+ Radiant Heating
	+ Geopolymeric energy-storing concrete
	+ PV Glass
	+ Kinemagnetic Vibrational Harvesters
	+ Construction technology & equipment
		- Excavation
		- Rammed Earth Construction
	+ Regenerative Microecology and

nanoclimate development

By gathering radiant energy and storing and circulating it within the structure, Metahaven’s interior will have a marked moderation of Fly Ranch’s seasonal extremes, with Earth’s thermal flywheel effect providing degrees of cooling in the summer and heating in the winter.

Solar energy is harvested in several ways - PV Solar glazing panels filter the sunlight into the interior space while generating energy during sunny days,

The glazings also facilitate specially designed passive solar radiant heat collectors, consisting of playacrete panels inlaid with radiant tubing, so that water flowing through the panels absorbs thermal energy from daily sunlight, to be used in a broader radiant heating program of floor elements and wall panels. The glazings also create a zone of heated air, which can be circulated via ductwork, and contribute to the passive heating of Metahaven’s internal structural elements.

PV Glass Glazing:

Using the latest technology in amorphous silicon photovoltaic glass paneling robust photovoltaic transparent glass glazing, each alcove supports a 9sqM glazing. With approx 650 sqM. of glazing around the base of the perimeter, Metahaven could generate a monthly average of over 500kwh, and a yearly estimated average of over 6,000 kWh from PV Solar alone.

Water management:

Metahaven incorporates a comprehensive water management system, from the protection and cultivation of the existing artesian well on the preferred site, to the conservation of rainwater, to the redemption of any waste-water generated by Metahaven’s user community.

Approximately 80% of all rainwater will be harvested through diversion and drainage into a water processing system to support interior agriculture and other uses. The northeast corner tower will incorporate the existing artesian well on-site, protecting the well and providing access to fresh groundwater, to be conditioned for drinking, agriculture and hygiene.

North Tower Cistern handles the artesian well groundwater

South Tower Cistern processes grey and blackwater, reconditioning for irrigation, fertilization and radiant heating.

East Tower Cistern handles rainwater diversion and processing

West Tower Cistern handles the solar heating systems both for the radiant system and on-site hot water generation.

Metahaven is built with a combination of terraforming techniques and modular concrete elements, mixed, poured and cast on site using local materials including playa dust, water, sand and rammed-earth construction which will convert most excavated earth into durable structural elements.

Reusable and durable fiberglass-type forms, ideally hemp-based, will be used for the concrete forms in a vocabulary of basic functional shapes. MetaBones and 3 styles of Meta facets.

The Bones and facets are designed to work together with gravity for semi-permanent stability, and once cast and cured, can be laid into place to create a functional variety of modular shapes, ranging from a single freestanding alcove to Metahaven’s arrangement as a large-scale contextual artwork.

Sailshade matrix:

A layered louver arrangement of interconnected solar sail shades is suspended from a central tower and connected by proprietary kinetic harvesters which convert the constant minute vibrations between each sail caused by the constant wind into small amounts of energy.

Each unit may only generate a few milliwatts, but with thousands of connectors in the overall sail matrix, an appreciable amount of energy can be harvested and stored constantly.

The layered louver design diverts precipitation to Metahaven’s outer perimeter while allowing strong winds to flow through, in a biomimetic hybrid of bird feather and fish scale techniques.

Underneath the sail shades, a thin, light and durable screen mesh of silverplated/nylon provides filtration of dust, mosquitoes and EMF pollution.

System inputs :

Sunlight

Wind

Gravity

Water

Maintenance would involve monitoring the energy systems and utilizing the energy harvested creatively. An emphasis on new materials makes Metahaven a low-maintenance, high-benefit operational cycle. Metahaven is designed to constantly gather and store electrical energy, thermal energy and good ideas.

System outputs:

* + Electricity

The combination of solar and wind harvesting techniques and a large storage capacity means that once performed and activated, Metahaven could continually gather and store potentially megawatts of electricity up to 1 Megawatt, generally considered sufficient to provide power for hundreds of typical homes. This presents opportunities for truly alternative lifestyles off-the-grid yet technologically empowered.

* + Produce
		- One of Metahaven’s major goals In nanoclimate management is to support the cultivation of quality organic produce for community consumption. Maintaining a moderate growth environment, with protection from wind and foragers, should allow for the sustainable cultivation of food onsite.
	+ Biowaste

LNT Practice will be the general custom, and in terms of human biowaste, Metahaven seeks to develop and incorporate composting toilets and other methods of converting human waste into food for plants, in a similar manner to how plants and humans exchange oxygen and carbon dioxide in breathing.

Primary materials used;

* + Specially formulated geoploymeric concrete, formulated onsite using local materials
	+ Large scale, heavy duty reusable plexiglass/bakelite/resin forms for casting concrete panels
	+ Metal reinforcement mesh converted to structural electronic use as anode/cathode/interconnect
	+ Rammed-earth techniques including cast forms, pavers and planters
	+ Durable (preferably hemp-based) solar sail shades
	+ PV Solar Glazing Panels
	+ Radiant tubing
	+ Construction scaffolding

Major dimensions:

The outer perimeter of Metahaven is approximately 72 M per side, for roughly 5000 square meters of enclosed space, not including the egress tunnels. The Grandyard and base level is 6 Meters below grade, and while the central tower is approximately 15m (or 5 stories), because of the inset, the peak is only 6m above ground level, keeping a low profile in conjunction with the site.

A central Grandyard of 1089 Sq M is set 6 meters below ground level, and ringed with 2 levels of structural elements. The ground level includes a rammed earth retaining wall and a 3m arched tunnel around the perimeter, with raised berms extending into the space on 3m level platforms which can support planters, fruit trees and gathering/camping.

3m above ground level, a 6m wide radiant floor deck, partially cantilevered over the lower level, supports 3m of open space and 3m covered by the Metabone-supported solar glazing, with 18 alcoves on each side. Each alcove can be configured for various uses, including gardening, shelter, performance and utility.

Corner Towers:

Each corner of Metahaven’s central square incorporate a multifunctional tower, built of rammed-earth and playacrete. The corner towers provide tensional anchoring for the sail shade matrix, cisterns for water management, air ventilation and circulation and egress/access points from the tunnels leading from the grand yard to the exterior.

Egress Tunnels

The Egress Tunnels are 6M wide and rise at a gentle slope to exterior ground level via a rampway of 45 meters, 18 meters covered/underground and 27 meters to open air. The tunnels provide egress, cooling, safety, filtration and security opportunities .

Order-of-magnitude conceptual cost estimate

 Using current cost estimates for conventional concrete, glazing and materials, the order of magnitude estimate for the total realization of Metahaven ranges from $500,000 to $750,000, not including excavation.

Given the scale of the required excavation, it will probably be more effective to rent the required equipment and expertise rather than paying per cubic meter. The other major factors are construction labor, which may be offset by volunteer and partnership opportunities, and the cost of the concrete itself.

Given that most of the material may be provided onsite, rather than pre-mixed offsite, once the proper recipe is determined, it may be more efficient to rent the equipment.

Short summary of strategy for on-site prototype development:

Metahaven can begin operational materials and research experiments in short order , and the prototype pilot program seeks to compare and confirm choices in available materials, site logistics and scalable technology/research partnership opportunities. Some elements, like the sail shade matrix and kinetomagnetic generators, can be developed, field tested and optimized.

One operant hypothesis speculates that playa dust, as a geopolymeric additive, may actually be an improvement over the current usage of fly ash, potentially because of alkalinity factors for the energy storage. The concrete/playacrete experiments an be tested in a variety of locations , including on-site.

Ideally, the prototyping could include the development and production of the duraforms used to create Metahaven’s elements, perhaps in collaboration with sculptural artists and craftspersons.

Environmental Impact Summary:

Metahaven is intentioned as a semi-permanent contextual art installation, and could possibly last for hundreds of years. While the full realization of the concept does involve relatively major excavation, soil testing and water analysis, along with respect for the natural environment, will guide the ongoing experimentation.

 At least 80% of the excavated earth will be processed on-site into rammed-earth pavers, blocks and fixtures, so in a way, Metahaven may enhance the natural resonances of the site by concentrating the earth into structure.

Metahaven seeks to encompass the existing artesian spring within its interior structure, to utilize in the construction process and to provide sustenance for its community of users as part of the comprehensive water management system.

Metahaven seeks to harvest at least 80% of any precipitation to recycle within the agricultural and existential activities. The construction process will involve a period of deep excavation and soil disturbance, but once completed will provide a degree of influence over groundwater management.

Metahaven will seek to grow edible nourishment options in gardening structures built with rammed-earth into each level. Metahaven’s semi-permeable barrier and nanoclimate systems should assist in controlling the dispersion of non-native plants, which would not normally be able to propagate in these conditions.

Although Metahaven’s users may drive vehicles in and out from the 4 ramps, and use conventional equipment in varying capacities, there will be no on-site generation of industrial pollutants. Wind and solar will provide a degree of utilizable energy without any need for fossil fuel consumption.

Once built, Metahaven will continue to evolve with the site it is built from, seeking to partner, even dance with nature rather than attempt complete isolation. Metahaven seeks to accomplish positive environmental impact. Ancient concrete structures still currently in use have endured for thousands of years,

From the outside, Metahaven will blend into the open landscape, as the central tower and sail matrix only rises 9 meters above grade at its highest central point. Metahaven may resemble a fluttering mirage of a pyramid, paying respectful homage to the nearby Pyramid Lake and the local indigenous culture of the Pyramid Lake Paiutes.

The modular nature of Metahaven’s component design provides for simple work opportunities for volunteers, interns and local residents. Forms can be cast whenever conditions allow for proper curing, and there will be a constant need for rammed-earth material … ramming.

Although heavy construction equipment will be required for the initial excavation, terraforming and PV glass installation, most of the construction will involve the creation and placement of modular elements, and the structure can be built over time.

Metahaven’s modularity also allows for iterative devlopment; in lieu of the desired technology options, the structures should work with other coverings and glazings, and smaller versions can be built to refine and develop structural and systemic hypotheses.