
AFVRL

project facts page

entry number 279

category **Industrial**

project name **Alternative Fuel Vehicle Research Laboratory (AFVRL)**

location Malta, NY

site characteristics The site is located outside Albany, New York, at the foothills of the Adirondack Mountains. Part of a newly created technology campus for clean energy initiatives, AFVRL will be located on a managed forest brownfield parcel, historically used for federal ballistics testing. The immediate site is a six-acre, undisturbed dense forest with a master plan in place to create a neighborhood of like-minded business and technology agencies.

description of client State agency responsible for environmental policy and protection.

program Emissions laboratory test cells, analytical and particulate matter measurement laboratories, vehicle and engine prep and rigging, offices, and collaboration spaces.

zoning constraints The site is zoned for light-industrial and manufacturing. Zoning challenges include the noise control demands of a nearby residential neighborhood and the capabilities of AFVRL industrial mechanics.

construction systems The building will use composite steel and concrete structural systems, with a focus on sustainable design measures. The test cells have heavy inertia, vibration, durability, and acoustic control demands which are well suited to concrete construction. In the case of the remaining spaces, such as offices and analytical labs, more economical structural steel was employed.

The exterior material palette was inspired by the Adirondack heritage of local stone bases and timber veneers, and connections to the outdoors.

funding source **State funds**

schedule **Design 2007-2008** **Construction is estimated to be complete in 2011**

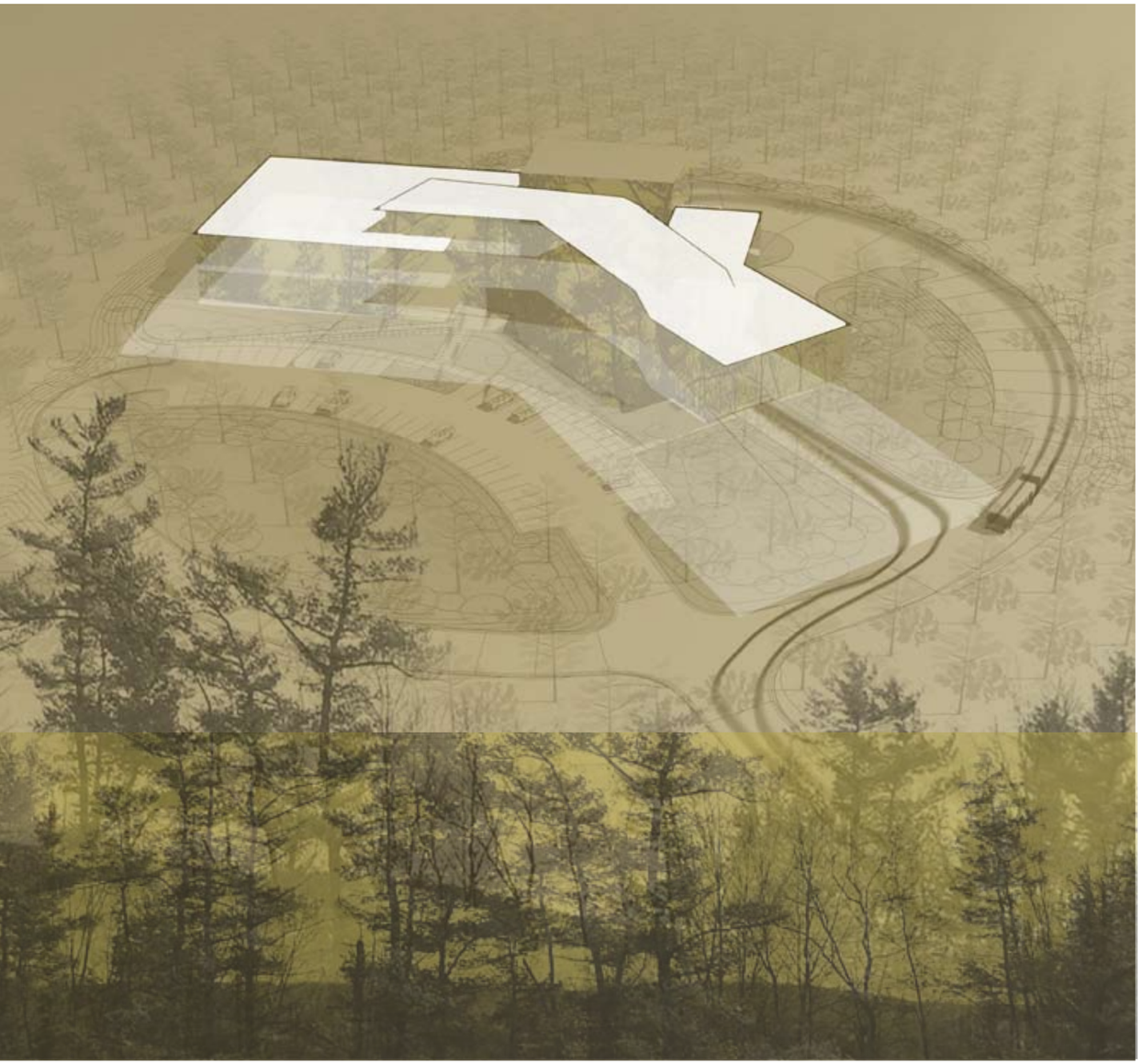
square footage **78,000 gross square feet** **projected cost** $38,000,000 (estimated)

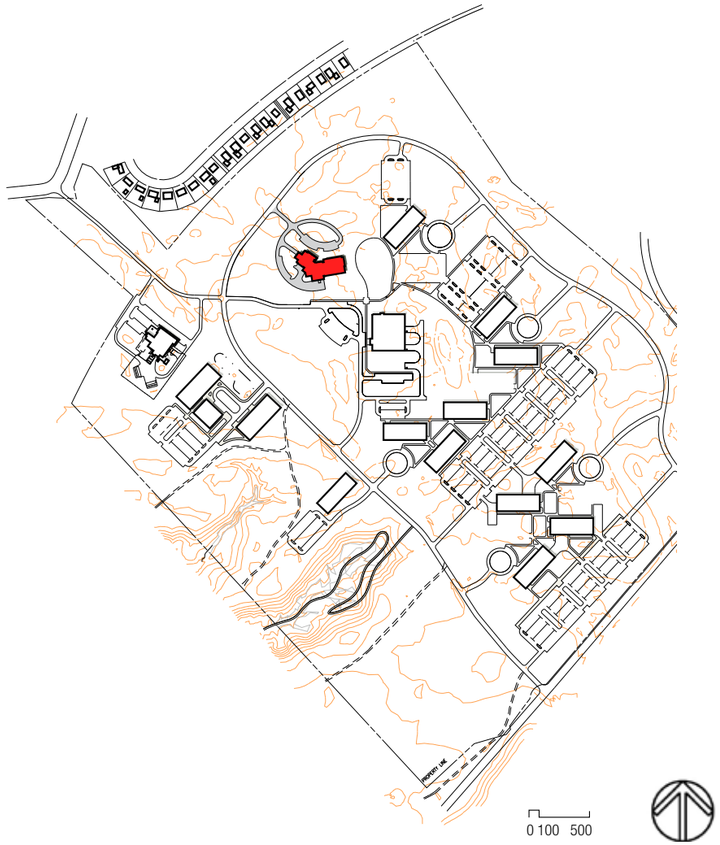
In 1885 New York State established the Forest Preserve, setting aside land in the Adirondacks and Catskills to be protected as "forever wild." For such an environmentally progressive state, this facility was a natural next step.

concept

Monitoring air for pollutants is a complex technical task, requiring not only direct measurement, but also the establishment of air quality standards and methods for quality assurance. The client primarily measures carbon monoxide, nitrogen oxides, and hydrocarbons from motor vehicles, at more than 80 sites across the state. The agency's goal is to limit vehicle emissions so they do not negatively impact public health or damage the environment.

The Alternative Fuel Vehicle Research Laboratory (AFVRL) will allow the client (a state environmental agency) to test, measure, and manage leading emissions research on a variety of combustion engines and fuel types. With this data they will establish statewide emissions regulations, guidelines, and policy. They will also conduct research collaboration with private industry and academic institutions to create, manufacture, and test new types of environmentally responsible combustion engines and fuels.





The immediate site development parti, similar to the overall building approach, was designed with New York City buses in mind – specifically their turning radius. On a more philosophical level, the site plan represents the mission of cleaner air by using the human lung as a metaphor for its overall organization.



site

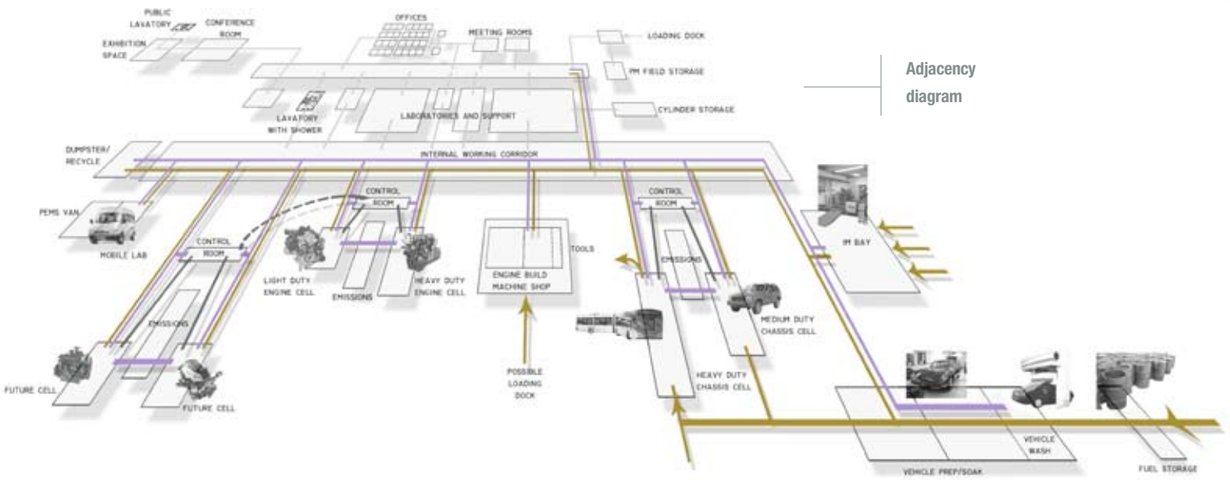
Situated between New York City and the Upstate New York Adirondack State Park, AFVRL will be located on a historical brownfield site near Malta, New York. Part of a larger 280-acre campus devoted to clean energy, energy efficiency, and environmental technological development, this site is the only state-initiated technology center of its kind. It is an ideal setting to grow the client's clean-energy and environmental technology. The individual parcel required for the test program is six acres, which is zoned for light manufacturing and industrial projects.

Historically the site, known as the Malta Test Station, had been used for innovative ballistics development and space research activities. The area also hosted various space-related and weapons testing work by federal contractors. It was environmentally remediated and subsequently covered with a managed evergreen forest in the 1970s.

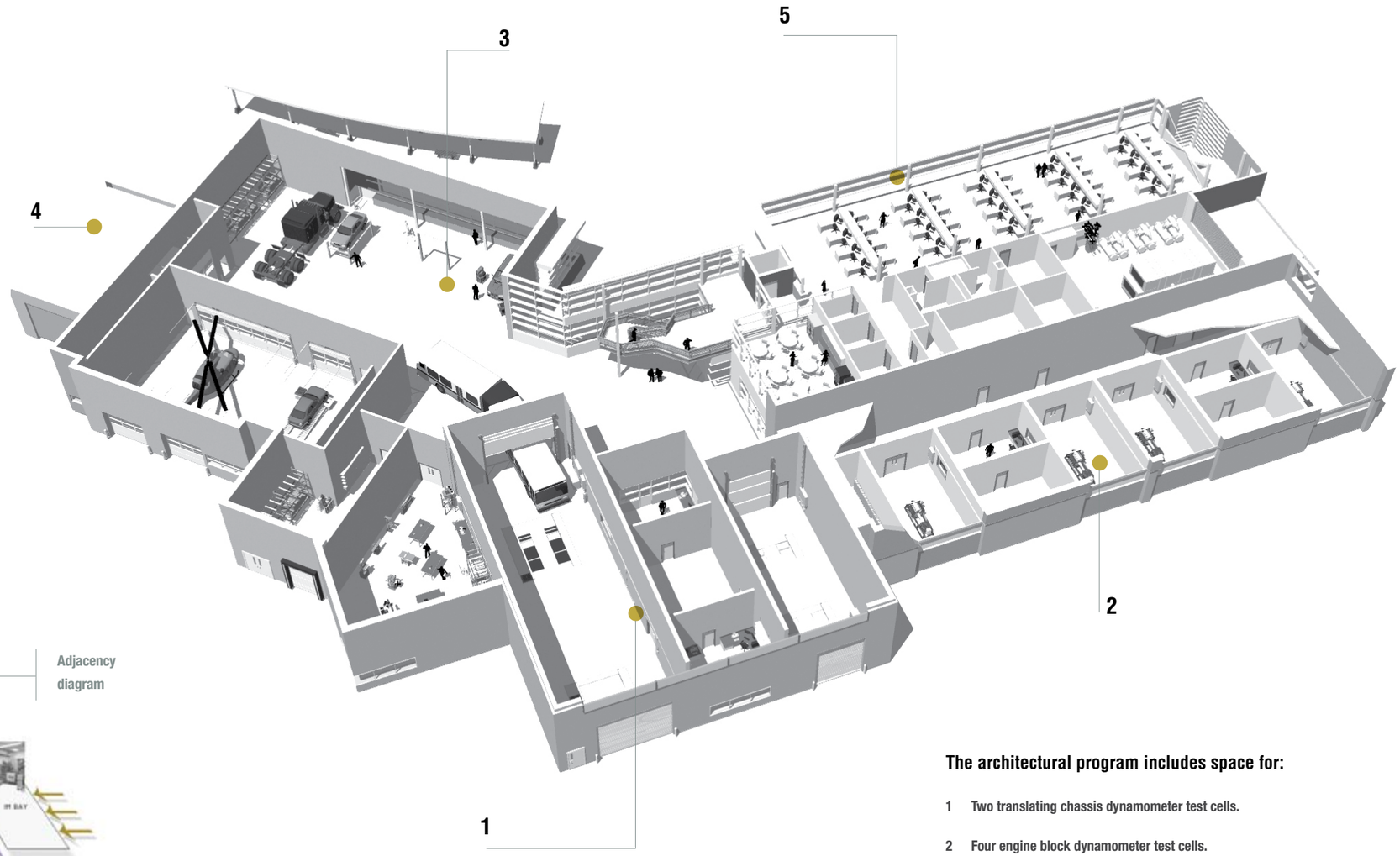
The architectural response works in the vernacular of the region — the craft and aesthetic of the Adirondack heritage is coupled with the mission of the client. This is further illustrated through a strong emphasis on environmental sustainability and the client's desire for a high-tech, yet modest building that complemented the surrounding forest.

program

The project is a 78,000-square-foot, state-of-the-art engine emissions testing facility. It provides an industrial research setting for state, federal, private, and academic teams to work together to measure, model, and manage combustion engine exhaust pollutants - working toward best practice emissions and policy. In order to conduct this diverse, leading edge research, this facility will house chassis dynamometers and engine test cells.



Adjacency diagram



The architectural program includes space for:

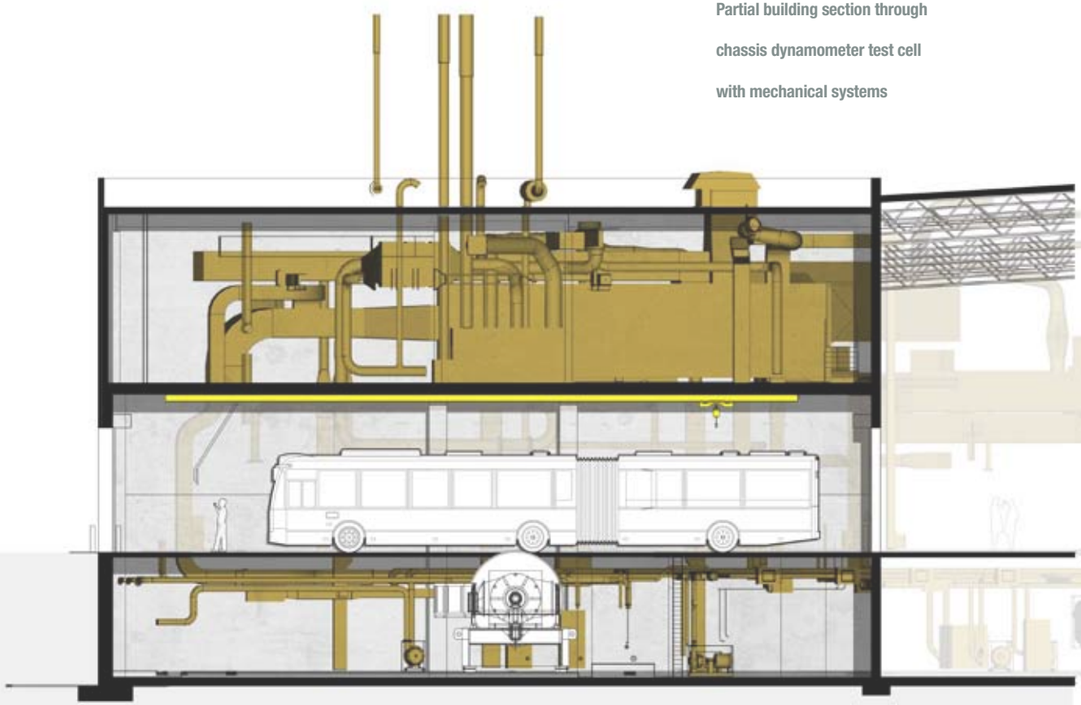
1 Two translating chassis dynamometer test cells.

2 Four engine block dynamometer test cells.

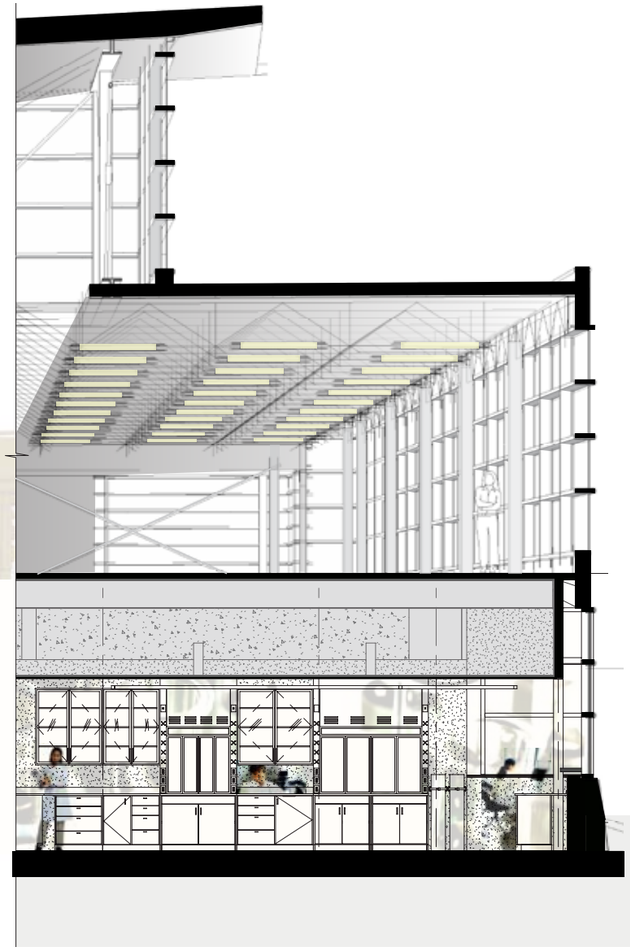
3 High-bay vehicle preparation and cleaning bays.

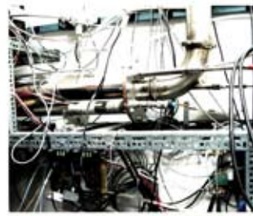
4 Fuel storage

5 Analytical and chemistry labs, including a particulate matter cleanroom lab.



Partial building section through chassis dynamometer test cell with mechanical systems



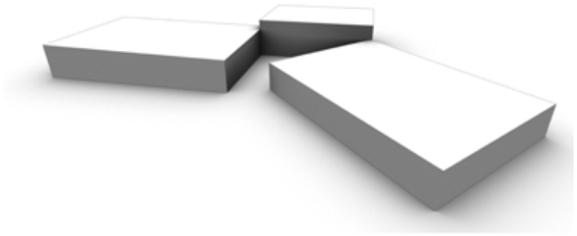


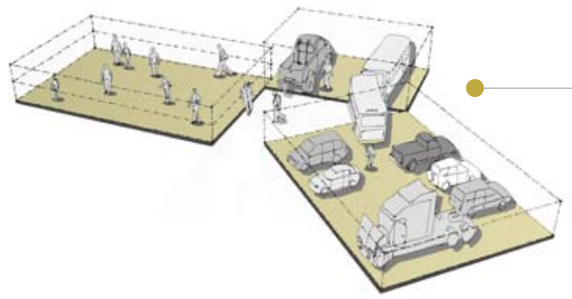
Digital and mechanical interfaces of emissions testing equipment

program

One of the main programmatic challenges was to accommodate the movement of large vehicles through the interior of the building. This included driving, prepping, and testing a 65-foot long, articulated New York City Metro bus through a vehicle soak area, into the large chassis dynamometer test cell, and out of the building on one continuous path.

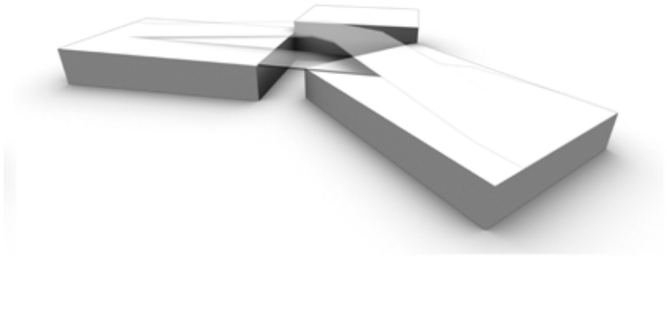
The test cells are coupled with data acquisition and monitoring stations. They are also linked to analytical laboratories that study fuels and particulates contained in energy and exhaust streams. Open offices, collaboration areas, and accommodations for public touring are juxtaposed with these test cell environments within this very industrial facility.

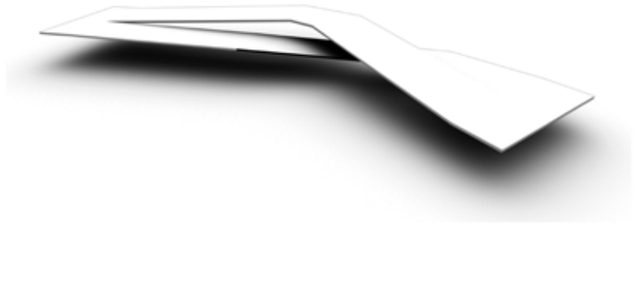


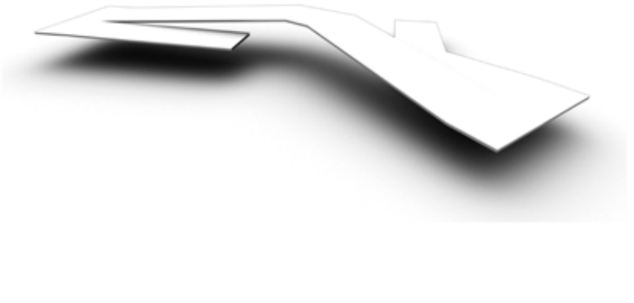


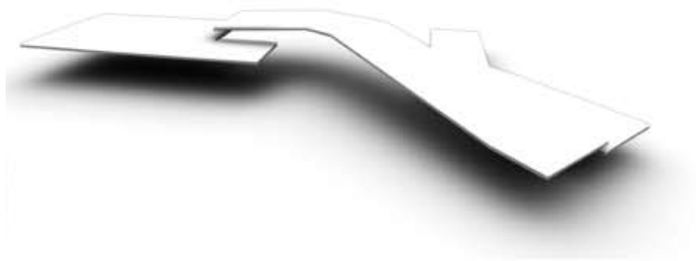
Concept illustrations of major program elements with architectural narrative of roof form evolution

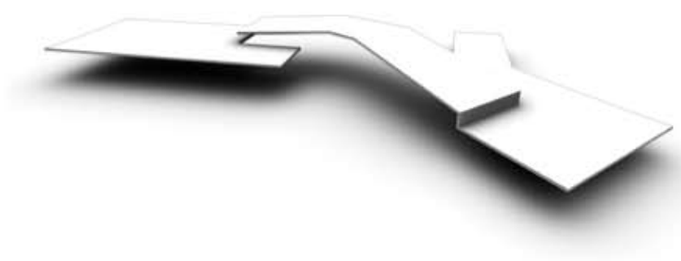
design solution

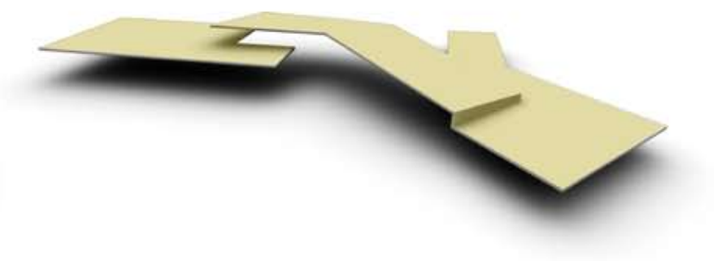








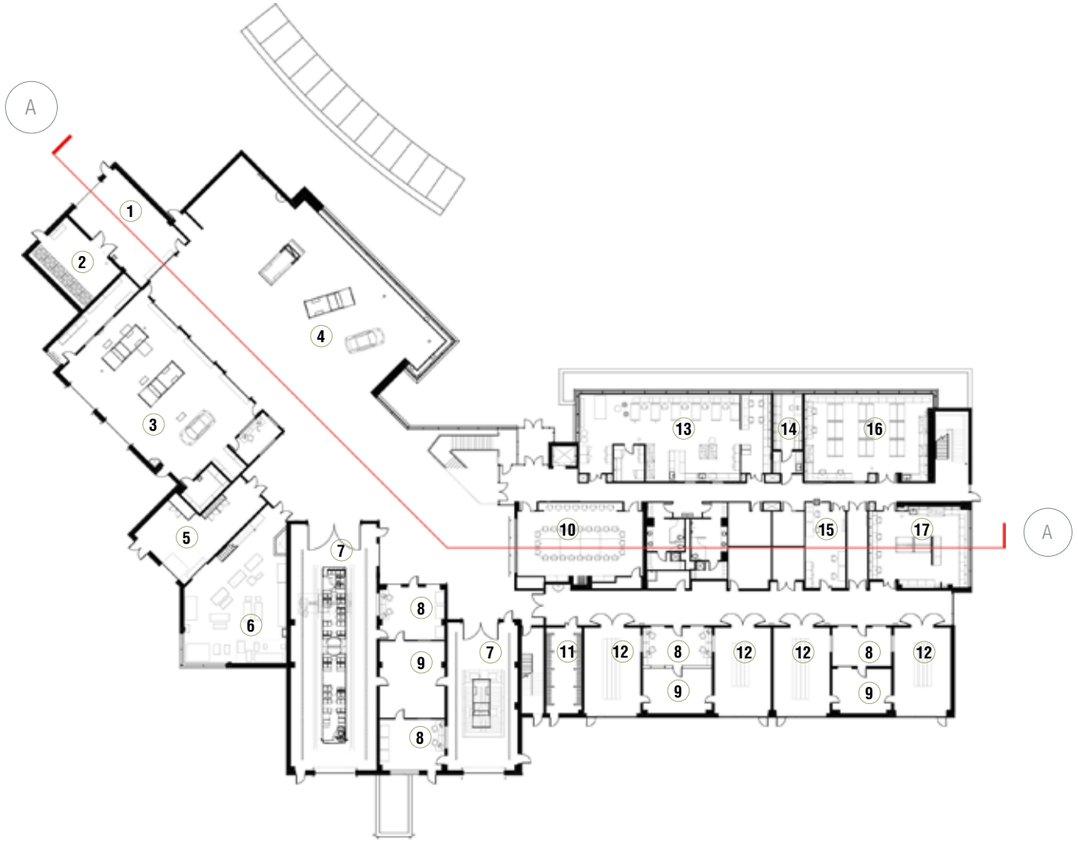




AFVRL supports rigorous industrial research through a sequence of highly specialized spaces. Physically, the building concept started with a circuitous interior path, or roadway, that enables fluid vehicular movement. Mechanical systems, including a geothermal heat exchange, close energy loops within the building and site. Scientists utilize a continuum of spaces in the lab, open office, test cells, and collaboration zones.

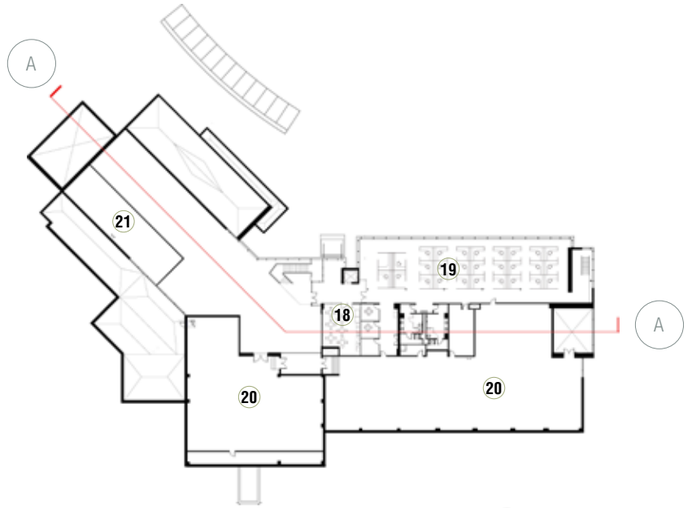
The design concept was inspired by the Mobius strip, a mathematical model used to explain a variety of phenomena germane to science conducted at this facility. The single closed-loop system helps weave together the three major programmatic components with disparate requirements - the lab/offices, engine test cells, and vehicle prep components. Programmatic functions with similar technical and scalar demands were grouped together to create a safe and collaborative pathway for researchers. Ultimately, the roof connects these programs in an architecturally cohesive response.

design solution



First Floor Plan

0 10 40



Second Floor Plan

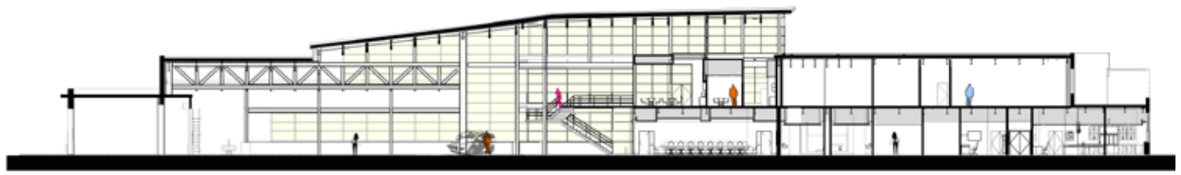
0 10 40

First Floor

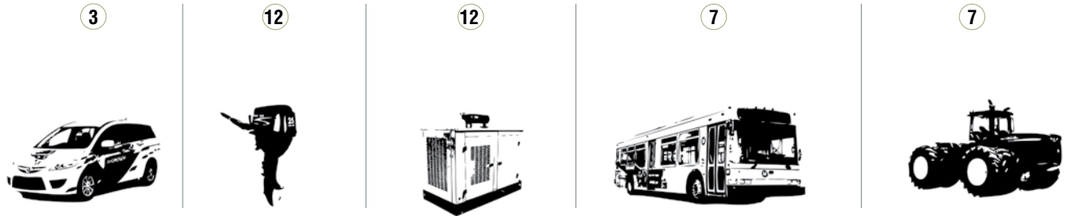
1 Vehicle Wash Bay
2 Fuel Storage
3 Diagnostics Testing Lab
4 Vehicle Prep/Soak Bay
5 Loading Dock
6 Machine Shop/Engine Rigging
7 Chassis Dynamometer Test Cell
8 Control Rooms
9 Data Acquisition
10 Conference Room
11 Gas Cylinder Storage
12 Engine Dynamometer Test Cell
13 Chemical Analysis Lab
14 Class 10,000 Clean Room
15 Electrical Lab
16 Particulate Matter Lab
17 Mobile Particulate Lab

Second Floor

18 Break Room
19 Open Office
20 Mechanical
21 Mezzanine



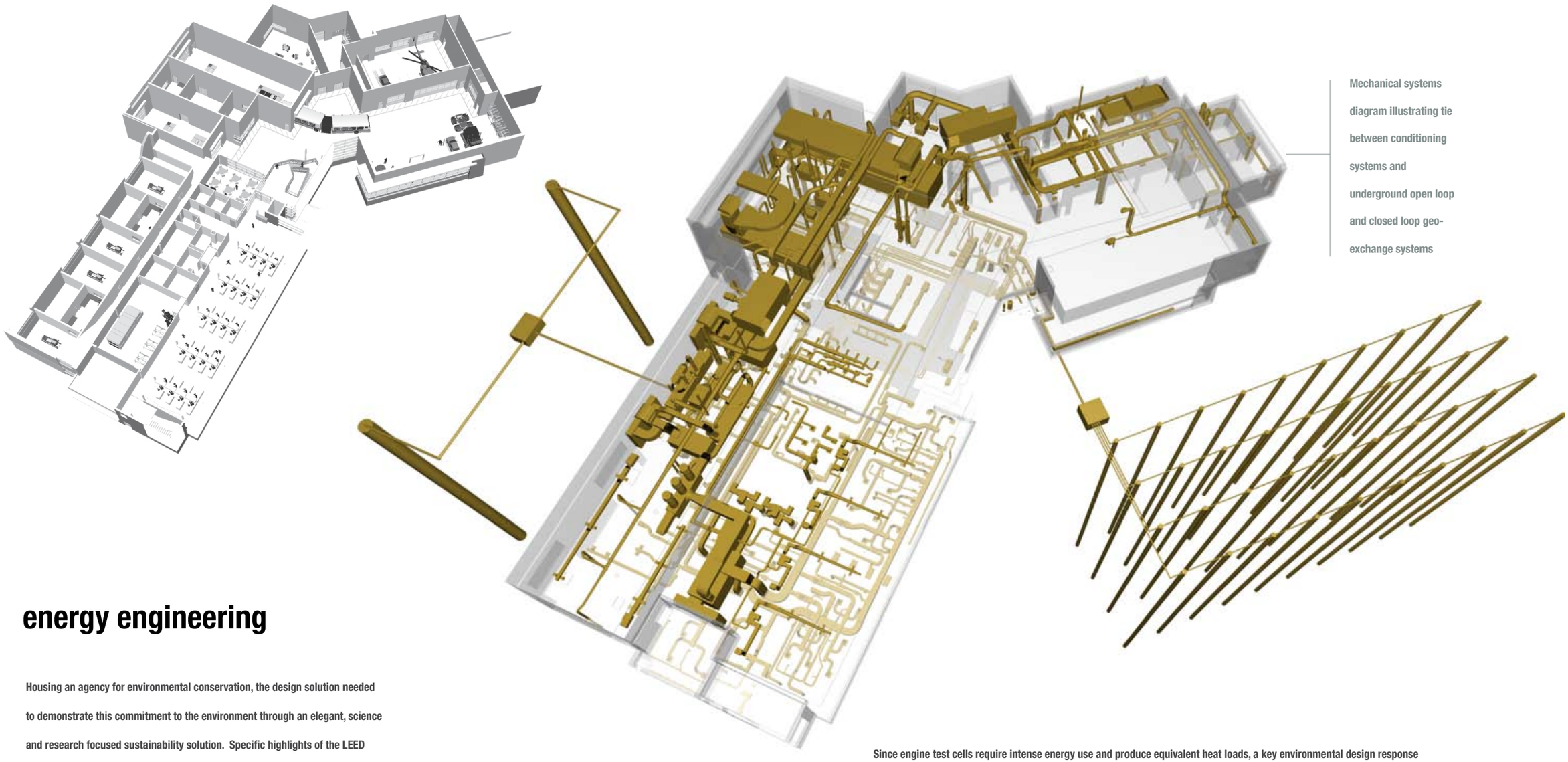
Section A - A



A second design response emphasized the environmentally responsible, human side of the work conducted within this decidedly industrial facility. This is evident in the building's pedestrian approach façade, which has a strong, transparent connection to the outdoors. It also visually demonstrates the roof motif, veils the heavy industrial components of the program, and showcases the on-site renewable features that are central to the client's commitment to the environment. Materials like local granite, wood, and site timbers also reinforce this aesthetic on the exterior.

design solution

Conceptual rendering of building within site and program context



Mechanical systems diagram illustrating tie between conditioning systems and underground open loop and closed loop geo-exchange systems

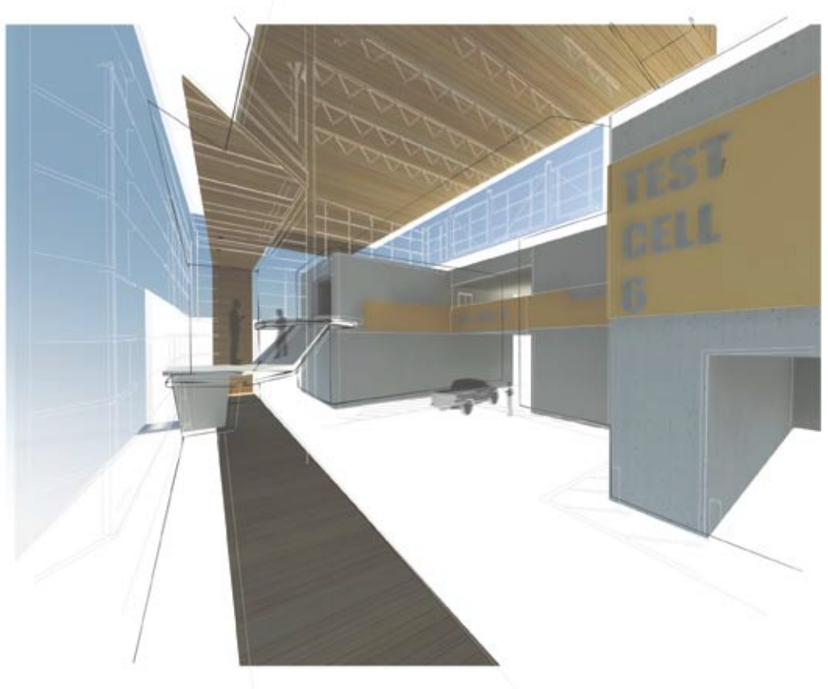
energy engineering

Housing an agency for environmental conservation, the design solution needed to demonstrate this commitment to the environment through an elegant, science and research focused sustainability solution. Specific highlights of the LEED Gold certified design include innovative technologies such as electrical power regeneration from process testing, and earth source geo-exchange heating and cooling of core building loads. Photovoltaic cells will be incorporated to enhance electrical usage and fuel cells for back-up power regeneration.

Since engine test cells require intense energy use and produce equivalent heat loads, a key environmental design response to AFVRL became a closed and open loop geo-exchange system coupled with technology enhancements to the basic vapor compression cycles of the test cells themselves.

This technology increases the efficiency of the basic Carnot cycle and accomplishes energy recovery in a cost-effective manner without compromising reliable, repeatable (and therefore publishable), emissions research data.

The structural system was chosen based on the needs of the space and the demands of flexible research. Massive trusses clearspan the prep/soak area accommodating vehicle travel and allowing maximum flexibility in spaces below. These exposed structural systems reflect the dynamic building form and express the industrial and earnest nature of the project while minimizing material usage.

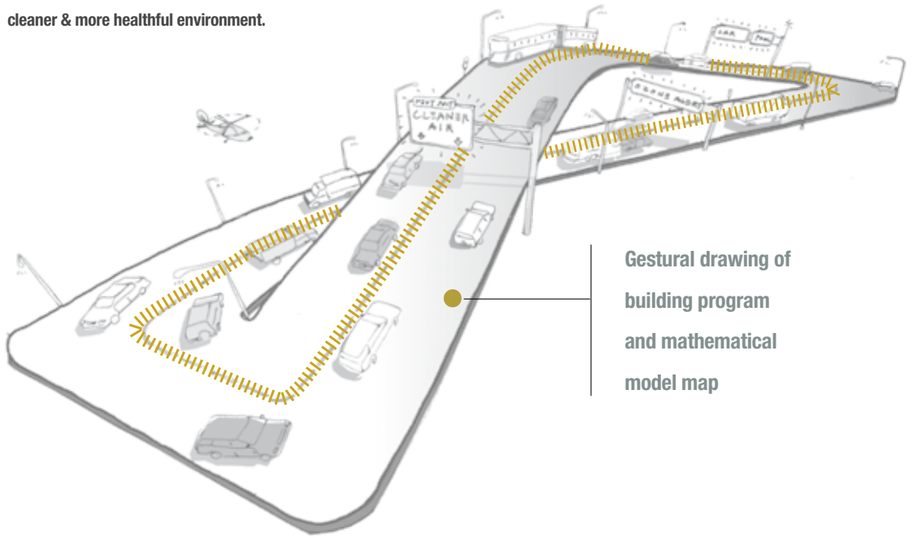


Initial concept diagram of building interior

Interior of main atrium where program and people come together in a safe and collaborative setting

Concept rendering of exterior entry façade

AFVRL creates public awareness of carbon usage amongst vehicle users ... working toward a cleaner & more healthful environment.



Gestural drawing of building program and mathematical model map