UNIVERSITY of HOUSTON

GERALD D. HINES COLLEGE of ARCHITECTURE

UH GBC

University of Houston
Gerald D. Hines College of Architecture
Green Building Components

The University of Houston Green Building Components Initiative
The mission of the Green Building Components Initiative in the Gerald D. Hines College of Architecture is to design, develop, and implement green building components and systems across the Architecture, Engineering, and Construction (AEC) Industries, and to increase the presence of sustainable technology in the built environment.

The University of Houston's Gerald D. Hines College of Architecture
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GOOD DESIGN

GREEN GOOD DESIGN AWARD

2010

UNIVERSITY OF HOUSTON GREEN BUILDING COMPONENTS

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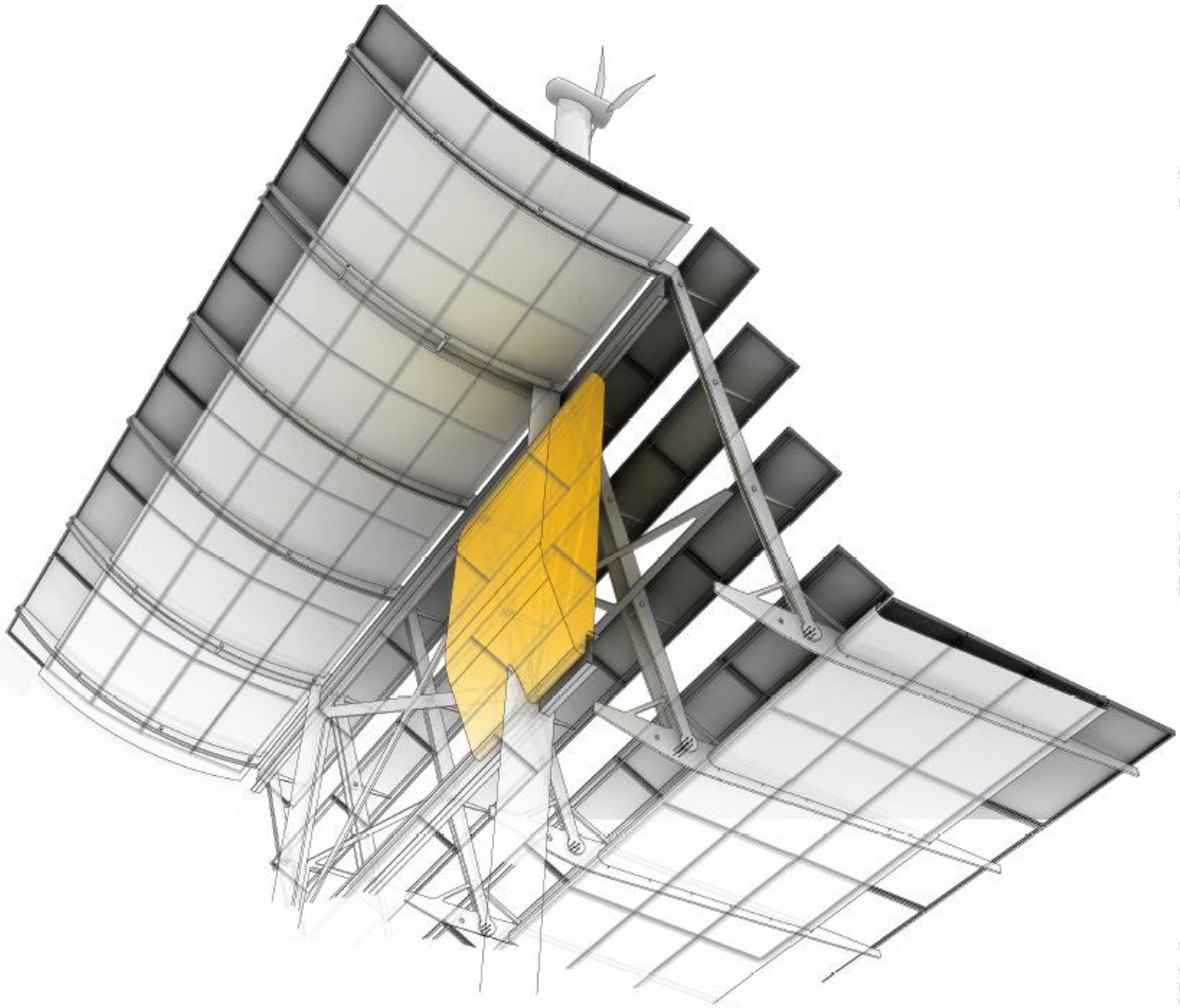
PowerLots

SCHEME ONE

PowerPack



PRINCIPAL INVESTIGATORS:

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ASSOCIATE PROFESSOR
FOURTH YEAR DESIGN COORDINATOR
RESEARCH ASSISTANT PROFESSOR

DUKE FLESHMAN
ADJUNCT ASSISTANT PROFESSOR
RESEARCH ASSISTANT PROFESSOR

CO - INVESTIGATOR:

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LECTURER
RESEARCH ASSISTANT PROFESSOR

GERALD D. HINES
COLLEGE OF ARCHITECTURE
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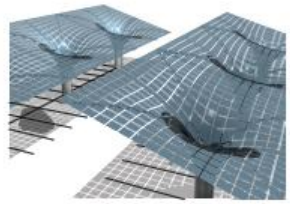
MATT LUEBE
AVADEK

LANCE BENNETT
COOPER LIGHTING

SCHEME ONE

PowerPack - Sun Wind Water



SCHEME TWO

The Integrated Solar Membrane Structure developed out of an interest in the inherent flexibility of thin-film photovoltaics and ETFE. By laminating the solar film between two layers of ETFE, an integrated flexible membrane is developed which simultaneously generates power, shades parking, captures rainwater and reduces structural loads.

SCHEME THREE

With its single column structure, the Solar Wing adapts to any parking lot configuration and solar orientation. The research investigates the minimum structure necessary to support PV panels as well as the design of connections to facilitate ease of shipping and assembly in disaster zones where the power infrastructure has been damaged.

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PowerLots

SCHEME ONE

PowerPack

POTENTIAL REVENUE - PowerLots Prototype

Additional Income from Preferred Covered Parking Spaces
18 Spaces @ + $30. / month — $ 540.00 / month

Income from Generation of Electricity
34,000 kWh @ $ 0.06 / kWh — $ 170.00 / month

Plug - In Charging Income

Rainwater Harvesting Savings for Irrigation
(currently UH System purchases 30,000,000 gallons of water / year from municipal utilities)

CORPORATE SPONSORS - PowerLots Prototype

AVADEK

ALTERNATIVE POWER SOLUTIONS

COOPER LIGHTING

SOLAR PARKING LOT PRECEDENTS

DELL COMPUTER - ROUND ROCK, TEXAS
56 parking spaces

STOCKTON COLLEGE - POMONA, NEW JERSEY
480 parking spaces

EAST LOS ANGELES COMMUNITY COLLEGE
530 parking spaces

HARBOR COLLEGE - LOS ANGELES, CALIFORNIA
1,040 parking spaces

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PowerLots

SCHEME ONE

PowerPack

PowerLots prototypes have explored the re-purposing of parking lots through the addition of renewable power generating infrastructure systems facilitating greater functionality from under utilized land. The PowerLots PowerPack prototype incorporates solar and small wind power generation with water harvesting in a single structural system. The structure provides covered parking, LED lighting and plug-in electric vehicle charging stations.

This prototype will be constructed in the parking lot adjacent to the Gerald D. Hines College of Architecture and has the potential to generate over 38,000 kWh per year, enough to power four 1,500 square foot houses.

The PowerLots team will include industry partners providing sponsorships for the construction of the POWERpack prototype and will collaborate with the University of Houston College of Technology for energy performance monitoring.

In addition to PowerPack, the PowerLots research has investigated additional options including scalable prototypes appropriate for diverse locations and disaster relief power generation and a prototype exploring the future potential of thin film applications.

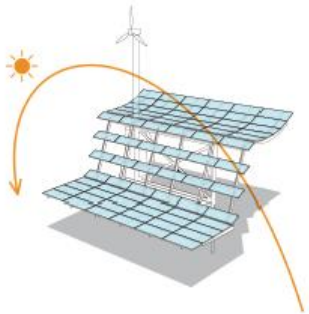
PowerLots POWERpack prototype Design Development is funded by UH RESEARCH

PowerLots POWERpack prototype will be developed in collaboration with

SMART GRID ENERGY TRAINING COALITION / COLLEGE OF TECHNOLOGY

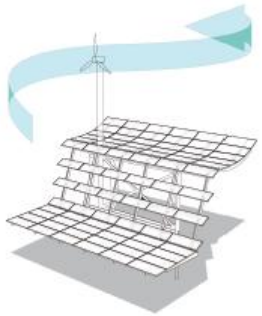
VIEW OF ELEVATED CISTERNS AND WATER CATCHMENT PANS

VIEW OF SOLAR PANELS AND WIND TURBINES



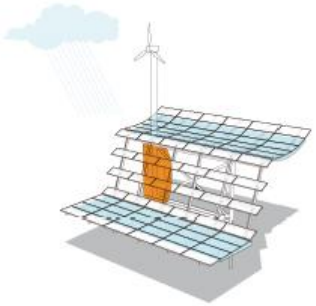
SOLAR

Solar panels provide the majority of the power generated by the PowerPack. Multiple orientations of the solar panels to the sun optimize the power generating performance by privileging angles which more efficiently capture light generated in the summer months.



WIND

The addition of the wind turbine option to the PowerPack reduces overall cost per kilowatt hour due to the economy of a single structural system utilized to support both solar and wind power generation. As wind speeds are typically stronger in the evening, the wind turbines generate power for the LED lighting system.



WATER HARVESTING

Large volume of runoff water from parking lots is often contaminated by road salt and automobiles and usually runs to streams untreated. The water harvesting option incorporated into the PowerPack allows for uncontaminated rainwater to be transported or linked to irrigation systems providing enhanced irrigation options. The University of Houston system currently purchases 30 million gallons of water annually for irrigation purposes.

Sun-Stop
Solar Service Stations

Charging at the Speed of Light

Kevin Conlin, CEO
Patrick Peters, UH College of Architecture

Designed Beyond Charging Electric Vehicles

- ✓ Renewable Power Generation…*at the point of use*
- ✓ Micro-grid Design…*strengthens distributed grid*
- ✓ ESCO Business Model….*minimal cost to host facility*
- ✓ Emergency Services…*unavailable elsewhere*
- ✓ Vending Convenience…*attracts new customers*
- ✓ Uninterruptable Power…*long term for critical load*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SUNSTOP
CHARGING AT THE SPEED OF LIGHT
Personal Electronics Charging Station
Today's Lesson
blink
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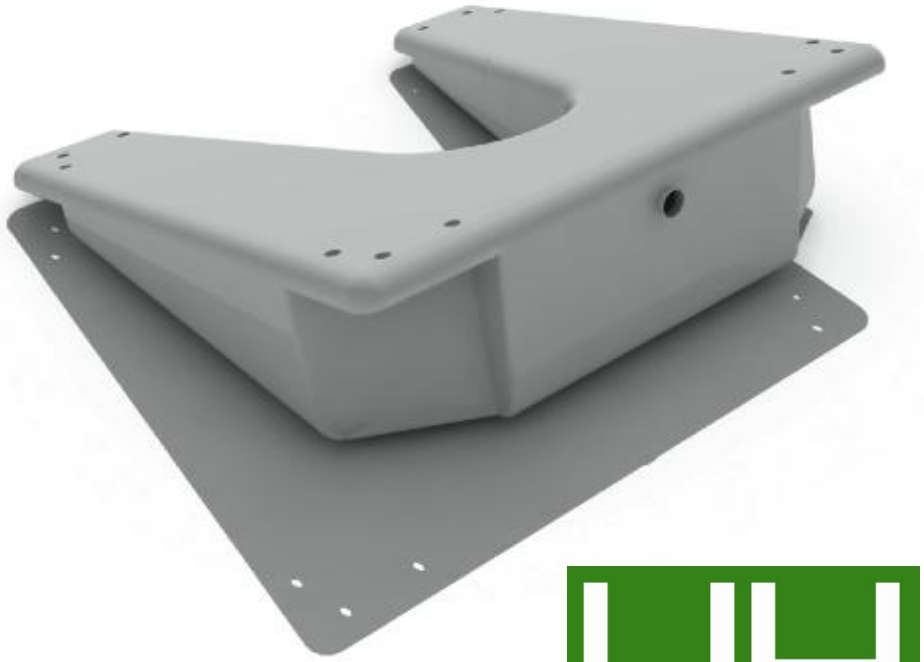
SUNSTOP
CHARGING AT THE SPEED OF LIGHT
blink

PV-POD



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STANDARD℠
Renewable Energy

[METALAB DIGITAL DESIGN + FABRICATION]

TREMCO

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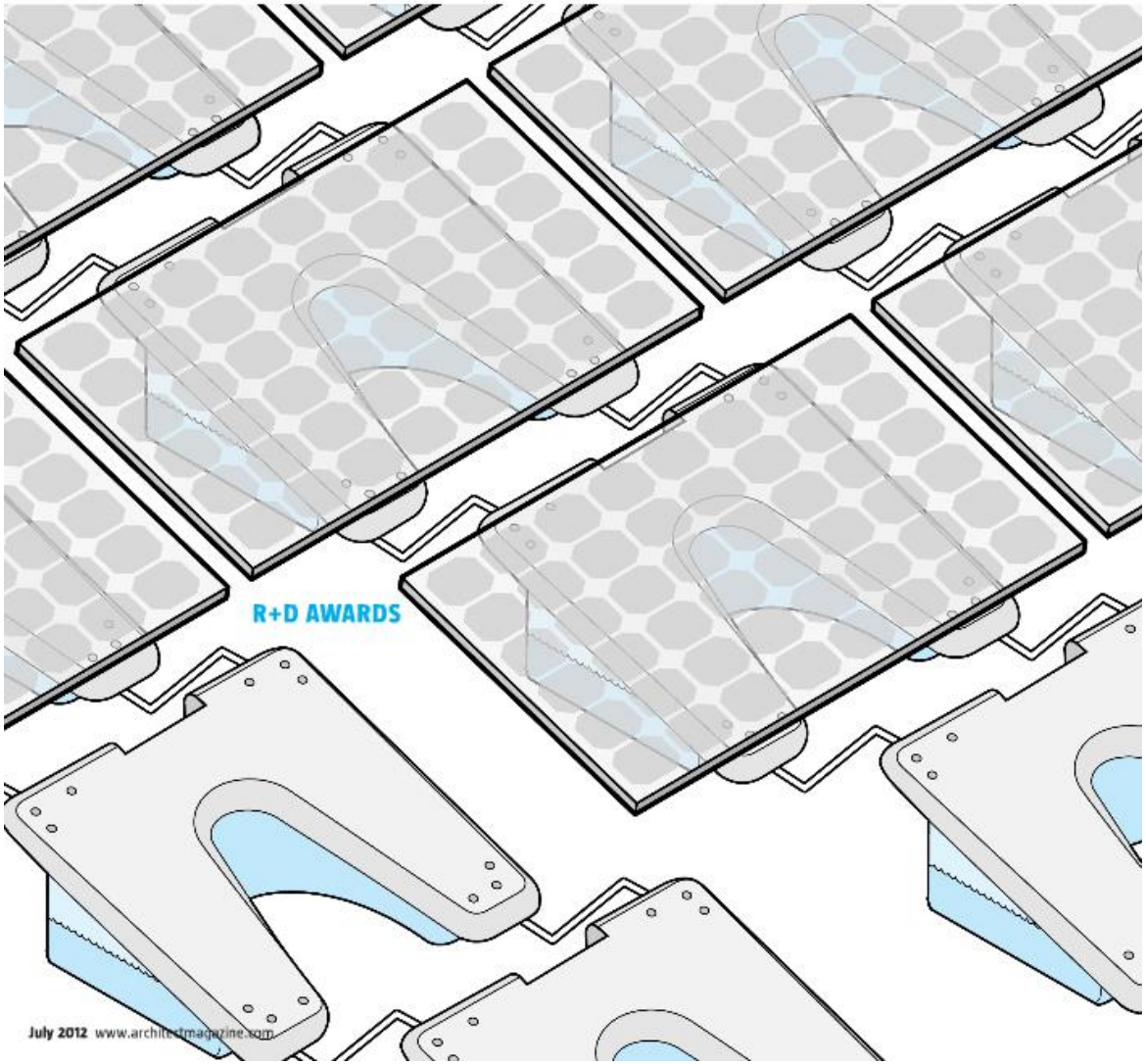
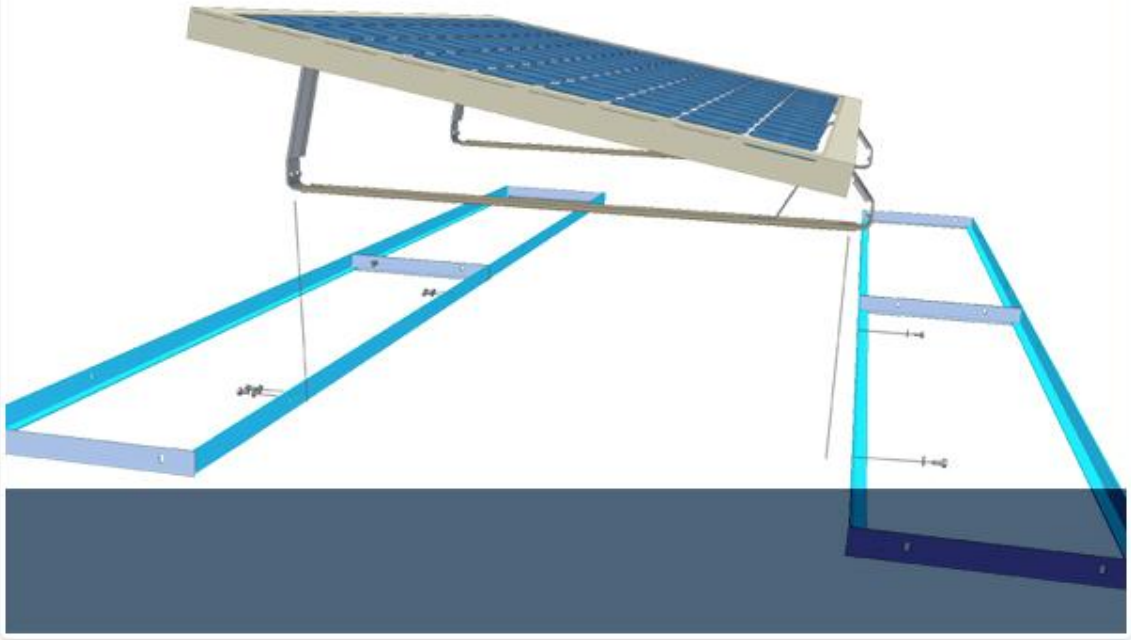
ARCHITECT

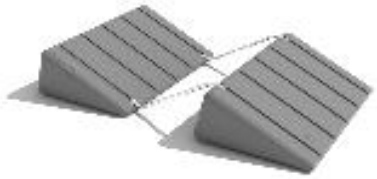
THE MAGAZINE OF THE AMERICAN INSTITUTE OF ARCHITECTS

hanley wood



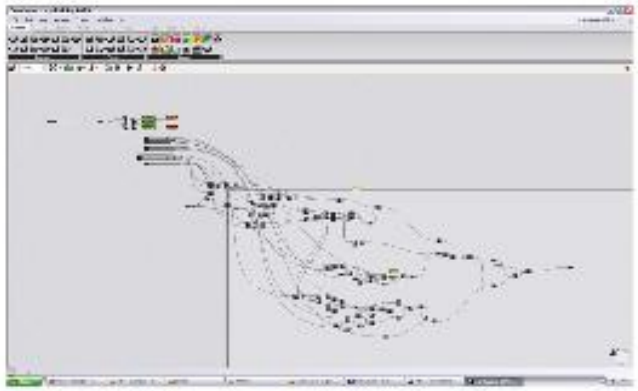
RapidRac G10



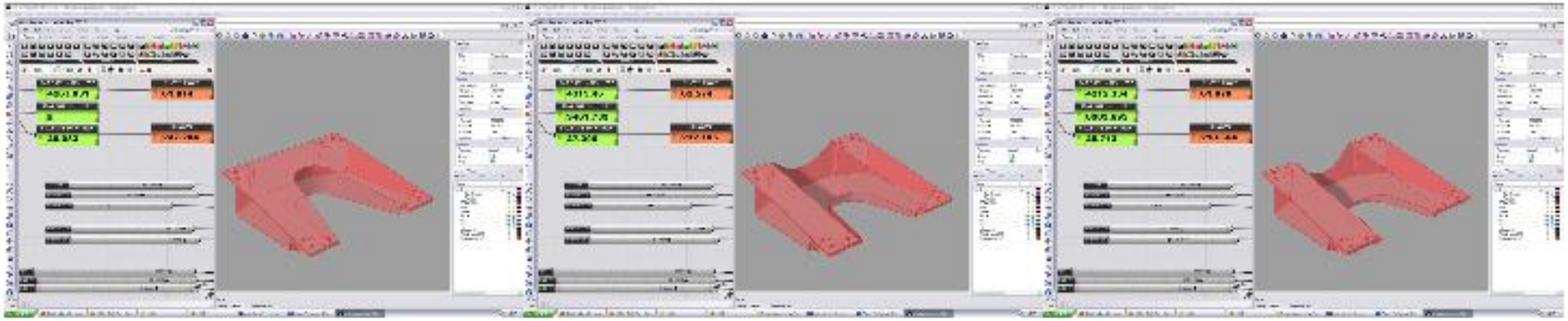


Design Parameters

Optimizing form through the use of parametric software, grasshopper, the size requirements of 3 major market panels were accomodated for direct attachment to the face of the pod, while simultaneously reducing surface area and cost, and providing more structural integrity and ergonomics to the pod through the indented U shape.



Evolution




SPACE
SOLAR POWERED ADAPTIVE CONTAINER FOR EVERYONE

SPACE

SOLAR POWERED ADAPTIVE CONTAINER FOR EVERYONE

The SPACE is a solar generator capable of producing up to 7 kW utilizing an international shipping container that can fold up for transport or severe weather. The SPACE is capable of rapid deployment as a first response center, emergency relief field office, remote check-point, park rangers station, public storefront, and as a disaster relief center. The proprietary solar panel rack system can deploy in less than 30 minutes.

Mirabeau B Sales Center - Prototype 2008

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University of Houston, College of Architecture - SPACE Beta 2010

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Waltrip High School- SPACE City of Houston Mobile Solar Generators 2012

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Introduction:

Employing patent-pending design and material innovation, SPACE is a sustainable field office and mobile solar generator made up of four major components:

- An up-cycled 20 ft. x 8 ft. shipping container housing a climate controlled work / storage space
- A proprietary solar rack capable of producing up to 7.5 kW of solar power
- A self-contained battery end-cap with up to 5 days of battery backup
- An advanced renewable energy power management system. Fully integrated, SPACE units are capable of accommodating job site activities, special events, and emergency response operations.

SPACE Specifications:

- PV System Size: 3.5 kW minimum, up to 7.5 kW maximum (16-30 Sharp 250 W Panels)
- Battery Capacity: Up to 5 Days Battery Backup Using Sealed AGM Batteries.
- Additional Solar / Battery Equipment: Outback Inverter with On and Off Grid Mode, Dual Charge Controllers.
- Interior SPACE Features: High Efficiency Mini-Split HVAC, CFL and/or LED Lighting, and multiple Interior and Exterior Power Outlets (Cabinetry, Millwork, and Other Options Available)
- Interior Square Footage: 140 sq. ft.
- Total SPACE Ground Footprint: 20'-0" x 8'-0"
- Total SPACE Dimensions with Panels Open: 28'-0" in length x 17'-9" in width x 13'-8" in height
- Total SPACE Dimensions with Panels Folded: 28'-0" in length x 8'-0" in width x 11'-3" in height
- Total SPACE Weight: 13,000 lbs.

Warranties:

All manufacturers' warranties will be provided for equipment supplied in SPACE units. SPACE will provide a one-year warranty for the finished product.

Typical Useful Life of significant Components:

- PV Panels: 25-30 Years
- Solar Batteries: 10 Years
- Solar Inverter: 15+ Years
- Charge Controller: 15+ Years
- Backup Battery Generator: 5-10 Years
- HVAC/ Interior Lighting: 15+ Years
- Container/ End-cap/ Solar Rack: 30 Years

Security Measures:

While traditional temporary offices and generators are designed to be highly mobile, they often lack security measures required for public applications. SPACE is secure due to the steel container construction and engineered components that protect valuable equipment from theft and operational damage.

Container/ End-cap:

By closing the padlocked shipping container doors on each end of the SPACE, all interior equipment is protected and secured. The container's strength also protects against wind and weather damage in severe conditions. Unlike many typical field offices and generators, SPACE can remain in the field during a storm and eliminate the need for office / generator transportation through obstructed roads and high water. SPACE is engineered and rated to 110 mph+ wind loads with panels closed and secured.

Solar Rack:

While the proprietary solar rack maximizes solar surface area, it also secures and protects panels from environmental and human related damage. Secured to the roof of the SPACE container, the solar rack sits high off the ground and limits pedestrian access to panels and wiring. Security fasteners attach panels in sets of two to an aluminum frame that is fixed to an integrally welded axle assembly.

All wiring is sheathed and contained within the rack and no electrical disassembly is required for deployment. For storm protection, the solar rack is engineered and wind rated to 110 MPH wind loads with panels folded.

Visability:

Employing cutting edge proprietary design, efficient digital fabrication, and material reuse, SPACE is a practical and educational mix of function, aesthetics, and technology. Not only a mobile solar generator, SPACE provides a climate controlled work and storage environment that can accommodate job site functions, special events, and emergency applications. Due to the design's high visibility, SPACE promotes renewable energy and commitment to sustainability.

Production Capacity:

- SPACE units are able to be produced in up to 20 units at a time in a period of approximately four months.
- Our partner facility, CAMPO Sheet Metal Works, INC is able to produce up to 50 units a year.
- CAMPO Sheet Metal Works, Inc.
  www.camposheetmetal.com
  8550 Telephone Rd., Houston, TX 77061
  832-325-6300

WELCOME TO CAMPO Sheet Metal WORKS INC.

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SPACE has sold 18 units in 2012, our first year of operation, to the following:

- 1 unit to the Ministry of Technology in Lagos, Nigeria
- 1 unit (rental, via Weston Solutions) to the U.S. Army in Yuma, Arizona.
- 17 units to the City of Houston- Mobile Solar Generators for Hurricane Response and Emergency Relief.
    - 2 mobile units on custom designed trailers
    - 4 units at City of Houston Fire Stations
    - 2 units at City of Houston Parks
    - 4 units at H.I.S.D. Schools
    - 5 units at Neighborhood Centers locations

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SOLAR POWERED PEDESTRIAN PATHWAY LIGHTING

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PHILIPS

HADCO

AMERESCO
Green • Clean • Sustainable

ccrd

SOLAR POWERED PEDESTRIAN PATHWAY LIGHTING

Off-Grid / Stand Alone Photovoltaic System

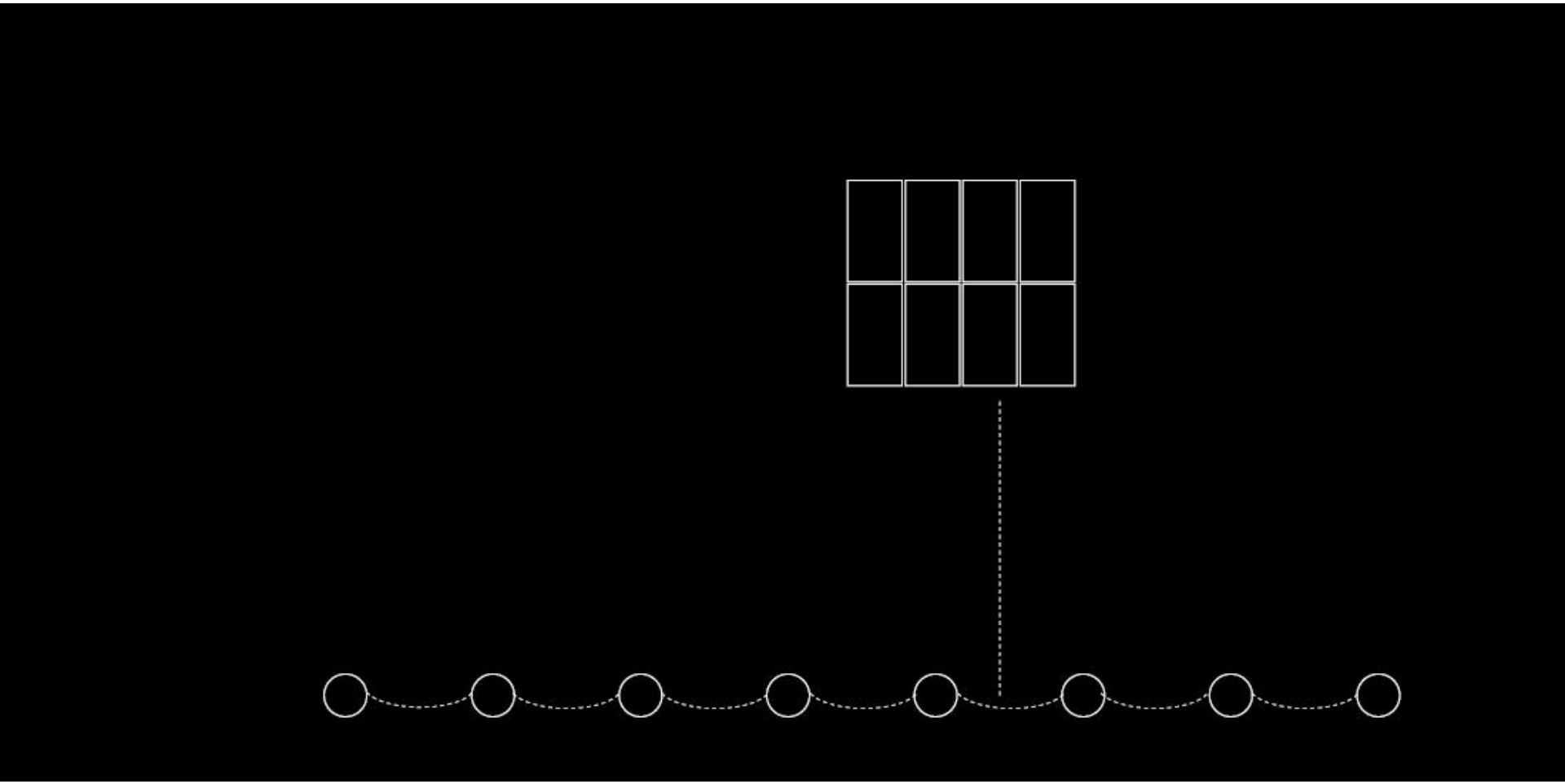
High Efficiency System Utilizing LED Lighting

Mid-Level Site Lighting

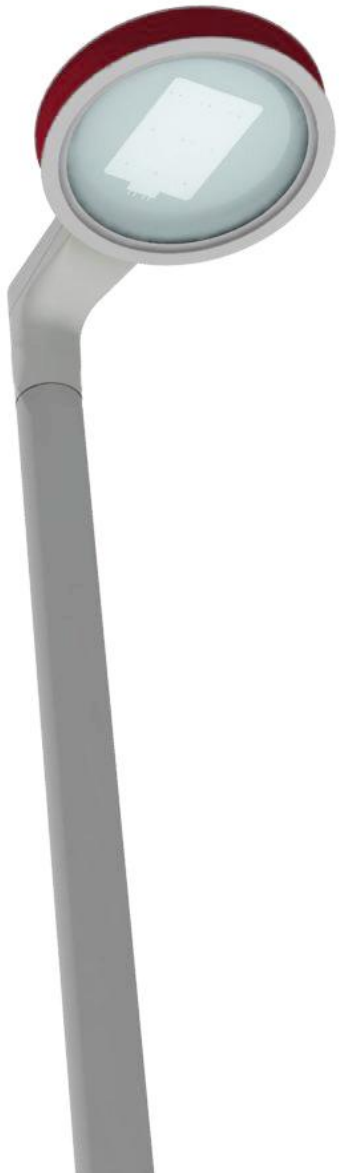
Limited area of Illumination

A Design Opportunity in the Greater East End

CLUSTER CONCEPT



DISCUS



DISCUS

The Discus is a newly developed mid to high level exterior light that responds to the flat nature of LED boards by creating a luminaire that is a simple thin disc shape with a simple and elegant mounting arm that transitions smoothly from circular pole to a shallow rectangular mounting arm.

The Discus was originally developed for Houston's Greater East End Management District as an innovative solution for a federally funded street and sidewalk improvements. Metalab teamed with Philips Hadco and Ameresco to design, develop and fabricate over 160 lights for this application, which are also completely off-grid and solar powered.

Discus lights may be powered from any power source, and can house a wide variety of LED boards from 16 up to 80 point sources. Philips LEDs and dyna-dimmer technologies provide state of the art in control, light quality, and energy efficiency.

Discus refers to the simple cylindrical form of the luminaire that takes advantage of the thinness of an LED light board. The Discus features a colored edge band, themed to location.

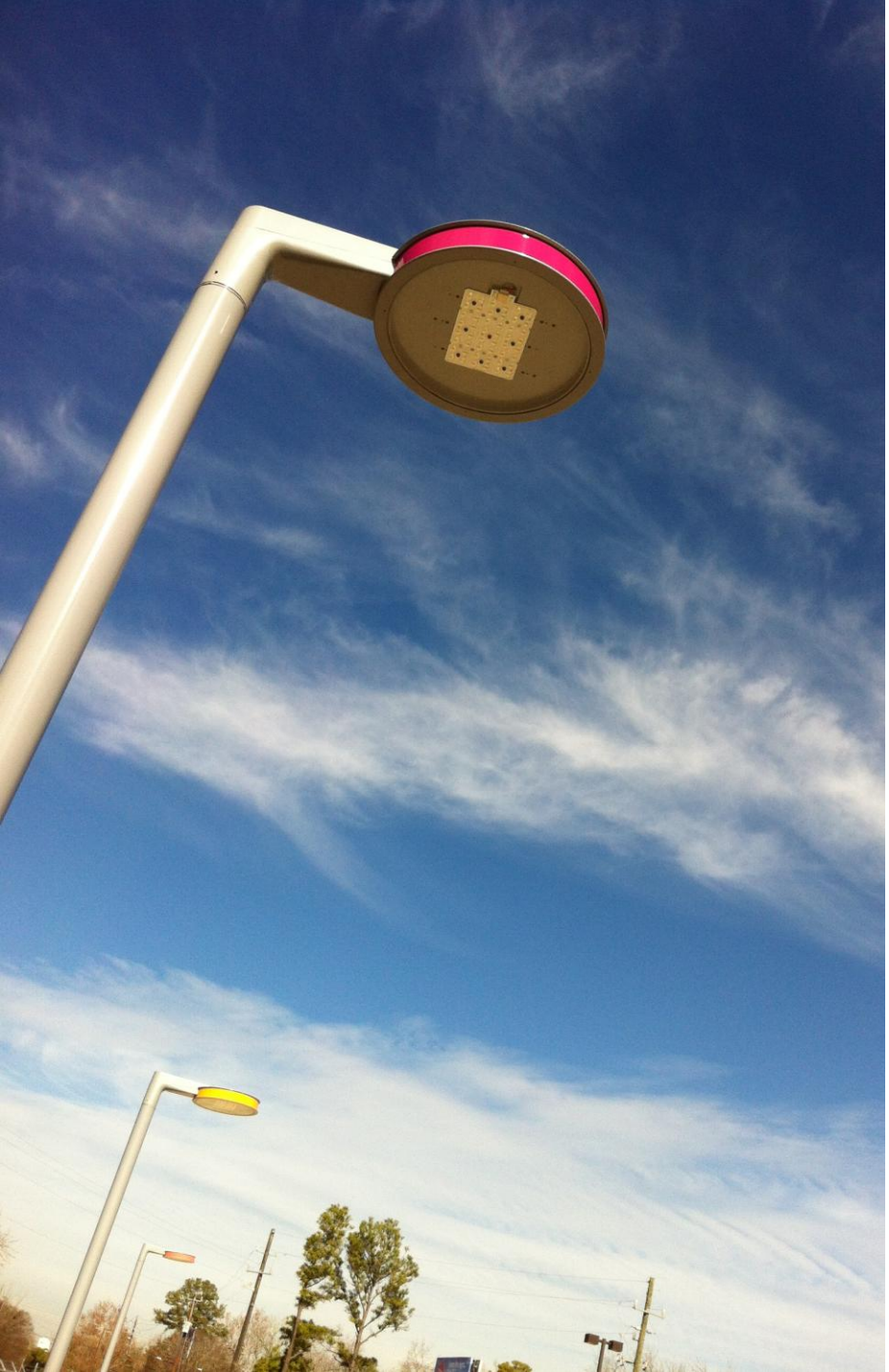
METALAB]

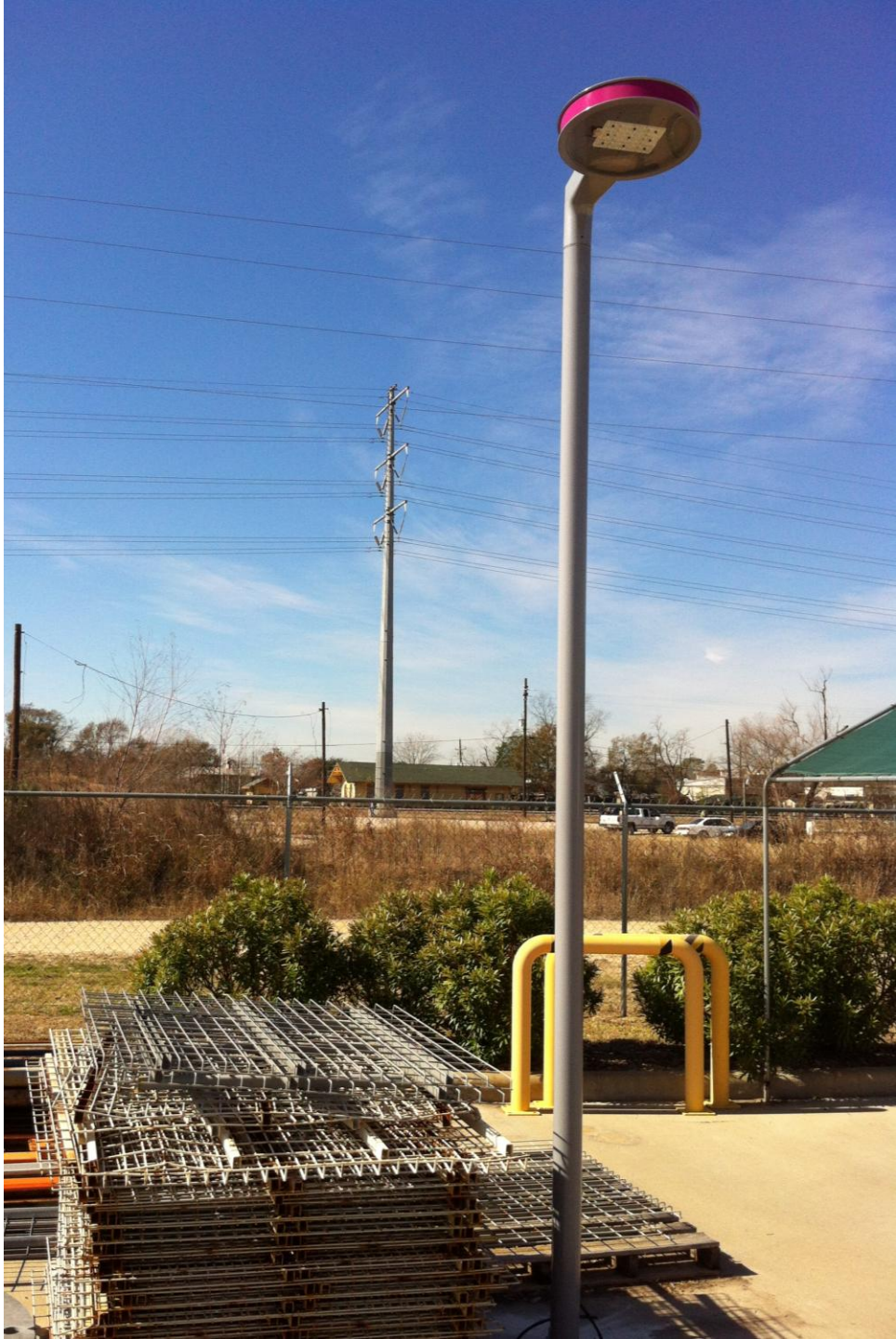
DISCUS

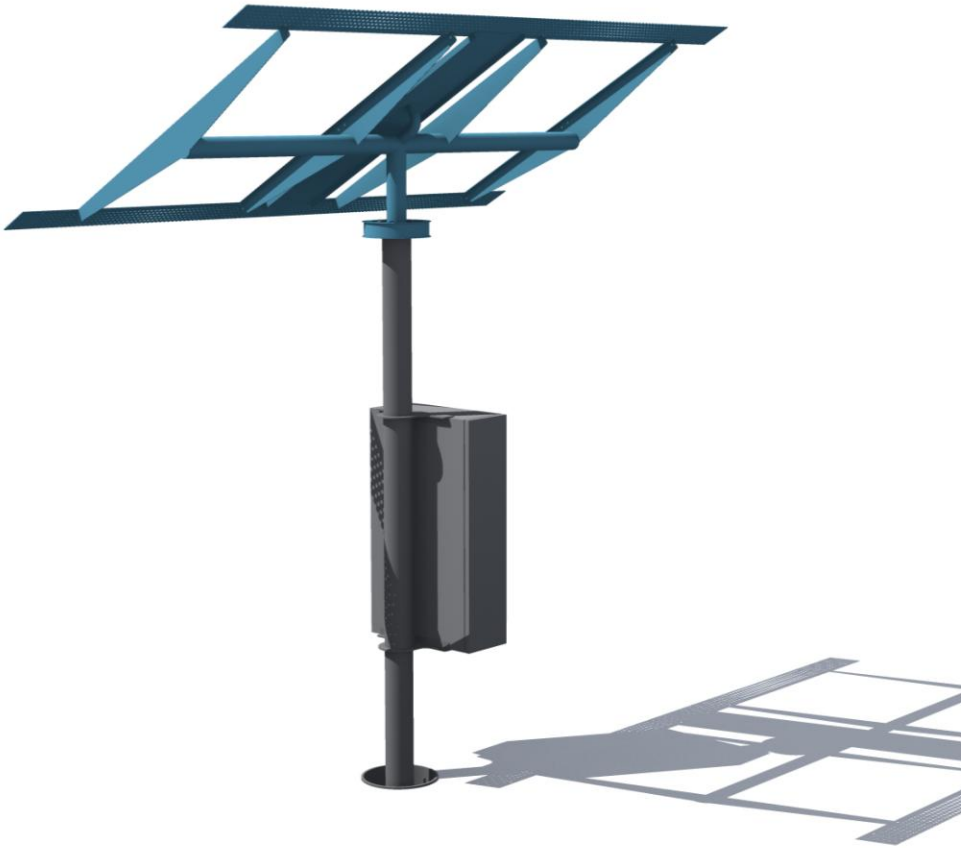
DISCUS, Houston, Texas, 2012, for Greater East End Management District

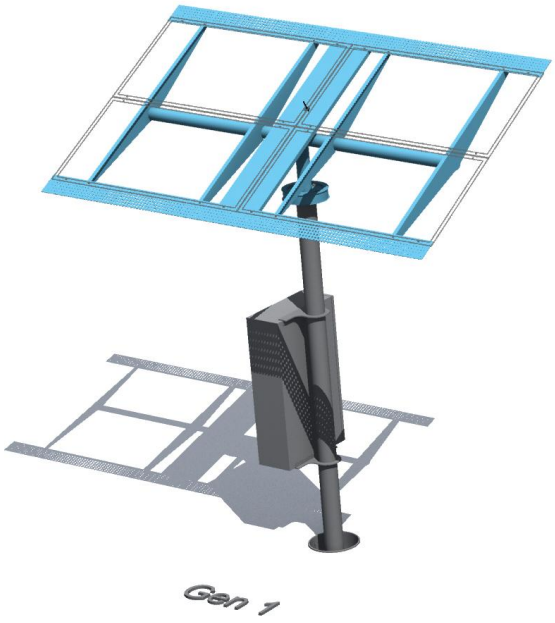
Metalab, Product Design for Philips-Hadco North America


FRAGILE
LEVITON







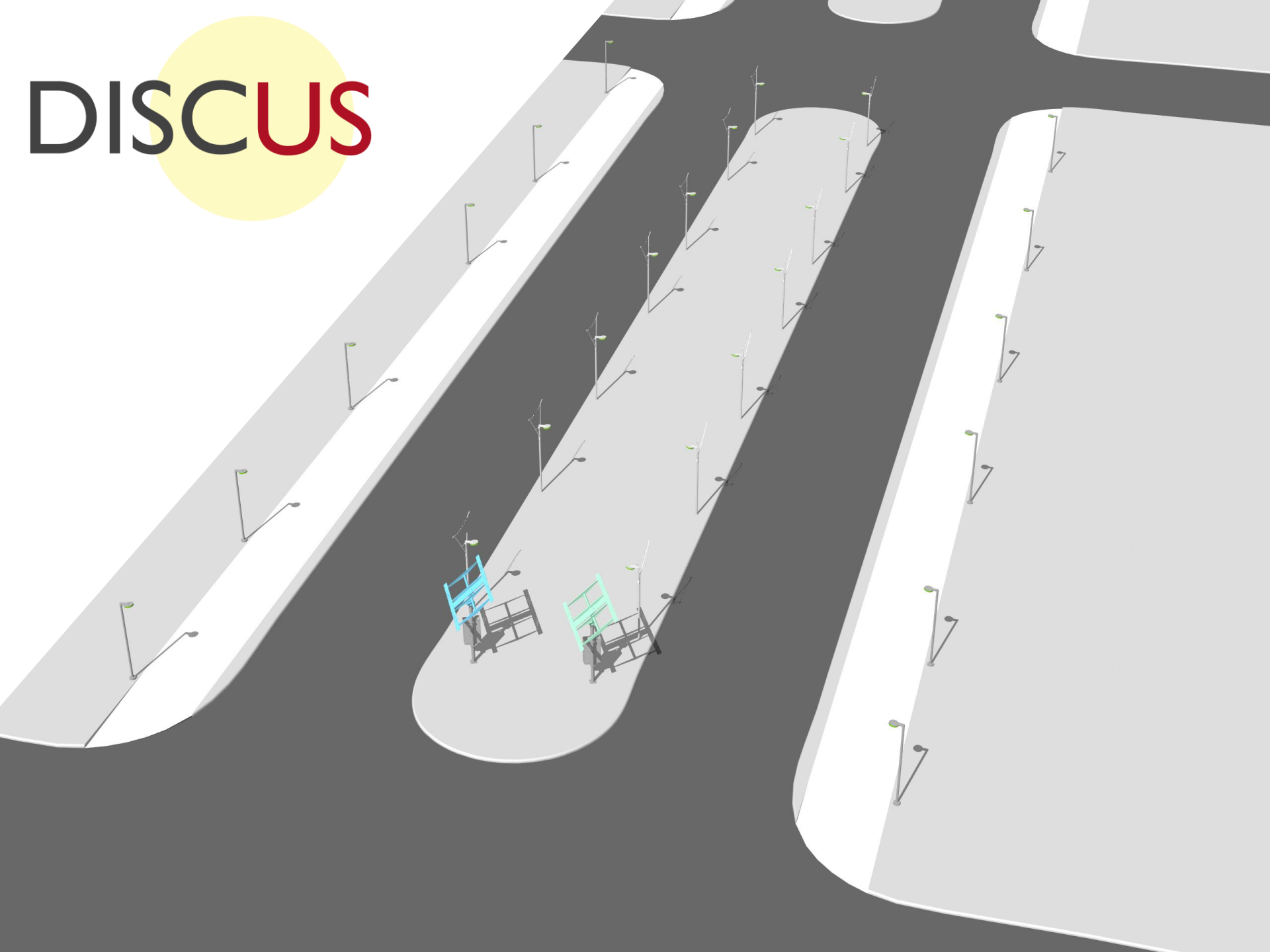


Gen 1

Gen 2

Gen 3

DISCUS



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