Hangar Modernization

23, April 2014 | 1:30pm – 2:15pm

PRESENTED BY:
Mark Stormberg, Tectonic Management Group, Inc.
SOLAR-POWERED TANNING SALON
$20/½ hr.
Tectonic Management Group, Inc.
Who We Are:

Tectonic is an Architecture and Construction company that specializes in Business Aviation facilities nationwide.

- Architecturally-led Design/Build company providing a single source of responsibility for the owner.
- Corporate Flight Departments
- Fixed Base Operators (FBO)
- Completions & Maintenance Facilities
- Aviation Paint Hangars
- New Construction and Renovation
There are many ways to achieve these goals…
Why Attend This Seminar?

Solve Exist. Facility Problems

Corporation Green Partner

Conserve Energy

Good Global Citizen

Solve Exist. Facility Problems

Owner

Practical solutions for a facility owner.

Sustainability:

“Meeting the needs of present generations without compromising the ability of future generations to meet their needs.”

- 1987 UN Brundtland Report
Tectonic Management Group, Inc.

Corporate Flight Departments:

www.tectonicdesignbuild.com
Tectonic Management Group, Inc.

Fixed Base Operators (FBO):

www.tectonicdesignbuild.com
Tectonic Management Group, Inc.

Completions & Maintenance Facilities:

www.tectonicdesignbuild.com
Tectonic Management Group, Inc.  
Aviation Paint Hangars:

www.tectonicdesignbuild.com
Tectonic Management Group, Inc.
Modernization: Re-use Existing Infrastructure

Before

After

• New Floor Coating
• New Light Fixtures With Daylighting Controls
Tectonic Management Group, Inc.

Modernization: Re-use Existing Infrastructure

Under Construction  After

• New Weatherstripping
• Re-glaze Windows
• New Floor Coating
• New Door Operators
Tectonic Management Group, Inc.

Modernization: Re-use Existing Infrastructure

• New Energy Efficient Windows
• Lighting Controls
• Interior Roller Sun Control Shades
Typical Energy Usage

Energy Use In Metal Building Systems

- Lighting
- Space Heating
- Air Conditioning /Ventilation
- Other
- Water Heating
- Refrigeration
- Computers & Office Equipment
- Cooking

Sources: Metal Building Manufacturers Association, U.S. Energy Information Administration
I'm pleased to be able to report considerable efficiency savings...

What We FEAR!

© JR 2010
Strategies:

• Minimize Energy Use
• Use Energy Efficient Systems
• Good Maintenance And Operations
• Use Clean Energy
• Take Advantage of FREE MONEY!!
Minimize Energy Use

Typical Metal Building:

- Cost Effective
- Steel superstructure with steel girt wall and steel roof purlin assembly.
- Metal siding and standing seam metal roof.
- Exterior ramp lighting (Metal Halide/LED)
- Interior hangar lighting (Metal Halide / LED/Fluorescent)
- Gas fired radiant tube heaters.
- Auxiliary ceiling fans
Minimize Energy Use

Thermal Performance of Metal Buildings

- Steel has great strength but offers very little thermal resistance.
- Thermal resistance: the ability of a material to resist the flow of heat.
Minimize Energy Use

Thermal Resistance

- Steel transfers heat more than 1,000 times more effectively than insulation.
- The highly conductive nature of steel creates thermal bridges, which significantly decrease the thermal performance of the wall assembly.
Minimize Energy Use

Insulation: Typical Girt Wall Assembly

- Thermal bridging occurs at steel girt.
- Anticipated: R-19 assembly insulation value.
- Actual: R-4 assembly insulation value.
Minimize Energy Use

Insulation: Expected Value vs. Actual Value

- Due in large part to thermal bridging, the actual effective wall assembly R-Value is far lower than what is expected.
Minimize Energy Use
Thermal Performance:
Infrared and Thermal Bridging
Minimize Energy Use

Insulation: Girt Wall Assembly – Simple Saver
Insulation and Thermal Tape

- Thermal bridging occurs at steel girt.
- Anticipated: R-30 assembly insulation value.
- Actual: R-20 assembly insulation value.
Minimize Energy Use

Insulation: Girt Wall Assembly – Simple Saver Insulation and Thermal Tape

Simple Saver Insulation @ Wall
Minimize Energy Use

Insulation: Girt Wall Assembly – Continuous Insulation and Simple Saver Insulation

- Thermal bridging occurs at steel girt.
- Anticipated: R-35 assembly insulation value.
- Actual: R-33 assembly insulation value.
- New energy code requirements/ rating systems
Typical Energy Mandates

Minimum Building Energy Performance Standards based Model Codes and/or LEED Certification

- International Building Code (as adopted/amended) IBC
- International Energy Conservation Code (as adopted/amended) IECC
- International Green Construction Code (as adopted/amended) IgCC
- LEED (Leadership in Energy and Environmental Design) (Voluntary, Only required if requested by private owner)
- USGBC (United States Green Building Council)

USGBC ® and the related logo is a trademark owned by the U.S. Green Building Council © and is used with permission
Minimize Energy Use

Insulation: Rigid Insulation @ Foundation Wall

- Creates Water Tight Joint Between Foundation & Metal Building Components
- Prevents Heat Loss Into Exterior Soils
Minimize Energy Use

Weatherproofing

- **Hangar Door Sensors**: interlocked with unit heater system turns heat off automatically when the doors are opened.
- **Hangar door jamb vertical bulb**.
- **Vertical and horizontal hangar door head closures**.
Minimize Energy Use

Weatherproofing – Hangar Doors

- Vertical Bulb
- Weather-stripping

Hangar Door: Vertical Bulb and Weather-stripping
Minimize Energy Use

Weatherproofing

- Hangar door head closure panels: horizontal and vertical
- Insulate above hangar door rails
Minimize Energy Use:
Heat Gain / Loss

Solar Shading Design
Minimize Energy Use:

Heat Gain / Loss – Low E Glass

Low ‘E’ Glass – Windows that feature a thin coating, and sometimes argon gas, that inhibit the emission of heat to the inside, reducing the heat gain to your space.
Minimize Energy Use:

Heat Gain / Loss – Glass Options & Shading

- Motorized Shades
- Silk-Screened Glass
- Interior Roller Sun Control Shades
Minimize Energy Use

Energy Audits

• Call your local electric or gas utility company
• Contact your state or local government energy or weatherization office
• Independent Energy Consulting Companies
I don't think lowering the level of lighting has saved any energy at all
Strategies:

- Minimize Energy Use
- **Use Energy Efficient Systems**
- Good Maintenance And Operations
- Use Clean Energy
- Take Advantage of FREE MONEY!!
Use Energy Efficient Systems
Types of Hi-bay Lighting

Metal Halide  High Output Fluorescent  LED
Use Energy Efficient Systems

Metal Halide Pros and Cons

• Pros
  – Low Upfront Cost to Purchase Fixture
  – Readily Available

• Cons
  – Degrades Up to 50% of Original Output Over Life of Lamp
  – High Energy Usage
  – Short Lifespan of Lamp (About 10,000 Hours)
  – More Maintenance Costs
  – Long Start Up Time
  – Noisy Ballast
  – Attracts Bugs
  – No Dimming
Use Energy Efficient Systems

Fluorescent Pros and Cons

• Pros
  – About 20% Lower Energy Usage Than Metal Halide
  – Instant On/Off of Lamps Allows for More Lighting Control Options
  – Lamps Only Degrade to 85% of Original Output Levels
  – Longer Lamp Life (About 20,000 Hours)

• Cons
  – Multiple Lamps Require More Storage and Maintenance Costs
  – Additional Ballasts Require More Wiring and Installations Costs
  – Lamp Life is Reduced by Heat (Typically Hot at Hangar Ceiling)
  – More Pieces and Parts to Potentially Fall on an Aircraft
  – Old Lamps are Hard to Dispose of because of Mercury
Use Energy Efficient Systems

LED Pros and Cons

• Pros
  – About 50% Lower Energy Usage Than Metal Halide
  – Instant On/Off of Lamps and Dimming Works With Daylight Harvesting
  – Lamps Only Degrade to 90% of Original Output Levels
  – Longer Lamp Life (+100,000 Hours)
  – Very Low Maintenance Costs

• Cons
  – Higher Upfront Cost to Purchase Fixture
  – Quickly Changing Market, Need to Research Manufacturers
Use Energy Efficient Systems

LED Retrofit of Existing Hangar
1 to 1 Replacement of Metal Halide Fixtures

**Before:** 1000 Watt Metal Halide Fixtures (after 5 years)

**After:** 604 Watt LED Retrofit (after 1 year)
Use Energy Efficient Systems

Daylight Harvesting

**Daylight Harvesting:** systems use daylight to offset the amount of electric lighting needed to properly light a space, in order to reduce energy consumption.

**Night:** no natural light, all fixtures on  
**Day:** all natural light, all fixtures off
Use Energy Efficient Systems

Daylighting Harvesting:

Varco Pruden Factory, St. Joseph, MO

Average: 8 Footcandles
Average: 45 Footcandles

- Electric lights off 57% of the time = $9,286/yr.
- Tax Deduction (EPact) = $25,920 (one-time)
Controls make the difference!

And you reckon it's cheaper to leave it running all the time?

www.Vesma.com
Use Energy Efficient Systems

Cost, Energy Reducing Statistics

- Case Study Of **NEW** 40,000 SF Hangar With Lights Mounted At 41’ AFF

<table>
<thead>
<tr>
<th>Fixture Type</th>
<th>Fixtures Required</th>
<th>App. Cost Per Fixture</th>
<th>Total Upfront Cost Of Fixtures</th>
<th>Watts per Fixture</th>
<th>Operational Cost Per Year @ $.068 per kWh</th>
<th>Total Cost of Fixtures In 10 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000 Watt Metal Halide (On 24 Hrs / Day)</td>
<td>42</td>
<td>$800</td>
<td>$33,600</td>
<td>1080</td>
<td>$31,523</td>
<td>$348,833.72</td>
</tr>
<tr>
<td>16 Lamp T5HO Fluorescent w/ Daylight Harvesting (On 16 Hrs / Day)</td>
<td>49</td>
<td>$1,100</td>
<td>$53,900</td>
<td>884</td>
<td>$16,882</td>
<td>$222,721.56</td>
</tr>
<tr>
<td>6 Bar LED Fixture w/ Daylight Harvesting (On 16 Hrs / Day)</td>
<td>36</td>
<td>$1,800</td>
<td>$64,800</td>
<td>604</td>
<td>$8,661</td>
<td>$151,405.48</td>
</tr>
</tbody>
</table>

**Estimated Payback W/ LEDs** 3-5 Years

- Case Study Of **RETROFITED** 40,000 SF Hangar With Lights Mounted At 41’ AFF

<table>
<thead>
<tr>
<th>Fixture Type</th>
<th>Fixtures Required</th>
<th>App. Cost Per Fixture</th>
<th>Total Upfront Cost Of Fixtures</th>
<th>Watts per Fixture</th>
<th>Operational Cost Per Year @ $.068 per kWh</th>
<th>Total Cost of Fixtures In 10 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000 Watt Metal Halide (On 24 Hrs / Day)</td>
<td>49</td>
<td>$800</td>
<td>$39,200</td>
<td>1080</td>
<td>$31,523</td>
<td>$354,433.72</td>
</tr>
<tr>
<td>4 Bar LED Fixture (On 24 Hrs / Day)</td>
<td>49</td>
<td>$1,440</td>
<td>$70,560</td>
<td>411</td>
<td>$11,996</td>
<td>$190,523.56</td>
</tr>
</tbody>
</table>

**Estimated Payback W/ LEDs** 2-3 Years

*charts do not include local rebate benefits, maintenance cost considerations, and installation costs
Use Energy Efficient Systems
Fixture Type Lifecycle Comparison

- Metal Halide Continuous Wattage Use: 1080
- Fluorescent Continuous Wattage Use: 864
- LED Continuous Wattage Use: 604
- LED Replacement 90% Light Output @ 604 Watts
- LED Lamp Replacement 85% Light Output @ 864 Watts

Design Point

Footcandle Levels

Wattage

Lamp Hours @ 24 Hours Per Day

2,000 4,000 6,000 8,000 10,000 12,000 14,000 16,000 18,000 20,000 50,000 100,000

0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360 380 400 420 440 460 480 500 520 540 560 580 600 620 640 660 680 700 720 740 760 780 800 820 840 860 880 900 920 940 960 980 1000 1020 1040 1060 1080 1100 1120 1140 1160 1180 1200
Use Energy Efficient Systems

Daylighting Methods

Translucent Panels (instead of siding)

Transmittance Options: 50% to 85%
Use Energy Efficient Systems

Daylighting Methods: Skylights

Prismatic
New or Retrofit

Dome
New Construction
Use Energy Efficient Systems

Daylighting Methods: Skylight Comparison

DAYLIGHTING COMPARISON

TRANSLUCENT PANEL
DOMED SKYLIGHT
PRISMAX SL & TRU SYSTEMS
Use Energy Efficient Systems

Daylighting Methods

Insulated Sandwich Panel

- Kalwall
- Major Industries
Use Energy Efficient Systems

Daylighting Methods

Glass Window Systems

$\text{\$\$\$}$
Use Energy Efficient Systems

Daylighting Methods:

Tubular Daylighting Device (TDD)

• Solatube International, Inc.
Use Energy Efficient Systems

Daylighting Methods: Tubular Daylight Device

Tectonic Management Group Offices: Solatube Installation
Use Energy Efficient Systems

Hangar Heat Choices

Hot Air
Heats Air

Radiant Heaters
Heats Objects

Radiant Floors
Heats Concrete Mass
Use Energy Efficient Systems

Hangar Heat Choices

Radiant Floors
Heats Concrete Mass
Use Energy Efficient Systems

Thermal Performance of Buildings: Stratification

- Definition: The layering of differing (normally rising) air temperatures from floor to ceiling. Heated air, typically 5-7% lighter than the cooler air in a space, collects at the ceiling.
Use Energy Efficient Systems

Thermal Performance of Buildings: Destratification

- De-stratify the air with a HVLS (High Velocity Low Speed) fans or a destratification fan.
Use Energy Efficient Systems

Thermal Performance of Buildings: Destratification Fans:

• Destratification Fan

• HVLS Fan (High Velocity Low Speed)
Use Energy Efficient Systems

Ventilation

Ridge Vent

Mid-Roof Circular Vent
Use Energy Efficient Systems

Energy Recovery System: 70-80% Heat Recovery

Typical Cross Draft Paint Bay Diagram

- Energy Recovery Unit (ERU): Use the normally exhausted air to precondition the incoming fresh air intake of an HVAC system.
Strategies:

• Minimize Energy Use
• Use Energy Efficient Systems
• **Good Maintenance And Operations**
• Use Clean Energy
• Take Advantage of FREE MONEY!!
One approach to maintenance…
Good Maintenance And Operations

• Mechanical/system preventative maintenance.
• Routine and scheduled filter changes.
• Designate specific location for recycling.
• Designate specific location for storage of expired lamp/batteries/electronics – dispose of properly.
• Pavement / Ramp maintenance.

dirty

clean
Good Maintenance And Operations

Ramp Evaluations
Good Maintenance And Operations

Ramp Evaluations

FIGURE: TYPICAL PAVEMENT LIFE CYCLE (Springer, 2005)
Good Maintenance And Operations

Floor Coatings
Good Maintenance And Operations

Floor Coatings

Colloidal Silicate Concrete Pretreatment

• Silicates react with alkaline to create a permanent gel

Standard Concrete

Treated Concrete
Good Maintenance And Operations

Floor Coatings – Minimize Vapor Transmission Rate

**HangarSpec™ HB-5**
Premium High-Build Coating System

Nominal System Thickness
35-40 mils

- Protect 2000 UR or Protect 4000 PA Topcoat
- Protect 2000 UR or Protect 4000 PA Topcoat
- Protect 1000 HB Epoxy Basecoat
- Protect 1000 HB Epoxy Basecoat
- Protect 1000 HB Epoxy Primer

Low Water/Cement Ratio Concrete

Stego Wrap 15mil Vapor Barrier

Water Vapor
Good Maintenance And Operations

Floor Coatings
Strategies:

- Minimize Energy Use
- Use Energy Efficient Systems
- Good Maintenance And Operations
- **Use Clean Energy**
- Take Advantage of FREE MONEY!!
Use Clean Energy
Using What You’ve Got

Grid Tied Solar Electric System

The AC electricity you do not use is sent back to the grid.

Solar (Photovoltaic or PV) panels turns photons from the sun into DC electricity.

Micro-inverters mounted on each PV panel will convert the DC voltage from the PV Panel to voltage suitable for your home.

Wind Turbines

Solar Photovoltaic
Use Clean Energy
Solar & Wind, Buying vs. Leasing

Options:

**Buying**
- Own the equipment
- Able to use tax credits
- Utilize all energy produced from the equipment for your building

**Leasing**
- Leasing company owns the equipment
- Leasing company assumes tax credits
- Partial reduction in utility bill, pre-arranged in contract

Programs vary in each area. Check with local vendors and municipalities

Strategies:

- Minimize Energy Use
- Use Energy Efficient Systems
- Good Maintenance And Operations
- Use Clean Energy
- **Take Advantage of FREE MONEY!!**
OK - bring me the energy figures
Take Advantage Of FREE MONEY!!

Acumen Energy Solutions

- Implemented over 100 Million sq. ft. of energy efficiency projects since 1996

- How?
  - We look for the ‘coins in the cushions’
    - Procurement alternatives
    - Federal Tax incentives and strategies
    - Ratepayer funded utility rebate programs
Take Advantage Of FREE MONEY!!

Procurement Strategies

• Ensure you’re buying power *Per Unit* as effectively as possible
• Regulated vs. Deregulated Markets
• Electric & Natural Gas
• Rate / Tariff Analysis
• Establish baselines for consumption to measure future efficiencies against
• Mexico?
Take Advantage Of FREE MONEY!!

Federal Tax Incentives and Strategies

• EPAct:
  – Currently expired but legislation introduced to extend and expand it
  – Allowed for deductions up to $1.80/sf for exceeding standards
  – Proposed to expand that to $3/sf and $/sf for facilities older than 10 years

• Cost Segregation
  – Applicable to facilities placed into service in the last five years
  – Accelerates depreciation schedules for assets
  – Tremendous cash flow impact for owners

• Cost Abandonment
  – Captures remaining asset value during retrofitting of facilities
  – Program expanded by the IRS just last year
Take Advantage Of FREE MONEY!!
Combined Approach:  198,000 sf property

- EPAct
  - $156,492 cash benefit
- Cost Segregation
  - $1,078,751 cash benefit
- Cost Abandonment
  - $435,482 cash benefit
Take Advantage of FREE MONEY!!
Utility Rebates

- Funded by ratepayers
- Cheaper than new generation
- Prescriptive and custom programs
- We design projects to optimize returns
Take Advantage of FREE MONEY!!!

Utility Rebates

- Programs vary based on capacity, not $/kWh
- Good rebates available in ‘cheap’ power areas
- We’ve secured over $25MM in rebates for clients
Summary

- Minimize Energy Use
- Use Efficient Systems
- Good Maintenance And Operations
- Use Clean Energy
- Take Advantage of FREE MONEY!!
In the End…

…it’s all about looking good!
For more information about us or to download a PDF version of this presentation, please visit:

www.tectonicdesignbuild.com

Click the “Sustainability” or “Latest News” category

6695 W. 48th Avenue
Wheat Ridge, CO  80033
303-403-1228
# Presentation Resource List

The following list is provided as a resource based on Vendors highlighted in the presentation.

<table>
<thead>
<tr>
<th>AREA OF EXPERTISE</th>
<th>COMPANY</th>
<th>CONTACT NAME</th>
<th>OFFICE PHONE</th>
<th>CELLULAR</th>
<th>EMAIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hangar - Architecture &amp; Construction</td>
<td>Tectonic Management Group, Inc.</td>
<td>Mark Stormberg</td>
<td>303-403-1228</td>
<td>303-898-8987</td>
<td><a href="mailto:mstormberg@tectonicdesignbuild.com">mstormberg@tectonicdesignbuild.com</a></td>
</tr>
<tr>
<td>Contact Tectonic for specific product questions or specifications:</td>
<td>Lighting Solatubes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>High Volume Low Velocity Fans</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Etc.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy Consulting, Tax Credits, Rebates</td>
<td>Acumen Energy Solutions</td>
<td>Justin Willett</td>
<td>913-433-7819</td>
<td></td>
<td><a href="mailto:jwillett@acumen-energy.com">jwillett@acumen-energy.com</a></td>
</tr>
<tr>
<td>Metal Buildings, Prixmax skylights</td>
<td>Varco Pruden Buildings</td>
<td>Craig Edwards</td>
<td>901-748-9263</td>
<td>252-412-6699</td>
<td><a href="mailto:Cedwards@vp.com">Cedwards@vp.com</a></td>
</tr>
<tr>
<td>Hangar Doors</td>
<td>Door Engineering</td>
<td>Dale Larson</td>
<td>507-931-6910</td>
<td>507-382-2572</td>
<td><a href="mailto:dlarson@doorengineering.com">dlarson@doorengineering.com</a></td>
</tr>
<tr>
<td>Hangar Door Installation / Repair</td>
<td>Dan’s Overhead Doors &amp; More</td>
<td>Dan Bernacki</td>
<td>319-626-3667</td>
<td>319-430-5200</td>
<td><a href="mailto:DRB@dansdoors.com">DRB@dansdoors.com</a></td>
</tr>
<tr>
<td>Floor Coating - New &amp; Repair</td>
<td>Protective Polymers</td>
<td>Arlie Newberg</td>
<td>309-496-1370</td>
<td>309-738-2388</td>
<td><a href="mailto:anewberg@protectpoly.com">anewberg@protectpoly.com</a></td>
</tr>
<tr>
<td>Hydronic Radiant Floor Heating</td>
<td>Fluid Designs</td>
<td>Josh Looper</td>
<td>330-620-5601</td>
<td>330-697-0362</td>
<td><a href="mailto:jlooper@fluiddesignllc.com">jlooper@fluiddesignllc.com</a></td>
</tr>
<tr>
<td>Wall Insulation, Simple Saver new/retrofit</td>
<td>Thermal Design</td>
<td>Matt Mohler</td>
<td>800-255-0776</td>
<td></td>
<td><a href="mailto:mattm@mail.thermaldesign.com">mattm@mail.thermaldesign.com</a></td>
</tr>
</tbody>
</table>
DEDICATED TO HELPING BUSINESS ACHIEVE ITS HIGHEST GOALS.