Bottle of Mescal

Hipopta agavis

Minimizing Risk:

The Bridge Between Wet Collections & Safety

In The Design For The

National Museum of Natural History

Presenters: Walter L. Crimm, AIA and Bryan L. Stemen, CSP, CFPS

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National Museum of Natural History Wet Collections

- Wet collections are among the largest in the world
  - 18 million wet collection specimens
  - VZ • IZ • Herps • Fishes
- Containers
  - Several hundred-gallon stainless steel tanks
  - 100-year-old 5-gallon (18.921 liters) brittle glass
  - 2 oz. (.0591 liters) vials
  - Primary medium 75% ethyl alcohol – the key hazard commodity
- Key factors driving the project
  - Safety of the public, staff, and collections
  - Preservation of these collections
  - Open up space at the NMNH building on the National Mall

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Team

- NMNH staff - Collections Managers and Researchers
- Museum Support Center (MSC) staff
- Office of Facilities Engineering and Operations (OFEO)
- SI Office of Safety and Environmental Management (OSEM)
- EwingCole - Architects and Engineers

3 Day Workshop

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8 Key Elements Influencing Design

1. User Programmatic Space Needs
2. User & Facility Operational Protocols
3. Site Issues
4. Codes/Local Jurisdictional Input
5. Safety & Risk/Hazard Assessment
6. Building Core & Shell Design
7. Building Systems Selection & Design
8. Schedule & Budget

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1. User Programmatic Space Needs

Storage Pod 91,248 SF (8,477.21 sq m)

- Measure by face area of shelving
- Shelves 12” (.30480 m) or 18” (.45720 m) deep
- Maximum Height – seven feet (2.1336 m) to the top of the highest shelf
- Compacted shelving
- Large tank lab
- Growth goal – accommodate 20 years

Collections Management Space 29,369 SF (2,728.46 sq m)

- Shared bulk alcohol, glass jar, & shipping material storage area
- Independent space for each collection management (CM) team
  - Different work styles
  - Frequency of collection movement
  - Processing incoming collections
  - Relabeling

Research Space 19,720 SF (1,832.04 sq m)

- Semi-customized - 4 modular lab prototypes
- Separate office/paper from collection/research work

Circulation/mechanical 9,649 SF (896.42 sq m)

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2. User and Facility Operational Protocols

Storage Pod Activities

- Minimal collections maintenance and no research activity
- Design for "limited occupancy" to simplify building systems
- Examination lab for large tanks

Collection Management and Research Activities

- Modular labs for flexibility
- Fixed equipment: fume hoods, snorkels, and sinks
- Glassed-in office space as a safe separate environment

Emergency Response Protocols

- Protocol developed for response to different events:
  - When to respond themselves
  - When to call building security/safety staff
  - When to call the local fire department
- Space provided for emergency equipment

3. Site Issues

- Zoning
  - SI is a Federal Government entity, public review is minimal
- Geotechnical reports
  - Different settlement – a heavy building with heavy contents
- Utility capacity deficiencies:
  - Electrical power unreliable
    - Dual incoming services
  - Fire protection water supply - 10-inch (.254 meters) main
    - Limited sub-compartment size to less than 5,000 square feet (464.51 sq. meters) with two-hour fire-rated barriers
- Site Footprint
  - Limited by setbacks from the road
  - Distances to existing facilities and parking
  - Forced three story solution

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4. Codes/Local Jurisdictional Issues

Lack of clear
PRESCRIPTIVE CODES

- International Building Code (IBC)
- National Fire Protection Association (NFPA)
- Distilled Sprits Council
- SI's OSEM supplemented performance-based criteria
- Factory Mutual Criteria

PERFORMANCE-BASED DESIGN
informed by
PRESCRIPTIVE CODES

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5. Safety and Risk/Hazard Assessment

- Properly define the potential hazards
- Determine acceptable level of fire safety
  - Identify hazard
  - Postulate scenarios or events with consequences (Failure Mode vs. Consequences)
  - Determine the likelihood of the event occurring
  - Establish a reasonable baseline
  - Design an umbrella of protective features
- Outcome: Balanced Design
  - Does not rely upon one system or protective feature
  - Builds in layers of protection that strive for a higher level of protection beyond basic code minimums

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Guidelines for the Assessment of Risk

PRIORITY

1 Acceptable Human Loss = 0

+

2 Acceptable Collections Loss or Damage
As close to zero as reasonably achievable based on postulated scenarios

+

3 Acceptable Property/Building Loss or Damage
As close to zero as reasonably achievable based on postulated scenarios

An Acceptable Level of Fire Safety within Pod 5

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6. Building Core and Shell Design

- Structure - concrete
  - Minimize pockets in the structure
  - Ability to provide a four-hour rating
  - Vibration during construction
- Building Shell
  - Precast building already on site
  - Achieve a four-hour fire rating
  - Roof material selected for fume compatibility
- Sub-Compartments within the Pod
  - Eighteen two-hour fire-rated sub-compartments
  - Draft curtains divide sub-compartments in half
- Compact Shelving
  - Six-inch (.1524 m) stops to space units
  - Manual operation – grounded
  - Spill reservoirs between rails

7. Building Systems Selection and Design

- HVAC Systems
  - 65°F (18.3 °C) – Reduce evaporation rate for ETOH
  - Hydrocarbon detectors – Emergency HVAC shut-offs
- Electrical Systems
  - Devices outside the Pods
  - Hazardous location lighting
  - Self-illuminated exit signs
  - UV protection
- Plumbing Systems
  - Spill containment and dilution within the Pod
  - Containment criteria of the local water authority
  - Trap primer
  - Piped alcohol system not used

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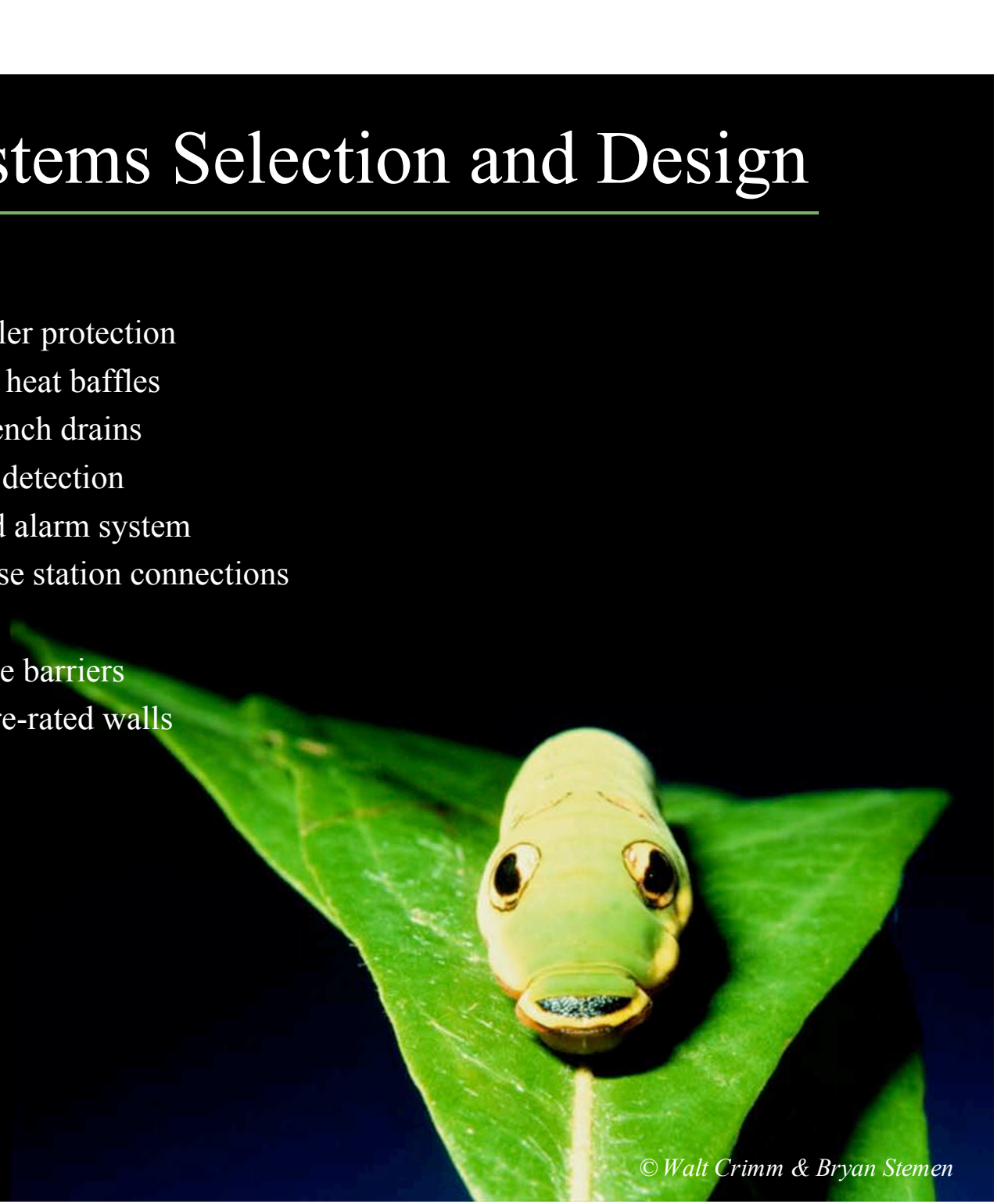
7. Building Systems Selection and Design

- Fire Protection
  - Automatic sprinkler protection
  - Coordinated with heat baffles
  - Spread control trench drains
  - Hydrocarbon gas detection
  - Fire detection and alarm system
  - Standpipe and hose station connections
  - Passive features
    - Two-hour fire barriers
    - Four-hour fire-rated walls



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8. Schedule and Budget

- Fast Schedule
- Tough Budget

Conclusions:

In planning a wet collections facility, consider the following recommendations:

1. Spend planning money upfront for a workshop to define complete scope prior to going to your Board or funding agencies for an allocation.
2. Based on the eight key elements, develop a list of knowns and unknowns under each item and work to define this scope completely prior to budgeting.
3. Bring in the local authority having jurisdiction at the beginning of discussions, and frequently thereafter throughout the design process.
4. Create a task force of users and others to make sure they can live with the decisions operationally.
5. Hire consultants who understand the complexity of this kind of building.

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Afterword

Since the project is defined by the influences of safety and operations on a series of decisions about a building and its systems, it fits the dictionary definition of a POD—"A protective container or housing"—to preserve the NMNH collections for the future.

So why is *Hipopta agavis* in the bottom of the bottle? According to *Ask Jeeves* search engine, "as proof of alcohol content and it apparently alters taste, color and smell of the liquor."

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