Exploration Architecture Corporation

Architecture for New Worlds®

Convergence of Space Tourist Processing and Suborbital Payload Processing in Spaceport Facility Design

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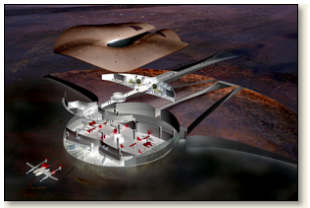
Spaceport Facility Development

- Spaceports to service commercial spaceflight industry
  - in development with either new construction, refurbishment of existing facilities, or at proposal stage for various locations around the globe
- Facility design concepts mostly centered on servicing
  - space tourist experience
  - processing spacecraft for rapid turnaround (up to 4 flights/day)
- Market expansion into suborbital payload services
  - places additional unique requirements on spaceport facility design to optimize operational concepts for processing
    - the space tourist and/or the scientific payload



Spaceport America
under construction

Cape Canaveral and Cecil Field Spaceports
refurbishment of existing facilities

Spaceport Sweden
proposed

UAE Spaceport
proposed

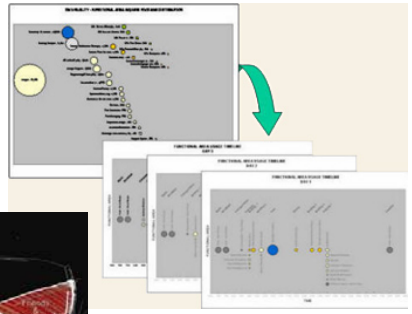
Tourist or Payload Specialist

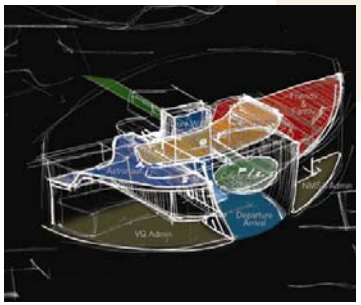
- Operational considerations in facility design
  - accommodate the tourist experience, including family and friends
  - accommodate the payload specialist experience overseeing a scientific payload

spaceport experience

payload experience

- Operational impact of each customer category
  - flying either together or as separate dedicated flights
  - impacts on pre and post flight processing operations
  - implication for facilities design

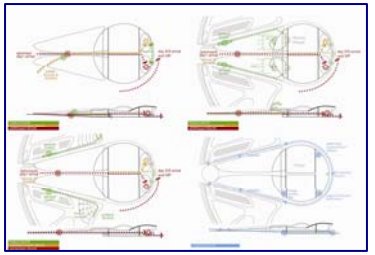




functional allocation of spaceport operations

Space Tourist Processing

- Terminal facility - activities and processes within the building centered on the astronaut journey
  - progresses from initial reception through training, food service, launch and celebration
  - segregation and hierarchy of users integrated into facility design layout
    - maintains varying degrees of access and exclusivity



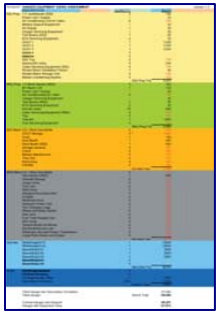
segregated routing patterns

- Hangar area - spacecraft flight prep and overhaul activities strive to maintain a turnaround schedule for more than one flight per day
  - typical key systems and hardware requiring routine checks and flight prep for flight turnaround may include:
    - installation/change-out of rocket motors
    - fueling
    - change-out/charging of batteries
    - thermal Protection System (TPS) cleaning/ overhaul
    - decal re-application
    - oxygen servicing
    - environmental Control System (ECS) servicing
    - replacement of nose skid shoe
    - seat widgets
    - general cleaning & interior/cabin overhaul
    - data download
    - placement of protective covers for vehicle windows and other miscellaneous

spacecraft fueling turnaround sequence

Payload Processing

- Payload processing for scientific research places additional requirements on facility
  - clean room protective spaces for scientific payloads
    - requirements and characteristics of specific payloads will vary for type of clean room needed
  - additional degree of spacecraft resources and ground support equipment for payload integration into the spacecraft
    - a standardized payload container system may be employed, adding additional facility accommodation
  - environmental implications for hazardous waste management
- Impacts storage, floor space, work area and functional adjacency requirements
  - which in turn may influence processing turnaround timelines
- Typical functional maintenance areas competing for floor space allocation include:
  - Flight Prep and Overhaul
  - Engineering & Maintenance
  - Bench Testing/ Backshops
  - Tools and Support Equipment
  - Storage Operations
  - Breathing Oxygen/ Liquid Oxygen
  - NDI/ XRAY
  - Cables/ Wiring
  - Hydraulics
  - Washing of Spacecraft
  - Rocket Motors



GSE square footage allocations

Dedicated Class 10,000 Generic Clean Room

Mobile Protective Tent (Class 10 – 100,000) Clean Room Environment

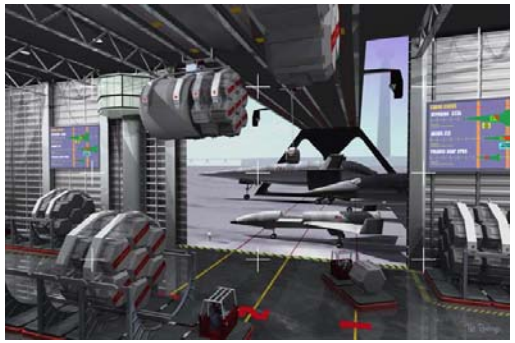
Dedicated Pharmaceutical Class 100,000 Clean Room

FastTrack™ Standardized Payload Container System

Summary

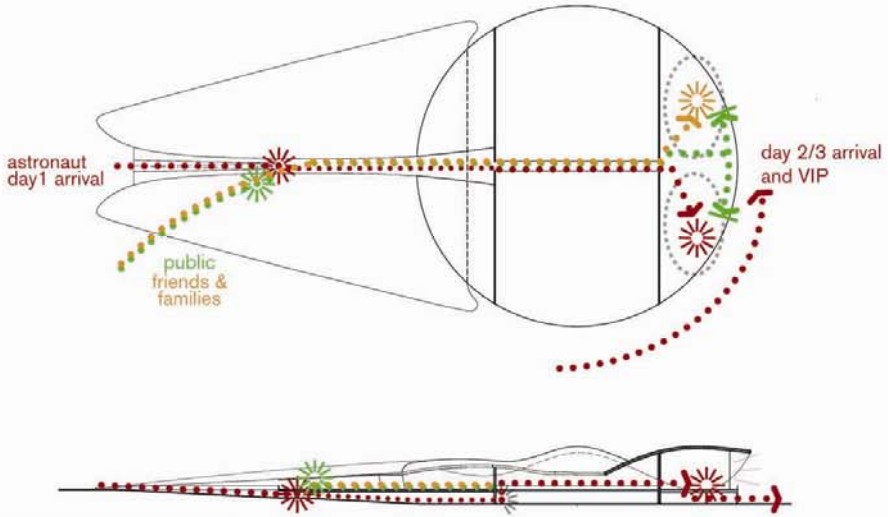
- A payload operations concept for science flights may be at odds with the flight profile for a typical tourist flight
- The preferred concept of operations for science flights and integration of science passengers with other spaceflight participants (space tourists) may impact ground pre and post flight processes and flight turnaround scheduling
- The degree of convergence of these two operational scenarios for spaceport and spacecraft operators should be considered in spaceport facility design and operations

Vision Spaceport artwork by Pat Rawlings/SAIC

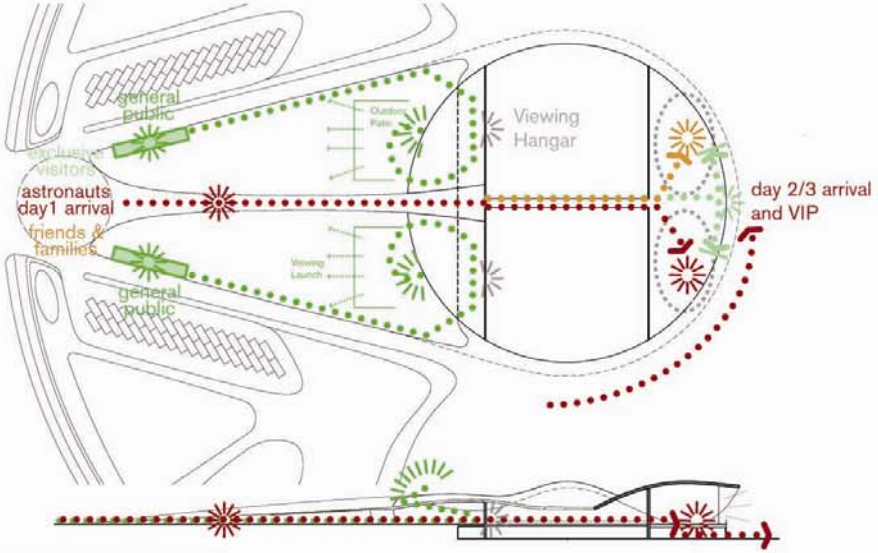

Vision Spaceport artwork by Pat Rawlings/SAIC

BACKUP


Timeline
08:00
09:00
09:30
10:15
11:00
11:30
11:45
12:15
13:00
15:30
16:15
17:00
Mysterious
Unique
Colours
Natural
Lights
Balanced /
Serenity
Arrivals
drop-off
Lunch
Flight
Spaceship
Serious
Calm
Stone
Concrete
Soft
Rough
Light
Space



PUBLIC ROUTE
FRIENDS & FAMILY ROUTE
ASTRONAUT ROUTE



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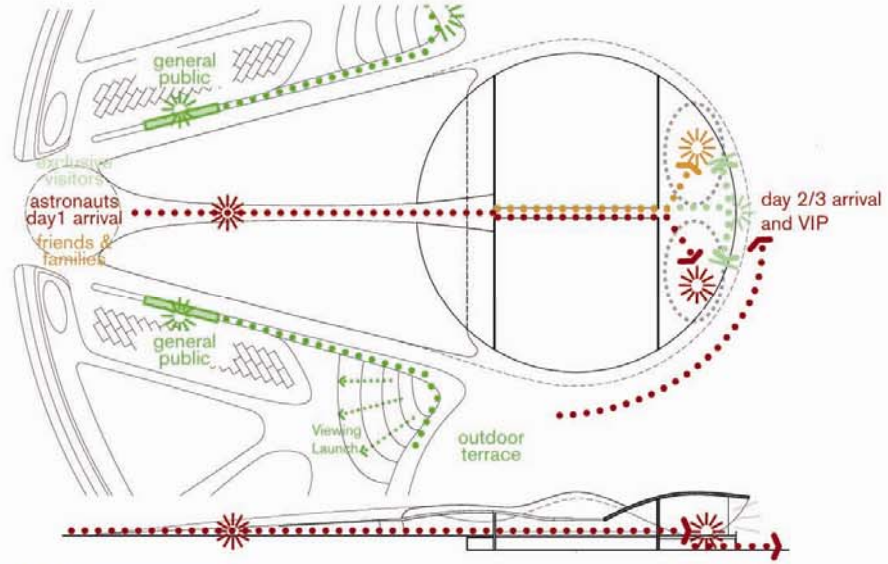

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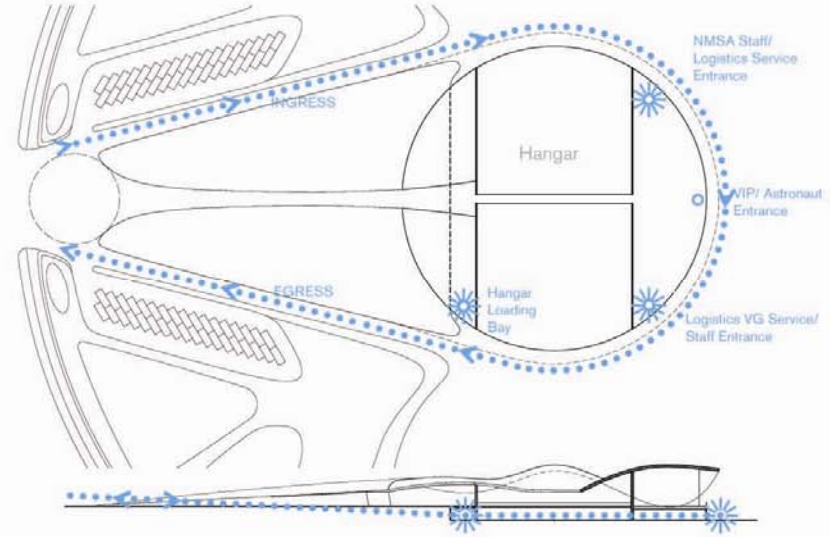

LOGISTIC ROUTE

Spaceships Fuelling Sequences