



Using SolidWorks & CFD to Create The Next Generation Airlocks

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SolidWorks & CFD Benefits



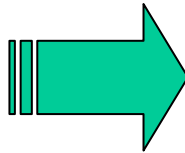
Capabilities

SolidWorks

- Prototype Design
- Assembly Drawings
- Parametric Models

CFdesign

- Smoke Ventilation
- Natural Ventilation
- Heating & Cooling Requirements
- Contaminant Dispersion
- Radiation (includes solar)
- Identify “Dead Air” Zones
- Airflow Patterns



Output

- Virtual Prototypes
- Photo Realistic Rendering
- Animations
- CFD Analysis
 - Cut Planes
 - Iso-Surfaces
 - Transient Analysis
 - Steady State Analysis
 - Particle Trace



Airlock Effort Abstract



Objectives

- Reduce purge rates
- Increase safety & ease of use
- Incorporate programmable logic into airlock doors (fixed site)
- Decrease set up time
- Decrease components, cost & complexity

Methodology

- Evaluate current design(s)
- Prototype Modeling
- Evaluate SolidWorks models in CFdesign
 - Compare prototype results to current designs

View Results

- Mobile Platform
 - Redesigned PE
- Fixed Site Shelter System
 - Milvan Airlock



Mobile Platform Airlock Background



- **Goal**

- Propose & evaluate design iterations
- Reduce recirculation cells within the airlock
- Propose a design with the least logistical burden to the current program

- **Methodology**

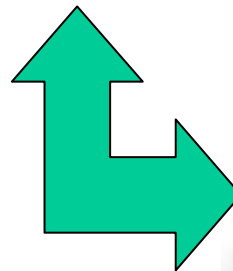
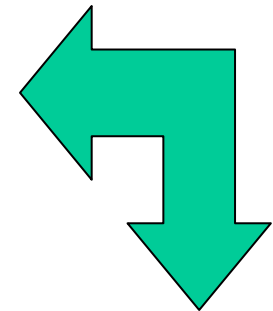
- Model the current PE using FloVent
- Model PE design iteration(s) using FloVent
- Compare the velocity profiles, over pressure, efficiencies of the above designs, etc

- **Things to Consider**

- Design interface with multiple CP shelters
- Utilize available hardware/geometry
- Create a self-establishing airlock



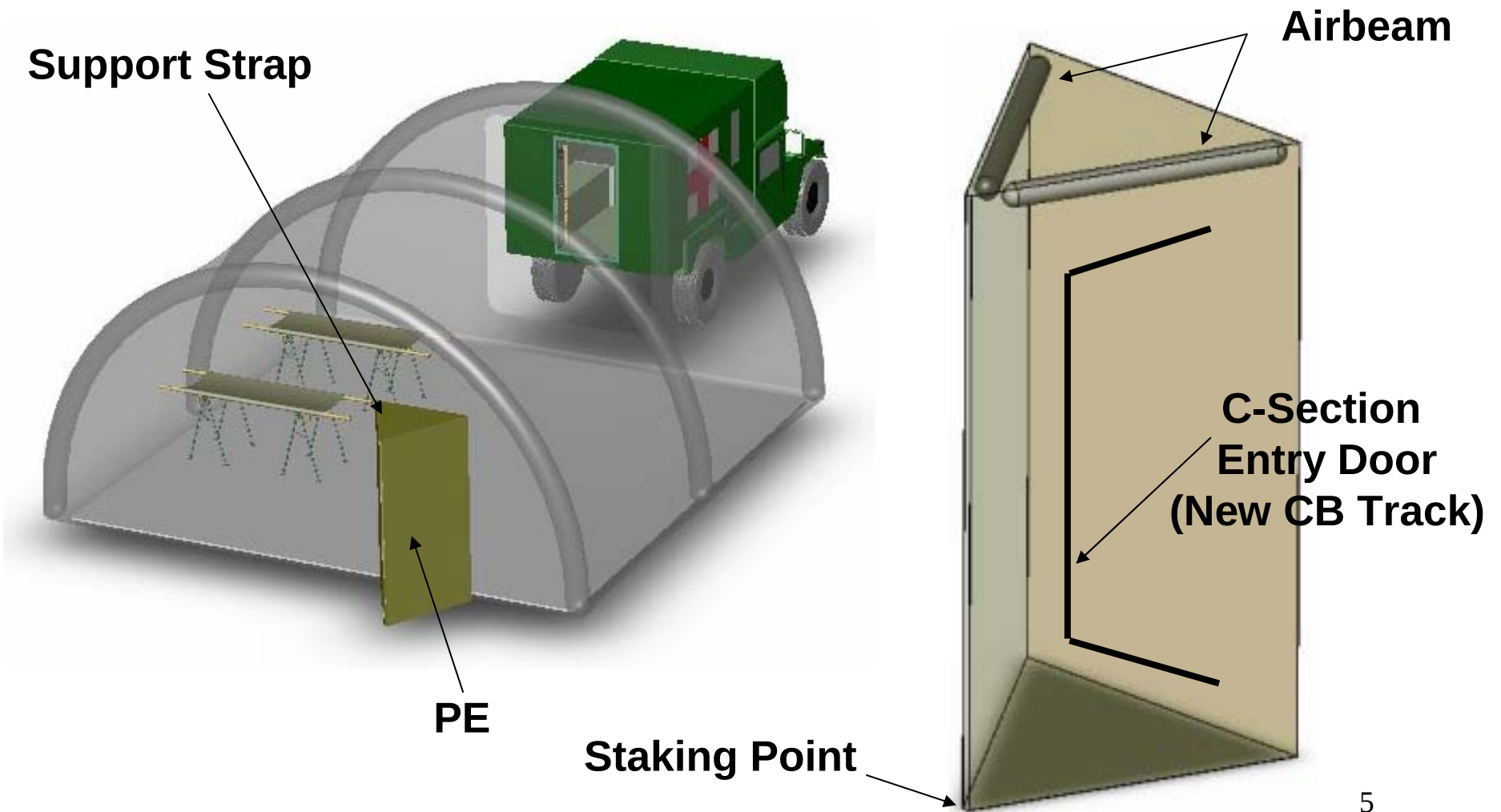
CP DEPMEDS
Protective Entranceway
(PE)



CBPS
Airlock



Mobile Platform Airlock Redesign



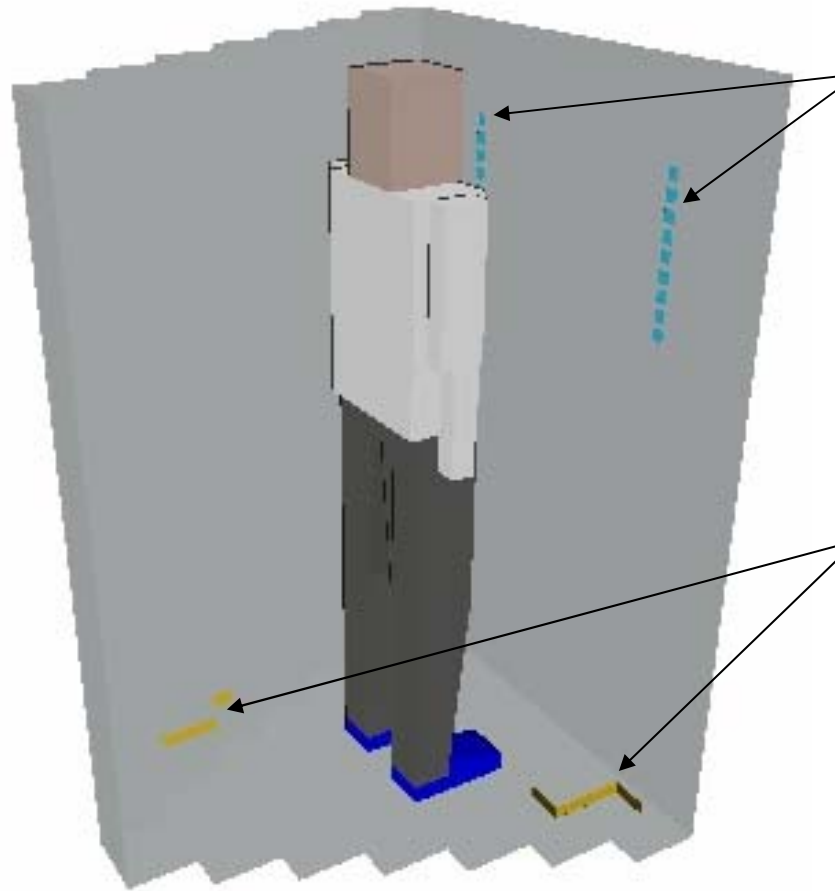
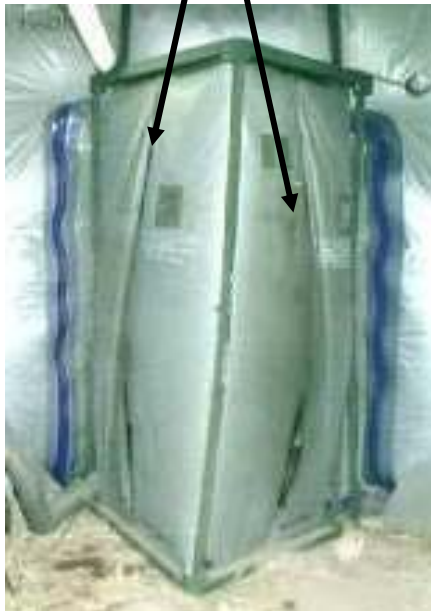


Mobile Airlock Redesign Background



Current PE Geometry

Entry



Supply:

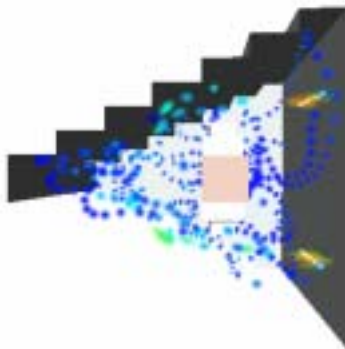
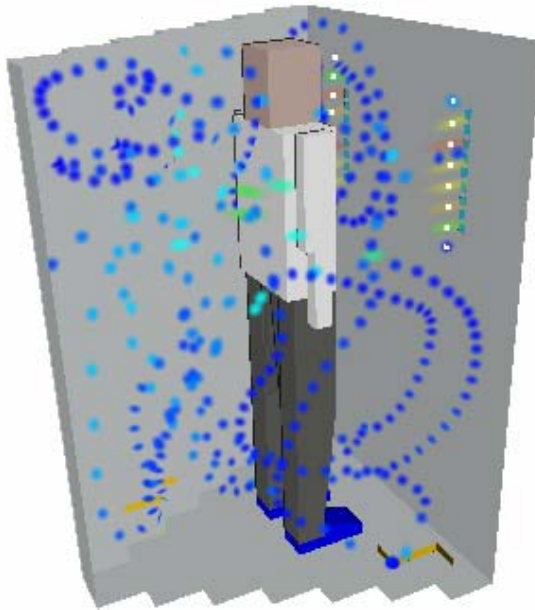
2 columns of 9
holes

14.3 CFM each
= 257.4 CFM

Exit Holes:
Open to atm.



Mobile Airlock Redesign Background



Current PE Airflow

- 18 Supply Holes @ 14.3 CFM each
- 18 Exit Holes on the bottom of each side of the PE
 - Entry velocity: 33 ft/s
 - Exit velocity: 10 ft/s
 - Pressurization: 0.5 IWG
- Air enters as concentrated small velocity jets which result in turbulent flow upon hitting objects (sidewalls & soldier body)
- Airflow is also forced by design to travel along all the x, y & z axis's. This in effect transmits vapor hazards to many areas of the body that potentially weren't contaminated.

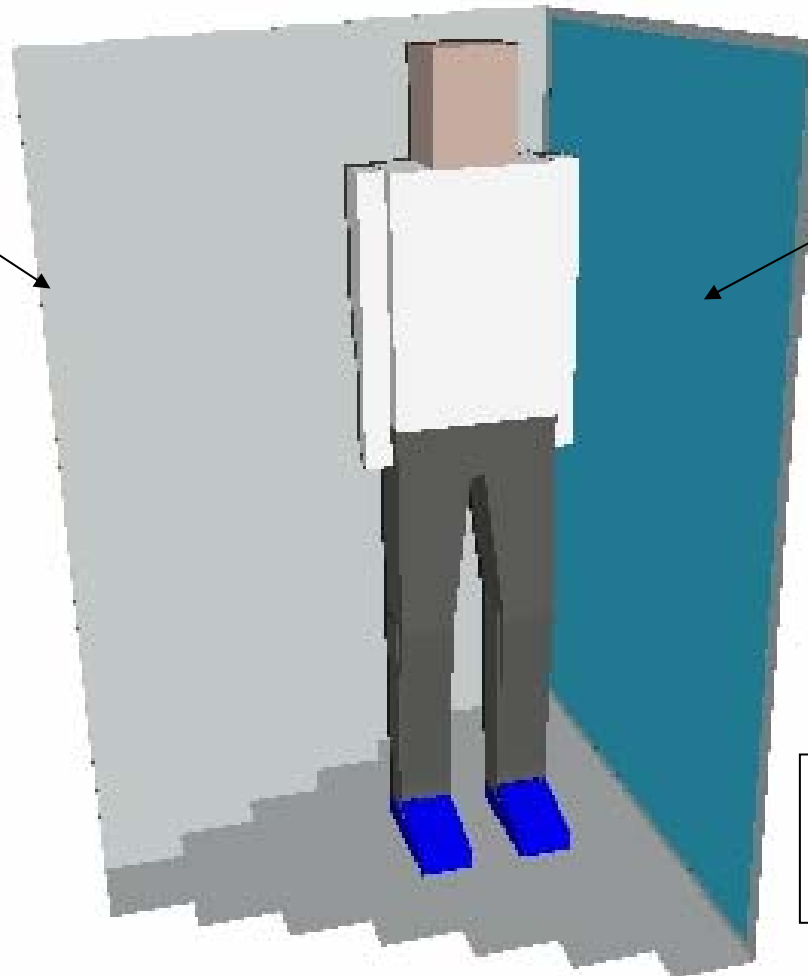
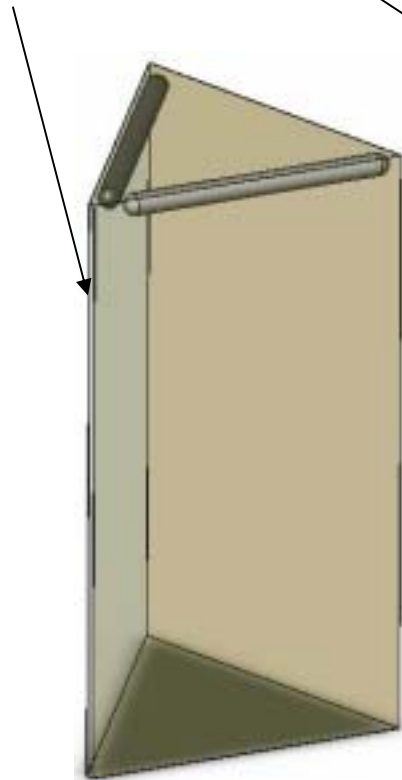


Mobile Airlock Redesign



Exit Holes:

Extend along
the front vertex
open to 0.0psi

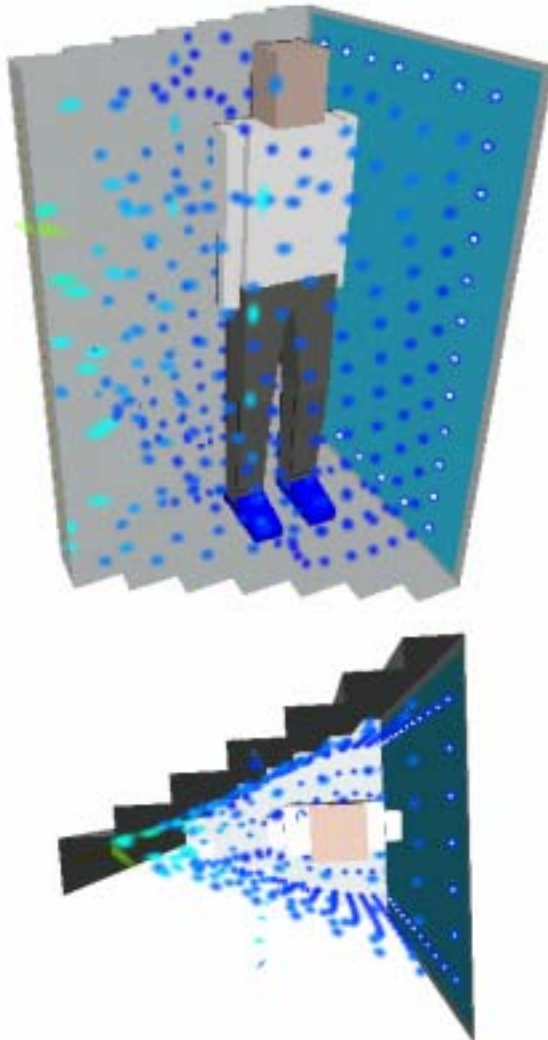


Supply:
257.4 CFM
spread over the
entrance wall

NOTE: Soldier
position within the PE
is rotated 90 deg



Mobile Airlock Redesign

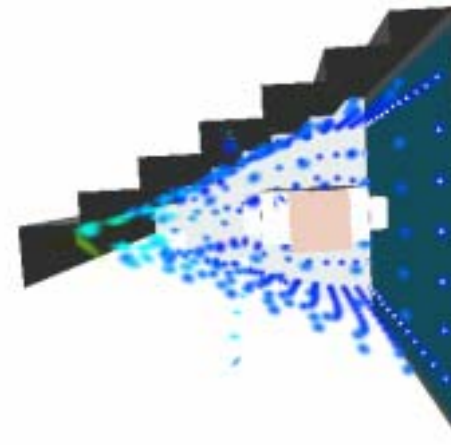
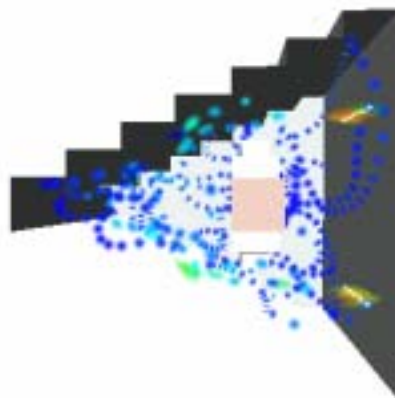
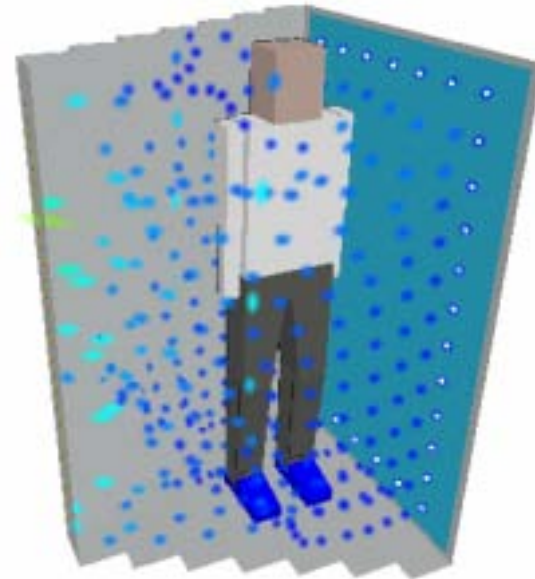
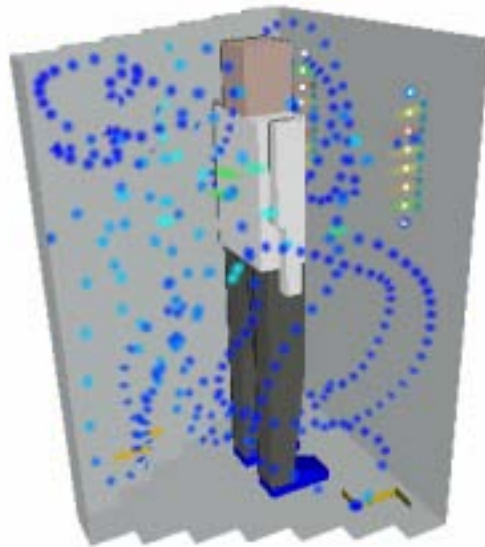


PE Mod-1

- Supply of 257.4 CFM over the front wall
- Exit holes down the front vertex of the PE
 - Entry velocity: 0.3 ft/s
 - Exit velocity: 5 ft/s
- Pressurization: 0.25 in H₂O
- Soldier body is rotated to reduce the airflow impedance in the airlock
- The geometry of the Mod-1 PE by design forces the airflow to increase in velocity as it approaches the exits holes. This aids in a unidirectional flow (laminar), and reduction in turbulence



Mobile Airlock Redesign Comparison





Mobile Airlock Redesign Overview



Airlock Summary

PE (current)

- The airflow distribution in the current PE is non-uniform with many zones of recirculation



PE (Redesign)

- The airflow distribution is more laminar, with reduced zones of recirculation
- This design would use a mesh screen in which the air would enter the airlock
- Airlock is self-establishing
- No costly hard doors!



Fixed-Site Airlock Overview



- **Goal**

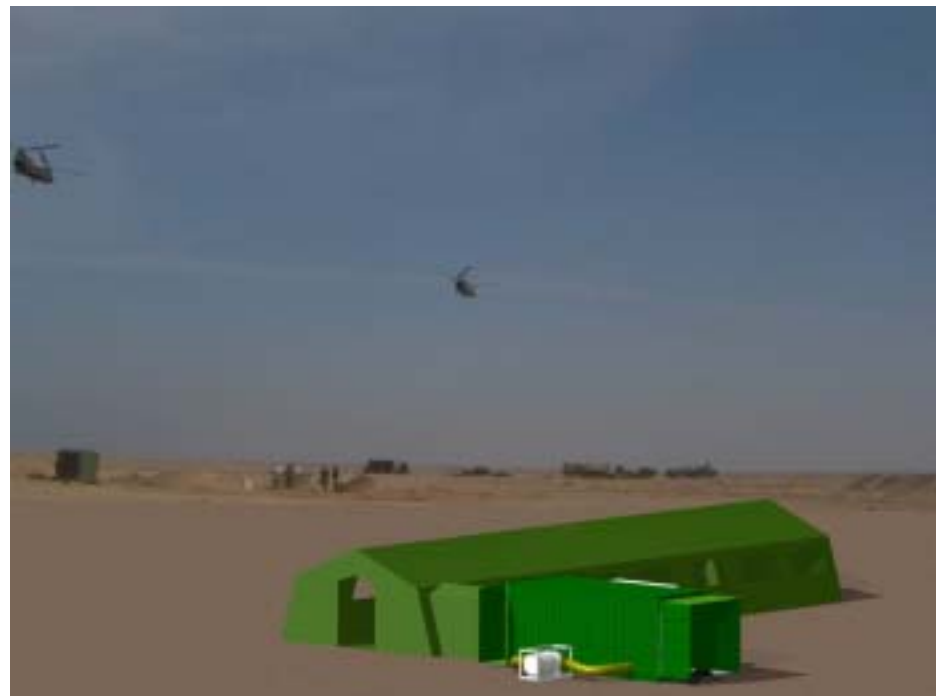
- Propose & evaluate design iteration(s)
- Reduce recirculation cells within the airlock
- Propose a design with the least logistical burden to the current program

- **Methodology**

- Study existing entry/exit airlocks
- Model the proposed design in CFdesign

- **Things to Consider**

- Design interface with multiple CP shelters
- Utilize available hardware/geometry
- Integrate ‘*Lessons Learned*’ from **OIF**
- Incorporate Ballistic Protection
- Design an airlock that can also be used as a standard MILVAN during shipment

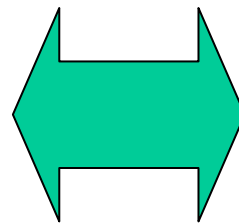




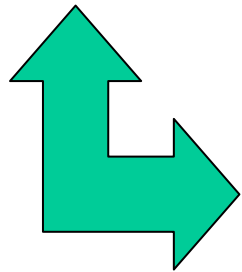
Fixed Site Airlock Background



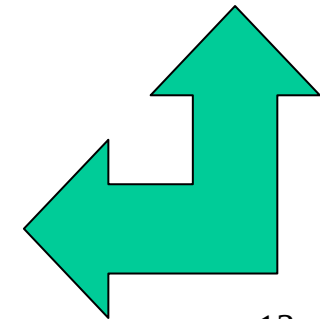
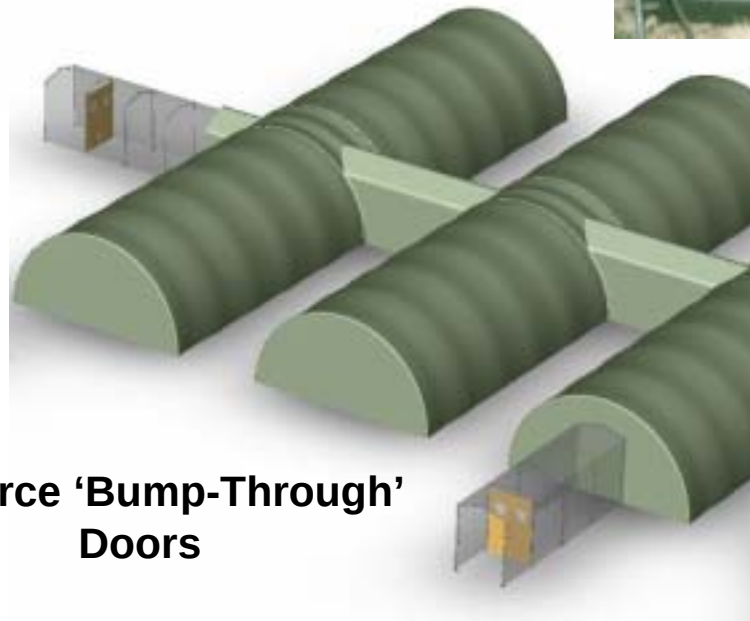
Standard 8x8.5x20
MILVAN



CP DEPMEDS
PE & TALP

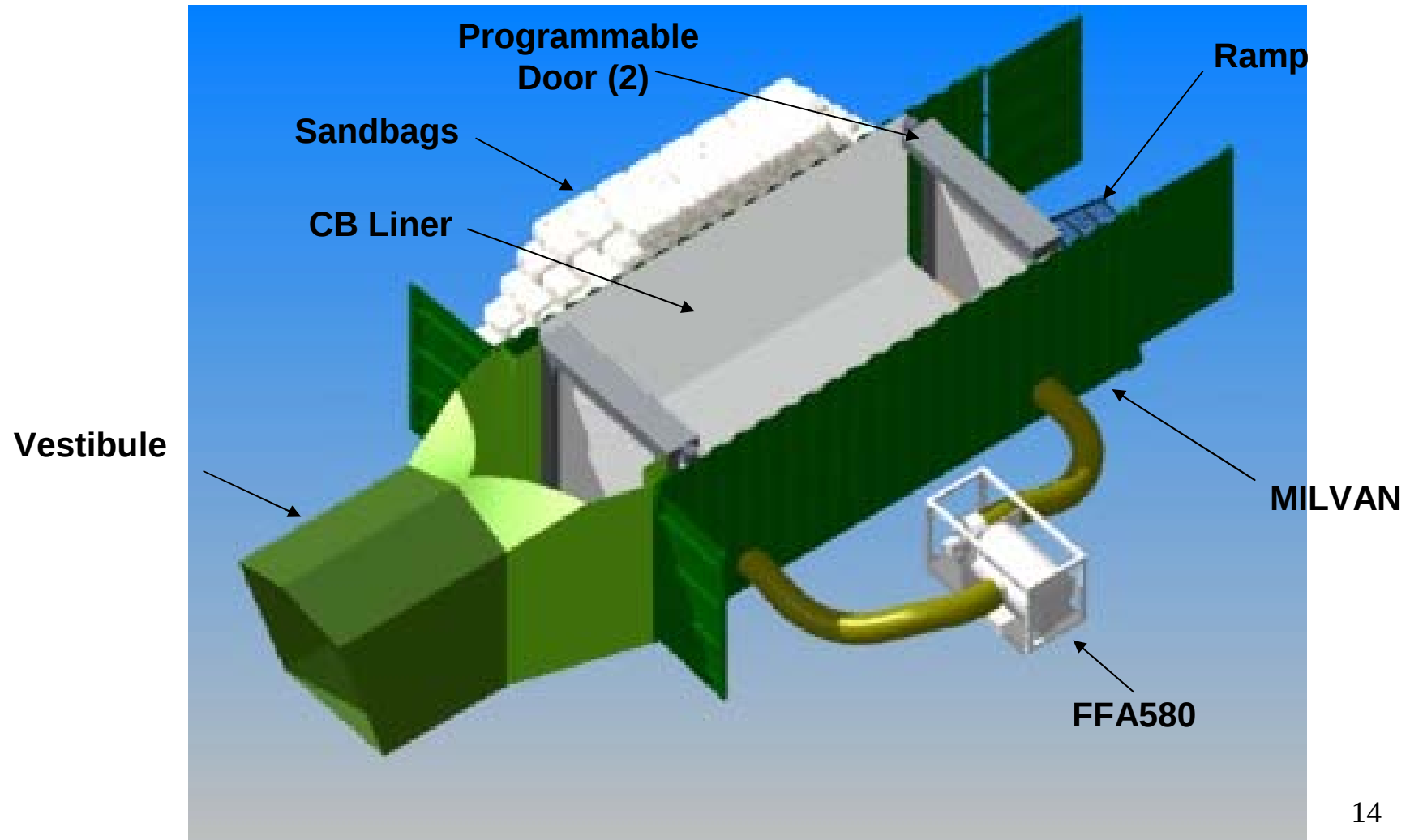


Air Force 'Bump-Through'
Doors





MILVAN Airlock Concept

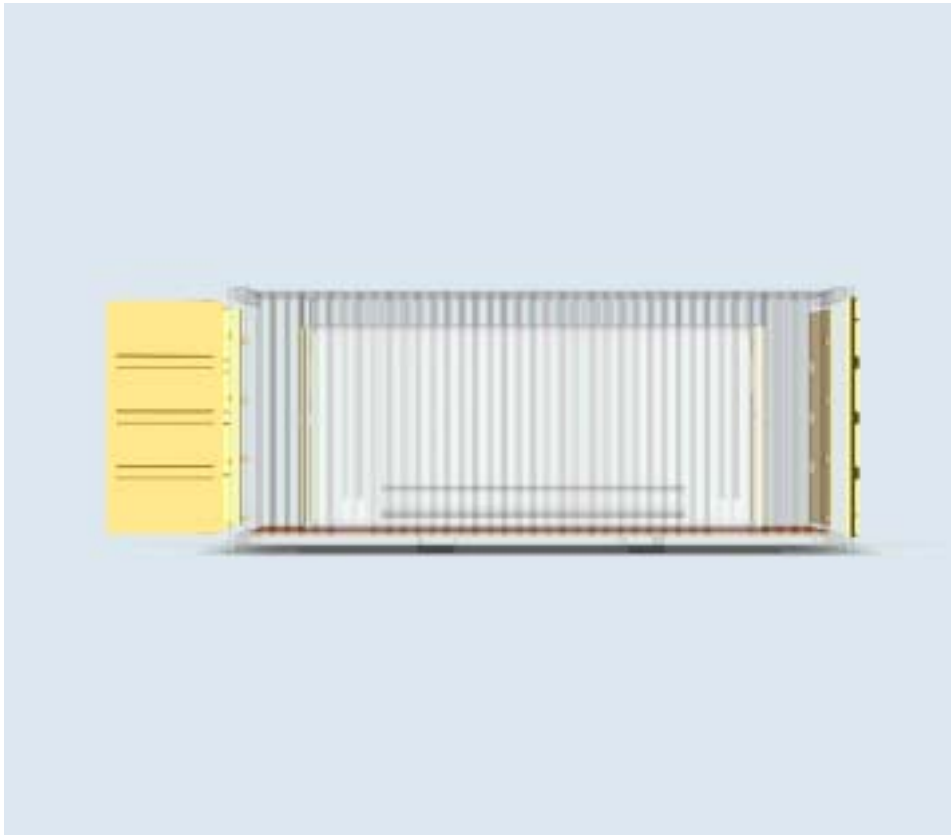




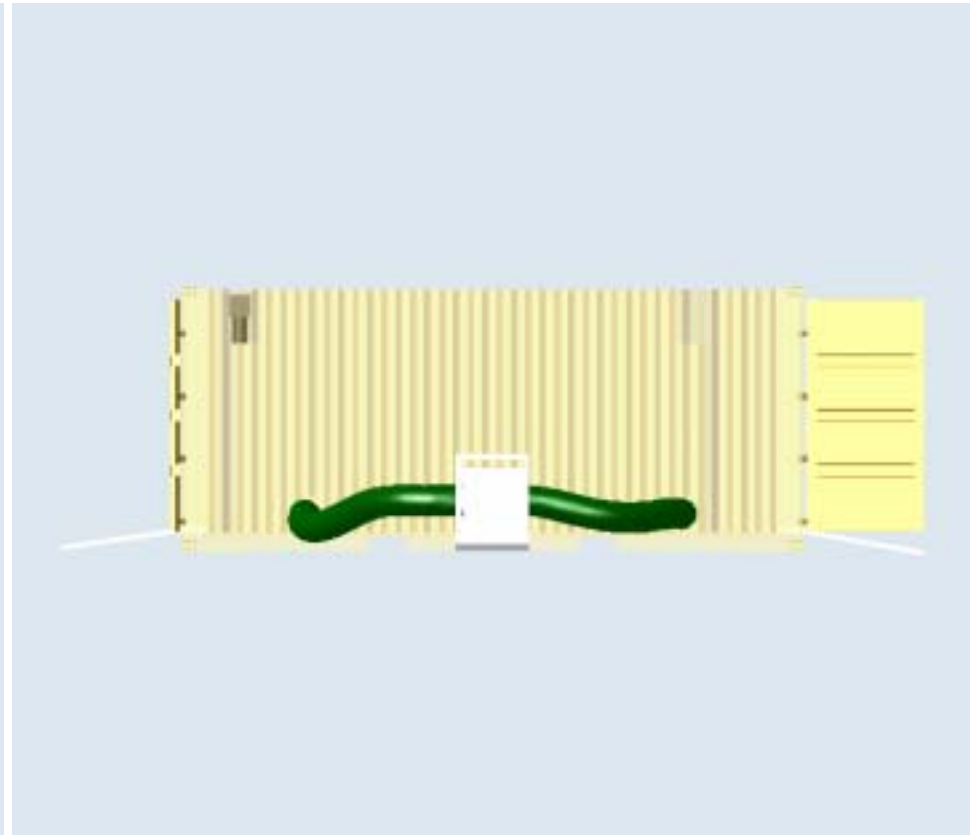
MILVAN Airlock High & Low-End Applications



Conventional “Bump-Through”

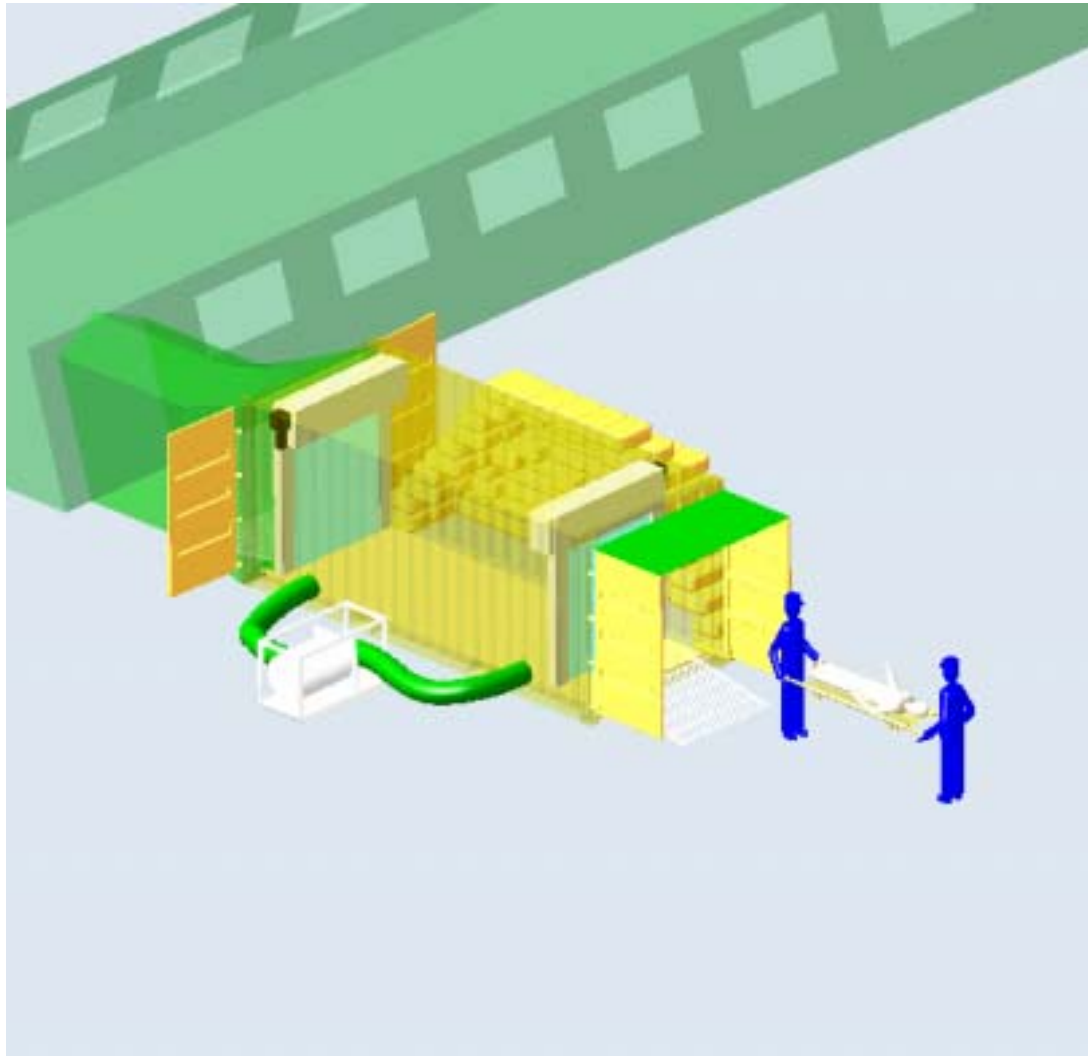


Programmable Automated Doors (Swing or Rise)





MILVAN Airlock Entry Procedures

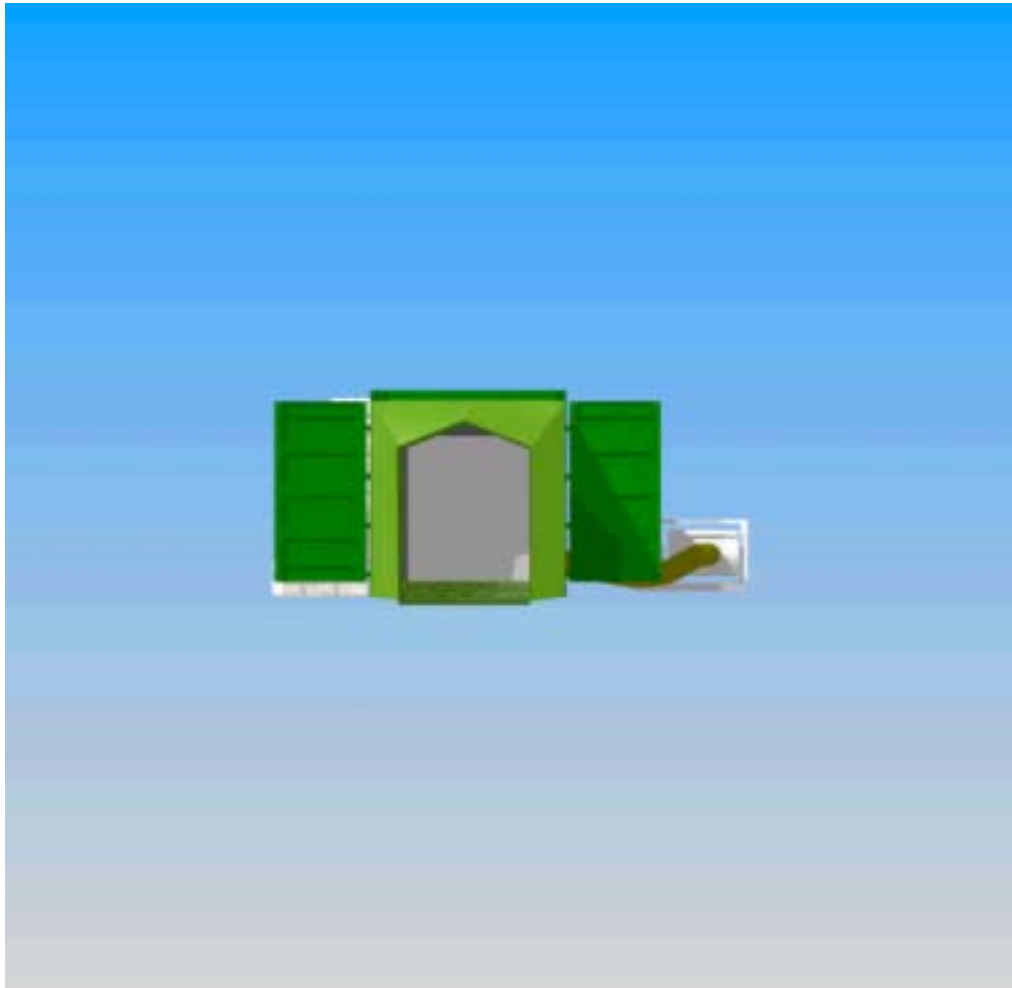


Used For:

- Litter Patient
- Standing Patients/Personnel
- Supplies
- Ballistic Protection



MILVAN Airlock Benefits



COMMENTS

- Can be used as a ballistic shelter during air raids
- Shipped in standard 8.5' Milvan
 - All additional components and system supplies are shipped within the Milvan
- Airlock large enough to serve many ambulatory patients, and/or multiple litter patients
- Able to be used as a supply airlock as well
- Utilizes existing hardware and 'off the shelf' items
- Compatible with many shelter systems



Conclusions...



**Ready to help YOU in your
Solid Modeling & CFD Needs**

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