Mobile Hospitals

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Format of Presentation

- **Historical Background**
- **Concept of Mobile Hospitals**
- **Operational requirements & NDMA guidelines**
- **Advantages & Functional characteristics**
- **Broad types, characteristics & suggested Layout**
- **Planning Considerations**
- **Uses other than in Disasters**
- **Summary**

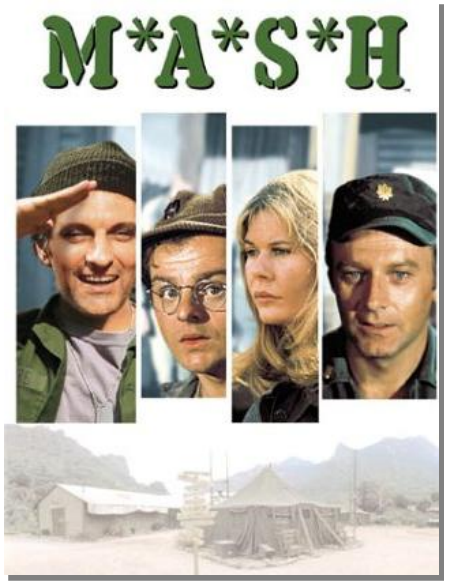
Introduction

- **Mass Casualty Events require immediate medical assistance, often on a massive scale**
- **Local medical infrastructure likely to have been overwhelmed or undermined**
- **Need to move the victims to point of delivery of medical care- difficult & impractical**
- **Alternatively medical care has to be brought to the victims- Mobile Hospital addresses this**

Historical Perspective

- **Portable Surgical Hospital developed in 1942 in US Army**

- **Operational & logistics constraints have imposed weight limitations undermining portability**
  - Lacked much of the anaesthesia equipment required
  - Bed capacity for post op cases
  - Never self sufficient



Historical Perspective (contd)

- **Technological advancements have upgraded the *'portable'* military field hospitals**

- **These mobile field hospital assets have been used by the armed forces when mobilising their resources for medical assistance at mass casualty events and disasters**

Current Perspective of the Concept

- **Concept of Mobile Hospitals for civilian use, is essentially to-**
  - **Bring hospital care-**
    - **Within 24-48 hrs to mass casualty event sites**
    - **To underserved areas**
  - **Meet surge requirement of static hospitals**

Concept of Mobile Hospitals

- **Today technology permits creation of working space, lighting, environmental conditions, with self sufficiency & availability of equipment similar to that available in tertiary care hospitals in Mobile Hospitals for delivery of specialised care at the site of deployment**

Deployment Profile of Mobile Hospitals

- **Worldwide deployment**
- **Extreme conditions of climate**
- **Missing infrastructure**
- **Bad conditions of hygienic**
- **Logistic difficulties**

Operational Requirements for Mobile Hospitals

- **Should be modular systems with short setup time as swift operational availability is paramount**
- **Be self-supporting to operate in areas without electricity & drinking water under extreme climatic conditions**
- **Containers preferably should have the capability to expand to 2 to 3 times its size to accommodate larger medical teams, stores & equipment**
- **Air & water tight locks between the containers & tents must ensure that the operational area remains sterile**
- **Customised layout of components & equipment to be fitted inside including capability to operate in CBRN environment**

Services Provided by Mobile Hospitals

- OPD
- ALS, ATLS
- OT
- ICU
- Post op care
- Inpatient care
- Lab
- Imaging (X-Ray, USG, CT)
- Dental
- Pharmacy
- CSSD
- Piped Medical Gas

- HVAC
- Plumbing for piped water
- Power generation
- Laundry
- Waste disposal
- CBRN
- Water treatment & storage
- Kitchen
- Staff living & sanitation
- Communication
- Telemedicine

NDMA Guidelines on Mobile Hospitals

- **Full fledged containerised mobile hospitals will be acquired & attached with hospitals earmarked by Centre/State at scales based on need assessment**

- **Will be strategically located and attached to designated hospitals**

- **Will be deployed at disaster sites involving Mass Casualty Event & places of large congregations of people to create additional capacity**

Characteristics of Mobile Hospitals Highlighted by NDMA

- **Capable of providing ALS facilities at the incident site**
- **Have OT, X-Ray, CSSD, Lab & acute wards**
- **Can be modified for CBRN management**
- **Self contained logistically in terms of power, waste disposal, food, water, sanitation/hygiene, toilet facility & lifting & lowering facilities**
- **Should have treatment plant & facility for storage of water**
- **Mobile kitchen with provision of seven days ration**
- **To be used for training when not in use & this will enable maintenance**

MoHFW Initiative for Mobile Hospital for Disaster Management

- **Procure one pre-fabricated, self-contained, 100-bedded container based Mobile Hospital which can be transported by rail, road or air to the incident site to provide at the MCE site-**
  - OT
  - ICU
  - Post-op care
  - Water purification
  - Kitchen
  - Sanitary unit
  - Power generation unit

Advantages of Mobile Hospital

- **Rapid Deployment**
- **Working conditions for doctors & nurses similar to civilian hospitals**
- **Able to operate in the difficult conditions of disaster and war**
- **Easy relocation and no ‘sunk’ cost**
- **Easy customisation**

Functional Characteristics of Container & Tents

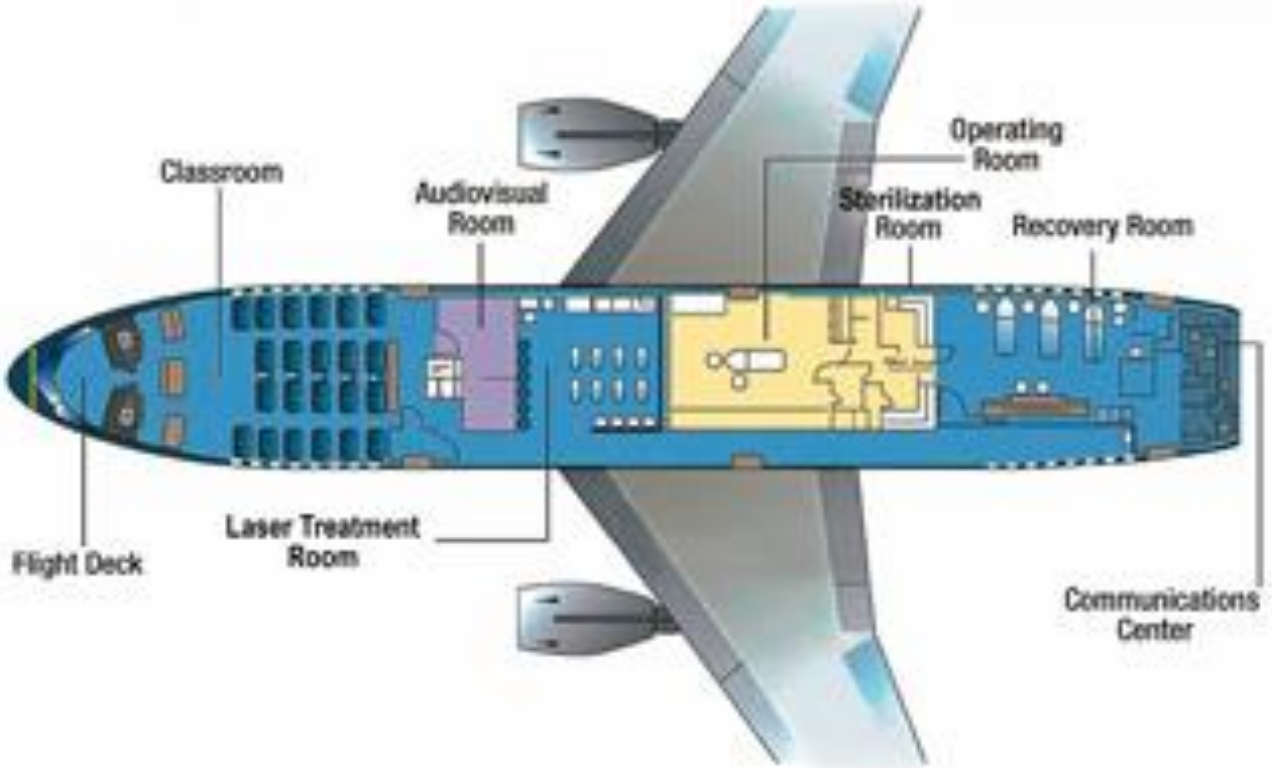
- **Environmental control for functioning under extreme climatic conditions (-10 C to 50 C)**
- **Ventilation units with provision for NBC filtration**
- **All modules are designed for deployment in shortest time using minimum manpower**
- **Rugged & sturdy to withstand repeated & frequent deployments by having long operational life as well as shelf life**

Broad Types of Mobile Hospitals

- **Land based**
- **Hospital Train**
- **Flying hospital**
- **Floating hospital**

Hospital Train: Lifeline Express

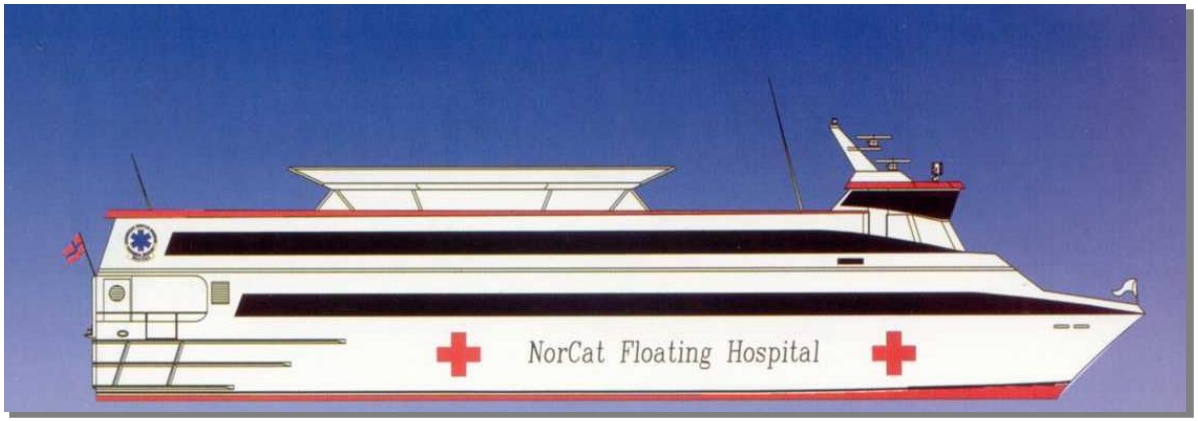
Flying Hospital



ORBIS

saving sight worldwide

Floating Hospitals & Hospital Ships



Mobile Medical Facilities

- **Types-**
  - Mobile Clinics
  - Mobile Diagnostics (Lab, X-Ray, CT Scan)
  - Mobile Surgical Unit
  - Mobile Hospital

- **Based on-**
  - Modern tents / soft shelters
  - Std ISO Containers **20′ x 8′ x 8′** / Hard Shelters
    - Foldable
    - Expandable
  - Combination
  - Fabricated vehicle

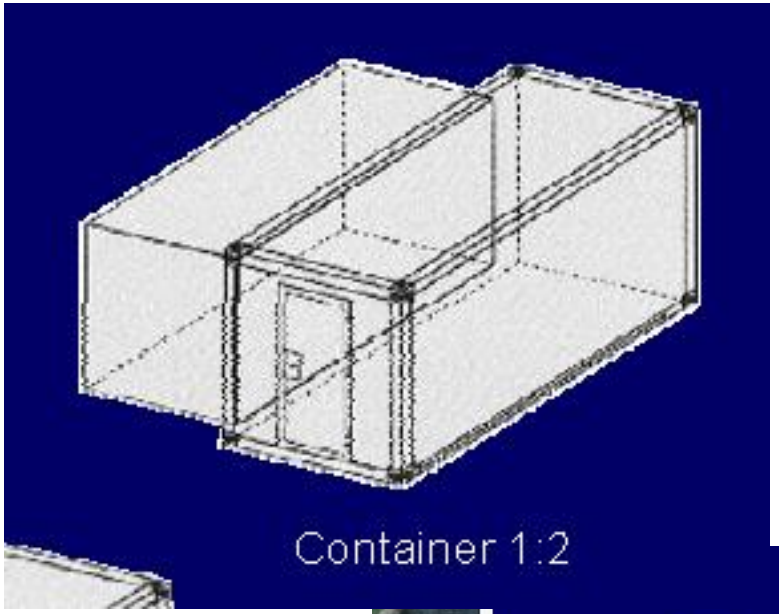
Inflatable Tents

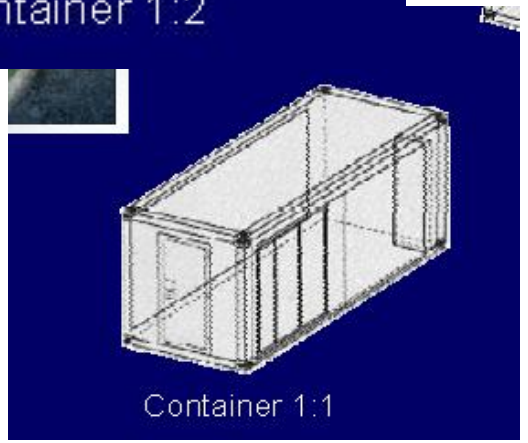
Modern Scalable Modular Shelters

Foldable Containers

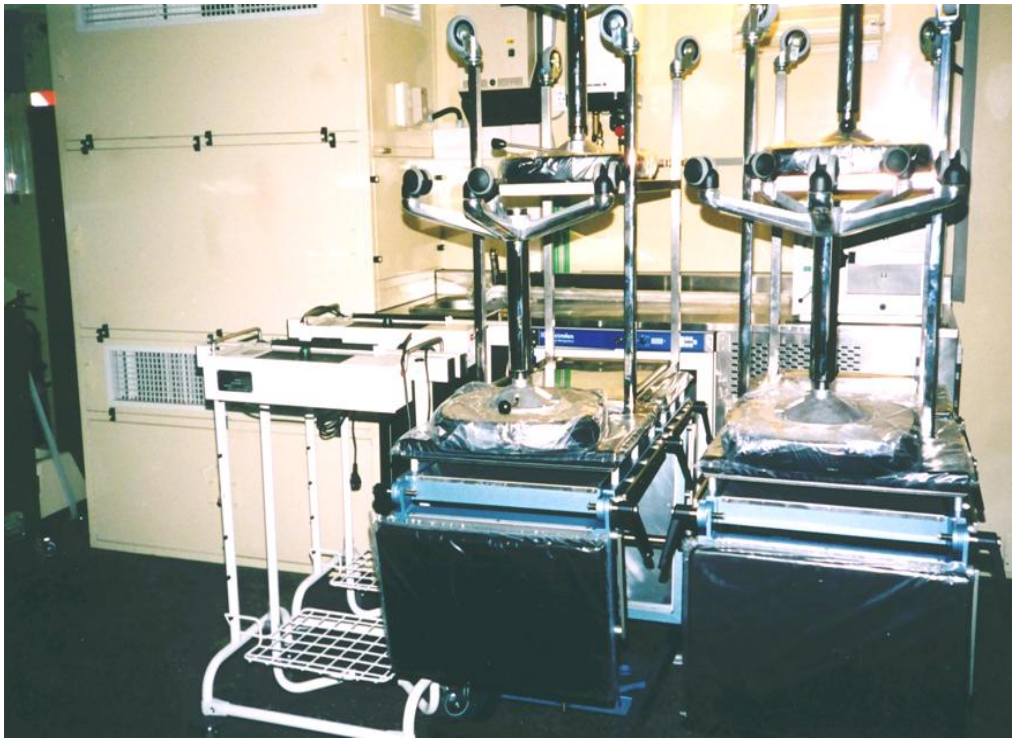
3 in 1 Expandable Container

Configuration of Containers





Transport Position in Containers



- **Most of the equipment is permanently fixed**
- **Special built-in boxes & firm fixing devices for the few non permanently fixed equipment**

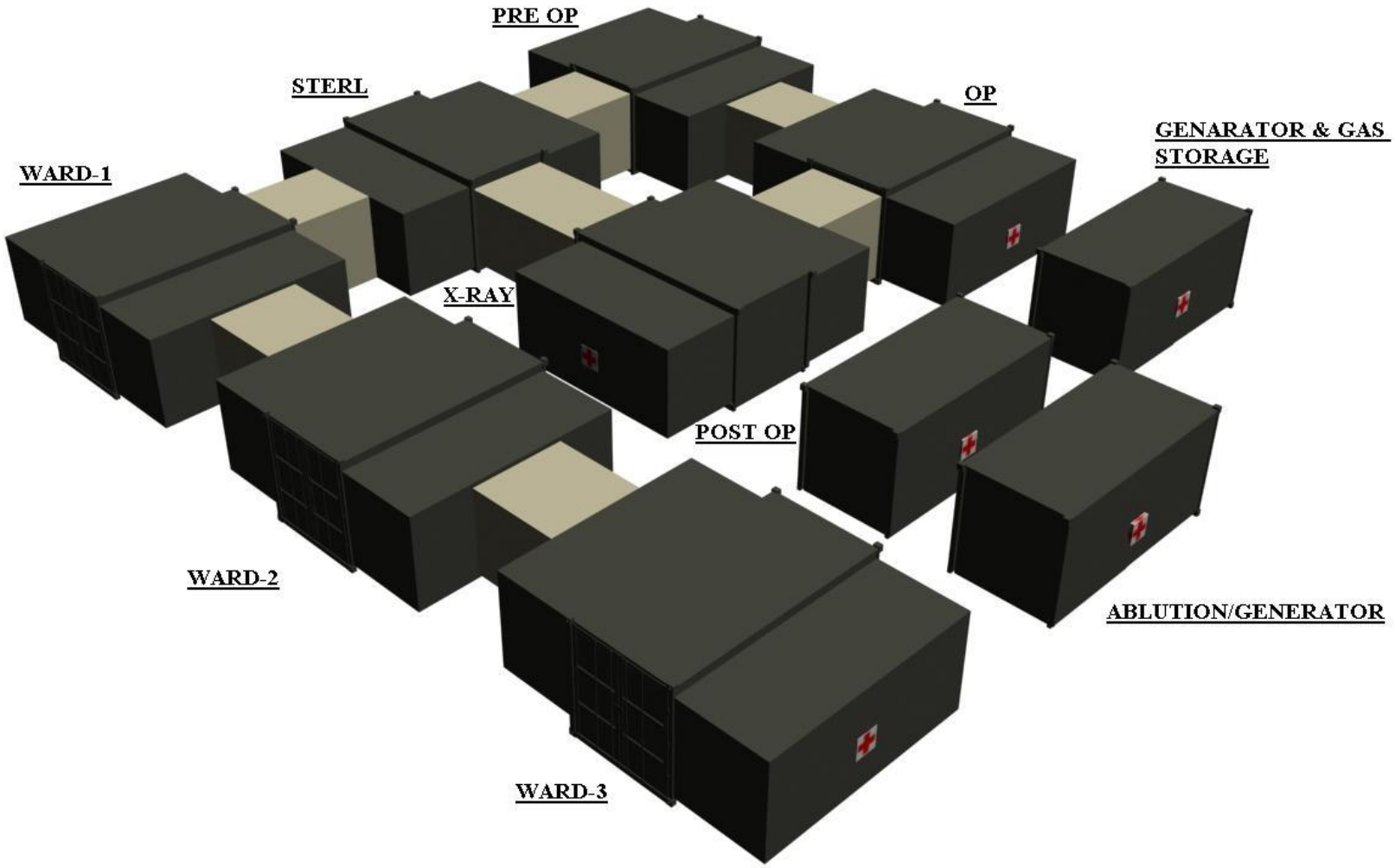
Deployment of Containers

By Hook Lift

By Crane

By Lifting Support

100% Containerized Mobile Hospital



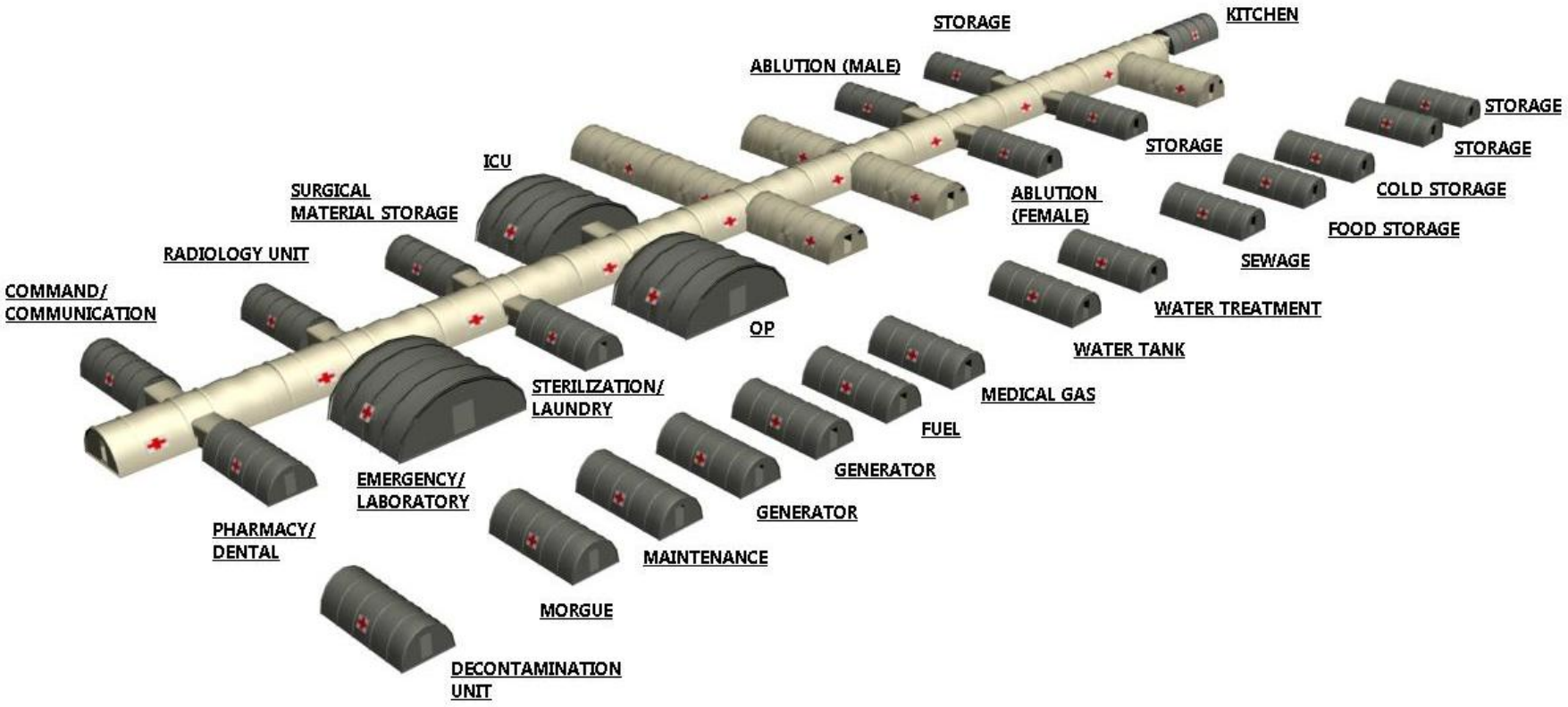
Corridor Tents

Corridor tents are connection tents between containers or between container & tents

100% Containerized Mobile Hospital

- **Application**
  - Hospital has complete mobility
  - Can function in adverse climates of high wind velocity & snowfall
- **Advantage**
  - Quick deployment
  - Equipment & accessories pre-fixed as per requirement
- **Disadvantage**
  - **High capital costs**
  - Specialised lifting & loading requirement
  - Specialised transportaion requirement
  - Require good road
  - Large open space for deployment

100% Tent structure Medical Hospital



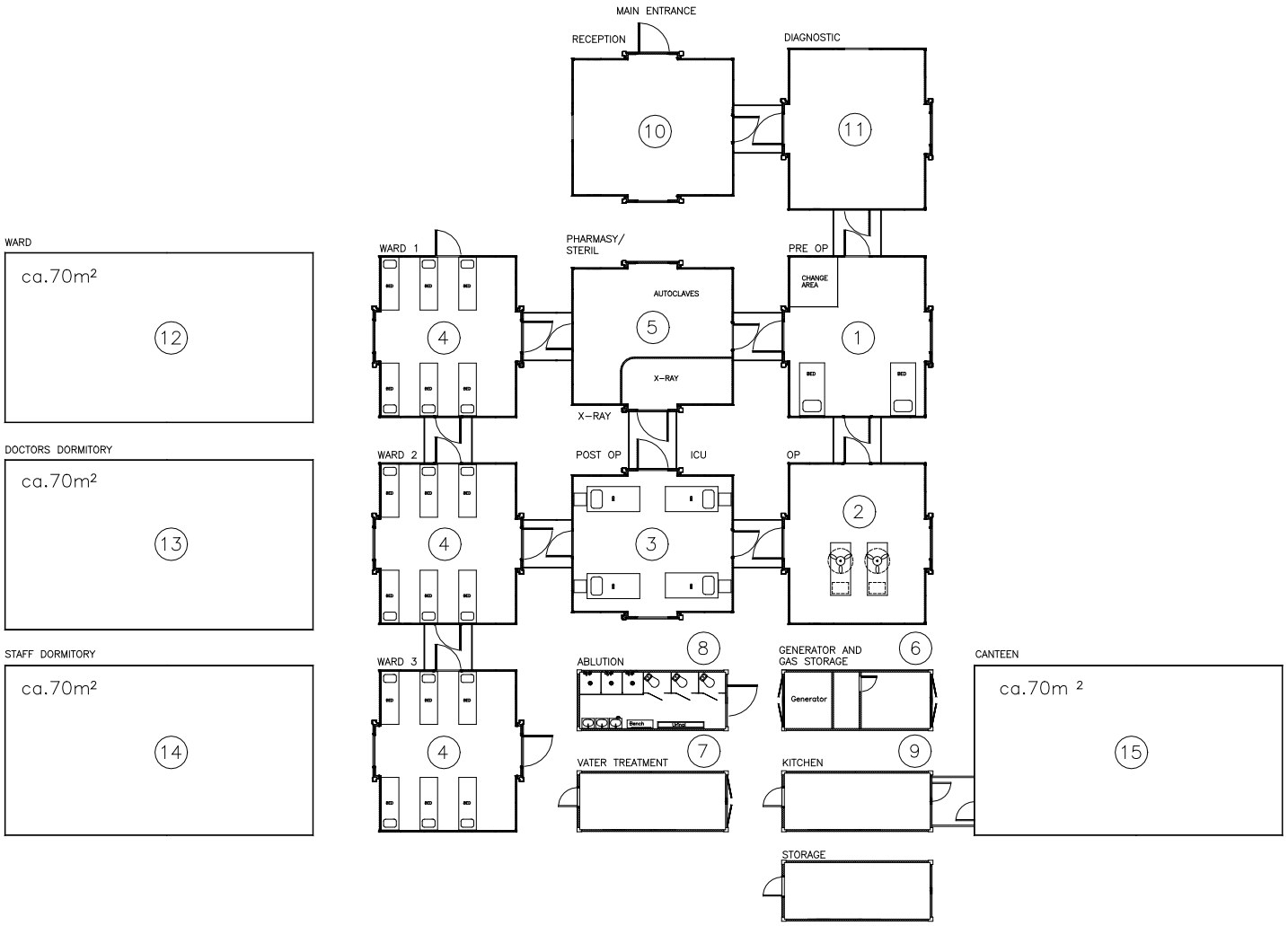
100% Tent Based Mobile Hospital

- **Application**
  - Require smooth terrain & good climatic conditions
- **Advantage**
  - Very cost effective for a small self-sufficient emergency hospital
- **Disadvantages**
  - Installation time is relatively high, as tent system has to be fully set up first & then respective equipments can be set up
  - Need to do installation of all medical equipments in respective positions as per design & needs

100% Tent Based Mobile Hospital (contd)

- **Disadvantages (contd)**
  - Need for installation of all piping systems for inlet & outlet of wash basins in all wards, ICU, OT, sanitary, kitchen etc
  - Need for installation of piping systems for sewage system, water, generator system, accommodation modules, kitchen & Sanitary modules every time it is shifted
  - Damage to equipments, due to repeated installations & transport especially medical equipments
  - During snow or rain or heavy wind– operation cannot be done effectively in tents

Optimized Container & Tent Combination



Optimized Container & Tent Combination

- **Application**
  - Mobility maintained
  - Can operate in all terrain & climatic condition

- **Advantages:**
  - Cost – effective for medium & big emergency hospitals
  - **OT, Lab & special units are containerized– so that all emergency operations will not be disturbed by any environmental conditions**
  - General wards, accommodation will be in tents making it cost-effective & yet comfortable for the inmates

Comparison of Mobile Hospitals

Concept	Mobility	Safety	Cost
100 % Containerized	High	High	Ø Initial Cost High Ø Low Maintenance cost
100% Tents	Restricted	Low	Ø Initial Cost Low Ø High maintenance cost
Optimized design of Containers & Tents	High	High	Ø Initial cost Optimized Ø Low maintenance cost

Each of the 3 concepts may be relevant in a particular situation as each has unique requirements based on the climatic, environmental & situational requirements

OT Container

Ward

Living Accommodation & Office

Dining Hall Container

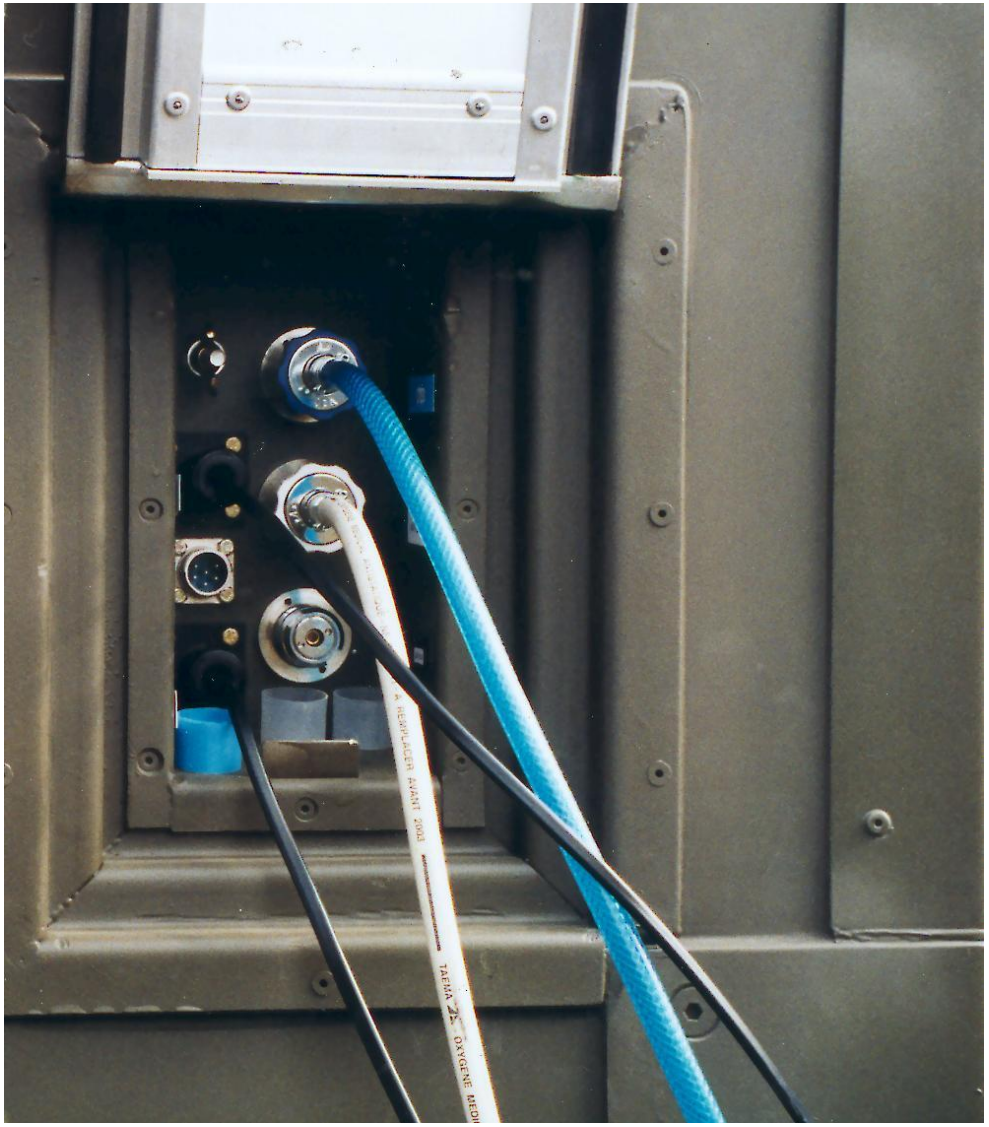
Kitchen Container

Lab Container

Ablution / Sanitary Container

Generator in Container

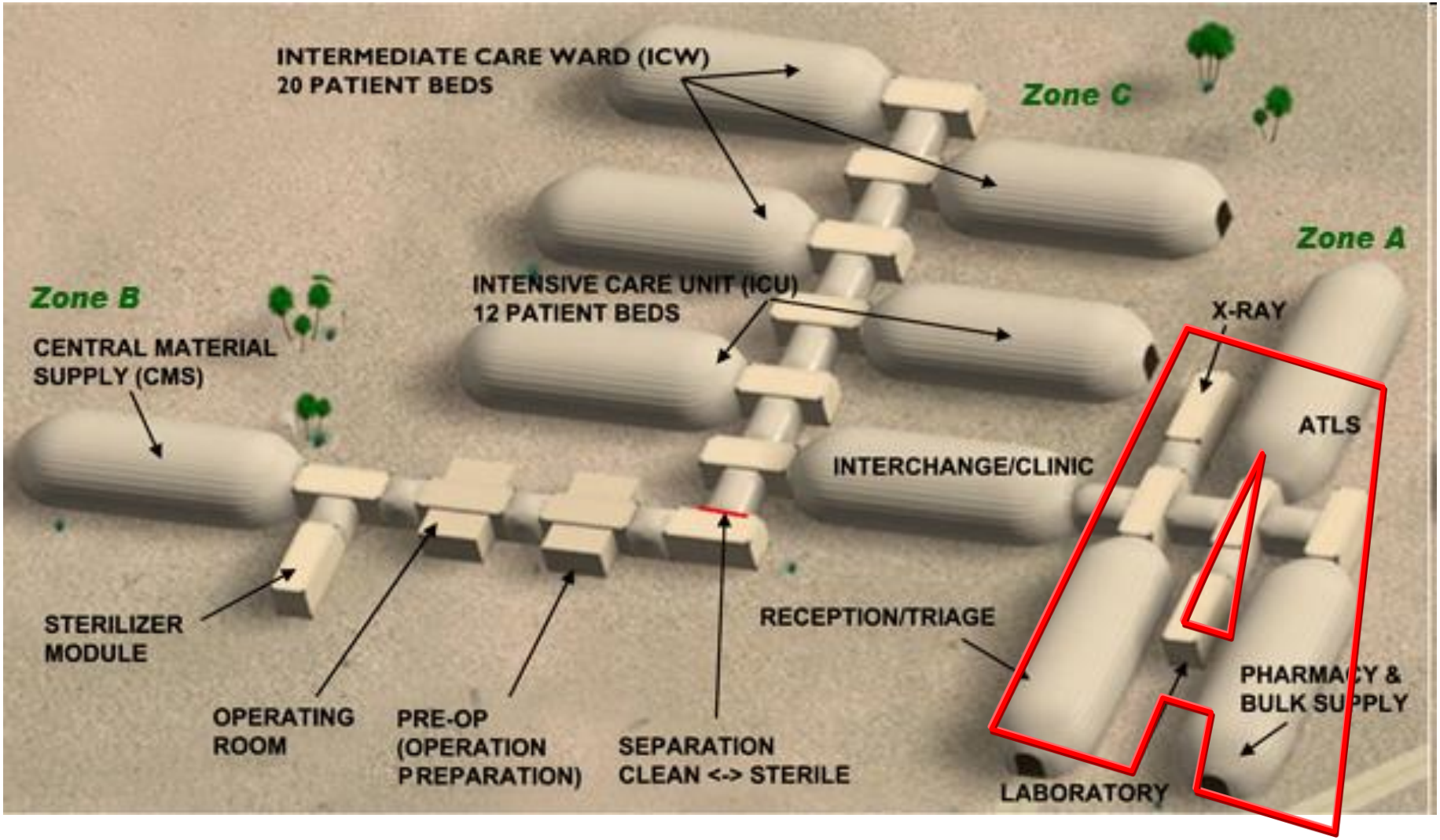
Medical Gas Distribution System



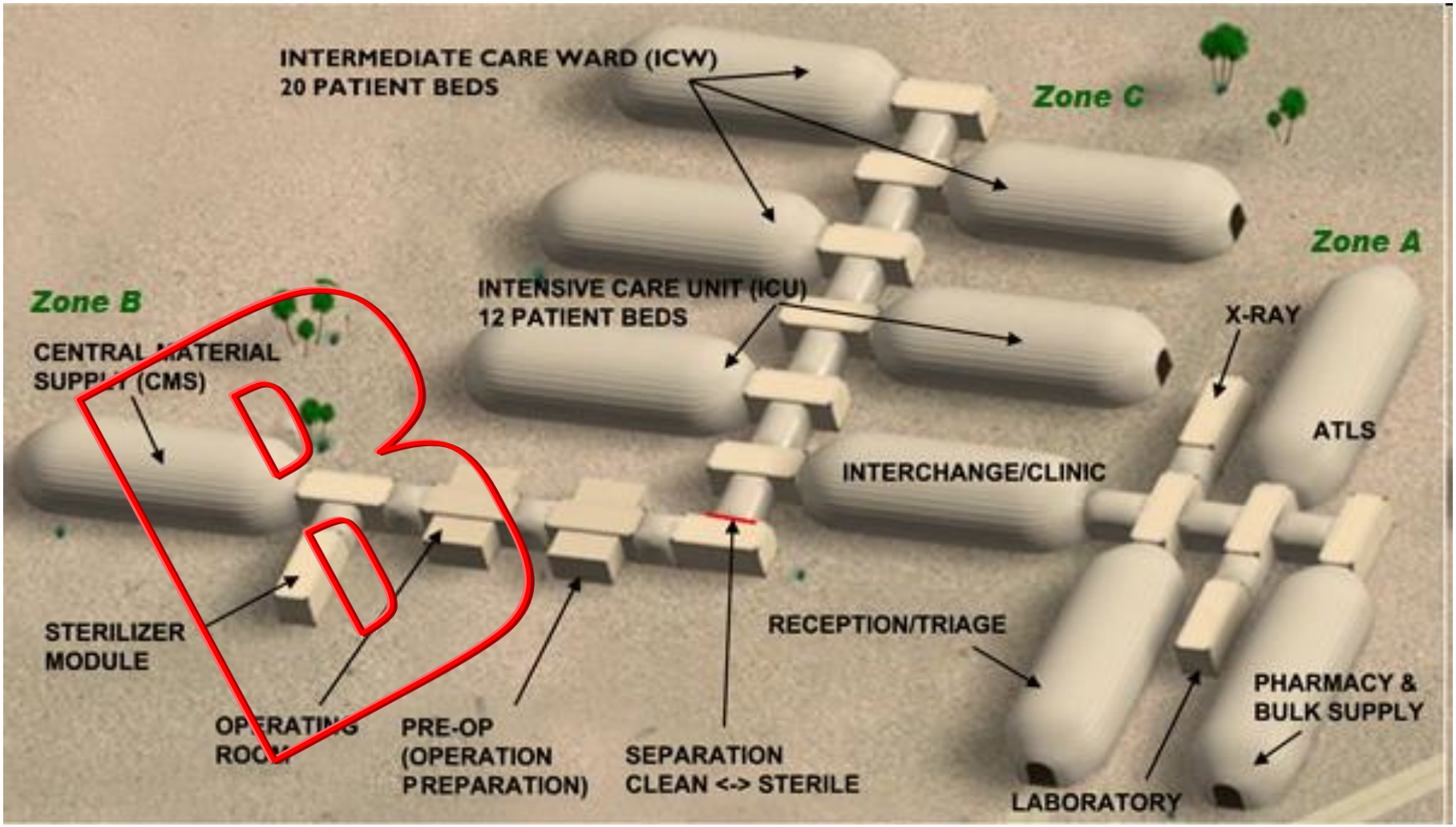
Layout Mobile Hospital

- **Patient Care Complex**
  - OPD Area
  - OT Complex
  - Ward Area
- **Administrative Area**
- **Staff Accommodation**
- **Utilities Area**

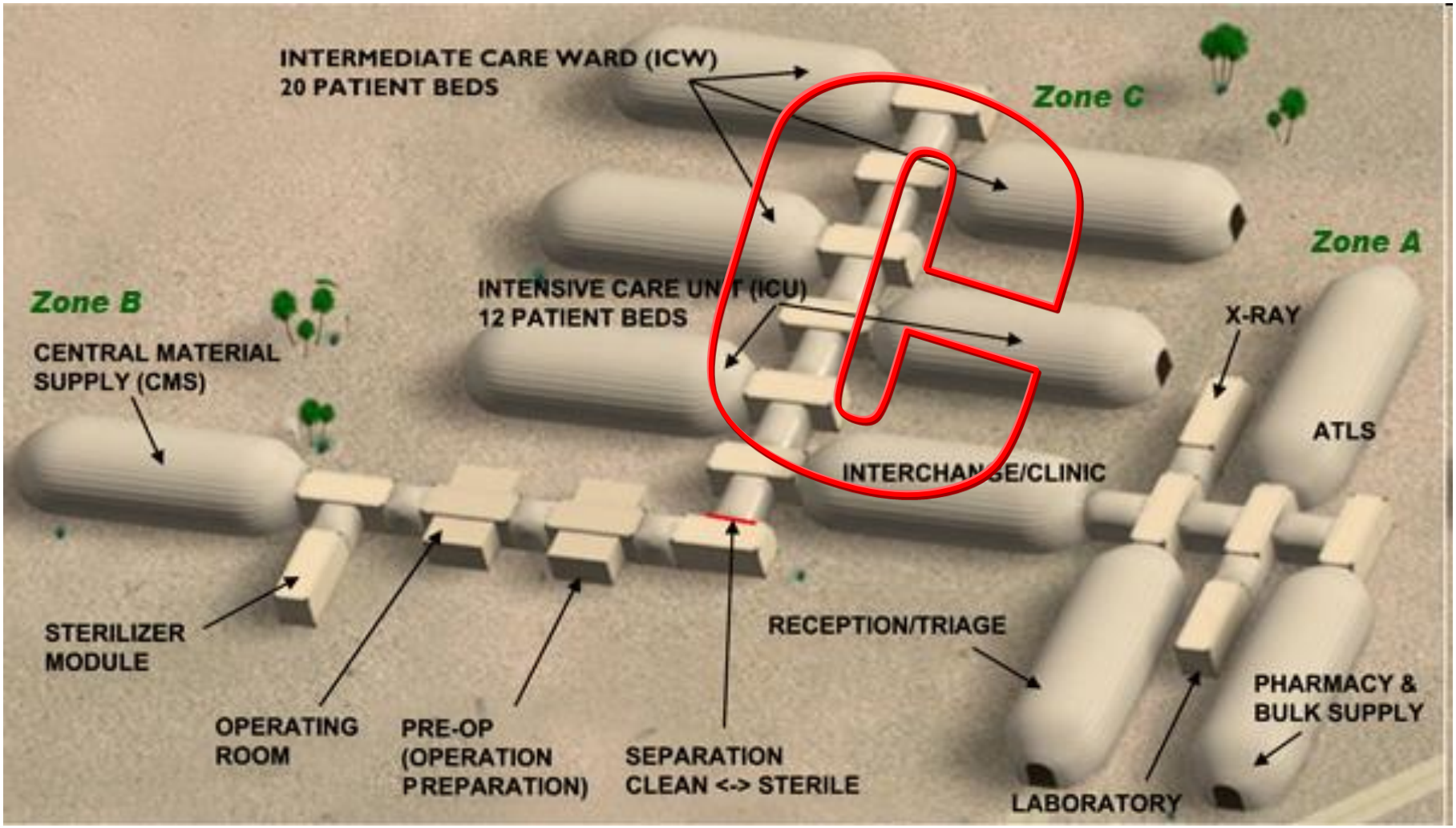
Zone A: Outpatient Area



Zone B: OT Complex

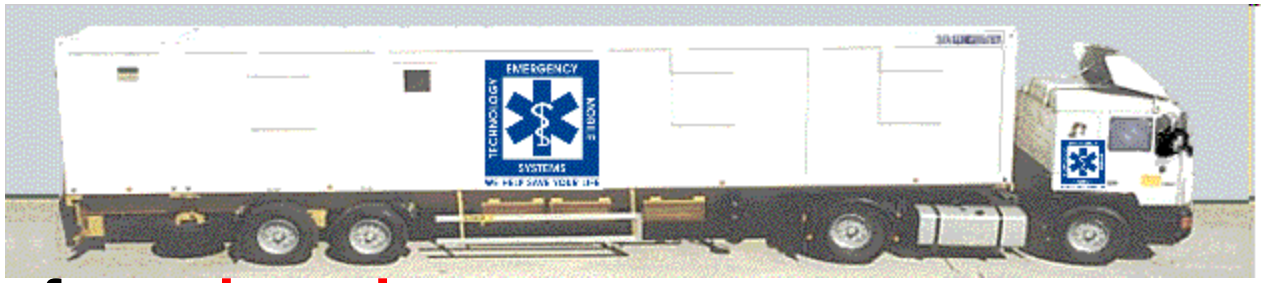


Zone C: Ward Area



Operational Constraints for Mobile Hospitals

- **Requirement of a large level area for setting up. Time for setting up can be anywhere from 2 to 72 hours after arrival**
- **Specialised lifting & loading requirement**
- **Specialised transportation requirement**



- **Requirement of good road**
- **Maintenance of large number of equipment**

Use in Other than Disaster

- **Mobile Field Hospitals can quickly be deployed to augment the surge capacity of hospitals when overwhelmed by casualties**
- **Moved to provide medical care in under-served areas on a rotational basis**
- **Bring down the waiting time of hospitals for diagnostics like USG, CT & Day-care Surgery**

Summary

- **Mobile hospitals essential for preparedness as well as speedy & effective medical response to mass casualty event**
- **A combination of containers & modern tents with customised configuration can provide high level of onsite medical care**
- **Mobile Hospitals can provide OPD, ALS, ICU, OT, post-op care, diagnostic, imaging, CSSD, piped medical gas, HVAC, waste disposal, laundry, kitchen & staff living facilities**
- **Operational constraints can be overcome with sound planning**
- **Training of assigned team to function as staff is important**
- **Comprehensive procurement proposal must be based on local parameters**
- **Mobile hospitals have use other than during disasters**

Thank You