

**65th International Congress of Aviation and
Space Medicine
Rome, 10-14 September 2017**



Aeromedical Evacuation of Patients with Highly Infectious Disease in Italy: Lessons Learned

*Évacuation aéromédique des patients avec
une maladie hautement infectieuse en Italie:
leçons apprises*



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Italian Air Force. Logistic Command – Medical Service

Overview

- Background
- Principle of isolation on aircraft
 - Aircraft Transit Isolator System
- Aeromedical Isolation Unit
- Operational challenges
- Operational experience
- Lessons learned

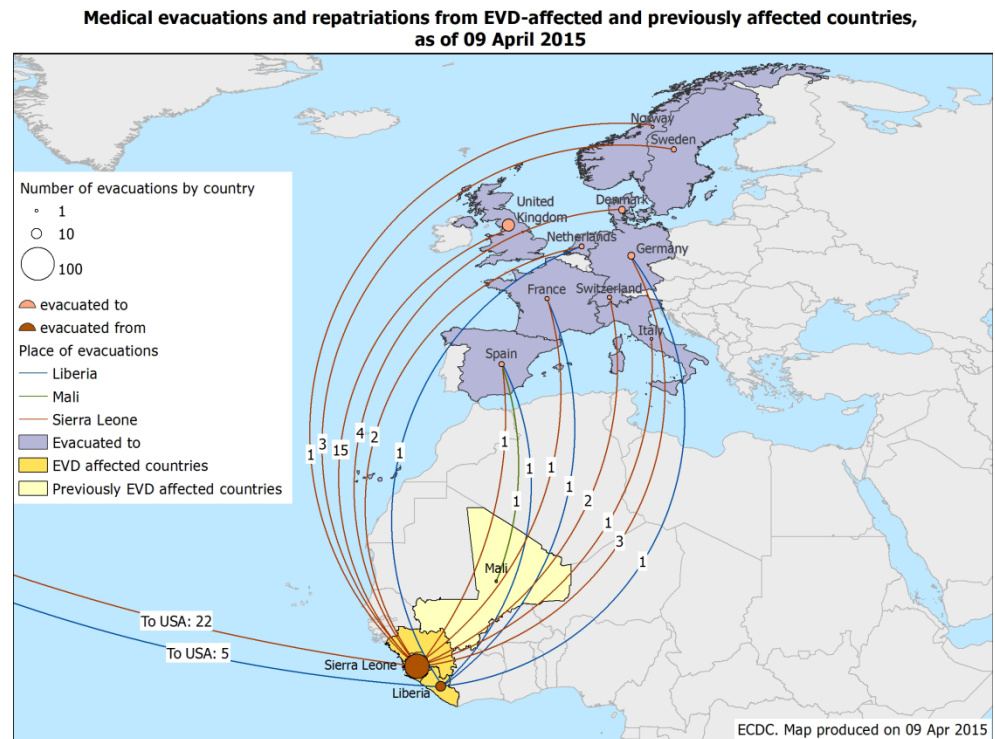
Background:

EVD and Aeromedical Evacuation

- The outbreak of Ebola Virus Disease (EVD) in West Africa has highlighted questions related to the evacuation of patients with highly infectious diseases (HIDs)

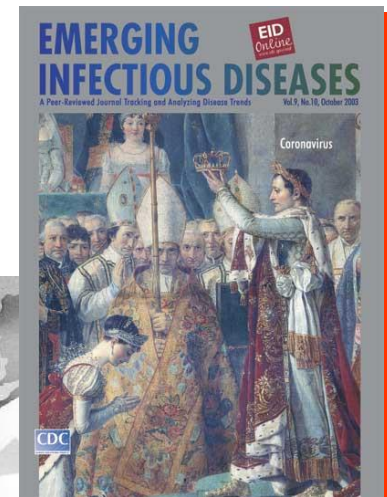
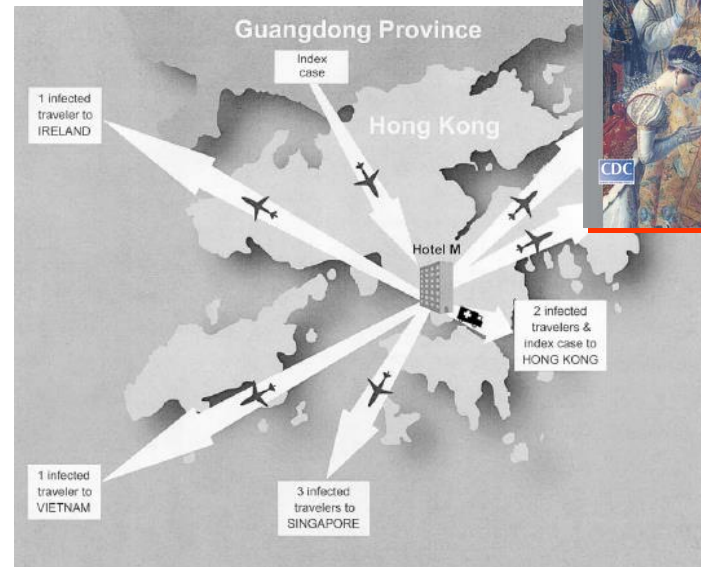
Medical evacuations from EVD-affected countries

- Total : 65
- Europe: 38
- USA : 27



AE of patients with highly infectious disease

- Usually an absolute contraindication for AE
 - Teichman et al. (N Engl J Med 2007;356:262-270)
 - AAMedP-1.1 (STANAG 3204)
- Risks
 - Spreading the disease
 - In flight transmission



AE of patients with highly infectious disease

DECISION MAKING



- Treatment in place
 - Policy most frequently in use
- Dedicated flight
 - Low risk of transmission, window of non-communicability
 - <http://www.cdc.gov/ncidod/sars/guidance/I/index.htm>
- Isolation systems
 - Exceptional circumstances (VHF)
 - Absence of local medical support
 - Limited number of patients
 - Proper mode of isolation: closed vs open isolation

Isolation on aircraft

Open Isolation

- The patient and medical staff inside a mobile isolation unit (e.g. tent, container, ambulance), HEPA and negative pressure
- Medical staff protected by PPE
- Enhanced monitoring and treatment interventions
- Highly complex logistics



Closed Isolation

- The patient is placed inside a physical containment: an isolation stretcher (HEPA + negative pressure)
- Medical staff outside without PPE
- Integrated gloves allow some basic patient handling from outside
- Easy to implement



The Aircraft Transit Isolator System

- The Italian Air Force employs the ATI System. Developed by Vickers in the U.K. in the 1970s
- Program development began in 2005
- Two isolators (modular system):
 - **STI - Stretcher Transit Isolator** : for ambulance
 - **ATI - Aircraft Transit Isolator**: for aircraft
- Sealed containers in PVC under negative pressure maintained by a battery-powered HEPA-filtered ventilation system



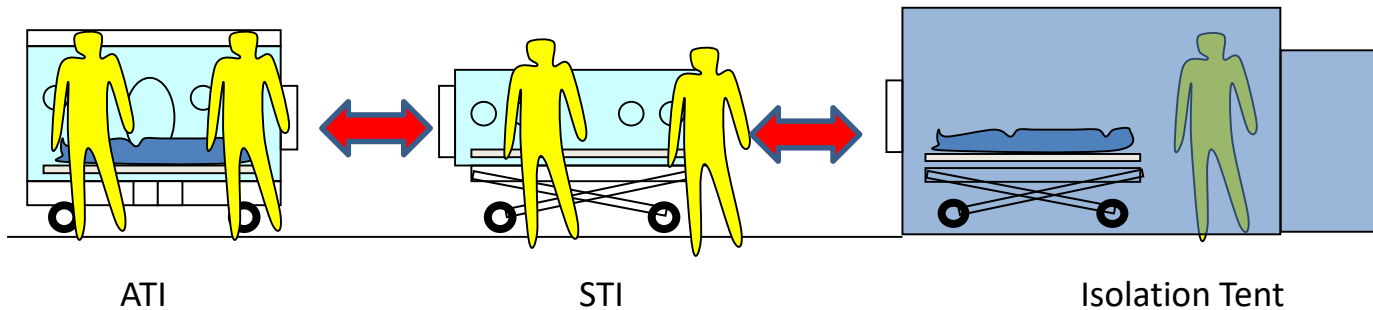
Aircraft Transit Isolator (ATI)



Stretcher Transit Isolator (STI)

The Aircraft Transit Isolator System

- Already in use
 - Aeromedical Isolation Team (US Army), Deployable Aeromedical Response Teams (RAF)
- Easy to implement
- Many monitoring and treatment interventions allowed (i.e. intubation, ventilation, fluids)
- Suitable for different aircraft (C-130J, C-27J, KC-767)
- Modular system: implemented with isolation tent for stand-by care (continuity of care)



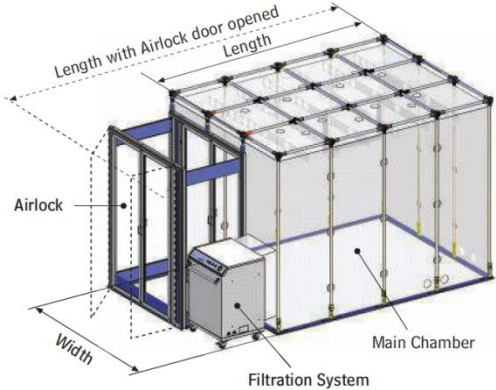
Isolation Systems



Aircraft Transit Isolator (ATI)



Stretcher Transit Isolator (STI)



Isoark Tent



Isoark N-36

The Aircraft Transit Isolator System Procedures

- Patient reception and isolation (ATI or STI)
- Patient transferring (ATI ↔ STI)
- In-flight patient care (monitoring and treatment)



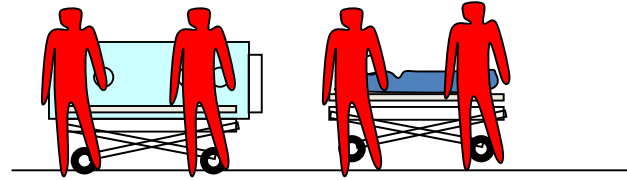
Aircraft Transit Isolator (ATI)



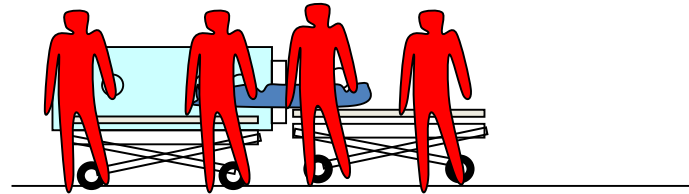
Stretcher Transit Isolator (STI)

Patient reception and isolation (ATI or STI)

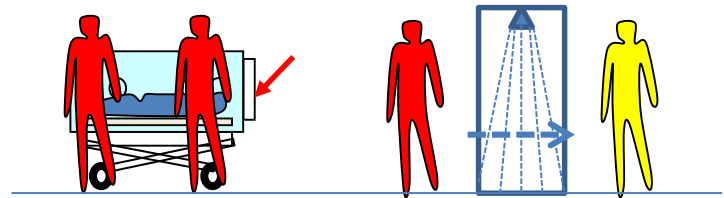
Personnel with PPE
Patient assessment and stabilization



Introduction into the isolator

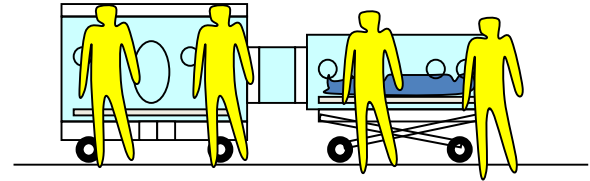


Panel fitting and securing
Staff decontamination and PPE doffing

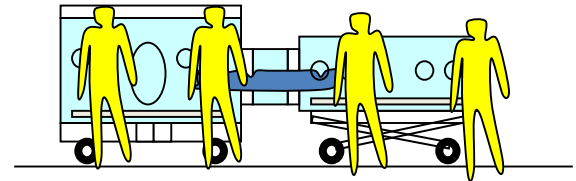


Patient transferring (ATI ↔ STI)

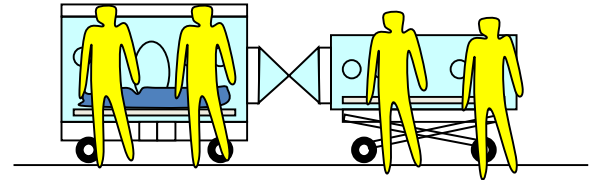
Personnel with or without PPE
Connection with a transfer sleeve
Panel removed from the inside



Transfer of the patient



Clamping and cutting
Without breaking the microbiological barrier



Transferring the isolated patient



Patient care – Nursing facilities



Half suit for patient intubation and airways management to be placed at the entry port

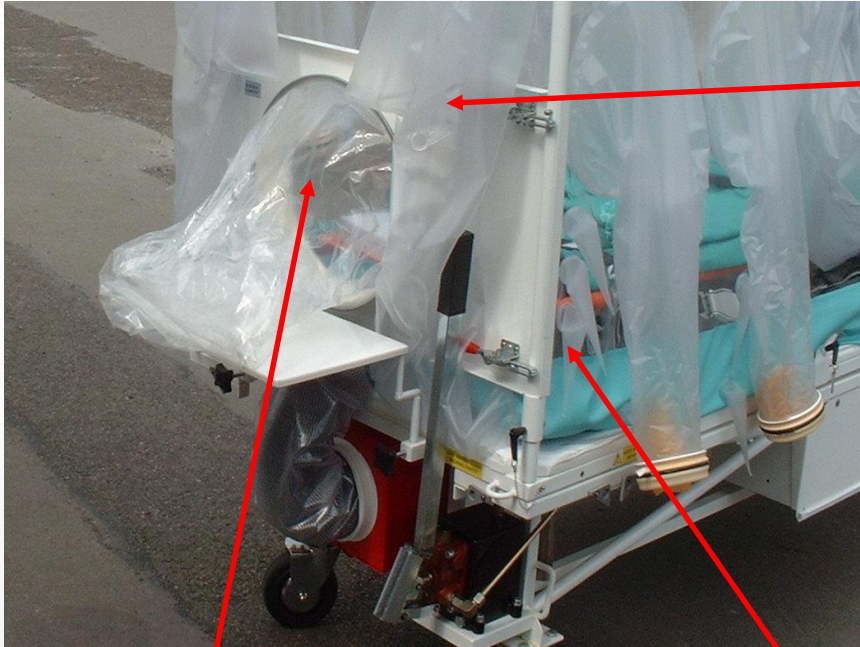
Materials required for patient care stored inside: absorbent pads, emesis basins, portable toilet, etc.

Two half suits for use if the freedom of movement within the sleeves is insufficient

Four pairs of gloved sleeves



Patient care – Nursing facilities



A supply port to bring supplies into the isolators using the double bag system

Various sealed cones which may be utilized to pass tubing and wires

Two long closed sleeves which are available for storage of waste material



Patient with suspect CC-HF intubated and ventilated during an AE in 2007



ATI Flight Certification Issues

- Whenever a certain modification is needed
 - **Military Operational Certification**
- Examples of certification issues:
 - ATI boarding (high loader on KC-767)
 - Restraint device and fastening
 - Power supply, EMC interference
 - Vibration, weight
 - Emergency egress procedures





C-130 J set-up

KC-767 set-up



The Aeromedical Isolation Unit



The Aeromedical Isolation Unit

- Pratica di Mare AFB Medical Wing
 - Provides Aeromedical Evacuation Support
 - Rapid response within 8 hrs
- Isolation devices
 - ATI (2 operational), STI, Isoark N-36, Isoark tent
- Operators
 - Medical Doctors (Flight Surgeons, Anesthetist, Infectious Disease specialist)
 - Flight nurses
 - Technicians (ATI Maintenance)
- Aircraft certified
 - FW: KC-767, C-130 J, C-27 J
 - RW: HH-139, HH-212

Training

- Training requirements
 - Initial course on medical management of HID patients in flight
 - Periodical Training (at least twice a year)
 - Other courses
 - Joint Forces CBRN Defence School (Italy)
 - MMCBC Course at USAMRIID (US)
- Joint activity with Ministry of Health
 - Reference HIU Spallanzani Hospital (Rome), Sacco Hospital (Milan)
- Topics
 - Patient care during transport, infection control practices, PPE (selection, donning, doffing, use), decontamination

OPERATIONAL CHALLENGES

MEDEVAC vs Bio-MEDEVAC

MEDICAL

Personnel
Training
Medical equipment
Patient management

AVIATION

Flight plan
Equipment Certification
Disinfection of aircraft

ORGANIZATIONAL

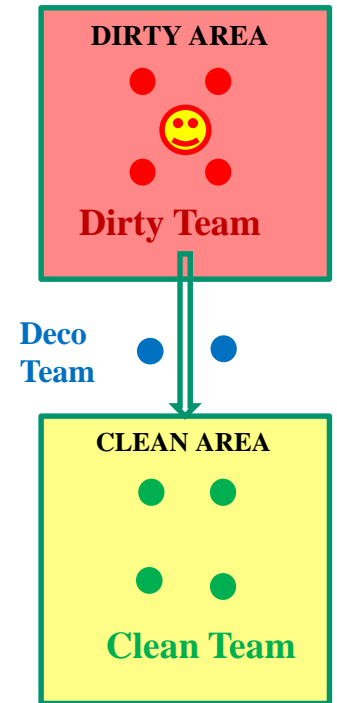
Responsibilities
Coordination

Operational Challenges

- Coordination
 - With sending/receiving facilities
- Flight planning according to IHR
 - Diplomatic clearance, diversion, in-flight emergency procedures
- Patient assessment (pre-mission)
 - Medical → contraindication to flight
 - Infectious risk (mode of transmission) → isolation precautions, PPE
- Equipment
 - Medical: electrical devices, drugs
 - Isolation: isolator + spare parts, PPE, decontamination systems etc
 - Waste disposal

Operational Challenges

- Field operations
 - Area set-up (clean / dirty area)
 - Patient evaluation and stabilization
 - Isolation procedures (onload, offload)
 - Decontamination and waste disposal
- In-flight care
- Patient hand-off
- Post mission
 - Modules sealed and transported for decon, disassembly, disposal
 - Disposable contents removed and incinerated
 - Usually aircraft decontamination not required



WIND



Operational experience



Operational experience

- 2006
 - 1. AE TBC Sardinia
- 2007
 - 2. AE suspect CCHF Torino
 - 3. AE TBC Sardinia
- 2009
 - 4. AE dengue Torino
- 2010
 - 5. AE TBC Sicily
- 2011
 - 6. AE TBC Sicily
- 2014
 - 7. AE suspect monkeypox Sicily
 - 8. AE EVD Sierra Leone
- 2015
 - 9. AE EVD Sardinia
 - 10. AE TBC Sardinia
 - 11. AE Suspect VHF Pantelleria



Operational experience

- Missions: 11
- Isolator: ATI (11)
- Range: 10 in Italy (8 from islands), 1 from Sierra Leone
- Aircraft: C-130 J (10), KC-767 (1)
- Receiving facilities: Spallanzani Hospital (Rome)
- Disease: EVD (2), TBC-MDR (5), suspect HF (3), suspect monkeypox (1)
- All missions succesfull, no incidents



Lessons learned - 1

- AE of patients with HIDs in an effective and safe manner is a challenge requiring a strong background in preparedness, including logistics, procedures and skills
- BIO-MEDEVAC vs AEROMEDEVAC more complex for infection control procedures (isolation, people involved, use of PPE & decontamination)
- AE capability achieved on short (helicopter, C-27) medium (C-130 J) and long range (KC-767)
- ATI in our experience was effective for in-flight patient management
- Easy aircraft recovery, no need for decontamination procedures

Lessons learned - 2

- Transport must be coordinated with public health and civil aviation authorities
- Value of collaboration with Ministry of Health already employed in the past with joint training and evacuation of other patients
- Limitations
 - Elevated number of patients
 - High level of care to critical patient for long flight
- Our ten years experience showed the added value of long-lasting preparedness for the management of a patient with high risk infectious diseases

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Grazie !



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