

# Air evacuation of patient with high infectious disease under biosafety containment



**Lt. Col Marco Lastilla** Italian Air Force - Medical Corps

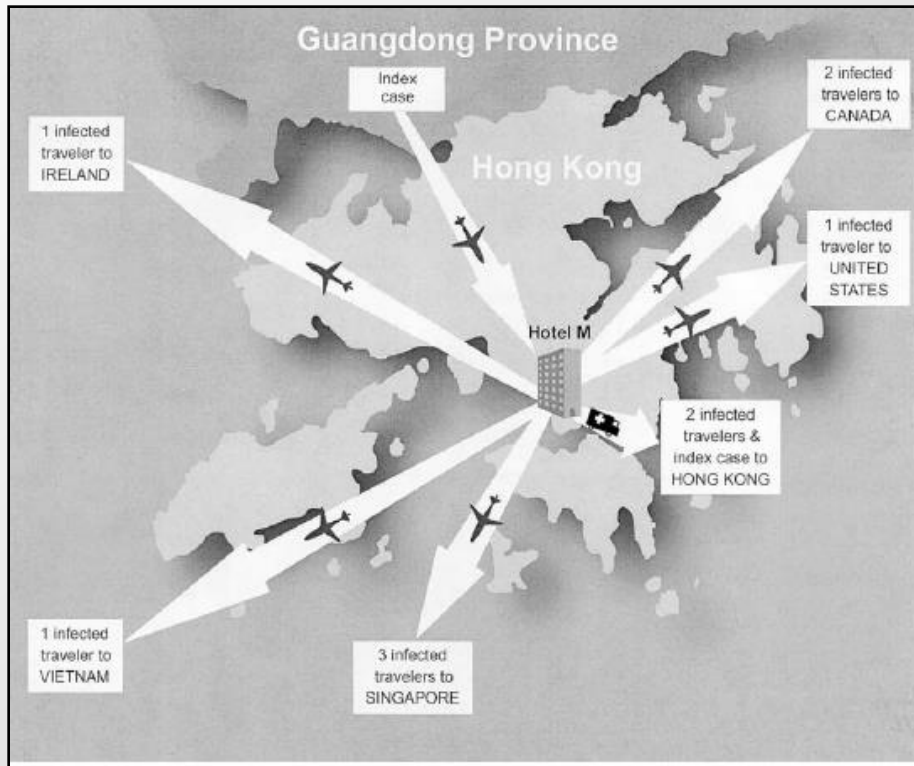
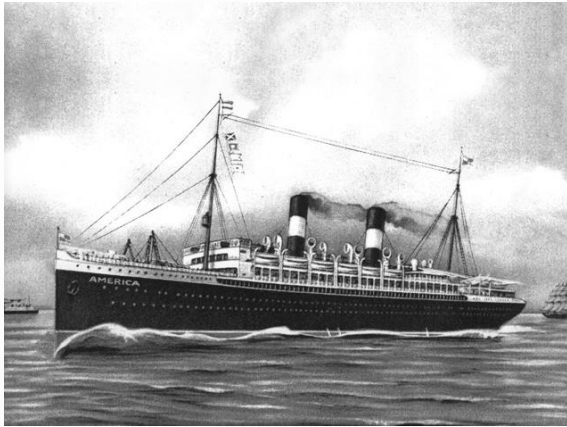




# NEMICI INVISIBILI

COME LE MALATTIE HANNO CAMBIATO LA STORIA





***Yersinia pestis***

**1350**

**1348**

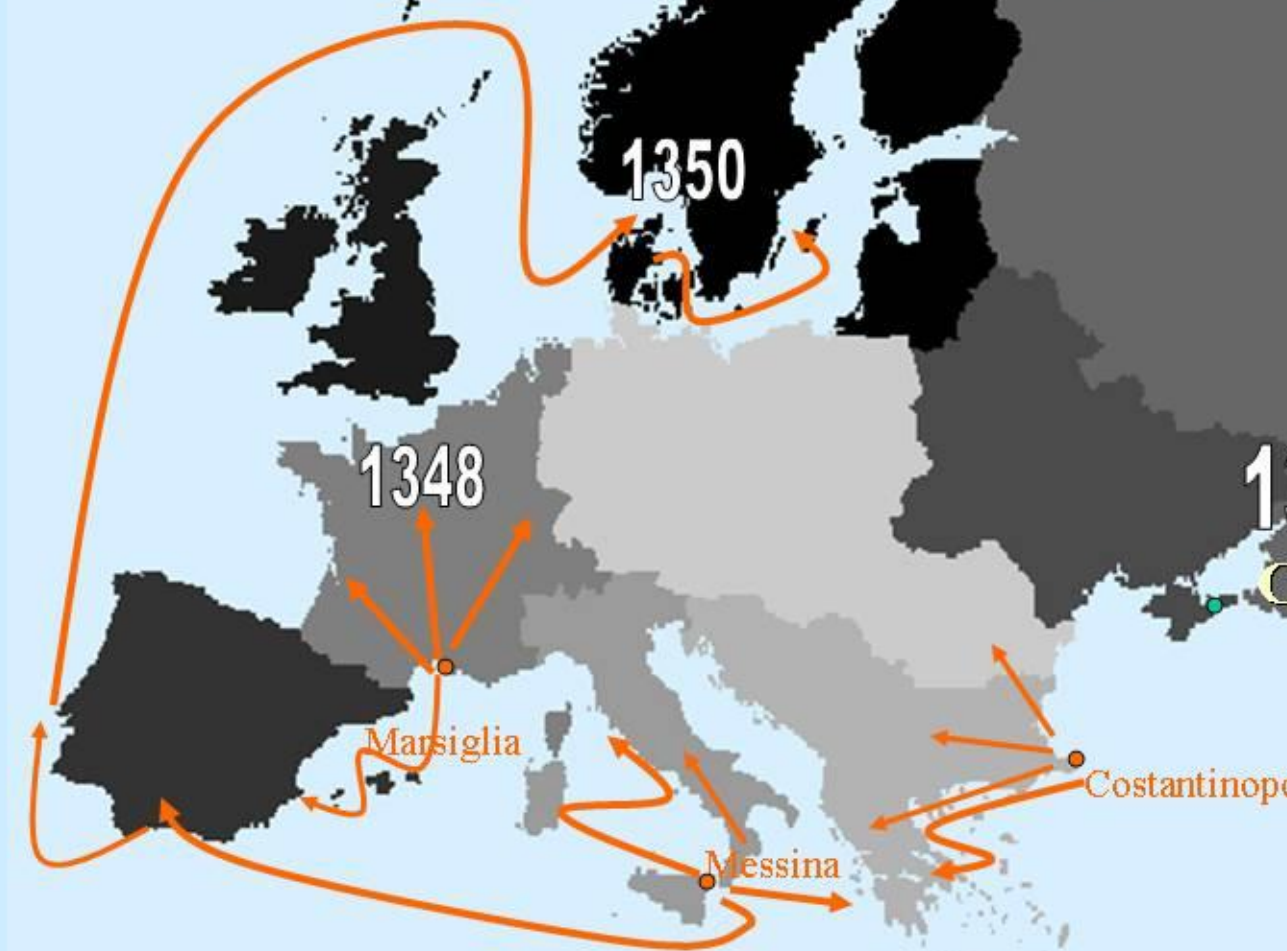
**1347**

**Caffa**

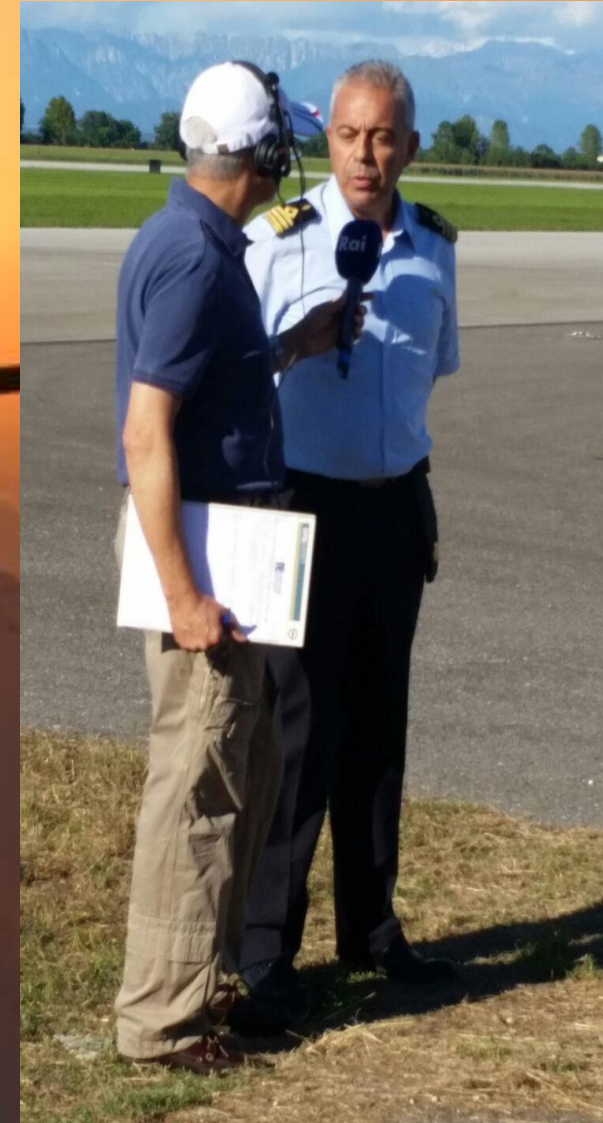
Marsiglia

Costantinopoli

Messina





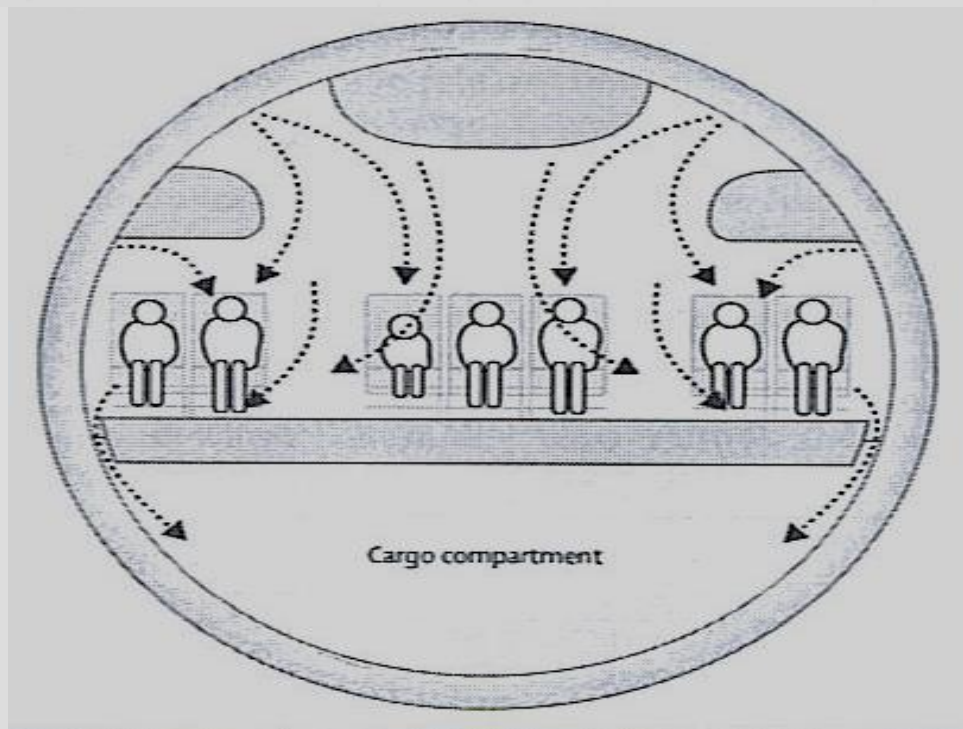


Exposure to possible risk of  
contracting a Highly Infectious Disease

# Transmission of infectious diseases during commercial air travel

Alexandra Mangili, Mark A Gendreau

Because of the increasing ease and affordability of air travel and mobility of people, airborne, food-borne, vector-borne, and zoonotic infectious diseases transmitted during commercial air travel are an important public health issue. Heightened fear of bioterrorism agents has caused health officials to re-examine the potential of these agents to be spread by air travel. The severe acute respiratory syndrome outbreak of 2002 showed how air travel can have an important role in the rapid spread of newly emerging infections and could potentially even start pandemics. In addition to the flight crew, public health officials and health care professionals have an important role in the management of infectious diseases transmitted on airlines and should be familiar with guidelines provided by local and international authorities.



	Number of reports	Comments
<b>Airborne/fomites</b>		
TB <sup>75,29,329-47</sup>	2	Positive TB skin test only. No active TB.
SARS <sup>17,46-48</sup>	4	No cases since WHO guidelines.
Common cold <sup>36</sup>	0	Difficult to investigate.
Influenza <sup>75,37,38</sup>	2	None since ventilation regulations.
Meningococcal disease <sup>34</sup>	0	21 reports of ill passengers, no secondary cases
Measles <sup>38,42</sup>	3	Imported cases and international adoptions
<b>Food-borne</b>		
Salmonellosis <sup>43,44</sup>	15	No recent outbreaks
Staphylococcus food poisoning <sup>45,46</sup>	8	No recent outbreaks
Shigellosis <sup>49</sup>	3	No recent outbreaks
Cholera <sup>51,52,58</sup>	3	During cholera epidemic
Viral enteritis <sup>46</sup>	1	Common on other types of transport
<b>Vector-borne</b>		
Malaria <sup>51,59</sup>	7	Probably underestimated
Dengue <sup>70</sup>	1	Likely to be airport, not aircraft, transmission
Yellow fever	0	No outbreaks since disinsection of aircraft
<b>Bioterrorism agents</b>		
Smallpox <sup>5,26,77</sup>	1	Before eradication

Table: Reported infections transmitted on commercial airlines





# DEDICATED FLIGHT

Evacuation of close contact, high risk contact,  
low risk suspect case

- Flight with aeromedical crew
- PPE
- Patient in isolated area of the aircraft with bathroom
- Patient with mask
- Disinfection and decontamination procedures of the aircraft

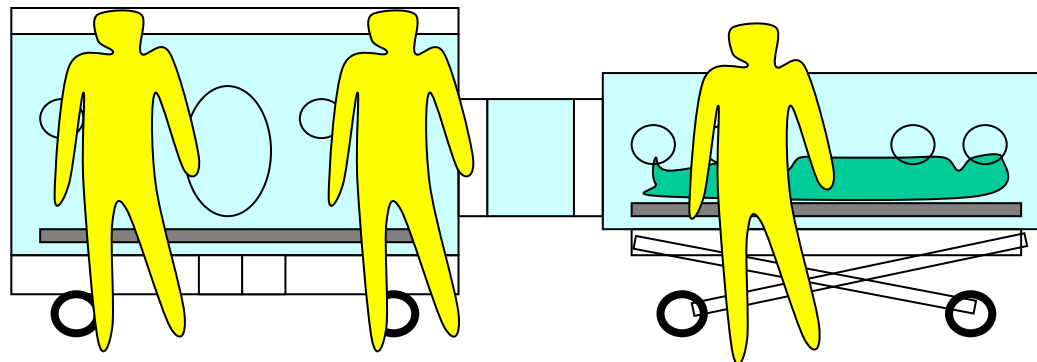




# The Aeromedical Isolation Team



A rapid response team who can deploy to any area of the world to transport and provide medical care with isolators to a limited number of patients exposed to, or infected with, highly infectious, potentially lethal pathogens.



## Air Evacuation under High-Level Biosafety Containment: The Aeromedical Isolation Team<sup>1</sup>

**George W. Christopher and Edward M. Eitzen, Jr.**

**U.S. Army Medical Research Institute of Infectious Diseases,  
Fort Detrick, Maryland, USA**

Military contingency operations in tropical environments and potential use of biological weapons by adversaries may place troops at risk for potentially lethal contagious infections (e.g., viral hemorrhagic fevers, plague, and zoonotic poxvirus infections). Diagnosis and treatment of such infections would be expedited by evacuating a limited number of patients to a facility with containment laboratories. To safely evacuate such patients by military aircraft and minimize the risk for transmission to air crews, caregivers, and civilians, the U.S. Army Medical Research Institute of Infectious Diseases maintains an aeromedical isolation team. This rapid response team, which has worldwide airlift capability designed to evacuate and manage patients under high-level containment, also offers a portable containment laboratory, limited environmental decontamination, and specialized consultative expertise.

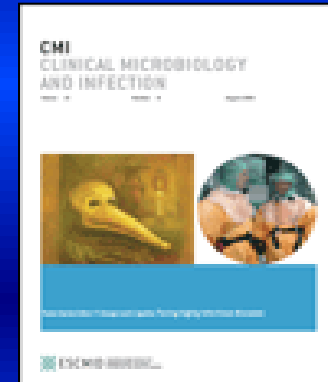


# ***European concepts for the domestic transport of highly infectious patients***

*S. Schilling* <sup>1</sup> , *P. Follin* <sup>2</sup> , *B. Jarhall* <sup>3</sup> , *A. Tegnell* <sup>4</sup> , ***M. Lastilla*** <sup>5</sup> , *B. Bannister* <sup>6</sup> , *F. Maria Fusco* <sup>7</sup> , ***R. Biselli*** <sup>5</sup> , *H.-R. Brodt* <sup>1</sup> and *V. Puro* <sup>7</sup> <sup>1</sup>) Department of Infectious Diseases, University Hospital Frankfurt, Frankfurt am Main, Germany, <sup>2</sup>) Department of Communicable Disease Prevention and Control, Västra Götaland, <sup>3</sup>) Department of Infectious Diseases, University Hospital Linköping, Linköping and <sup>4</sup>) Department of Communicable Disease Prevention and Control, Swedish National Board of Health and Welfare, Stockholm, Sweden , <sup>5</sup>) ***Italian Air Force, Health Service, Rome, Italy*** , <sup>6</sup>) Department of Infectious Diseases, Royal Free Hospital, London, UK and <sup>7</sup>) National Institute for Infectious Diseases 'L. Spallanzani', Rome, Italy

*Highly infectious diseases involve clinical syndromes ranging from single to multiorgan infections and pose a constant threat to the public. In the absence of a definite treatment for most causative agents, patients benefit from maximum supportive care as clinical conditions may deteriorate in the short term.....*

*Despite the development of consensus curricula for the clinical management of highly infectious patients, medical transportation lacks a common European approach. This article describes, as examples, three current European concepts for the domestic relocation of highly infectious patients by ground vehicles and aircraft with respect to national legislation and geography.*



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Diseases



# WHAT IS AN AIR TRANSIT ISOLATOR ?

An Air Transit Isolator (ATI) is a self-contained isolation facility designed to transport safely a patient during air evacuation, protecting healthcare personnel, air crew and the aircraft from exposure to the infectious agents

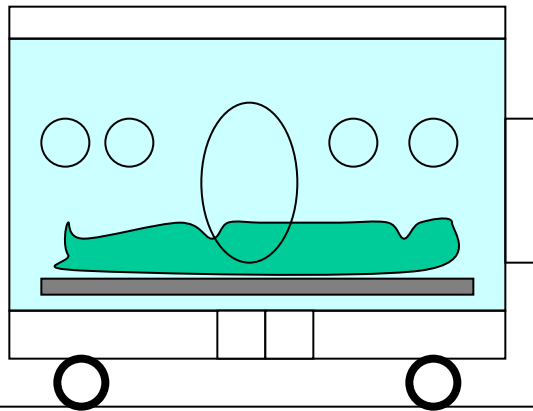




# ATI/STI systems

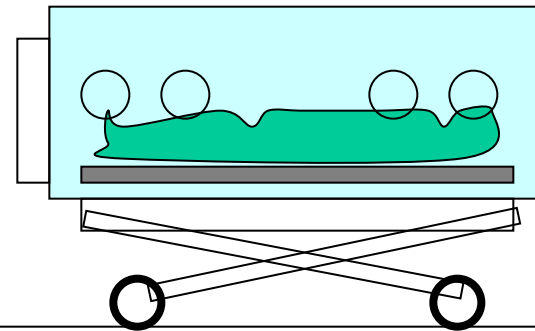
- Transport isolators have been designed specifically to provide a microbiologically secure environment for a patient requiring transportation

For air  
transportation  
and in-flight  
care



**ATI: Aircraft Transit Isolator**

For  
transportation  
by ambulance  
or other means



**STI: Stretcher Transit Isolator**



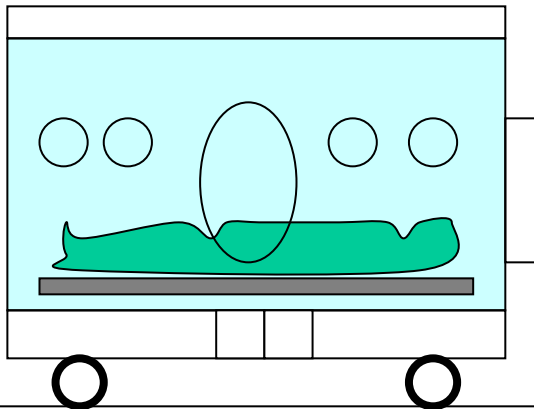
# Isolation Principles

4. Personal Protection Equipment

3. HEPA (High Efficiency Particulate Air) filters

2. Negative pressure

1. PVC envelope



Multi-layer protection



# ATI: Nursing facilities

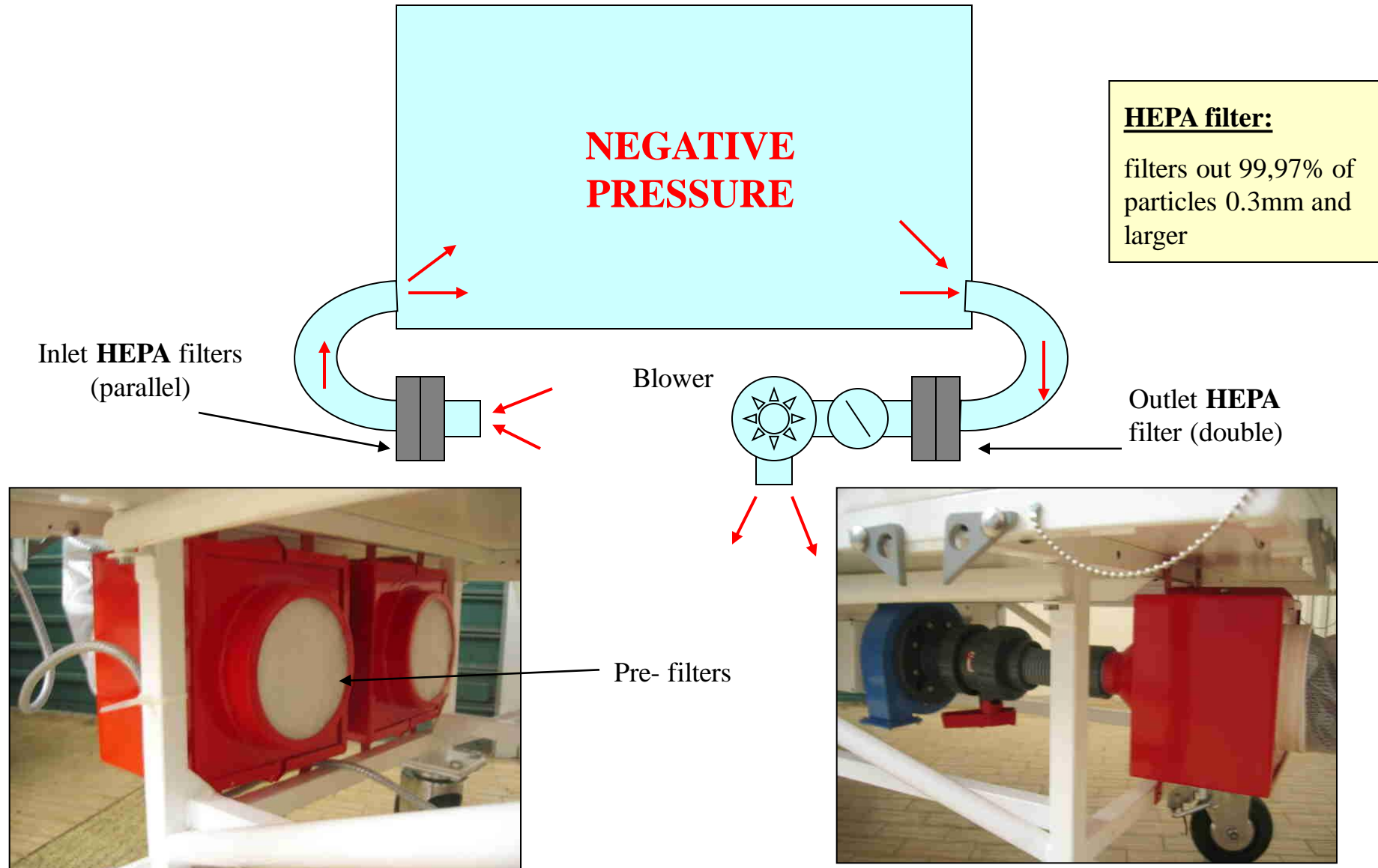
Two sleeves for  
intravenous drip  
bags

Four pairs of gloved  
sleeves

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



# ATI - Air Supply Unit



# ATI - Electrical Supply System

Control panel beneath  
the isolator baseboard

## DOUBLE SYSTEM

- **Four 12 volt BATTERIES**  
with operating time of 6  
hours each (24 hours  
independent time)
- **Compatible electrical  
connections with C130J  
for emergency**





# • PPE: Different Biosafety Levels

**1.** Gown, facial mask, goggles, gloves



**2.** Suit (tyvek), full face mask with filters, gloves



**3.** Full body suit (tychem C) with positive pressure, gloves



# Flight Certification

- *Rapid decompression Test*
- *Vibration Test*
- *Electromagnetic Test*
- *Environmental Test*

According to **Air Safety Certification** the isolator must undergo stringent safety testing in extreme conditions

**Air Transit Isolator (ATI)**

**Hercules C130-J - C27 - B.KC 767**



Located at Pratica di Mare Air Force Base  
Founded in 2005



**Two teams, each comprised of:**

- 1 Team leader, (Flight surgeon, Medical Corps)
- 2 Physicians (Medical Corps)  
(2 specialist: 1 in infectious diseases and 1 in anesthesia)
- 6 Health care specialists (Nurse Corps)  
+ 1 Laboratory Technician (Mission dependent)





**2 ATI**



*Major equipment  
of Aeromedical Isolation Unit*



**2 STI**

### **Portable decontamination system**

- Curtain of decontamination for the insulators;
- 2 showers of decontamination for the staff;
- Material and liquids recovery contaminated containers



*Major equipment  
of Aeromedical Isolation Unit*



*Major equipment  
of Aeromedical Isolation Unit*

### **Trolley equipped for the service and care of the patient one aboard**

- Cardiac and respiratory monitoring system;
- Portable O<sub>2</sub> support;
- Defibrillator with monitor;
- Infusion Pumps; Suction apparatus;
- Paramedic drugs/supplies



- **PPE** Various levels of "biosafety" according to the risk level





# *Aeromedical Isolation Unit*

*...training....training...training....training....*

Every 15 days the team trains in Pratica di Mare

- *Patient placed in cell*
- *Management of the patient on the stretcher both on the ground in flight*
- *Decontamination*





**Spallanzani Hospital Team and Air Force Team working together**



**High Containment Ambulance  
of Spallanzani Team**





**Unità di Isolamento Aeromedico, ITALIA – Aeromedical Isolation Team, USA**  
*Joint Training*  
*Pratica di Mare 20 Settembre 2006*









# Teams of Aeromedical Isolation Unit in the world





## ***"Case Reports"***

January 2006: patient with MDR TB - from Alghero (Sardinia) to Milan;

May 2007: patient with suspected Congo-Crimea hemorrhagic fever (after returning from Nepal) - from Turin to Rome;

July 2007: patient with MDR TB - from Alghero (Sardinia) to Bergamo

October 2009: patient with suspected hemorrhagic fever (after returning from Senegal) - from Turin to Rome;



## ***Aeromedical Isolation Unit Deployments***

**First operating mission: January 24th, 2006**





Milano

Alghero

Pratica di  
Mare

January 24<sup>th</sup> 2006



Lung Tuberculosis MDR

Chest X-Ray after first cycle of chemotherapy

January 2006: patient with MDR TB - from Alghero (Sardinia) to Milan;



**Torino**

**Roma**

**Spallanzani Hospital**

**Pratica di  
Mare**

**3<sup>rd</sup> May 2007**

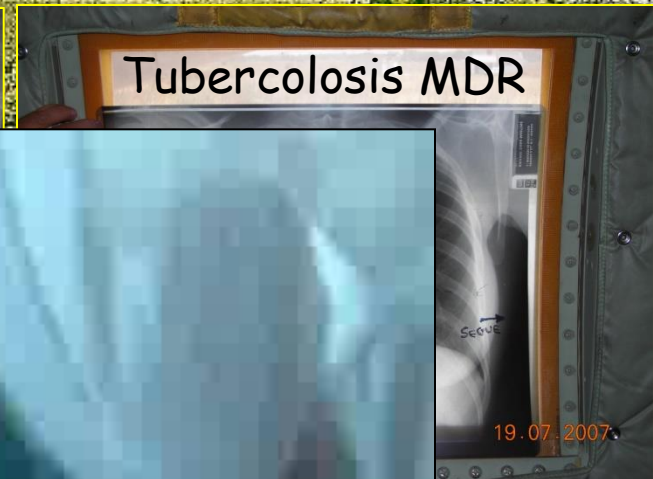
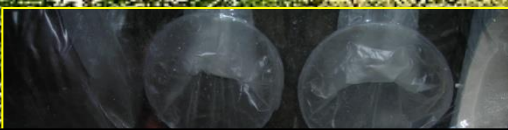
**May 2007:** patient with suspected Congo-Crimea hemorrhagic fever  
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## *Aeromedical Isolation Unit* Deployments





**July 2007:** patient with MDR TB - from Alghero (Sardinia) to Bergamo.



Torino



Spallanzani Hospital

Pratica di  
Mare

10<sup>th</sup> October 2009

October 2009: patient with suspected hemorrhagic fever (after returning from Senegal) - from Turin to Rome;













# Nov 25 2014 – EVD Patient from Sierra Leone

- **Patient**
  - Physician, aged 50, EVD positive
  - Clinically stable (fever 38.5°C)
- **Team composition (16)**
  - Team leader, 2 flight surgeons, 1 infectious disease specialist, 2 intensive care specialists, 10 flight nurses
- **Mission outline**
  - Aircraft : K767
  - Departed Rome on Nov 24 16.00 local
  - Direct flight on ocean route for the available diplomatic clearance issues (6 hrs)
  - Departure Free Town on Nov 25 12.00 (time on the ground 2 hrs)
  - Arrive Rome on Nov 25 06.00 local







**BIO MEDEVAC**



**BIO MEDEVAC**





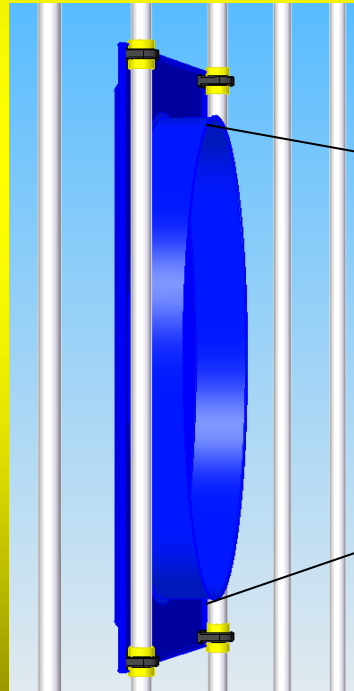
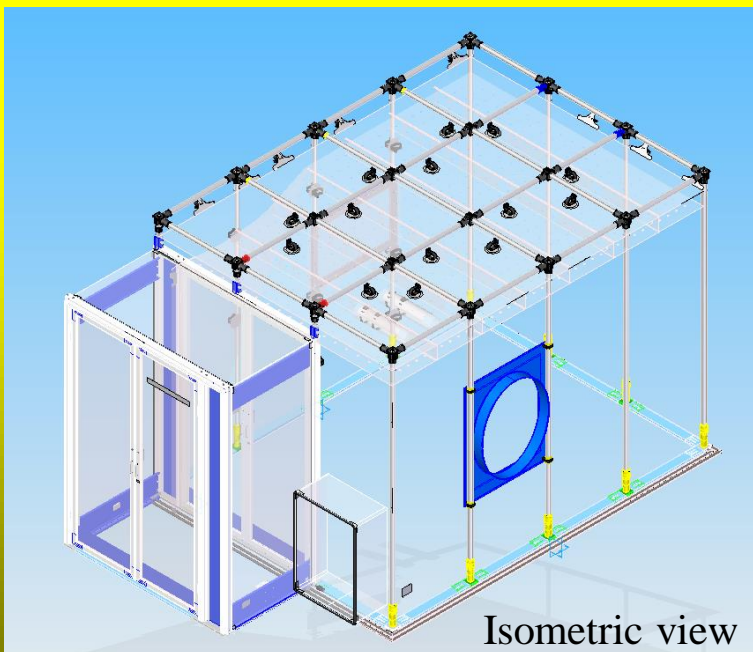
**BIO MEDEVAC**

- Flying with an infectious patient means having the clearance of the countries we are flying over, because in case of emergency we could be forced to land; for this reason the flight must be carefully planned
- *The transfer could be long*.... How long is it possible, to manage the patient and the isolators in an acceptable way on the C130J aircraft? If the distance is very long, there may be an intermediate stop due to a technical or meteorological problem and so the aspects of distance and length of flight are crucial points.



*In light of this, we added to its equipment also a portable negative pressure room, called Isoark, able to allow us to manage the patient for a long period.*

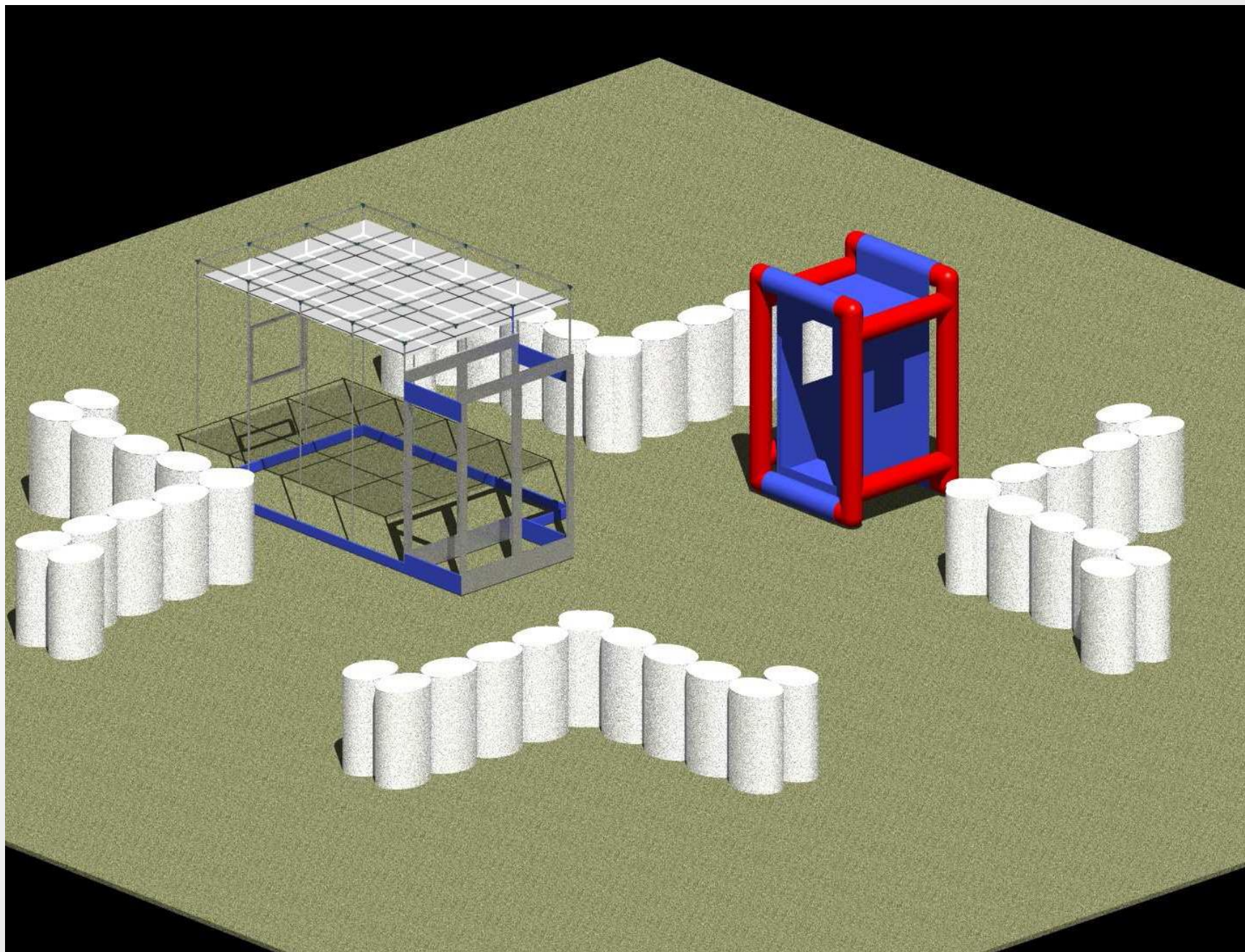
## NEGATIVE PRESSURE ROOM (ISOARK)















*Caratteristiche: struttura a croce a modulo unico, compartimentabile in 4 locali indipendenti  
atta a consentire -1. un ordinato flusso operatori/pazienti e l'allocazione di  
presidi/attrezzature/ e materiali in dotazione -2. il raccordo tra le tende delle strutture  
sanitari e campali; tenda pneumatica ad allestimento rapido (10 minuti- autonomia 8 h in  
assenza di corrente elettrica) per l'operatività immediata; sistema climatizzato naturale,  
idoneo alle operazioni sanitarie.*



*The IsoArk 36-2 Isolation System is an ideal solution to rapidly isolate patient or an item temporarily, which is thought to be contaminated by infectious particles or disease to an isolated area for safe treatment. This system provides maximum protection and operational safety for both contaminated patient or item and the operational team*





# NEXT STOP





**Movement of highly infectious patients is *possible***



*Maintaining well trained and equipped personnel to deal with such a situation is key factor. Without a trained staff care would be inadequate.*



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## The added value of preparedness for aeromedical evacuation of a patient with Ebola

[Roberto Biselli](#)  , [Marco Lastilla](#), [Ferdinando Arganese](#), [Natale Ceccarelli](#), [Enrico Tomao](#), [Piervalerio Manfroni](#)

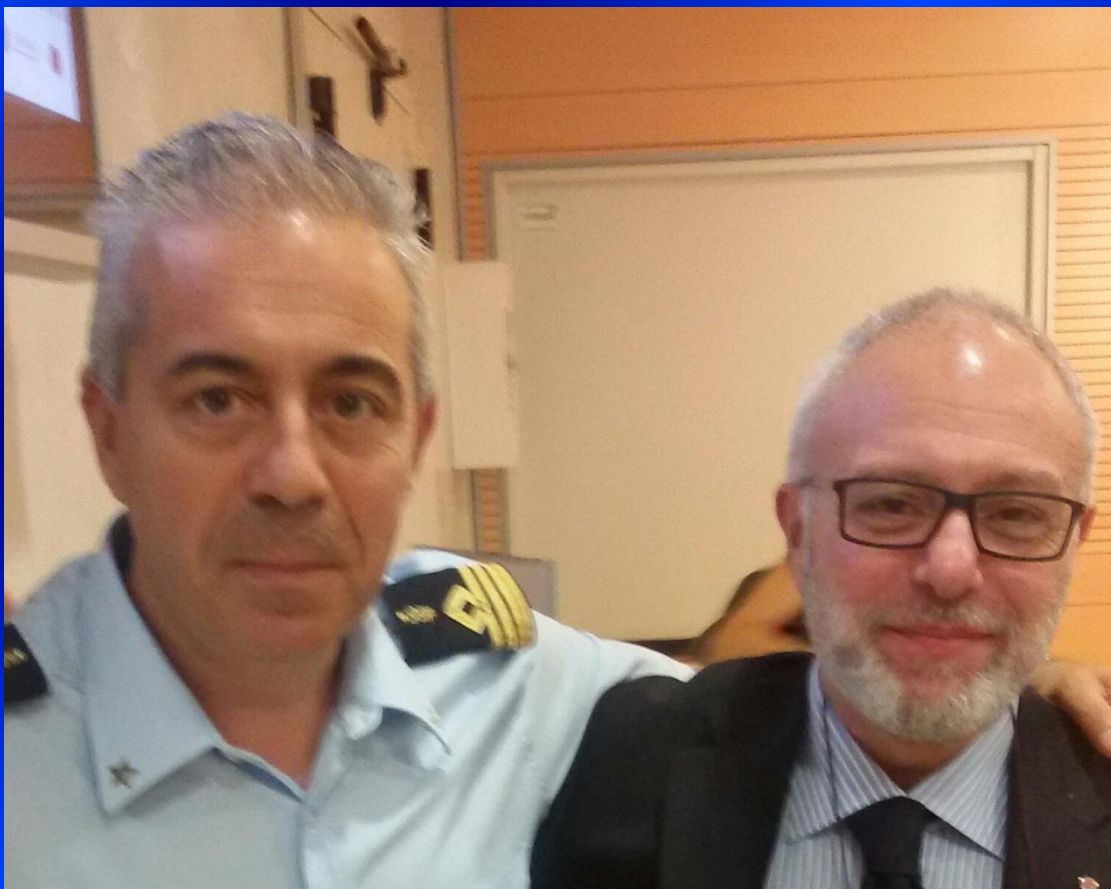
Italian Air Force, Logistic Command, Health Service, Italy

Published Online: April 25, 2015



# 10 ottobre 2015 - GIORNATA DEL MEDICO- OMCEO - FERRARA

## PREMIO CARLO URBANI - CONFERITO ALLA UNITA' DI BIOCONTENIMENTO DELL'AERONAUTICA MILITARE



*«Per il grande impegno e l'elevata qualificazione professionale dimostrata dal personale della UIA durante la recente epidemia da virus Ebola. Emergenza durante la quale con specifico riferimento al trasporto di due pazienti italiani, sono stati utilizzati specifici sistemi di biocontenimento sui velivoli da trasporto dell'Aeronautica Militare Italiana. Un'esperienza che a nostro avviso denota l'alta professionalità del personale sanitario addestrato»*