



**AREU**  
AZIENDA REGIONALE  
EMERGENZA URGENZA

---



Regione  
Lombardia



**118**  
SOCCORSO  
SANITARIO



# ECMO

# LONG DISTANCE

# TRANSPORTATION

**MAURIZIO RAIMONDI**

**AREU Lombardia, AAT 118 PAVIA**  
**I.R.C.C.S. Fondazione Policlinico S.Matteo,**  
**PAVIA,**

# The Introduction of Extracorporeal Membrane Oxygenation to Aeromedical Evacuation

**Authors:** Allan, Patrick F.<sup>1</sup>; Osborn, Erik C.<sup>2</sup>; Bloom, Brian B.<sup>1</sup>; Wanek, Sandra<sup>2</sup>; Cannon, Jeremy W.<sup>3</sup>

**Source:** [Military Medicine](#), Volume 176, Number 8, August 2011 , pp. 932-937(6)

**Publisher:** [AMSUS - Association of Military Surgeons of the U.S.](#)



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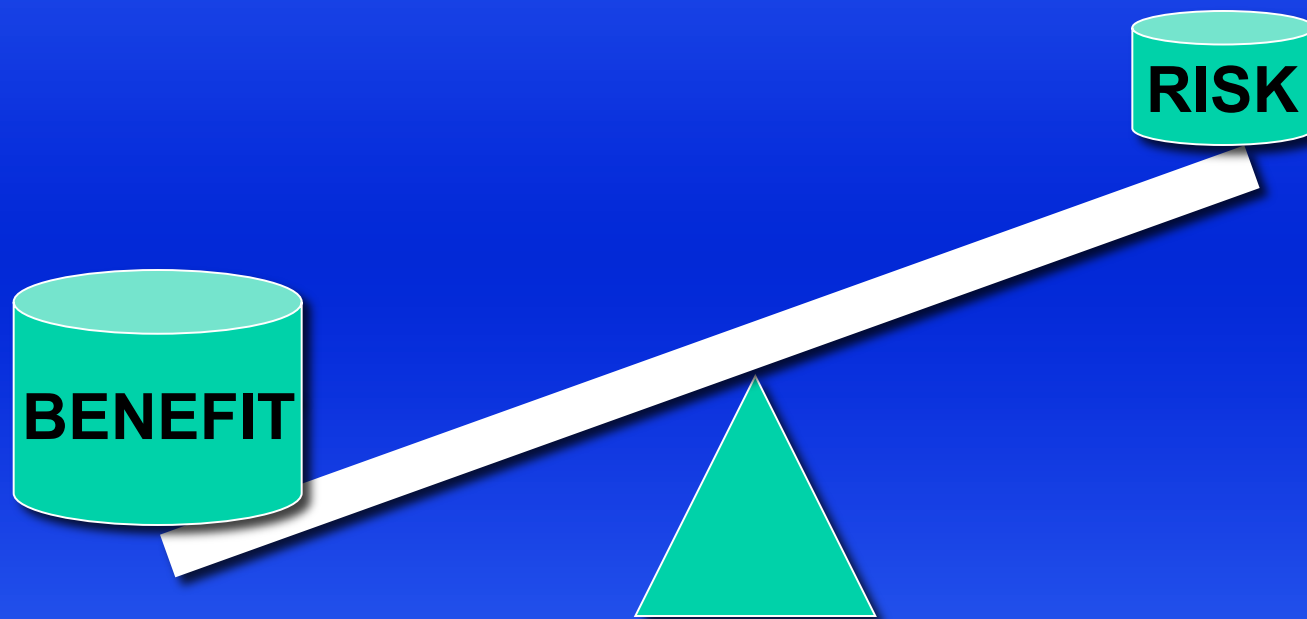
[Mark item](#)

**Abstract:**

**ABSTRACT**

**Objective:** To review the principles of extracorporeal membrane oxygenation (ECMO) and to describe the recent advancements in ECMO technology that permit use of this rescue therapy for severe lung injury in combat casualties. **Methods/Results:** Lung protective ventilation has defined the state-of-the-art treatment for acute lung injury for more than a decade. Despite the benefits provided by a low tidal volume strategy, lung injury patients may experience deterioration in gas exchange to the point that other rescue interventions are needed or the patient succumbs to progressive respiratory failure. When this occurs in combat casualties, management of the patient in an austere environment and movement to definitive care become problematic. Recent advances in ECMO technology permit long-range transport of these critically ill casualties with greater physiologic reserve and potentially less mortality. **Conclusions:** Advances in ECMO technology now enable the stabilization and aeromedical evacuation of even the most critically ill combat casualties with severe lung injury.

# TRANSPORTATION



**ALL**

**TRANSPORTATION**

**IS A RISK**

**DOES NOT EXIST  
TRANSPORT  
IMPOSSIBLE!**

**SC&RA** Specialized  
Carriers  
& Rigging  
Association



# Paziente grande obeso 190 kg











# TRANSPORT "IMPOSSIBLE"

- TEAM/TRAINING
- EQUIPMENT
- TRANSPORTATION
- COST
- COST/BENEFIT
- CLINICAL CONDITIONS

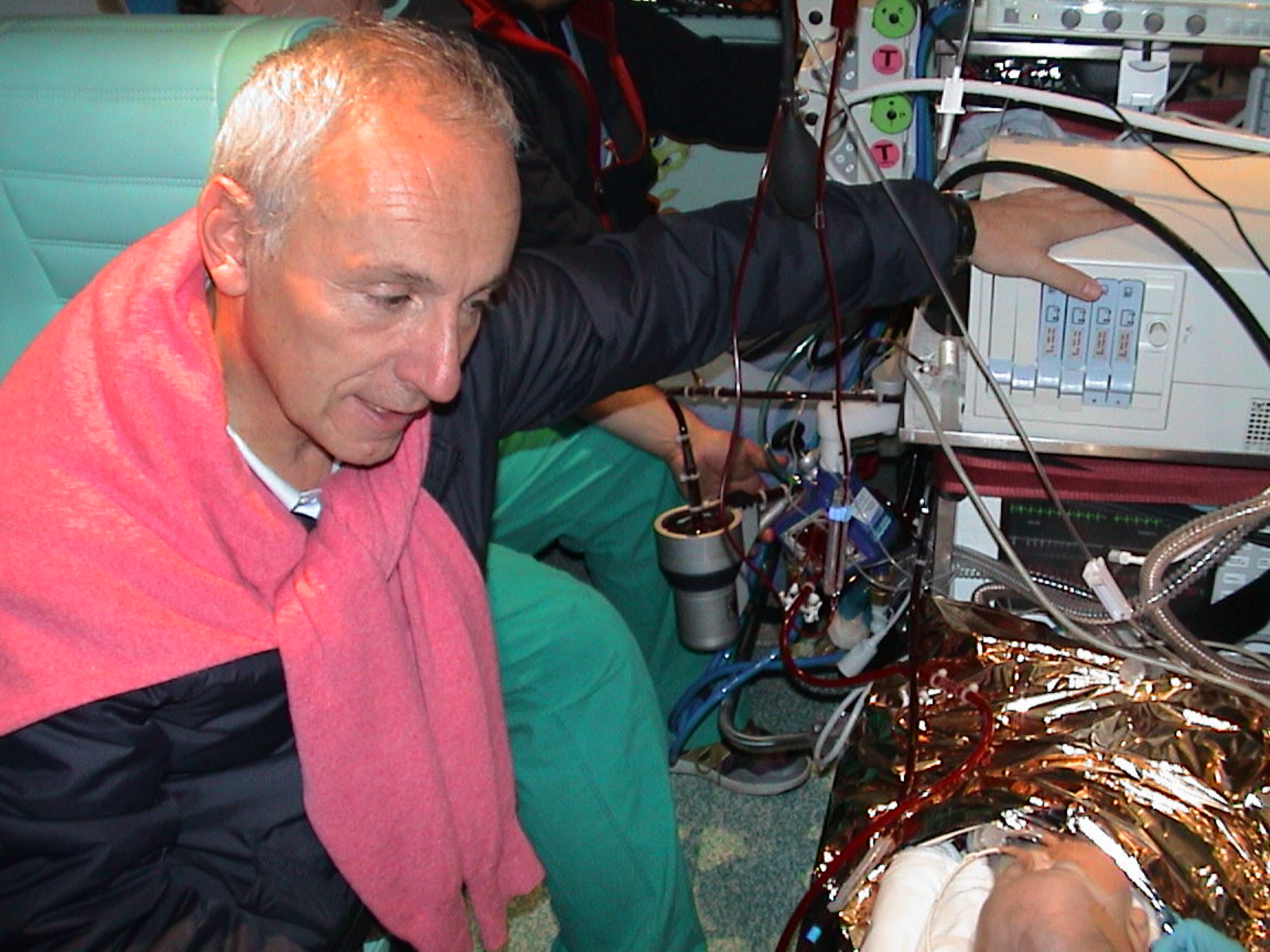
# TRAINING



# TRAINING









# Multidisciplinary ECMO TEAM

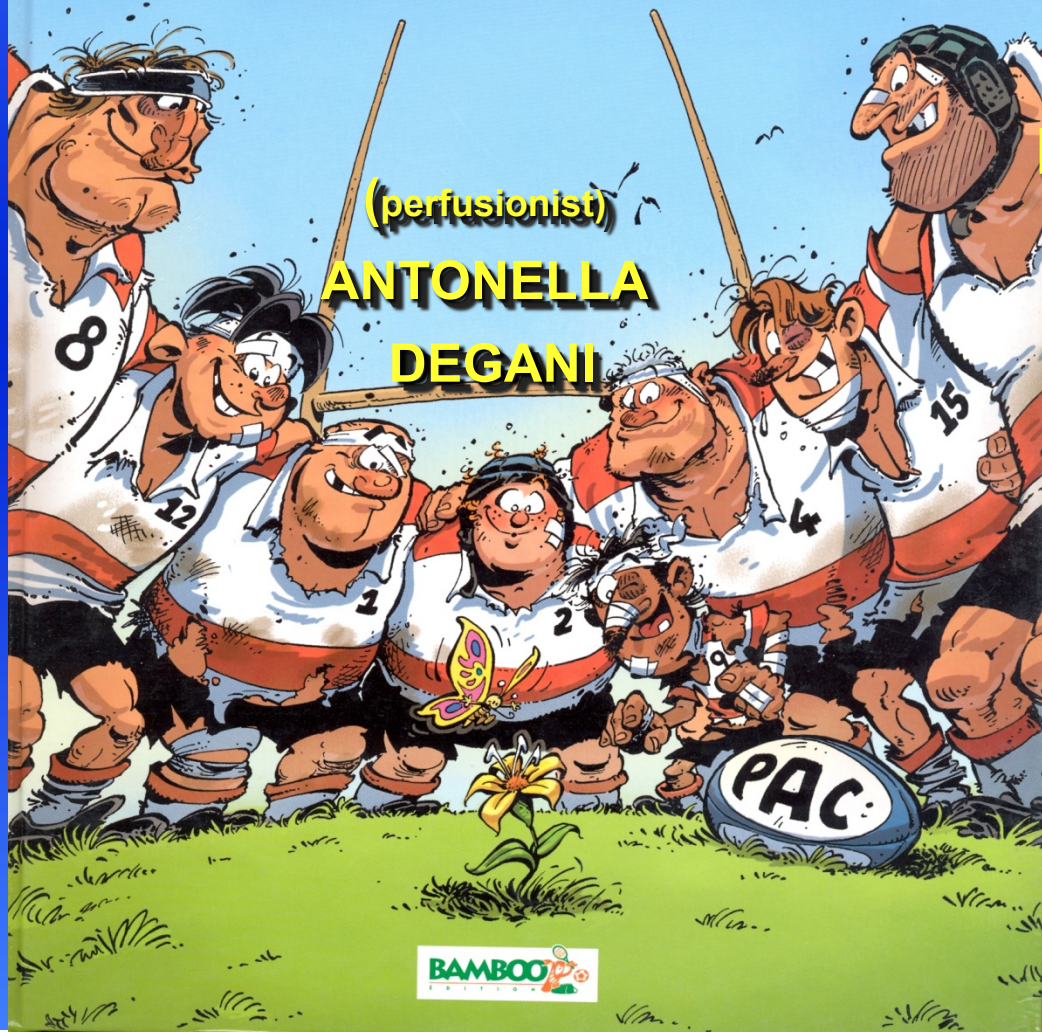
- **Intensivist**
- **Cardiosurgeon**
- **Perfusionist**
- **Nurse**
- **Technician**

# les RUGBYMEN 4

**DI MANCHE PROCHAIN,  
ON JOUERA SAMEDI!**

**MIRKO  
BELLIATO**  
(intensivist)

**CARLO  
PELLEGRINI**  
(cardiosurgeon)



(perfusionist)

**ANTONELLA  
DEGANI**

**EQUIPMENT**

**IF LIFESAVER ....**

**TAKE TWO !!!**

# EQUIPMENT



# EQUIPMENT







MAQUET







# CLINICAL PREPARATION

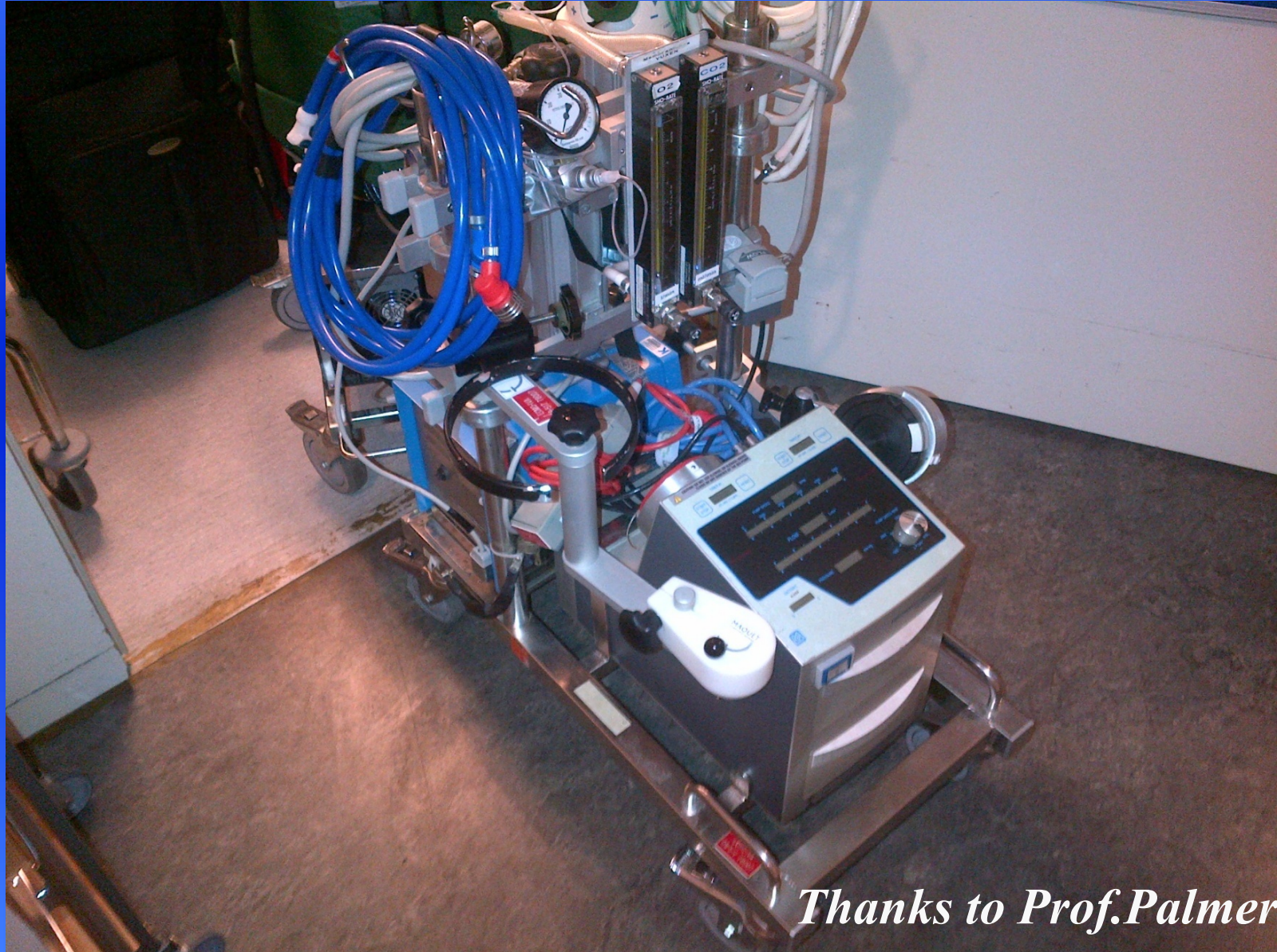
# “MECHANICAL” PREPARATION

# Karolinska Institute



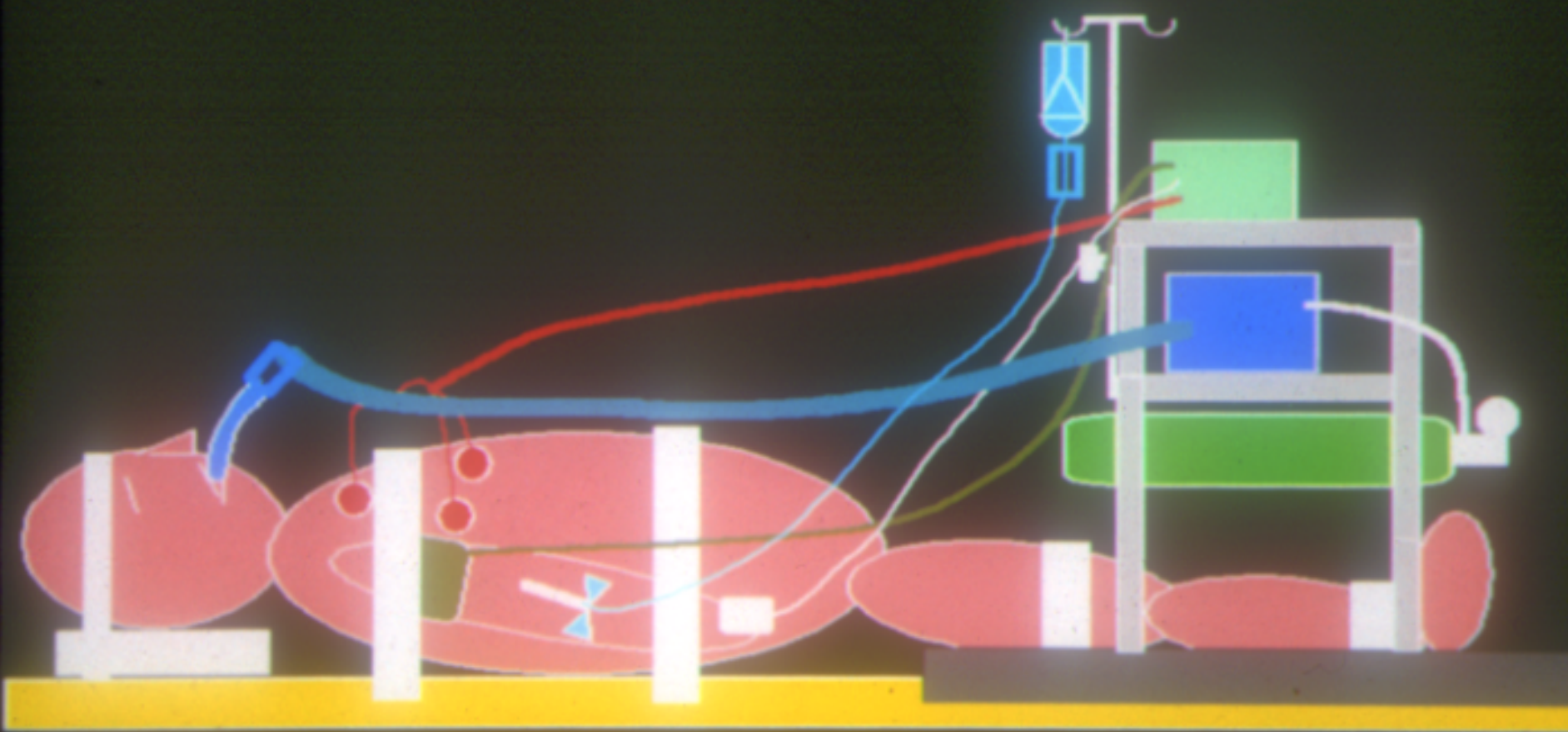
*Thanks to Prof. Palmer*

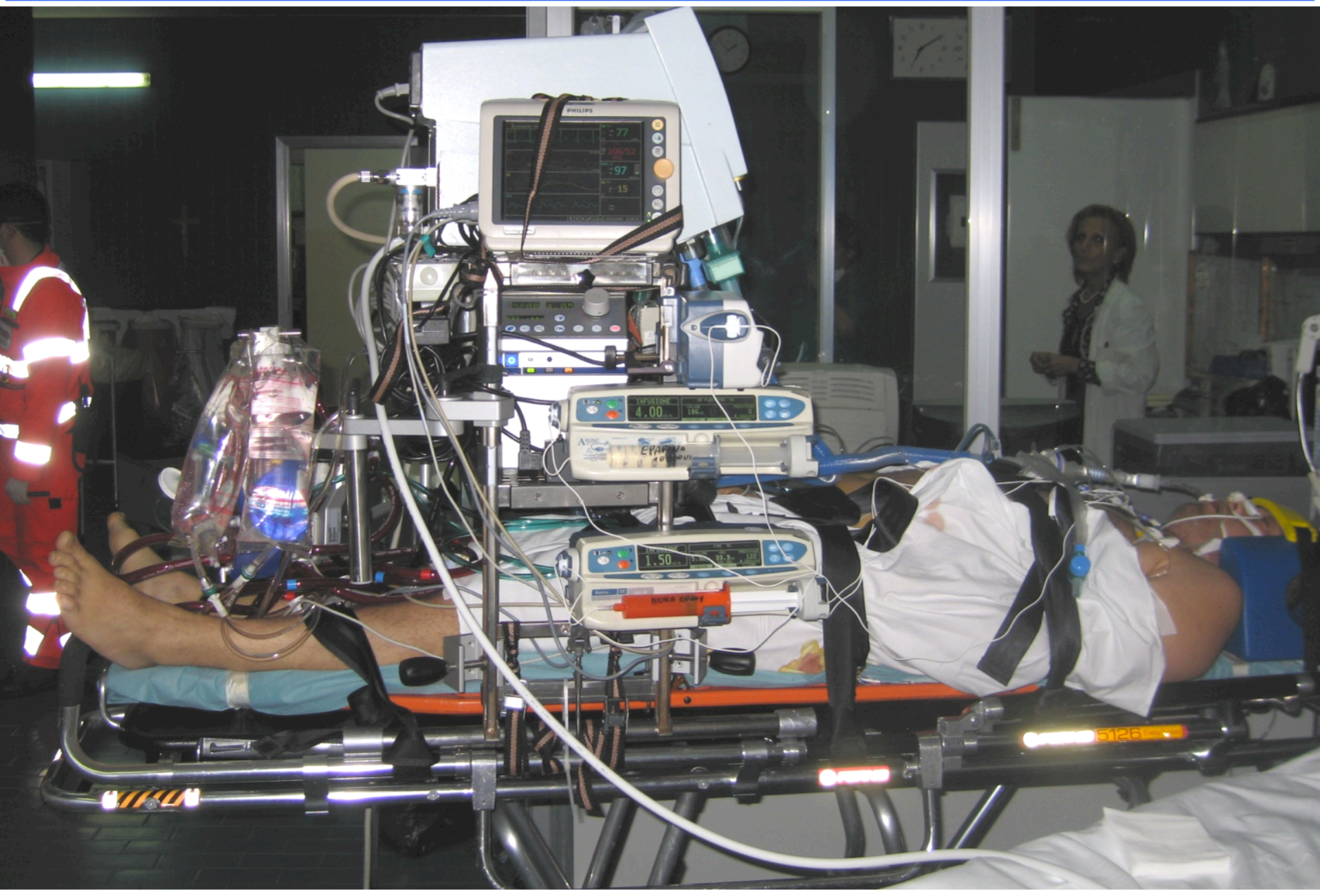
# Karolinska Institute



*Thanks to Prof. Palmer*

















# RETE DELLE TERAPIE INTENSIVE PER LA GESTIONE DELLA SINDROME DA INSUFFICIENZA RESPIRATORIA ACUTA GRAVE.

Pandemia da virus influenzale da A H1N1 - autunno 2009

DELIBERAZIONE N° VIII / 010228 Seduta del 28 SET 2009

- pianificare la risposta del Servizio Sanitario Regionale attraverso:
  - la componente extraospedaliera, deputata al trasporto protetto dei pazienti;
  - la componente delle strutture sanitarie, definita secondo una logica di rete integrata con nodi collocati a differenti livelli operativi;
  - l'identificazione dei Centri di Riferimento Regionale per il trattamento dei pazienti con apparecchiature per l'Extra Corporeal Membrane Oxygenation (ECMO);
- Criteri per l'adulto:
  - Insufficienza respiratoria in paziente con sospetta infezione da AH1N1 in cui è presente uno dei seguenti:
    - Sat O<sub>2</sub> < 85% per almeno 1 ora;
    - Indice di ossigenazione (Pressione media delle vie aeree x FiO<sub>2</sub> x 100/PaO<sub>2</sub>) >25 per 6 ore in condizioni di ottimizzazione della ventilazione;
    - PaO<sub>2</sub>/FiO<sub>2</sub> <100 con PEEP ≥10 per 6 ore in condizioni di ottimizzazione della ventilazione;
    - Ipercapnia con acidosi respiratoria pH <7.25;
    - Saturazione venosa <65% nonostante adeguato ematocrito (>30) e dopamina o altra catecolamina per sostenere il circolo;

I Centri di Riferimento Regionale sono:

1. AO Ospedale San Gerardo dei Tintori, Monza;
2. Fondazione IRCCS Policlinico San Matteo, Pavia;
3. Fondazione IRCCS Osp. Maggiore Policlinico, Mangiagalli e Regina Elena, Milano;
4. IRCCS Fondazione Centro San Raffaele del Monte Tabor, Milano;
5. AO Ospedali Riuniti, Bergamo con particolare specificità per i pazienti in età pediatrica.



**- AMBULANCE**

**- HELICOPTER**

**- AIRPLANE**

# **GROUND TRANSPORT**

**-BACK UP**

**-NUMBER OF VEHICLES**

**-DIMENSION OF WORK AREA**

**-GAS SUPPLY**

**-GAS AUTONOMY**

**-ELECTRIC SUPPLY**

**-VIBRATIONS AND DUMPING**

# GROUND TRANSPORT

**-BACK UP**

**-NUMBER OF VEHICLES**

**-DIMENSION OF WORK AREA**

**-GAS SUPPLY**

**-GAS AUTONOMY**

**-ELECTRIC SUPPLY**

**-VIBRATIONS AND DUMPING**





# GROUND TRANSPORT

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# GROUND TRANSPORT

-BACK UP

-NUMBER OF VEHICLES

-DIMENSION OF WORK AREA

-GAS SUPPLY

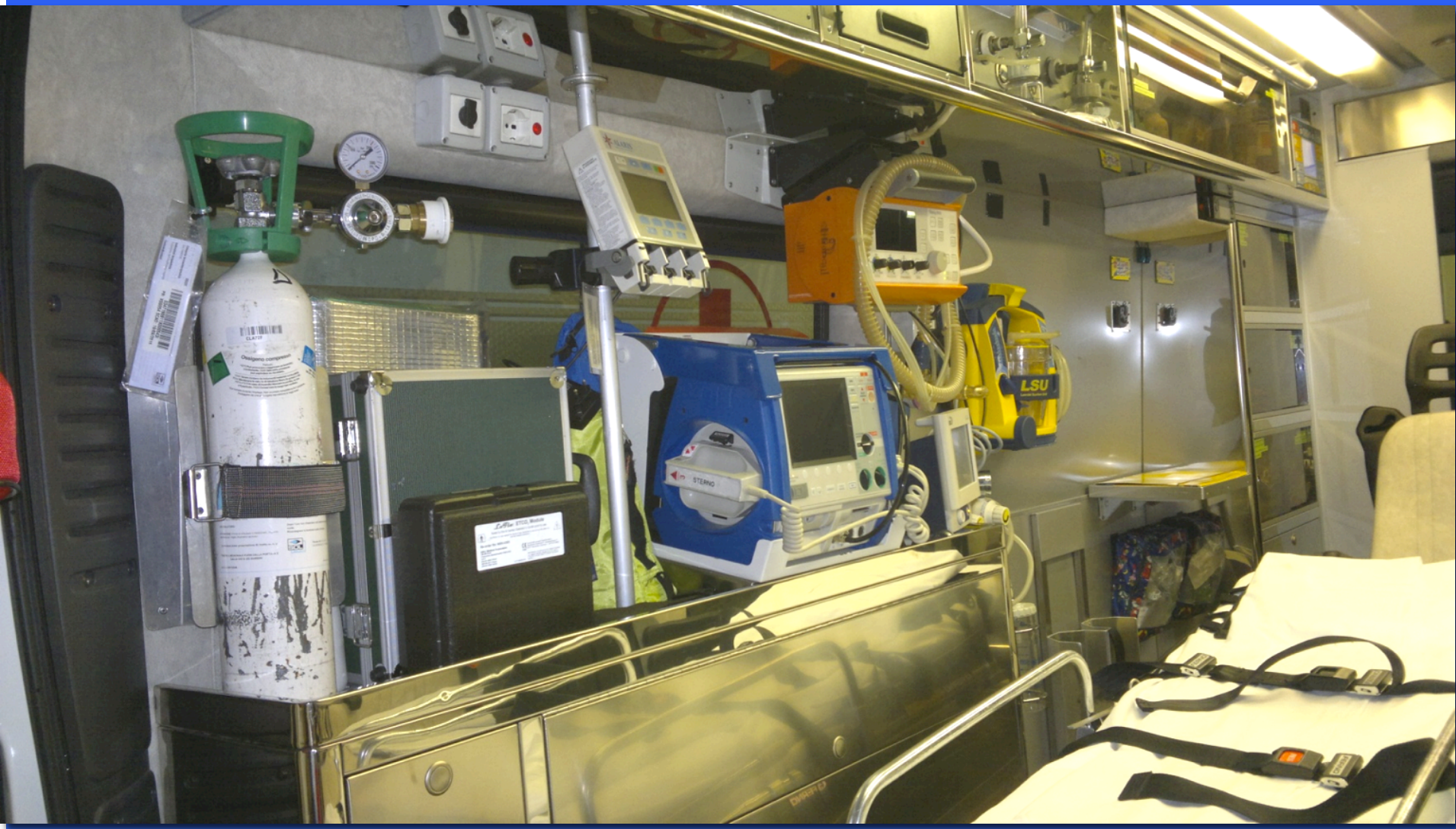
-GAS AUTONOMY

-ELECTRIC SUPPLY

-VIBRATIONS AND DUMPING







# GROUND TRANSPORT

-BACK UP

-NUMBER OF VEHICLES

-DIMENSION OF WORK AREA

-GAS SUPPLY

-GAS AUTONOMY

-ELECTRIC SUPPLY

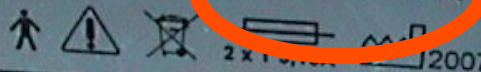
-VIBRATIONS AND DUMPING

Abklober zur Klammhalterbelegung abziehen  
Push label to mount the clamping holder

**MAQUET**  
Cardiopulmonary AG  
D-72145 Hirrlingen

**Heater Unit**  
REF HU 35  
SN: 90003032  
230 V 50 Hz 530 W IPX1

CE 0124

 2x1,5/2,5 2007



# GROUND TRANSPORT

-BACK UP

-NUMBER OF VEHICLES

-DIMENSION OF WORK AREA

-GAS SUPPLY

-GAS AUTONOMY

-ELECTRIC SUPPLY

-VIBRATIONS AND DUMPING

# HELICOPTER

- GROUND CONNECTIONS
- TEAM NUMBER/LUGGAGE
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- COMUNICATIONS
- EQUIPMENT AUTHORITY APPROVAL
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- GAS AUTONOMY
- ELECTRIC SUPPLY
- VIBRATIONS
- GAS EXPANSION
- DEFIBRILLATION

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- ELECTRIC SUPPLY
- VIBRATIONS
- GAS EXPANSION
- DEFIBRILLATION

# “ECMO Flying Team”



Photo © by: Damiano GUALDONI 2007



**EXIT**  
**SALIDA**

MAX HOIST LOAD 272 kg ( 600 lbs )  
CABLE CUTTER UNDER  
HOIST OPERATOR SEAT

**CAUTION**  
THE OPERATOR'S HAND MUST  
BE ON THE CABLE AT ALL TIMES  
DURING HOIST OPERATION

MAXIMA CARGA GRUA 272 Kg ( 600 lbs )

COCHA CABES BAJO ASIENTO DE  
OPERADOR DE GRUA

**ATENCIÓN**  
LA MANO DEL OPERADOR DEBE PERMANECER  
SOBRE EL CABLE EN TODO MOMENTO DURANTE  
LA OPERACIÓN DE LA GRUA

**EMERGENCY**  
**PUSH HERE**  
EMERGENCIA  
EMPUJAR AQUI

**EMERGENCY**  
**PUSH HERE**  
EMERGENCIA  
EMPUJAR AQUI

**EMERGENCY**  
**PUSH HERE**  
EMERGENCIA  
EMPUJAR AQUI

**PUSH** → **TURN**  
**SLIDE** →

**EMERGENCY**  
**DESLOC**



BOX A

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- 48. ...
- 49. ...
- 50. ...

A

FARMACI  
RIA2

# HELICOPTER

- GROUND CONNECTIONS
- TEAM NUMBER/LUGGAGE
- DIMENSION OF WORK AREA
- COMUNICATIONS
- EQUIPMENT AUTHORITY APPROVAL
- GAS SUPPLY
- GAS AUTONOMY
- ELECTRIC SUPPLY
- VIBRATIONS
- GAS EXPANSION
- DEFIBRILLATION



MAGNET  
BPM 187  
210 96.7  
23.5

**REGOLI DI SICUREZZA**  
Il trasporto è un'operazione che comporta rischi per la salute e la sicurezza. È necessario seguire attentamente le istruzioni e le avvertenze riportate in questo manuale di istruzioni. Leggere attentamente il manuale di istruzioni prima di utilizzare il prodotto. Il trasporto deve essere effettuato solo da personale qualificato e autorizzato. Il trasporto deve essere effettuato in modo sicuro e stabile. Il trasporto deve essere effettuato in modo sicuro e stabile. Il trasporto deve essere effettuato in modo sicuro e stabile.

**SALA DI EMERGENZA**  
SALA DI EMERGENZA  
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0-239985

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- GAS AUTONOMY
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MAQUET  
CARDIOHELP

3.07	181
99	181
204	36.9
23	49.6



# HELICOPTER

- GROUND CONNECTIONS
- TEAM NUMBER/LUGGAGE
- DIMENSION OF WORK AREA
- COMUNICATIONS
- EQUIPMENT FLIGHT AUTORITY APPROVAL
- GAS SUPPLY
- GAS AUTONOMY
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- DEFIBRILLATION



MAQUET  
3.08 120/80  
-98 182  
205 36.8  
23 45.1  
CARDIOHELP

AREU

SonoSite

EMERGENCY

# HELICOPTER

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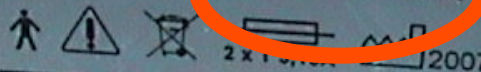
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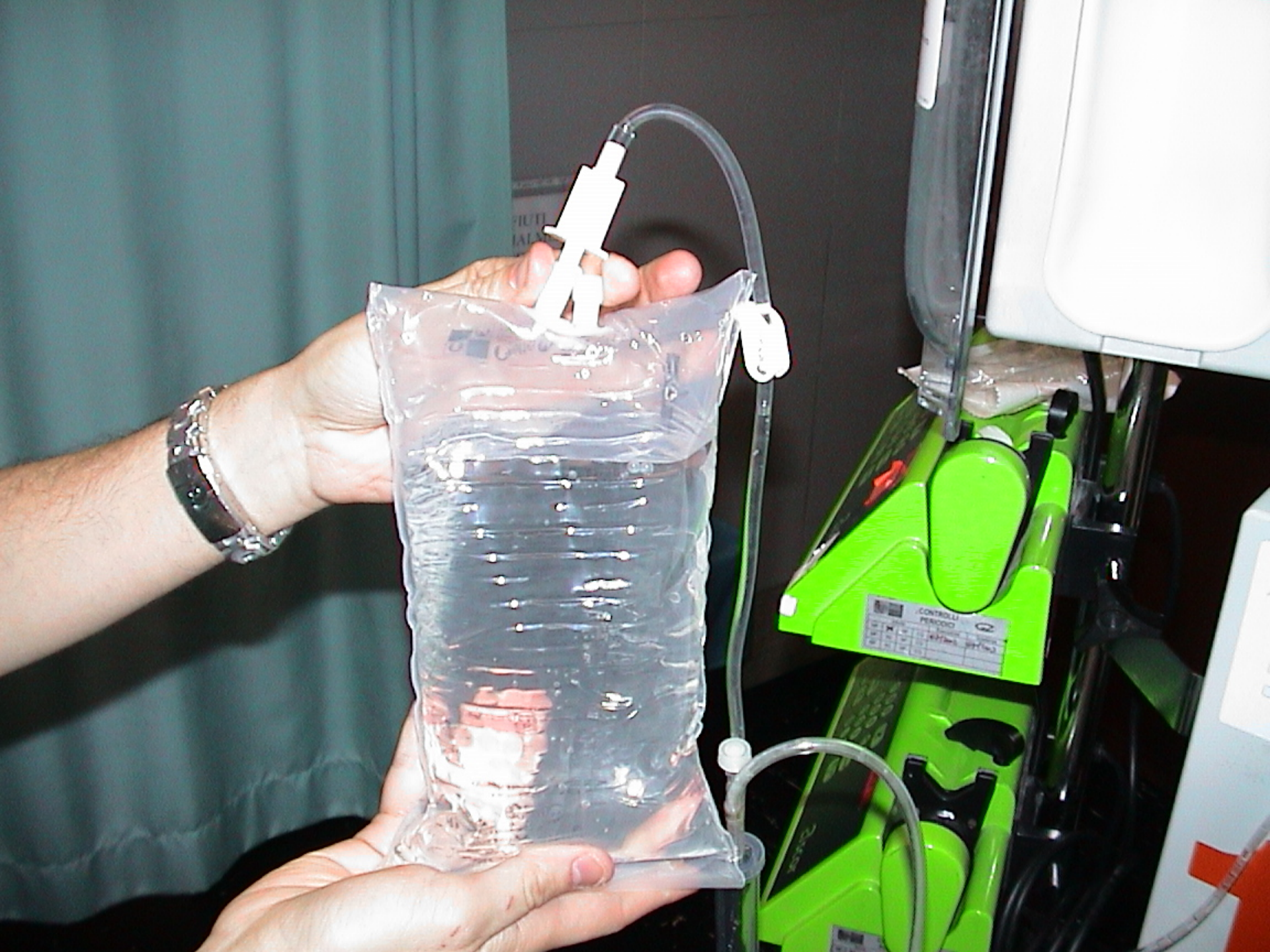


Photo © by: Damiano GUALDONI 2007



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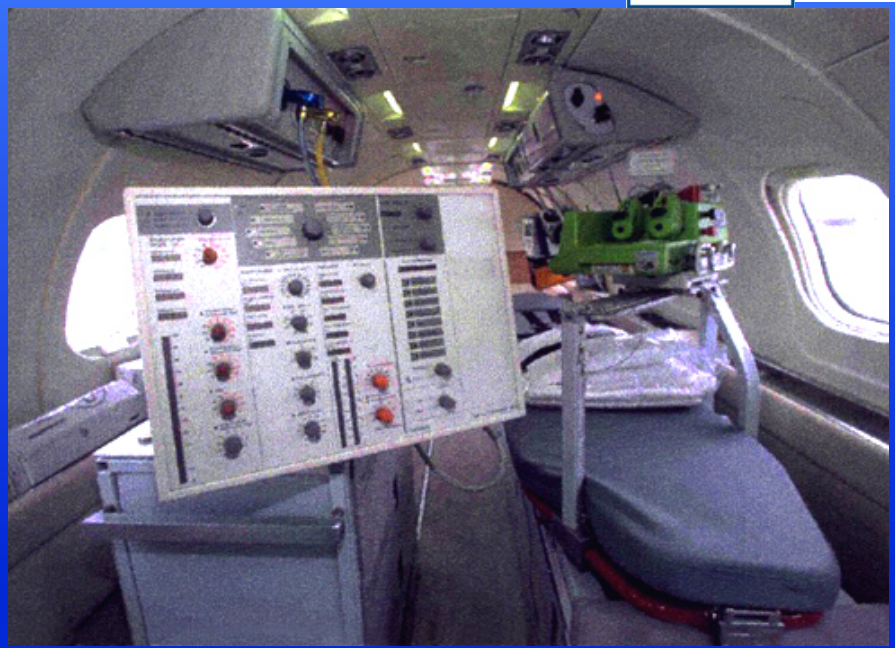
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# AIRPLANE

- GROUND CONNECTIONS
- TIME PREFLIGHT
- DOOR DIMENSION
- DIMENSION OF WORK AREA
- COMUNICATIONS
- GAS SUPPLY
- GAS AUTONOMY
- ELECTRIC SUPPLY
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## Falcon 50

# P-180



## Cesna Citation II





# C-27J



# C-130 HERCULES



# AIRPLANE

- GROUND CONNECTIONS
- TIME PREFLIGHT
- DOOR DIMENSION
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# ECMO TRANSPORT





# HERCULES C130J TRANSPORT 2 AMBULANCES



# AIRPLANE

- GROUND CONNECTIONS
- TIME PREFLIGHT
- DOOR DIMENSION
- DIMENSION OF WORK AREA
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# ECMO TRANSPORT 2015



# AIRPLANE

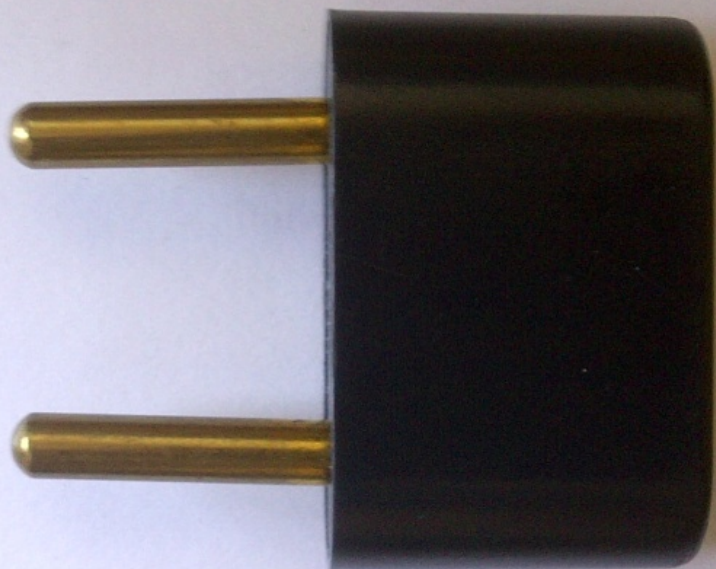
- GROUND CONNECTIONS
- TIME PREFLIGHT
- DOOR DIMENSION
- DIMENSION OF WORK AREA
- COMUNICATIONS
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- GAS AUTONOMY**
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# THANKS FOR ATTENTION !

AMBULANCE TRANSPORT .... OR  
.... TRASPORT OF AMBULANCE...!

