Collective aero medical evacuations using the MoRPHEE and MEROPE systems in France during the COVID 19 pandemic

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    2. MoRPHEE VS MEROPE
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3. Focus : the MEROPE Mission
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1. Epidemic context

- The COVID pandemic was responsible for a high saturation of critical care resources across the world.

- Collective aeromedical evacuations from congested regions to others, with tactical aircrafts.
  - MRTT Multi Role Tanker Transport A330 Phénix : 6 patients
  - A400M Atlas : 4 patients

    → Team work : FAF and FMHS

    →*Rapid and unprecedented implementation of evacuation modules in a crisis context.*

Service de santé des armées

A330 MRTT Phénix

A400M Atlas

2. MoRPHEE VS MEROPE

- **MoRPHEE Module:** A330 MRTT Phénix
  - 6 patients, 6 flights : 36 patients
  - From 03/18 to 04/03/2020
  - France

The MoRPHEE Module

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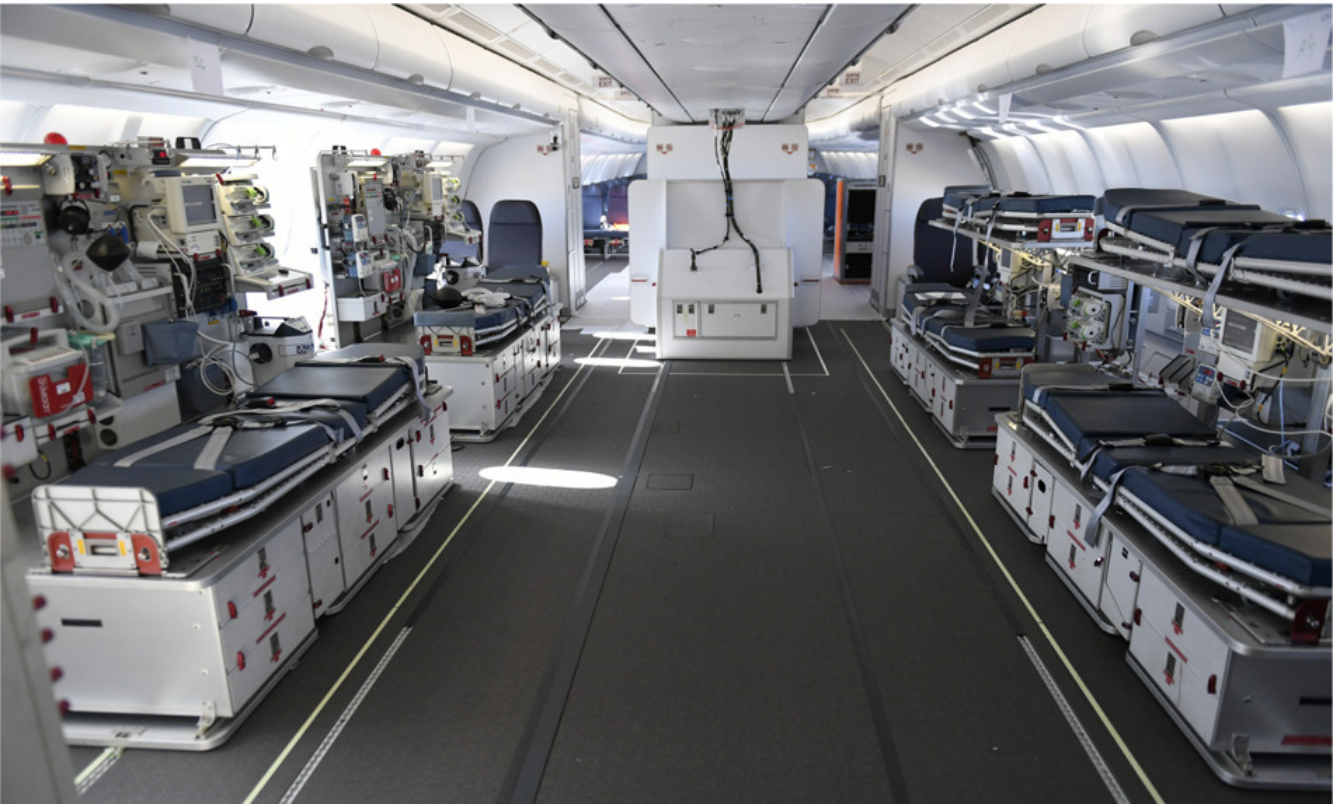

2. MoRPHEE VS MEROPE

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- **MEROPE Module:** A400M Atlas
  - 4 modules for 4 patients
  - 23 patients, 7 missions
  - From 06/27 to 07/07/2020 : French Guyana and French West Indies
  - From 10/28 to 11/17/2020 : France

The MEROPE module

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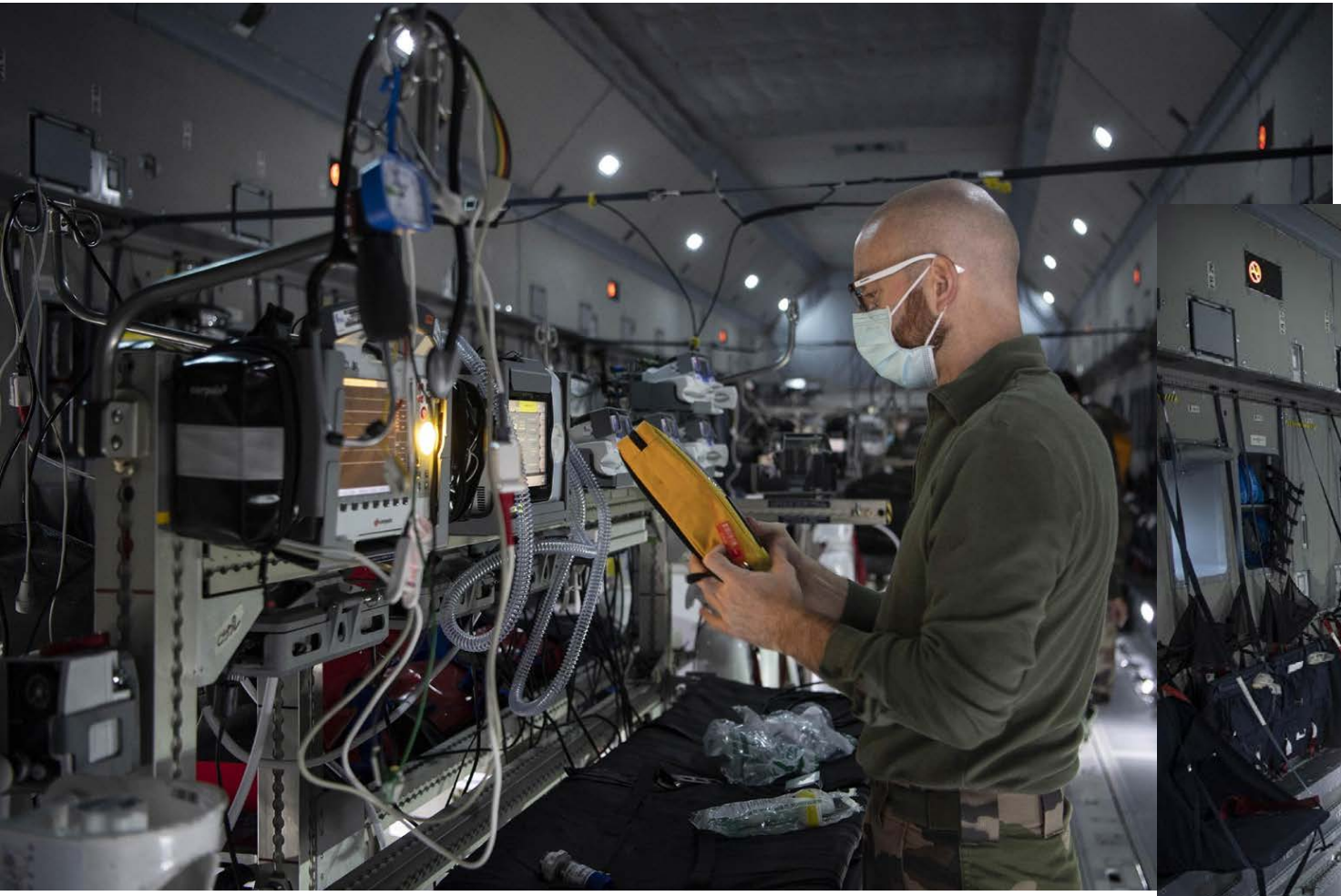

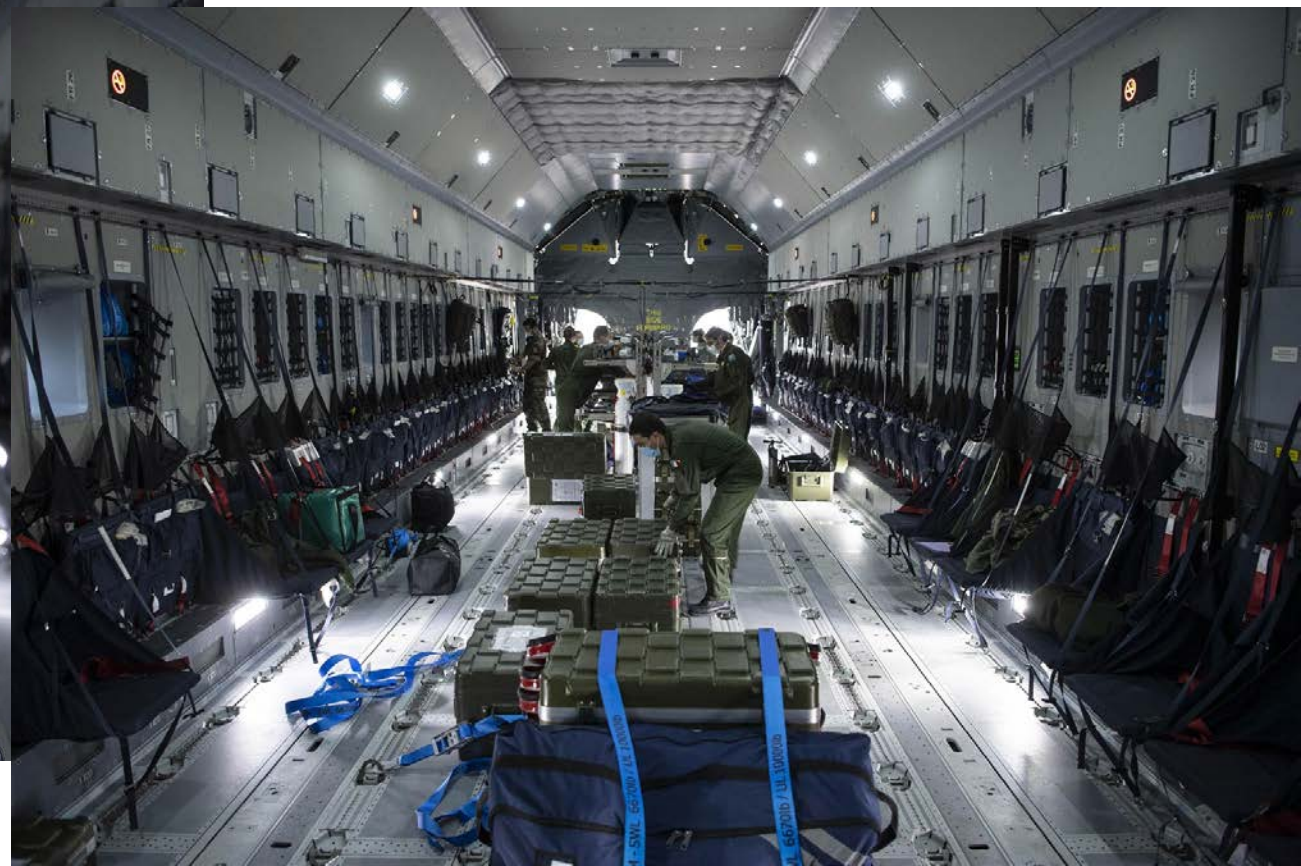


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1. Selection criteria - screening patients

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Table 1 Patient's characteristics the day before the flight	
Characteristics	**All patients (n=22)**
Age, median (IQR)	69 (63–73)
Male gender, n (%)	20 (91)
BMI, kg/m^2, median (IQR)	29 (26–33)
Comorbidities	
Charlson score, median (IQR)	4 (2–4)
Diabetes, n (%)	5 (23)
Hypertension, n (%)	13 (59)
Obesity (BMI >30), n (%)	10 (45)
SOFA score, median (IQR)	3 (3–6)
SOFA Respiratory score, median (IQR)	3 (3–3)
SOFA Cardiovascular score, median (IQR)	0 (0–0)

Martinez et al, BMJ, June 2021

1. Selection criteria - screening patients

Service de santé des armées

Days since symptoms beginning, median (IQR)	17 (13–19)
Days since ICU admission, median (IQR)	8 (6–16)
Days since mechanical invasive ventilation, median (IQR)	6 (4–11)
Treatments before flight	
Tidal volume, mL/kg, median (IQR)	6.2 (6.0–6.4)
PEEP, mm Hg, median (IQR)	10 (8–12)
FiO_2, %, median (IQR)	50 (45–50)
Neuromuscular blockade, n (%)	13 (60)
Corticosteroid treatment, n (%)	23 (100)
Pneumonia, n (%)	9 (41)
Prone positioning, n (%)	17 (74)
Number of prone position sessions, median (IQR)	1 (1–3)

BMI, body mass index; FiO_2, O_2 inspired fraction; ICU, intensive care unit; PEEP, positive end-expiratory pressure; SOFA, Sequential Organ Failure Assessment score.

Martinez et al, BMJ, June 2021

2. Timeline : D-1

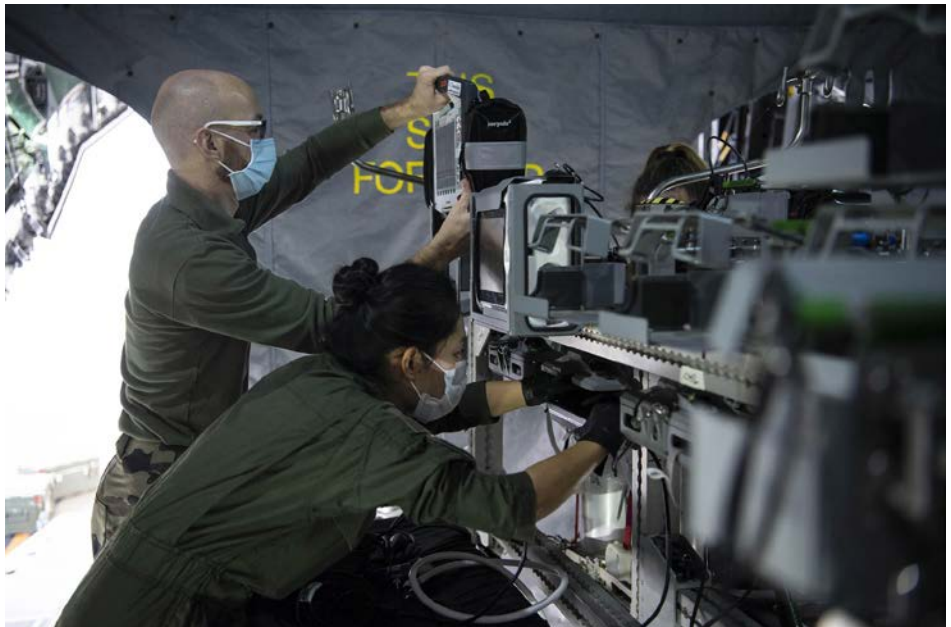
- 5:00 pm : conference call between the medical director, the emergency service and the chiefs medical officers of some ICU

→ Objective : choose stabilized patients who can handle a flight

- 7:00 pm : coordination with the Health Operational Headquarters, and the French Air Force

2. Timeline : D-day

- 7:00 am : detailed presentation of the patients
- 7:30 am : briefing the crew members
  loading the medical equipment in the aircraft



2. Timeline : D-day

- 8:00 am : confirmation of the patients' list

- 10:00/10:30 am – 12:00 pm : Preparation of the hold
  Installation of our medical equipment
  Lunch

2. Timeline : D-day

- 12:00 pm - 01:30 pm : arrival at the destination and transmissions
  loading of the COVID patients

- 3:00 pm : arrival at the final destination, unloading of our patients

- 04:00 pm : end of the medical care

- 04:00 pm – 05:00/05:30 pm: return flight to Paris
  cleaning of all the equipement

2. Timeline : D-day

- 05:30 – 07:00 pm : decontamination chain of all the medical team
  decontamination of the aircraft
  unloading of all the equipment

- 08:00 pm : end of the mission

2. Mission proceedings

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1. Medical team

For 4 patients :

- 1 intensivist
- 2 flight surgeons
- 2 nurses anesthetists
- 2 flight nurses
- 2 nurses

2. Clinical data

- 7 missions including 3 between French Guyana and the French West Indies
  - Avignon
  - Lyon

- N = 23 patients
- Median age : 68 years old
- Sex ratio : 80% of men (n=20)

2. Clinical data

Characteristics	Value
FiO_2, %, median	60
PEEP, cmH_2O, median	10
Tidal volume, ml/kg, median	6,2
O_2 consumption, L/H per patient, median	341
Event requiring medical intervention, n	12
Flight duration, median, min	90

2. Clinical data

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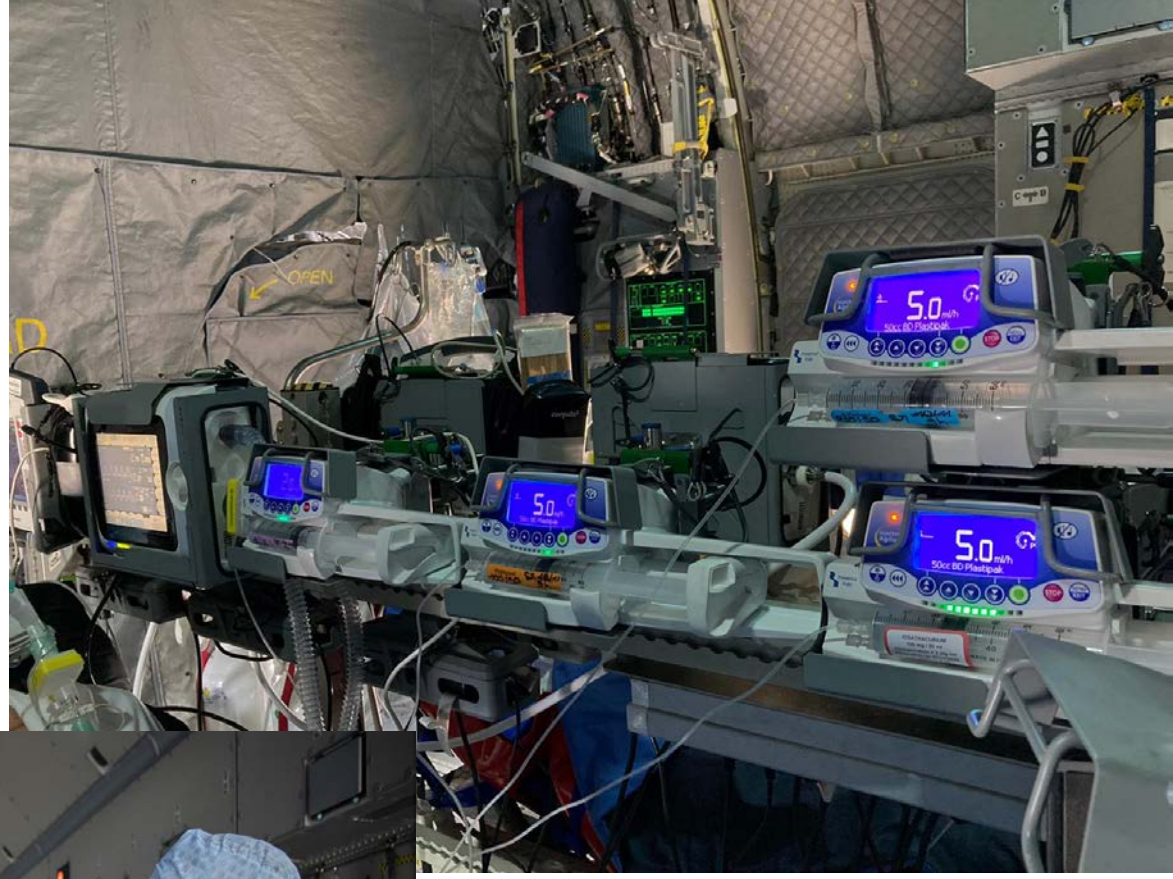
Characteristics	Values
ARDS	
Severe	1
Median	13
Mild	8
Comorbidities	
Hypertension, n (%)	13 (57%)
Obesity, n (%)	8 (35%)
Diabetes, n (%)	6 (26%)
Charlson score, median	3

2. Clinical data

Service de santé des armées

- Equipment for each patient :
  - IV lines for fluids, amines and antibiotics
  - Electric syringe pumps
  - Arterial catheter
  - Transport ventilator for invasive mechanical ventilation
  - 4 bottles of Oxygen, 15L, 200bar
  - Urinary tube
  - Blanket and a light stretcher

  - Blood analysis system and ultrasound system if needed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3. Key points

- 23 patients evacuated included 16 patients in 4 flights
- A medical team trained together
- 9 persons dedicated to 4 patients
- Trained and ready in a very short time
- Quick solution to the saturation of some ICU

- Death rate during the mission or right after : 0

3. Key points

Before the flight :

- Screening and fixing a list of stabilized patients
- Organizing a loading plan according to their medical condition
- Gathering people from different regions within 24h

3. Key points

During the flight :

- Most critical time : the transfer between the medical teams

- Dividing our nurses, depending on the medical condition
  - 1 anesthetist nurse for a severe patient,
  - 1 general nurse for a less severe patient
  - 1 flight nurse responsible for the aeromedical part
  - 1 flight surgeon in charge of coordination for the two patients of his side

→ A team work


OPEN
HIS
SIDE
FORWARD

3. Key points

Service de santé des armées

During the flight :

- Monitoring the vital parameters :
  - Arterial gazometry x2
  - Invasive mechanical ventilation : FiO_2, PEEP, respiratory rate
  - Pa/FiO_2
  - Hemodynamic status : noradrenaline

- Assessing the tolerance of the flight on a severe COVID patient requires a constant monitoring

4. Limits

- Availability of the tactical aircraft
- Time-consuming loading of the medical equipment
- Having to wear a protective personal equipment during a lot of hours
- Threshold of tiredness : ALCYONE, for long-duration flights
- Required time for the decontamination chain and for the aircraft

3. Focus : the MEROPE Mission

ALCYONE : Abri Léger de reConditionnement phYsiologique du persONnEl

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ALCYONE : Abri Léger de reConditionnement phYsiologique du persONnEl

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Conclusion

Service de santé des armées

- First collective aeromedical transfers in France and in Europe
- Flying transportation : high risk of morbidity for severe COVID ARDS
- Collaboration between the French Air Force and the French Military Health Service
- Positive and informative experience for all the medical team
- Decision to keep on training for a future use

Service de santé des armées

Flying through uncertainty…