

The Procedure

Patient (secured in a rescue bag) and doctor are lifted, patient with feet toward the front of the helicopter.

The patient and doctor are winched to the maximum height.

The winch is retract to its flying position

The winch operator extends the AeroGlide

While loosening the winch, the winch operator assist the doctor in rotating the patient 90°, his feet enter the helicopter first.

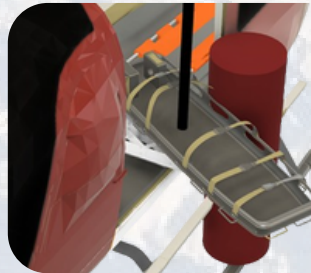
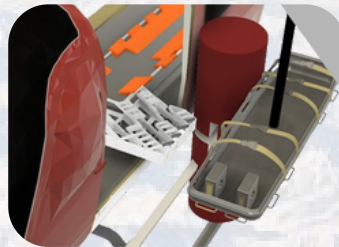
A safety line is attached to the patient and the doctor. The winch is unhooked and raised again to its maximum height.

Using the platform's rollers, the patient is slide onto the stretcher.

Once the patient is safely on the stretcher, the platform is retracted back to its stowed position.



Doctor



Integrated Aerial Patient Transfer System for Helicopter Rescue Operations



Raphael JAVARY
Romain LATTION

Corentin BARUT
Rémy GRANGE

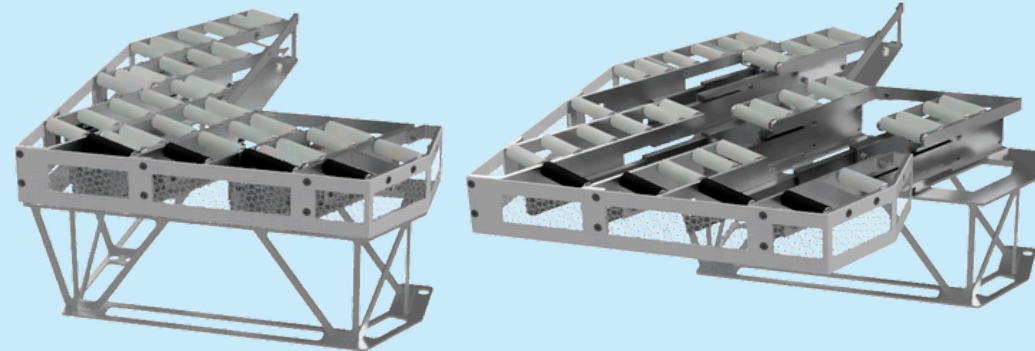
AeroGlide

*Lightweight retractable
rescue platform*

The AeroGlide offers a simple yet highly effective solution to the complex challenge of mid-air patient transfers. Its streamlined design ensures smooth, safe transfers, with the platform extending enough to position the winch bag's center of gravity securely. The rollers, featuring anti-backward locking, allow controlled sliding of the patient. Easy to mount and dismount, the AeroGlide requires minimal maintenance. Lightweight, retractable, and cost-effective, it combines safety and reliability for rescue operations.



Mechanism



AeroGlide in Flight Position

AeroGlide in Operational Position



Minimum installation and
modification



Light weight, 18.5kg



Robust element
Withstand 200kg (security factor 3)



Space-efficient
Ground-level area 0.196m²



Easy to maneuver



Easy to install

The simple, reliable, and cost-effective solution that ensures safe and efficient mid-air patient transfers, designed to perform when every second counts.

Robotic Integration for Safe Extraction

**ENHANCE SAFETY,
EFFICIENCY, AND
COMFORT WITH RISE.
DESIGNED SPECIFICALLY
FOR THE REGA H-145 D3**



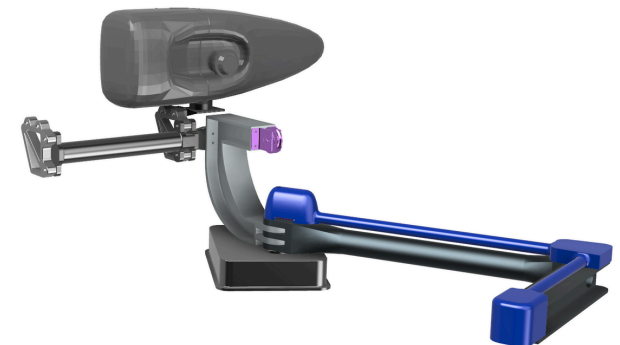
GROUP 2

Max A. Aebi
Raphaëlle Paracuellos
Jan Röthlisberger
Thomas Roulet

Assist:
Konstantin Jacoby
Professor:
Jürg Alexander Schiffmann

SEAMLESS PATIENT TRANSFERS IN FLIGHT

- Eliminates the need of landing for patient rescue
- Streamlines operations, decreasing rescue times.
- Minimal crew retraining required by using existing tools.
- Built to endure tough environments
- Ensures smooth transitions, reducing patient discomfort



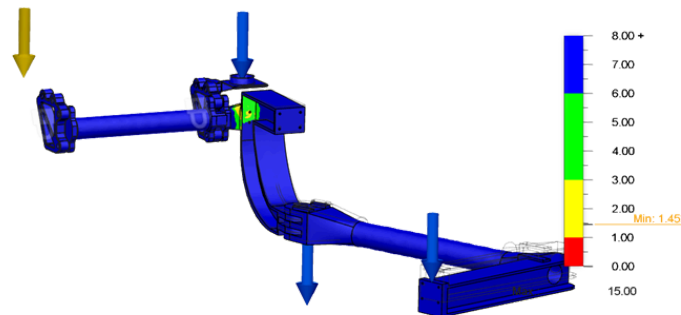
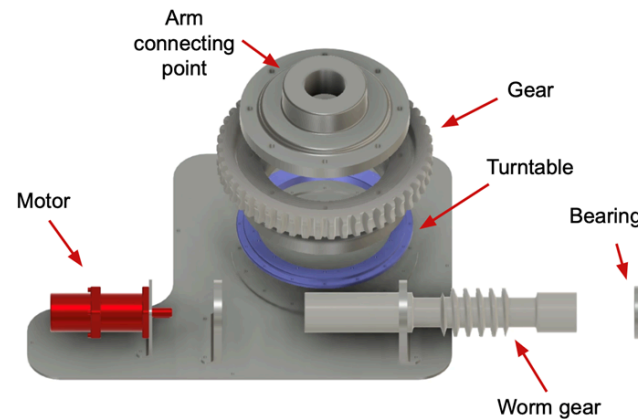
ENGINEERED FOR EXCELLENCE

- Secure doctor to hoist inside the helicopter and engage robotic arm drive to move doctor outside of the helicopter
- Descend and secure patient
- Lift patient
- Engage robotic arm drive to move patient back inside
- Secure patient inside the helicopter



Technical data

- Lift up to 270kg
- Available for H145
- Transfer time of 20s
- Designed to be compatible with all currently used systems
- Patient swinging to angles of more than 45° can be handled by system



MISSION SUCCESS, EVERY TIME

Get in touch today to learn more about how we can improve your patient transport operations. Project Manager Max A. Aebi is available to answer your questions under max.aebi@epfl.ch
photo credit: www.rega.ch

Scan this QR for
animations of the
transfer procedure

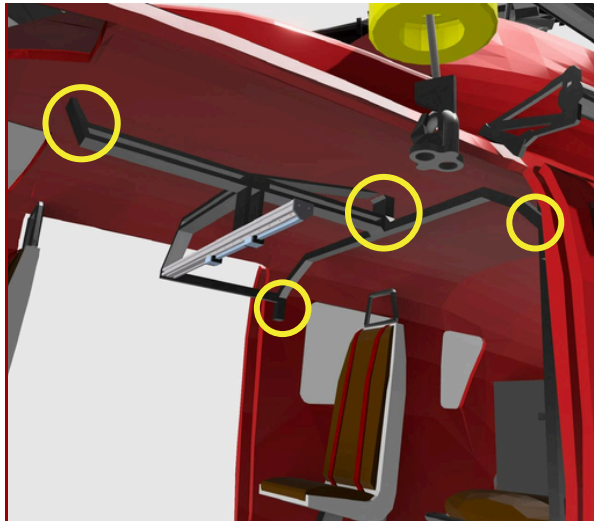


Insertion in the H150



The stretcher (fixed on the roller in (2)) then rotates and slides inside of the helicopter on the rail, with the copilot door open.

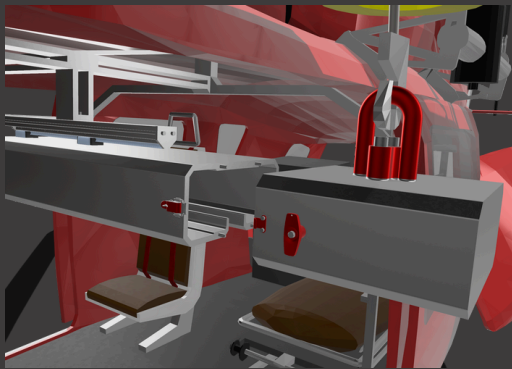
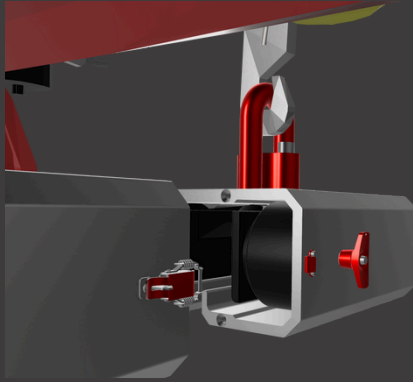
Where to fix it?



Using existing fixation points: two on the central line of the ceiling, one next to the side door on the pilot side and another one next to the copilot's side door.

Security

- Safe transfer: a blocking insures the fixation of the rail with the winch attachment



- Doctor and copilot safety: They do not get exposed outside of the helicopter, they handle the system from the inside.
- Minimal training required.
- No power consumption so no effect on the fuel of the helicopter or compromise of other systems.



Your new

Patient Transfer System

Group 3



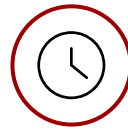


Our concept: Sliding rail system

A sliding rail comes out of the helicopter and blocks itself to a winch attachment. The stretcher, fixed on a roller in the winch attachment then slides on the rail and enters the helicopter. The copilot's door opens to facilitate stretcher rotation for seamless entry. Once inside, the stretcher is detached, the rail comes back inside, and the helicopter resumes flight. This system ensures a fast, safe, and efficient mid-air patient transfer.

1

Our system is...



fast: 4 minutes
max transfer



CG approved



0 W



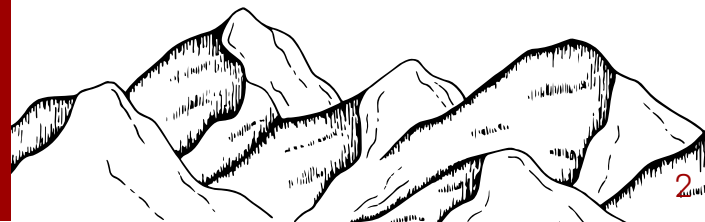
170 Kg



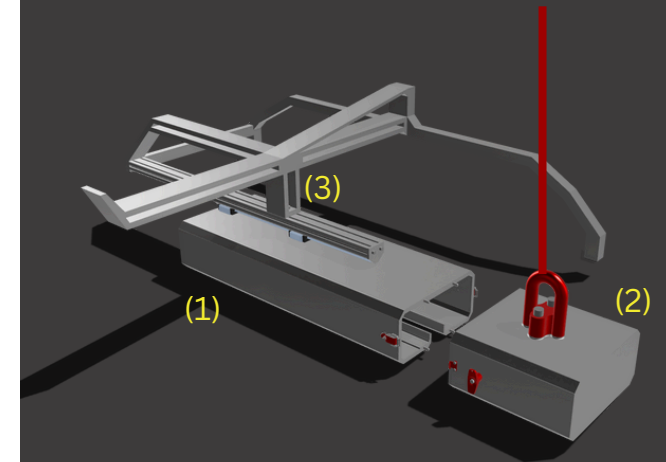
3800 CHF

Minimum modifications

- The system is fixed on built-in fixation points of the helicopter requiring no need for additional attachments.
- It takes no ground space as it's attached to the cab ceiling.

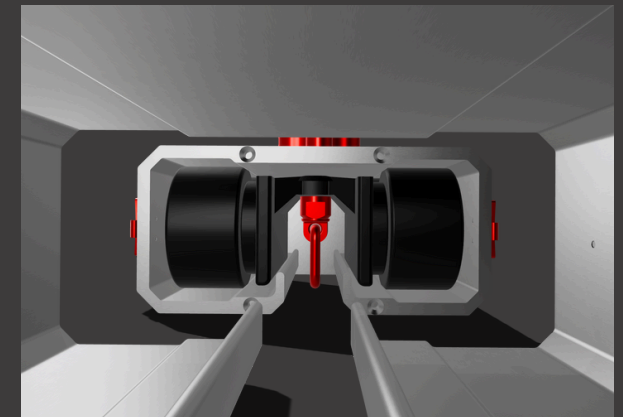


How does it works?



The rail (1) is fixed on a sliding mechanism (3), it slides outside and connects to a winch attachment (2) which has the stretcher attached inside.

The mechanism



The winch attachment (2) ; box fixed on the hoist cable, contains a rolling mechanism that allows the stretcher to slide along the track. The rail fixes itself to this box.

3

Our Strenghts

SkySafe™ Medical Arm is cleverly designed to support all rescue scenarios: reducing response time, minimizing risks, and improving access to difficult locations. Its efficient and practical approach enhances safety and reliability in critical patient transfer operations.



SAFETY

Ensuring the patient's safety during the transfer is our main concern. Our design allows to eliminate the risk of injuries for both patient and staff.



EASE OF USE

The system is designed to ensure ease of use and intuitive movements throughout the steps for easy transfers.



STRUCTURAL MODIFICATIONS

The implementation of our system requires very little structural modification and benefits from using the existing winch, reducing the time required to upgrade helicopters.

Detailed Characteristics



Weight

11 kg



Duration

6 min



Max Load

150 kg



Max Length

0.975 m

SKYSAFE™ MEDICAL ARM

GROUP 4

Simon Barbe

Simon de Bazelaire

Manon Oulevey

Audrey Ventura



The situation

Rega plays a vital role in delivering emergency medical aid across Switzerland's challenging terrains, relying on the Airbus H145 helicopter. Current rescue procedures, which involve landing at intermediate sites, are time-consuming and complex. The SSMA proposes an Integrated Aerial Patient Transfer System to enable secure, uninterrupted patient transfers directly into the helicopter, saving time, reducing risks, and improving access efficiently.

Our system

SkySafe™ Medical Arm is a 3-degree of freedom mechanism, consisting of a horizontal articulated arm. Reaching the patient outside, the arm allows to transfer the patient safely inside, directly on the medical stretcher. The system is integrated inside the helicopter, above the stretcher.



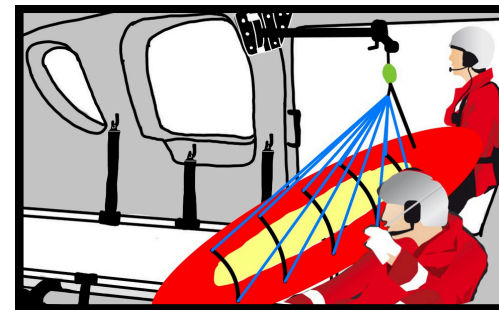
Detailed steps

1 - Bring up and attach to arm



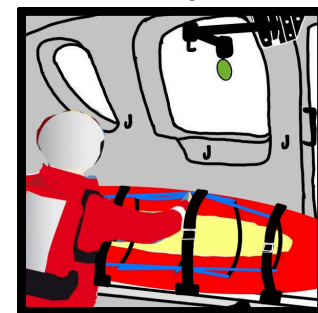
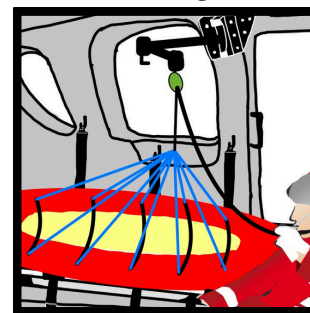
Retract fully the hoist cable and take the arm's ropes from the rescue aid and attach them to the arm.

2 - Transfer the patient inside



Rotating the arm, transfer the patient carefully inside. Move it until the final position above the stretcher is reached.

3 & 4 - Bring down & secure the patient



Using Petzl descender, cautiously bring down the patient on the stretcher. Then secure the patient on the stretcher with the belt system. Store the arm next to the window.

Usability



The system has been designed to be easily used by the paramedic while airborne. It is compact and compatible with other onboard systems (external hoist, rescue bag, electrical power, ...)

Size - Weight

The arm fits inside the cabin while allowing the paramedic to move. It weighs less than 35 kg and can lift a 120 kg patient.

Safety



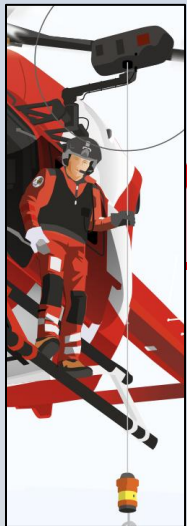
The system ensures the safety of the patient and the emergency flight physician while transferring them into the helicopter. It allows for the sequence of previous operations in case of any undesired problems.

Speed

This system is quick and does not require many manipulations. The streamlined process makes for a swift and efficient rescue.

Integrated Aerial Patient Transfer System for Helicopter Rescue Operations





SAFETY

Ensure the well-being of all parties, at all times.



VERSATILITY

Ensure the possibility to deploy any existing rescue mechanisms.



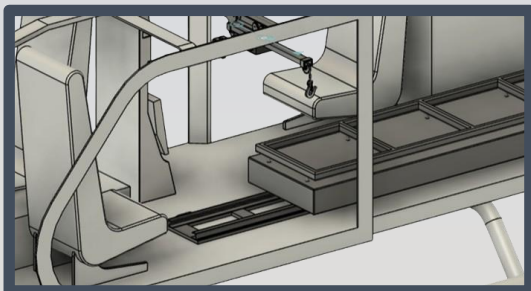
EASE OF USE

Streamline the procedure for efficient patient rescue.

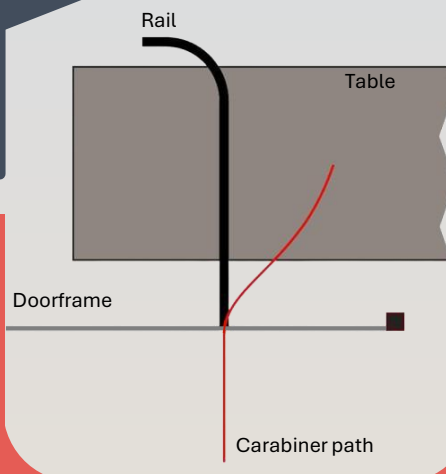


COMPATIBILITY

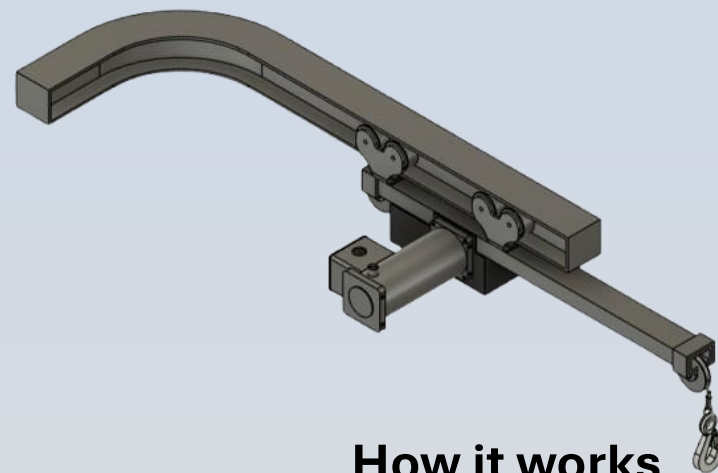
Maintain functionality across all onboard systems and equipment.



The curved trajectory of the rail, drawn in black, makes the patient move towards the back of the helicopter, over the medical table. The trajectory is shown here in red.



Our System



How it works

1. The Table

The rail on which the table slides is extended. It has two secure positions, front or back.

- The table is slid into its front position
- The patient is brought up to the cabin's level by the outside hoist
- The winch folds towards the cabin

2. The Arm

The arm moves along the rail on its wheels. It features a small electric hoist

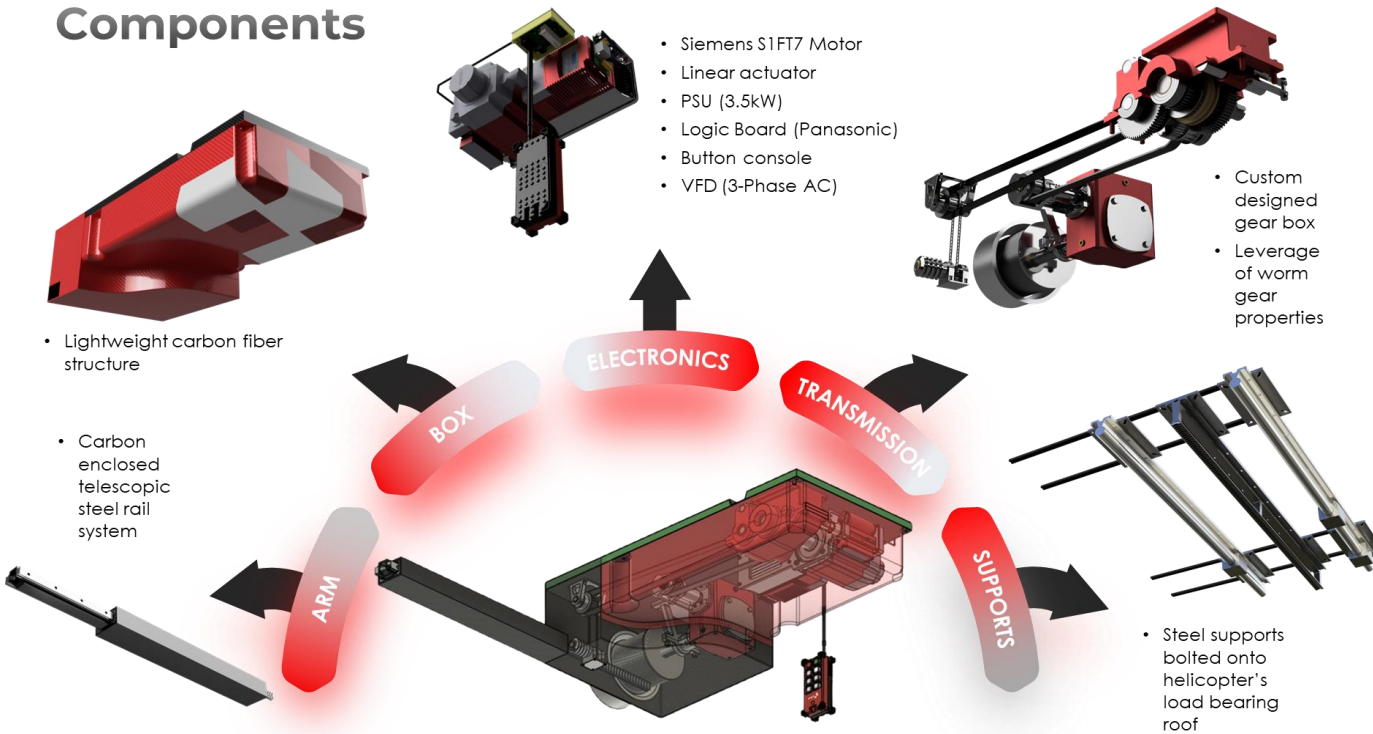
- The arm slides outside the cabin
- The patient is transferred to the arm's carabiner
- The arm slides back inside, bringing the patient over the table

3. The Rail

The rail guides the arm's wheels along a curved trajectory.

- The patient is lowered onto the table using the inside hoist
- The patient is secured, and the table slides back for transport

Components



THE JET ANGEL

AERIAL PATIENT TRANSFER
SYSTEM FOR HELICOPTER
RESCUE OPERATIONS



Our team:



N. P. Bagnoli
GM



A. Ruggeri
GM

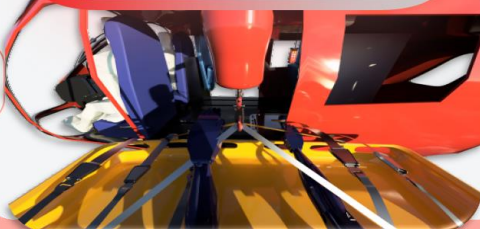


B. Bjarnadóttir
GM



A. Dubulsson
GM

Emergency flight physician exits cabin
secured to stretcher



Lowering and raising



Crane arm starts to retract and
Emergency flight physician re-enters
cabin



Stretcher is fitted to base and slid back to
the transport position



Specification

OLD system

NEW system

Weight

42 Kg

70 Kg

Speed

1.2 m/s

1.6 m/s

Load

270 Kg

300+ Kg

Compactness

Na

0.06 m³

Safety

Cable
cutter

Self- lock

Versatility

Seating/
laying

Seating/
laying

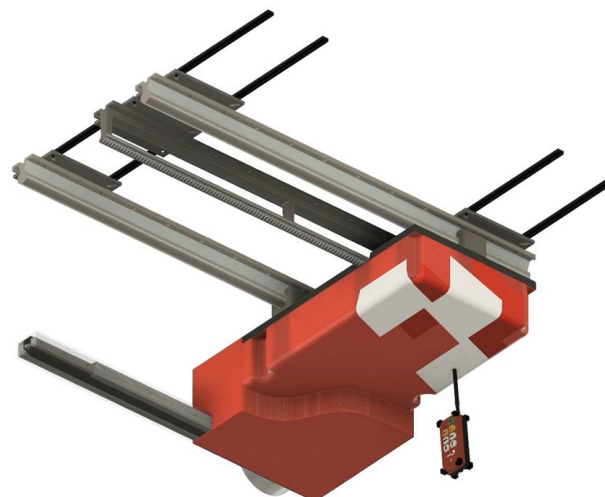
Efficiency

Longer
time

Shorter
time

Cost

45'420 CHF*



Total cost:

45'420 CHF

(per system considering
the production of 20
systems)



Rescue without landing

Eliminates the need to land to
transfer patient inside



Ease of operation

Intuitive process that requires
minimal effort from the staff



Easy installation

This product requires minimal
modifications to the helicopter

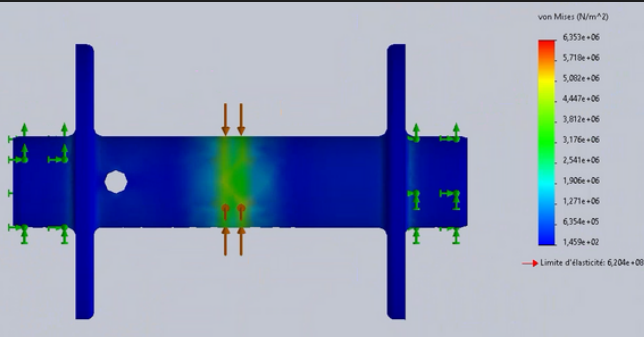
Why it works

Component specification

- The **rope** is 5m long and can carry 400 kg.
- The **carabiner** holds up to 2549 kg.
- The **motor** has a nominal torque of 86.55 Nm and a nominal speed of 0.2 m/s.
- The winch is fixed to **two fixation points** inside the helicopter that can hold up 200 kg each. (This information was found in the flight manual.)

Quality assurance

- We made many **calculations** :
 - Required length of rope
 - Drum dimensions based on rope
 - Center of mass change of the helicopter
- We then added a security factor to those numbers
- We also **compared** the bought parts, like the motor or the bearings, to find the one with the best capabilities and adapted to our needs.
- We did some Finite Element Methods (FEM) **simulations** on the drum and fixations to make sure it can hold the expected forces.



More infos

Advantages

- User friendly
- Minimal number of components
- Many parts are available for purchase
- Lightweight
- Installation requires no modification of the cabin

Potential optimization points

- Improving ergonomics
- Refining fixation geometry
- Reducing overall weight
- Lowering the cost of parts
- Optimizing size

—> With a bit more time these optimization would have been implemented.

Global data

- Weight : 15kg
- Volume : 0.01m³
- Dimensions : 532 x 119 x 196 mm
- Price (estimated) : ~10'000CHF
- Time to bring patient inside : 40s to 1min

Thank you for your attention !

Do not hesitate to read our report if you want to find out about our calculations and simulations or to see the assembly steps and more !

If you have more questions do not hesitate to contact us :

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EPFL



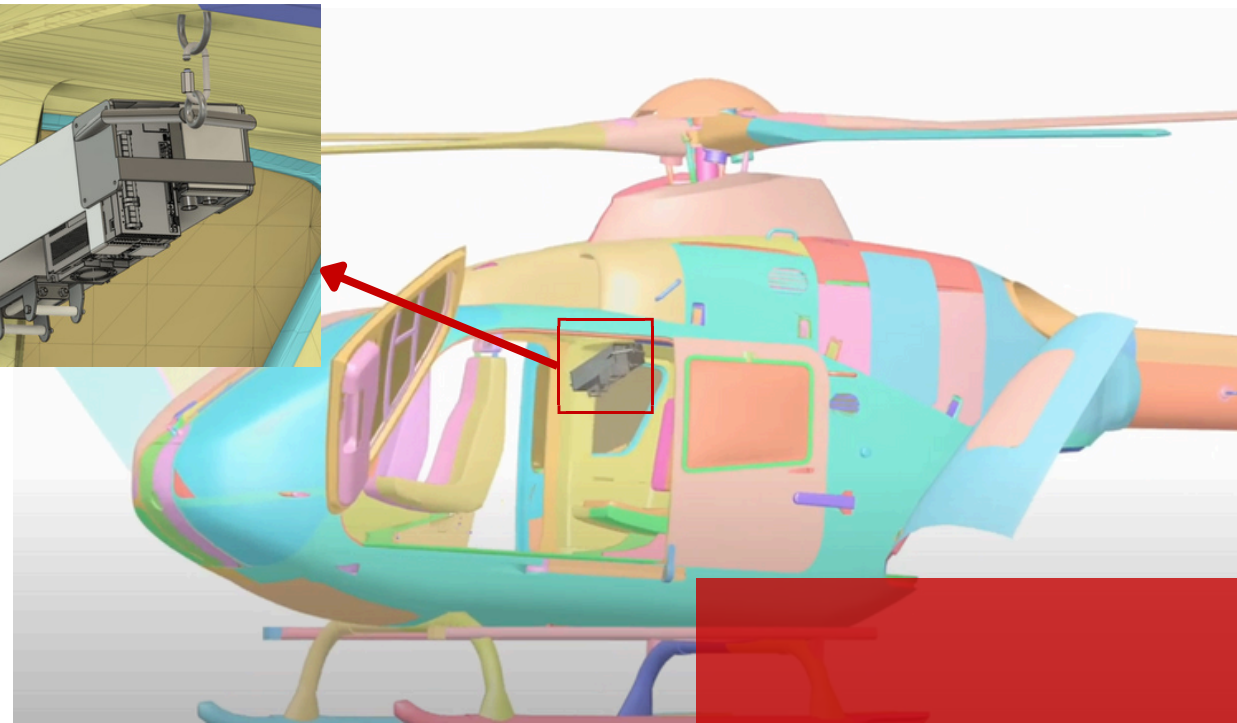
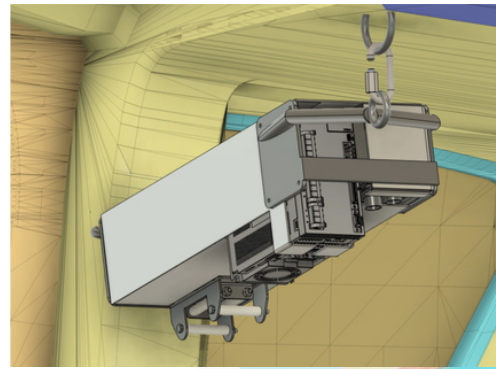
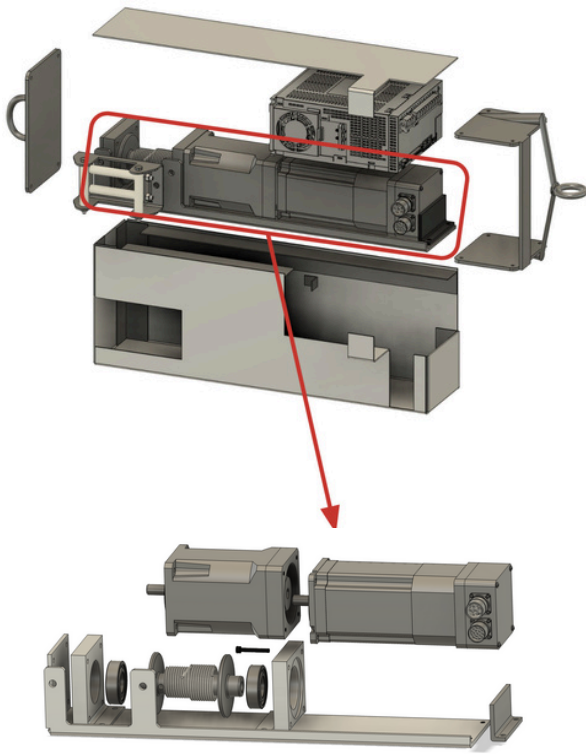
Integrated Aerial Patient Transfer System for Helicopter Rescue Operations

ME-403 Group 7

Tania Rosset
Bron Ward

Alexis Ruprecht
Joshua Levy-Baron

supervised by Anupam Jena



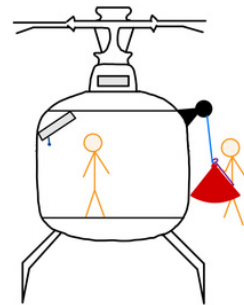
Our Solution

What ? To transfer the patient inside the helicopter we want to add a **secondary smaller winch**.

Where ? It is **inside** the helicopter at the opposite of the door.

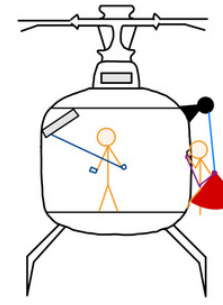
How it works ? A DC motor connected to a reducer makes a **drum rotate**. A rope is rolled up around this drum and it can be unrolled as wished.

How to use ? Controlled by a **remote controller**. It carries the patient inside with the help of the outside winch.

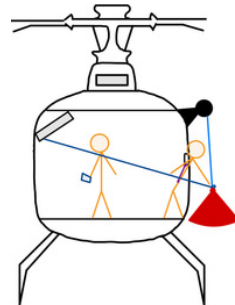


Step 1: Use the **outside winch** as usual and stop at door level

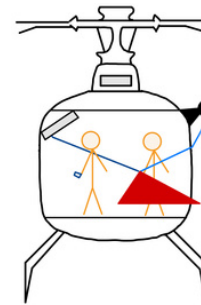
The patient is safely inside the stretcher (red triangle)



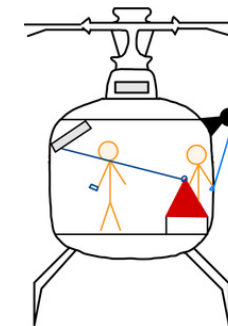
Step 2: The doctor attaches one of his two carabiner to the inside of the helicopter and **walks in**



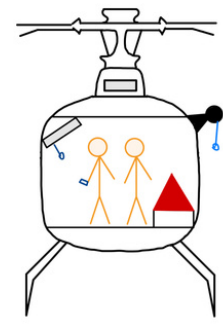
Step 3: Someone attaches the carabiner of the **inside winch** to the patient



Step 4: The doctor and staff **pushes and rotate the patient** inside. He is lifted by both winches.



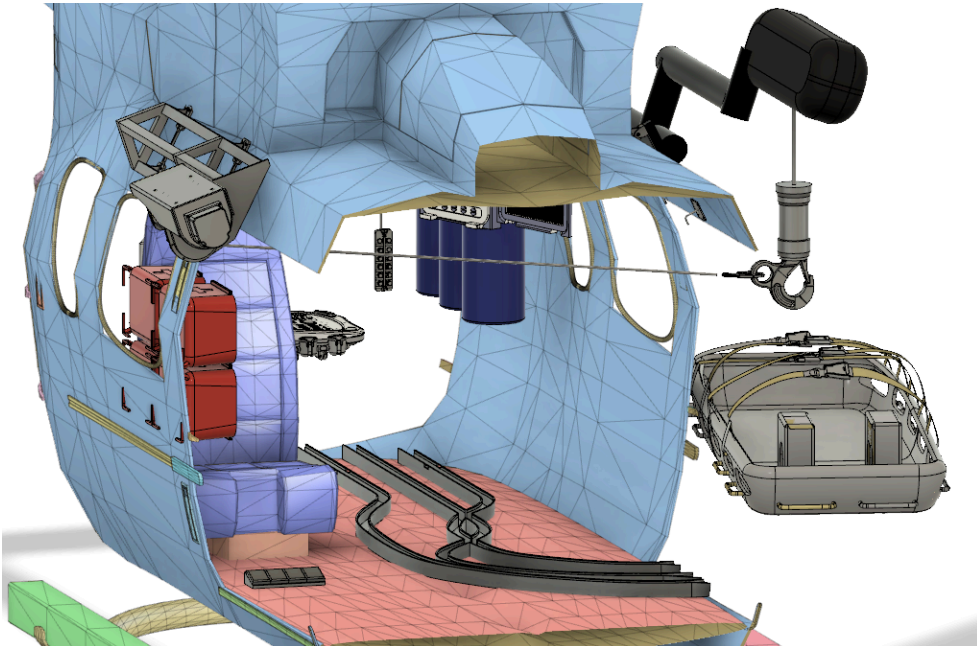
Step 5: Once the patient is on the stretcher, someone can **detach** the patient from the **outside winch**...



Step 6: ... and then from the **inside winch**.

How to use it

Integrated Aerial Patient Transfer System for Helicopter Rescue Operations



Overview

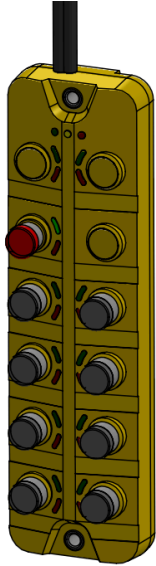
To counter REGA's current issues, our team proposes a solution to reduce time loss during aerial rescue missions.

Our design will enable REGA to transfer patients from the ground to the helicopter without landing.

Secondary winch system

We have installed a secondary winch on the opposite side of the helicopter. This system allows the patient to be pulled from outside to inside the helicopter through the side door. Once the patient is secured, the attachment point is fixed to the ceiling to avoid any difficulties with crew movement in the helicopter.



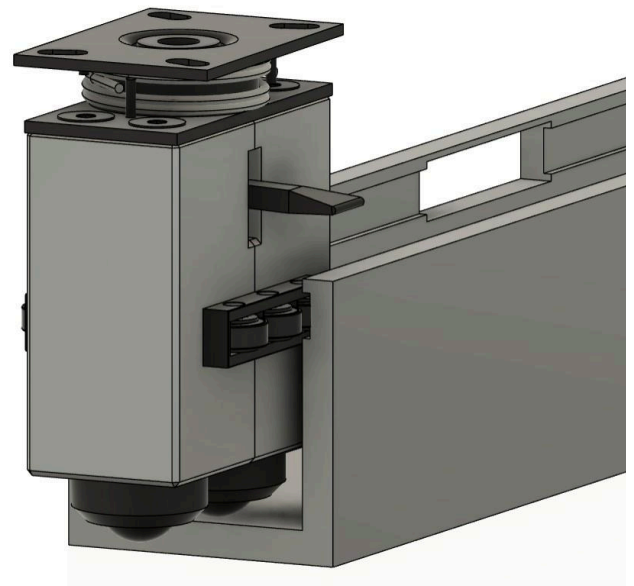


Remote control

To ensure an easy guidance for the attachment point, we propose a synchronous motion control between the two winches. Hand and pedal remotes allow an easy displacement in the x and y axis (winches - stretcher plane) as well as independent control on each winch.

Railing system

Our system comprises a rail fixed to the floor of the helicopter and sliding blocks mounted on the stretcher, guaranteeing perfectly guided and safe movement for the patient. Thanks to their flared shape, the rails allow rapid attachment of the stretcher, which is held in the grooves by a spring mechanism. Integrated notches lock the stretcher in the transport position and allow it to be easily unlocked by pressing.



Patient safety

Patient safety is our priority. The secondary winch and rail system ensure complete guidance of the patient during transfer to the helicopter. The self-locking sliders provide a hands-free experience for the helicopter crew, allowing for quicker care of the patient.

Implementation

The design that we propose uses the support pins already present on the helicopter for the secondary winch holding structure, and keeps the overall helicopter structure intact. Minor modifications are needed on the ceiling, to provide an opening for the secondary cable, the attachment point holder and the redirection pulley.

ABOUT US

Imagine a life-saving mission where **every second counts**, but traditional systems make loading patients mid-flight nearly impossible.

Our company changes this with an innovative solution that **safely integrates stretchers into helicopters while airborne**.

This breakthrough simplifies rescue operations, ensuring **faster & safer** patient care in the moments that matter most.

CONTACT US



Juliette Vildé



Amaury Pailloux



Blanche Roquejoffre



Baptiste Grollier



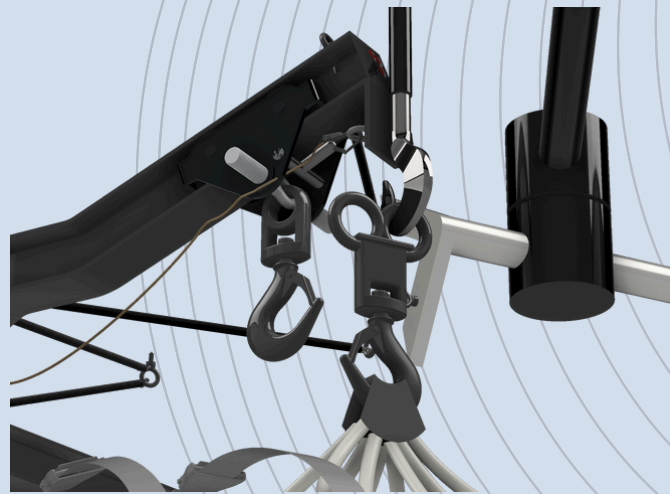
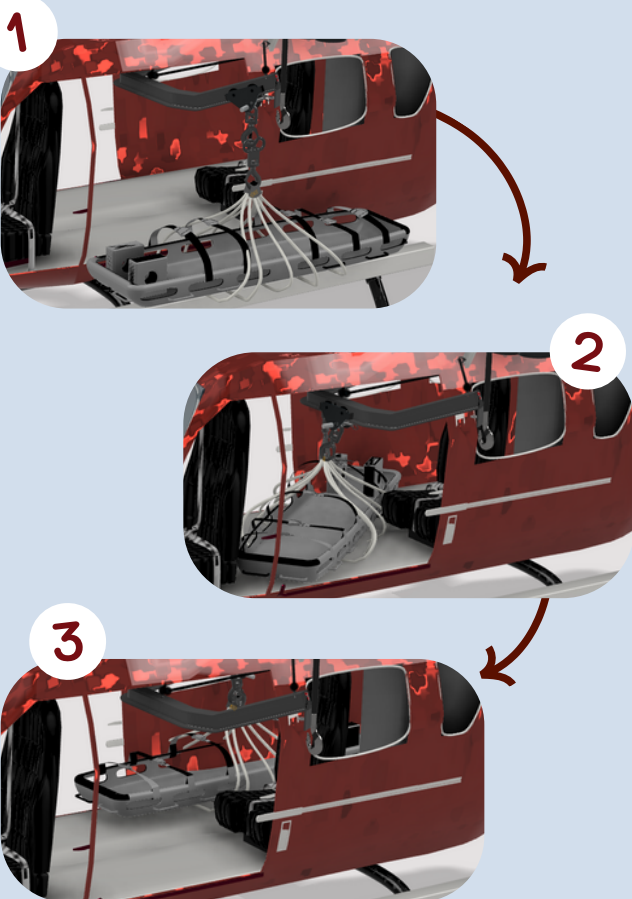
SKYRGENT

*"Where security
meets safety"*

OUR OFFER

Speed and Efficiency in Emergency Situations

With an **ergonomic and intuitive design**, patient loading is performed in **record time**, crucial for rescue operations where every second matters.



Optimal Safety for Patients and Crew

Secure locking mechanisms provide **quick and reliable** fixation

minimizing the risk of movement or falls during critical maneuvers.

Robust and Durable Design

Built with **high-quality, lightweight** materials, the system combines durability with efficiency. Its **low-maintenance** construction guarantees **long-term usage** while reducing operational downtime.

PRODUCT

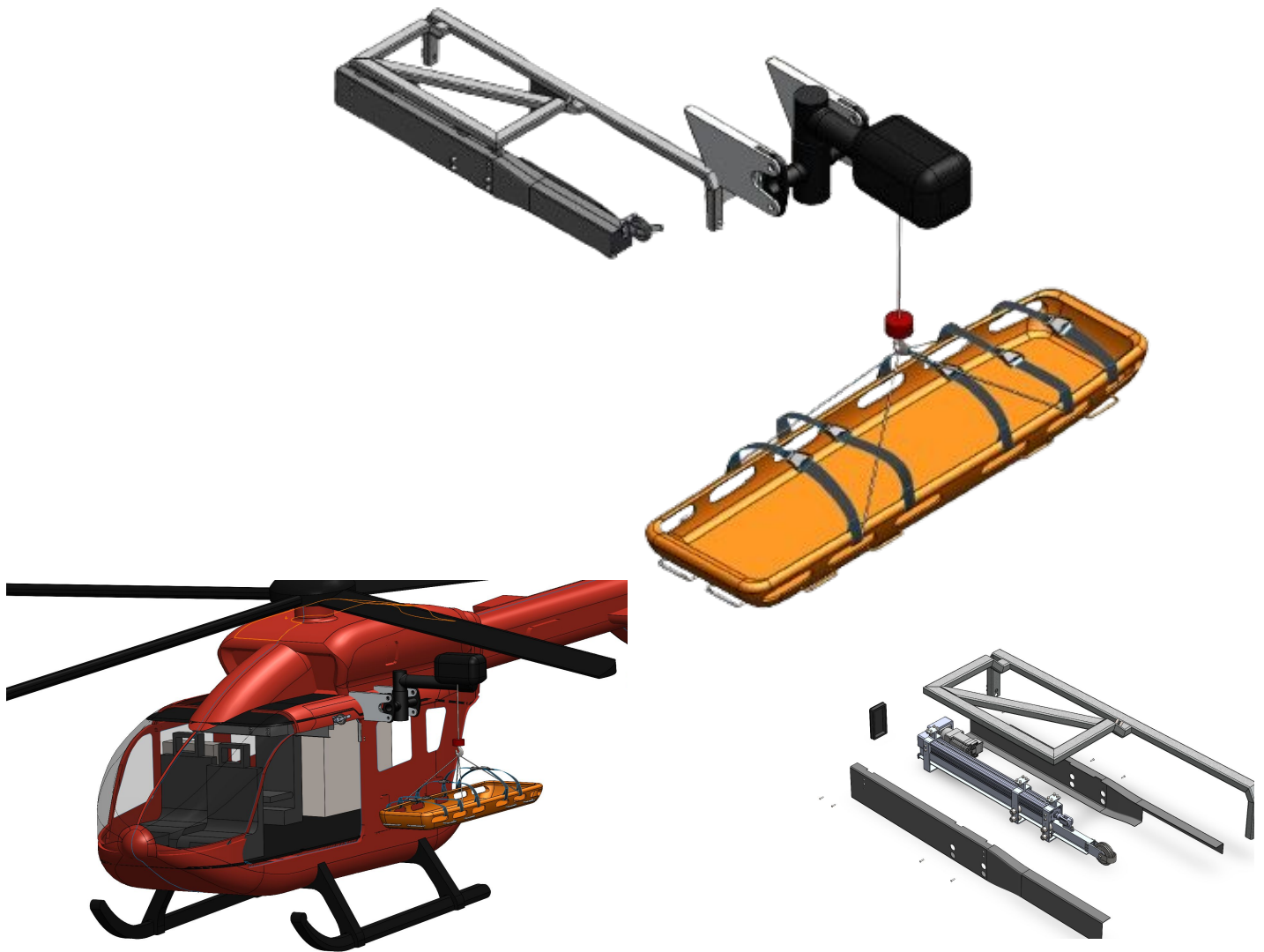
Specifications:

Unitary Price	10'000 CHF
Expected lifespan	10 years
Rescue time	20 min
Load capacity	170 kg
Device Total Weight	47kg

Advantages:

- Time saving
- Money saving
- Allows longer flights
- Benefit after 2 years

Integrated Aerial Patient Transfer System



IAPTS: a removable device designed for Airbus H145 helicopters. Enables the rescue of individuals via helicopter and their transfer into the cabin during hover flight. Thus eliminating the need for an intermediate landing, saving both time and fuel.

BOOST EFFICIENCY, SAVE ENERGY, MISSION'S READY!

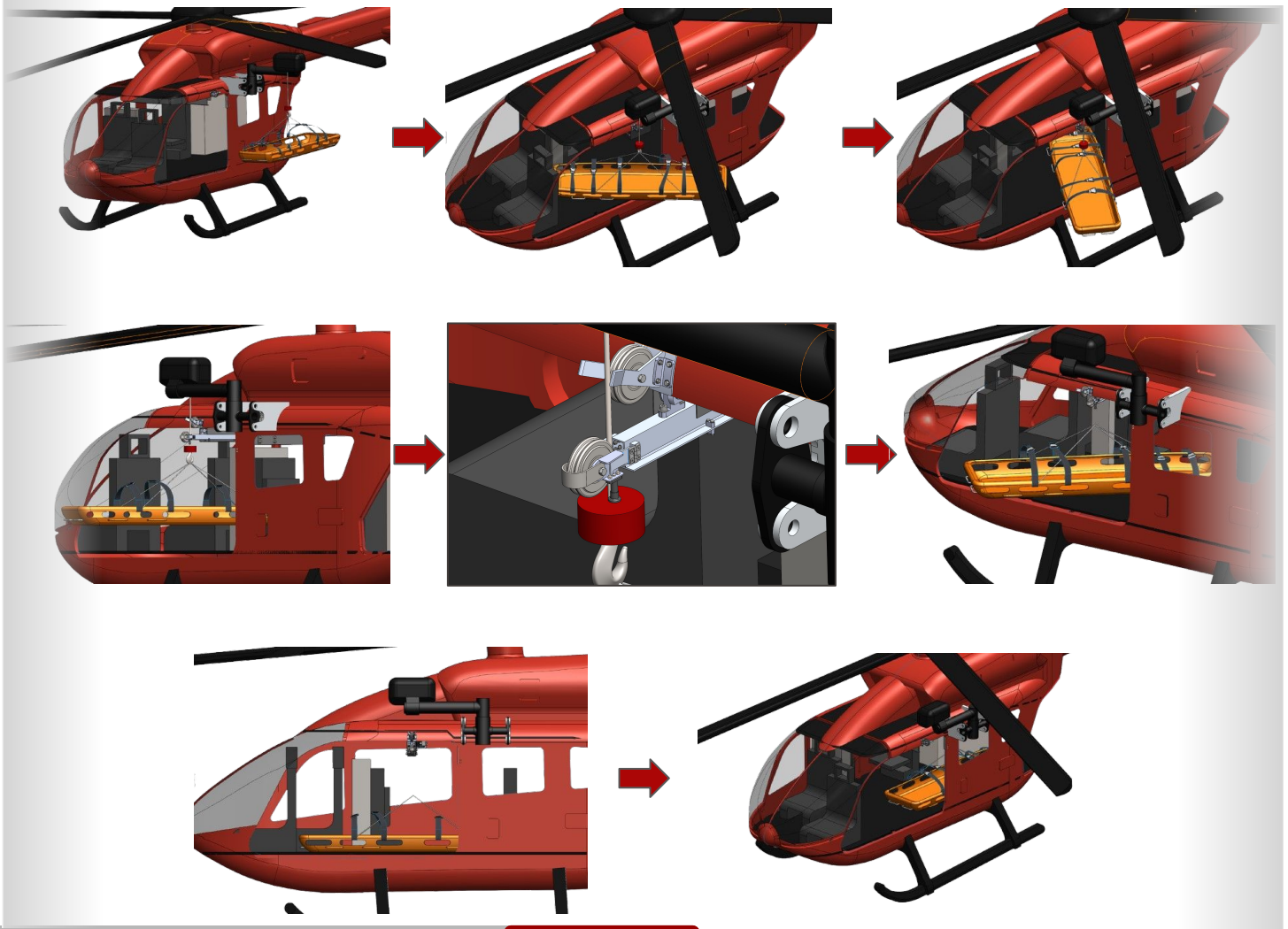
DEVICE WEIGHT:
24.5 kg

MAXIMUM LOAD:
270 kg

LOW COMPLEXITY:
Low part count, compatible with REGA's winch system

REMOVABLE:
No major modifications on the helicopter for installation

INGRESS PROCEDURE



Rescue Hoist 44301

Cable length : 90m
Max Load : 270kg
Speed : 80 m/min
Weight : 41.8 kg

Pulley, Hinged opening

Easy opening,
Pull the cable inside

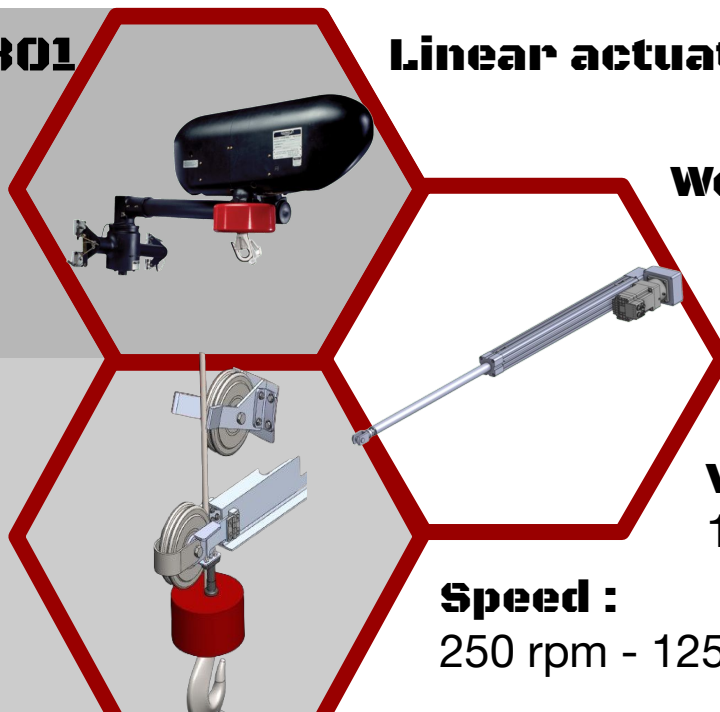
Linear actuator RSA32

Weight : 9.7kg

Power :
320 W

Voltage :
12 - 72 VDC

Speed :
250 rpm - 1250 mm/min



WAYS OF IMPROVEMENT:

Folding mechanism → save space in cabin
Optimisation of part shape → Weight reduction
Modular components → Adaptability to other model