

# S.A.F.E. SUSTAINABLE DESIGN OF ANTI-SEISMIC FURNITURE AS SMART LIFE-SAVING SYSTEMS DURING AN EARTHQUAKE

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PON  
RICERCA E INNOVAZIONE

MIUR / PON - RICERCA E INNOVAZIONE 2014/2020

Progetto di Ricerca Industriale e non preponderante Sviluppo Sperimentale nell'Area di Specializzazione "Design, Creatività e Made in Italy"

# S.A.F.E. SUSTAINABLE DESIGN OF ANTI-SEISMIC FURNITURE AS SMART LIFE-SAVING SYSTEMS DURING AN EARTHQUAKE

**OBJECTIVES** furniture as life-saving objects  
during seismic events that are:

- Sustainable
- Work as a system
- Incorporate smart functions

**METHODOLOGY** cooperation between:

- University
- Furniture industry
- Furniture certification centre
- Information technology industry

to go beyond already available non-systematic  
“earthquake-proof” solutions

(for example stronger desks that are very  
expensive and heavy, thus, impractical in everyday  
life and economically unaffordable in most  
situations)



**Furniture as additional hazard  
during seismic events**

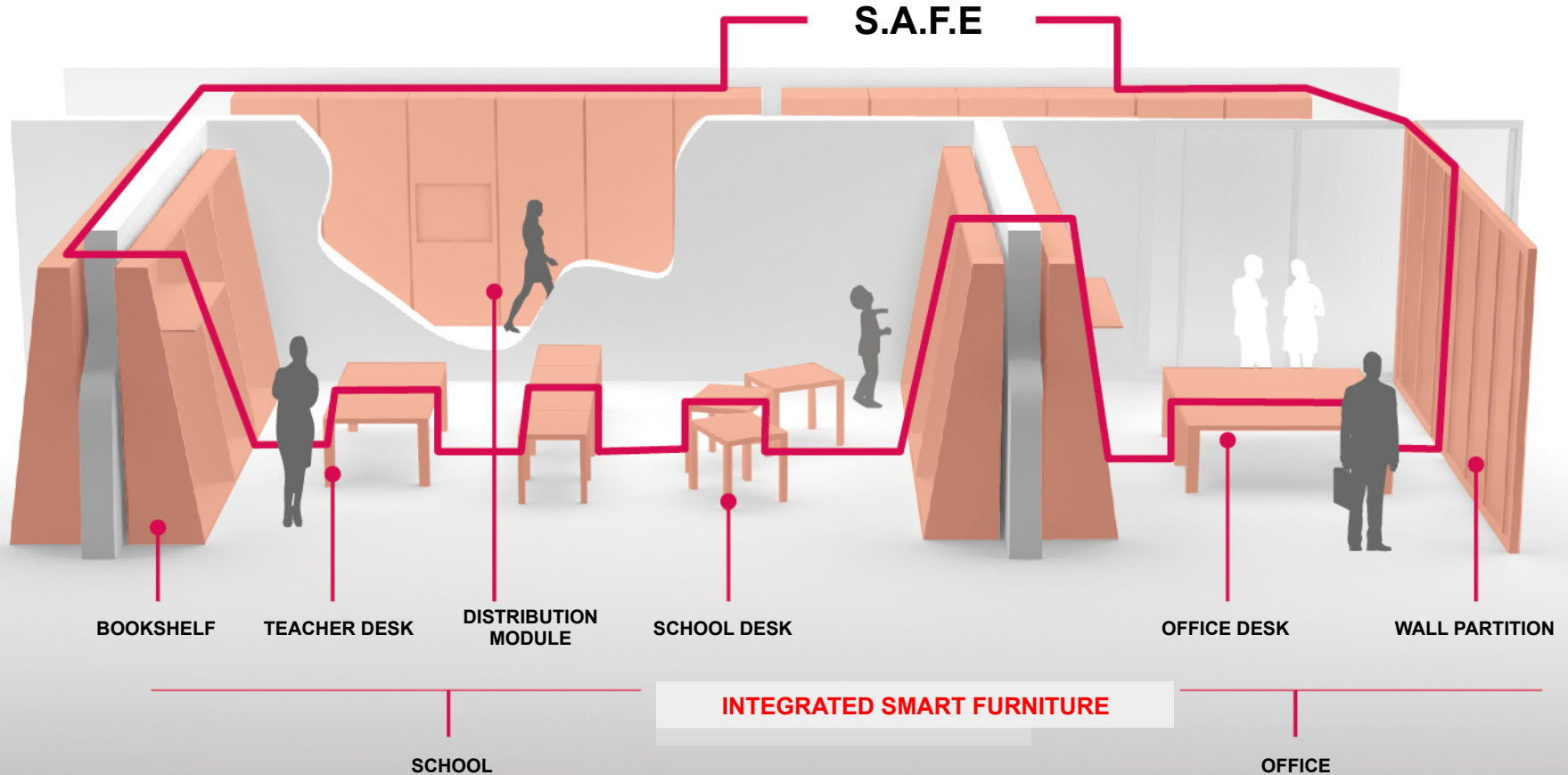
**VS**



**Furniture as life-saving objects  
during seismic events**



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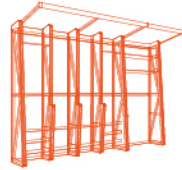
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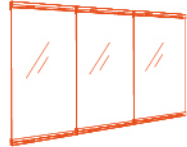
**DESK**



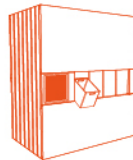
**BOOKSHELF  
EQUIPPED WALL**



**PARTITION WALL**



**AUTOMATED  
DISTRIBUTION MODULE**



**CONCEPT**

**DESIGN DEVELOPMENT**

**PRELIMINARY STRUCTURAL TESTS**

**FIRST PROTOTYPING**

**TEST PROTOCOLS**

**EXPERIMENTAL TESTS**

**DESIGN OPTIMISATION**

**FINAL PROTOTYPING**



**S.A.F.E.**





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**DESK**

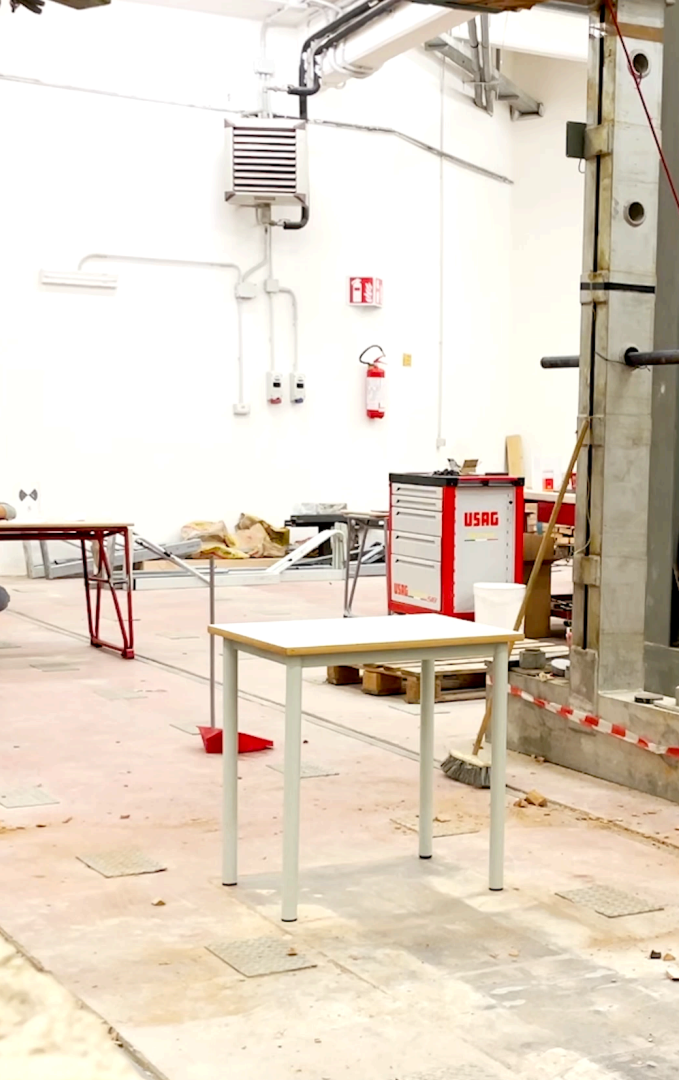


**Students and teachers are instructed to hide under their desk in the case of an earthquake**

**Are today school desks able to resist a structural collapse?**

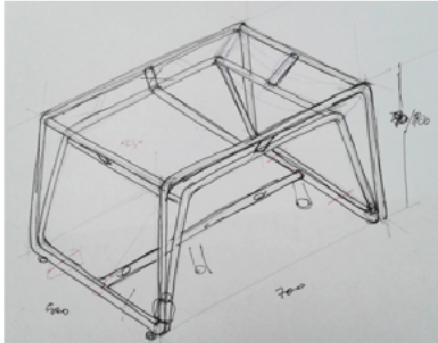
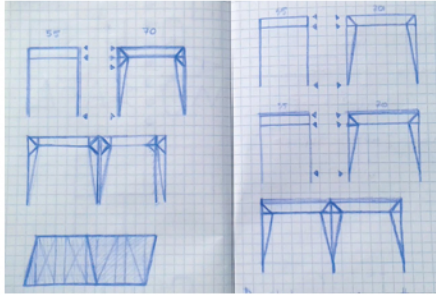
**Is it possible to design and produce school desks able to resist a structural collapse using the same production technologies and resulting in similar weight and price?**



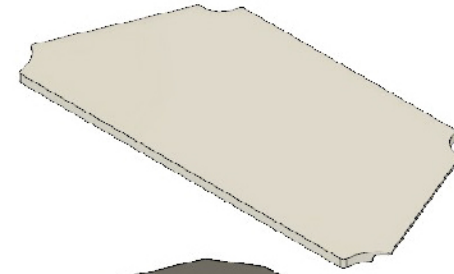
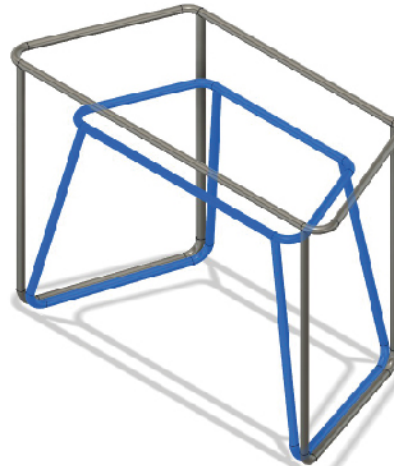
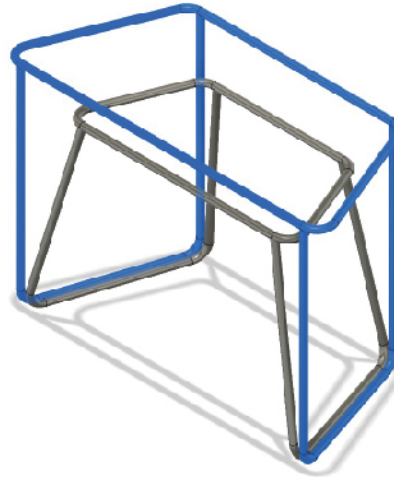


MASS 600 Kg - HEIGHT 1.75 m

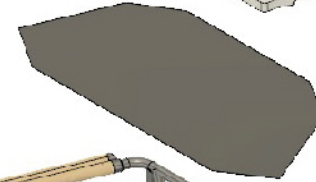
## STRUCTURAL ENGINEERING



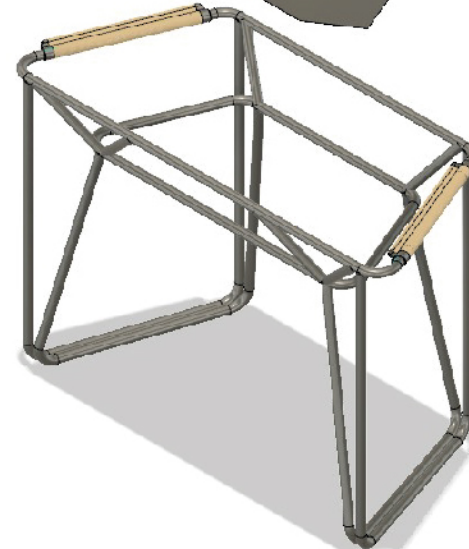
## INDUSTRIAL DESIGN



PLYWOOD TOP



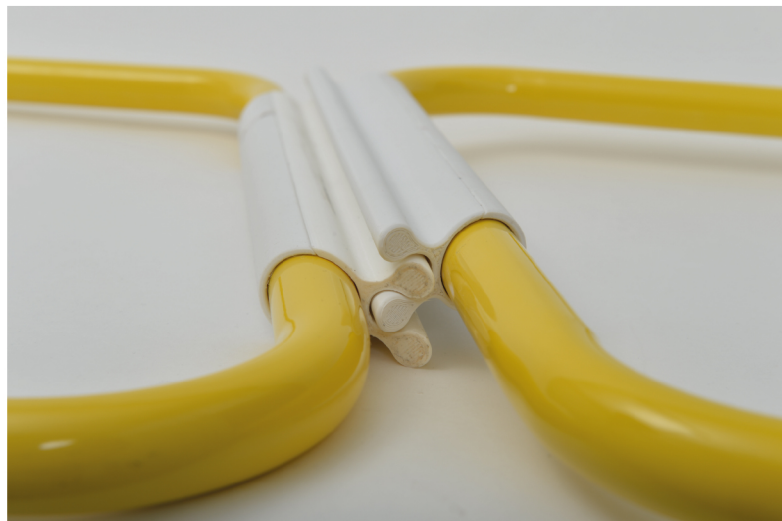
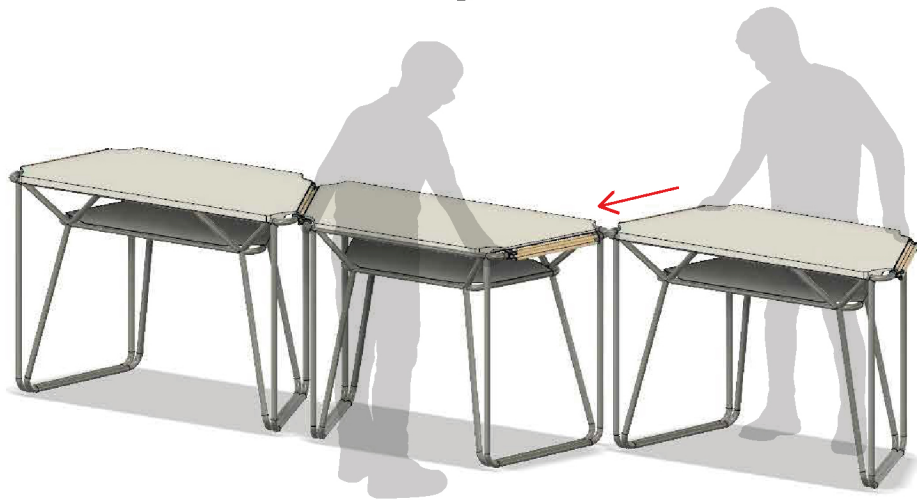
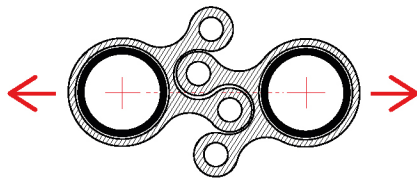
SAFETY SHEET METAL



DESK/DESK  
CONNECTION

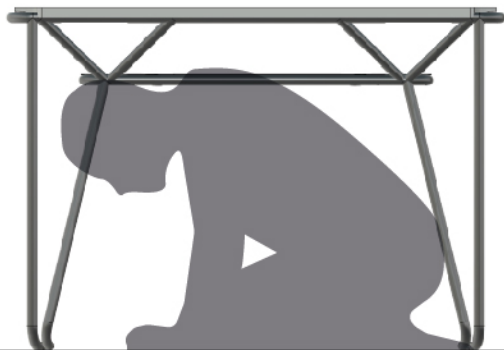
LIFE-SAVING  
STRUCTURE







1° VERSION



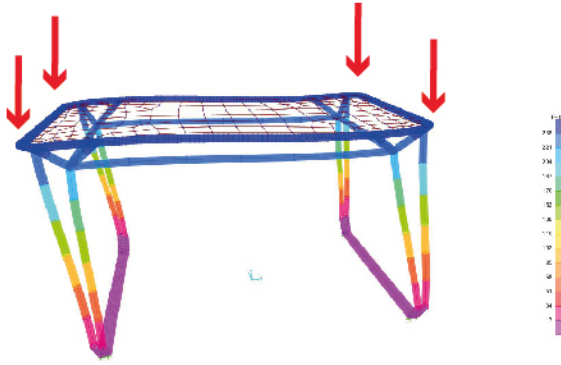
2° VERSION



3° VERSION

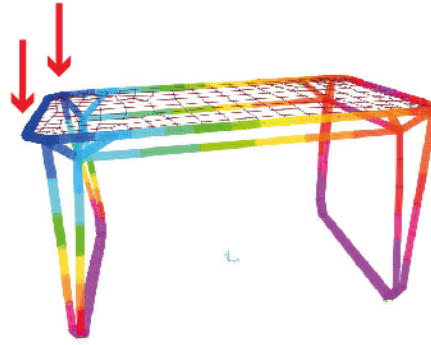


**CONCENTRATED LOAD**  
**4 CORNER**



**CRITICAL LOAD**  
**161 KN**

**CONCENTRATED LOAD**  
**2 CORNER**



**CRITICAL LOAD**  
**110 KN**

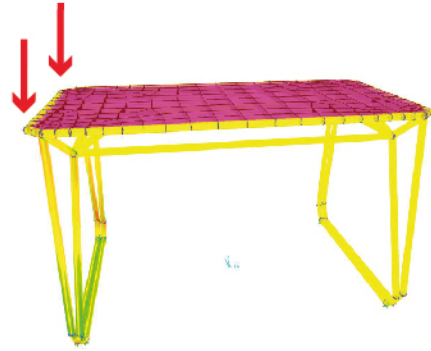
**CONCENTRATED LOAD**  
**1 CORNER**



**CRITICAL LOAD**  
**98 KN**



**ELASTIC LIMIT**  
**26 KN**



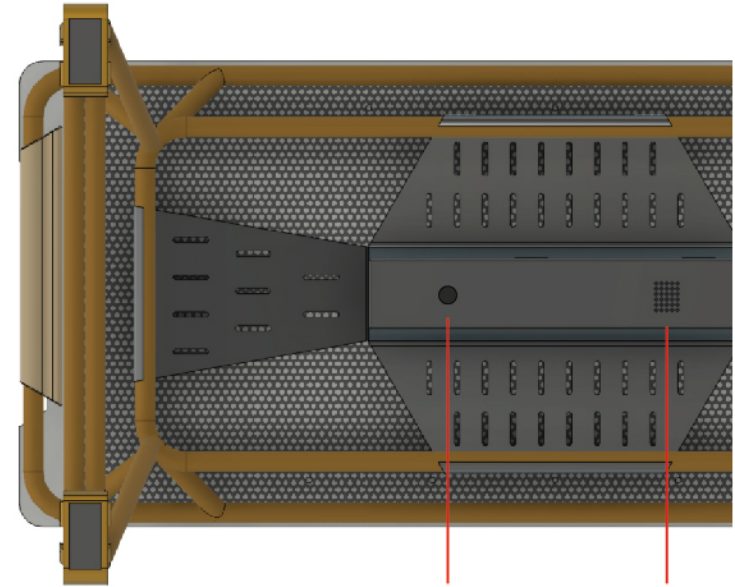
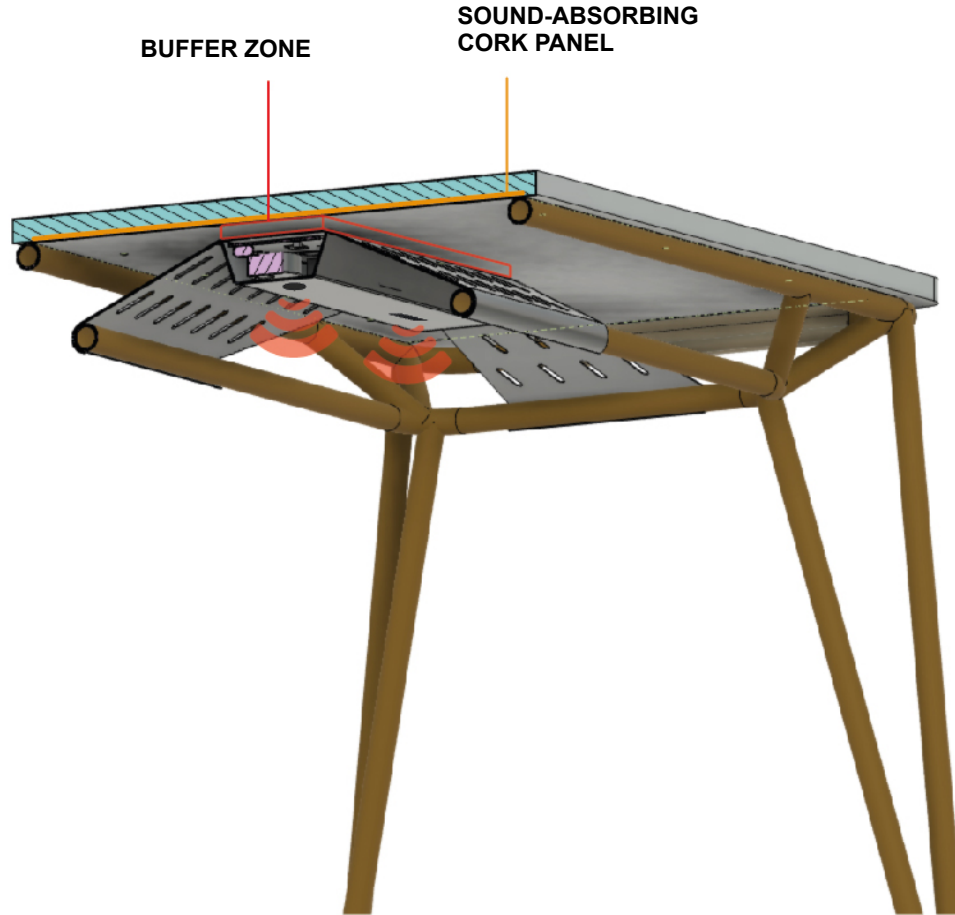
**ELASTIC LIMIT**  
**12 KN**



**ELASTIC LIMIT**  
**6 KN**



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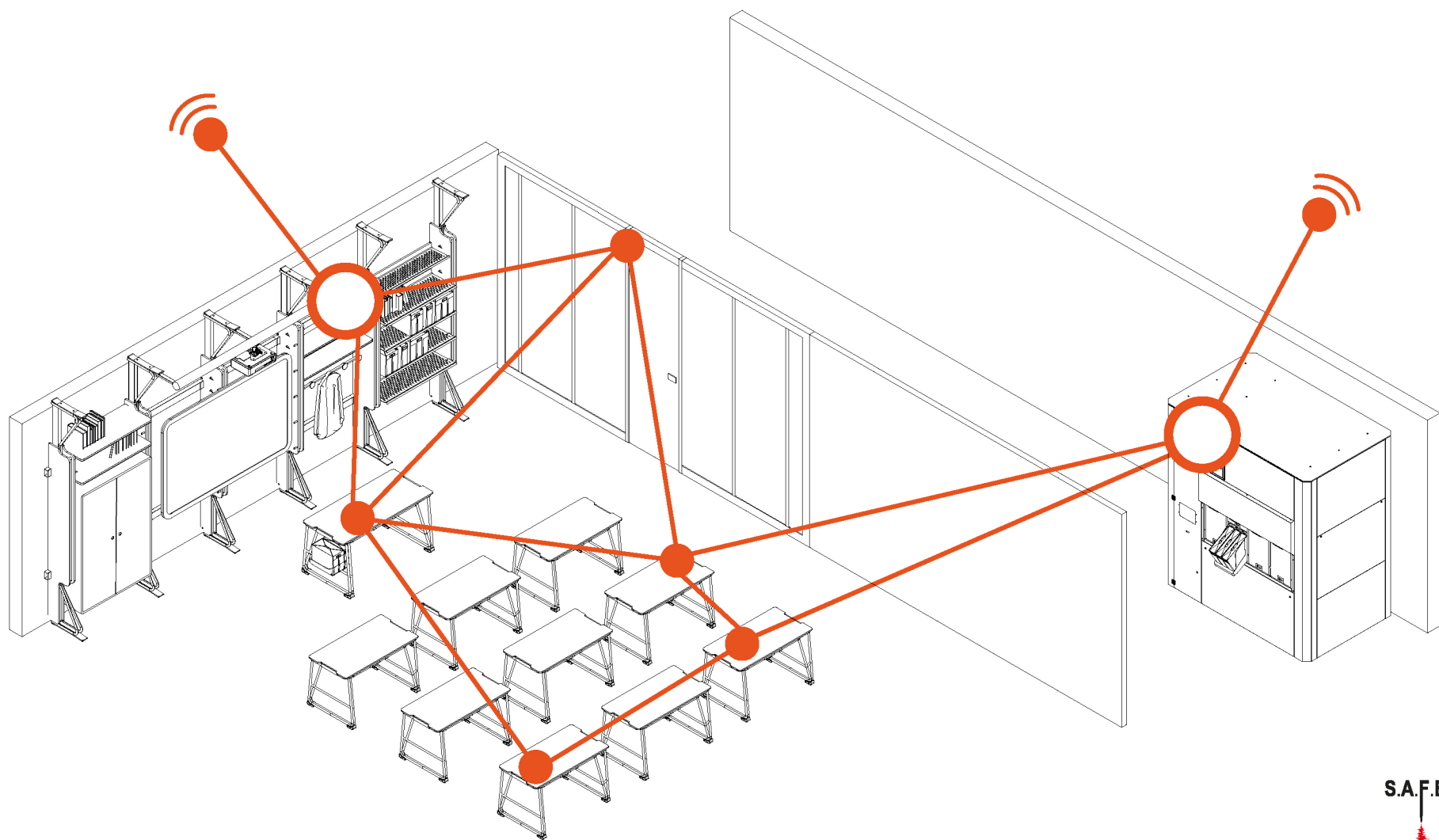
PIR SENSOR

CO2 SENSOR

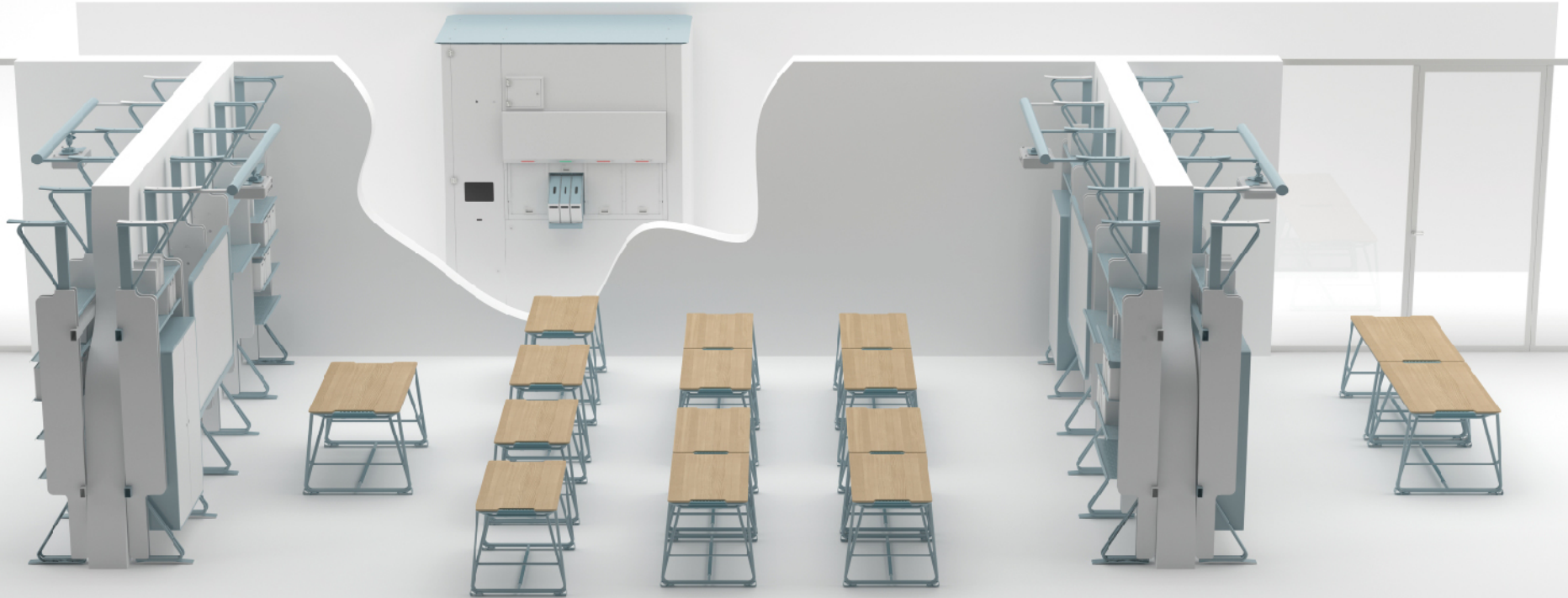
S.A.F.E.







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## Project leader



### UNICAM

Scuola di Architettura e Design

scientific research field: industrial design

scientific research field: structural engineering

Scuola di Scienze e Tecnologie

scientific research field: informatics

Scuola di Scienze del Farmaco e dei Prodotti della salute

scientific research field: chemistry

## Universities

### UNIVAQ

Dipartimento di Ingegneria Civile, Edile-Architettura, Ambientale

scientific research field: structural engineering

Dipartimento di Ingegneria e Scienze dell'informazione e Matematica

scientific research field: informatics



### UNIBAS

Laboratorio SISLab - Materials and Structures Test Laboratory

scientific research field: structural engineering

## Furniture Companies



Styloffice



## ICT and IoT Companies

## Distribution Company

## Technology Center

## Advisory Board



PROTEZIONE CIVILE  
Presidente del Consiglio dei Ministri  
Dipartimento della Protezione Civile



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