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10.12.2020

<http://idw-online.de/de/news759776>Forschungs- / Wissenstransfer, Kooperationen  
Chemie, Energie, Medizin, Umwelt / Ökologie, Verkehr / Transport  
überregional**Fraunhofer is developing a technical system for mobile medical care in crises and emergencies**

Mobile, distributed systems that provide medical care to the public can be a crucial addition to the existing healthcare infrastructure in crises and emergencies such as the current Corona pandemic. Six of the Fraunhofer-Gesellschaft's institutes have joined forces under the lead management of the Fraunhofer IFF in Magdeburg and are developing an integrated system for mobile, distributed medical care in the Demo-medVer project. What makes it special is that all of the complete system's components are modularized, are closely interconnected, and complement each other. A functional prototype is intended to be built by the end of next year.

The Fraunhofer research scientist are opting for a modular design for its technical implementation. It can be standardized, thus making the system flexible to use and quick to set up and dismantle. The individual components of the modular system can be individually modified for different specifications: Technologies, such as disinfectant production or water purification, and facility components, such as an intensive care hospital room, can be custom combined based on the country of operation (developed, newly industrialized or developing country), reason for use (pandemic, environmental disaster, meteorological disaster) or emergency response organization, such as the THW, fire department, emergency medical services, Doctors Without Borders, universal healthcare, and the infrastructure on hand (power, water, gas, heat).

Several Fraunhofer institutes are collaborating on the overall project coordinated by the Fraunhofer IFF in individual subprojects. The Fraunhofer Institutes ICT, IFAM, IGB, ISE and IST are involved along with the Fraunhofer IFF. The Fraunhofer Institutes have formed consortia for the overall project's individual aspects of »disinfection and sterilization«, »oxygen supply« and »supply and infrastructure«.

**Disinfection and Sterilization**

Since work and equipment surfaces in a medical unit have to be quick and easy to clean hygienically so that germs do not infect patients, surface materials that inhibit the spread of or even inactivate viruses and bacteria will be tested and selected in the MATSE subproject.

The objective of the MATSE subproject is to produce the agents needed for disinfection right on site. To this end, a diamond electrode system will make it possible to disinfect surfaces with hypochlorite. UV-LEDs will also provide a very energy-efficient option for sterilizing surfaces without contact »at the push of a button«. Sensors with which the medical surfaces can be tested for viruses and bacteria reliably and rapidly will be employed for inspection.

The development of a demonstrator device that produces disinfectants easily, self-sufficiently and cost effectively on site is additionally planned in the OzoSter subproject. The mobile system is intended to ensure a continuous supply of

disinfectants even during emergencies. Ozonized water will be used in an autonomous spray system. The researchers in the P2MedCon subproject are working on utilizing the available heating potential to preheat water and to supply energy to an electric autoclave that sterilizes medical instruments using the supply infrastructure based on electrolyzers and fuel cells. The FAMOS subproject is concentrating on developing a functional prototype battery-powered sterilizer.

## Oxygen Supply

A novel electrochemical oxygen generator technology will be developed and used for the first time in the subproject e3C-O<sub>2</sub>. The objective of the O<sub>2</sub>GEN subproject is to design and test a novel prototype device for the generation and controlled supply of pure oxygen (> 95 volume percent), which is used widely in emergency medicine, critical care medicine, medical, nursing care and households, among other things. Oxygen will be supplied as a by-product from the infrastructural supply in the subproject P2MedCon.

## Supply and Infrastructure

A mobile intensive care hospital room for the treatment of critically ill patients in intensive care beds with ventilators will be refined in the P2MedCon subproject as well. It will be implementable in emergency response plans and free up hospital capacities. Container clinics will be connected with the newly developed system components.

Since reliably supplying such a medical unit is crucial, one aspect in the MATSE subproject concerns supplying hygienic water uncontaminated with viruses and bacteria. At the same time, contaminated wastewater may not simply be released into the environment. Solutions for self-sufficient and flexible raw water purification (removal of viruses, bacteria and toxins), and effective wastewater (blackwater and gray water) treatment systems will therefore be developed.

Another fundamental requirement for mobile operation is a reliable and readily available power supply. The development of a self-sufficient energy supply is therefore one of the most important aspects of the project. An energy supply system solely based on photovoltaics can do this, for instance. This will make it possible to use the system in regions without any connection to the electricity grid or where frequent power outages are common. The power supply must also be guaranteed whenever solar output cannot be produced for a number of days. Adequate storage capacities must be kept in reserve too in conjunction with a smart energy management plan. Redundancy in the event of malfunctions must also be ensured to be able to supply cooling systems, emergency lighting and other important energy consumers with power for a certain period.

## Efficiency and Versatility

This bundling in one integrated design reduces equipment and infrastructure and increases availability and reliability for patients and staff, thus making the complete system very efficient. Available resources, especially staff, are used optimally. Important capacities can be freed up and employed elsewhere for crisis management. Uses for this modular system are varied and go beyond crises or emergencies: It can also be used as a back-up system and to supply micro-hospitals as well as to provide staff basic and advanced training without having to restrict a hospital's usual routine. The modular design also permits the use of individual system components alone.

In the future, these technical solutions can also be refined by low cost analysis and frugal innovation, even under the economic and social constraints in newly industrialized and developing countries, thus ensuring medical care in regions

where this has not been possible or is possible only to a very limited extent.

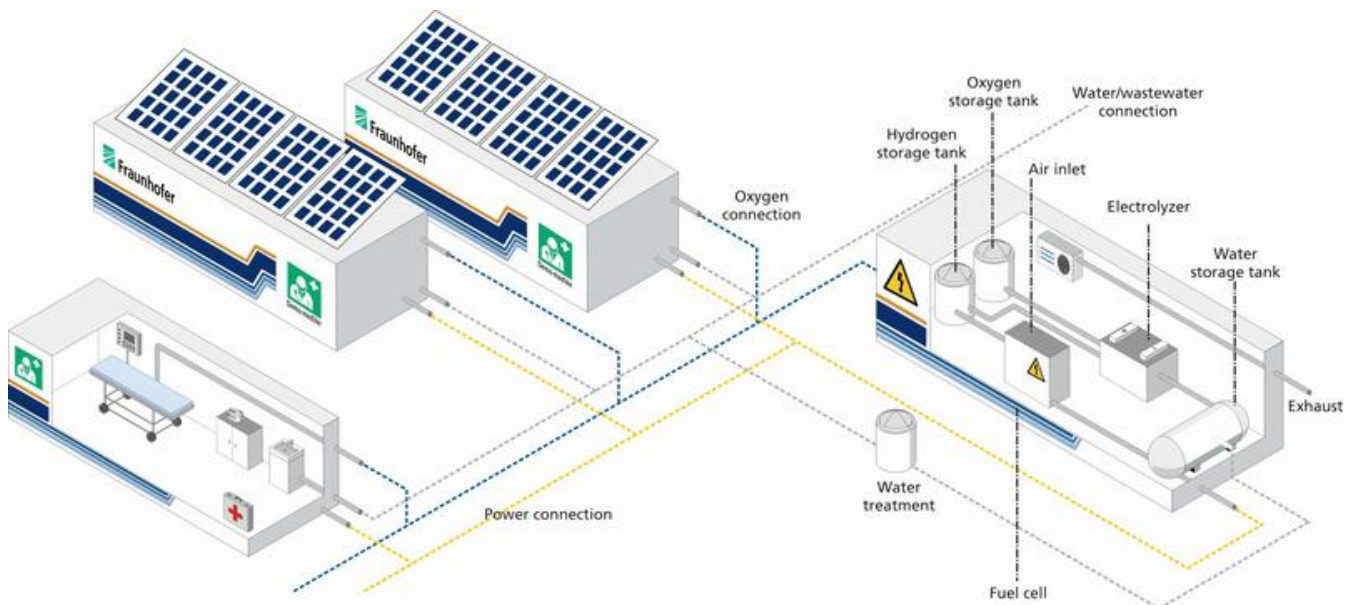
Participating Fraunhofer Institutes:

- Fraunhofer Institute for Factory Operation and Automation IFF, Magdeburg
- Fraunhofer Institute for Chemical Technology ICT, Pfinztal
- Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM, Bremen
- Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM, Dresden
- Fraunhofer Institute for Interfacial Engineering and Biotechnology IGB, Stuttgart
- Fraunhofer Institute for Solar Energy Systems ISE, Freiburg
- Fraunhofer Institute for Surface Engineering and Thin Films IST, Braunschweig

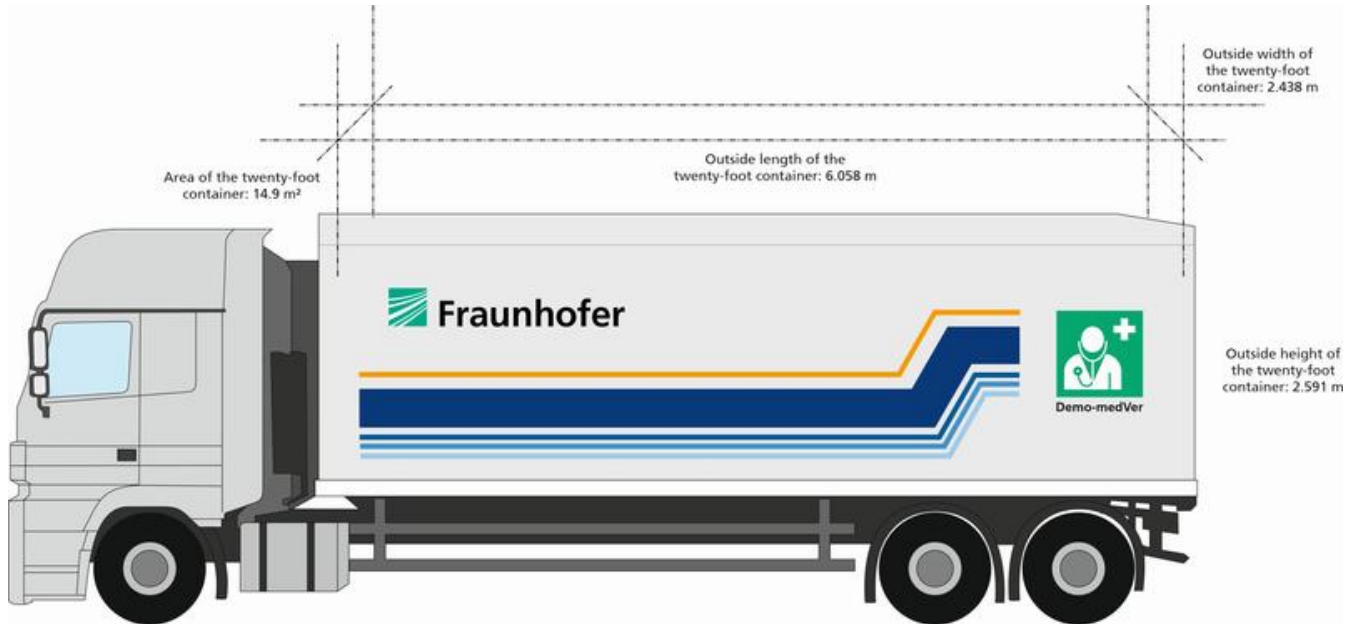
The Demo-medVer project was conceived in the Fraunhofer-Gesellschaft's »Fraunhofer vs. Corona« action program.

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The complete Demo-medVer design  
Fraunhofer IFF



A mobile, systemically integrated supply module.  
Fraunhofer IFF