„C^{4}I" SYSTEM DESIGNED FOR MANAGEMENT OF EMERGENCY SITUATIONS RESULTING FROM NATURAL CATASTROPHES, TECHNOLOGICAL HAZARD, MILITARY OPERATIONS AND TERRORIST ATTACKS

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Abstract. *This article presents an innovating product, designed, built and tested by the authors within S.C. AEROSTAR S.A Bacău. The requirements and needed facilities of a decision support system are identified and described. Depending on the end-user requirements, the system is equipped with necessary facilities in order to fulfill different task, such as command, control, communication, computer and information centers in case of emergency situations or military operations. This is a complex integrated system, which required special production and assembly operations. The main objective to limit the critical infrastructure destruction and to prevent human loses.*

Keywords: Command, Control, Communication, Computers, Intelligence

1. Introduction

The industrial development and population density growth in urban centers, from the last half century, lead to an increase in electrical power consumption (for heating, lighting, public transportation, telecommunication networks, antennas).

Another consequence of the evolution is the diversification of economic activities using, producing and trading hazardous materials.

The changes from the last two decades have shown that the society vulnerability has increase also due to critical infrastructure lack or degradation, making it susceptible to different threats and risk sources.

The definition of what constitutes an EU critical infrastructure would be determined by its cross border effect which ascertains whether an incident could have a serious impact beyond the territory where the installation is located.

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Full consideration would be given to interdependencies within and between businesses, industry sectors, geographical jurisdictions and authorities in particular those enabled by information and communications technologies. It is necessary to identify these interdependencies and to protect (from terrorism, organized crime, natural disasters and particularly severe accidents) all security-relevant networks and infrastructure assets.

The actual geostrategic circumstances could be described on one hand through extreme climatic changes and on the other hand through an increase in non-military threats on national security, both with an important influence on the citizen health, safety, security and welfare, or the country administration well-functioning.

In the beginning of the 21st century, the civil society interests are focused upon the environment, the health and the safety, thereby influencing the political priorities, the prescriptions, the standards, the local authorities, international treaties, the trends in various fields, etc. The evolution of the European Union must be based on the principle of sustainable development.

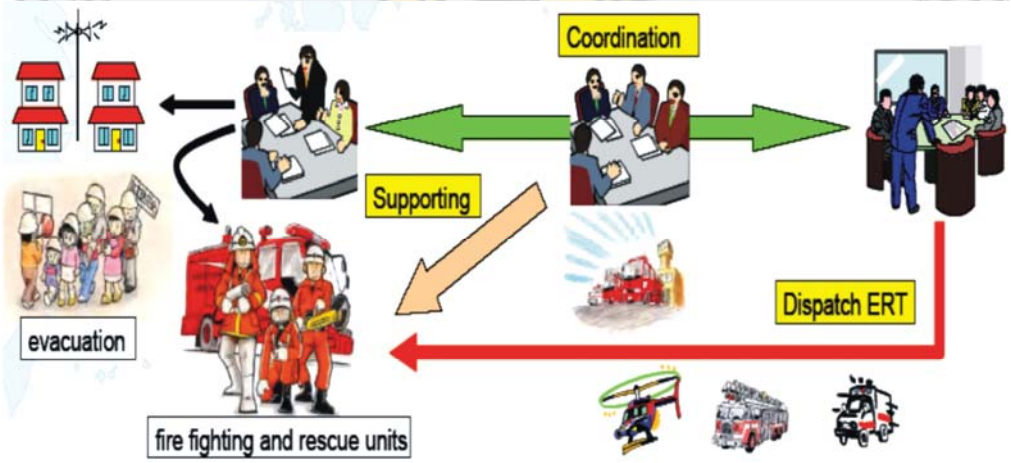

Fig. 1. The reaction and intervention scheme in case of disaster.

The climatic changes, the terrorist attacks risk increase, the Romanian army participation in the conflict areas from foreign countries, and the experience exchange within UE and NATO are strong arguments to support the necessity and the opportunity to develop a new modern device.

2. Specifying the Objectives of the Main Element for a Command, Control, Communication, Computers and Intelligence Center, "C4I"

The development of a decision support system is necessary and appropriate in order to manage the situation resulted after natural disasters or terrorist attacks.

This must ensure the fast and efficient reaction, through the efforts coordination of the four "main actors" (political decision factors, public administration, fast reacting forces and specialized NGO's).

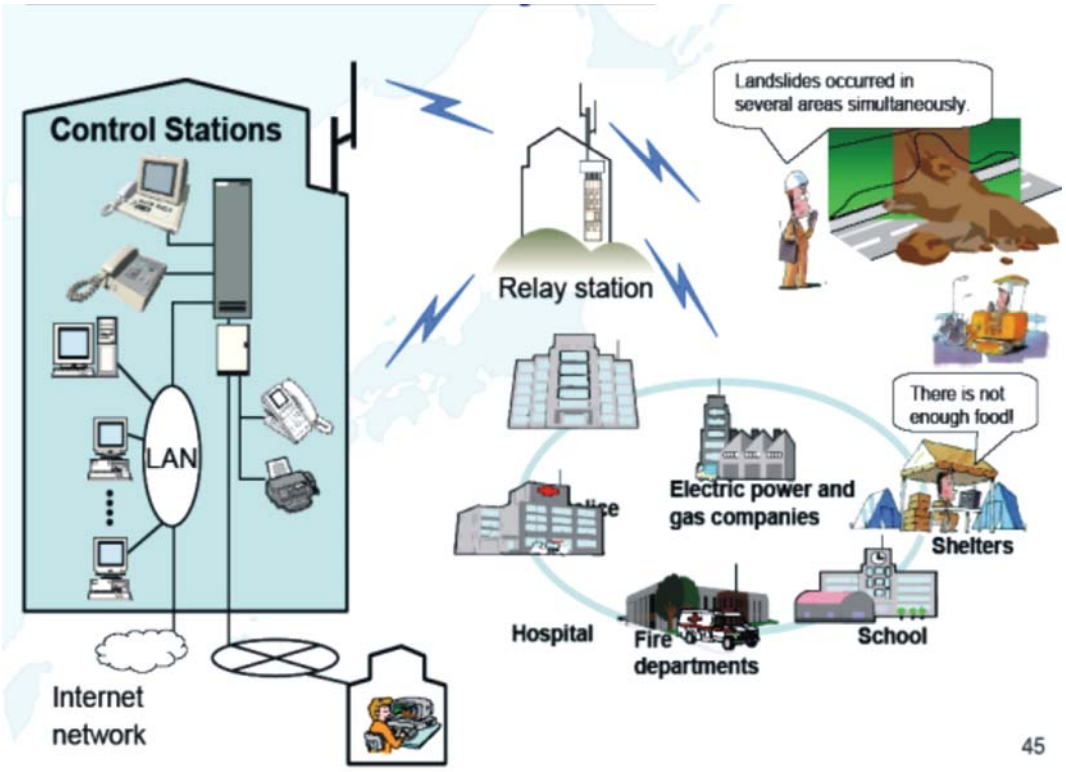

Fig. 2. Functional integration of the SSD in the Emergency Situations Communication System.

3. Highlighting Specific Functional Requirements for a Command, Control, Communication, Computers and Intelligence Center, "C4I"

The main scope of disaster management is to minimize the impact of technological hazards or natural disasters that cannot be avoided. The evaluation of such events has to consider different criteria in order to account the social, environmental, economic, and technical consequences of a potential emergency situation.

The functional requirements of the "C4I" relate to:

- Rapid warning in case of an event.
- Determining the necessary information (the data describing the existing situation, the actions that have to be taken, the reaction forces that have to intervene and the means that have to be used) in a short time interval and organized for an easy understanding and employment.

- Interpret the received information from different areas of activity: power engineering, mechanics, army, physics, meteorological phenomena, risk management, biology, chemistry, informatics, psychology, etc.
- People evacuation supervision.
- Interface between different categories of critical infrastructures and monitoring of information exchange between reaction forces. In this respect the following actions have to be taken:
  - the identification and inventorying of all affected critical infrastructures (public services and objectives, infrastructure networks and components);
  - determine the specific protection measures in terms of intervention and recovery actions, based on well-defined plan and strategic actions, in order to limit, disperse or neutralize the risk;
  - establish the dependencies between different critical infrastructures and limit the vulnerabilities resulted from these connections.

Under these conditions the decision support system has to be transportable and able to fulfill its tasks in isolated environments, affected by disasters, and catastrophes, such as earthquakes, floods, landslides, forest fire, and technological accidents leading to important toxic substances release.

4. Identification of the Technical Requirements for the Main Element of Some Command, Control, Communication, Computers and Intelligence Centers, "C^4I"

In order to cope with the requirements of the potential users, the main element of some command, control, communication, computers and intelligence centers, "C^4I"can be employed, controlled, moved and placed in the following meteorological and geographical conditions:

- Maximum altitude: 3.04 km;
- Temperature: -30ºC to 55ºC;
- Relative humidity: 95% at +30ºC;
- Rain: 10,16 cm^3/hour;
- Mould;
- Salted fog: near the seaside (5% salt and 100% humidity) and wind carrying salt;
- wind – 50 kNt and above 100 kNt without irreparable damages;

- wind with sand: sand concentration 0,25 g/m^3 and wind speed of 30 m/s or sand concentration 0,7 g/m^3 and wind speed of 9 m/s;
- solar radiation: 1120 W/m^2.

In the design phase the following technical characteristics were imposed:

- Thermal transfer coefficient: ≤ 0,28 BTU/ HR/ SQ/ F;
- RFI screening: 40 dB in the range 14 kHz -100 kHz, 100 kHz – 2 GHz and 2 GHz – 10 GHz;
- EMI screening: max. 4 ohm;
- Roof loading: 300 kg/610 mm × 305mm or 366 kg/m^2 of snow;
- Floor loading: 464 kg/610 mm × 305mm; dispersed 317 kg/m^2 and punctual 58 kg/6.45 cm^2;
- vibrations: from transportation, with frequencies from 5 to 500Hz;
- mechanical shock;
- EMC, EMI, EMP protection, through grounding system of max. 4 ohms;
- Transportation by motorcar, train, ship or airplane.

5. Description of the Designed, Built and Tested Main Element

The materials use in the production process were purchased from specialized suppliers, the latter being selected using rigorous criteria in concordance with the standard SR ISO 9001.

The product operates as a base component of some command and action centers in case of natural disasters and catastrophes, terrorist attacks (with classical means or with chemical, bacteriologic or nuclear weapons) or military operations.

The system will fulfill tasks regarding the human operator's life support and command centers deployment, which are managing the crisis situation or the military operations development.

Considering the particular requirements for a specific application, the main element could be equipped as a functional command, control, communication, computer and information center (C^{4}I) for civil applications, as well as for military operations.

The main equipping makes possible the effective transmission of decisions, dispositions and orders, guaranteeing the communication connections with the National Operational Center, other operative centers with permanent functioning and other forces involved in the emergency situation management.

Furthermore, other connections could be also provided, such as the connections with the National Meteorology and Hydrology Agency, national radio and television, governmental and central commissions and districts emergency situations headquarters.

The main element of some command, control, communication, computers and intelligence centers, "C^4I" is a complex integrated system, which required special production and assembly operations. A specialized department provided the raw materials.

All the production activities were made based on some approved procedures, in concordance with the quality management requirements implemented at S.C. AEROSTAR S.A. Bacău. For a better understanding, Figures 3 to 5 are presenting the designed and built SSD charts, highlighting the main functional components, such as:

Container structure – which includes the base structure, the main and emergency doors with the afferent stairs, the electrical junction panel, etc.

The container is built on a welded structure of steel bars, able to undertake the mechanical efforts during the normal operation, transportation, and storage.

The structure includes 8 corner components, according to the ISO1161 standard, for handling (lifting for mounting and dismounting from a chassis).

Furthermore, inside the container there are special elements used to fix the equipments and the furniture during the transportation.

Container facilities

- Thermo-isolation (the ceiling and floor are doubled with thermo-isolating panels installed inside the container) and container partition (depending on the necessities);
- Main electrical system (distribution panel, power and lighting circuits)
- Integrated grounding system and lightning protection system;
- Back-up generator;
- Air-conditioning system to control the air humidity and heating;
- NBC (Nuclear, Bacteriologic and Chemical) filtering system;
- Fire detection and alarming system.

Container subdivision and equipping

- Working places provided with equipments needed to perform the activities corresponding to the mission tasks;

- Bathroom facility, with facilities for the personal hygiene;
- Kitchen facility, with facilities to prepare meals;
- Built-in beds, for human operators repose;
- Security and protection equipments for human operators and facilities;
- Data acquiring system, information analyzing and synthesis systems (meteorological station with built in sensors, detection and alert equipment for NBC contamination);
- The communication interface with the local and central administration, mass communication means (radio, TV) used to transmit the actions, protections measures meant to limit the disasters consequences;
- Container lifting and horizontal positioning devices;

Fig. 6 presents the technical compartment where the SSD back-up generator is placed.

The information analyzing and synthesis system is presented in Fig. 7.

In the background of Fig. 8 can be seen the kitchen facility, and in the left-hand side the filtering and ventilation system.

Fig. 9 presents the bathroom facility.

All the facilities correspond to the end-user requirements, depending on the particular needs for the specific activity.

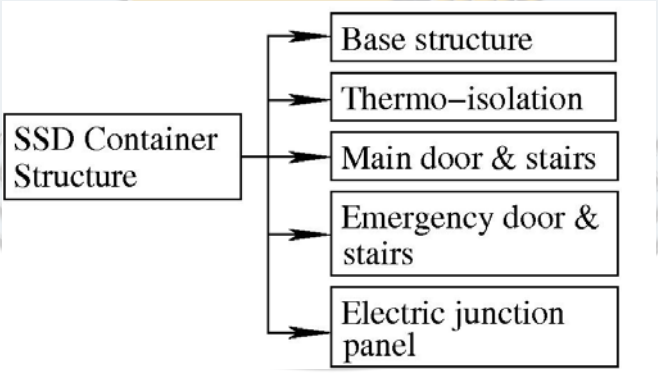

Fig. 3. Main structure of the main element container.

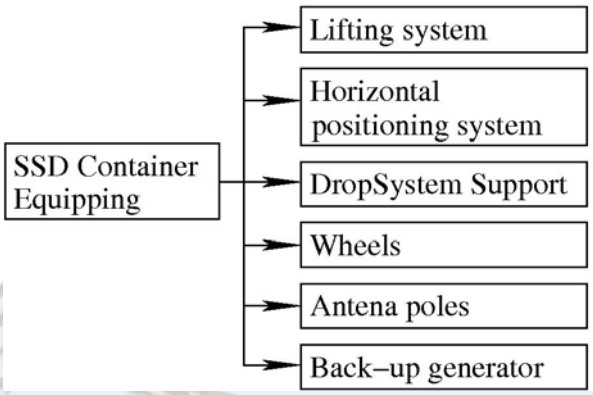

Fig. 4. Main equipments with which
the main element of the C^4I container is endowed.

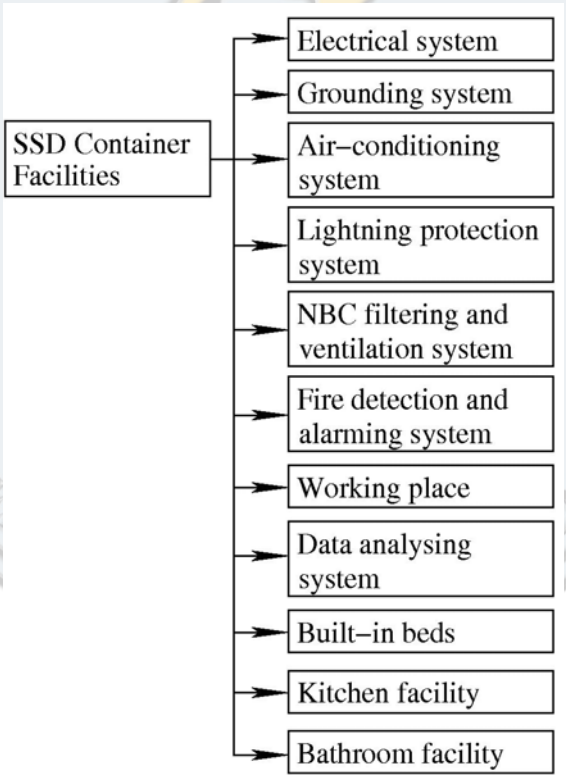

Fig. 5. Main facilities
of the main element of the C^4I container.

Fig.6. Inside view of the technical compartment with the back-up generator of the "C4I"

Fig. 7. "C4I" Information analyzing and synthesis system.

Fig. 8. Kitchen facility and NBC filtering system.

Fig. 9. Bathroom facility.

Fig. 10. Outside view of the "C^{4}I".

6. Conclusion

The main element of some command, control, communication, computers and intelligence centers, "C^{4}I" offers numerous facilities to support the information analysis, evaluation and synthesis, emergency situation or military activities evolution monitoring. The product is included in the national development policy of research-design activities, production of equipments designed in the country, as well as increasing the competitivity of these products on the global level. Its parameters are in compliance with the military needs regarding the operating war zones and peace forces all around the world.

The expected selling price for the main element of some command, control, communication, computers and intelligence centers, "C^{4}I" is 140.000 EURO, 35-40% lower than similar imported equipment.

In the context of important climatic changes from the past years and the alarming increase of terrorist attacks threats (including NBC attacks) there is a need to conceive reaction strategies in order to limit the consequences of natural disasters.

The prevention, operative reaction and recovery measures in case of disasters – natural calamities and catastrophes, in order to limit the social, economical, environmental consequences, are imposed through Ordinance no. 47/1994 regarding the protective means against disasters.

The proposed solution to manage the emergency situations resulting from catastrophic events is new, and has a high complexity standard, which involved specialists from different complementary fields.

The resulting C^4I represents a breakthrough in this domain, in our country, in terms of design, implementation and testing of such security infrastructure and intervention in case of natural disasters.

Product presented in the paper is addressed primarily to the crisis headquarters (if there are no military operations) and military headquarters of a certain level (for military actions).

This product may help in future to increase capacity to ensure the security and safety in operation of critical infrastructure. Project partners will continue to work together, in order to upgrade the system designed

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