



SATELLITE COMMUNICATION SYSTEM FOR EMERGENCY MONITORING WITHIN THE CHERNOBYL EXCLUSION ZONE

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A Satellite Emergency Monitoring system of the Chernobyl Exclusive Zone (SEM CEZ) was designed to provide the Ukraine authorities and the neighbouring countries with updated information when an emergency situation occurs in the Exclusion Zone. This is of particular importance when environment contamination has transboundary effect.

SEM system consists of mobile and fixed sensors reporting data via a dedicated satellite communications link. Mobile sensors are fitted with Global Positioning System (GPS) receivers that determine current coordinates of the sensor.

Sensors data are transmitted to the Emergency Monitoring Centre equipped with PC and a satellite terminal. Both sensors data and the current position are visualized on digital maps.

Transmission and reception of sensors data and position are performed thanks to the PRODAT-2 system, a store-and-forward satellite communication system promoted by the European Space Agency.

In addition to usual features of other satellite messaging systems, PRODAT-2 allows to exchange data messages from mobile terminal to mobile terminal, in total independence of the telephone infrastructure (PSTN). To take advantage of this feature, the fixed user application, the Emergency Monitoring Center, was developed around a mobile terminal installed in a fixed position.

PRODAT-2 also allows multi-receipient messages. It means that one mobile transmission may be automatically routed towards preset various destinations. This allows parallel monitoring of the same emergency situation from any place within the satellite footprint, i.e. all Europe (West and East).

Field tests in Chernobyl Exclusion Zone started in May 1994. Specific experiments were carried under ESA contract.

The High Technology Institute (Kiev) and the Administration of Chernobyl Exclusive Zone in cooperation with FIAR (Italy) and SAIT Systems S.A. (Belgium) led dedicated experiments to assess the efficiency of PRODAT-2 system for radiation monitoring within the Exclusion Zone.

The first trials were carried out with sensors interfaced with PRODAT-2 Mobile Earth Station (MES). Two kinds of mobile were chosen to carry the sensors : ground based vehicle and light aircraft. Two Emergency Monitoring Centers were set up : one in Kiev and another in Brussels.

A Radiation Reconnaissance Vehicle, equipped with a radioactivity sensor, was travelling while measuring the local level of radioactivity. A PRODAT-2 MES, connected via serial line to the sensor, was in charge of sending to Kiev and to Brussels at the same time, the sensor data together with the mobile position thanks to an internal GPS receiver (Photo 1). For the time being, data collection at mobile side is based on a User Terminal emulation, that requests a portable PC inserted between MES and sensor. To reduce installation cost in the mobile and to favor flexibility, a programmable Intelligent Serial Interface (electronic stand-alone equipment working without human intervention), will interface directly the sensor through the serial port of the PRODAT mobile terminal.

When received, sensor data and mobile position are displayed on a digital map, simultaneously in Kiev and in Brussels (fig 1). The software designed for the Emergency Monitoring Center(s) allows to trace simultaneously a large number of mobiles. This software consists of a cartography application, a user information system and a PRODAT control module. It allows to visualise the position of the mobiles on the maps at three different scales and to retrieve on-line information from the mobiles. The entire software application works under Microsoft Windows 3.1.

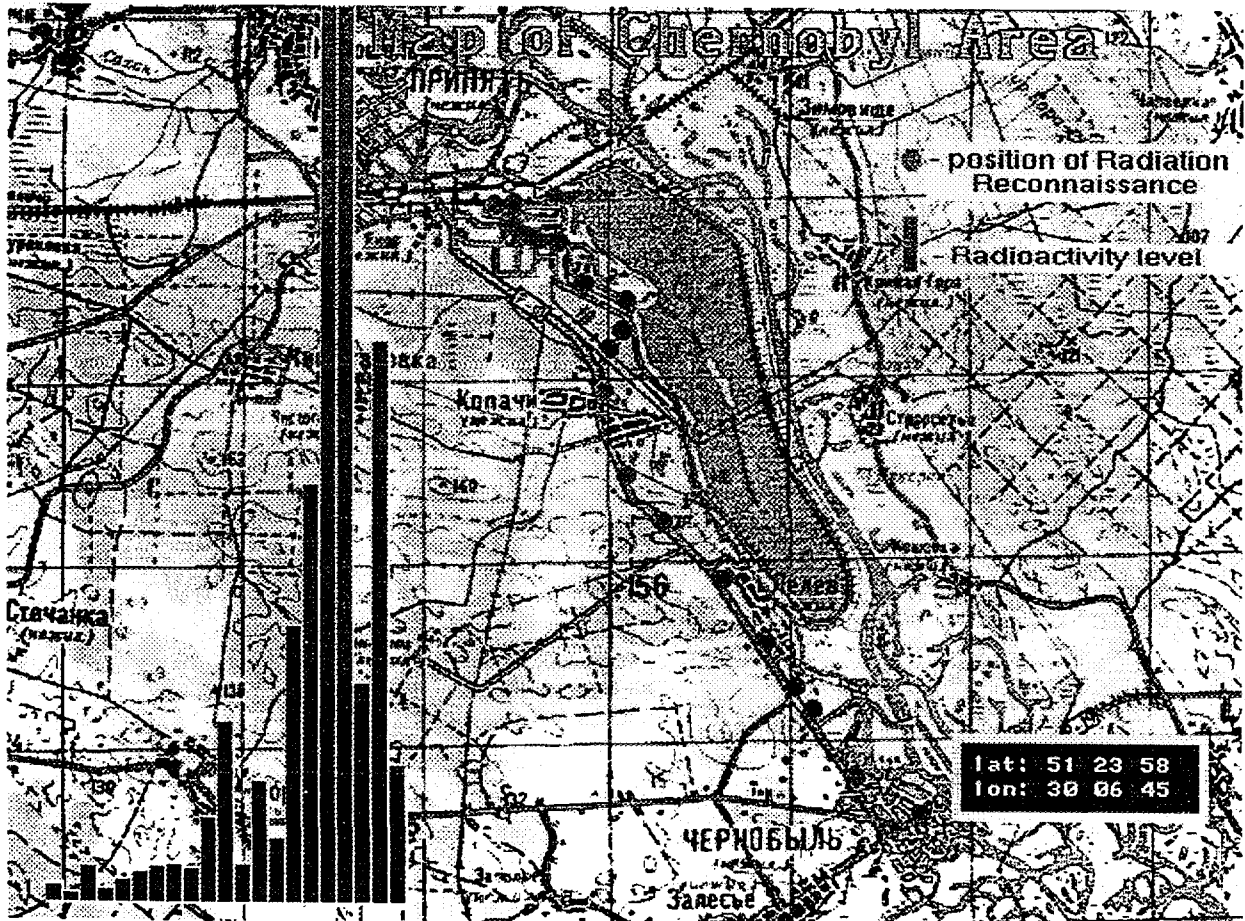
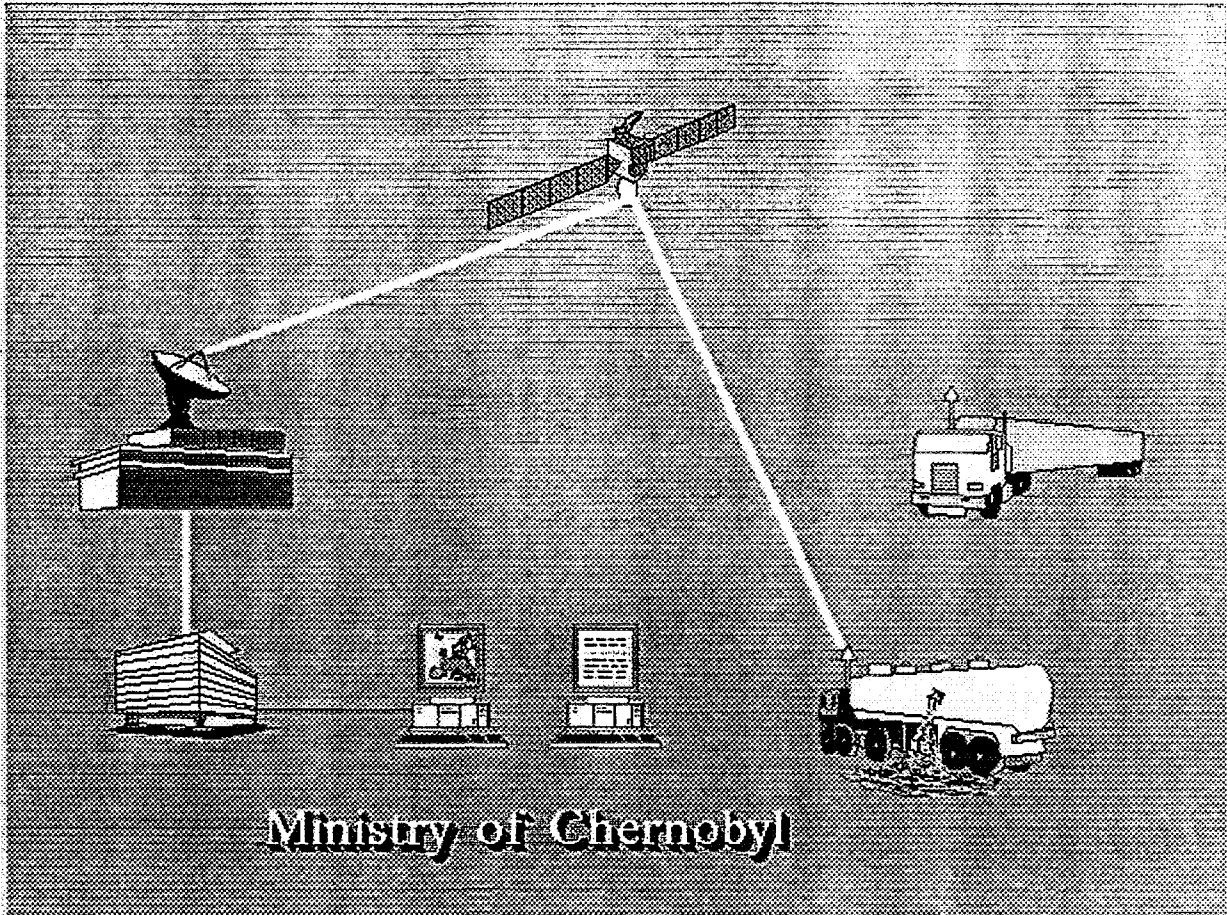
Additional experiments were carried out with a Radiation Reconnaissance aircraft. The reconnaissance flights took place at an altitude of 100 m with a maximum speed of 160 km/h.

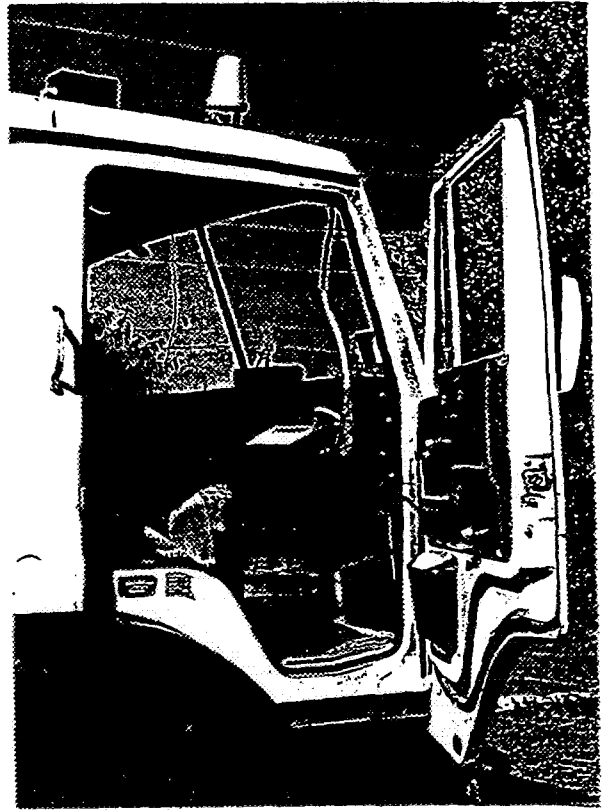
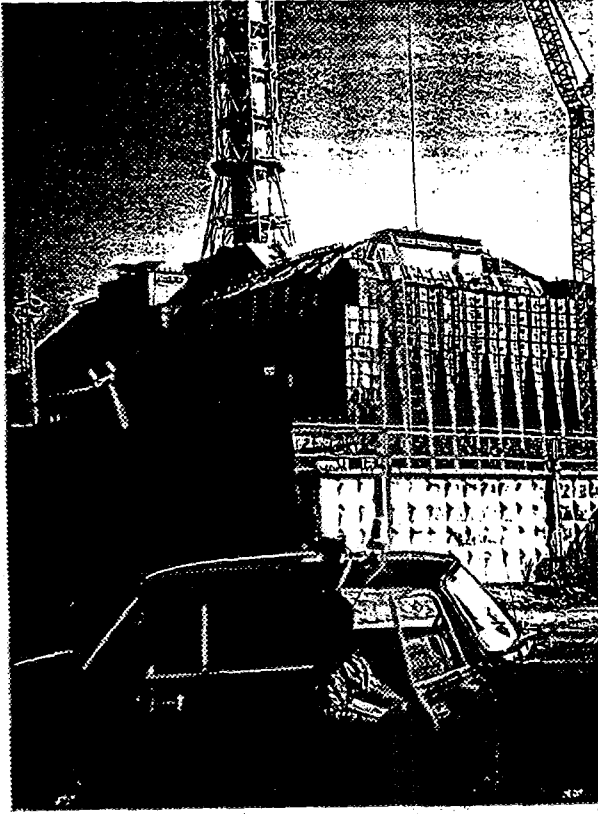
The experiments demonstrated the reliability of satellite communications provided by the PRODAT-2 system to relay sensor data from plane and from ground mobiles.

In case of emergency situation causing transboundary propagation of the radiation (forest fire, dust storm), a key issue is to measure the meteorological parameters (direction and speed of wind) in order to predict the pattern of the contamination and therefore to trigger all necessary actions to protect the populations.

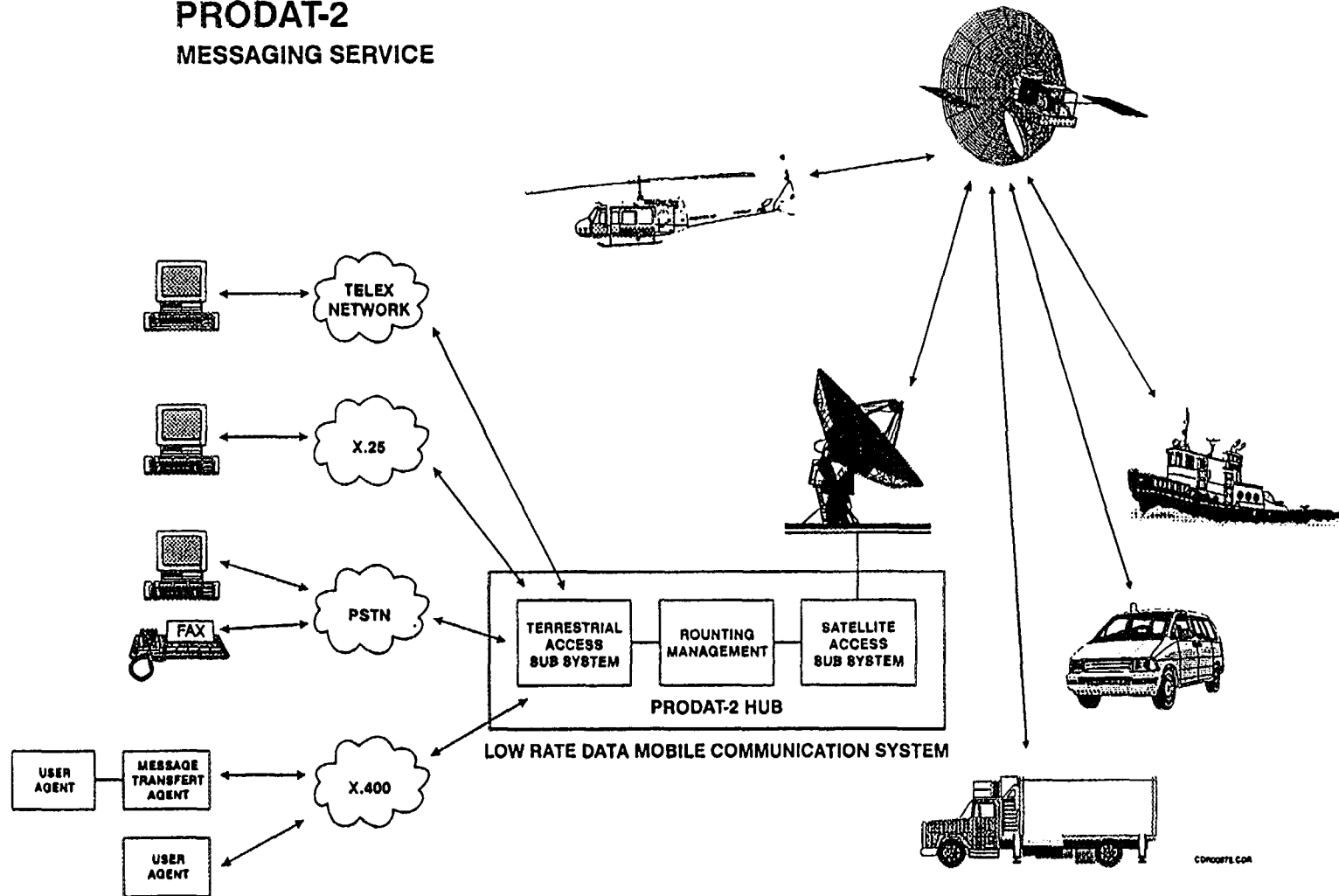
FIAR has proved experience in using PRODAT-2 for Meteorological Departments in Italy and Germany. Similar use in the Chernobyl Exclusion Zone is now under consideration.

So, sensors data and meteorological data, collected by the same communication system, can be combined in the Emergency Monitoring Centers to predict the contamination evolution thanks to mathematical prognosis models. From there on, preventive actions can be initiated.





PRODAT-2 MESSAGING SERVICE



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On request of the Administration of the Tchernobyl Exclusion Zone, the PRODAT-2 system was also used to monitor transportation of radioactive materials inside the Zone.

Photos 2 and 3, taken near Ditjki Control Post, show a specialized truck dedicated to radioactive waste transportation, equipped with a PRODAT-2 MES and a radiation sensor . Antena and radiation sensor were installed on the roof of the cabin of truck (photo 3). The position of the truck and the level of radioactivity were remotely monitored via satellite communications in the Kiev Emergency Monitoring Centre on a digital map of the Exclusion Zone.

The positive experience of PRODAT system for radiation monitoring in the Chernobyl Exclusion Zone has led to the concept of a Global Satellite Emergency Monitoring System aiming at the control of the Hazardous Industries.

The first steps in this direction have already been taken in Ukraine: PRODAT-2 system has been applied to monitor the transportation of radioactive waste and hazardous chemicals. Now the application of this technology to monitor nuclear stations, hazardous chemical factories and pipe-lines is under consideration.