

*Yu .A. Popadiuha*

## **A MOBILE SYSTEM FOR MONITORING OF DIVING WORKS IN SHALLOW WATER REGIONS**

Along with the use of technical means for world ocean exploration (autonomous and remote controlled submarine apparatuses) the essential amount of work is performed by shallow and deep water divers; the special attention is paid to father facilitation of their activities.

The design Office "Storm" is involved in creation of mobile system for shallow water diving work monitoring to support the shallow water diver's group activities while carrying out underwater technical and construction works, which includes:

- control panel (CP);
- mobile diver's block (MDB);
- anchored radiohydroacoustical buoy set (RHB);
- diver's computer.

System provides the following facilities:

- determination of work region's size and point of RHB place by calculation beam picture of acoustical wave spreading considering hydrological background;
- determination of given and trajectories of diver (diver's group) movement over the work region;
- diver's movement control and real time correction of their trace;
- representation of RHB positions, predicted and real trajectories of diver's movement on CP monitor's screen;
- diving works documenting;
- memorise of trajectory point's coordinates and work out point guiding diver's return to these points by the shortest way (if required);
- transmission date on current depth, diver's pulse and breathing frequency and his body temperature by hydrological communicational channel (HCC);
- transmission instruction on diver's movement, diver's physical state testing request, emergency lifting up, signal-replay requests signalling by HCC;
- fixing diver's emergency lifting up coordinates by using hydroacoustical and radio beacons;
- formation individual lifting up-down diver's regime, taking into consideration prior lifting up-down schedules and functional state of diver;
- information exchange between CP base computer (BC) and DC;
- DC indicates satiation degree of organism unditional tissue in the form of histogram and value of tolerance supersaturating foreach conditional tissue;
- prognosis and indication of continuance, trajectories of the first and next diving submergence; undecompressing submergence continuance;
- recording submergence trajectory into DC's memory;
- astronomical time, initial time for submergence, current and maximal tolerance deep of lifting-down are indication and prognosis;
- visual and sound signalling of emergence sciling, finish of undecompression submerge and discharge of accumulator battery;
- it is possible to decompress by himself;
- service set (10-20) of DC by the base computer.

CP is appropriate for information processing, which is incoming from RHB, transmission of operation command, signalling and condition request into MDB, obtaining and processing of telemeasure information and diver's signal - replay from MDB, realise of calculations, which is necessary for RHB location and determination of given and real trajectories of diver(s) movement, indicate on DC video's screen of required service information, which include: the derivation of given and real trajectories of diver movement, buoyage and finish underwater work points; guiding diver's return trajectory to work point; data of diving submergence from DC; testing DC; data-base; diver's emergency lifting up coordinates.

Documenting of underwater works and their results may be done either in the form of text material in the documenting block (which is the printer) or files, which are safe on diskette.

RHB provide receiving of MDB marker signals into HCC and transposing their into USW communicational channel.

MDB provides:

- receiving from HCC and processing of diver's movement control command, request his state, signalling to diver and emergency lifting up;
- required signalling to diver according commands;
- bathymetry of diver's submergence and his physiologic parameters (body temperature, pulse and breathing frequencies);
- transmission of measuring results, diver's signal-replay and marker signal to HCC for determination his real coordinates;
- emergency lifting up;
- transmission radiobeacon signal in crash mode.

The system is working as the following. The hydrological back-ground data over the work region enter into computer. PC calculates hydrology, derivation of real beam picture, recommend size of diving work region and RHB location points. The RHB allocates into calculated points and determines true RHB coordinates with standard navigation hardware. The RHB coordinates data is enter in PC. All required information is displayed.

After MDB preparing the diver[s] can be rigged. Simultaneously, PC calculates given trajectory of diver(s) movement, which is displays for divers. While their underwater movement, HDB transmits marker hydroacoustical signals, which are retranslated by RHB to CP. HC calculates current diver's coordinates and estimates real trajectory of his movement by dint of receiving marker RHB signals. Given and real trajectories of their movement are displayed. CP receive remote measuring information from DB and current data on depth, diver's pulse and breathing frequency and his body temperature outputting on video screen.

If real trajectory is deviate from given, then the command for movement correction passes from CP to MDB by HCC. Diver reacts to the command indicated on alarm device and corrects his own trajectory. Required signalling command transmits from CP to MDB. Diver receives this commands and confirms that with the panel of signal-reply device.

If on analyze of telemeasure information discovering, that deep of diver's submergence more than calculated deep or observed deviation of his physiological parameters from norm, than state request commands pass from CP to MDB. Diver inform about own feel by signal-replay device after getting this command.

If CP get information about diver's unsatisfactory condition or if the diver don't response on condition request command, CP pass emergency lifting up coordinates to MDB with fixing coordinates of emergency lifting up point on PC memory. Radiobeacon turn on automatically, when is surface and let determine diver's location.

In case diving process is finished according to schedule or it is breaking, coordinates of work finish (breaking) points are memorize. It allow to take care guiding diver's return (if required) to breakpoint for work continuation.

Diving process documenting in the form of text material or files on diskette diving work finish and diver's return.

Recenzent: doc. hab. n. med. R. Olszański

Autor: Yu.A. Popadiuha "Storm" Design Bureau, National Technical University of Ukraine "Kiev Politechnical Institute", Ministry of Education of Ukraine, Kiev, Ukraine.