REMOTE CONTROL SYSTEM OF AIDS TO NAVIGATION

INTRODUCTION

In order to permanently raise the level of safety of navigation and reduce the maintenance costs of aids to navigation, Plovput introduced the Remote Control System on 103 aids to navigation which have the major importance for safety of navigation (intervention within 24 hours on an extinguished light).

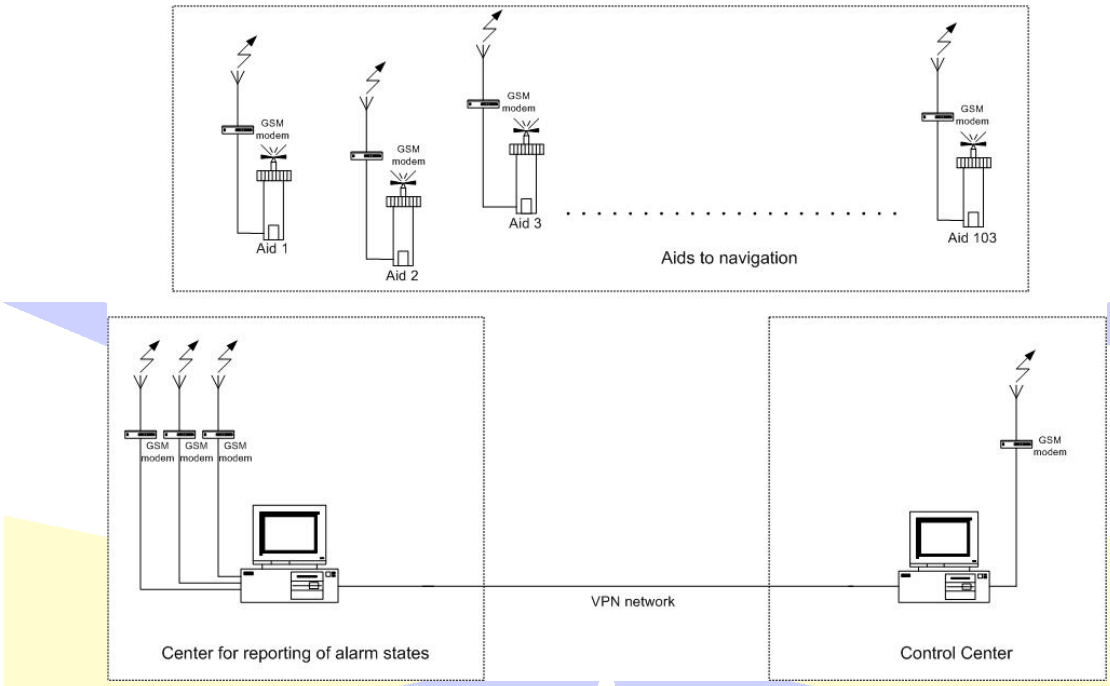
Before introducing the System it was necessary to fulfill determined prerequisites such as:
- automation of main and standby light on lighthouses which did not lead to the complete abolition of classical lightkeepers service, but resulted in reduction of number of lightkeepers;
- installment of automatic standby light, fog system (fog signal and fog detectors) and racons on important aids where they did not exist before;
- modernization of other aids to navigation by installment of standard solar lighting equipment.

REMOTE CONTROL SYSTEM

The Remote Control System of aids to navigation functions in a way that information about light failures and unauthorized entrance into a lighthouse is obtained from the most important aids in real time, as well as all other information related to the functioning of lights and installed equipment.

The basic functions of the System are:
- to transmit immediately alarm situations to the Centers within the communications from aids to the Centers (automatic roll-call) and after that, in dependence of the type of alarm, to carry out interventions and failure repairs;
- to collect permanently the data within the communications from the Centers to aids (cyclic calls, directed calls), to elaborate and store them and to present them in graphical and tabular form. On the basis of collected data it is possible to act preventively to assure the continuity of correct functioning of lights, to reduce the number of light failures, to reduce the minimum quantity of spare parts in the stores and to be able to plan more precisely regular visits to aids to navigation made by service vessels of Plovput;
- archiving of the data about aids to navigation included into the Remote Control System, such as general data about aids to navigation, data about installed equipment, interventions, etc.

The Remote Control System consists of:
- Center for reporting of alarm states ;
- Control Center;
- Aids to navigation.



Picture No. 1: *Remote Control System of aids to navigation*

The System functions in the following way:

1. Programmable logic controller (PLC) which controls and measures all the values of devices and states on aids to navigation via a special interface, in case of alarm situation elaborates the data and convert them in the form suitable for transmission. After that, PLC gives the order to GSM device in the aid to call the GSM device located in the Center for reporting of alarm states which accepts the data, presents them on the computer located in the Center and at the same time transmits them to the computer located in the Control Center. In case GSM device located in the Center for reporting of alarm states is occupied, the aid will transmit repeatedly the call until the information about the state of alarm is not received. The operator in the Center for reporting of alarm states will inform the competent person about the information received, who will organize the intervention and failure repair, in dependence of the type of alarm.
2. When the Center is calling the aid, the procedure is opposite and PLC collects and transmits the data on request of the Center.

The data collected on aids to navigation depend on the type of installed equipment and on power supply and include:

- correct functioning of main and stand-by light;
- correct functioning of other devices installed on an aid to navigation;
- unauthorized entrance into an aid;
- existing voltage, charging and discharging current of batteries;
- public network voltage;
- temperature inside an aid...

Apart from aids to navigation control, there is also management on local level which includes:

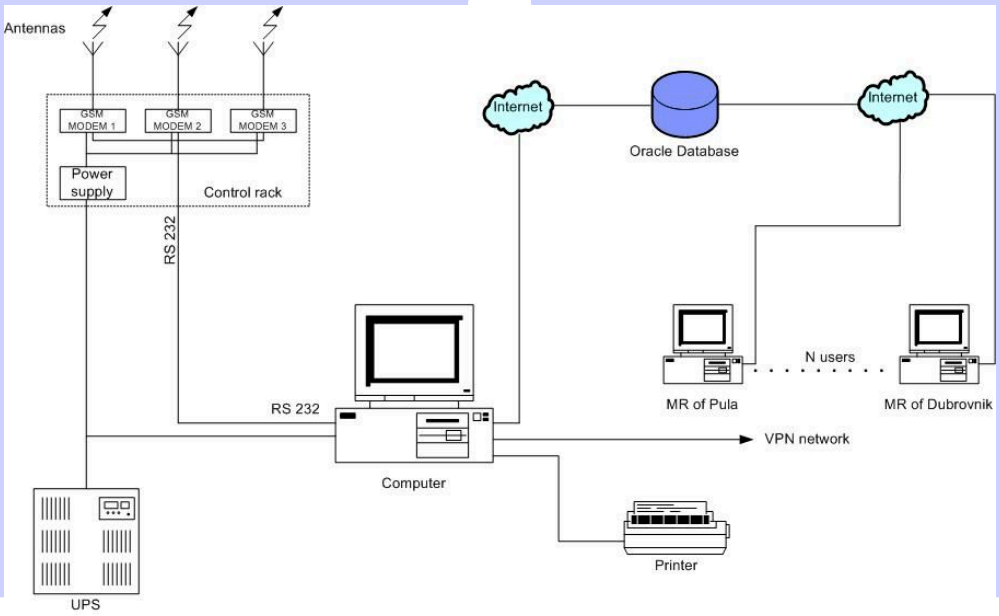
- on some aids to navigation, engagement of stand-by light in case of a failure on the main light,

- on all aids to navigation, in case of a failure of light batteries or remote control equipment, switching from one battery to another.

By introducing the Remote Control System of aids to navigation it is made possible to obtain the information about the state of single devices and equipment in real time, with special accent being given to correct light functioning, namely light failures and unauthorized entrance into an aid. All this reduces the number and duration of light failures and its direct consequence is the increase of safety of navigation level.

CENTER FOR REPORTING OF ALARM STATES

The Center for reporting of alarm states with 24-hours watch is located in the Coast Radio Station Split Radio. From this Center all aids to navigation are called once a day and data about various parameters are collected. At the same time all alarm situations are immediately transmitted to the Center.
The Center has a computer with SCADA program for the control of functioning of the System (iFIX). The computer is connected with aids to navigation via 3 GSM devices in the way that 2 GSM devices serve for receiving of alarm states from the aids, while the third one serves for calling of aids. It is connected with the Control center via VPN network.

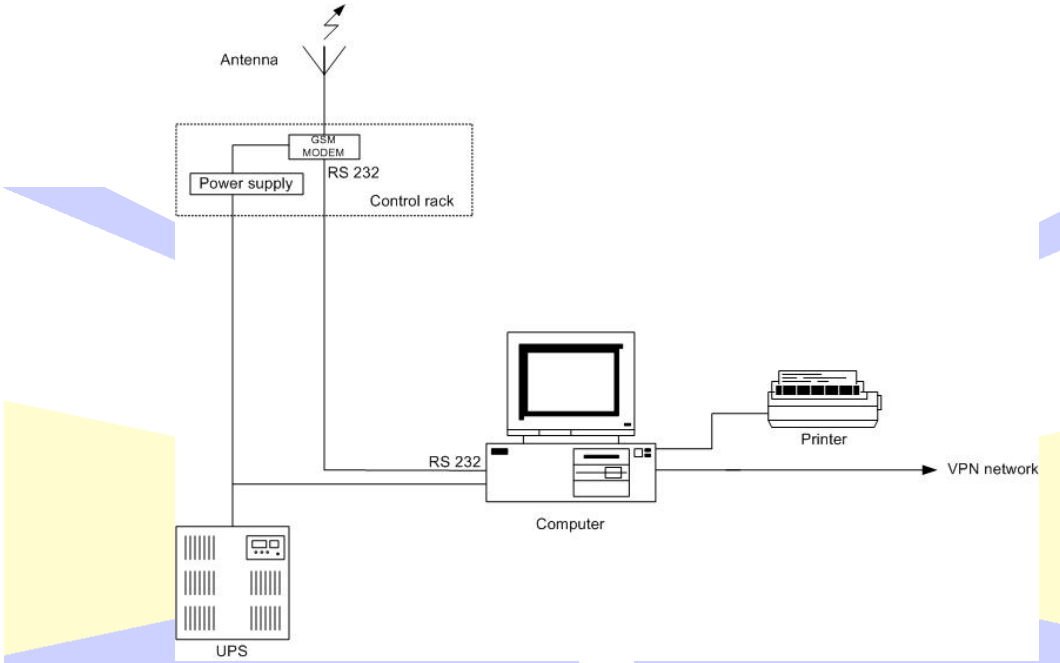


Picture No. 2: *Remote Control System of aids to navigation (Center for reporting of alarm states)*

CONTROL CENTER

The Control Center is located in Plovput's Maintenance department in Split. Here all the information received from the aids to navigation is elaborated and preventive actions on aids to navigation undertaken.
The Control Center has a computer with SCADA program which is connected via VPN network with Center for reporting of alarm states from which it obtains information about aids

to navigation. The Control Center is also equipped with GSM device for independent calling of aids to navigation.

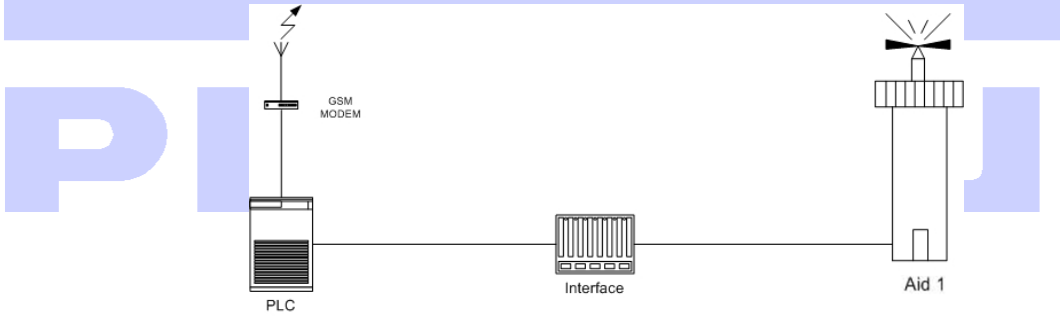


Picture No. 3: *Remote Control System of aids to navigation (Control Center)*

All Maritime Regions can monitor alarm states on aids to navigation by means of a special application which enable the access to the data base of alarms located in their premises. Alarm states are automatically registered in the data base.

AIDS TO NAVIGATION

Aids to navigation are allocated along the Croatian part of the Adriatic. By means of programmable logic controller (PLC) the data about aids to navigation are collected, analyzed, stored and transmitted via GSM device towards the Center for reporting of alarm states.



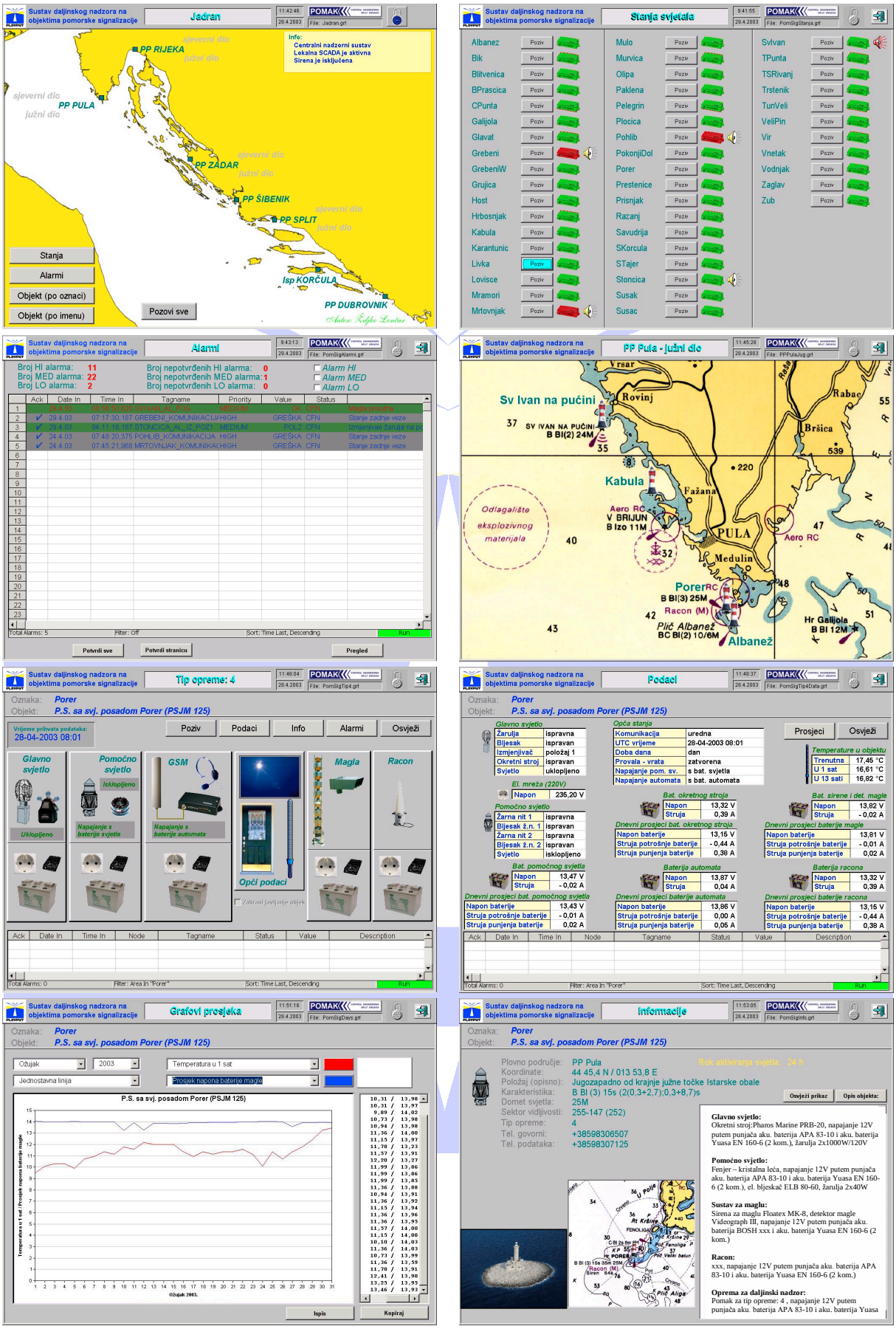
Picture No. 4: *Remote Control System of aids to navigation (Aids to navigation)*

No.	Name of aids to navigation	Position of aids
75	P.S. (s.p.) Rt Savudrija	45 29.4 N / 013 29.5 E
76	Svj. Oz. Pličina Paklena W strana	45 26.5 N / 013 30.3 E
87	O.S. Rt Zub	45 17.9 N / 013 34.4 E
94	O.S. Otočić Altiježˇ	45 11.9 N / 013 34.4 E
98	Svj. Oz. Pličina Mramori	45 08.9 N / 013 34.5 E
104	P.S. (s.p.) Hrid Sv. Ivan na pučini	45 02.6 N / 013 37.1 E
105	Svj. Oz. Greben Kabula	44 56.8 N / 013 42.8 E
113	P.S. Rt Peneda	44 53.3 N / 013 45.5 E
115	O.S. Rt Kumpar, gl. lukobr.	44 53,2 N / 013 47,7 E
125	P.S. (s.p.) Hrid Porer	44 45.5 N / 013 53.8 E
128	Svj. Oz. Pličina Albanež	44 44.1 N / 013 54.4 E
131	O.S. Rt Marlera	44 48,2 N / 014 00,4 E
135	O.S. Rt Ubac	44 56.7 N / 014 04.2 E
129	O.S. Hrid Galijola	44 43.8 N / 014 10.8 E
143	O.S. Rt Crna Punta	44 59.2 N / 014 10.5 E
146	O.S. Rt Brestova	45 08.3 N / 014 13.7 E
151	P.S. Rt Prestenice	45 07.2 N / 014 16.6 E
156	P.S. Hrid Zaglav	44 53.3 N / 014 17.6 E
164	P.S. Rt Vnetak	44 37.2 N / 014 14.4 E
166	P.S. (s.p.) Otok Susak	44 30.8 N / 014 18.5 E
183	P.S. Mlaka	45 20.0 N / 014 25.5 E
202	O.S. Rt Kavranić	45 16,9 N / 014 34,1 E
210	O.S. Tenka punta, rt	45 13.7 N / 014 32.1 E
226	O.S. Rt Manganel	45 04.4 N / 014 26.2 E
236	O.S. Otok Cres – Rt Tarej	44 57.3 N / 014 29.5 E
237	O.S. Otok Plavnik, Rt Veli Pin	44 58.8 N / 014 29.4 E
240	O.S. Otok Prvić, Rt Stražica	44 56.0 N / 014 46.4 E
244	O.S.Rt Kalifront, Donja punta	44 47.4 N / 014 39.5 E
246	O.S. Rt Frkanj	44 45.1 N / 014 45.6 E
254,5	O.S. Rt Zali (Pag)	44 36.8 N / 014 54.8 E
258	Svj. Oz. Hrid Bik	44 32.5 N / 014 37.4 E
259	P.S. Otočić Trstenik	44 40.1 N / 014 35.0 E
266	P.S. (s.p.) Otočić Grujica	44 26.6 N / 014 34.4 E
293	O.S. Jablanac, Rt Štokić	44 42,6 N / 014 53,8 E
333	P.S. Otok Vir	44 18.2 N / 015 01.9 E
343	O.S. Otočić Pohlib	44 23.7 N / 014 53.9 E
353	O.S. Otočić Greben zapadni	44 20.0 N / 014 41.7 E
357	O.S. Rt Bonaster	44 12.0 N / 014 50.6 E
358	O.S. Otočić Golac	44 11.3 N / 014 51.0 E
360	O.S. Otočić Tun Veli	44 11.3 N / 014 54.5 E
365	P.S. (s.p.) Veli Rat	44 09.1 N / 014 49.5 E
366	P.S. (s.p.) Otočić Sestrica Vela	43 51.2 N / 015 12.5 E
367	P.S. (s.p.) Blitvenica	43 37.5 N / 015 34.8 E
367,1	O.S. Otočić Raparašnjak	43 40,9 N / 015 35,5 E
368	O.S. Otočić Mrtovnjak	43 42.6 N / 015 32.5 E
370	P.S. Otočić Tri Sestrice (Rivanj)	44 10.3 N / 015 01.0 E
371	Svj. Oz. Pličina Sajda	44 11.3 N / 015 02.4 E
387	O.S. Hrid Galijolica	43 52.7 N / 015 22.5 E
388	O.S. Otočić Košara	43 53.0 N / 015 24.5 E
389	O.S. Otočić Karantunić	44 00.5 N / 015 14.6 E
390	O.S. Otočić Mrtovnjak	44 00,7 N / 015 10,8 E

Table No. 1: *Remote Control System of aids to navigation (list of aids – part I.)*

No.	Name of aids to navigation	Position of aids
394	P.S. Oštri rat	44 07.8 N / 015 12.5 E
410,2	O.S. Otočić Mišnjak	44 01,6 N / 015 16,1 E
425	P.S. (s.p.) Otočić Babac	43 57.4 N / 015 24.0 E
433	O.S. Otočić Sv. Katarina	43 55.9 N / 015 26.0 E
446	P.S.Otočić Prišnjak	43 47.0 N / 015 39.1 E
450	O.S. Hrid Kukuljari	43 45.6 N / 015 38.3 E
455	Svj. Oz. Brak Praščića	43 40.5 N / 015 38.9 E
457	O.S. Otočić Hrbošnjak	43 38.8 N / 015 44.5 E
463	O.S. Otočić Komorica	43 39.0 N / 015 50.7 E
478	O.S. Otok Zlarin, Rt Rat	43 39,7 N / 015 52,5 E
481	O.S. Rt Jadrija	43 43.3 N / 015 51.3 E
515	P.S. Hrid Mulo	43 30.9 N / 015 55.4 E
517	P.S. (s.p.) Rt Stončica	43 28.0 N / 016 03.7 E
519	O.S. Otočić Host	43 04.6 N / 016 12.6 E
525	O.S. Rt Stupišće	43 00.4 N / 016 04.3 E
526	O.S. Otok Biševo, rt Kobila	42 59.2 N / 016 01.5 E
527	O.S. Otočić Muljica	43 28,4 N / 016 01,0 E
528	P.S. (s.p.) Otočić Murvica	43 28.0 N / 016 03.7 E
533	O.S. Hrid Galera	43 28.3 N / 016 11.5 E
565	P.S. Split, lkb. Glava	43 30.1 N / 016 26.5 E
565	P.S. Split, lkb. Glava	43 30.1 N / 016 26.5 E
571,2	O.S. Otočić Stipanska	43 24,4 N / 016 10,4 E
574	O.S. Rt Livka	43 19.8 N / 016 24.2 E
575	P.S. (s.p.) Rt Ražanj	43 19.2 N / 016 24.9 E
592	P.S. Pučišća, Rt Sv. Nikola	43 21.7 N / 016 44.4 E
594	O.S. Rt Lašćatna	43 18.9 N / 016 54.2 E
598	O.S. Rt Pelegrin	43 11.7 N / 016 22.3 E
607	O.S. Otočić Zečevo	43 11,5 N / 016 42,1 E
612	P.S. Poluotok Sv. Petar	43 17.7 N / 017 00.8 E
616	O.S. Otok Vodnjak veli	43 10.1 N / 016 19.0 E
620	P.S. Otoćič Pokonji Dol	43 09.4 N / 016 27.4 E
624	P.S. Otočić Pločica	43 01.8 N / 016 49.2 E
625	O.S. Rt Velo dance	42 55,5 N / 016 38,6 E
630	O.S. Otočić Proizd	42 59.0 N / 016 36.7 E
634	O.S. Rt Lovišće	43 02.8 N / 017 00.4 E
635	O.S. Otočić Kneža vela	42 58.9 N / 017 03.5 E
643	P.S. Otočić Sestrica vela	42 57.8 N / 017 12.7 E
644	O.S. Rt Ražnjić	42 55.0 N / 017 12.4 E
645	P.S. Rt Sućuraj	43 07.5 N / 017 12.1 E
648	O.S. Rt Višnjica – S strana	43 02.4 N / 017 25.3 E
686	O.S. Otok Prežba, Rt Kremene	42 45,2 N / 016 49,1 E
689	O.S. Otočić Tajan Velji	42 48.9 N / 016 59.7 E
690	P.S. Otočić Glavat	42 45.9 N / 017 09.0 E
692	P.S. (s.p.) Rt Struga	42 43.4 N / 016 53.4 E
693	P.S. (s.p.) Otok Sušac, rt Kanula	42 45.0 N / 016 29.7 E
694	P.S. (s.p.) Otočić Palagruža	42 23.5 N / 016 15.6 E
697	O.S. Otočić Lirica	42 52.4 N / 017 25.9 E
703	O.S. Otočić Olipa	42 45.5 N / 017 46.9 E
708	P.S. (s.p.) Otočić Sv. Andrija	42 38.8 N / 017 57.3 E
710	P.S. Hridi Grebeni	42 39.1 N / 018 03.2 E
724	O.S. Otočić Daksa	42 40.2 N / 018 03.6 E
742	O.S. Rt Oštra	42 23.6 N / 018 32.2 E

Table No. 1: *Remote Control System of aids to navigation (list of aids – part II.)*



Picture No. 5: *Remote Control System of aids to navigation – computer program*