Journal of International Scientific Publications:
Materials, Methods & Technologies, Volume 7, Part 2
ISSN 1313-2539, Published at: http://www.scientific-publications.net

THE ROUTE OF THE MOVING OF THE OVERLAND TRANSPORT FACILITY CORRECTION ON BASE AGGREGATION OF ALGORITHM OF THE PROCESSING RADIONAVIGACION DATA AND ANALYSIS OF THE SCENES

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Abstract

The modern complex of the navigational facilities is considered which enables to get the data about location of the mobile object, its speed and acceleration, to compare with cartographic information, to define the point of the route, to take the decision on parameter of the further motion. The results of nature experiment for different climatic period depending on the temperature of the air, atmospheric pressure, rainfall, moisture of the air are presented. In accordance with the simplest algorithm of aggregation it is provided the use at the outlet of navigational complex of the coordinates and the speed of satellite radio navigation systems at its normal work and the information of the isolated system under inoperability of satellite radio navigation systems.

Key words: *recognition of the image, radio navigation, route of the motion.*

1 INTRODUCTION

1.1 THE MODERN NAVIGATIONAL EQUIPMENT

The Modern navigational equipment presents itself symbiosis of the satellite system of the positioning, modern radio communication and electronic cartography, allows to define the location and the speed of the transport facility, to calculate the distances, to lay the routes and to trace their observance, to get the references about cartographic object. Herewith the required accuracy is found at a rate of group of ten of the meters that allows in some cases to use satellite radio navigation system (SRNS) as main means to navigations. The Realization of the systems to navigations of completely autonomous transport facilities is controlled by a variety of reasons, one of which is that the use of SRNS GPS is complicated by possibility of purposive crudely of system data above that or other region, depending on external policy of the situation. Herewith, the questions of integration with the other facility gain the importance, in particular, with inertial navigational system (INS) technical vision system (STZ). Increasing of the accuracy of measuring information from SRNS expects the study of inaccuracy and the following their algorithmic compensation on base of the collation with the data got from other measuring systems [1-3]. In given work the questions of increasing of the accuracy of the navigational systems, functioning in different mode on base of the compensation of different factors, influencing upon noise-immunity of radio navigation signal, as well as collations to navigational information with data from sensors of the technical vision system are considered.

1.2 THE AUTONOMOUS NAVIGATION MODEL

When driving the transport facility on hard given route, for instance, in the event of fasten to road network, installation of the route is executed beforehand with provision of the goals solved by autonomous transport facility. With this, the system of the shaping the route must take into account the possibility of the origin obstacle on way of the following of the transport facility (TS) and provide the possibility of their pass-by with the following most quick return on route. In this situation the effective

algorithms can be received on the base complex navigational information and march, worked out in theories of the processing the scenes.

For building of the models of autonomous navigation is offered to use three levels of navigation. The First level is a system of the satellite positioning, defining the position TS on the map. Usually the map of satellite navigation presents itself the earl. The System of the satellite positioning defines, on what rib of the earl is found TS at the moment. By means of this level is defined global position of TS: city, street etc. In the same way, the first level creates the array of the checkpoints, through which must pass TS. The Given array is a coordinate of the top of the map earl. Algorithms of searching the way are used for searching for of these tops in earl such as wave algorithm and algorithm A*.

The Second level to navigations is a system of the technical vision of the car, using as sensor laser scanner or video cameras. By means of this level is built card surrounding world, and is in the same way is found way to the next checkpoint. On given level is impossible to use the algorithms of searching for the way on earl, in view of absence of the whole map surrounding world, but in the same way in view of possibility not forecasting motion an element of the world.

The Third level is a managerial system TS. The mechanism of the gearshift pertain to such system, tumbling meat loaf, checking TS size. The Given level defines the complex a tumbling TS for determination of the correct path of the motion and the following achievement of the checkpoint, but in the same way orientation in limited space.

1.3 THE REALIZATION OF THE FIRST LEVEL OF NAVIGATION

The Realization of first level of navigation is realized through systems of GPS navigation. The Program for satellite navigation builds the way on top of earls of the map. The Data of the system return the set of the checkpoints, motion on which is realized by means of the second and third level. The Checkpoints are found by means of algorithm of searching for of the way in earl. It Is expected that duty of the calculation of the route on earl completely lies to system of the navigations.

1.4 THE REALIZATION SECOND LEVEL TO NAVIGATIONS

The Result of the functioning second level navigational system is broken, bending around obstacles on way to checkpoint. On given moment exists the row an algorithm on finding of the way between two points such as A* or wave algorithm. Impossibility of the use one of them for decision of the put(deliver)ed task is conditioned that that all known algorithms given class search for the way on ready card, containing whole information on obstacle. In given task whole card to terrain not known, and there is information on that impenetrable point only, which were received as a result of scans from the current point of the position TS. So preliminary laying of the best-route turns out to be the impossible.

One of the main of the tasks to navigations autonomous TS is a revealing the passable zones - an area to surfaces, on which possible motion TS, but in the same way global positioning.

The Sidebar impenetrable point is built by scans by lazer sensor with at a walk 0,1o. If scan ray got through checkpoint, which is considered that point is found right in field of vision, and possible follow to her stright. Otherwise follows to research the way of the pass-by of the obstacle on way before endpoint of the route.

The Following at a walk is a determination of the breakup in sidebar of the obstacle. The Certificate of the breakup is a far cry between nearby point of the sidebar. Hereinafter follows to define, to what from two breakups follows to move.

After finding of the following point of the route, possible proceed with realization of the complex manoeuvre for his (its) achievements.

1.5 THE REALIZATION THIRD LEVEL TO NAVIGATIONS

For development of the complex of the methods on determination of the correct path necessary to define the notion TS.

The Notion TS, must possess the following characteristic:

1. The Size.
2. The Issue, back (R) or anteroom (D).
3. The Radius of the tumbling.
4. The Corner of the current u-turn comparatively begin global coordinates;

but in the same way following methods:

1. Motion on circumferences. Depending on issues, on sentry or counterclockwise.
2. Motion straight.

The First that necessary to identify, this direction of the u-turn - to the right or to the left.

After determination of the direction of the tumbling, follows to define, possible u-turn in given direction i.e. no on way of the impenetrable point.

If at least one of these point is an impenetrable issue is changed on opposite.

If during complex previous manoeuvre corner of the direction TS, has complied with углом of the deflection of the following point, that TS has taken the necessary orientation to move to the following point straight, in such event issue is switched on front. But during complex manoeuvre following point could disappear from field of vision TS in this case algorithm of the redefining of the following point is started. In any event with each iteration of the algorithm TS will approach to given to point.

2 EXPERIMENTAL

2.1 THE ANALYSIS RADIO NAVIGATION TO INFORMATION

The Influence of the temperature on noise-immunity radio navigation signal. The Measurements were conducted at winter period, month - a February. The Volume experimental data has formed the order 40320 reports. We Control, as change of importance of the temperature of the air in приземном layer influences upon quality of the signal. Four days shall choose For comparison with different importances of the temperature (3, 14, 22 and February 26), differring at the average on 50 S. Graphs of the change of importance S/N in the course of time at miscellaneous to temperature for fcompanion (satellite) 21 (GPS) c frequency L1 (1575,42 MHZ) and L2 (1227,60 MHZ) are brought on figure 1.

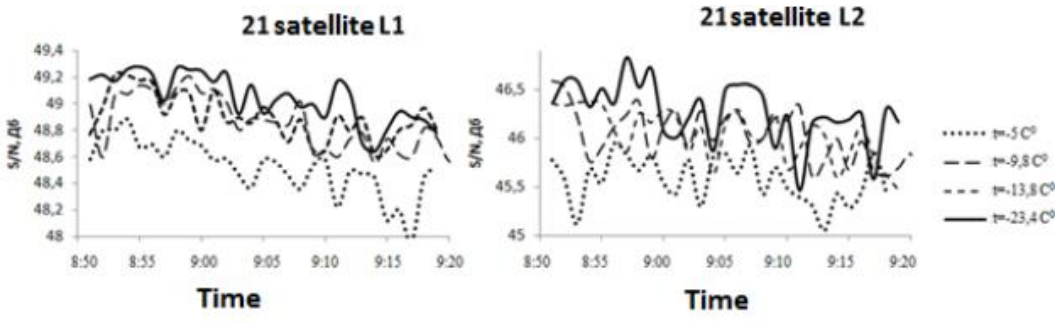


Figure 1. The graphs of the change of S/N meanings over the time at different temperature for satellites № 21 frequencys L1 u L2

Valuing got results, possible do the following conclusion: change the temperature of the air in under terrestrial layer influences on noise-immunity radio navigation signal. Reduction of the temperature at winter period enlarges the attitude S/N. Moreover change the temperature from -50 C before -150 With has brought about improvement quality satellite feed in for system GPS on 0,57 db and 0,7 db accordingly. This can be connected with that that amount decreases because of reduction of the temperature and intensity natural noise, but accordingly and hindrances.

2.2 THE INFLUENCE OF THE ATMOSPHERIC PRESSURE ON NOISE-IMMUNITY RADIO NAVIGATION SIGNAL

We shall Analyse the influence of the atmospheric pressure on noiseproof factor radio navigation signal. The Analysis was conducted for three different importances of the atmospheric pressure moreover the temperature of the air in at land layer alike and forms (-130C) - (-140C), presence of the precipitation are absent.The Graphs of the change relations S/N in the course of time under different importance of the atmospheric pressure for fcompanion (satellite) 21 (GPS) c frequency L1 and L2 are brought on figure 2.

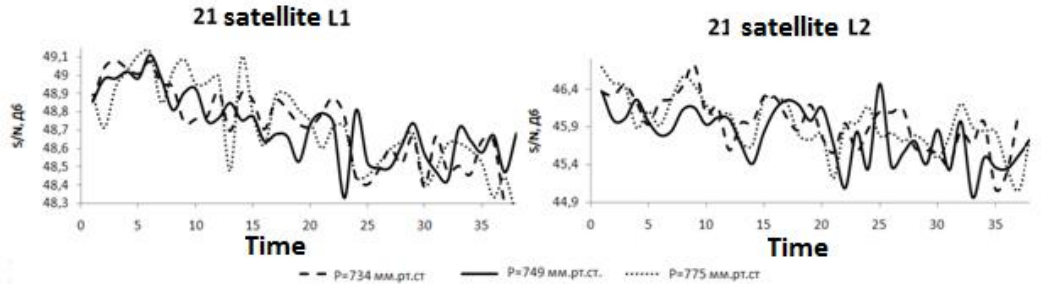


Figure 2. The graphs of the change of relations S/N over the time at different meaning of tension for satellite № 21 with frequency L1 u L2

On the grounds of got experimental data and built on him empirical models get that attitude S/N for radio navigation signal practically is not changed with change of importance of the atmospheric pressure.

2.3 THE INFLUENCE RAINFALL ON NOISE-IMMUNITY RADIO NAVIGATION SIGNAL

The Degree of the weakening radio of wave in setting depends on their water, sizes of the drop. The least weakening exists in mist, the most in rain. Oblaka influence upon weakening radio of the signal in the same way, either as mists, t. e. weakening pro rata water, and only powerful cumulous and rain cloud powerfully weaken the signals because of greater sizes of the drop in them. The Weakening radio of the wave at fallout of the hail usually much less, than in the event of fallout rain same water. The Signals reflected from snow, hang from intensity of the snow (water), sizes snowflake and mainly from presence on them layer of water (has ed). Under low temperature reflected from snow signals much weakly signal from rain equal water. The Reflected signals from wet snow more, than signals from rain equal intensity. This is explained that that reflecting surface of the wet snow more, than drop with such amount of water, but electric permeability his(its) ed surfaces is such for drop rain. Dry snow has electric permeability in groups of ten once smaller, than water in consequence of which he weakly reflects radio of wave [5].Within the framework of study for estimation of noise-immunity radio navigation signal as precipitation were taken into account intensities of the fallout rain and snow. In process of the experiment importance rain has formed 3.3 mm/ch. This importance pertains to level of the moderate precipitation [6].The Results of the study for companion (satellite) 2 (GPS) and frequency L1 and L2 are brought on figure 3.

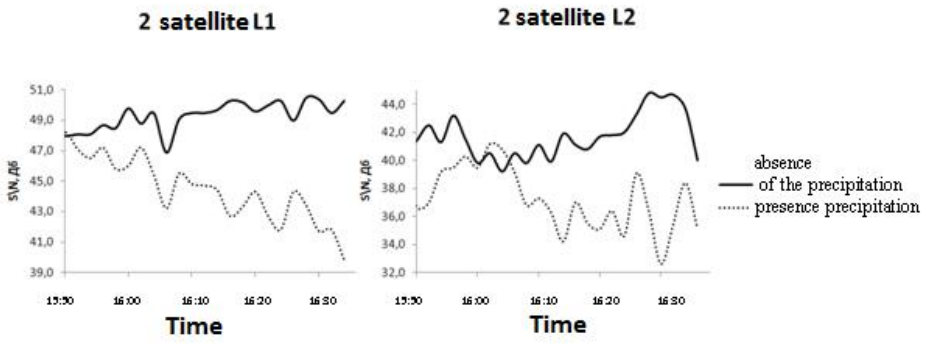


Figure. 3. The graphs of the change of S/N meanings over the time for satellite №2 with frequency L1 u L2

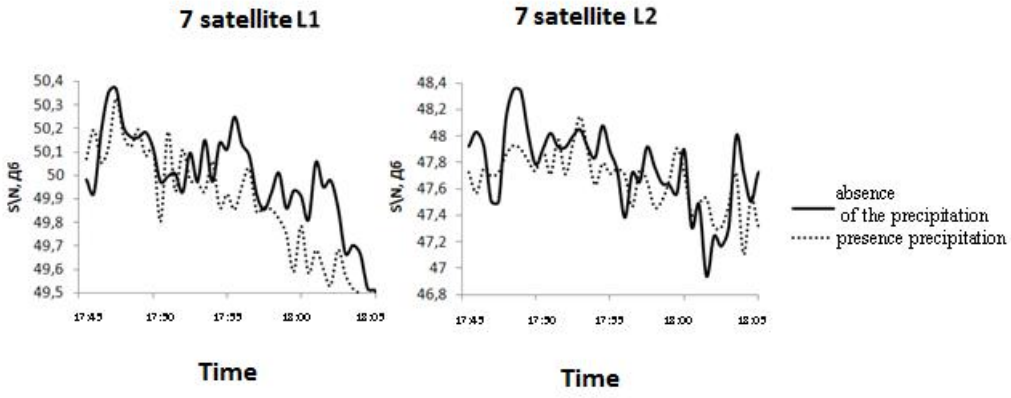


Figure 4. The graphs of the change of S/N meanings over the time for satellite №7 with frequency L1 u L2

The Called on experiments have shown that at presence of the precipitation attitude S/N falls. This effect possible to explain that that precipitation(draft) (the rain, mist, snow) weaken the signal. Than intensive precipitation (draft), that more weakening of the signal. Also noticeably that at rain signal weakens more, than during snow. Possible here plays the role linear polarization (horizontal or vertical). The Drop of water as optical lens declines, or rotates the vector to polarizations. But such drop at rain, much. For system GPS signal during rain weakens at the average on 7 Db.

2.4 THE INFLUENCE TO MOISTURE ON NOISE-IMMUNITY RADIO NAVIGATION SIGNAL

The dependencies of the influence were built In the course of experiment to moisture on attitude signal/noise for year. Partly graphs of the change relations signal/noise are in the course of time brought on figure 5.

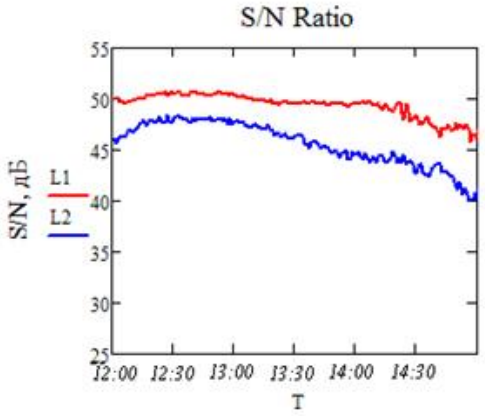


Figure 5 The graph of relations signal/noise frequency L1 u L2 for 02.06.12 on satellite 7

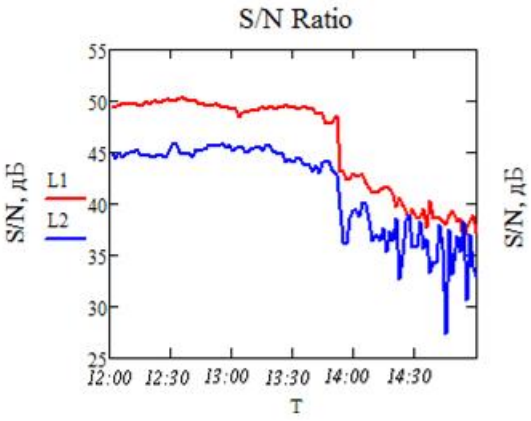


Figure 6 The graph of relations signal/noise frequency L1 и L2 for 18.10.12 on satellite 25 at humidity 58%

The dependencies S/N were built In the course of the further experiment, for year, under different moisture from which follows that when change of moisture at the average on 20% signal grows worse:

- At spring period at the average in 1,25 times for frequency L1 and in 1,56 times for frequency L2 for fcompanion(satellite) GPS
- At year term at the average in 1,4 times for frequency L1 and in 1,78 times for frequency L2 for fcompanion(satellite) GPS
- At autumn period at the average in 1,56 times for frequency L1 and in 2 times for frequency L2 for fcompanion(satellite) GPS
- At winter period at the average in 1,25 times for frequency L1 and in 1,56 times for frequency L2 for fcompanion(satellite) GPS.

2.5 KOMPLEKSIROVANIE ALGORITHM INFORMATION HANDLING SRNS AND STZ

Existing at present systems expect that key elements to paths of the motion (the points взлета, boarding etc.) are assigned person beforehand and can not as required change when operating the transport facility in local modes. The Proposed project is directed on removal of this restriction of the functional possibilities of the transport facilities. STZ can execute processing as flat (2D), so and spatial (3D) of the scenes. For modern systems of the technical vision typical transition from processing the two-dimensional scenes to processing the three-dimensional scenes. Particularly brightly, this trend exists in system, providing decision of the problems to orientation and navigations of the transport facilities. This is explained by increase информативности 3D scenes in contrast with 2D scenes and provided to account by this growing quality taken decisions. The Technical base of the spreading the systems of the processing the three-dimensional scenes is a growing computing resource available at the disposal developer, reducing the price of and broad spreading sensor 3D scenes. In proposed system is expected use lazer range finder and cameras that will allow to integrate information handling in STZ. Thereby, the main problem will be a reception of the identical mathematical models 3D scenes, development of the methods of their analysis.

As it is shown in [1,2,7-8] the most perspective will be a methods kvaternionnogo and contour analysis, as well as special mathematical models [1,2,7-8], allowing effectively and firm to work even in condition big amount noise and disappearings of a part to signal information.

As a result offered system will allow to execute the autonomous navigation of the overland transport facility to account of the integrated processing and collations given SRNS and STZ. The Algorithms of the processing will allow to forecast current accuracy of the determination of the coordinates, and on base this defines the necessary specific contribution STZ. With provision for foregoing system will be of the form of, expressed on figure 7.

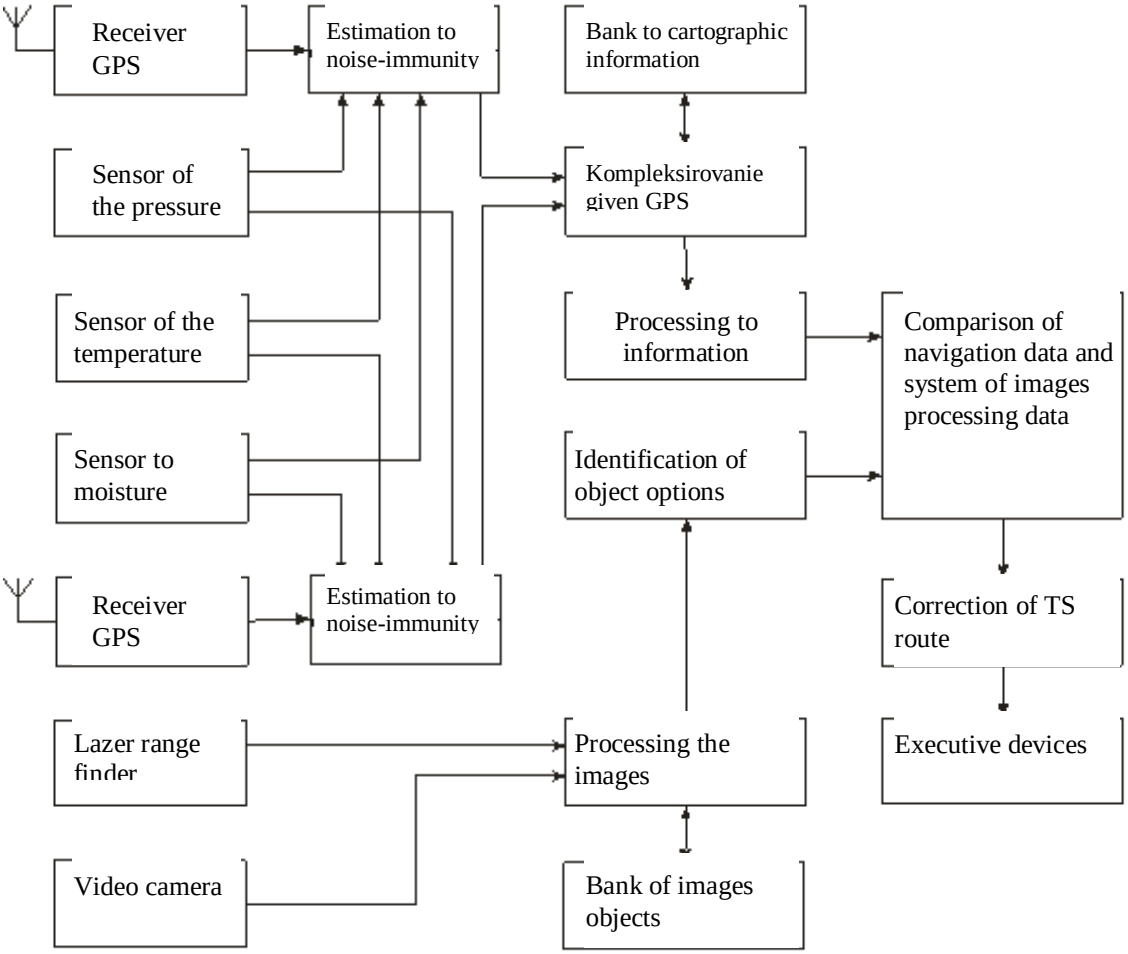


Figure 7 Scheme to correcting the route of the moving the overland transport facility

3. CONCLUSION

The Modern complex of the navigational facilities enables to get given about location of the rolling object, his(its) velocities and speedup, compare with cartographic information, define the point of the route, take the decision on parameter of the further motion. Herewith important problem is a reception

of the miscellaneous algorithm комплексирования available observations for the reason determinations of their efficiency. In accordance with the most simplest algorithm комплексирования is provided use on leaving the navigational complex of the coordinates and velocities SRNS under her (its) normal work and information of the isolated system under неработоспособности SRNS.

At present actual is a problem of the development device, which on base of the analysis of the scenes surrounding space capable to define the own location, come to a conclusion about correction or about change the route of the following of the transport facility, find the suitable platforms for time stop of the transport facility etc.

Decision making real-time possible to provide to account of the introduction to necessary correcting the coordinates, on the grounds of information on the current inaccuracy SRNS and integrations of the necessary volume финмации, extracted at the current moment from STZ.

Got in project results can be used at system development to orientation and navigations autonomous transport facilities, in particular, for choice of the landing grounds by unmanned flying machines, choice flat fragment seabed undersea device, management overland transport facility under their motion on town and country superhighway, for decision of the problems астроориентации on scenes starry sky and etc. Aside from specified areas, the got results can be used in system of the recognition of the three-dimensional scenes in radar system of the review of the air space and laying under surfaces, in system of the biometric identification etc.

The Economic effect from introduction is provided to account of the reduction of the requirements to hardware ensuring the systems of the processing 3D scenes, to account of the possibility of the reduction amount operator, realizing support of the operating the unmanned flying machines, to account of the reduction risk malfunction in system of the orientation and navigations and in accordance with this losses.

REFERENCES

1. Furman YA.A. The Visualization of the scenes in 3D scene. The Textbook. - Yoshkar-Ola, 2007.

2. Evdokimov A.O. Pattern Recognition of Space Group Point Objects on the Basis of their Shaping Flat Representations // 8th Open German-Russian Workshop (OGRW-8-2011). Workshop Proceedings, Nizhni Novgorod - 2011. - P. 56-59.

3.Ivanov V.A.,Ryabova N.V., Zuev A.V., Kislicyn A. A., Wing S. V. Study of the influence upon noise-immunity radio navigation signal meteo condition and cosmic weather // Herald MARGTU.- Yoshkar-Ola: Mari state technical university, 2011.- 3. - P. 25-35.

4. The Refraction of the electromagnetic waves in troposphere [Electronic resource - a Mode of the access: http://moryak.biz/modules.php?name=Content&pa=showpage&pid=366 (the Date of the address: 14.05.2011).

5. Manual automatic system meteorological observation on aerodrome [Electronic resource - a Mode of the access: http://www.aviadocs.net/icaodocs/Docs/9837_cons_ru.pdf (the Date of the address: 25.02.2011).

6. Scientific library thesis and abstract disserCat http://www.dissercat.com/content/povyshenie-effektivnosti-ispolzovaniya-sputnikovoi-radionavigatsii-na-transportnykh-vertolet#ixzz2ZNgh28q5

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7. Increasing to accuracy of the estimation of the coordinates of the small-dimensioned unmanned flying machine with use the system of the technical vision subject to thesises and abstract on VAK 05.13.01, 05.07.09, candidate of the technical sciences of the Smiths, Andrey Grigorievich

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