# THE USING OF NAVIGATION IN ARMED FORCES: SATELLITE SYSTEMS IN UNMANNED AIR FORCE.

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Nowadays it's hard to imagine the army without modern communication devices and satellites. Let's describe the innovational GPS-based system, called RELNAV. This system allows to control refueller plains of U-NAV and to complete the air operations with highest accuracy by itself. Wherein, there's no constant circulation to the head airplane system. It becomes possible due to debugged system of data refreshing, which is formed in onboard plane computers. The new solution is better than previous solutions, based on traditional kinematics methods, because they provide the most accurate positioning. It greatly simplify the message exchange between airplanes and it decreases the time of data recognition.
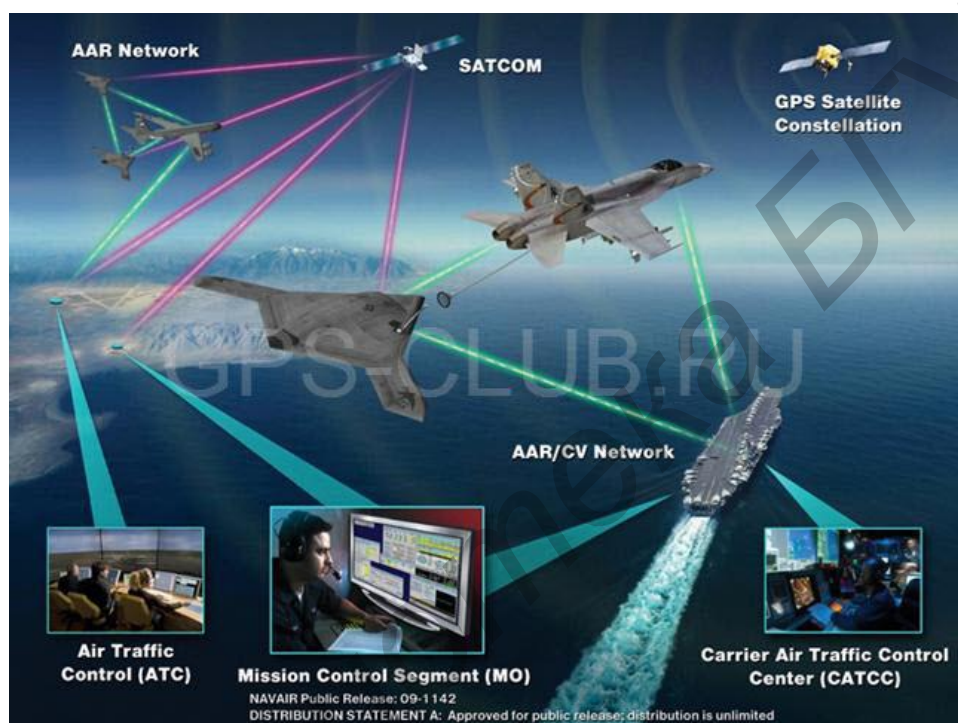

Picture 1. General scheme of autonomous air refill.

The UCAS-D testing system is developed for creation of technologies which allow aerocarrier to produce some kind of operations without human's intervention like autonomous air refuel (AAR). In case of it's (UCAS-D) success there'll be a transmission to the group of other perspective programs, which are made to describe a risk in using unmanned and human controlled machines.

The main goal of N-UCAS program is the developing such AAR-system, which allows performing long-time operations. As you can see from pic. 1, the AAR's developing goal is to show man-controlled air refueling system as authentically as possible. Also you should consider the position of construction elements (for example, the bar which is used to deliver fuel) and develop working algorithm according to features of refueling.

Developed bar refueling systems are presented on pics 2 and 3. For both situations, the inertial location systems for tanker and plane are used for achieving the most accurate position between them. It allows to define correct trajectory for the second plane and to locate it correctly for the back of refueling plane.
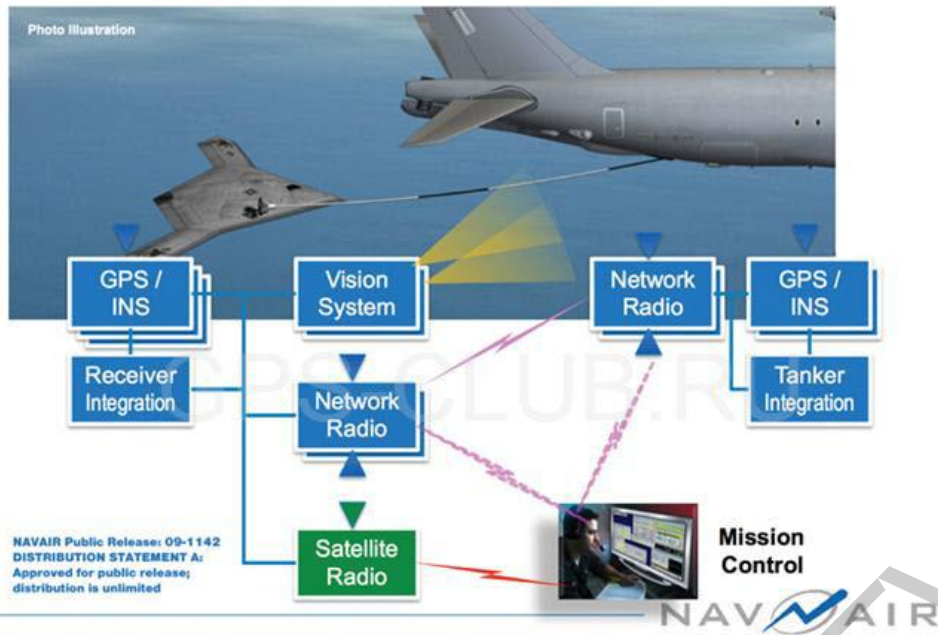
Picture 2. Movable probe refueling
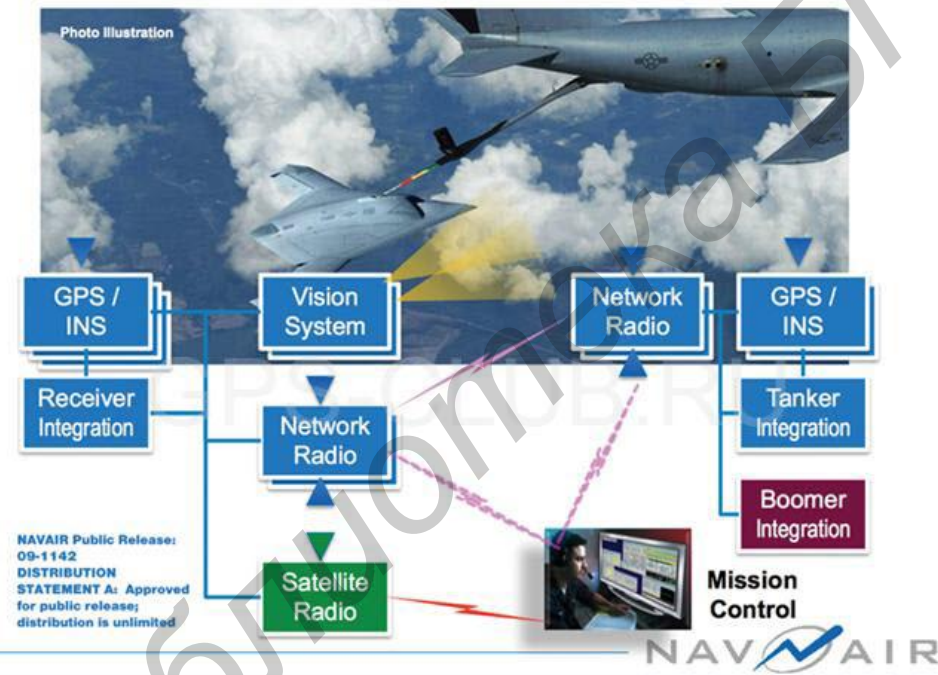
Picture 3. Fueling scheme with direct fuel amount supply

Accurate location system P-RELNAV. Working algorithm:

The method of object position calculating was developed by the project "PMA-268". It's based on GPS-integration. You can see it on the pic. 4. Navigation systems on both planes take part in the modeling of inertial vector 'e' which is used for real time aiming. The data from refueler plain is also transmitted on UAS, where the system produces kinematic data. They are sent to the aerocarrier and are used for determining more accurate airplane position and the distance between them.

For developing this system it took a lot of time to solve a lot of problems, connected with different data between the planes. These plane used the same algorithm which was created for correct planes landing and accurate GPS-locating. Then GPS-data is used for calibration of offset. It is caused by inertia. As result the built-in equipment is used for offsetting the plane to make refueling enable.
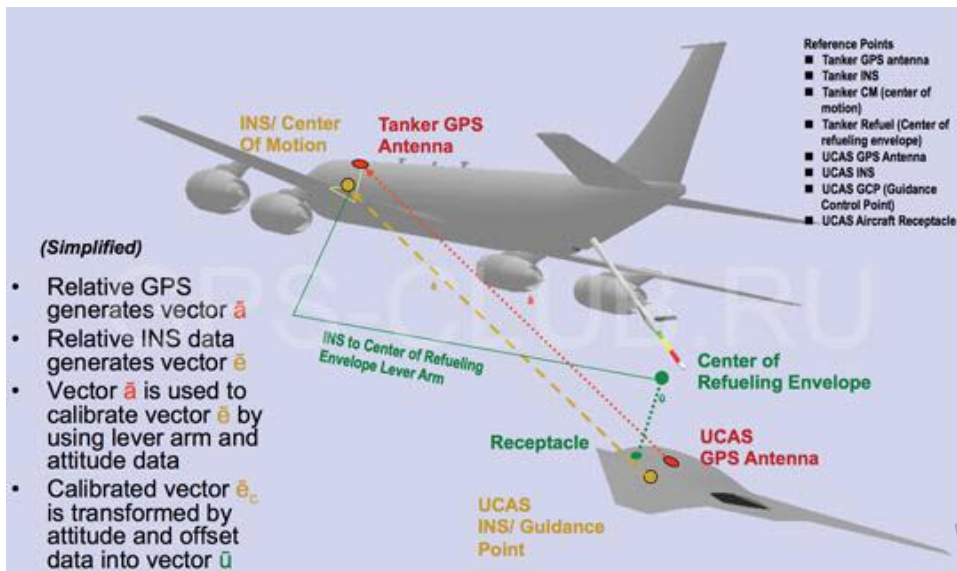
Picture 4. Accurate positioning with the help of correlated GPS-based systems.

During the P-RELNAV systems work, the correct ephemeris data are sent to both planes. They use GPS-based "NAMATH" technology for it. NAMATH provides a lot of possibilities for the communication organization in the armed forces. This system (NAMATH) uses JRE-system and the system of correcting GPS-data. This data is being refreshed due all the system's working time. The data is being refreshed by special system which is response for control GPS-data. Nowadays, NAMATH is used in USA armed forces for solving problems, like more accurate rocket shooting and increasing the quality of airplanes location.

Conclusion:

The using of P-RELNAV system has following advantages:

1. Initialization quickness: there's no more problem connected with airplane navigation system.

2. Safe work when refueler plane covers the part of sky over the second plane and as the result signal loss appears. Now it won't made any influence on system's work because of data transferring from both airplanes system.

3. There's no need in reinitializing when the connection to the aerocarrier is lost at the moment of refueling or preparing for it.

Nowadays the P-RELNAV navigation system is being refined. The additional information received during the system testing is collected for improving it. Also this information is used for UCAS-D program, which is used for connecting 2 planes for checking the P-RELNAV complex possibilities.

Список использованных источников:
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2. Синякин А.К., Кошелев А.В. Физические принципы работы GPS-ГЛОНАСС / Новосибирск: СГГА, 2009. – 110 с.