UAV OPERATOR'S CHRONICLE
t.me/xronikabpla

RECOMMENDATIONS FOR WORKING WITH DRONES OVER THE WINTER

Russia 2024

CONTENTS.

1. GENERAL PROVISIONS

During the operation of equipment and the onset of cold , operation implies preparation of equipment for the winter period. In peacetime, the deputy technical officer (for armaments) and the same deputy for ias (engineering and aviation service in aviation units)), issues an order for the unit, which establishes in what terms the equipment should be prepared for inspection.

When flying in winter at permanent deployment sites, UAV crews are in "greenhouse" conditions that allow for postponement of UAV takeoffs. Postponements may be due to various reasons: icing of an already flying UAV, battery discharge, poor communication between the launch position and the NAPC, torn harnesses on the launch pad, the launch pad is not standing properly.

But in the conditions of combat operations, such mistakes are not acceptable, except here, except for the group of UAVs "Forpost-R", "Orion", which are at significant distances from the line of contact.

This material is intended solely as a recommendation and not as a call to action.

Icing is the deposition of ice on the external surfaces of UAVs. Icing occurs mainly when flying in supercooled water clouds or mixed clouds, or in a supercooled rain zone, mainly at temperatures of from 0 to 10°. At contact with the airplane, supercooled drops freeze, covering the airplane with an icy crust. Warm fronts are especially dangerous with respect to icing.

The experience of using UAVs in winter during combat operations indicates that sometimes some UAVs are sent to the area of reconnaissance. reconnaissance
with a high threat of icing, despite the awareness of higher command.

This material will mainly deal with lithium polymer batteries, if some other type of battery is used, it will be reported.

To understand the life of a lithium battery, it is important to understand the concept of cycles. A charge cycle refers to the process of discharging a battery from 100% capacity to a certain level and then recharging it to full capacity. It is important to note that a charging cycle does not necessarily mean a complete discharge and recharge. Even partial discharges and subsequent recharges contribute to the total number of charge cycles

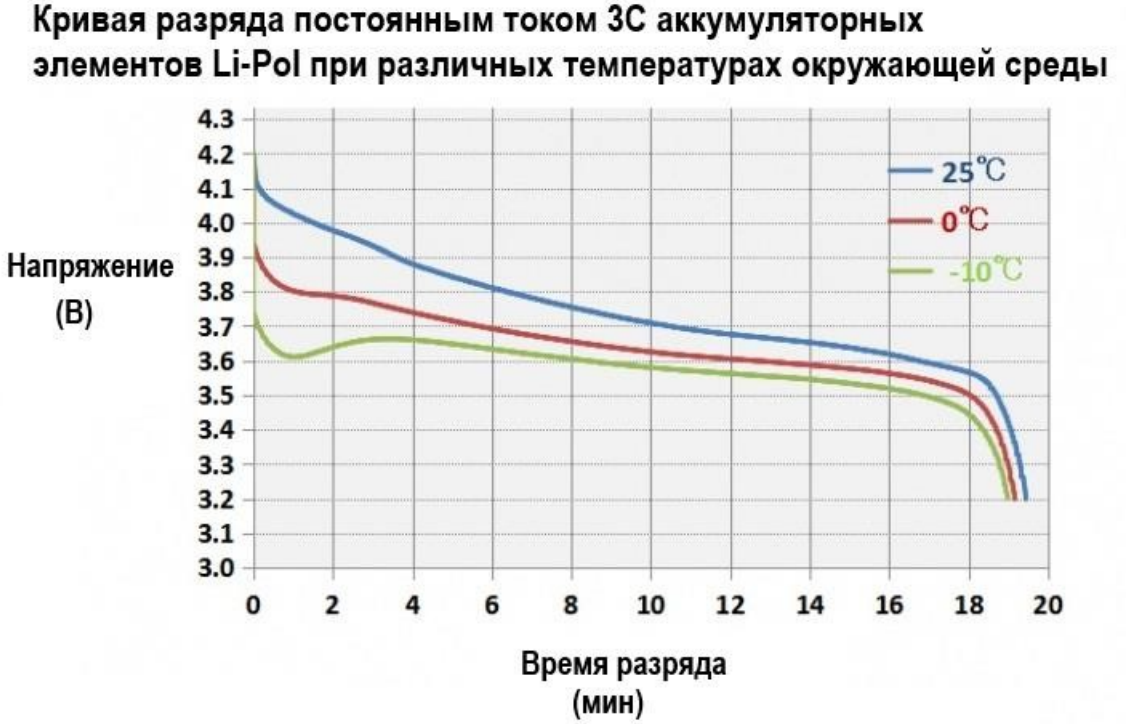
The maximum number of charge cycles a lithium battery can withstand depends on various factors, including the specific type of lithium battery. Different lithium battery chemistries have different lifespans. For example:

Lithium-ion (Li-ion) batteries typically offer about 300-500 charge cycles before their capacity begins to deteriorate noticeably.

Lithium polymer (LiPo) batteries can typically withstand 400-600 charge cycles.

Cold reduces the activity of lithium ions, so discharge capacity is reduced and runtime is shortened. If a Li-Polymer battery is used at low temperatures for a short period of time, its degradation is temporary: performance and capacity will be restored when it is warmed up. However, if it is charged or discharged in the cold for a long period of time, metallic lithium will deposit on the surface of the anode. The process will become irreversible and permanently reduce the battery capacity.

Let's see how their performance is affected by temperature



From the graph above, we can see that the ambient temperature has a great impact on the performance of lithium polymer battery.
In the cold, the voltage drops, discharging faster.

Charging the battery is of particular importance for prolonging its life. It is important to remember that a strongly cooled or overheated battery should not be charged, but should wait until it warms up to an acceptable temperature or cools down. The temperature range at which LiPo (lithium polymer) batteries can be charged is from 5° to 45° C, and the optimum temperature is 10°C to 20°C.

It is important not to let the battery idle and use it within 48 hours of charging, I recommend halving this time to 24 hours.

2.1 Multi-rotor UAV

Due to the fact that the number of multirotor UAVs we use has increased dramatically since the beginning of the SWO, several times, it is impossible to bypass these UAVs.

Extensiveness of the manufacturing plant:

- DJI;
- Autel;
- UCO;
- Xiaomi FIMI;
- and a number of others.

In order to provide flights in winter time on UAVs of multirotor type we need:

1. Keep rechargeable batteries warm. In the case when after their charging there is no possibility to store them in a warm room it is necessary to use a container for their storage with the use of disposable warmers for hands/feet. The container can be constructed, both from improvised means (the main thing is that it should have as little air permeability as possible), and to purchase special shockproof cases, both for carrying UAVs and for storing batteries.
2. The temperature of the copter should be equal to the ambient temperature, in sub-zero weather this is due to the fact that when you take the UAV from a warm room to the "street", condensation will form on it, which will later lead to icing of the copter.

Tip: Use two shockproof cases. One for storing the copters at temperature and one for storing the batteries using disposable hand/foot warming pads. If you cannot use the case, use backpacks, pouches, etc.

3. At the moment of reaching the launch pad (take-off position), it is also necessary to observe the temperature conditions. It is important to take into account the fact that in cold discharge of battery occurs much faster than in warmth. . In this regard, is necessary: the copter should be transported in a shockproof case, which has the ambient temperature. Battery, it is desirable to always have 2 batteries with you: main and spare. Transportation can be carried out, as in second container with the use of warming insoles, as well as throwing them in utilitarian bags, , pockets, it is important to remember one thing - they must warm.
4. To possibly increase UAV flight in sub-zero temperatures, the following action should be taken:

Put a hand warmer on the copter's battery before going into position. It is important to remember that there are batteries that have built-in heating, DJI has them from the Mavic 2 Enterprise : all 3, 30,

300 have built-in heating. But it is worth considering the fact that the battery heating process itself is energy consuming for the battery itself.

5. It is also important to know the battery life of multi-rotor type batteries, usually this information can be found in the UAV control application It is important to use batteries that have a battery life starting from 0 cycles to 100-120 charging cycles.

Pictured above is a case that can be used to transport batteries as well as quadcopters.

The backpack from TRIADATCO, for transporting the MATRICE 30T, will also fit the "smaller versions", is waterproof and protected from damage. At the bottom

There is a battery compartment. The backpack is perfect for going out on a UAV calculation task, as it holds everything you need for your work.

2.2 ZALA 421-16E and Lancet, Orlan-10, Orlan-30, Aileron-3, Aileron-7, Tachyon, Supercam S350, Albatross;

This section deals with fairly large BPLA's.
One important point is that all of these UAVs are launched with launchers or by hand, but they have one thing common - they are rubber bands for tensioning (harnesses). The harnesses should be kept warm for as long as possible before launching the UAV. When traveling to a position, if the launcher container is stored on the vehicle, the harnesses should be transferred to the vehicle - this is necessary to maintain the temperature.

When launching UAVs, harnesses must not be stretched for long periods of time in the cold - this may cause the rubber band to tear, which will then lead to the failure of the combat mission.

When working with these UAVs, it is also important to always check the battery charge before departure, and take an extra battery with you whenever possible - this is due to the fact that in severe cold, when transporting the battery from the place of deployment/auto to the starting position, a sufficient amount of time may pass and the battery charge may drop (if the battery is old).

If there is in complex UAV manual starter, it is obligatory to take it to the starting position and to start the UAV starter using it (in severe frosts).

Before departure, it is necessary to start the engine on the UAV in order to warm it up in advance of the launch. This is to reduce the time the technician and his assistant are at the launch position.

Battery storage and operation of the batteries on such UAVs is similar to that of multirotor UAVs.

Storage and transportation of UAVs, must be carried out in transportation containers at a temperature equal to the ambient temperature, so that no condensation forms on the equipment itself.

Storage and transportation of the battery, should be carried out at a temperature of 10-20 degrees Celsius.

A number of UAVs listed above use lithium-ion batteries. There are no differences in operation between LiPo and LiIon in winter. The only differences are in their characteristics:

1. High energy storage density of lithium-ion batteries.
2. No memory effect. Due to this, lithium-ion batteries can be charged and discharged more freely. At the same time, lithium polymer batteries do not have to be charged to 100%, but are best charged to 100%, and

then discharge it to almost zero before plugging it back in.

3. Longer life. The effective capacity of lithium-ion batteries usually decreases significantly (up to about 80%) after 500-1000 recharge cycles. This is not a good indicator, but Li-Polymer batteries will feel even worse after such an experience.

CONCLUSION

In conclusion, I would like to say the following, that the use of various de-icing mixtures, which are offered to make on the Internet has a temporary effect and will not bring any beneficial effect on long flights. When flying on UAVs, which are specified in paragraph 2.1., it is worth to orient in space and see where there is cloud cover/landing and where there is not. It is preferable to avoid clouds/clouds in order to reduce the risk of icing. At the moment of flight, it is worth monitoring the situation on the UAV, looking at the telemetry and using a camera on the wing console, air pressure receiver, tailplane and propeller. When a small amount of ice forms, it is necessary to start monitoring telemetry readings, and at the moment when the icing "declares" itself on the instrument, take measures to return the UAV to the "home" point. At the same time, when building a flight route for reconnaissance in winter, it is necessary to study the flight area and the location of neighboring units, all this is necessary in order to have several "home" points return in case of icing.