New AI Task System

DCS: A-10C has new task system for AI-controlled groups of unit. It provides to create flexible and detail configurable AI group behavior in a mission. Necessary improvements done both in AI engine and Mission Editor.

Architecture

There are main terms: controller, task, background task, action and behavior option.

Controller is a object that controls units or group of units.

Controller performs a **tasks**. Task is a process, so performing of task by controller requires a time. Flying route, following leader, engaging targets and performing a mission are samples of tasks.

There are two types of tasks: main tasks and background (en-route) tasks.

Main task is a solid and uninterruptable task. When performing this type of task controller each time is performing an actions those associated with this task. One and only one main task can be performing by controller same time. Task performing can be finished by itself or finished by user. Performing mission, flying route, orbiting, engaging designed target or bombing designed point are samples of main task.

Background (en-route) task is a task that can be performing with main tasks simultaneously and can interrupts main task many times to perform associated with this background task actions. Several background tasks can be running same time one main task running. Background task can be finished by user only.

If you want order flight of battleplanes hunting enemy vehicles along the route you can assign “Flying Route” main task and “Engaging vehicles” background task to group controller. When new target detected group will interrupt flying route and start engagement. After engagement group will resume it's route.

Because several background tasks can be running at same time there may be a situation when several tasks at same time requires group to perform actions associated with these tasks. For example A-10 flight detected many targets while performing two background tasks. One task requires enemy armour engaging in one zone and enemy truck convoy attacking in second zone. Both target detected, but we want this flight to destroy truck convoy first. To solve this problem all background tasks has priorities.

Combo task is a task that combines several tasks (main or background), actions and behavior options those running one-by-one or switching by any other rule. Mission is a sample of combo task. When performing mission group following route and performing tasks and actions associated with each waypoint.

Commands don't require time for performing. Changing waypoint, changing radio frequency, jettison payload, restoring fuel and ammo are samples of commands.

Behavior options defines restrictions those has effect on controller behavior all time. When controller performing any tasks it stay under these restrictions. Options can be changed many times and at any time of mission. Behavior option can be represented by <variable> = <value> pair. “ROE” = “Return Fire”, “Radar using” = “Keep radars switched off”, “Aggressiveness”=“Low” are samples of behavior options.

The common term for tasks, commands and behavior options is **actions**.

Implementation

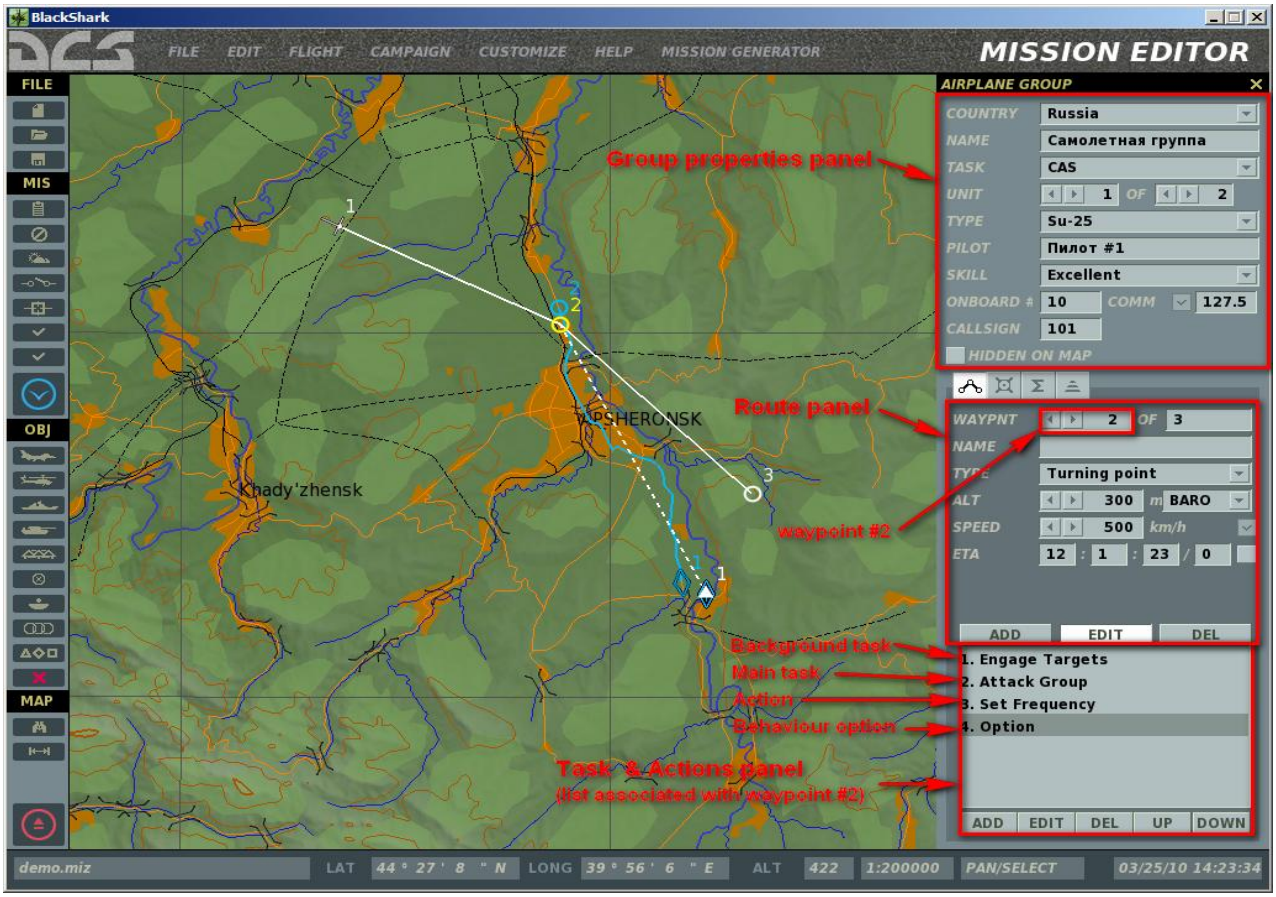
In DCS:A-10C controllers are presented by vehicle and air groups. There is no way for mission designer to control separate units in group.

Mission

Mission is the most high level task for all controllers.

Mission consists of route and actions lists each of them associated with own waypoint of route. When group passing the waypoint actions of associated list will be performing one-by-one.

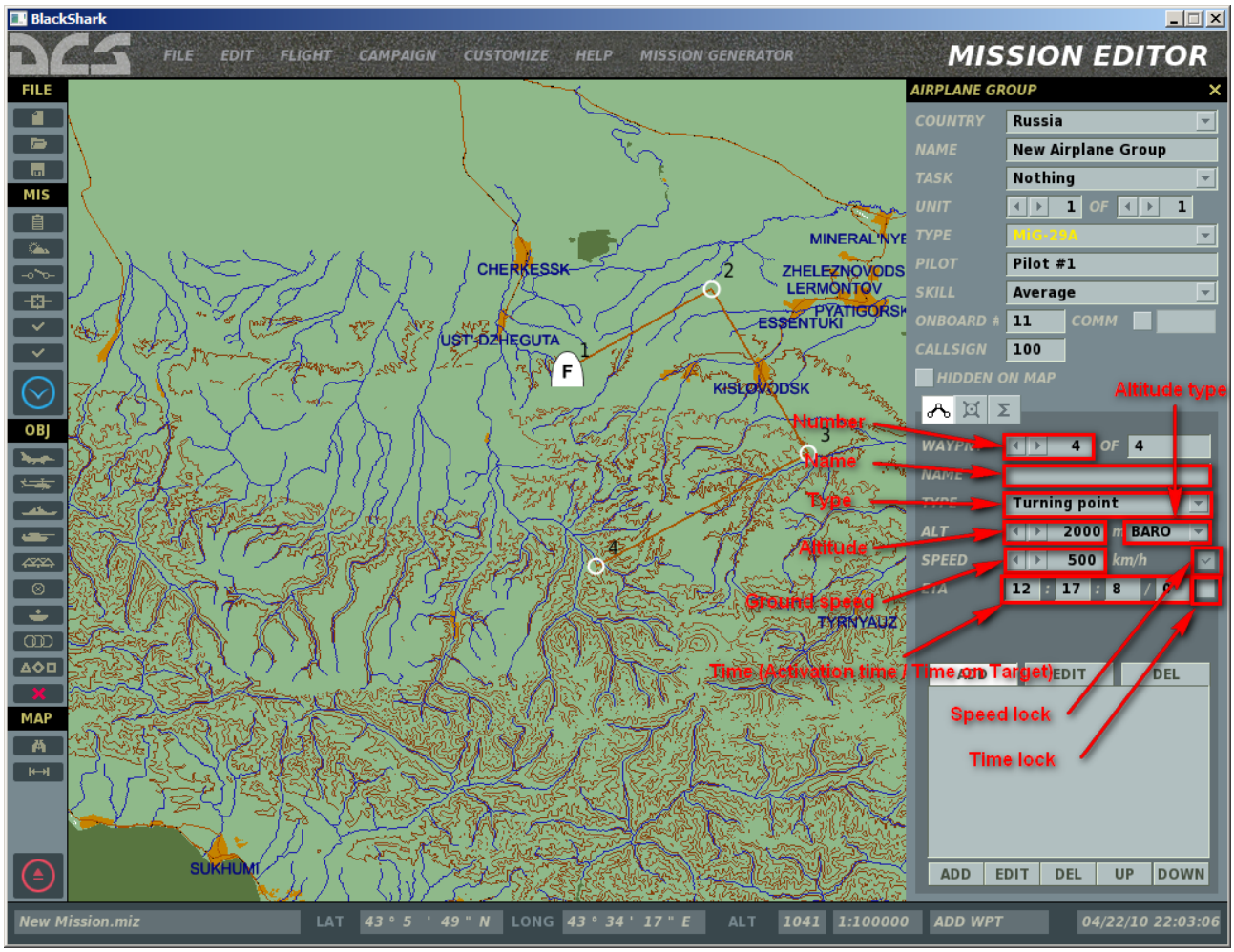
You can edit route in route panel and tasks & actions lists of any waypoint of route in actions panel.



Route

Route consist of several waypoints.

Each waypoint has 9 properties.



1. Number.

2. Name.
   Just a string that can be a helper in briefing.

3. Type.
   There are 6 types available. These types grouped into 3 groups:
   1. Takeoff types. Available only for first waypoint of route.
      1. 1. “Takeoff from runway”.
      1. 2. “Takeoff from ramp”.
   2. Waypoint passing methods. Available for all but not last waypoint of route.
      2. 1. “Turning point” is a passing method that requires lead turn.
      2. 2. “Fly over point” requires flying over waypoint and flying course of previous route leg.
      2. 3. “Fin point” requires flying over waypoint and flying course of next route leg. Not implemented yet.
   3. Landing type - “Landing”. Available only for last waypoint.

4. Altitude.
   When flying to this waypoint group will climb or descend to reach assigned altitude as fast as possible.

5. Altitude type.
   Barometric (above MSL) or radio altitude (above ground level).
   - When altitude type changed the result altitude MSL must be stay same. So indicated altitude will be converted correctly.

6. Speed.
   - Unavailable for first waypoint.
   - When flying to this waypoint group will accelerate or decelerate to reach assigned speed as fast as possible.

7. Speed lock (flag).
   - Unavailable for first waypoint.
   - If flag raised the group will keep assigned speed on route leg from previous to this waypoint.
   - If flag raised AT/TOT edit box becomes read-only and indicates estimated ETA for route leg. If estimated speed exceed maximum value for this type of aircraft text becomes red.
   - If values lock flags of the waypoint or neighbor waypoint(s) cause error “Speed lock” check box will be bounded by red contour.

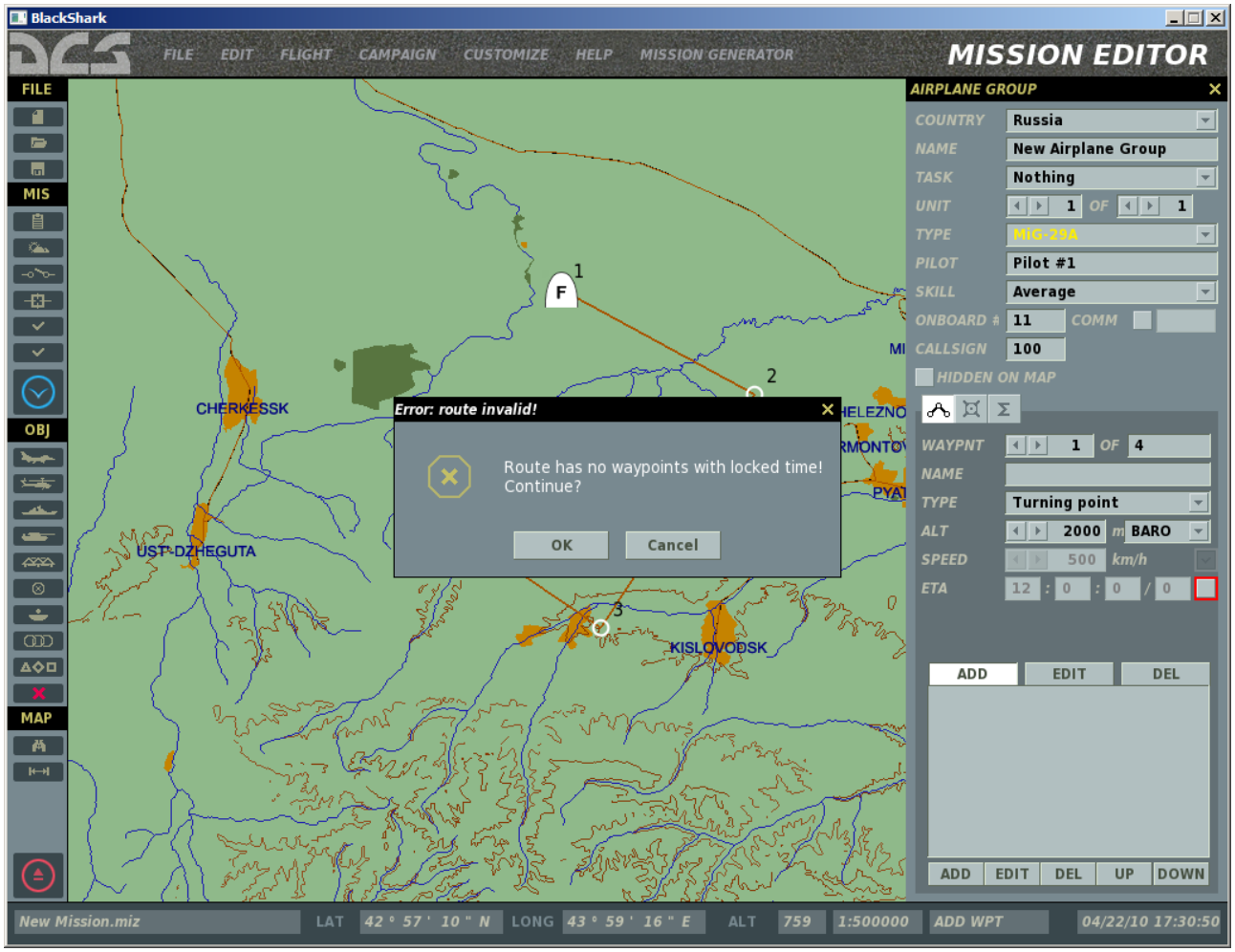
8. Time (AT / TOT).
   - Group activation time (AT) for first waypoint or assigned time on target (TOT) for other waypoints.
   - By default group activate time is mission start time.

9. Time lock (flag).
   - By default in this flag raised for first waypoint so AT locked by default.
   - If AT unlocked the group will be activated at time to arrive to nearest next waypoint with locked TOT at assigned speed of legs between.
   - If time of other waypoints (TOT) locked group will adjust it's speed to arrive to this waypoint at assigned TOT. By default TOT of a waypoint is unlocked.
   - If flag raised speed edit box becomes read-only and indicates estimated speed for this route leg.
   - If values lock flags of this waypoint or neighbor waypoint(s) cause error “Time lock” check box will be bounded by red contour.

Lock flags

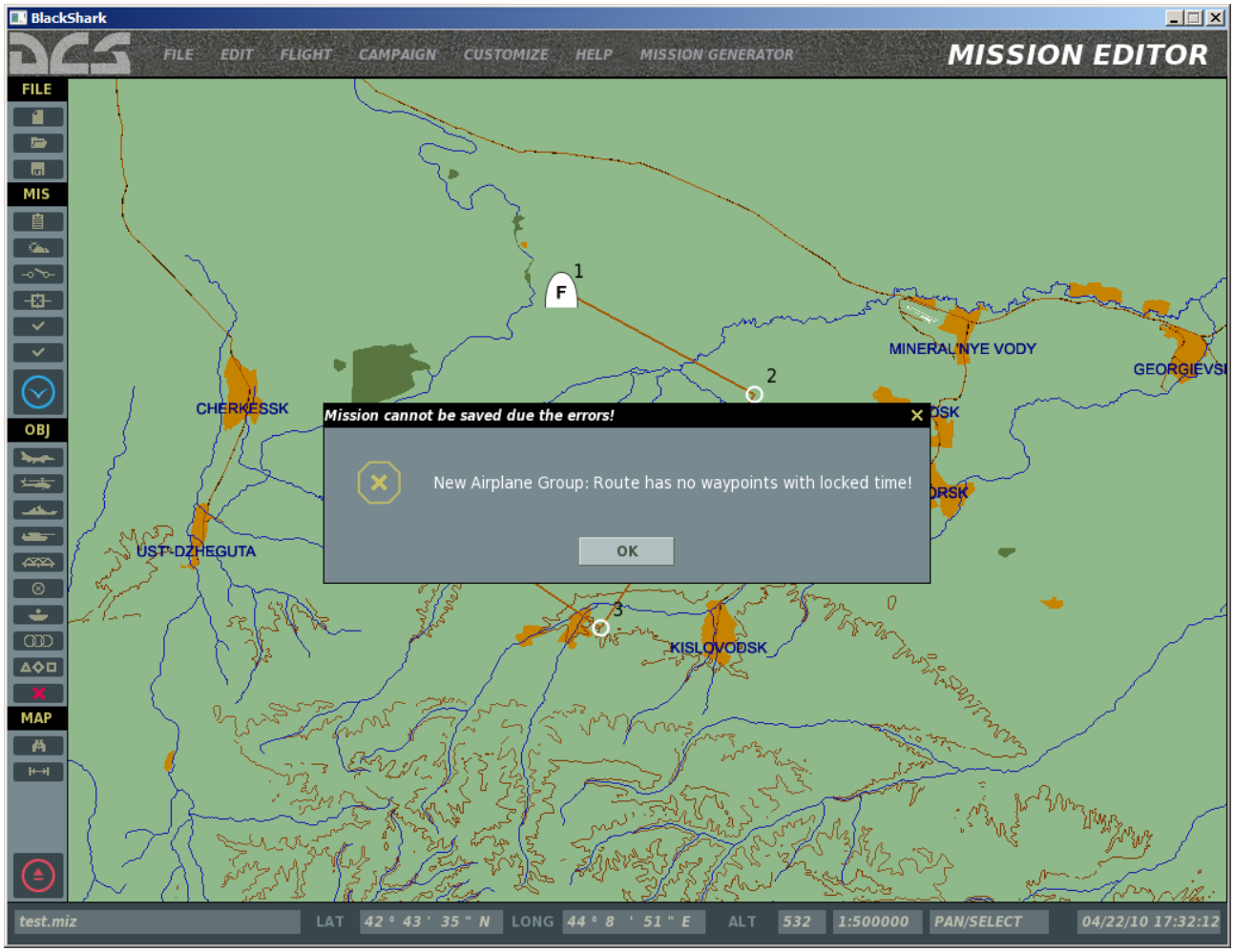
Speed and time flags of the waypoint can be changed independently, but the waypoint will be only valid if values of its lock flags conformed with lock flags values of other waypoints of route, unless error will be indicated.

Route only valid if it has at least one waypoint with locked time.
By default first waypoint has locked time. If you unlock time of all waypoints check boxes of lock flags will be bounded by red contour and you will get error message window when closing route panel.



Error: route has no waypoints with locked time.

Also you will not be able to save mission due the error.



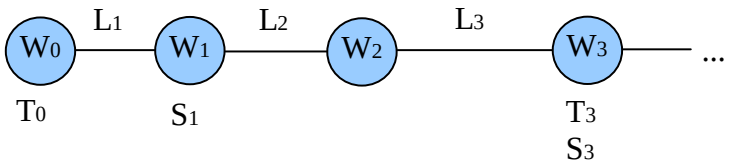
Error: mission cannot be saved because of route of New Airplane Group has no waypoints with locked time.

Waypoint with both speed and time locked only valid if the waypoint has no previous waypoints with locked time or has at least one waypoint with both unlocked time and speed between the waypoint and nearest previous waypoint with locked time.

See the picture below.

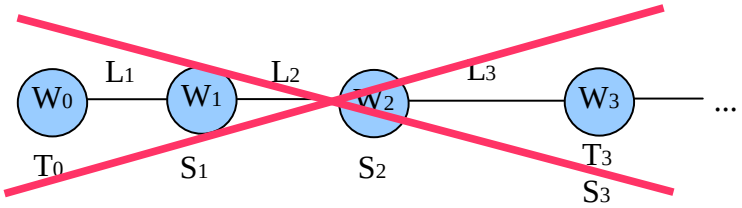
In this picture and other pictures waypoint #i represented by W_i. If waypoint #i has locked speed it represented by Si. If waypoint #i has unlocked time it represented by Ti. Route legs are numbered by number of "to" waypoint so route leg from waypoint #i-1 to waypoint #i is leg #i. Route leg #i length represented by L_i. Estimated speed on route leg #i is S_{Ei}.

Waypoint W_{i+1} has both speed and time locked and it's valid because waypoint W_2 with both unlocked speed and time located between W_3 and nearest previous waypoint with locked time W_0.

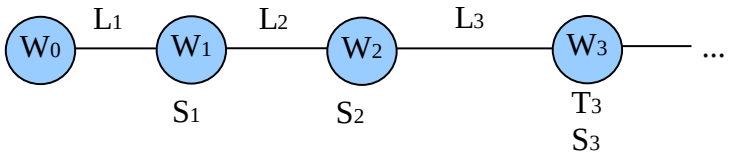


So group when flying leg 1 and 3 will keep assigned speed (S_1 and S_3), but when flying leg 2 group will adjust its speed to reach W_2 at time that make possible to reach W_3 on speed = S_3 at time T_3. The estimated speed on route leg 2 is $S_{E2} = L_2 / (T_3 – T_0 – L_1 / S_1 – L_3 / S_3)$.

If you lock speed of W_2 it causes error because legs #1 - #3 will has locked speed and this thing will be in conflict with locked time of W_3.

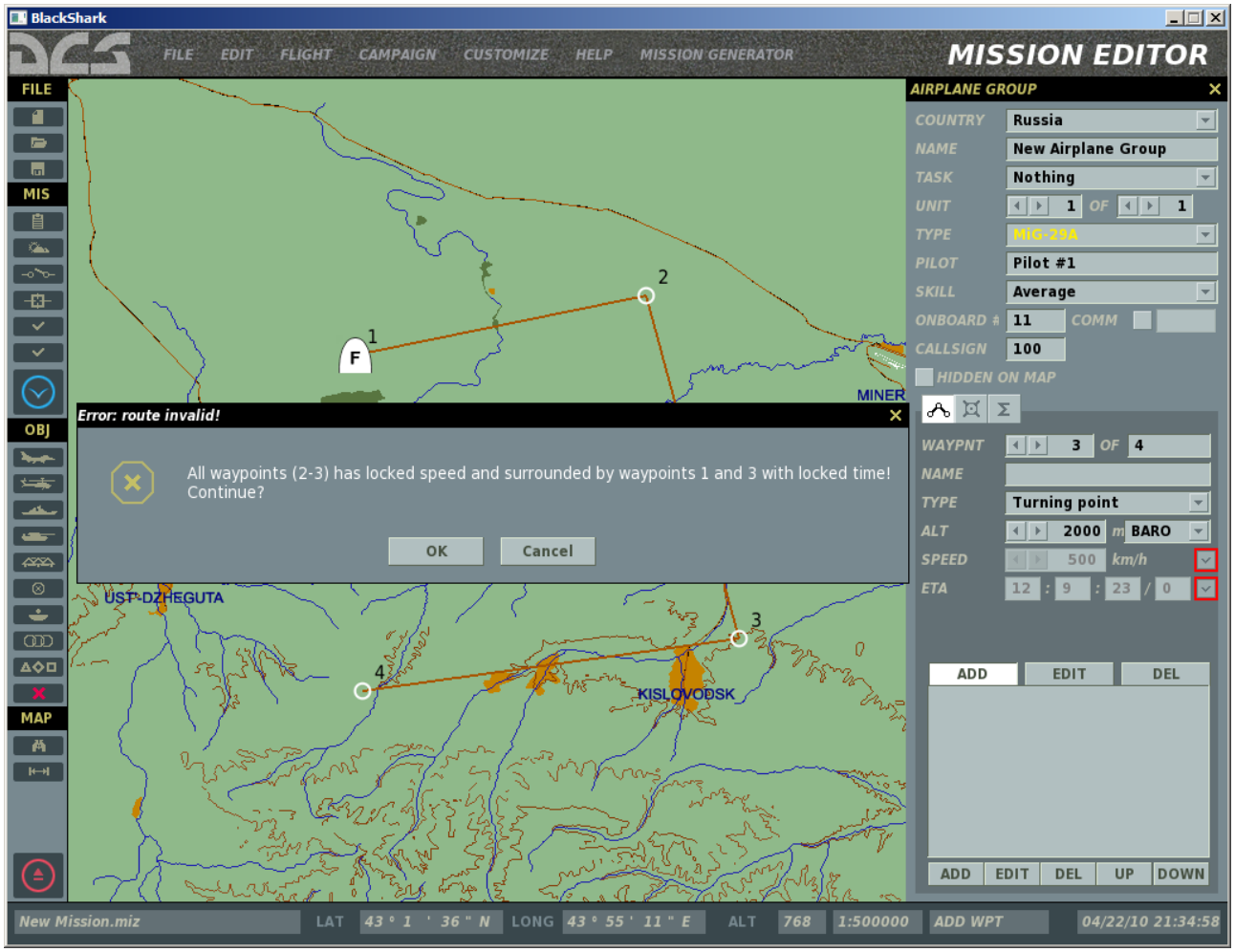


But if you unlock time of first waypoint (group activation time) route will be valid again.



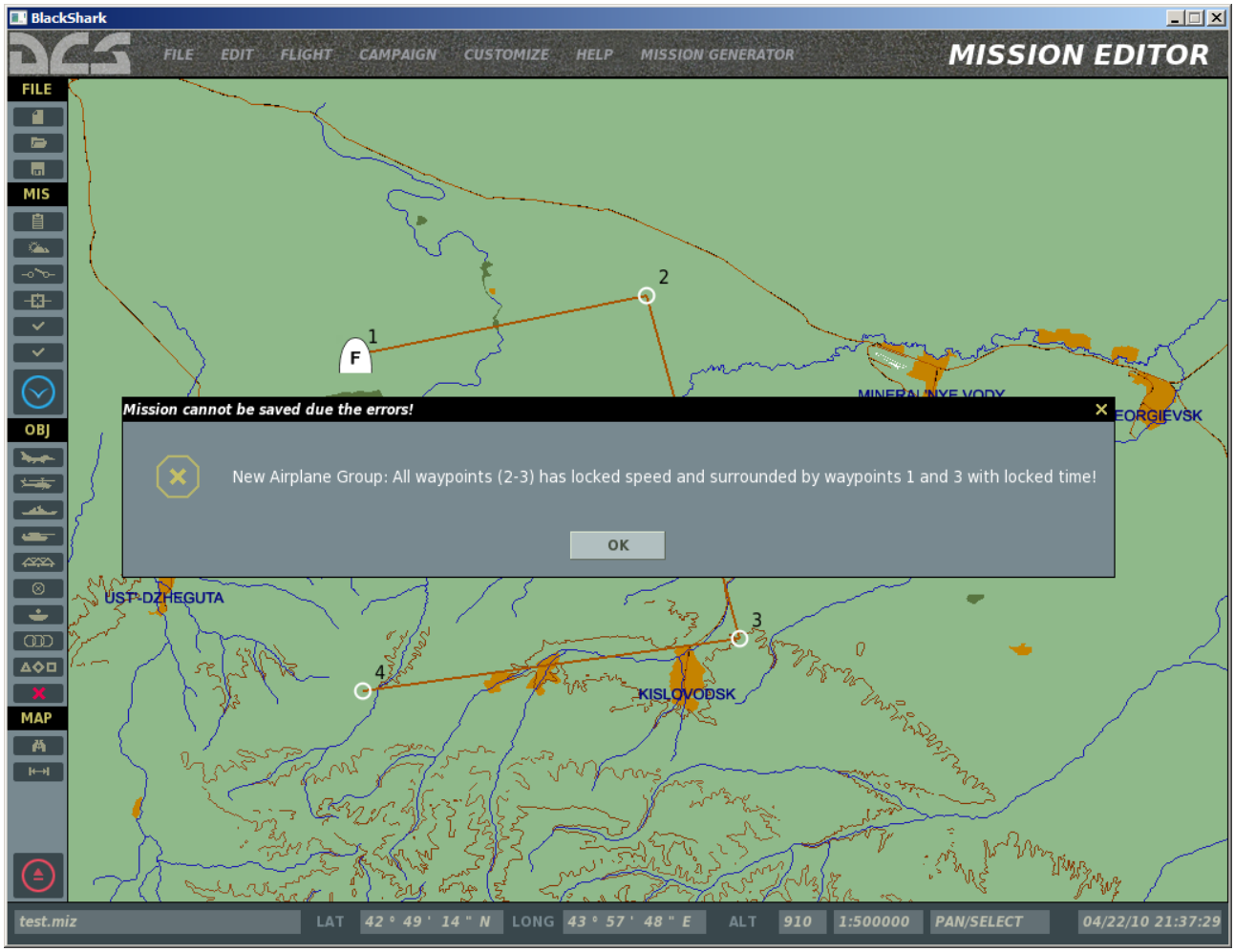
Group will be activated at time to reach W_3 at time T_3 by flying route legs 1, 2 and 3 with assigned speeds S_1, S_2 and S_3. Estimated time of activation is $T_{E0} = T_3 – L_1/S_1 – L_2/S_2 – L_3/S_3$.

If you raise both flags of the waypoint that has previous waypoint with locked time and all waypoints between has speed locked it cause error: check box of lock flags will be bounded by red contour and you will get error message on route panel closing.



Error: waypoints all with locked speed surrounded by pair waypoints with locked time.

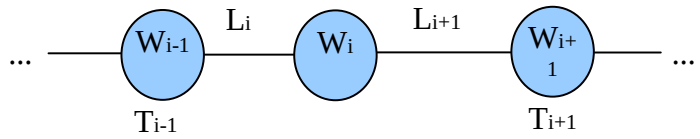
Your also will not be able to save the mission due the error.



Error: mission cannot be saved because of route of New Airplane Group has waypoints (2-3) all with locked speed surrounded by two waypoints (1 and 3) with locked time.

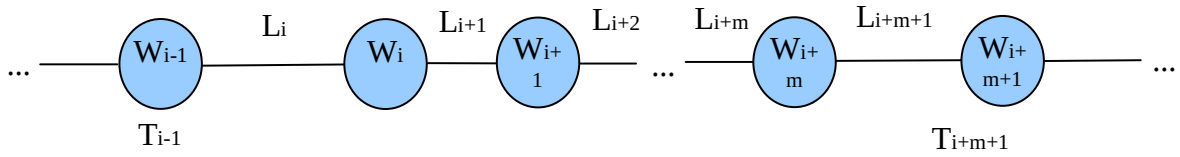
Waypoint with both speed and time unlocked only valid if at least one of next waypoints has locked time and at least one of previous waypoints has locked time.

See the picture below. Waypoint W_i with both lock flags valid because one of next waypoints has locked time (W_{i+1}) and one of previous waypoints has locked time (W_{i-1}). So when flying to waypoint with both speed and time unlocked (W_i) group will adjust its speed to arrive to nearest next waypoint with locked time (W_{i+1}) at assigned time (T_{i+1}).



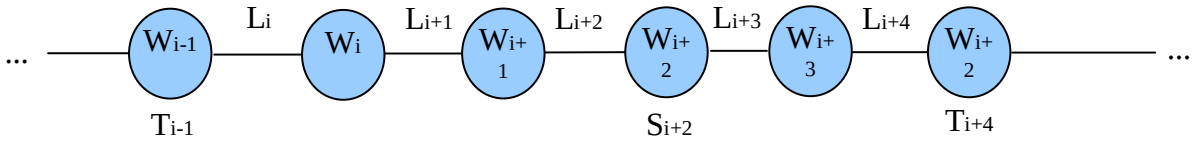
The estimated speed on route leg #i and #i+1 is $S_{Ei} = S_{Ei+1} = (L_{i+1} + L_i) / (T_{i+1} – T_{i-1})$.

There may be several (W_i, W_{i+1}, W_{i+m}) ordered one-by-one waypoints with both parameters unlocked.



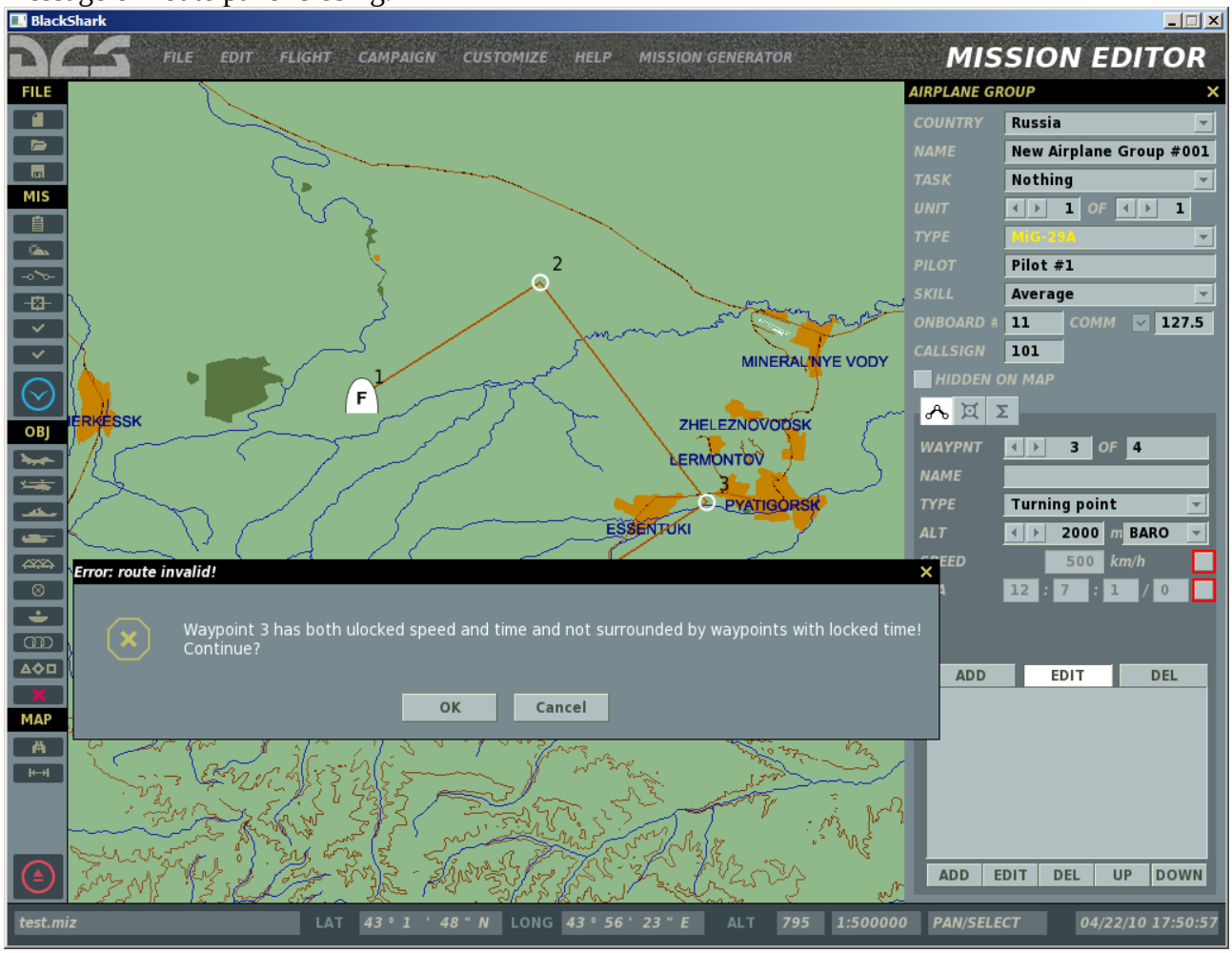
The estimated speed on route legs # i … i+m+1 is $S_{Ei}=...=S_{Ei+m+1}=(L_i+...+L_{i+m+1})/(T_{i+m+1}-T_{i-1})$.

There may be a situation when some waypoints between two waypoints with locked time (W_{i-1} and W_{i+4}) has locked speed (W_{i+2}) and some of them has both time and speed unlocked (W_i, W_{i+1}, W_{i+3}).



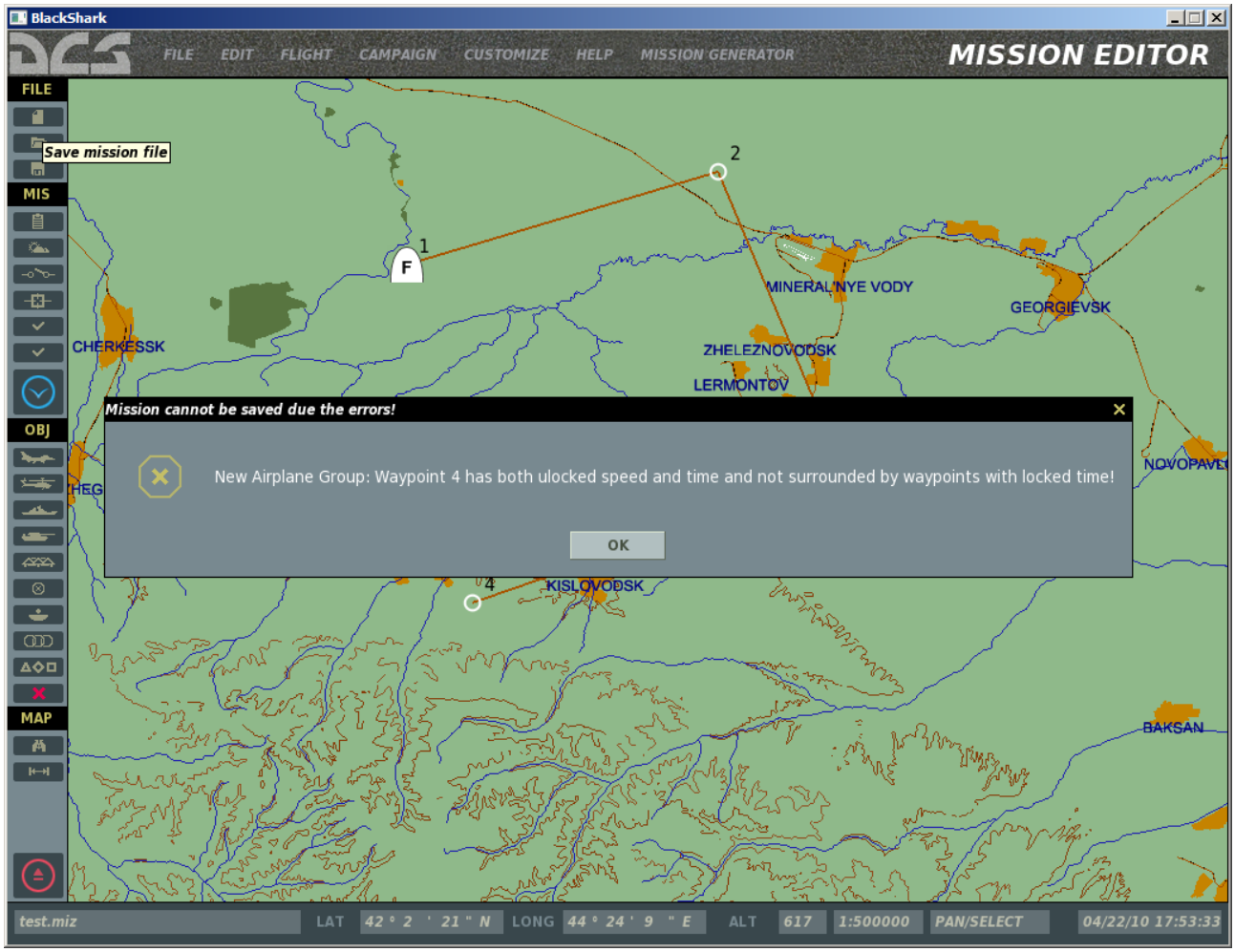
In this situation when group flying to one of these waypoints with both parameters unlocked (W_i, W_{i+1}, W_{i+3}) it will adjust its speed to arrive to nearest next waypoint with locked time (W_{i+4}) at time T_{i+4} keeping in mind that fact some route legs between requires flying with assigned speed (leg i+2 with speed S_{i+2}). The estimated speed on legs #i, #i+1, #i+3 and #i+4 is $S_{Ei}=S_{Ei+1}=S_{Ei+3}=S_{Ei+4}=(L_i+L_{i+1}+L_{i+3}+L_{i+4})/(T_{i+4}-T_{i-1}-L_{i+2}/S_{i+2})$.

If you lower both lock flags of the waypoint that has no next or has no previous waypoints with locked time check boxes of the waypoint will be bounded by red contour and you will get error message on route panel closing.



Error: waypoint 3 has both unlocked speed and time and not surrounded by waypoints with locked time.

Your also will not be able to save the mission due the error.



Error: mission cannot be saved because waypoint with unlocked speed and time not surrounded by waypoints with locked time.

Actions list

The list of actions can be associated with a waypoint of route. Group will start perform actions (tasks, commands or behavior options) of this list one-by-one once group leader passed over the waypoint.

As said before tasks (main and background tasks) requires a time to perform, but commands and behavior options changes requires no time.

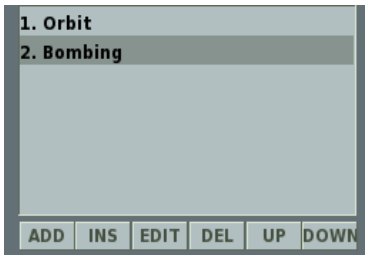
All actions always run in an order that enumerated in list by.

Once main task started group will not be able to run next action of the list until this main task finished. Only one main task can be running at same time.

Background task after start allows to run next actions because background task can be running simultaneously with several other background tasks and one main task.

As commands and options change requires no time for performing it doesn't delays next action start.

Actions handling



Buttons:

ADD.
Add action to the end of the list.
New action will be selected by cursor and item property window will be opened.

INS.
Insert action before selected item of list.
New action will be selected by cursor and action property window will be opened.

EDIT.
Edit action.
Shows and hides action property window.
Toggle button. It indicates state of action property window. It highlighted when this window is opened.

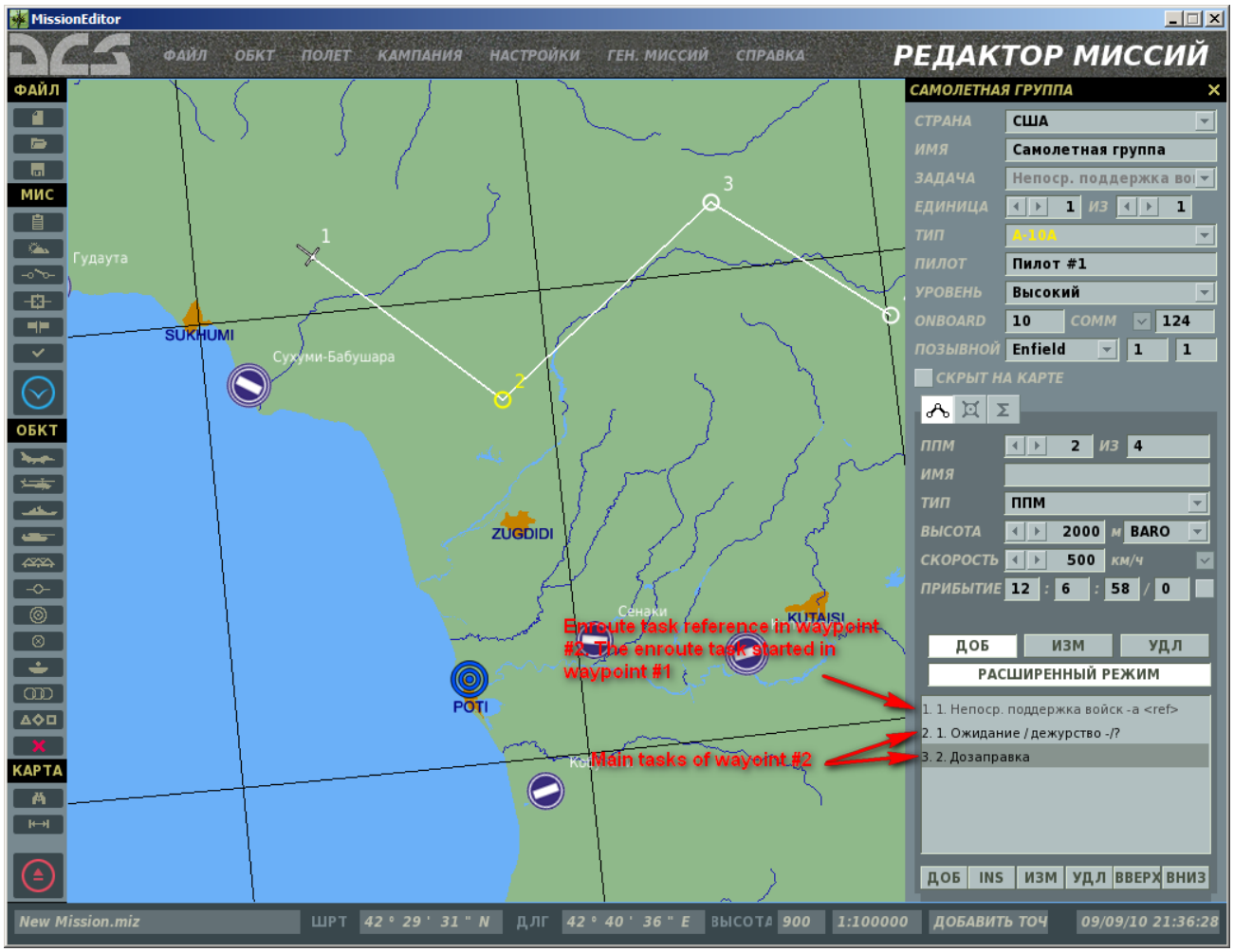
DEL.
Delete action.

UP.
Swap current and previous actions.
Cursor will stay on same action on its new position.

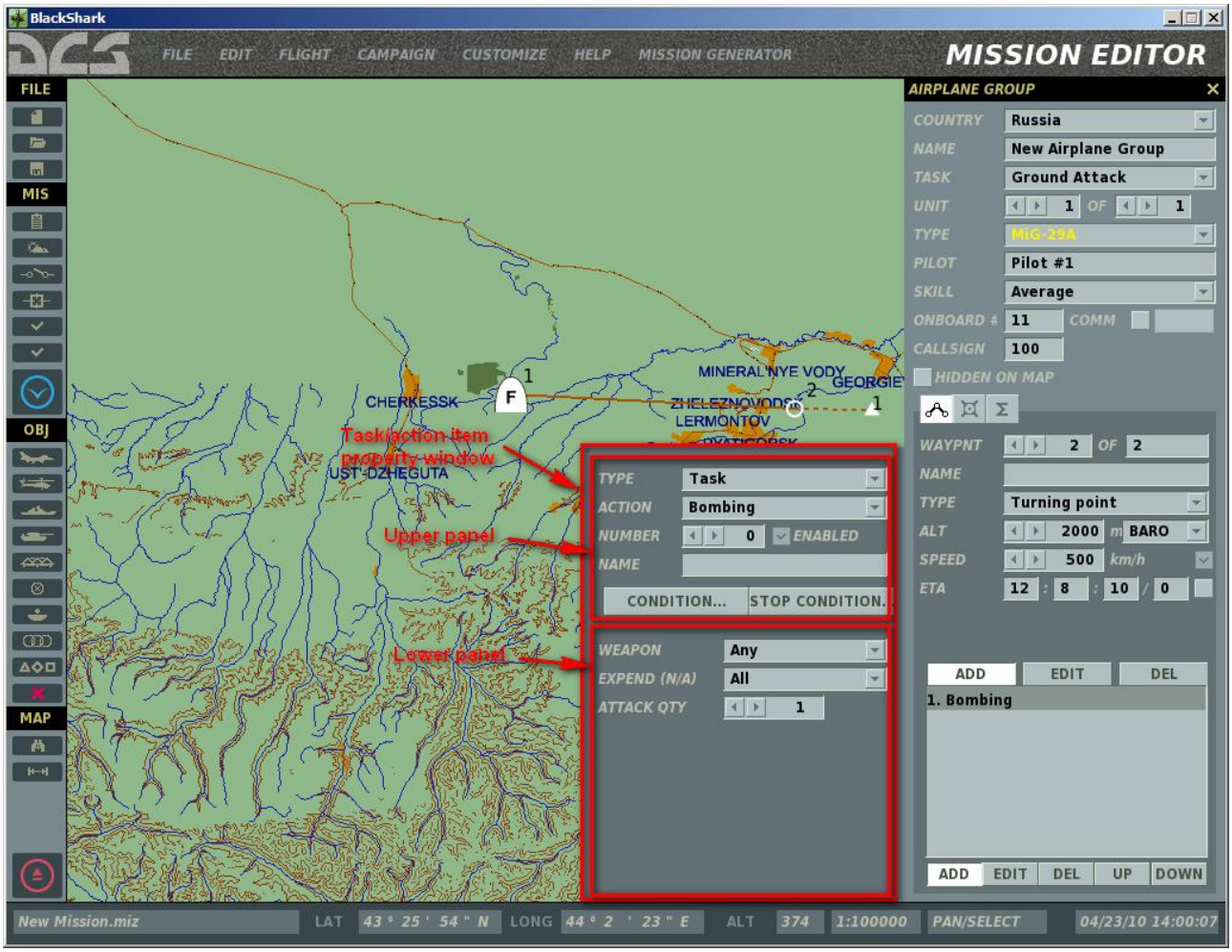
DOWN.
Swap current and next actions.
Cursor will stay on same action on its new position.

Enroute task reference

Enroute task presents not only in action lists of waypoint where it started. It presents in list of next waypoints before waypoint where it must be finished (if “Last waypoint” option set in stop conditions). In other waypoints enroute task presented as a reference while its “body” stored in the list of the waypoint where it started. Reference item marked by “<ref>” attribute. References always located on the top of actions list. You can edit and remove action reference, but you cannot move it. References helps mission designers to see what enroute tasks will be running in each waypoint of route.



Action property window



In this window you can view and edit properties of just added or existing actions of list.

To add new action and open action property window click “ADD” button to add new action at the end of list or “INS” button to add new action before selected existing action.

By default item type is “Task” and task is dummy “No Task”. To close property window click “EDIT” button. “EDIT” button also acts as an indicator of property window state. When “EDIT” button highlighted property window is opened.

To view or edit any existing action select the item in list and click “EDIT” button or make double click on this item in list. Property windows will be opened and “EDIT” button will be highlighted.

When property window is opened you can change current action by clicking on other item in list or changing value of “NUMBER” spin box in the window.

Upper panel

Used for editing of common parameters of items.

1. Type (combo box).

Type of action can be selected here. These types are:

“Perform task”, “Start Enroute Task”, “Do Command”, “Set Option”

Once action type changed Action combo box will be filled by names of actions.

2. Action (combo box).

Task or action can be selected here. Items list of Action combo box depends on selected action type (Type combo box). If action type is “Task” or “Enroute Task” items list of the combo box will be dependent also on group type (airplanes, helicopters, vehicles) and selected group task.

3. Number (spin box).
You can switch action that represented in window by this spin box.

4. Enabled (check box).
Enables and disables action. If action is disabled it stays in list in ME but it will be ignored by the group in simulator. Disabled items has “x” attributes.

5. Name (edit box).
The string just a helper.

6. Condition (button).
The button opens and closes (start) condition window.
Conditions can be set for action of any type. Conditions determine in what cases this action must be performed by controller. If there is the time to run the action (task or action) but conditions are violated controller will not run this action and switch to next action
The button opens and closes condition window.

7. Stop condition (button).
Available only for tasks.
The button opens and closes stop condition window.
Task will be finished when stop conditions applied.

Lower panel.

Used for editing of specific parameters of items.

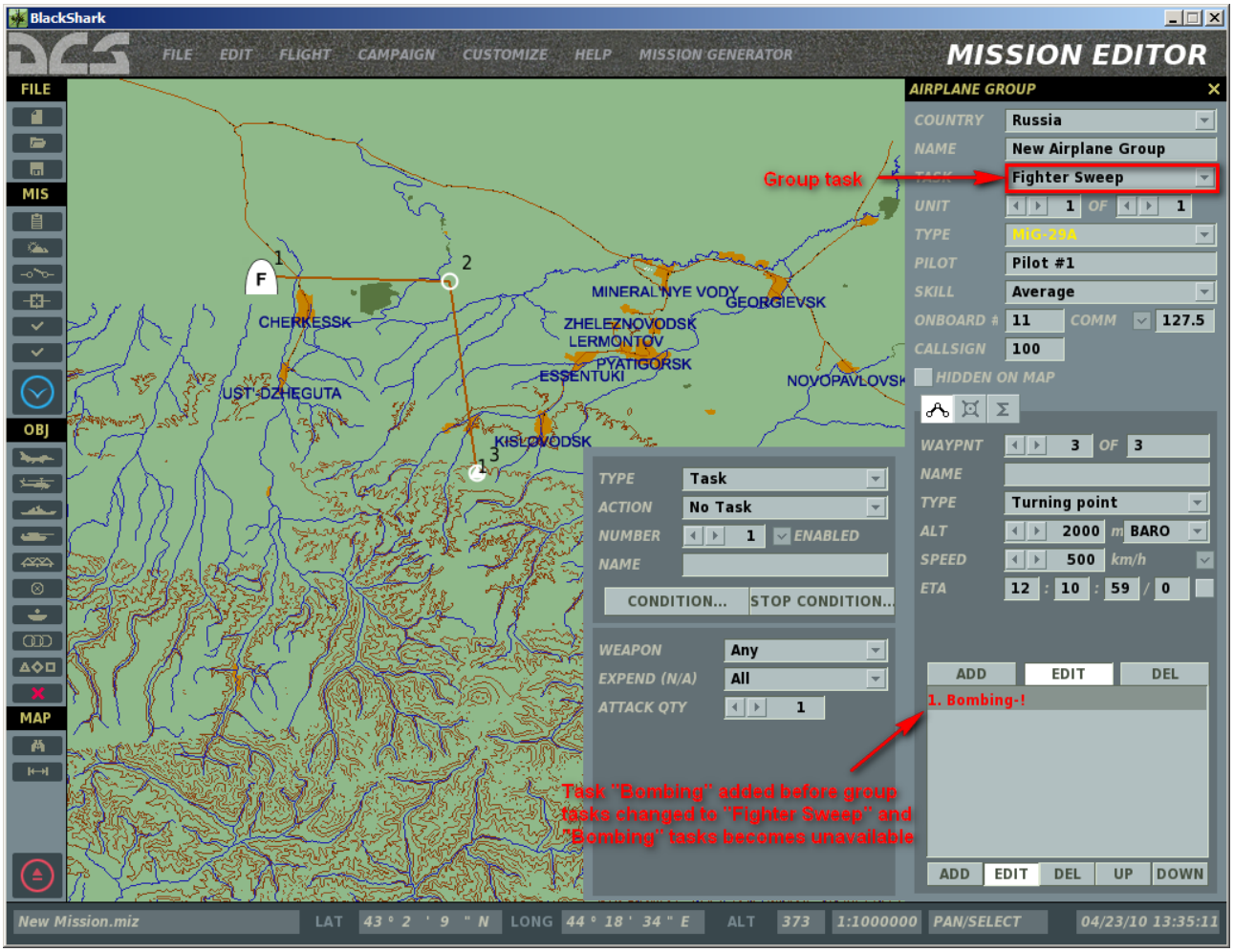
Tasks

Group task

Group task is the constant attribute of group that determines group role in mission. Group task has no effect on group behavior directly, it is just a filter of available tasks in those can be assigned to group.

List of available tasks depended on group type (airplanes, helicopters, vehicles, ships) and selected group task. There are also may be limitations on task parameter values those depended on group task.

If you added some tasks into group mission and then change group tasks to value that makes these tasks unavailable or makes parameters of these tasks violate limitations of new group task it will cause error: tasks will be indicated by red font and attribute “!” will appear.



You will get error message on panel closing and you will not be able to save the mission due the error.

Automatic tasks

To make mission design process faster automatic tasks was added. Several group tasks associated with automatic tasks. Each time mission designer add new group or change group task of existing group automatic task will be added or changed automatically. This eliminates unnecessary operations of adding tasks in list if simple behavior required from group. These next enroute tasks

can be used as an automatic tasks for group task with same name: “AWACS”, “Tanker”, “CAP”, “Fighter Sweep”, “CAS”, “SEAD”, “Anti-Ship”. All these tasks are enroute tasks. Tasks “CAP”, “Fighter Sweep”, “CAS”, “SEAD”, “Anti-Ship” in fact just a wrapped “Engage Targets” with locked parameters (selected target types). Automatic tasks can be deleted, moved or changed, but cannot be edited. Automatic task has “-a” attribute in actions list.

However same tasks can be added into list manually as usual non-automatic tasks. In this case these tasks will not be changed automatically on group task change. Mission designer should delete or change it manually.

Action type “Perform Task”.

Performs a main task.

1. **No Task**.

Dummy task.
The group will do nothing. Tasks will finish itself just started.
Group types: all.
Group tasks: all.

2. **Attack Group**.

Attack of assigned air, ground or naval group.
Group types: airplanes, helicopters.
Group tasks and limitations:
SEAD, CAS, AFAC – only ground group can be assigned as target,
Antiship – only ships group,
Interception — only aircraft group.
Assigned enemy group will be attacked even if it not been detected! Other words the group always knows about where it its target.
Group as target for attack can be selected in “GROUP” combo box or by clicking on any enemy group on map. While task property window is opened all left mouse button click on map will be interpreted ME as target selection attemption. When target selected it will be connected with waypoint by dashed line.
You can select weapon for attack in “WEAPON” combo box. Only weapon of this type will be used. If group will be out of required weapon it will not attack this target group.

3. **Attack Unit**.

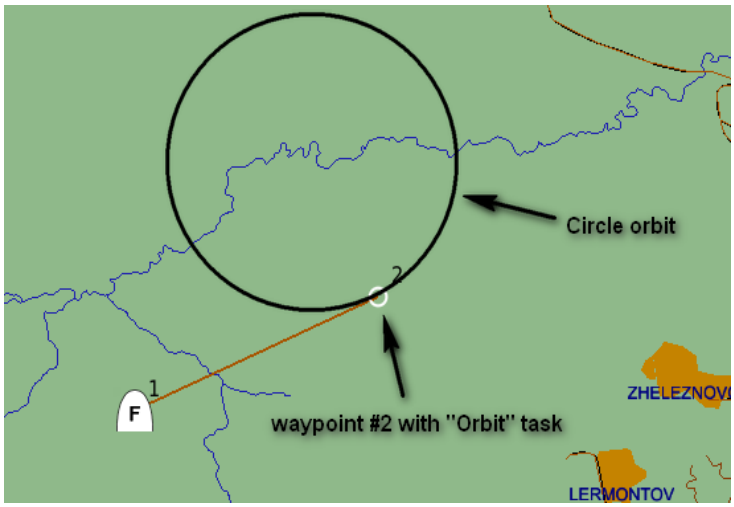
Attack of assigned air, ground or naval unit.
Group types: airplanes, helicopters.
Group tasks and limitations:
SEAD, CAS, AFAC – only ground unit can be assigned as target,
Antiship – only naval unit,
Interception — only aircraft.
Assigned enemy unit will be attacked even if it not been detected. Other words group knows about where its target.
Unit of any group as target for attack can be selected in “GROUP” and “UNIT” combo boxes or by clicking on any enemy unit on map. Static object can be selected in “STATIC” combo box or by clicking on any static object on map. While task property window is opened all left mouse button click on map will be interpreted ME as unit or static selection attemption. When target selected it will be connected with waypoint by dashed line.
You can select weapon for attack in “WEAPON” combo box. Only weapon of this type will be used. If group will be out of required weapon it will not attack this target group.

4. **Attack Map Object**.
Attack of any map object such as bridge, building any other structure.
Group types: airplanes, helicopters.
Group tasks: Pinpoint Strike, Ground Attack, Runway Attack.
Because map object are not presented in ME map as object there is only way to select it is select nearest point to object you want group to attack. You can select this point by clicking on map. While task property window is opened all left mouse button click on map will be interpreted ME as point selection attemption. When point selected it will be connected with waypoint by dashed line.
Group will attack nearest to this point map object.
You can select weapon for attack in “WEAPON” combo box.

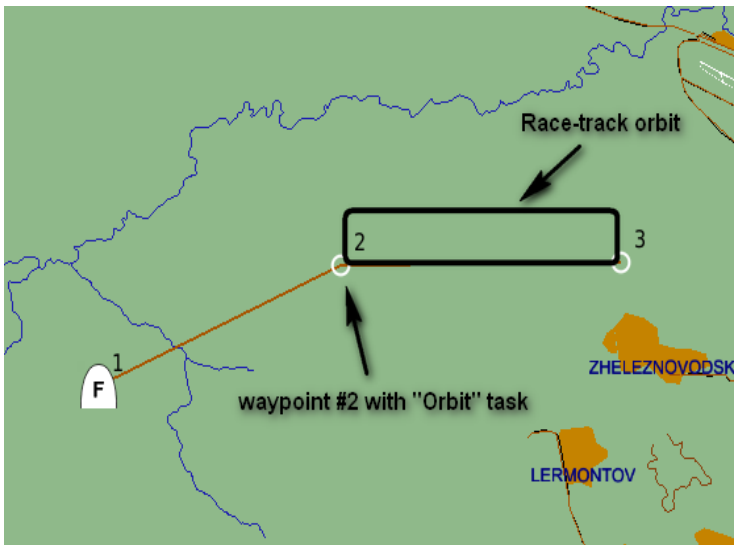
5. **Bombing**.
Delivering air-to-ground weapon to the point on ground.
Group types: airplanes, helicopters.
Group tasks: Pinpoint Strike, Ground Attack, Runway Attack.
You can select this point by clicking on map. While task property window is opened all left mouse button click on map will be interpreted ME as point selection attemption. When point selected it will be connected with waypoint by dashed line.
You can select weapon for attack in “WEAPON” combo box.
«EXPEND” combo box there to select how many ordnance must be delivered on point. Not implemented yet.

6. **Bombing runway**.
Attacking assigned airdrome.
Group types: airplanes, helicopters.
Group task - Runway Attack.
Airdrome can be selected both in “RUNWAY” combo box and by moving target mark around the map. While task property window is opened you can move the target mark from airdrome to airdrome to select it. Selected airdrome connected with waypoint by dashed line.
You can select weapon for attack in “WEAPON” combo box.

7. **Orbit**.
Flying circle or race-track orbit at altitude of the waypoint and maintaining speed 432 km/h.
Group types: airplanes, helicopters.



Group tasks - all.
When flying circle orbit group will just keep -23 degrees roll and stay in left turn.



So race-track orbit can be selected only if waypoint is not last waypoint.
You should define stop conditions for this task unless group will only stop flying orbit when it will be in bingo fuel state to RTB.

You can use this task to order group stop following route and start waiting for defined time on station or for some events those will be a triggers for resuming route. To do this set necessary parameters in "**Stop condition**" panel.

Orbit task also useful for creation of combat patrol missions. If you want group patrol in region and engage detected incoming targets just add combat background task(s) before "**Orbit**" main task.

8. **Land**.
Landing at assigned point on a field.
Group type – helicopters.
Group tasks – all.
Not implemented yet.
Mission designer must assign point to land. This point is represented by yellow moving triangle connected with the waypoint on the map. To order helicopters takeoff and continue flight mission designer must define stop condition.

9. **Refueling**.
Refueling from tanker.
Group type – airplanes.
Group tasks – all.
Refueling from nearest tanker. Not implemented yet.

10. **FAC - Attack Group**.
Control of attacking the enemy group by friendly attack aircraft(s).
Group type – all.
Group tasks – AFAC (in case of aircraft group).
Group will acts as FAC and when player arrived into region and established communication with FAC FAC will order him to attack assigned enemy group and will provide terminal attack control.
FAC will not order player attack other enemy groups.
FAC always knows about the target group and knows where it located.
Group for attack can be selected same way In "Attack Group" task.
You can also select weapon that FAC will order player to use in attack.

Action type “Start enroute Task”

Starts a enroute / background task.

1. Engage targets.

Engaging detected targets of specified types around route.
Group type – airplanes, helicopters.
Target types can be selected in hierarchical check box list with items. There is the limitation of available target types in this list dependent on group task.

1. SEAD.
Air Defence
    AAA
    SAM
        SR SAM
        MR SAM
        LR SAM
2. Antiship.
Naval
    Ships
3. CAS and AFAC.
Ground units
    Infantry
    Fortifications
        Vehicles
        Armour
            Tanks
            IFV
            APC
        Artillery
        Unarmed
4. CAP and Fighter Sweep.
Air
    Airplanes
    Fighters
        Bombers
        Helicopters

With “MAX DISTANCE FROM ROUTE LEG” check box and edit box pair you can limit distance from target to route legs. All targets those distance from route legs greater than that value will not be attacked.
Task priority can be set in “PRIORITY” spin box. Greater value – higher priority.
This task useful for creation of combat patrol missions. Just add this task to list before “**Orbit**” task and.

2. **Engage targets in zone**.

The same task “Engage targets” with the only difference that group will engage targets in specified circle-shaped target zone.
Group type – airplanes, helicopters.
Group tasks and limitations – the same “**Engage targets**” group tasks and limitations with exception of this task unavailable for “CAP” and “Fighter Sweep” group tasks. Target zone has a text caption that consists of item number, task type name and task given name. Target zone can be moved around the map by dragging its center (yellow triangle). Target zone connected with

waypoint by dashed line.
Radius of target zone can be set in “ZONE RADIUS” edit box.
Task priority can be set in “PRIORITY” spin box. Greater value – higher priority.
This task useful for creation of combat patrol missions. Just add this task to list before “Orbit” task and.

2. **Engage Group**.

The same task “Attack Group” but the only difference is the target group will be attacked only after it will be detected.
Task priority can be set in “PRIORITY” spin box. Greater value – higher priority.
This task useful for creation of combat patrol missions. Just add this task to list before “**Orbit**” task and.

3. **Engage Unit**.

The same task “Attack Unit” but the only difference is the target unit or static will be attacked only after it will be detected.
Task priority can be set in “PRIORITY” spin box. Greater value – higher priority.
This task useful for creation of combat patrol missions. Just add this task to list before “**Orbit**” task and.

4. **Tanker**.

Aircraft will play a tanker role.
Group type – airplanes.
Group tasks – Refueling.
Aircraft will refuel other flights.
Once Refueling group task selected Tanker background task added automatically to first position of list of first waypoint to start on group activation. This automatic task cannot be removed, edited or moved.

5. **AWACS**.

Aircraft will play an AWACS role.
Group type – airplanes.
Group tasks – AWACS.
Aircraft will perform radar searching of airborne targets and sharing this information among friendly units those may include player.
Once AWACS group task selected AWACS background task added automatically to first position of list of first waypoint to start on group activation. This automatic task cannot be removed, changed or moved.

6. **FAC**.

Forward air controller.
Group type – all.
Group tasks – AFAC (for aircrafts).
The group will act as FAC. The group will select most important or dangerous targets in battlefield and assign it to player's flight for attack and will provide terminal attack control. **There are no limitations on targets those FAC will order player's flight to attack.**

7. **FAC - Engage Group**.

The same “FAC - Attack Group” task, but in this task FAC don't know about the target group and where it located. FAC must detect this group during mission.
Task priority can be set in “PRIORITY” spin box. Greater value – higher priority.

8. **CAP**.
The task just a “Engage Target” with “Aircrafts” selected as a target type . Priority set to 0. The parameters of the task are non-editable. Used as an automatic action for “CAP” group task.

9. **Fighter Sweep**.
The task just a “Engage Target” with “Fighters” selected as a target type . Priority set to 0. The parameters of the task are non-editable. Used as an automatic action for “Fighter Sweep” group task.

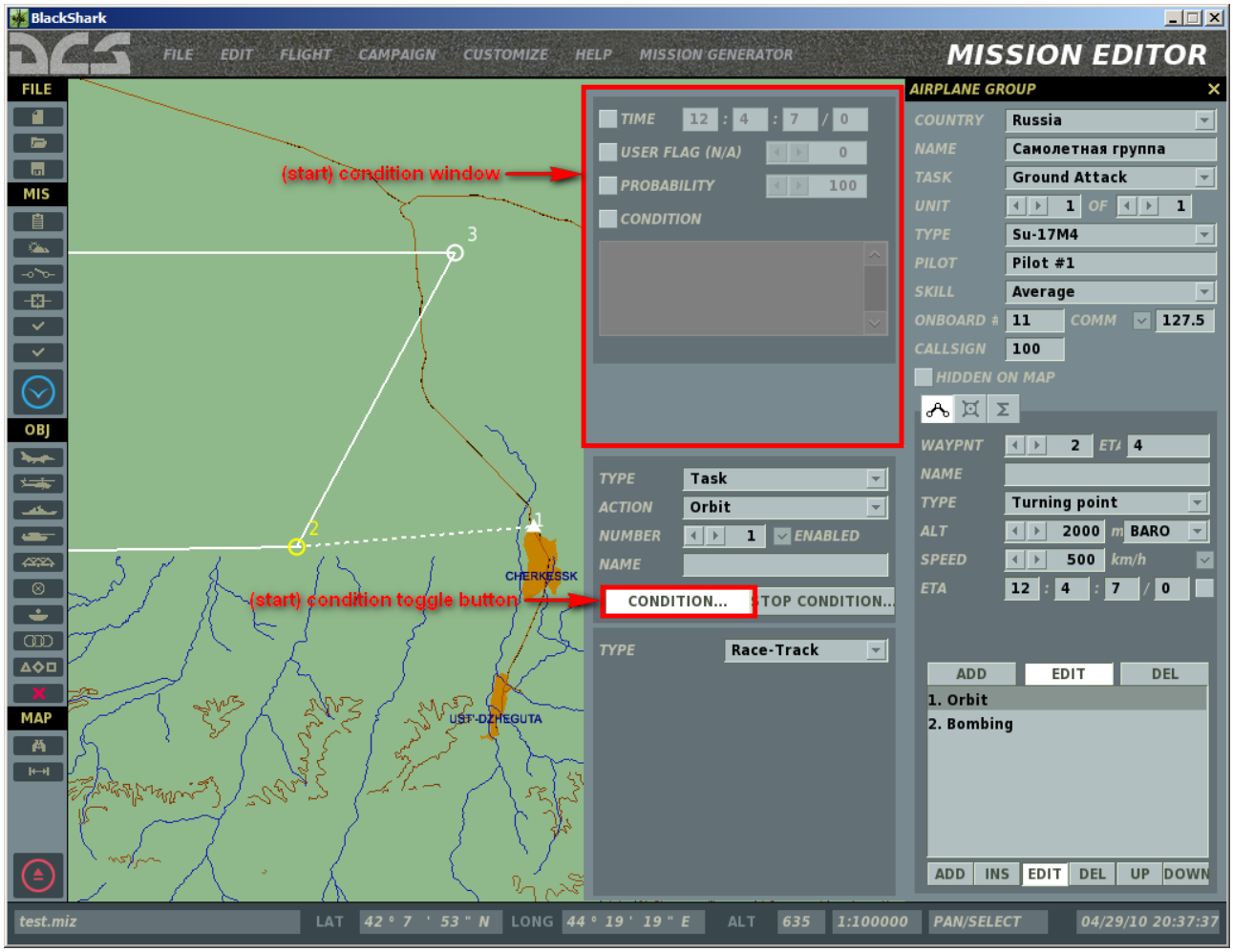
10. **CAS**.
The task just a “Engage Target” with “Ground Units” selected as a target type . Priority set to 0. The parameters of the task are non-editable. Used as an automatic action for “CAS” group task.

11. **SEAD**.
The task just a “Engage Target” with “Air Defence” selected as a target type . Priority set to 0. The parameters of the task are non-editable. Used as an automatic action for “SEAD” group task.

12. **Anti-Ship**.
The task just a “Engage Target” with “Naval” selected as a target type . Priority set to 0. The parameters of the task are non-editable. Used as an automatic action for “Anti-Ship” group task.

Conditions

(Start) condition window.



Available for actions of any type.

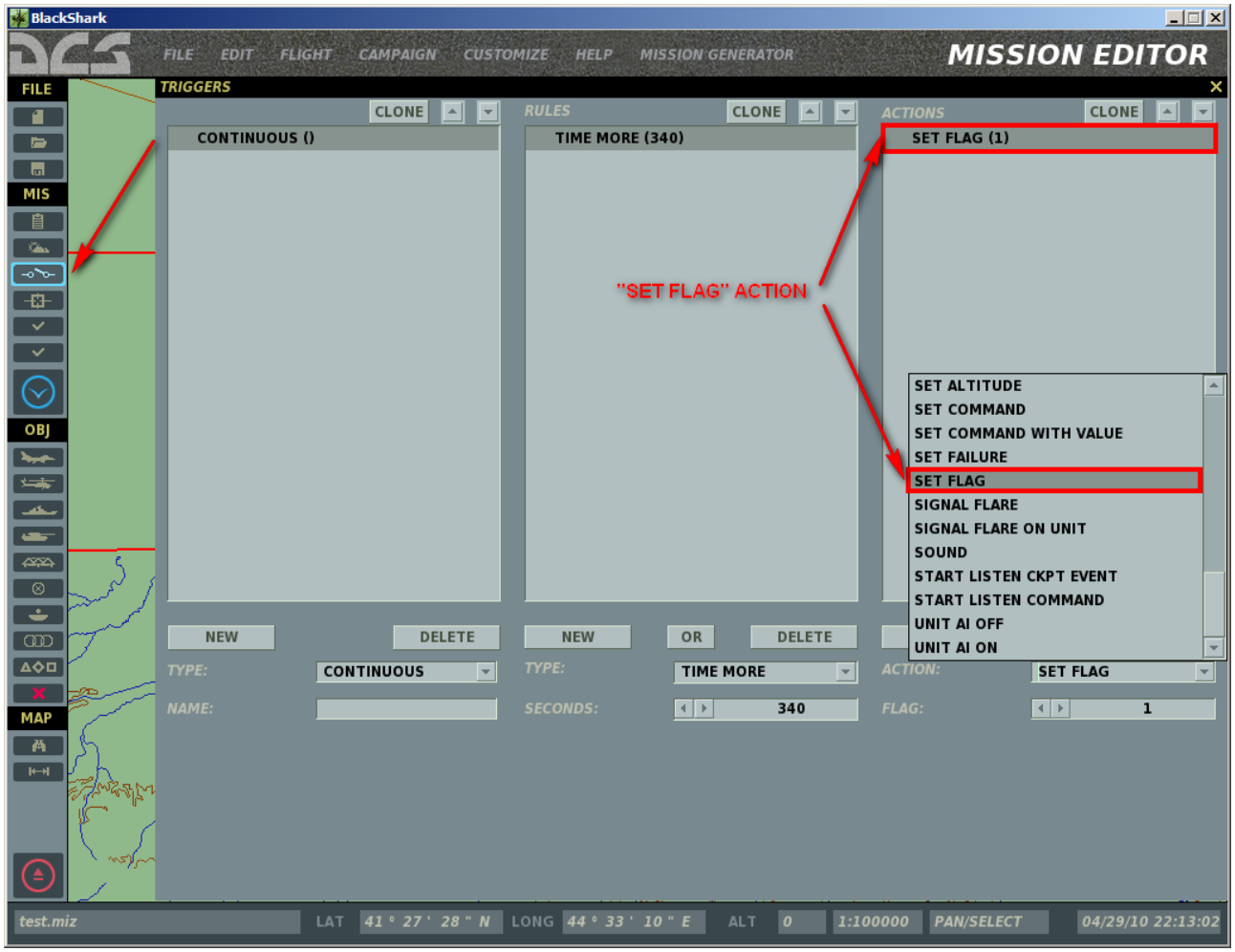
Conditions for action start-up can be set here. There are 4 condition options presented here. Each option can be enabled and disabled by its check box.

1. Time.

The earliest allowed time of action start-up. Action only will started when current time greater than this time.

2. User flag.

User flag number can be set in spin box. User flags can be raised or lowered by triggers. Triggers can be edited in trigger rule window. If this user flag is raised item the action will started and it will skipped otherwise.



3. Probability.

Probability of action start. Random value has evenly distribution.

4. Condition.

There is the memo edit box for lua expression. This expression will be inserted into lua function

function <generated_name>()

return <lua code>

end,

which will being called periodically and its return value will be used as the action start-up condition. You can implement as sophisticated logic as you want here.

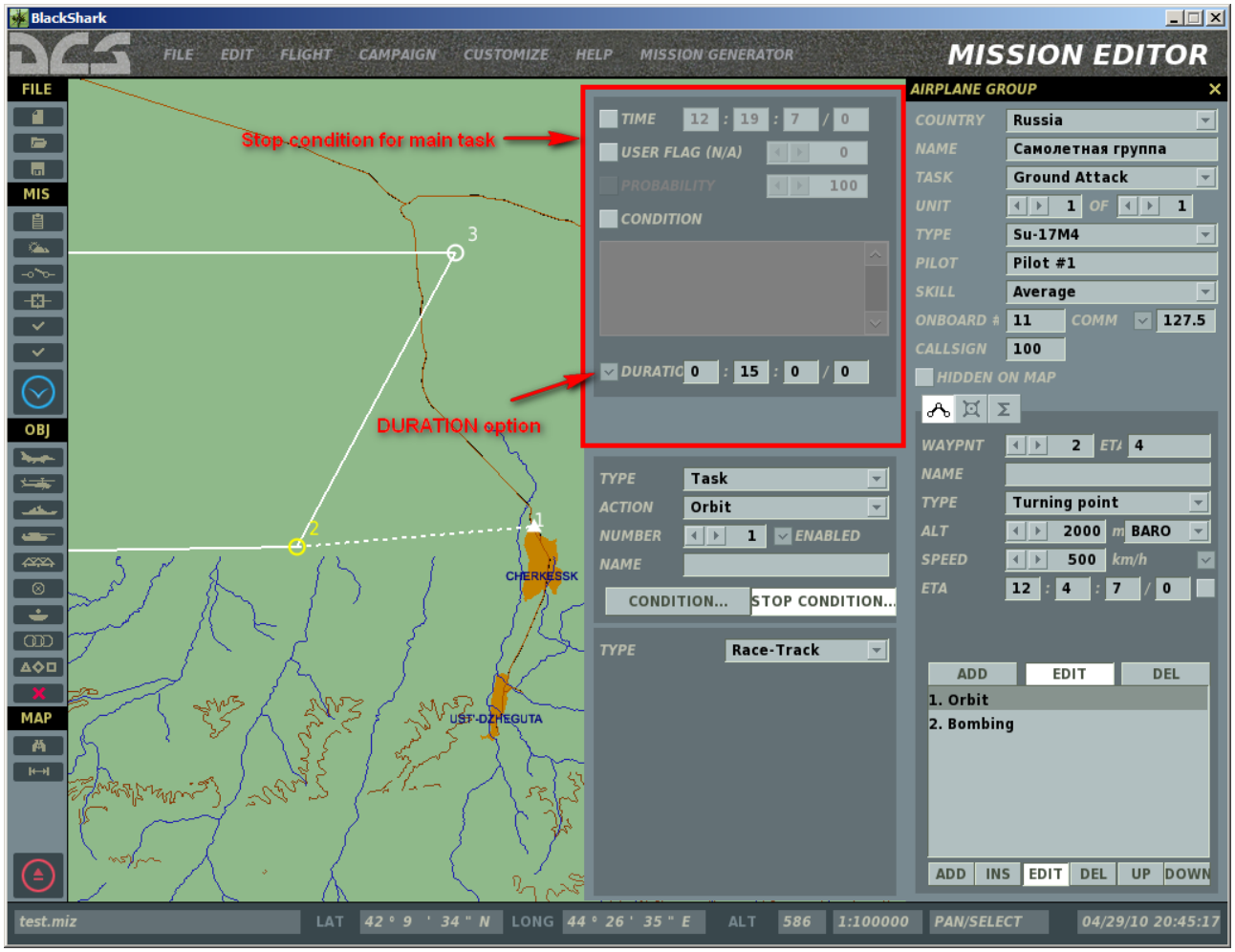
Action will be started if at least one enabled condition option gives positive result or if there are no enabled options here. Other words condition options are logic operands and logic operator is “OR”.

Stop condition window.

Available only if item has “Task” or “Background task” type.

You can set conditions for task abortion here. Main task can be aborted by stop conditions before it will terminate itself (when task performed). Background task termination can be triggered only by stop conditions (background task cannot terminate itself by definition).

For “Task” item type (main task) there are 4 options available.



1. Time.

The task performing deadline. If current time greater than the time task will be aborted.

2. User flag.

Once flag will be raised by trigger the task will aborted.

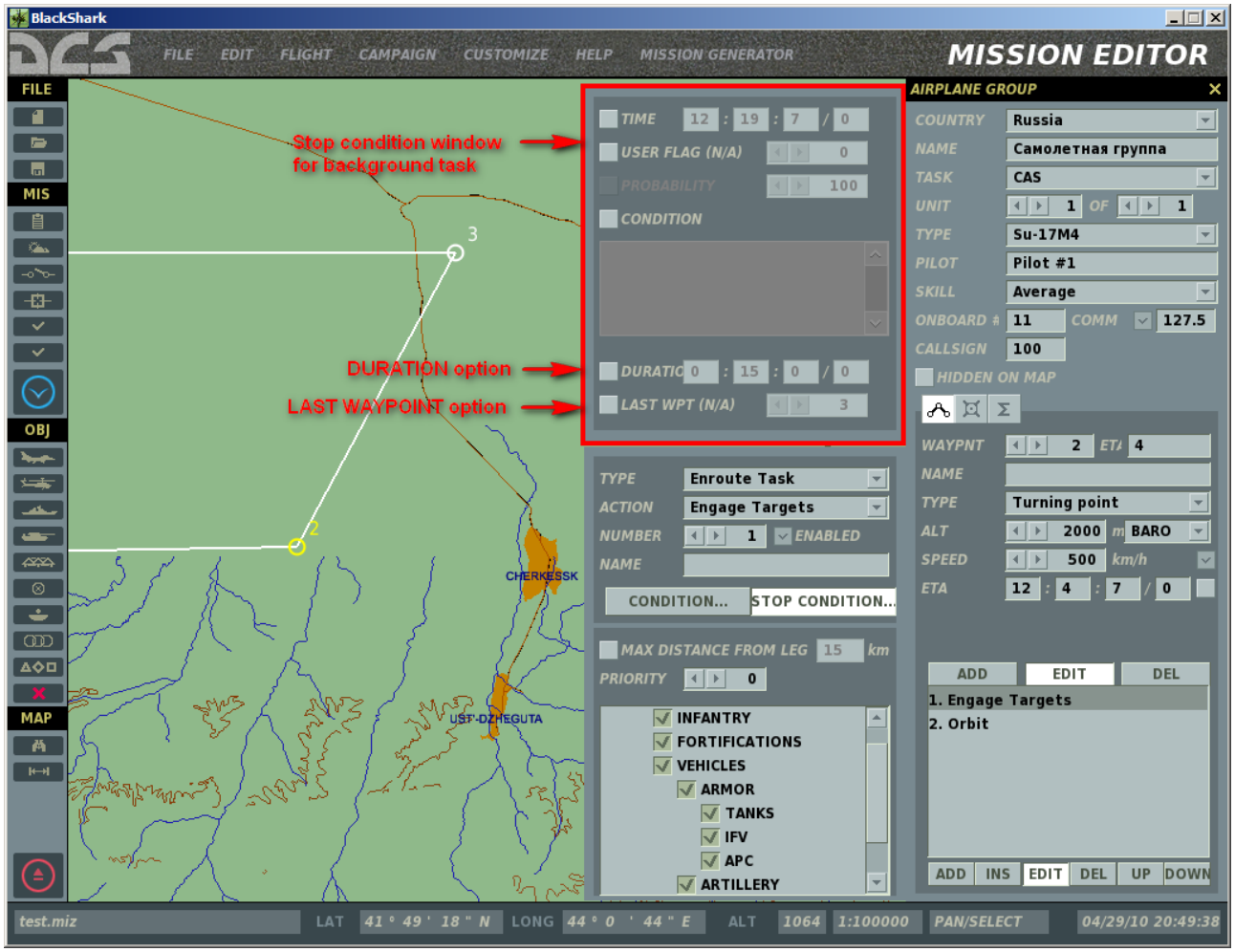
3. Condition.

The lua code that wrapped into function which have being called periodically and when it will return true the task will be aborted.

4. Duration.

The limit on maximal duration of task performing. When the time since task start will be greater than duration task will be aborted.
You can use this option to define time on station for “Orbit” task or to limit staying over target of attack aircrafts.

For “Background Task” item type (background task) there are 5 options available.



1. Time.
2. User flag.
3. Condition.
4. Duration.
5. Last waypoint.

Determines waypoint on flying to which background task still active. Once group passed the waypoint the background task will be terminated.
You can use this option to define on which segment of route the group will perform background tasks like engaging detected targets around route legs.

Action type “Do command”

Performs command.

1. **No Action**.

The dummy command. This is the default command.
Group will do nothing.

2. **Script**.

This is just a lua code running.
You can edit lua code in memo edit box. “**Script**” command allows mission designers make as sophisticated command as they want.

3. **Set Callsign**.

Changing callsign of group. If group consists of two or more aircrafts only common part of their callsigns can be changed. For example, you have pair of A-10 with callsigns Hawg21 and Hawg22. You can change Hawg2 flight callsign to Boar4.

4. **Set Frequency**.

Changing frequency and modulation of radio communicators of all units in the group. Frequency units is MHz and there are two type of modulation available: FM and AM.

5. **Switch waypoint**.

Changing “from” and/or “to” waypoint.
The group will follow from “from” to “to” waypoint even if “to” and “from” waypoints are not neighbor waypoints. Number of “from” waypoint will be a new value of current waypoint.
By default “from” waypoint is current waypoint and “to” waypoint is next waypoint (if current waypoint is not last) or first waypoint of route (if current waypoint is last). By clicking “CURRENT” toggle button you can set “from” waypoint to current waypoint.
Once “from” waypoint changed by “**Switch Waypoint**” command the running main task (that is the item of actions list of old current waypoint) will be aborted and group will start running actions of new current waypoint list of actions.
This action helpful for creation of looped route. “Switch waypoint” command may have a conditions for ending loop.

6. **Switch Item**.

Switching to another action of the list of current waypoint.
You can select action to switch in “Action” combo box. There are all actions, but not current enlisted there.
Once current action switched by “**Switch Item**” command running main task will be aborted.
You can use this action to create structures such a conditional branching or cycles within actions list.

7. **Invisible**.

This is the way to make group invisible for enemy AI units. Option has flag “ENABLE” as a single parameter. You can set any group invisible or visible again.

8. **Immortal.**

To make all units in group immortal use this action. Enemies will see the units and engage them but with no effect. Option has flag “ENABLE” as a single parameter. This action works same way “Invisible” action works.

Action type "Set Option"

Changes behavior option.

1. **ROE**.
Rules of Engagement.
Determines in what conditions group must engage enemies. There are 5 values:
"OPEN FIRE". The group will engage all enemies it can engage.
"OPEN FIRE. FIRE AT WILL". Group will engage all enemies it can engage, but enemies those must be attacked by mission (targets those specified in active tasks) will be attacked first.
"OPEN FIRE". The group will engage only targets those specified in its active tasks.
"RETURN FIRE". The group will only engage threats for itself.
"HOLD FIRE". The group will not attack enemies.
The default value is "OPEN FIRE".

2. **REACTION ON THREAT**.
Determines what group should to do when faced a threat.
"NO REACTION". The group will not evade and use countermeasures.
"PASSIVE DEFENCE". The group will use countermeasures.
"EVADE FIRE". The aircrafts of the group will perform evasive maneuvers to evade attacking enemy aircraft or missile.
"BYPASS AND ESACPE". The group will bypass enemy SAM or fly at safe height (fly low to be safe from LR and SR SAM or high to be safe from LR SAM) and escape from enemy fighters under protection of friendly SAM or fighters. Not implemented yet.
The option regulates only defensive actions. If attacked aircraft decide to attack its threat **TREAT REACTION** option will not has effect on this decision, but **ROE** option will.
The default value is "EVADE FIRE".

3. **AGGRESSIVENESS**.
Aggressiveness level. In fact this level determines maximal acceptable level of risk. In a situation when level of risk higher than specified the group will cancel it task. For example if pair of A-10 armed only with iron bombs ordered to destroy enemy armored column ("**Attack Group**" main task) and has low aggressiveness level will detect two "Tor-M1" SAMs, "Osa" SAM and many AAA and MANPADs in target area the pair will cancel its mission and RTB.
There are only two levels of aggressiveness for now.
"LOW". The risk depends on available weapon and target air defense.
- If a target protected with SAMs the aircrafts of the group will attack a target only if the group has air-to-ground missiles or guided bombs those can be released from height above SAM maximal height.
- If a target protected with AAA the aircrafts of the group will attack a target only if then group has air-to-ground missiles, guided bombs or rockets.

"HIGH". The group will attack their targets at any conditions.
The default value is "LOW".

4. **RADAR USING**.
Regulates in which cases radar should be used.
"NEVER USE". The group will never use radar for searching and weapon guidance.
"USE FOR ATTACK ONLY". The group will use its radars for weapon guidance only. The group must use other sensors and outer sources for target searching.
"USE FOR SEARCH IF REQUIRED". This allows the group to use its radars for target searching. The aircrafts of the group may switch off the radar to make silent attack or if picture from outer sources is enough.

"USE FOR CONTINUOUS SEARCH". This makes the group keep its radars switched off all the time.

The default value is " USE FOR SEARCH IF REQUIRED".

5. **FLARE USING**.

Determines in what cases flare must be released.

"NEVER USE". The group will never release flares.

"USED AGAINST FIRED MISSILES". Flares will be used for defense from launched and detected enemy missile.

"USE WHEN FLYING IN SAM WEZ". Flares also will have being released periodically while aircraft will flying in WEZ of detected enemy SAM or enemy fighter armed with IR-guided missiles.

"USE WHEN FLYING NEAR ENEMIES". The aircrafts of the group also will have been releasing flares periodically when flying near enemies to protect itself from undetected MANPADS and short-range SAM with IR-guided missiles. Not implemented yet.

The default value is "USE WHEN FLYING IN SAM WEZ".

As said before all behavior options will has effect on group behavior all the mission whatever tasks is running. If option change not added into actions list the default value of this option in effect. You can change value of same options as many times as you want.

6. **RTB on BINGO**.

You can deny group return to base when group in bingo state by this option. The option value is flag. When flag is true return to base on bingo state enabled and disabled otherwise. The option true by default.

7. **SILENCE.**

When flag is true no group will no transmit radio messages. By default the option is false.