AI Tutorial

Despite its somewhat unearned reputation, programming the AI is not all that difficult, as this AI Tutorial should show. The most important thing to do is to do all database work, such as the OB and the Areas of Operations first, before doing the AI. We need more scenarios created, so any questions from scenario creators in the SSG forums or via email will get SSG's undivided attention.

AI Overview

It is certainly true that the AI looks a little confronting at first glance but its actually not that hard to understand. The new AO system makes configuring the AI much easier, as each formation has a limited set of tasks to perform.

The AI mechanics have certain overrides and priorities, such as automatic overruns and a reluctance to carry out required actions if they would send units into an isolated (red) state, so you need to run the AI a good number of times, watching very closely to see that what you ask is achievable and required for that part of the game. On any load game the AI is loaded fresh so that you can play a particular turn over and over again while making minor changes to the AI scripts.

At any point in the game, each formation has an AO and in the same way each formation has a current AI Operation. We shall start by examining a single AI Operation and then elaborate on the details of an Operation and how Operations are selected.

There are a few different data entries, so rather than list them all straight away, we shall consider an example first, by way of illustrating how things work, before considering each entry in detail.
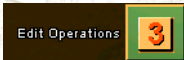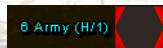
AI Operation Example

Start by going to the editor and hitting the AI button.

From the list of formations on the left hand side select the 6th Army.

Hit the Edit Operations button at the bottom of the screen.

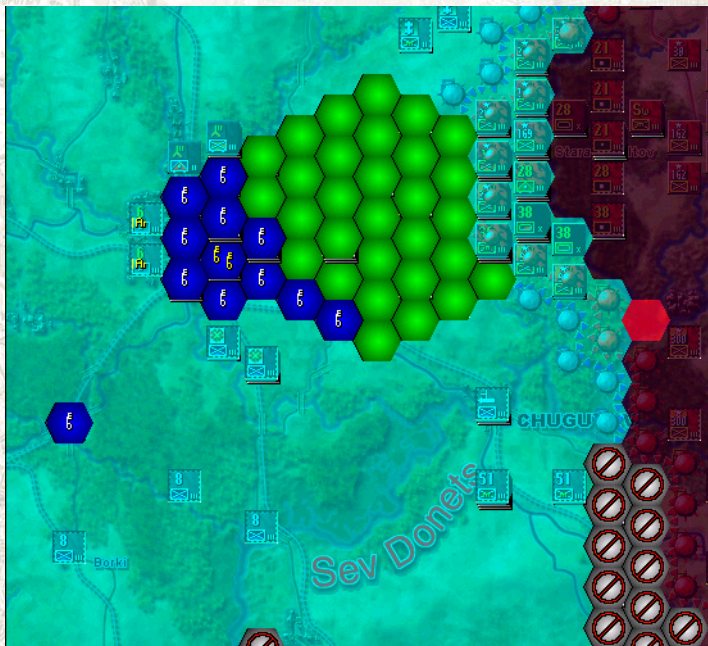On the next screen ensure that the 6 Army (H/1) is selected.

Hit the Select Regions button.
You should now be on the map screen, with the formations

AO hexes shaded blue and all other hexes shaded red.

Hit the Show All Flags button and you will see a display as shown below in the screen shot.

The different colored hexes tell the story. As mentioned, the light blue shading denotes the AO for the formation.

The blue hex with the two yellow key symbols is a Vital Defensive Hex. This is located on the Kharkov objective hex. If the Vital Defensive Hex is enemy occupied, the AI will give top priority to assaulting it and getting it back, if the formation has Assault or Probe orders. At the end of the turn, the AI will attempt to keep a nominated number of steps in the Vital Defensive Hex and this will take priority over everything else.

The blue hexes with a single key symbol are Key Defensive Hexes. If any of them are enemy occupied, then the AI will give priority (after the Vital Defensive Hex) to getting them back, if the formation has Assault or Probe orders. The AI will be looking to keep a nominated number of steps in these hexes at the end of each turn

in order to defend them.

Green hexes are Primary hexes. After any requirements with the Vital and Key Defensive Hexes have been satisfied, the AI will be looking to conduct operations in Primary hexes for offensive and defensive hexes.

The hexes with the no go symbol are, funnily enough, no go hexes. The AI won't enter the hexes with a nogo symbol, and will ignore any enemy targets in those hexes. We don't want the Sixth Army units being mixed up in fighting too far away from the real center of operations.

The hexes on the western edge of Kharkov with the Ar symbol are artillery parks, nominating useful places for the AI to park artillery units. The various types of hexes can be shown individually, showing all flags is just a handy way to see what's going on.

So the overall story, for Sixth Army, is that it will, because it has a Probe order, try to attack any enemy units in the blue hexes, with priority given to the Vital hex. Once any attacks needed in the Defensive Hexes have been made the AI will conduct attacks on enemy units in the green hexes and after that on enemy units located anywhere else in its AO. At the end of the turn, the AI will attempt to put a specified number of steps in the Defensive hexes, again giving priority to the Vital Hex. Artillery, AA and HQ units are all given suggestions on where to locate themselves. There are details to this overall plan, and just painting the hexes is not enough to cause the AI to carry out attacks, but these will be explained in the entries about the individual settings. However, looking at the map like this will give you a good idea of the overall plan.

Different Operations

The operation we have been looking at is labelled Sixth Army (H/1). While still at the map screen hit the Go Back button and make sure that you are still looking at Sixth Army (H/1).

In the middle of the screen are drop down menu boxes for Friendly and Enemy Objectives. These are the conditions that need to be true for the AI Operation to be chosen. You will see that for Sixth Army (H/1) we need KHARKOV to be friendly and IZYUM to be enemy controlled. This will obviously be true at the start of the game.

	Enemy Objective	Friendly Objective
#1	97: IZYUM	57: KHARKOV
#2	▭	▭
#3	▭	▭

6 Army (H/2) If you select Sixth Army (H/2) you will see that this plan is valid if CHUGUYEV, IZYUM and KHARKOV are all friendly. In this case things are obviously going well and if you examine the map you will see that 6th Army is ordered to drive east towards the Russian objective of STARAYA SALTOV.

6 Army (H/3) Plan H/3 applies if CHUGUYEV, IZYUM and STARAYA SALTOV are all friendly and provides for general operations to the south east.

6 Army (H/4) Plan H/4 applies if KHARKOV is enemy controlled. In this case all efforts are directed towards recapturing KHARKOV.

AI Data Entries Initial Screen
The first AI creation screen has few entries and is mostly concerned with information display. Buttons on the top right of the screen select the side, and the formation list below those buttons allow you to select the formation you are dealing with. The units belonging to each formation are shown in the middle of the screen, as shown below.

AI Name: Enter a name for the AI file. The system will append '_Allied.ai' or '_Axis.ai' to the files as appropriate, and the two .ai files will be saved in the scenario folder.

AI Description: This is a string entry can be used to provide further info to the scenario creator.

Computer +Bonus: Enter a number which will be multiplied by 10 and added to the computer player's score on the Computer+ setting.
Computer ++Bonus: Enter a number which will be multiplied by 10 and added to the computer player's score on the Computer++ setting.

Load Old AI: This structure is not currently used, just leave the default setting.

Defensive Integrity: This structure is not currently used, just leave the default setting of 1 point.

Edit Operations
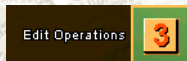
Most of the details for AI Operation is entered on the Edit Operations screen. Hit the Edit Operations button to get to this screen. As before, we will refer the German 6th Army as an example.

Each formation can have a number of AI Ops created for it. These are listed on the right hand side of the screen. Each formation can have a Default Op, which it will do if no other operations are valid. We have chosen not to use this feature in Kharkov but instead have created AI Ops plans to cover all eventualities.

Choose the 6th Army (H/1) plan to follow through these examples. You should see the same display as shown in the screen shot. The data entry details are explained below.
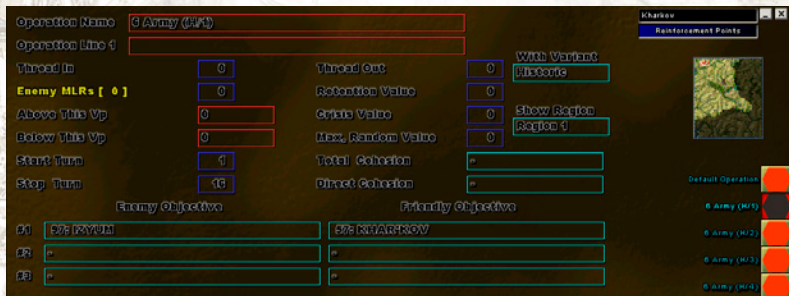
Operation Name: Enter a name for the AI Operation. We have adopted a naming convention that helps to keep matters organized. This is the formation name, followed by the letter 'H' for Historical or 'Vn' where 'n' is the number of the variant, followed by a '/' and the number of the plan. Thus (H/4) is the fourth Op of the Historical variant and (V5/2) is the second Op of Variant 5.

Operation Line 1: Enter further descriptive text if required.

Thread In/Thread Out: This structure is not currently used. Leave these values at 0. This function will be eliminated in the next version of the editor.

Retention Value, Crisis Value, Max Random Value: These three values operate together to determine what happens when more than one Op is valid and a choice needs to be made. The Retention Value is a number that is used by the current Op. The Crisis Value is a number used by any Ops that are not the current Op but are now valid. The Max Random Value sets the size of a virtual dice that is to be rolled. For each possible Op a random number is rolled. The current Op adds its Retention Value to its random number to get a total. Each non-current Op adds the Crisis Value to their random numbers and they each end up with a total. The Op with the highest total is the winner and will be chosen.

Enemy MLRs: When editing the map you can create a Main Line of Resistance, which will be explained later. The text in yellow tells you how many MLR hexes you have in the Op. If this number is 0, then the entry can be left at 0 as it will have no effect. If you have defined an MLR, then the number you enter here specifies how many hexes of the MLR have to be enemy controlled in order for the Op to become invalid. Note that if you do have an MLR defined then leaving this setting at 0 will mean that the Op will become invalid as soon as a single hex of the MLR becomes enemy controlled.

Above this VP: Enter a Victory Point value into this field. If the current game score is greater than this value then the Op will become invalid. A setting of zero is ignored.

Below this VP: Enter a Victory Point value into this field. If the current game score is less than this value then the Op will become invalid. A setting of zero is ignored.

These two entries allow you to change the Op based on whether the AI is doing well or badly.

Start Turn, Stop Turn: The Start and Stop turn numbers are absolute limits to the validity of the Op so an OP cannot be valid outside the limits set here. A setting of zero is treated as always valid.

With Variant: An Op can be associated with the Historic scenario or a Mystery Variant. Use this to make the appropriate associations. As a further example, look at the German 1st Panzer Army, which has a number of Ops for its Historic scenario and other Ops for some of the Mystery Variants.

Enemy Objectives, Friendly Objectives: Up to 3 Enemy and 3 Friendly objectives can be defined. The Op will only be valid if the control of the Objectives is as specified in the objective boxes. For example, the Op 6th Army (H/1) is only valid if IZYUM is enemy controlled and KHARKOV is friendly. This is the situation at the start of the game, so this plan will be a valid Op at the start of the game. Other plans are valid for different combinations of objectives, this allows the AI to respond to changes on

the battlefield in a dynamic manner.

There is more AI information than can fit on one screen, so we use the Switch Screens button. There are actually two additional screens, so we will be using this button again. Just make sure that you are still looking at our example Op, Sixth Army (H/1).

Vital Hexes, Key Hexes: These two entries specify how many steps the AI should use to occupy Key and Vital hexes. Obviously, there are plenty of circumstances in which the AI won't be able to carry out these orders perfectly, but it will normally do a reasonable job. You will see that the region in and around Kharkov in this plan has a large number of Key Hexes. This is to force the AI to pull back as many units as possible to the safety of Kharkov in the dangerous early turns of the Russian Offensive.

Vital Hexes	6 Steps/hex
Key Hexes	6 Steps/hex
Release Order	-
Activity Level	Probe

Activity Level: Only three orders here are still used. Assault, Probe and Defend. Assault allows the AI to make a full move and still attack, so should be used when the formation is conducting a full offensive. Probe only allows the AI to use half its OPs to conduct any attacks. This will still leave it with half its OPs, and should provide enough OPs left for the AI units to make it back to safe ground after conducting attacks. This is exactly what happens in the (H/1) Op, with the Probe order ensuring that the 6th Army units will counter-attack the Russian spearheads, but reserve half their OPs for scurrying back to the relative safety of Kharkov. Defend will cause the AI, in the absence of any other cues like Vital or Key Hexes, to form some sort of defensive line.

Release Order [-, Release Strongpts]: The Release Strongpts order will cause the AI to release any Strongpoints that are tied to units. This order isn't used in the Kharkov scenario.

Bridge Actions	-
IF Support	All Subordinate
CC Support	All Subordinate
IF Attack Rules	Primary Hexes+
CC Attack Rules	Primary Hexes+
Detachments	No Detachments
Priority	Priority 3
IF Options	Focus Fire

Bridge Actions: The AI operates under the assumption that in any one Op you are going to be either repairing or blowing bridges. In either case you can allow all units to blow/repair or restrict the action to support units only. Note that if you order the AI to blow bridges, it has no mechanism for getting units across the bridge before blowing it. If the order is restricted to Blow with Support, then the combat units will have moved first and will have more of a chance of being on the right side of the bridge. If blowing bridges is going to be critical, it might be safer to have the bridge blow itself up when enemy units approach, as was done in the Market Garden scenario of our Battlefront game. This order only applies to those hexes marked on the map for a Bridging Action and will apply to all bridges in that hex.

IF Support: The AI will always use guns belonging to the current formation, unless specifically ordered not to by the IF Options setting (see below). This setting regulates from which other formations the current formation can use artillery. The formation is an important attacking formation then you would allow it to use guns from other formations. If not, you would tend to restrict it.

CC Support: This setting operates on the same lines as IF support, and regulates which formations you can take units from to use in Close Combat with units from the current formation. Again, strong offensive formations should be given the ability to use units from anywhere to prosecute their attacks.

IF Attack Rules [Everywhere, All Regional Hexes, Tertiary+, Secondary+, Primary+, Key Hexes only]: This setting regulates which hexes will be valid as targets for IF attacks. The '+' at the end of many of the settings indicates that it includes all hexes above the setting in priority. So the setting Tertiary+ includes the

Tertiary hexes plus all Secondary, Primary and Key hexes.

CC Attack Rules [Everywhere, All Regional Hexes, Tertiary+, Secondary+, Primary+, Key Hexes only]: This works in the same way as IF Attack Rules but regulates which hexes will be considered as valid targets for Close Combat attacks.

Detachments: [No Detachments, Lay Detachments]: Specifies whether you want the units in the formation to lay detachments.

Priority: Assigns a priority to the formation which is used when assessing which formation to move first. Formations which move first are get first choice (within the restrictions noted above) of artillery, combat units belonging to other formations and off map airstrikes. Highest priority should go to the strongest, most attacking formation.

IF Options [Hold Fire, Focus Fire, Area Fire]: Hold means that this formation won't use IF. If it has artillery it won't fire, unless it is co-opted by another formation. Focus Fire means that it will fire at targets within its region. Area Fire means that IF fire can take place anywhere.

This section deals with instructions for using Special Attacks, Air Strikes and Artillery.

Attack Phase	Special Attack	Air Strike 1	Air Strike 2	Artillery
Units	▫	Anyone	▫	Anyone
Strong Points	▫	Anyone	▫	Anyone
Type Of Attack	Region Structured			
SP Rules	Persist on SP KIA			

The Units line deals with attacks on units.
Special Attack [-, Legal, Key, Key+]: The options are to not use any Special Attacks on units, use on any legal target (i.e. any target within the formations AO) , use on any target in a Key Hex or use on any target in a Key or Vital hex.

Air Strike [-, Anyone, 2 Step +, 3 Step +]: The options are to not use the Air Strike on units, use the nominated Air Strike on any target, or only on targets with 2+ or 3+ steps.

Artillery [-, Anyone, 2 Step +, 3 Step +]: The options are the same as Air Strikes.

The Strong Points line deals with attacks on Strong Points. It has the same options as the Units line. Note that for each attack, you should ensure that at least one of Units or Strongpoints are a valid target type, otherwise the attacks will not be used.

Type of Attack [-, Region Structured]: A Region Structured attack will give priority to attacking targets in Vital, Key or Primary hexes, and should be the default choice for an Op.

SP Rules [Evaluate on SP KIA, Persist on SP KIA]: This option regulates what the system will do when it has chosen a multi-step strongpoint as a target. If Evaluate is chosen, then after the attack the AI will evaluate all targets, and may choose a different target for the next attack. The Persist option means that the AI will, if possible, continue to attack the same strongpoint without considering other targets. So if Persist is chosen the AI will try to eliminate all steps in a multi-step strongpoint and this should be the default option.

Second Edit Operations Screen
This screen deals mainly with OMAs and how the AI handles them.

11: XVII Korps Refit Area	-
12: Belgorod	Reinforce Map
1: -	-
2: -	-
3: -	-
4: VIII Korps Refit Area	-
5: Dzerzhinsk	-
6: Petropavlovka	-
7: Dnepropetrovsk	Reinforce Map
8: 17 Army Refit Area	-
9: Krasnograd	Reinforce Map
10: LI Korps Refit Area	-
Invasion: Style	Regular Landing
Invasion	at 4 - 1
At End (CC)	No Move Attack

The 12 OMAs are listed in a typically whimsical order dreamt up by a programmer who doesn't have to write the rules explaining them. However, each OMA has the following options:

The '-' will result in the OMA doing nothing at all with the units in it, so make sure that you don't use it unless you really want to.

The 'Unused' option will have the same effect.

The 'Reinforce Map' option will take the units in the OMA and send them to OMA entry points on the map. The AI has built in routines to ensure that this happens in a reasonably intelligent fashion.

The 'Move To' option transfers the units to another OMA.

Invasion Style: Regular Landing means to land and attack using the Invasion setting to below it to choose the odds that the AI will use as a minimum for any attacks. Defensive Landing means that on the landing turn the AI will simply land units and won't try to attack.

Invasion: Choose the odds the AI will use as minimum for invasion attacks.

At End (CC): Although tucked away at the bottom of the screen, this is an important AI setting. After all AI Ops cards have been executed, the AI goes through a sort of cleanup routine to see if any viable attacks still remain. This cleanup is controlled by the following settings:

No Move Attack – the AI will conduct attacks at or above the AI Minimum odds using any units that can attack without moving. This is the default setting, and is recommended.

Move Attack - the AI will conduct attacks at or above the AI Minimum odds using any units that can attack with or without moving. This is an aggressive setting and may result in units leaving positions (such as Defensive Hexes) in order to conduct attacks. Use with caution.

No Attack Allowed – no attacks will be done in this AI phase.

Opportunity Cards

Opportunity Cards are a mechanism for the scenario designer to issue specific directions to the AI, as opposed to the AI Operations where the scenario designer creates a plan which the AI must carry out.

Opportunity Cards (OCs) apply to all units rather than being restricted to a particular formation like AI Ops. Individual units will not ignore their AO restrictions, but apart from that, all units are eligible to take part in an Opportunity Card.

As an example, a formation might have a Defend order, which prohibits attacks. However, the formation might be defending a particular objective and an Opportunity Card might be created to attack the objective, if it should fall into enemy hands.

In Kharkov, OCs are used to direct close combats fire onto strongpoints to make sure that the correct strongpoints are cleared at the start of the Russian and German offensives. This also saves artillery units for attacks on real units rather than strongpoints.

Opportunity Cards run in two phases. The First Phase happens at the very start of the turn, before any AI Ops are run. The Second Phase happens after the AI has done its AI Ops combats.

Operation Name	Destroy SP (43,51)		
Operation Line 1			
Operation Line 2			
Enemy MLRs [0]	0		
Above This Vp	0	**Script Type**	Script Both Phases
Below This Vp	0	**Opportunity Value**	25 **Highest First**
Start Turn	5		
Stop Turn	6		

	Enemy Objective	**Friendly Objective**
#1	=	=
#2	=	=
#3	=	=

The OC conditions, MLRs, VPs and Start/Stop turn are the same as those for AI Ops, so they won't be repeated here.

Script Type: As mentioned above, OCs can be run in the first, second or both OC phases.

Opportunity Value: This is a ranking value for execution order. The card with the highest number will go first.

Select Regions: Each OC has a region attached, painted in the same way as the regions for AI Ops. As seen in the strongpoint attack examples, the region can be as small as one hex.

Second Screen

Select Units	Germany				
Interdict Air 1	0	0			
Interdict Air 2	0	0	Bridge Actions	-	
Interdict Grd 1	0	0	Digging Rules	-	
Occupation Rules	Ignore Occupy				
Select Rules	All Units		Min Attack	Use Normal AI Odds	
Occupy # Hexes	All		Opt Attack	Use Normal AI Odds	
Card Protocol	Attack		At End	Hand on	
Number Transported	0		How Transported	-	

Attack Phase	Special Attack	Air Strike 1	Air Strike 2		Artillery
Units	-	-	-		-
Strong Points	-	-	-		-

Card Protocol: This is most important setting for an OC, even though it is listed halfway down the page. The options for it are as follows though again we will dispense with the listed order.

Attack: The AI will attack targets in the region that meet the Minimum Attack odds, trying to reach the Optimum attack odds specified elsewhere on the card.

Attack and Clear: Operates the same as the Attack OC except that the AI will try to get a friendly unit onto as many enemy controlled hexes as possible.

Occupy: The AI will attempt to occupy hexes in the region, but it won't attack in order to do so. This is used to deal with a situation where an important hex is enemy controlled, but doesn't have any actual enemy units in it and therefore can't be attacked. The Occupy command will try to get friendly units to walk into the undefended hex.

As an example, consider the OC orders for the Germans. On the second page of German OC cards are two cards, Capture Kharkov and Occupy Kharkov. So at the very start of the AI turn, the OC will attack any enemy units in Kharkov or move units into it if it is friendly. The same deal exists with cards for Krasnograd.

Transport to Key: This is a mechanism for directing the AI to use transport modes in the game. It is not used in Kharkov, but was used in Market Garden to direct the Germans to use the ferries that were their only alternative with the Arnhem Bridge blocked by 1st Airborne. To use it, set a Key Defensive Hex on your destination.

The AI will take units in the region that are not already on a Key Defensive Hex and use the appropriate Transport to get them to the destination. Units will not be transported in excess of stacking limits and will not be transported to an enemy controlled hex. This command uses the Number Transported and How Transported settings to control the action.

Bridging Action: The AI will carry out the Bridging Action for the card specified in the Bridging Action field elsewhere on the card. Caution should be employed in using an OC to blow bridges, especially if the card is set to run in the first phase, unless you are certain that your units are on the right side of the bridge! Remember you can use a formation AI Op to blow bridges as well. An OC might be a good idea to repair bridges, since you may well desire this to happen as early as possible in a turn.

Indirect Strike: This will use the Air Strike 1, Air Strike 2 and Artillery Settings to filter targets within the region and conduct an Indirect Fire attack. Remember, the region can be as small as one hex if required.

Attack No Forts: This is same as the Attack command, except that it will not be valid if there are enemy strongpoints in the region.

Attack and Clear (Regional): This is the same as an Attack and Clear card except that only units in the card's region are eligible to take part in any attacks.

Interdiction: This command uses the (X,Y) co-ordinates specified in Air 1, Air 2 and Ground 1 as the locus for Interdiction. The AI will try to get as close as possible to the specified point but won't overlap interdictions. This command ignores regions and just uses the (X,Y) co-ordinates. The AI does a catch up at the end of the turn to make sure that interdictions aren't wasted, so you don't have to use this command, but a well directed interdiction can make a big difference so you have nothing to lose by using this command.

Occupation Rules: Specifies how many units to use when carrying out Occupy commands.

Select Rules: Specifies which type of units to use for general occupy orders, transport units and bridging actions.

Occupy # Hexes: Not used and will be removed in future versions of the game.

Digging Rules: Choose if units carrying out Occupy actions should Entrench.

At End: Choose what happens when the actions on the OC are carried out. Terminate Turn means that units which were used are flagged by the AI and will not be used in that turn for another OC action. This could be important if units are given critical occupy orders. Hand On means that units are still available for other OC cards to use.