# MWGrid software – Usage Instructions

## Version 1.0

### Intro

These are the instructions for the use of the MWGrid suite of software. Please follow the installation instructions if you have not already done so. It is not easy to use some parts of the software and understanding why an error has occurred can be a challenge. If you need any assistance then please email [P.Murgatroyd@Bradford.ac.uk](mailto:P.Murgatroyd@Bradford.ac.uk) although it may be a good idea to drop me a line first anyway as I may be able to save you some effort. Accessible, user-friendly software is a priority for me, but the majority of the MWGrid suite was written before the importance of ease-of-use was fully appreciated, and the time for a complete rewrite is not available at the moment.

These instructions assume you are using the Eclipse IDE and Microsoft Excel. It should be possible for a reasonably techically proficient user to follow these instructions, adjusting any to suit their own circumstances. As always, drop me a line if there are any queries.

### The Initialisation file

By default, the MWGrid ABM looks for a file titled ‘SPinitfile.txt’, which contains all the variables that can be changed by the user without changing the programme. The software looks for a variable name within the file and reads the value which follows it on the same line. Each readable line must contain a variable name, in capital letters, with a single space and then an appropriate value. Boolean variables are either the single text word *true* or *false*. Any line that does not contain a valid pair of variable name and value will be ignored, so comments and empty lines can be included in the file to ensure a degree of organisation within. Below are the contents of the sample initialisation file, along with a description and the type of each variable. Variable names are in bold and values are in italic for clarity within this document, but they are all in plain text in the initialisation file.

**OFFICERS** *0* – The number of Officers located in the centre of the camp layout. Each constitutes a ‘squad’ containing only a single, mounted Officer. Integer.

**OFFICER\_CAVALRY\_SQUADS** *2000* – The number of squads of Officers located in the centre of the camp layout. Each squad contains the number of mounted Officers specified in the OFFICER\_CAVALRY\_SQUAD\_SIZE variable. Integer.

**CAVALRY\_SQUADS** *0* – The number of Cavalry squads in the army. These will be located in the exterior portions of the camp and will be placed in the column of march after the Officers but before the Infantry and Baggage. Each squad contains a Cavalry Officer and the number of Cavalry Soldiers specified in the CAVALRY\_SQUAD\_SIZE variable. Integer.

**INFANTRY\_SQUADS** *0* - The number of Infantry squads in the army. These will be located in the exterior portions of the camp and will be placed in the column of march after the Officers and Cavalry but before the Baggage. Each squad contains an Infantry Officer and the number of Infantry Soldiers specified in the INFANTRY\_SQUAD\_SIZE variable. Integer.

**MULE\_SQUADS** *0* – The number of Mule squads in the army. These will be located in the corner sections of the camp and contain a single human Baggage Handler and the number of Mules specified in the MULE\_SQUAD\_SIZE variable. Integer.

**DONKEY\_SQUADS** *0* - The number of Donkey squads in the army. These will be located in the corner sections of the camp and contain a single human Baggage Handler and the number of Donkeys specified in the DONKEY\_SQUAD\_SIZE variable. Integer.

**HORSE\_SQUADS** *0* - The number of Horse squads in the army. These will be located in the corner sections of the camp and contain a single human Baggage Handler and the number of Horses specified in the HORSE\_SQUAD\_SIZE variable. Integer.

**CAMEL\_SQUADS** *0* - The number of Camel squads in the army. These will be located in the corner sections of the camp and contain a single human Baggage Handler and the number of Camels specified in the CAMEL\_SQUAD\_SIZE variable. Integer.

**CART\_SQUADS** *0* - The number of Cart squads in the army. These will be located in the corner sections of the camp and contain the number of Carts specified in the CART\_SQUAD\_SIZE variable. Each Cart takes up two spaces in the simulation and it is advised to set CART\_SQUAD\_SIZE to 1 to avoid weird crowding effects. Integer.

**SQUAD\_MULE** *false* – If this variable is true then each Cavalry and Infantry squad will have a single Mule in addition to its Officers and Soldiers, otherwise it will not. Boolean.

**SECTOR\_C\_MULE\_SQUADS** *2448* – Additional Mule squads located in the centre section of the camp and inserted into the column of march after the other units which start in the centre section. Each will contain a single human Baggage Handler and the number of Mules specified in the MULE\_SQUAD\_SIZE variable. Integer.

**SECTOR\_N\_MULE\_SQUADS** *0* - Additional Mule squads located in the north section of the camp and inserted into the column of march after the other units which start in the centre section. Each will contain a single human Baggage Handler and the number of Mules specified in the MULE\_SQUAD\_SIZE variable. Integer.

**SECTOR\_W\_MULE\_SQUADS** *0* - Additional Mule squads located in the west section of the camp and inserted into the column of march after the other units which start in the centre section. Each will contain a single human Baggage Handler and the number of Mules specified in the MULE\_SQUAD\_SIZE variable. Integer.

**SECTOR\_E\_MULE\_SQUADS** *0* - Additional Mule squads located in the east section of the camp and inserted into the column of march after the other units which start in the centre section. Each will contain a single human Baggage Handler and the number of Mules specified in the MULE\_SQUAD\_SIZE variable. Integer.

**SECTOR\_S\_MULE\_SQUADS** *0* - Additional Mule squads located in the south section of the camp and inserted into the column of march after the other units which start in the centre section. Each will contain a single human Baggage Handler and the number of Mules specified in the MULE\_SQUAD\_SIZE variable. Integer.

**OFFICER\_CAVALRY\_SQUAD\_SIZE** *4* – The number of Cavalry Officers in the OFFICER\_CAVALRY\_SQUADS. There are no Soldiers in these squads so this number will determine the total number of agents in a squad. Integer.

**CAVALRY\_SQUAD\_SIZE** *4* – The number of Cavalry Soldiers in the CAVALRY\_SQUADS. There will also be an Officer in each squad, so if the value of this variable is 4, there will be a total of 5 agents in the squad.

**INFANTRY\_SQUAD\_SIZE** *9* - The number of Infantry Soldiers in the INFANTRY\_SQUADS. There will also be an Officer in each squad, so if the value of this variable is 9, there will be a total of 10 agents in the squad.

**MULE\_SQUAD\_SIZE** *5* – The number of Mules in each Mule squad, regardless of where it is located. There will also be a Baggage Handler agent added to each squad whose speed is set to the same as that of the Mule. Integer.

**DONKEY\_SQUAD\_SIZE** *3* - The number of Donkeys in each Donkey squad, regardless of where it is located. There will also be a Baggage Handler agent added to each squad whose speed is set to the same as that of the Donkey. Integer.

**HORSE\_SQUAD\_SIZE** *3* - The number of Horses in each Horse squad, regardless of where it is located. There will also be a Baggage Handler agent added to each squad whose speed is set to the same as that of the Horse. Integer.

**CAMEL\_SQUAD\_SIZE** *3* - The number of Camels in each Camel squad, regardless of where it is located. There will also be a Baggage Handler agent added to each squad whose speed is set to the same as that of the Camel. Integer.

**CART\_SQUAD\_SIZE** *1* – The number of Carts in a Cart squad. If this is not set to 1 it may cause crowding issues. Integer.

**CAMP\_SPACE\_BETWEEN\_SQUADS** *3* – The space between squads in the camp layout, measured in 5m cells of the simulation. This is used when laying out the camp and assigning a start and end location to each squad. Integer.

**GAP\_BETWEEN\_SECTORS** *5* – The space between each sector of the camp, measured in 5m cells of the simulation. This is used when laying out the camp and assigning a start and end location to each squad. Integer.

**COLUMN\_LEADERS** *1* – The number of route planning agents in the army, which is functionally identical to the number of columns into which the army is split on the march. There will still be only 1 Emperor agent, who is always a route planner, but any extra column leaders are Officers who take on the behaviours of a route planner. If this is greater than 3 then strange behaviours may result. Integer.

**TEXT\_ID** *JR6NL3-3* – An identifying text string that is inserted within the output filenames in order to distinguish the outputs from those with similar initialisation data. If this is too long it could create an invalid filename. String.

**TERRAIN\_LOGGING** *false* – This determines whether the simulation also outputs a DTM covering the area of this particular march. This can be used by one of the Blender Python scripts to create a 3D model of the terrain over which the march is being made. Boolean.

**TERRAIN\_BORDER\_SIZE** *600* – This is the extra terrain that is added to the calculated area that the army occupies on the march. It ensures that there is a border of terrain around the area where the movement occurs. It is only used when the TERRAIN\_LOGGING valuer is true. Integer.

**3D\_TRACE** *true –* Adds the current height of the agent to the data written to the output tickfile. This will enable 3D visualisation using the Blender Python scripts. Boolean.

**SECONDARY\_UNIT\_SIZE** *20* – Specifies a separate type of organisation among the units when setting off from camp. In this case, the gap in ticks specified in SECONDARY\_SETOFF\_SPACING will be used every 20 squads. Integer.

**SETOFF\_SPACING** *3* – This is the time in ticks between each squad setting off from the start location. This prevents all the squads setting off at the same time and simulates the delay between one squad and the following squad setting off. Integer.

**SECONDARY\_SETOFF\_SPACING** *3* – This is the setting off delay that replaces that specified in SETOFF\_SPACING every *x* squads, where *x* is specified by SECONDARY\_UNIT\_SIZE. Integer.

**SECTION\_SETOFF\_SPACING** *3* – The gap in ticks between the end of one sector of the camp setting off and the beginning of the subsequent sector. Integer.

**OUTPUT\_TICK\_FILENAME** *SPtickfile.txt* – The end of the name of the output tick file, recording where each agent is each tick of the simulation. This string is preceded by a string incorporating the TEXT\_ID and showing other useful info about the scenario. It helps with subsequent file handling if this string ends in “.txt”. String.

**OUTPUT\_DAY\_FILENAME** *SPdayfile.txt* - The end of the name of the output day file, recording aggregate data for each agent on the day’s march. This string is preceded by a string incorporating the TEXT\_ID and showing other useful info about the scenario. It helps with subsequent file handling if this string ends in “.txt”. String.

**START\_LOCATION** *30280,35250* – The starting location of the centre of the camp, in cells on the x and y axes from the lower left corner of the terrain data. This is in 5m simulation cells and not 50m terrain data cells. Two Integers separated by a comma, with no spaces.

**DESTINATION\_lOCATION** *34190,36270* - The destination location of the centre of the camp, in cells on the x and y axes from the lower left corner of the terrain data. This is in 5m simulation cells and not 50m terrain data cells. Two Integers separated by a comma, with no spaces.

**RESOURCE\_LOCATION** *d:/ManzikertSP/newMz/* - The folder containing the terrain data file. String.

**END\_TIME** *14451* – Total number of ticks in the simulated day. The simulation will stop after this tick regardless of where the agents are. Integer.

**REST** *false* – If *true*, the agents will take a rest every hour during the central section of the march. Boolean.

**FLAT\_TERRAIN** *false* – If *true*, the terrain file will not be read and a completely flat terrain is used. If *false*, the terrain data file will be read and used. Boolean.

**SQUAD\_MODE** *true* – If *true*, the simulation will ignore squad sizes and use one agent per squad. This is primarily useful when combined with HEIGHTCRAWLER to produce a cross section of the route planned. Otherwise, set to *false*. Boolean.

ContextSingleton

**MAX\_AGENT\_SIZE\_IN\_CELL** *20* – The maximum total size of agents in each 5m cell of the simulation. The default agent size of an Infantry Soldier is 1, and a Cavalry Soldier is 4, resulting in 20 Infantry or 5 Cavalry per cell. Integer.

TravelTo

**INIT\_HEURISTIC\_MOD** *2.5*

**MIN\_HEURISTIC\_MOD** *0.5*

**INIT\_ROADTEST\_HEURISTIC\_MOD** *1*

**INIT\_MAXSTEPS** *50000*

**INIT\_ROADTEST\_MAXSTEPS** *3000*

**HM\_STEP** *0.05*

Move

**CUTOFF\_MED\_STEEP** *25*

**CUTOFF\_SHALLOW\_MED** *15*

**CUTOFF\_LEVEL** *5*

**COST\_LEVEL** *1*

**COST\_UP\_SHALLOW** *1.5*

**COST\_UP\_MED** *2*

**COST\_UP\_STEEP** *3*

**COST\_DOWN\_SHALLOW** *1.5*

**COST\_DOWN\_MED** *2*

**COST\_DOWN\_STEEP** *3*

**COST\_ROAD\_LEVEL** *0.75*

RoutePlan

**DEFAULT\_HEURISTIC\_MOD** *2*

Environment

**NUMBER\_OF\_X\_PARTS** *1830*

**NUMBER\_OF\_Y\_PARTS** *852*

**SIZE\_OF\_PART\_LIST** *4*

HumanAgent

**HEIGHTCRAWLER** *false* – If true, this incorporates both time and height data into the tickfile so it can be used to construct a cross-section graph of the route. Best used in conjunction with SQUAD\_MODE. Set to false for normal operation. Boolean.

**AGENT\_WEIGHT** *70*

PlanMacroRouteTo

**MARCH\_SPACING** *1*

Cavalry

**CAVALRY\_LEAD** *5*

**CAVALRY\_WALK** *5*

**CAVALRY\_TROT** *5*

Weather

**MARCH\_CUTOFF\_TEMP** *99*