NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

SUPPLEMENTAL TO THESIS
(2 OF 6: GAMETReadMe)

STATE SPACE ANALYSIS OF THE GENERAL ANALYTIC MINEFIELD EVALUATION TOOL: IN PURSUIT OF THE ADVANCED UNDERSEA WEAPON SYSTEM

by

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March 2019

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*** Readme File for GAMET Version 3.3 ***
12/16/2013

You must fill out the GAMET Registration and Non-Disclosure Form and email the signed, scanned electronic copy to the GAMET CM Manager at Brian.Belton@navy.mil prior to using the software. An electronic copy of the form is included in the software package. User's must adhere to the GAMET Distribution Notice that appears on the cover page of the User's Guide and on software start-up.

GAMET Version 3.3 include an enhancement since version 3.2 which requires changes to pre-existing mine input files, *.min. Please refer to the GAMET User's Guide for specifics. The simulation enhancements include:

- Node Group Assignment – Each node group in the mine file is assigned a node group ID which is applied when GAMET establishes the networking in cooperative fields. Only node groups with the same ID will be included in given network, thereby allowing subnets to be established in a minefield.
- Planning Mode – GAMET now offers a Planning mode in addition to the normal Analysis mode. In planning mode, the simulation determines the number of mines or sensor nodes needed to reach a user-specified MOE value. The simulation mode is selected prior to running the sim via the drop down Simulation menu. An additional input data file Planning.pln has been added which contains the parameters used during Planning mode. The four new planning parameters in the file are MaxPlanningIterations, StartIteration, PlanningMOE(SIT,EC) and RequiredMOEvalue.

GAMET Version 3.2 includes several enhancements since version 3.1 which require changes to pre-existing mine input files, *.min. Please refer to the GAMET User's Guide for specifics. The simulation enhancements include:

- Probability of Fire (POF) – Post-detection mine function similar to Ship Count. When each mine/node is laid, a POF number between 0.0 and 1.0 is assigned. For each target detection, a random draw is compared to the assigned POF to determine if a weapon fires. Multiple POF numbers can be given to a group of nodes and then each node's setting is randomly selected from among them, similar to the assignment of Ship Count. This POF capability was added to GAMET because it exists in current in-service mines. The new POF parameters are entered within the *.min files for each node group.
- "LIST" node placement option – A third placement option is now offered for placing nodes in the field. When planned or measured location information is known for each node, this list option can be used to provide the x,y node locations.
- Mixed node placement of RANDOM, LINES and LIST – A mixture of lines, random, and list placement can now be used to place nodes in the field. Each node group is assigned a placement type (LINES,RANDOM,LIST) in the mine input file, *.min.

- Increased significant digits in statistical output – The number of significant digits have been increased for some of the probability numbers in the output files.

GAMET Version 3.1 includes multiple enhancements since version 3.0 which require changes to pre-existing input files. Please refer to the GAMET User's Guide for specifics. The simulation enhancements include:

- Dual Power Comms Transmission – Allows node-to-node communication at two different power/performance levels (Prob vs Range), with a user-specified number of transmission attempts at each level. There will also be a user-specified power usage for each transmission level (low and high). This enhancement will provide a more robust, fault-tolerant network.
- Comms modem reliability – The sensor reliability random draw done at the start of each run will now be applied to both the modem and sensor. Failed modem nodes will not be included in network setup at run start. This new modem reliability feature represents an ineffective node due to such things as node placement behind rock, buried, ineffective anchor, water seal leak/electronic failure, etc.
- Comms modem range performance specified by node type - This will allow a mix of modem types or cooperative and standalone mines in the same field. This will provide a more flexible and robust communication performance implementation and allow analysis on a wide range of field component mixes. Now for each node type name, there must be a *.cmt file with that same name providing the comms table probabilities (similar to *.sen and *.whd).
- Added a network overlay GUI option to GAMET which allows the user to view the full network configuration for a given scenario run. This facilitates the user's understanding of the network that was set up by GAMET's shortest time-path algorithm.
- Added option to require two separate remote sensor node detections before weapon launch. The two separate detection messages must travel back to a single weapon node before a weapon will be launched at the target. This simulates the requirement to collect adequate sensor detection data to complete weapon node data fusion on the target.
- Added Test Mode GUI option in GAMET which outputs additional case data when selected. This will be useful for detailed analysis and troubleshooting.
- Added TransitorFrequency.out output file to record the max, min, mean and standard deviation of time between transitors to support analyzing the transitor frequency during a study case.
- Added a Transmission Attempts Per Hop statistic to the CommStats.out out file which provides the average number of transmission attempts made at each communication hop, regardless of success.

GAMET Version 3.0.2 fixes an issue involving replenishment. When warheads were replenished at a weaponized node, their warhead range may not have been set for the first transitor following the replenishment. This has been corrected in version 3.0.2 and newer.

GAMET Version 3.0.1 only has one change from version 3.0: The mine icons scale to the window size rather than being a set size. This is purely a visual/GUI change and doesn't affect any of the Monte Carlos aspects of the sim.

GAMET Version 3.0 incorporates major updates since the Version 2.2 release. These enhancements will require changes to some pre-existing input files. The updated User's Guide provides additional information.

New features in GAMET version 3.0:

- Routed communication networking – for cooperative fields, Floyd's shortest path algorithm (based on time-path) is used to construct a message routing network at the start of each run. Unweaponized nodes will use this network to route detection messages to the nearest weapon node. Communication attempts are displayed on the screen using dashed (unsuccessful) and solid (successful) white lines. New data inputs for node pair process time, maximum transmission attempts and transmission retry delay must be entered in the *.cms file.
- Multi-warhead node capability is now available. Multi-warhead nodes should be only be used in cooperative fields, since traditional standalone mines (non-cooperative) are destroyed upon weapon use. The *.min file provides the input for number of warheads per node in each mine group.
- Power usage – Each node begins with a specified number of power "units". Their remaining power level is then decremented for transitor detection, and the power to transmit and receive messages. These actions won't take place if there isn't sufficient power at the node. Once a node's power level reached zero, it turns off. These new inputs are specified in the *.min file.
- Minefield replenishment – in cooperative fields, a warhead replenish threshold can be set for each weapon node (this parameter isn't used for non-weaponized nodes). Once the number of warheads remaining reaches this threshold number, a field replenishment trigger is set. The weapon node, along with any non-weaponized nodes which fit the user-specified replenish criteria, will be scheduled for replenishment (based on the replenish time delay). If necessary, the replenishment activity will wait for a transit to complete in order to avoid field replenishment during a target's transit. These new inputs are specified in the *.min file.
- Multi-activity threading – multiple processes can now be occurring simultaneously in GAMET. This allows the transitor to be moving while multiple messages may be routing through the field to their destination.
- Minefield display zoom – clicking on the minefield boundary box will toggle a zoom view of the minefield and battlespace.
- Output files are now stored in a subdirectory below the scenario and batch file location. This allows data to be kept separate from the executable, and also allows the executable to be run from a CD while data files are read and stored on the computer's hard drive.

A sample set of input files is included in the fileset. It is recommended that users modify existing input files in order to minimize input errors. The User's Guide explains the content of the input files to assist these modifications.

For configuration management purposes, we ask that you not distribute copies of the software to other individuals. If someone is interested in obtaining a copy of GAMET, please have them contact the CM Manager. A complete copy of the fileset will then be sent to them and their names will be added to the distribution list. A GAMET Registration and Non-Disclosure Form, “GAMETNonDisclosureForm.doc”, is included in the fileset. Anyone receiving the software must sign and return a copy of this form to the GAMET CM Manager.

A user's guide, "GAMETUG.doc", is included in the fileset. This file explains the simulation and required input files.

A change proposal form, "GAMETchange.doc", is also included. This file should be filled out and sent electronically to the GAMET CM Manager to request any program modifications or to alert to any possible program errors. Including the scenario fileset which created the errors may also be helpful. Please send files as email attachments to the CM Manager.

Gamet.exe is the main executable file for this simulation. The "GAMET -noimage" option (see User's Guide) executes GAMET without on-screen animation, allowing it to run much faster. The “GAMET-NoImage.bat” file is included as an optional way to execute the “GAMET –noimage” option.