

4.7.8.5 Btry Network Restrictions

Duplex links to the commander and to Btry's subordinates are required. The message class for both links is command.

4.7.9 Surface-to-Surface Fire Unit (SS FU)

4.7.9.1 SS FU Overview

The SS FU can launch surface-to-surface weapons against both scripted and commanded assignment targets. These surface-to-surface weapons can either be a ballistic missile or a weapon defined as a captive platform or complex weapon using the AGAttacker ruleset and a specified airframe. Once active, the SS FU launches weapons against all scripted targets according to the launch times specified on its target list. Once all of the scripted targets have been engaged, the SS FU can engage against commanded assignment targets.

The SS FU receives target assignments from its commander and sends acknowledgement messages to the commander indicating whether it can execute an assignment. The SS FU then launches on the assigned target and, after launching, moves to the next waypoint. Both scripted and commanded launches take place only at launch sites.

The SS FU also has the capability of hiding from attackers, as well as reloading. Hide sites can be used to reduce the SS FU's susceptibility to attack or to damage. Reload sites can be used to replenish the SS FU's weapons count to its count-per-reload number of weapons.

4.7.9.2 SS FU Battle Management Phases

The SS FU ruleset uses tactical operations, launch, intercept, reload, and hide phases.

4.7.9.2.1 SS FU Tactical Operations Phase (Setup Operation)

The setup operation is the part of the Tactical Operations Phase that is scheduled when the SS FU reaches a launch site and the SS FU still has weapons. This operation represents the amount of time it takes to ready the launcher for launching weapons against targets. Upon completing the setup, the launch phase is scheduled if a target exists. If no target exists, the Tac. Ops. Phase is scheduled, for the tear-down operation, at the waypoint off-time and the SS FU is free to relocate to the next waypoint. Upon reaching the launch site, if the SS FU has no weapons, it immediately relocates to the next waypoint without executing the setup operation.

If the SS FU is at a deployed user-defined launch site during this phase, its susceptibilities are adjusted based on the site's susceptibility parameters.

Otherwise, the SS FU's susceptibilities to detection and damage remain unchanged. Subsection 4.7.32 describes the susceptibility adjustments at a launch site.

For further explanation of the Tactical Operations phase see section 4.20 of the Methodology Manual.

4.7.9.2.2 SS FU Launch Phase

If a viable target exists on its target list, the launch phase of the SS FU is scheduled upon reaching a launch site and executing the setup operation. The target can be either scripted or received through a commanded assignment. If the target is within range of the weapon, a surface-to-surface weapon is launched according to the launch-phase timing delays. If the target is no longer in range, a condition that should not occur, the tear-down operation is scheduled and the launcher is ready to relocate to the next waypoint. After launching, the tear-down operation is scheduled and the launcher is ready to relocate to the next waypoint.

If the SS FU is at a deployed user-defined launch site during this phase, its susceptibilities are adjusted based on the site's susceptibility parameters. Otherwise, the SS FU's susceptibilities to detection and damage remain unchanged. Subsection 4.7.32 describes the susceptibility adjustments at a launch site.

To introduce randomness into the target position, the Random Targeting option, located on the Launch Phase window may be used. The purpose behind this option is to be able to treat a target as a targeted area as opposed to a single point. If selected, a random target position within the target's system radius will be computed by EADSIM. If randomness is eliminated, no error will be applied to the target location.

If this option is selected the random position is computed based on the following methodology illustrated in **Figure 4.7.9-1**.

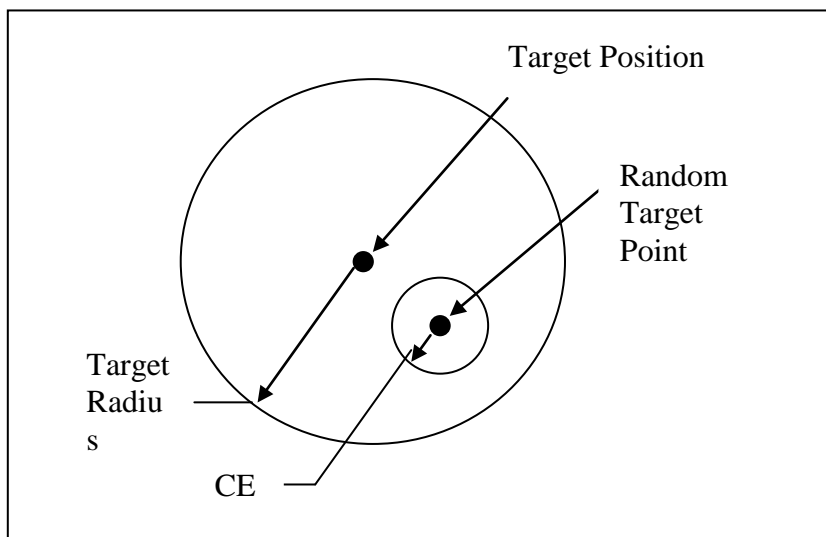


Figure 4.7.9-1 Random Target Position Computation

If Uniform Distribution is selected,

$\sigma = \text{Target Radius}$.

If Gaussian Distribution is selected,

$\sigma = \text{Multiplier} * \text{Target Radius}$,

where

Target Radius = the user-defined radius on the target's System Definition.

Multiplier = the user-defined sigma multiplier

σ = the standard deviation associated with the random position.

For Uniform Distribution, the displacement in the x and y directions are random numbers between +/- the target radius. For Gaussian Distribution, the displacement is calculated by taking a normal distribution with zero mean and given σ . The multiplier can be used to create a concentration of aim points at the target center or more evenly spread across the target radius as the multiplier is increased. Random draws will be taken on x and y until:

$$(X^2 + Y^2) < \text{Target Radius}^2$$

Once X and Y are randomly computed, the displacements are rotated into ECI coordinates containing the new target position. This target position will be the aim point for the missile. If CEP options are selected, the CEP will be applied about this targeted aim point.

4.7.9.2.3 SS FU Tactical Operations (Tear-Down Operation)

The tear-down operation is the part of the Tactical Operations phase that is scheduled after the launch phase has been completed and the weapon is launched, or when the setup operation is complete and no targets exist on the target list. This operation represents the amount of time it takes to take down the launcher and ready it for transport. Upon completion of this operation, the SS FU begins moving to the next waypoint in the waypoint list.

If the SS FU is at a deployed user-defined launch site during this phase, its susceptibilities are adjusted based on the site's susceptibility parameters. Otherwise, the SS FU's susceptibilities to detection and damage remain unchanged. Subsection 4.7.32 describes the susceptibility adjustments at a launch site.

For further explanation of the Tactical Operations phase see section 4.20 of the Methodology Manual.

4.7.9.2.4 SS FU Intercept Phase

The intercept phase evaluates the results of the engagement. The ballistic missile model allows the deployment of a variety of missile objects, both lethal and non-lethal. Lethal objects are objects for which a kill determination is performed upon impact. Kill determinations are not performed when non-lethal objects impact. Booster and RV type objects are considered lethal and will be evaluated for target destruction upon impact. The Booster being a lethal object provides modeling of a non-separating ballistic missile. Debris, PBV, Decoy and Chaff type objects are considered non-lethal and no further processing will occur when they impact.

The intercept phase determines the result of ballistic missile engagements. To determine when to schedule the intercept phase, the C3I model performs a look ahead while updating state information for each scenario interval to determine if a missile impacts within the next scenario interval. The intercept phase is scheduled at the time of missile impact/detonation plus the start time for the phase. For the case where detonation occurs with a non-zero height of burst, intercept phase start time is ignored and the intercept phase is scheduled for the exact time of detonation. For the nuclear detonation case, interceptor missiles and ballistic missile are propagated to the time of detonation to support nuclear area kill determinations. Propagation of ballistic missiles and interceptors is performed by the internal 3-DOF aerodynamic flight model as described in section 5.7.3 of the Methodology Manual.

The specific target is evaluated first. If the ground range from the targeted location to the actual target location is greater than the maximum lethal radius, the target will not be destroyed. The probability of kill against the specific target type is next evaluated against a random draw from a uniform distribution. If the target

does not match a specified target type for which a probability of kill has been defined, the default probability of kill is used. If the engagement is judged a success based on the random draw, three separate conditions are evaluated. If the target is already dead, the intercept is logged as a hit on a dead target (Fail Dead Ground). If the target is an airbase, the action is logged as Hit Base and the airbase is damaged as described in Subsection 4.7.3.2. Otherwise, the engagement is logged as a Success. If randomness is eliminated, the engagements are always a success.

The weapon element definition also provides an option for an area kill against ground platforms. When a weapon with the area kill option selected intercepts the ground platform (i.e., impacts), the lethality of the weapon is evaluated against all platforms within the weapon's lethal radius. For a weapon event platform to be destroyed using area kill, the weapon event platform must not be at its detonation point.

A weapon's Pk can be either a single-value Pk or a Pk table. The Pk tables include the parametrics of downrange and crossrange from the intercept position to the location of the platform being evaluated. Downrange is computed in the horizontal plane along a vector from the launch position to the intercept position. Crossrange is computed along a vector orthogonal to the downrange component in the horizontal plane. These two parametrics can be used to form a two-dimensional table of lethality data. The Pk tables also include a parametric of ground range from the intercept position. This option can be used as a one dimensional table of lethality data. More information about the Pk tables is given in Appendix B6.

A single-value Pk is the user-specified Pk out to the user-defined percentage of the weapon's lethal range. The Pk decreases linearly from the specified value at the user-defined percentage of the weapon's lethal range to a second user-defined percentage of the specified Pk value at the lethal range of the weapon. This Pk is compared with a random draw.

When the target is an SS FU, the weapon's Pk may be degraded to help model protective capabilities of various sites. If the SS FU is at a user-defined site and the site has an anti-weapon, the weapon's Pk is reduced by the effectiveness of the anti-weapon [R(eff)]. The reduction is computed as:

$$Pk(eff) = Pk [1.0 - R(eff)]$$

4.7.9.2.5 SS FU Reload Phase

When the SS FU arrives at a reload site the reload phase is scheduled. During the reload phase, all weapons on the SS FU that require reloading, are reloaded to their count-per-reload value provided the reload site is still alive. The SS FU remains at the site until the maximum of the reload phase timing or the waypoint off-time is reached or until a commanded assignment sends the SS FU on to its next waypoint.

If the reload site is a user-defined site that does not possess any of the required weapons and the SS FU is totally out of weapons, then it either goes to another reload site if it exists; goes to a hide site, if it exists; or remains at this site.

If the reload site is not a user-defined site, then it is assumed that an infinite amount of the necessary weapon(s) exists and the unit reloads to its count-per-reload value(s) for each weapon.

If the SS FU does not require reloading, the FU will remain at the site until the off-time of the waypoint is reached, or until a commanded assignment sends the SS FU on to its next waypoint.

If the SS FU is at a deployed user-defined reload site during this phase, its susceptibilities are adjusted based on the site's susceptibility parameters. Otherwise, the SS FU's susceptibilities to detection and damage remain unchanged. Subsection 4.7.31 describes the susceptibility adjustments at a reload site.

4.7.9.2.6 SS FU Hide Phase

If the SS FU arrives at a hide site, then the hide phase is scheduled for the FU. If the SS FU has weapons and a target, it will stay at the hide site until hide phase repeat time is reached.

If the SS FU has weapons but does not have a target, it will stay at the hide site until the off-time of the waypoint is reached or until commanded to leave. This simulates the time an SS FU waits in a protected area until it is assigned by its commander to engage a target.

If the SS FU does not have weapons, it remains at the hide site until the hide phase time is reached. This simulates the waiting period for a launcher that has just launched a weapon and is getting ready to go to a reload site.

If at a deployed user-defined hide site during this phase, the SS FU's susceptibilities are adjusted based on the site's susceptibility parameters. Otherwise, the SS FU's susceptibilities to detection and damage remain unchanged. Subsection 4.7.30 describes the susceptibility adjustments at a hide site.

4.7.9.3 SS FU Received Message Processing

The SS FU message-processing routine receives target assignments from a Ground Attacker Commander or ground-capable Flexible Commander and sends acknowledgments to the commander as to whether the command was executed. If a weapon can be launched, the launch phase is scheduled to execute the launch. If the commanding unit is a Ground Attacker Commander or Flexible Commander then a COMPLETE message is sent after the intercept phase so that a Battle Damage Assessment (BDA) may be performed by an AGAttacker or an Intel Center.

4.7.9.4 SS FU System Configuration

The SS FU ruleset can be used only on ground platforms. A communications device and weapons are recommended. Valid weapon types are surface-to-surface weapons, either a ballistic missile or a weapon defined as a captive platform or complex weapon using the AGAttacker ruleset and a specified airframe. Sensors are not used. The SS FU cannot be a commander, a flight leader, or a wingman. The SS FU can be commanded by a Ground Attacker Commander or a ground-capable Flexible Commander. Asset lists are not used.

4.7.9.5 SS FU Network Recommendations

A duplex link with message class command to the SS FU's commander is recommended.

4.7.10 Red Transporter Erector Launcher (Red TEL)

4.7.10.1 Red TEL Overview

The Red TEL launches surface-to-surface weapons against scripted targets. These surface-to-surface weapons can either be a ballistic missile or a weapon defined as a captive platform or complex weapon using the AGAttacker ruleset and a specified airframe. The Red TEL launches surface-to-surface weapons at scripted targets, if the targets are within range, and determines the outcome of the engagement.

4.7.10.2 Red TEL Battle Management Phases

The Red TEL utilizes launch and intercept phases.

4.7.10.2.1 Red TEL Launch Phase

Platforms using the Red TEL ruleset launch surface-to-surface weapons at a predefined target, if that target is within range. The time of the launch is specified by the user when deploying the Red TEL platform.

To introduce randomness into the target position, the Random Targeting option, located on the Launch Phase window may be used. The purpose behind this option is to be able to treat a target as a targeted area as opposed to a single point. If selected, a random target position within the target's system radius will be computed by EADSIM. If randomness is eliminated, the target position will not be errored.

If this option is selected the random position is computed based on the following methodology illustrated in **Figure 4.7.10-1**.

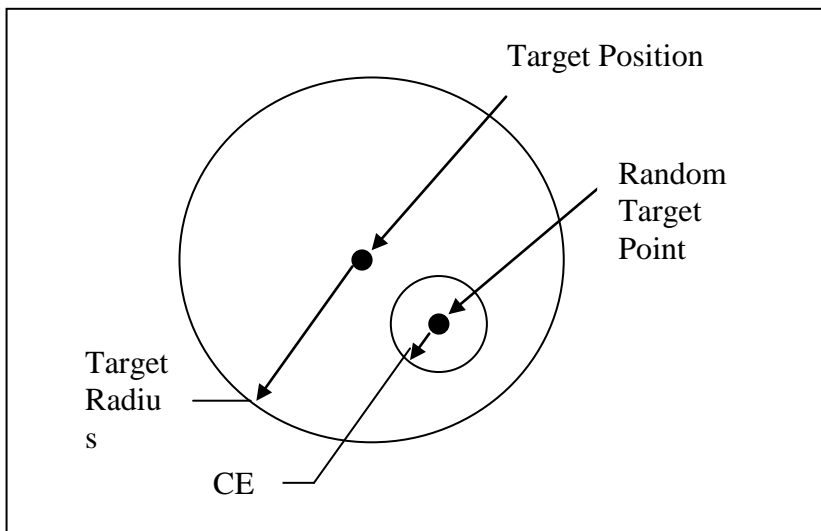


Figure 4.7.10-1 Random Target Position Computation

If Uniform Distribution is selected,

σ = Target Radius.

If Gaussian Distribution is selected,

σ = Multiplier * Target Radius,

where

Target Radius = the user-defined radius on the target's System Definition.

Multiplier = the user-defined sigma multiplier

σ = the standard deviation associated with the random position.

For Uniform Distribution, the displacement in the x and y directions are random numbers between +/- the target radius. For Gaussian Distribution, the displacement is calculated by taking a normal distribution with zero mean and given σ . The multiplier can be used to create a concentration of aim points at the target center or more evenly spread across the target radius as the multiplier is increased. Random draws will be taken on x and y until:

$$(X^2 + Y^2) < \text{Target Radius}^2$$

Once X and Y are randomly computed, the displacements are rotated into ECI coordinates containing the new target position. This target position will be the aim point for the missile. If CEP options are selected, the CEP will be applied about this targeted aim point.

4.7.10.2.2 Red TEL Intercept Phase

During the Red TEL intercept phase, a determination is made as to whether the launched missile succeeded or failed. The determination is identical to that of the SS FU intercept phase. The intercept phase is scheduled after the launched missile has impacted, as determined by flight processing.

The intercept phase determines the result of ballistic missile engagements. To determine when to schedule the intercept phase, the C3I model performs a look ahead while updating state information for each scenario interval to determine if a missile impacts within the next scenario interval. The intercept phase is scheduled at the time of missile impact/detonation plus the start time for the phase. For the case where detonation occurs with a non-zero height of burst, intercept phase start time is ignored and the intercept phase is scheduled for the exact time of detonation. For the nuclear detonation case, interceptor missiles and ballistic missile are propagated to the time of detonation to support nuclear area kill

determinations. Propagation of ballistic missiles and interceptors is performed by the internal 3-DOF aerodynamic flight model as described in section 5.7.3 of the Methodology Manual.

4.7.10.3 Red TEL Received Message Processing

The Red TEL has no message-processing capability.

4.7.10.4 Red TEL System Configuration

The Red TEL ruleset can be used only on ground platforms. Sensors and communications devices are not used. Valid weapon types are surface-to-surface weapons, either a ballistic missile or a weapon defined as a captive platform or complex weapon using the AGAttacker ruleset and a specified airframe. The Red TEL uses scripted targets; it does not use assets. The Red TEL cannot be a commander nor have a commander; the Red TEL cannot be a flight leader or a wingman.

4.7.10.5 Red TEL Network Recommendations

Establishing networks with the Red TEL is not required as the Red TEL does not have a message-processing capability.