JTLS-2020-15046 Include Aircraft In Tactical Intel Reports

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1.0 Summary of Model Change Request

Aggregate Resolution Units (ARUs) and High Resolution Units (HRUs) provide Tactical Intelligence Reports. These reports represent the information Units and HRUs gather on a continual basis and include Convoys, Units, and HRUs coming into and out of a Unit's or HRU's area of operations. This ECP requests that aircraft information be added to Tactical Intel Reports.

2.0 Design Summary

2.1 Current Capabilities

Currently, JTLS-GO provides Tactical Intel information for the objects listed in Table 1.

Table 1. Objects Included in Tactical Intel Report

TYPE OBJECT
Target
Unit
HRU
Convoy

Tactical Intelligence reports include detection information picked up by HRU or ARU Lookouts. By default, both HRUs and ARUs are given a visual sensor from the INTELLIGENCE INFORMATION PROTOTYPE, which is the IIP VISUAL SENSOR. This is the default sensor the model uses when processing HRU and ARU lookout detections. If the Unit or HRU has a stronger or longer range visual sensor than the one listed by the IIP, then the stronger sensor is selected.

2.2 Design Approach

This design envisions renaming IIP VISUAL SENSOR to IIP GROUND VISUAL SENSOR and adding an IIP AIR VISUAL SENSOR. As implied, the IIP GROUND VISUAL SENSOR will be used to process ground lookout detections and the IIP AIR VISUAL SENSOR will be used to process air lookout detections.

3.0 Detailed Design

3.1 Deploying Lookouts

When a Unit or HRU is created or moves, a similar process is followed to deploy lookouts. First, all grids which are covered by the sensor of the Unit or HRU are gathered. The grids within range are determined by using the location of the Unit or HRU as a center point and then extending out to the lookout range of the Unit or HRU.

a. Unit Lookout Range = Unit Radius + TUP/SUP Organic Range

b. HRU Lookout Range = HRU Radius + Longest Visual Sensor Range

These grids are placed in the Effects Set of the Unit or HRU. Once the appropriate grids have been gathered, the lookouts begin the detection process using the following steps:

1. Calculate the Baseline Probability of detection of the visual sensor of the Unit or HRU. The Baseline Probability is the ST EFFECTIVENESS of the Sensor degraded by the ST NIGHT FACTOR depending on the light condition.

2. Calculate the Working Probability of detection which is the Baseline Probability * Sensor Type Weather Condition Factor.

3. Calculate the Final Probability of detection based off the type of object as described in Table 2.

4. Calculate a random draw for detection using .RNS.SENSOR.DETECTION to determine if a detection was made or not.

Table 2. Probability of Detection Modifiers by Object Type

TYPE OBJECT	DETECTION MODIFIERS
Target	Probability of detection affected by the Target's category and whether the Target is mobile and moving with its owning unit or stationary. Additional multiplier added to detection if it is a Naval-based Target.
Naval Unit	Probability of detection affected by terrain type and depth of the Naval Unit.
Ground Unit	Probability of detection affected by the sheltering status of the unit.
HRU	Covert HRUs and Underwater HRUs cannot be detected by lookouts. Probability of detection affected by HUP NON COVERT DETECTION MULTIPLIER.
Convoy	No special multipliers have an effect on detection probability.

Based on the random draw, the object is either detected or not detected. Figure 1 summarizes the current detection process that occurs after the random draw is processed.

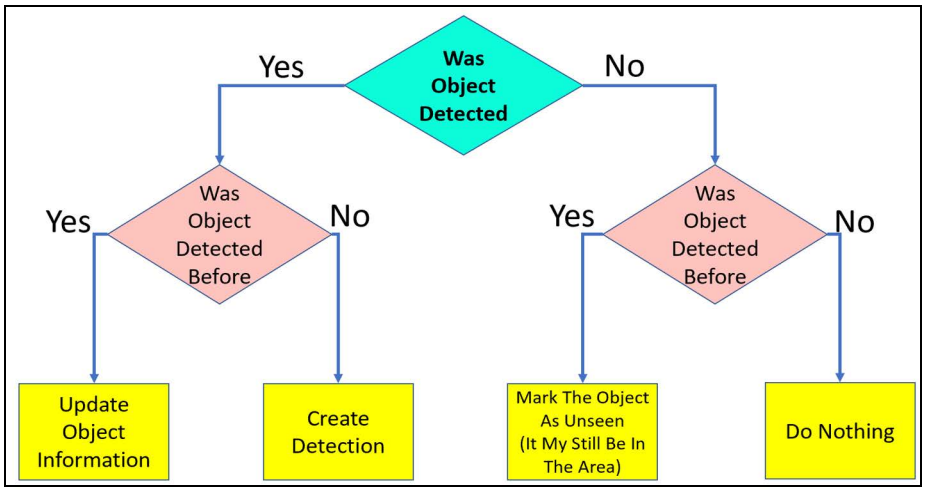

Figure 1. Detection Flowchart

3.2 Checking for Lookouts

If a Unit, HRU, or Convoy moves, the model checks for lookouts in the area. For every lookout that exists in the area, the model executes the following logic process:

1. Check if the moving or changing object is within the Lookout Range of the Unit or HRU.

2. Calculate the Baseline Probability of detection of the visual sensor of the Unit or HRU. The Baseline Probability is the ST EFFECTIVENESS of the Sensor degraded by the ST NIGHT FACTOR depending on the light condition.

3. Calculate the Final Probability of detection based off the type of object as described above in Table 2.

4. Calculate a random draw for detection using .RNS.HRU.DETECTION to determine if a detection was made or not.

> Note: the Design Team has noted the inconsistency between this logic and the lookout lay down logic in the use of different random number streams. This inconsistency oversight has absolutely no affect on the model operations, but will be corrected while implementing this ECP. Instead of using the.RNS.HRU.DETECTION, the .RNS.SENSOR.DETECTION stream will be used when the look outs are laid down for the first time and used when an object moves.

If random draw indicates that the object is detected, the logic outline in Table 3 is followed based on the type of the moving object. As noted, convoys have some special logic because the starting of major tasks are subject to detection and reporting as part of the periodic intelligence report.

Table 3. Type Occurrence Reported in HRU or ARU Tactical Intel Report

TYPE OCCURRENCE	TYPE OF INTEL REPORTED
Object Arriving in the detecting object's lookout area. Except for convoys.	Minimum Level of Intel reported immediately.
Object Leaving the detecting object's lookout area. Except for convoys.	Once last immediate intelligence update. Level of Intel Reported dependent upon how long unit has been in the area
Object Moved within the area covered by the detecting object's lookout area. Except for convoys.	Immediate intelligence update, with Level Intel Reported dependent upon how long unit has been in the area.
Convoy movement and major posture or task changes: Loading, Offloading. Convoys are Essential Elements of Information (EEI) for HRU reporting.	Convoy change recorded for periodic message summary. Convoys currently are not perceived objects within JTLS-GO; thus, their information is only made available to a foreign detecting side as part of a message. Making convoys a perceived object is well beyond this ECP, but should be consider for the future making the proposed implementation more consistent.

3.3 Lookouts For Air Missions

Air Mission are much like Convoys except, while flying, an Air Mission can be perceive and tracked by foreign sides. Although Air Missions on the ground can be detected and reported in messages create by satellites or reconnaissance missions, they are currently not perceivable objects within JTLS-GO. Only flying Air Mission can be detected and tracked by foreign sides. This design needs to address, how Lookout detections for Air Missions will be processed while an Air Mission is on the ground and while it moves.

3.3.1 Lookouts For Air Missions On The Ground

It is beyond the scope of this ECP to make ground-based Air Missions a perceivable object; therefore, the plan is to treat ground-based Air Missions exactly as we treat Convoys. Each time an Air Mission executes a major task and the mission is covered by a foreign lookout, the model will determine if the change in task is observed.

The tasks listed in Table 4 will trigger a check for lookouts covering the location of the air mission. In all circumstances, if an HRU lookout accomplished the detection, an appropriate EEI will trigger an emergency report. If no emergency report is triggered, the normal report will contain the information described in Table 4.

Table 4. Reportable Air Mission Ground Tasks

MISSION TASK	COMPLETION TRIGGERS LOOK	EXPLANATION
Task Alert	Yes	The mission will be simply reported as starting alert. A task completion will only be reported if the mission is not completing alert to go on a mission or intercept.
Task Load Supplies	No	Other than the fact that supplies are being loaded, no other information will be provided.
Task Offload Supplies	No	Other than the fact that supplies are being offloaded, no other information will be provided.
Task Load Unit	No	The mission and type of unit being loaded will be provided in the resulting detection. The perceived name of the unit being loaded will be provided in the report.
Task Offload Unit	No	The mission and type of unit being offloaded will be provided in the resulting detection. The perceived name of the unit being loaded will be provided in the report.
Task Rearm	No	The mission will be simply reported as rearming.
Task Refuel	No	The mission will be simply reported as refueling.

For consistency, the reporting of convoy information will be changed to match the same information that Table 4 indicates for air mission. Currently Convoys only report the fact they are loading or offloading. There is no mention of what is being loaded or offloaded.

5. The computation for detection will work as it currently does for Convoys and will use the IIP GROUND SENSOR as it does for units, HRUs, and convoys. This means that Table 2 and Table 3 will be expanded to include Air Missions. The expanded full tables are provided as Table 5 and Table 9.

Table 5. Expanded Table 2 Probability of Detection Modifiers by Object Type

TYPE OBJECT	DETECTION MODIFIERS
Target	Probability of detection affected by: • The target's underground flag. If set target cannot be detected. • The Target's Category and Sub-Category - IIP TGC PROB DETECTION MULTIPLIER. • The Target's Category and Subcategory mobile multiplier if its owning unit is moving. - IIP TGC MOBILE PD MULT

Table 5. Expanded Table 2 Probability of Detection Modifiers by Object Type

TYPE OBJECT	DETECTION MODIFIERS
Naval Unit	Submerged submarines cannot be detected. All other naval units probability of detection are affected by: • IIP TGC PROB DETECTION MULT for the naval units Ship Unit Prototype (SUP). • If the naval unit is in a dual capable or small island grid: Modified by terrain type TT.SHIP.DETECTION.MULTIPLIER
Ground Unit	Probability of detection affected by: • The unit's sheltering status - If all owned Combat Systems are sheltered, the unit cannot be detected. • The basic type of the unit (Ground, Airbase, Squadron, etc) and the size of the unit. IIP TUT US DETECTION MULTIPLIER
HRU	Covert HRUs and Underwater HRUs cannot be detected by lookouts. Probability of detection affected by HUP NON COVERT DETECTION MULTIPLIER.
Convoy	No special multipliers have an effect on detection probability.
Air Mission on the Ground	The sensor probability will further be modified by the IIP TGC PROB DETECTION MULT for the missions Aircraft Target Type. There is no possibility of considering the ground mission as moving.

Table 6. Expanded Table 3 Reported Information For Tactical Intel Report

TYPE OCCURRENCE	TYPE OF INTEL REPORTED
Object Arriving in the detecting object's lookout area. Except for convoys and Air Mission.	Minimum Level of Intel reported immediately.
Object Leaving the detecting object's lookout area. Except for convoys and Air Mission.	Once last immediate intelligence update. Level of Intel Reported dependent upon how long unit has been in the area
Object Moved within the area covered by the detecting object's lookout area. Except for convoys and Air Mission.	Immediate intelligence update, with Level Intel Reported dependent upon how long unit has been in the area.
Convoy movement and major posture or task changes: Loading, Offloading. Convoys are EEI for HRU reporting.	Convoy change recorded for periodic message summary. Convoys currently are not perceived objects within JTLS-GO; thus, their information is only made available to a foreign detecting side as part of a message.

Table 6. Expanded Table 3 Reported Information For Tactical Intel Report

TYPE OCCURRENCE	TYPE OF INTEL REPORTED
Air Mission major task changes. Air Missions movement on the ground is not represented. Task changes are EEI for HRU reporting. The HRU needs to have an EEI that includes the appropriate Aircraft Target Class.	Air Mission change recorded for periodic message summary. Air Missions while on the ground will not be perceived objects; thus, their information is only made available to a foreign detecting side as part of a message.

3.3.2 Lookouts For Air Missions While Flying

3.3.2.1 Basics Of Flying Air Mission Detections

Air Mission moves, takeoffs, or landings will be handled by the air logic. The IIP AIR VISUAL SENSOR assumed to be available to all units and HRU will be used to handle these detections. The important sensor attributes that will be used for this algorithm include:

- ST RANGE - Air Missions must fall within the range of the IIP AIR VISUAL SENSOR. For a given Unit or HRU, only one set of lookouts will be placed in the covered grids. The longest range sensor, whether that is the IIP GROUND VISUAL SENSOR or the IIP AIR VISUAL SENSOR will be used to determine the grids that are covered for lookouts. When processing flying air missions, a check will be included to compute the distance between the mission and the lookout's owner. This distance must be less than the ST RANGE of the IIP AIR VISUAL SENSOR.

- ST.MAX.DETECTION.ALTITUDE - If the air mission has an altitude greater than this altitude, a lookout detection will not be possible. This leads to the question of at what altitude is a mission assumed to be flying during the "Take Off" and "Landing" process. The details concerning this process are described in Section 3.3.2.2.

- ST PROB ACURATE REPORT - If a flying air mission is detected, then a random number will be drawn to determine if the reporting Unit or HRU can determine the exact type of aircraft or only the Aircraft Target Class. For example, assume that an F35A is detected and the IIP AIR VISUAL SENSOR has an ST PROB ACCURATE REPORT of 0.40 and a random number of 0.86 is drawn. This results in an "Inaccurate Report" and the detection will be reported as a "5TH.GENERATION.FIGHTER" instead of an F35A.

- ST REAL TIME FLAG - If set to No, then the detected mission will only exist in the Unit or HRU Report. It will not update the perception of the mission. If set to YES, then the detection will update the perception of the Air Mission for the detecting side.

- ST JAM CAPABLE - The Design Team does not expect that the IIP AIR VISUAL SENSOR to be capable of being jammed, but the model will not impose this restriction. If the sensor is jam capable and there are jammers in the area, they can stop the detection.

- ST COP CAPABLE - This database parameter. used to indicate whether the detection information makes its way to the Common Operational Picture (COP), can have one of three values as shown in Table 7. It is fully expected that the IIP AIR VISUAL SENSOR will have an ST COP CAPABLE of NO, but the design will support other values.

Table 7. ST COP CAPABLE Attribute Impact On Flying Tactical Intel Reporting

ST COP CAPABLE	DESCRIPTION
No	The detection will not result in the updating of the Air Mission's COP Location. Even though the air mission will appear on the WHIP as a detected foreign mission, the update will not be provided to the COP but either the Over The Horizon (OTH)-Gold JTLS Operational Interface (JOI) or the Link-16 JOI.
OTH-Gold Capable	The detection will result in updating the Air Mission's COP Location. If the OTH-Gold JOI is running, this will trigger an update to the COP.
Link-16 Capable	The detection will result in updating the Air Mission's COP Location. If the Link-16 JOI is running and the detecting object holds a Link-16 Source JU Number, this will trigger an update to the COP.

3.3.2.2 Special Considerations For Flying Mission Detections

The following additional considerations will be built into the tactical intelligence detections of flying Air Missions:

- Terrain Masking - Terrain masking for the detection will be considered in the same manner it is detected for all other air search sensors that cover the moving mission. If there is any interfering terrain, no detection will be possible.

- Altitude Consideration For Takeoff and Landing - As mentioned, the lookout detection of a moving Air Mission has an altitude limitation. This leads to the question: At what altitude should the model consider an Air Mission to be at when determining if an Air Mission's

take-off or landing is observed? This question is only important when considering whether there is terrain masking to stop the detection of the take-off and landing. Table 8 defines the rules that will be used.

Table 8. Rules For Detecting Take-Offs And Landings

RULE
If the landing location is covered by the IIP GROUND VISUAL SENSOR for the detecting Unit or HRU, the take-off and landing can be observed.
If the mission's current altitude is less than the ST MAX DETECTION ALTITUDE, then the mission's altitude just prior to landing will be used to determine if there is any terrain masking that prevents the detection.
If the mission's current altitude is greater than the ST MAX DETECTION ALTITUDE, then the value of ST MAX DETECTION ALTITUDE will be used to determine if there is any terrain masking that prevents the detection.

- Flying detections will not consider ST PROB ACCURATE DETECTION. This would be contrary to all other flying air mission detections.
- The AAR will not hold landing and takeoff detections but it will include the detection of the flying aircraft.
- As with Ground-based lookout detections, air mission flying detections picked up by an HRU Lookout will trigger and Urgent report if the detecting HRU holds an EEI for the appropriate Aircraft Target Class.

The following Data Constraints have been noted:

- The IIP GROUND VISUAL SENSOR should be a surface search sensor and IIP AIR VISUAL SENSOR should be an air search sensor. A new SVP check should be added to enforce this constraint.

4.0 Data Changes

The following database changes are needed.

IIP GROUND VISUAL SENSOR - Name Change

- Dimension: Variable - Entity Attribute
- Mode: Text
- Unit of Measure: N/A

- Range: The name of a valid SENSOR TYPE.
- Definition: This variable is an attribute of the INTEL INFO PROTOTYPE (IIP) entity. For factions that use this IIP, this variable determines the index to the sensor type that this faction's units use as their default ground visual sensor.
- Relationships: This variable is related to the variables that describe the unit's ability to use their organic assets to detect foreign ground objects, and to the variables that describe HRUs abilities to detect ground objects. The ST MEAN FUSION TIME of this sensor.

IIP AIR VISUAL SENSOR - New Parameter

- Dimension: Variable - Entity Attribute
- Mode: Text
- Unit of Measure: N/A
- Range: The name of a valid SENSOR TYPE.
- Definition: This variable is an attribute of the INTEL INFO PROTOTYPE (IIP) entity. For factions that use this IIP, this variable determines the index to the sensor type that this faction's units use as their default air visual sensor.
- Relationships: This variable is related to the variables that describe the unit's ability to use their organic assets to detect foreign air missions, and to the variables that describe HRUs abilities to detect foreign air mission's.

  The ST MAX DETECTION ALTITUDE of the IIP Visual Sensor will be used to limit the detection of flying air mission detections.

5.0 Order Changes

The orders listed in Table 9 will need to be changed.

Table 9. Design Required Order Changes

ORDER	DESCRIPTION OF NEEDED CHANGE
SET IIP DATA	The current "Visual Sensor" field will be renamed to "Ground Visual Sensor." A new field will be added to change the "Air Visual Sensor." The CEP will ensure that the controller cannot set the Ground Visual Sensor to AIR_SEARCH and the Air Visual Sensor cannot be set to SURFACE_SEARCH.

Table 9. Design Required Order Changes

ORDER	DESCRIPTION OF NEEDED CHANGE
SET SENSOR TYPE DATA	If the sensor type is being used as the IIP GROUND VISUAL SENSOR then the controller cannot change the ST USE to anything other than AIR_SEARCH. Likewise, if the sensor type is being used as the IIP AIR VISUAL SENSOR then the controller should not be allowed to change the ST USE to anything other than AIR_SEARCH.

6.0 JODA Changes

No changes needed.

7.0 Test Plan

The goal of this test plan is to verify that Air Missions can be detected by HRU and ARU Lookouts and are included in Tactical Intelligence Reports.

7.1 Test SET IIP Data Order

Purpose: Verify the IIP Ground and Visual Sensors can be modified.

Step 1: Attempt to change the IIP Ground and IIP Visual Sensors to point to the same sensor. Verify the order is rejected and the controller receives a cannot comply message.

Step 2: Attempt to change the IIP Ground and Visual Sensors to different sensors.

Expected Results: The IIP Ground and Visual Sensors can be changed but cannot point to the same sensor.

7.2 Test the SET SENSOR TYPE Data Order

Purpose: Verify the Sensor Types that are being used by the IIP follow the specified restrictions.

Step 1: Attempt to change the ST USE of a sensor type for which the IIP Ground Visual Sensor is accessing to AIR_SEARCH. Verify the order is rejected and the controller receives a cannot comply message.

Step 2: Attempt to change the ST USE of a sensor type for which the IIP Air Visual Sensor is accessing to SURFACE_SEARCH. Verify the order is rejected and the controller receives a cannot comply message.

Expected Results: The ST USE of a Sensor Class that the IIP Ground and Air Visual Sensors are using cannot be changed.

7.3 Test Air Detections

Purpose: Verify only detectable air missions appear in Tactical Intelligence Reports.

Step 1: Have two air missions take off and ensure one is within the detection range of a nearby HRU. Ensure one air mission is flying along a route at an altitude that is within the detection range of the ARUs and HRUs visual air sensors and the other air mission is flying along a route at a higher altitude.

Expected Results: Both air missions should be reported by the HRU who was in the area during take off. The air mission which was flying at a lower altitude should appear in the Tactical Intelligence reports of units which were in the area. The air mission flying at a higher altitude should only have detection info regarding the mission's take-off and landing.

7.4 Test Ground Detections Of Air Missions

Purpose: Verify air missions are detected when they change tasks on the ground.

Step 1: Setup the situations outlined in Table 10.

Table 10. Ground Mission Lookout Detections

TASK CHANGE	LOOKOUT OBJECT	EXPECTED RESULT
Start Alert	ARU	Alert should be reported in next Tactical Intel Report generated by the detecting unit.
Stop Alert	HRU	Off alert should be reported in next HRU Intel Report generated by the detecting HRU.
Start Loading Supplies	HRU With Aircraft Target Class EEI	Urgent report should be generated reporting the loading of supplies.
Start Offloading Supplies	ARU	Offloading supplies should be reported in next Tactical Intel Report generated by the detecting unit.
Start Loading Unit	HRU	Loading unit should be reported in next HRU Intel Report generated by the detecting HRU.
Start Offloading Unit	HRU With EEI For Offloading Unit	Urgent report should be generated reporting the offloading of the unit.

Table 10. Ground Mission Lookout Detections

TASK CHANGE	LOOKOUT OBJECT	EXPECTED RESULT
Start Rearming	ARU	Rearming should be reported in next Tactical Intel Report generated by the detecting unit.
Start Refueling	HRU	Refueling should be reported in next HRU Intel Report generated by the detecting HRU.