JTLS-2013-11748 Better Representation of Ground Unit UAVs

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1.0 Summary of Model Change Request

This Design Plan encompasses two related Engineering Change Proposals (ECPs), JTLS-2009-10195 Non-Squadron Units Fly UAVs and JTLS-2013-11748 Better Representation of Ground Unit UAVs. Each is concerned will the better representation of Unmanned Aerial Vehicle (UAV) by ground units within JTLS-GO. JTLS-2009-10195 Non-Squadron Units Fly UAVs is being subsumed into this ECP and will no longer be tracked separately.

The overarching goal is to improve the modeling of small-scale, tactical UAVs that are becoming commonplace assets within ground units in the real world. The improvements requested will allow tactical UAV aircraft to launch from ground (non-squadron) units to fly reconnaissance and attack missions.

2.0 Design Summary

2.1 Current Capabilities

Currently in JTLS-GO, small tactical UAVs are implicitly represented by the organic tactical intel collection range of their owning ground unit. An increased range reflects the capability of the unit to gather intelligence using tactical UAVs. Although this implicit methodology does update the owning force side's battlefield view as detections are made, several drawbacks exist.

- Implicit UAVs are not subject to attrition because they don't exist as aircraft missions.
- If the intel collection range becomes excessive, the circular search area grows unrealistically large such that the full covered area yields too much collected data.
- Ground players are not able to actively plan and fly tactical UAV collection missions in exercises for which this may be a training objective.
- Collected data simply updates battlefield perception. No messages are generated for the exercise audience.

Large, high-value UAVs, such as the Global Hawk, Predator, and Reaper, are explicitly represented in JTLS-GO as individual aircraft that fly missions. These UAVs belong to squadrons and, like other aircraft in JTLS-GO, are subject to attrition and are constrained by their actual capabilities. These UAVs are capable of flying reconnaissance and attack missions, based on

their specific aircraft type (class), sensors, and armaments. These assets are not typically flown as tactical collectors by ground commanders.

> Note: Currently, all explicitly flown aircraft (including UAVs) must belong to a squadron unit and each squadron may have only one aircraft type. There are no plans to modify this squadron concept for major aircraft and strategic UAV assets.

2.2 Design Approach

Given the wide variety of tactical UAVs used by ground units in the real world, it is not practical to represent these assets as aircraft assigned to squadrons. To do so would require a separate squadron for each UAV type and multiple squadrons for each ground unit. The number of squadrons required would greatly increase within a given scenario database. Furthermore, these "extra" squadrons would not be present in the training audience's Order of Battle because they represent embedded assets.

This design allows any aircraft that does not require a runway to be owned and flown from any type of unit, not just squadrons. These aircraft do not necessarily need to represent UAVs, but can represent any aircraft (helicopter or UAV) that does not require a runway. This means that Army and Marine helicopters no longer need to be represented as independent squadrons, but can be represented as belonging to the unit that actually owns the air asset.

Only one UAV type would be permitted for each unit. This restriction implies that only the most capable UAV type would be explicitly modeled in each unit. Such a restriction is consistent with current doctrine that typically assigns only one primary UAV type to any given ground unit. Any remaining UAV types would be presumed to be less capable or more tactical and would be represented implicitly in the unit's tactical intel range as they are now.

The player would use the existing JTLS-GO air mission orders (e.g. Recce, OAS, or SEAD) to explicitly launch the UAV. The existing Manage Air Mission Tasks order would be used to add, modify, or cancel specific tasks (e.g. Move, Fire Weapon, etc.). The UAV aircraft would be subject to attrition as other aircraft are now.

3.0 Detailed Design

To implement the new UAV capabilities as described above, significant modifications are necessary in JTLS-GO. Areas impacted include Database Development System (DDS), the Combat Events Program (CEP), Scenario Verification Program (SVP), standard database, and player orders, Each of these are discussed in detail in the following sections.

3.1 Database Development System (DDS)

Several database structure changes are needed to implement this ECP.

3.1.1 UAV As Combat System

Currently there is nothing stopping the database builder from giving any unit type a Combat System that has a CS SPECIAL CAPABILITY of Aircraft. It is unusual to do so, but it is currently not illegal. Thus no changes are required in the definitions to TUP and SUP Combat Systems.

To give a unit its own UAV capability, the database builder needs to add the Combat System that represents Aircraft in the TUP/SUP CS definition table. This record will indicate the TO&E for the unit. The TO&E represents the number of UAVs the unit has. These UAVs will be capable of explicitly flying in the model using existing air mission player orders.

3.1.2 Squadron Unit Attributes For Non-Squadron Units

Any JTLS Unit Type, Ground Combat Unit, Support Unit, Airbase, Forward Arm and Refuel Point (FARP), and Naval Unit, as well as the current Squadron Unit Type will now be allowed to have aircraft Combat Systems. Currently Squadron Units have several unique attributes that the database builder must specify. Table 1 identifies how this needed data will be assigned to other unit types that have the Combat System CS SPECIAL CAPABILITY of Aircraft.

Table 1. Squadron Specific Data Items

SQUADRON ATTRIBUTE	PURPOSE
AIRCRAFT_TYPE	Identifies the single aircraft class that represents the UAV owned by this unit, The ground_unit, support_unit, airbase_unit, farp_unit, naval_unit tables will have this attribute added and the database developer must specifically indicate what single type of aircraft the unit owns, Note that this is a unit characteristic. This means that two Battalions that use the same TUP can be given two different types of UAVs.
MAX SORTIES PER DAY	Identifies the maximum number of sorties that the unit can fly per day. The computation for UAV maintenance will follow the same algorithm followed by squadrons. This means that surging will be allowed, but after several days of surging, UAV maintenance will take longer and fewer sorties will be feasible per day. The ground_unit, support_unit, airbase_unit, farp_unit, naval_unit tables will have this attribute added and the database developer must specifically indicate the maximum sortie rate for the unit.
SQUADRON MISSION TRACK BLOCKS	UAVs flying from non-squadrons will not be able to hold Link-16 tracks. They will be able to report their own location via Link-16, if the aircraft type is Link-16 capable, Each unit in the database currently has Link-16 blocks and if their assigned aircraft are Link-16 capable, enough of the block will be reserved for the Joint Tactical Information Distribution System (JTIDS) Unit (JU) aircraft number. If the unit owns five aircraft, five JU numbers will be reserved for the aircraft. Assigning specific track blocks to each aircraft JU number will be a capability reserved only for squadron owned aircraft and their air missions. More details are discussed in Section 3.1.6.

Table 1. Squadron Specific Data Items

SQUADRON ATTRIBUTE	PURPOSE
NAVAL QUALIFIED	Identifies whether the squadron's pilots are naval qualified. This limits whether the aircraft can or cannot land on naval units. This information will not be placed in the database; instead, it will be implied and set by the model when the initialization database is read in using the following rules: • Squadrons will continue to get this parameter from the database. • Ground units, support units, FARPS, and airbases will assume that the UAVs are not naval qualified. • Naval units will assume that the UAVs are naval qualified.

3.1.3 Mission Support Source

The owning unit will serve as the source of weapons and fuel as needed for UAV missions. Again this will not require any significant code changes because the aircraft from non-squadron units will not be located at an airbase, FARP, or naval unit. As with current independent squadrons, the squadron is responsible for all fuel and weapon needs for the aircraft. SVP checks will be added to ensure the ground unit has aviation fuel and/or weapons required for the UT AIRCRAFT TYPE mission loads.

3.1.4 Attach/Detach Rules

A non-squadron unit that detaches will inherit the UT AIRCRAFT TYPE of the parent unit. attaches are a little more complicated. Table 2 summarizes these rules.

Table 2. Rules For Attaching Two Units With Aircraft

ATTACHING UNIT	ATTACHED TO UNIT	
	UT AIRCRAFT TYPE	UT AIRCRAFT TYPE = NONE
UT AIRCRAFT TYPE	The two aircraft types must be the same even if one of the two units no longer has any aircraft combat systems.	The attach is allowed and the UT AIRCRAFT TYPE for the attached unit is changed to the UT AIRCRAFT TYPE of the attaching unit.
UT AIRTCRAFT TYPE = NONE	This is allowed. The attaching unit should not have any aircraft combat systems.	This attach is allowed always. Neither unit should have any aircraft combat systems,

3.1.5 Resulting Air Missions

No changes will be made to the air mission modeling as a result of this design. An air mission flown from a non-squadron unit will go through the same "Launch Capable" logic currently used for squadron air missions. The air missions will have sensors, weapons, supplies, and fuel, in the same way that squadron air missions currently work. They will use fuel using the same algorithm as air missions currently work.

This means that there are no planned change in the detections created by these non-squadron air missions. The onboard sensors will determine if the mission collects:

- Everything that is covered
- Everything within assigned Directed Search Areas (DSAs)
- Place coverage for special collection assets such as Electronic Intelligence (ELINT) or Communications Intelligence (COMINT).

3.1.6 Detailed Link-16 Discussion

Table 1 identified a Link-16 limitation associated with this design. Currently the JTLS database structure allows what are called Mission Link Blocks to be defined as part of the initialization database. These link blocks look like the example data shown in Table 3.

Table 3. Example Three Aircraft Squadron Mission Track Blocks

LINK-14 MISSION JU NUMBER	TRACK BLOCK START	TRACK BLOCK END
01100	AA100	AA777
01101	AB100	AB&77
01102	AC100	AC777

When an air mission takes off, the mission is assigned a Link-16 JU number and the associated track block. Currently, this design does not call for creating these Link-16 Mission JU numbers with their associated track blocks.

Besides the data specified in Table 3, a squadron also has a Link-16 Start Block value and a Link-16 End Block value. If these are specified, the model will automatically create mission JU numbers without associated Track Blocks. Thus currently for a squadron for which the database builder specified a Link-16 Start Block of 02100 and an Link-16 End Block of 02013, the model

would automatically create Mission Tack Blocks as shown in Table 4.

Table 4. Example Four Aircraft Squadron Mission JU Numbers

LINK-14 MISSION JU NUMBER	TRACK BLOCK START	TRACK BLOCK END
02100	0000	0000
02101	0000	0000
02102	0000	0000
02103	0000	0000

This design only allows for non-squadron air mission to operate as shown in Table 4. This means that the air missions flown from non-squadron will be able to report their own location via Link-16, but they will not be allowed to hold any tracks.

3.1.7 Air Tasking Order (ATO) Translator (ATO-T)

The ATO-T needs to allow the user to link an ATO tasking unit to not only squadrons but any unit on the proper side in the scenario.

3.1.8 UAV Representation Alternatives

3.1.8.1 More Than One Type Of UAV In Squadron

Again, only the most capable UAV owned by the specific ground unit should be the asset designated in this manner by the scenario builder. All other tactical UAV types owned by the unit, if any, will continue to be represented implicitly in the unit's tactical intel range (i.e. the TUP ORGANIC REPORT DISTANCE plus the unit's current radius).

For example, if the scenario requires multiple UAV types assigned to a single battalion-sized unit, the database builder will have two options:

- Assign the most important UAV to the battalion and adjust the organic intel range to represent the less important UAVs in the unit, or
- Establish subordinate company (or smaller) units and assign a different UAV type to each company.

3.1.8.2 UAV Needs A Solid Surface To Takeoff and Land

The scenario builder must take care to ensure the UT AIRCRAFT TYPE for non-squadron aircraft does not require a runway to operate. An SVP check will be added to ensure the UT AIRCRAFT

TYPE for a non-squadron unit holds an aircraft class with AC TAKEOFF LENGTH and AC LAND LENGTH equal to zero.

In some scenarios, the UAV aircraft types assigned to a squadron may also be assigned to a ground unit which usually does not have access to a runway. In the real world, the unit would re-purpose a nearby road or level area to launch and recover the UAV. To represent this situation, the database builder will have two options:

- Create a second aircraft type with identical characteristics, with zero take-off and landing distances, to be assigned to the ground unit, or
- Change the take-off and landing distances to zero for the existing aircraft type so that it can be assigned to either a ground unit or a squadron.

3.1.8.3 UAV Can Hold Link-16 Tracks

If the limitation that non-squadron air missions cannot hold Link-16 tracks is a problem, the scenario builder will have two options:

- Make the UAV a squadron.
- Accept that fact that the UAV cannot report any Link-16 tracks.

3.2 Scenario Verification Program (SVP) Changes

The following SVP changes are required to support this design,

- Non-squadron aircraft must not require a runway. Both AC TAKEOFF LENGTH and AC LAND LENGTH must be zero.
- If a non-squadron unit uses a TUP that has Combat System Aircraft, then the unit must indicate what type of aircraft are held by the unit. This will be considered an Error.
- Similarly, if a non-squadron unit has a specified UT AIRCRAFT TYPE, then the unit must have a Combat System that indicates it represents aircraft. If not such Combat System exists, the SVP will generate a Warning.
- HUPs cannot have COMBAT SYSTEM AIRCRAFT.
- Link16 aircraft cannot be assigned to a non-squadron unit. The structure of assigning a Source JU Number and a Track Block is currently held by Squadron Units. Expanding that structure to all units is not impossible, but the Design Team feels that it is unlikely that these tactical UAVs are Link-16 capable aircraft. As an efficiency, the Design Team is proposing to impose this limitation.

3.3 Player Orders

Existing air mission orders will be used to explicitly launch and fly the individual UAV missions from the assigned ground unit. The following enhancements, at a minimum, are anticipated:

- The Squadron selection list in all air mission orders will be expanded to include any unit type that have an assigned UT AIRCRAFT TYPE (i.e. value greater than zero).

- A Yes/No option will be added to the Reconnaissance order to indicate whether a collections report should be generated for the player.

  Note the UAV aircraft type must carry a ground search sensor with a detection method of DETECTION OBSERVED to generate a report without a Directed Search Area (DSA). If the sensor method is DETECTION INSTANTANEOUS, the player must create a DSA and assign the UAV to collect on that DSA to generate a report, as is the case now for any Reconnaissance mission. All Reconnaissance missions, with or without an assigned DSA, will detect foreign objects and update the force side's perceived view of the battlefield, as always.

3.4 MUSE Considerations

The MUSE external model interfaces with JTLS-GO to provide high fidelity UAV visualization of JTLS entities on the playing field. MUSE launches and controls the positions of aircraft while the game is running. JTLS-GO reflects the MUSE aircraft as external air missions in the model. Cross-model combat is supported in this link between JTLS-GO and MUSE. Currently, MUSE only launches and flies aircraft originating from squadrons. These squadrons are fully owned by MUSE at the start of the game. Unit ownership transfer is not currently supported between JTLS and MUSE.

For MUSE to fly aircraft from ground units, the current system requires that those units be fully owned and controlled by MUSE. However, since MUSE does not model the behaviors of ground-based combat systems, changes to the link between JTLS-GO and MUSE are required. One possible solution is to implement the transfer of ownership for UAV air missions. This would allow JTLS-GO to manage the capabilities of the ground-based combat systems while MUSE controls the airborne aircraft. In this scheme, JTLS-GO would launch a mission and then pass ownership of it to MUSE. JTLS-GO would continue to reflect the MUSE owned air missions until MUSE returned ownership of it. JTLS-GO would then retrieve and return the aircraft back to the ground unit.

In short, the Government has two options:

- Only allow MUSE to continue to fly UAVs from squadrons. This limitation does not seem to be overly burdensome and basically maintains the current implemented capability. Nothing in the design will alter the current MUSE link capability.

- Fund a new ECP that calls for a non-HLA object transfer between JTLS and MUSE. Implementing such a new capability, outside of the HLA-realm, will be useful not only for the UAVs owned by ground units but moving toward a non-HL:A federation between JTLS and more tactical level models. current structure of the link between JTLS and MUSE will require improvements, which are beyond the scope of this ECP. Allowing for the transfer of ownership of air missions is needed to make good use of UAV aircraft in ground units.

4.0 Data Changes

Each of the following DDS Tables will be altered as a result of this design:

- ground_unit
- airbase
- farp
- support_unit
- naval_unit

Each table will have a new attribute that indicates the type of aircraft held by the unit. Unlike the squadron table, this new table field will be optional. If filled, then the combat systems labeled as an aircraft system will be considered to be the indicated aircraft type. The data will be held within the model in the unit attribute called UT AIRCRAFT TYPE.

5.0 Order Changes

The Squadron selection list in all air mission orders will be expanded to include and accept any unit with UT AIRCRAFT TYPE not equal to zero.

The SET UNIT CHARACTERISTIC Order will be changed, to allow the Controller to change the Aircraft Type for any unit that owns Combat Systems designated as aircraft.

A report option (Yes/No) will be added to the Reconnaissance mission order. The Yes option will cause a collections report to be generated if the UAV aircraft is carrying a ground sensor with a detection method of DETECTION OBSERVED; otherwise, Yes will have no effect. The default value will be No.

6.0 JODA Changes

The unit attribute UT AIRCRAFT TYPE will be added as a JODA attribute. The attribute will be necessary to manage data displayed in the Information Management Terminals (IMTs).

The existing IMTs will be utilized to track missions launched from ground units. However, ground units will now be included in the Squadron IMT if their UT AIRCRAFT TYPE is non-zero. In addition, a new filter tab “Unit Type” will be added to the Squadron IMT configuration screen to filter which unit types are displayed. The list will include Airbase, Ground, Squadron, Support, Naval, and FARP. The default will be Squadron (only).

7.0 Test Plan

Text [*Describe the basic test objectives and procedures. This Test Plan section may be published as a separate document.*]

7.1 Test 1 Title

Purpose: [*Describe the specific feature, function, or behavior to be tested or measured.*]

Step 1: Text

Step 2: Text

Expected Results: [*Describe the specific model behavior to be observed.*]

7.2 Test 2 Title

Purpose: [*Describe the specific feature, function, or behavior to be tested or measured.*]

Step 1: Text

Step 2: Text

Expected Results: [*Describe the specific model behavior to be observed.*]