

Delta3D
Articulated Parts Rigging Guide

V. 1.6

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Table of Contents

1 Introduction..... 3

2 Vehicles..... 3

 2.1 Wheeled Vehicles 3

 2.1.1 Naming Examples..... 4

 2.2 Tank Vehicles 4

3 Case Example - HMMWV..... 6

4 Nodes 8

 4.1 Level of Detail Nodes (LOD's) 8

 4.2 Degrees of Freedom Nodes (DOF's) 8

 4.3 Group Nodes 9

5 JSAF DOF References..... 9

1 Introduction

The following guide outlines a possible naming convention and use of DOF nodes when rigging static mesh models for use in Delta3D. This guide has been written with the technologies of the OSGExp exporter for 3DS Max in mind. The guide is general enough however to be used with other software applications that support the open flight format for DOFTransform nodes.

2 Vehicles

2.1 Wheeled Vehicles

The following example is based on a four wheel static mesh model. The figure below has 4 wheels that are each attached to the axle. This means that there will be 4 DOF's.

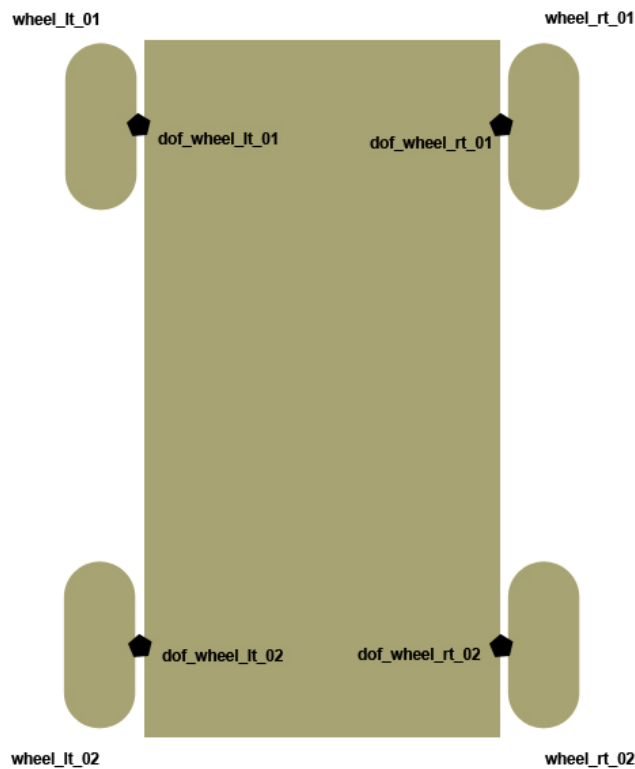


Figure 1: 4 Wheel Vehicle Static Mesh Model

The naming convention for static meshes is very simple.

1. In the figure above the front tires are labeled [object]_[side]_[number]. Note that the only time you would add a number to a label is to indicate its position in the model. If our model had additional tires in the rear, the

labels would reflect this with [wheel]_[direction]_03. If you were modeling a metal chain that required articulation, the chain would have links named [link]_01, [link]_02, [link]_03 etc...

2. The dof nodes are named almost identical to the mesh labels with the addition of 'dof'. So a typical dof node will be named dof_[object-label]. In the example above a wheel would have dof_wheel_lt_02.
3. The additional 'lt' and 'rt' included in the static mesh label indicates its side in the model.

2.1.1 Naming Examples

4 Wheeled vehicle naming convention:

[object]_[side]_[number]

2 Wheeled vehicle naming convention:

[object-label]_[number]

2.2 Tank Vehicles

The following example is based on a simple two gun static mesh model.

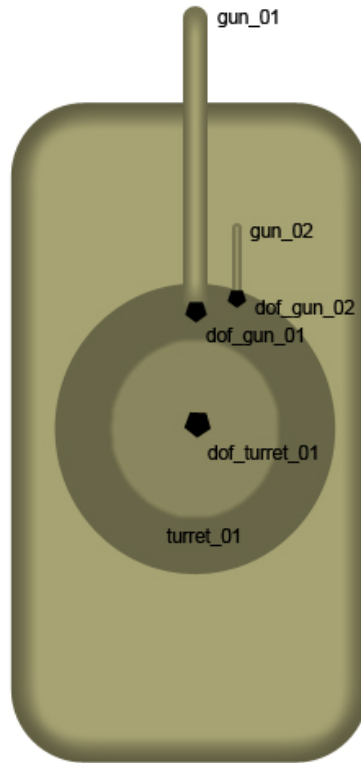
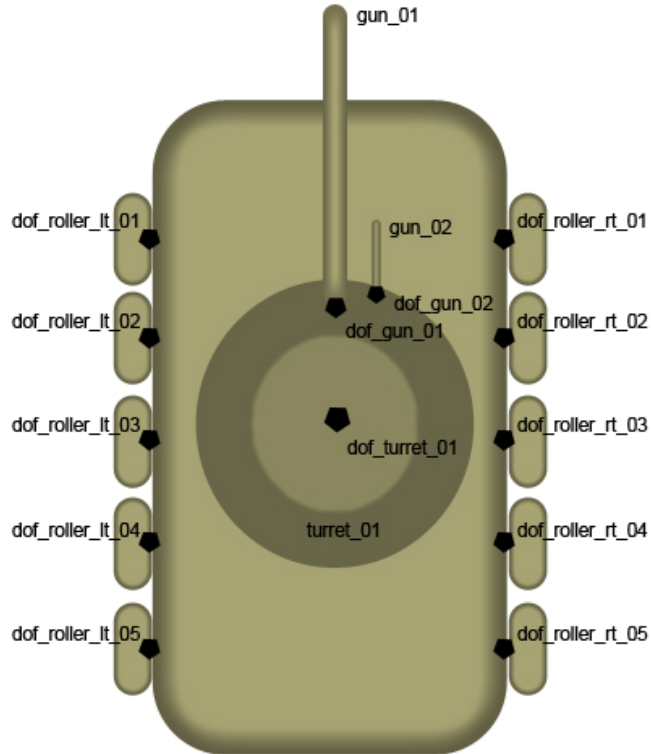


Figure 2: Tank Static Mesh Model

1. Guns should be named simply `gun_[number]`. The dof for the guns should be named `dof_gun_[number]`.
2. Turrets should be named `turret_[number]` and the dof for the turret should be named `dof_turret_[number]`.

The rules for naming the tread rollers are the same as for the vehicle naming convention listed in **figure 1**.

You can see what the dof naming convention would look like from the figure below.



3 Case Example - HMMWV

The following is the rigging hierarchy for an HMMWV (Hummer) vehicle that has 4 wheels. Additionally the vehicle has 5 LOD's for the chassis and 4 LOD's for the wheels.

HMMWV – Wheeled vehicle

- model_group
 - dof_chassis
 - lod_chassis
 - hmmwv_xhigh
 - hmmwv_high
 - hmmwv_medium
 - hmmwv_low
 - hmmwv_xlow
 - dof_wheel_rt_01
 - lod_wheel_rt_01
 - wheel_rt_01_xhigh
 - wheel_rt_01_high
 - wheel_rt_01_medium
 - wheel_rt_01_low
 - dof_wheel_lt_01
 - lod_wheel_lt_01

- wheel_rt_01_xhigh
- wheel_rt_01_high
- wheel_rt_01_medium
- wheel_rt_01_low
- dof_wheel_rt_02
 - lod_wheel_rt_02
 - wheel_rt_02_xhigh
 - wheel_rt_02_high
 - wheel_rt_02_medium
 - wheel_rt_02_low
- dof_wheel_lt_02
 - lod_wheel_lt_02
 - wheel_lt_02_xhigh
 - wheel_lt_02_high
 - wheel_lt_02_medium
 - wheel_lt_02_low
- dof_turret_01
 - turret_group_01
 - lod_turret_01
 - turret_01_xhigh
 - turret_01_high
 - turret_01_medium
 - turret_01_low
 - turret_01_xlow
 - dof_gun_01
 - lod_large_gun
 - large_gun_xhigh
 - large_gun_high
 - large_gun_medium
 - large_gun_low
 - large_gun_xlow
 - dof_gun_02
 - lod_small_gun
 - small_gun_xhigh

Let's take the hierarchy one step at a time. The first node you see is a group node, named 'model_group'. The reason we have a group node on the root is so we can use this nodes transform while grouping all sub nodes. The next node in our hierarchy is the dof_chassis node. This node includes the lod_chassis node which includes all appropriate chassis static mesh data. After this we have the dof's in our group for the wheels and the turret.

To properly set up your models scene graph you'll need to understand and follow a couple simple rules about nodes. The following sections will give you more specific implementation details.

4 Nodes

4.1 Level of Detail Nodes (LOD's)

You'll need to add all resolutions of your geometry to an lod. So with 4 levels of detail for the front left tire, you would assign:

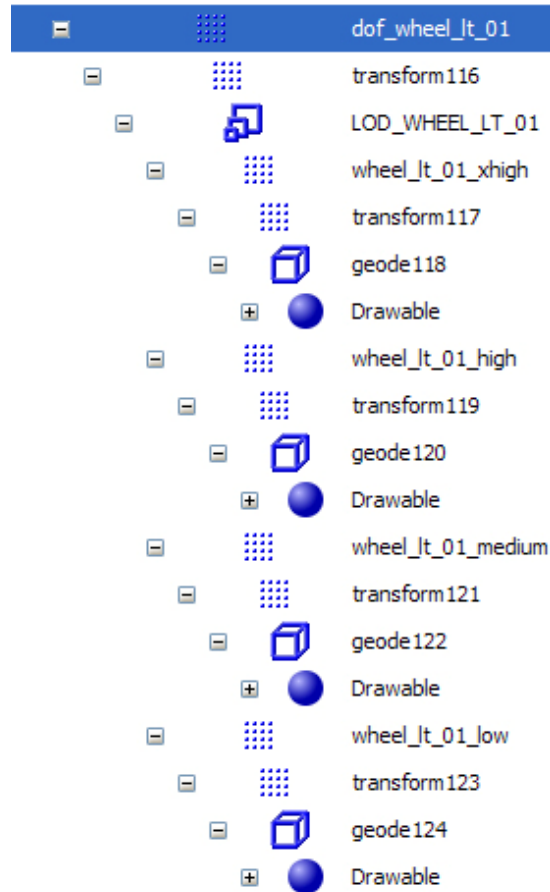
- lod_wheel_lt_01 (lod node)
 - wheel_lt_01_xhigh (geometry)
 - wheel_lt_01_high (geometry)
 - wheel_lt_01_medium (geometry)
 - wheel_lt_01_low (geometry)

4.2 Degrees of Freedom Nodes (DOF's)

Once you have your lod nodes in place you'll need to assign them to your dof nodes.

- dof_wheel_lt_01
 - lod_wheel_lt_01

To help explain what we've discussed so far we can use the following OSGExp screen capture. You can see the breakdown of the HMMWV models scene graph for the dof_wheel_lt_01 node. Under the dof_wheel_lt_01 node we have a position (transform116) and an assigned lod_wheel_lt_01 node



That gives you an idea of what your scene graph should look like.

4.3 Group Nodes

You're probably wondering why you need group nodes. Well these actually parent your dof nodes to lod's. If you examine the above HMMWV hierarchy you can clearly see how they work. The group node right under the dof_hmmwv is 'grouping' the lod for the chassis and all the dof's for the tires. This allows all those nodes to be assigned to one dof node!

5 JSAF DOF References

Many groups using Delta3D are involved in Modeling and Simulation. Often times, you may find yourself linking your application to other simulations like Joint Semi-Automated Forces (JSAF). Below is an example table of articulations used by JSAF. The number value is used as the 'key' that is sent over HLA. In addition, the table shows the relevant JSAF name and what you might consider naming your DOF node in your model file.

JSAF Name	JSAF Key	Delta3D DOF Name
"Other"	0	""
"Rudder"	1024	"dof_rudder"
"LeftFlap"	1056	"dof_left_flap"
"RightFlap"	1088	"dof_right_flap"
"LeftAileron"	1120	"dof_left_aileron"
"RightAileron"	1152	"dof_right_aileron"
"HelicopterMainRotor"	1184	"dof_heli_main_rotor"
"HelicopterTailRotor"	1216	"dof_heli_tail_rotor"
"OtherAircraftControlSurfaces"	1248	"dof_aircraft_control_surface"
"Periscope"	2048	"dof_periscope"
"GenericAntenna"	2080	"dof_generic_antenna"
"Snorkel"	2112	"dof_snorkel"
"OtherExtendableParts"	2144	"dof_other_extend_part"
"LandingGear"	3072	"dof_landing_gear"
"TailHook"	3104	"dof_tail_hook"
"SpeedBrake"	3136	"dof_speed_break"
"LeftWeaponBayDoors"	3168	"dof_left_weapon_bay_doors"
"RightWeaponBayDoors"	3200	"dof_right_weapon_bay_doors"
"TankOrAPChatch"	3232	"dof_tank_apc_hatch"
"Wingsweep"	3264	"dof_wing_sweep"
"BridgeLauncher"	3296	"dof_bridge_launcher"
"BridgeSection1"	3328	"dof_bridge_section_01"
"BridgeSection2"	3360	"dof_bridge_section_02"
"BridgeSection3"	3392	"dof_bridge_section_02"
"PrimaryBlade1"	3424	"dof_primary_blade_01"
"PrimaryBlade2"	3456	"dof_primary_blade_02"
"PrimaryBoom"	3488	"dof_primary_boom"
"PrimaryLauncherArm"	3520	"dof_primary_launcher_arm"
"OtherFixedPositionParts"	3552	"dof_other_fixed_position_parts"
"PrimaryTurretNumber1"	4096	"dof_turret_01"
"PrimaryTurretNumber2"	4128	
"PrimaryTurretNumber3"	4160	
"PrimaryTurretNumber4"	4192	
"PrimaryTurretNumber5"	4224	
"PrimaryTurretNumber6"	4256	
"PrimaryTurretNumber7"	4288	
"PrimaryTurretNumber8"	4320	
"PrimaryTurretNumber9"	4352	
"PrimaryTurretNumber10"	4384	
"PrimaryGunNumber1"	4416	"dof_gun_01"
"PrimaryGunNumber2"	4448	
"PrimaryGunNumber3"	4480	
"PrimaryGunNumber4"	4512	
"PrimaryGunNumber5"	4544	
"PrimaryGunNumber6"	4576	
"PrimaryGunNumber7"	4608	
"PrimaryGunNumber8"	4640	
"PrimaryGunNumber9"	4672	
"PrimaryGunNumber10"	4704	
"PrimaryLauncher1"	4736	"dof_pri_launcher_01"
"PrimaryLauncher2"	4768	"dof_pri_launcher_02"
"PrimaryLauncher3"	4800	"dof_pri_launcher_03"
"PrimaryLauncher4"	4832	"dof_pri_launcher_04"
"PrimaryLauncher5"	4864	"dof_pri_launcher_05"
"PrimaryLauncher6"	4896	"dof_pri_launcher_06"
"PrimaryLauncher7"	4928	"dof_pri_launcher_07"
"PrimaryLauncher8"	4960	"dof_pri_launcher_08"
"PrimaryLauncher9"	4992	"dof_pri_launcher_09"
"PrimaryLauncher10"	5024	"dof_pri_launcher_10"
"PrimaryDefenseSystems1"	5056	"dof_pri_defense_system_01"
"PrimaryDefenseSystems2"	5088	"dof_pri_defense_system_02"
"PrimaryDefenseSystems3"	5120	"dof_pri_defense_system_03"
"PrimaryDefenseSystems4"	5152	"dof_pri_defense_system_04"
"PrimaryDefenseSystems5"	5184	"dof_pri_defense_system_05"
"PrimaryDefenseSystems6"	5216	"dof_pri_defense_system_06"
"PrimaryDefenseSystems7"	5248	"dof_pri_defense_system_07"
"PrimaryDefenseSystems8"	5280	"dof_pri_defense_system_08"
"PrimaryDefenseSystems9"	5312	"dof_pri_defense_system_09"

"PrimaryDefenseSystems10"	5344	"dof_pri_defense_system_10"
"PrimaryRadar1"	5376	"dof_pri_radar_01"
"PrimaryRadar2"	5408	"dof_pri_radar_02"
"PrimaryRadar3"	5440	"dof_pri_radar_03"
"PrimaryRadar4"	5472	"dof_pri_radar_04"
"PrimaryRadar5"	5504	"dof_pri_radar_05"
"PrimaryRadar6"	5536	"dof_pri_radar_06"
"PrimaryRadar7"	5568	"dof_pri_radar_07"
"PrimaryRadar8"	5600	"dof_pri_radar_08"
"PrimaryRadar9"	5632	"dof_pri_radar_09"
"PrimaryRadar10"	5664	"dof_pri_radar_10"
"SecondaryTurretNumber1"	5696	"dof_turret_02"
"SecondaryTurretNumber2"	5728	
"SecondaryTurretNumber3"	5760	
"SecondaryTurretNumber4"	5792	
"SecondaryTurretNumber5"	5824	
"SecondaryTurretNumber6"	5856	
"SecondaryTurretNumber7"	5888	
"SecondaryTurretNumber8"	5920	
"SecondaryTurretNumber9"	5952	
"SecondaryTurretNumber10"	5984	
"SecondaryGunNumber1"	6016	"dof_gun_02"
"SecondaryGunNumber2"	6048	
"SecondaryGunNumber3"	6080	
"SecondaryGunNumber4"	6112	
"SecondaryGunNumber5"	6144	
"SecondaryGunNumber6"	6176	
"SecondaryGunNumber7"	6208	
"SecondaryGunNumber8"	6240	
"SecondaryGunNumber9"	6272	
"SecondaryGunNumber10"	6304	
"SecondaryLauncher1"	6336	"dof_sec_launcher_01"
"SecondaryLauncher2"	6368	"dof_sec_launcher_02"
"SecondaryLauncher3"	6400	"dof_sec_launcher_03"
"SecondaryLauncher4"	6432	"dof_sec_launcher_04"
"SecondaryLauncher5"	6464	"dof_sec_launcher_05"
"SecondaryLauncher6"	6496	"dof_sec_launcher_06"
"SecondaryLauncher7"	6528	"dof_sec_launcher_07"
"SecondaryLauncher8"	6560	"dof_sec_launcher_08"
"SecondaryLauncher9"	6592	"dof_sec_launcher_09"
"SecondaryLauncher10"	6624	"dof_sec_launcher_10"
"SecondaryDefenseSystems1"	6656	"dof_sec_defense_system_01"
"SecondaryDefenseSystems2"	6688	"dof_sec_defense_system_02"
"SecondaryDefenseSystems3"	6720	"dof_sec_defense_system_03"
"SecondaryDefenseSystems4"	6752	"dof_sec_defense_system_04"
"SecondaryDefenseSystems5"	6784	"dof_sec_defense_system_05"
"SecondaryDefenseSystems6"	6816	"dof_sec_defense_system_06"
"SecondaryDefenseSystems7"	6848	"dof_sec_defense_system_07"
"SecondaryDefenseSystems8"	6880	"dof_sec_defense_system_08"
"SecondaryDefenseSystems9"	6912	"dof_sec_defense_system_09"
"SecondaryDefenseSystems10"	6944	"dof_sec_defense_system_10"
"SecondaryRadar1"	6976	"dof_sec_radar_01"
"SecondaryRadar2"	7008	"dof_sec_radar_02"
"SecondaryRadar3"	7040	"dof_sec_radar_03"
"SecondaryRadar4"	7072	"dof_sec_radar_04"
"SecondaryRadar5"	7104	"dof_sec_radar_05"
"SecondaryRadar6"	7136	"dof_sec_radar_06"
"SecondaryRadar7"	7168	"dof_sec_radar_07"
"SecondaryRadar8"	7200	"dof_sec_radar_08"
"SecondaryRadar9"	7232	"dof_sec_radar_09"
"SecondaryRadar10"	7264	"dof_sec_radar_10"
"DeckElevator1"	7296	"dof_deck_elevator_01"
"DeckElevator2"	7328	"dof_deck_elevator_02"
"Catapult1"	7360	"dof_catapult_01"
"Catapult2"	7392	"dof_catapult_02"
"JetBlastDeflector1"	7424	"dof_jet_blast_deflector_01"
"JetBlastDeflector2"	7456	"dof_jet_blast_deflector_02"
"ArrestorWires1"	7488	"dof_arrestor_wires_01"
"ArrestorWires2"	7520	"dof_arrestor_wires_01"
"ArrestorWires3"	7552	"dof_arrestor_wires_03"
"WingOrRotorFold"	7584	"dof_wing_or_rotor_fold"

"FuselageFold"

7616

"dof_fuselage_fold"