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What's New in AAA?

Version 3.7

November 2016

AAA 3.7 contains many enhancements and revisions to AAA version 3.6.2 as well as bug fixes and enhancements to AAA version 3.6.2.

Section 1 shows the enhancements and modifications made to AAA. Major enhancements include new modules and calculations. Section 2 contains problem fixes.

The AAA Manual describes the installation procedure and all modules. The manual is available in pdf format on the installation CD and download from www.darcorp.com.

1. Enhancements and Modifications

Differences between AAA 3.7 and AAA 3.6.2 are:

1.1 Weight

1. New window for calculating take-off weight and fuel weight for a given empty weight.
2. Show individual and total Class II inertias for pylons, nacelles, floats, tailbooms and stores.
3. Show individual and total Class II C.G. for pylons, nacelles, floats, tailbooms and stores.
4. Cells not applicable in L/D from Weights are grayed out.
5. Engine inertias added to component inertias.
6. Added plot with 3-view to draw flight control cabling and calculate weight based on length of cabling.
7. Added plot with 3-view to draw hydraulic lines and calculate weight based on length of lines.
8. Elevon control weight added to Class II Flight Control weight.
9. Y-coordinate of class II component center of gravity is added.
10. Propeller take-off shaft horsepower added as input per propeller.
11. Class II Instrumentation weight allows for hybrid and no engines
12. Cargo volume is allowed to be 0.

1.2 Aerodynamics

1. Oswald efficiency factor is calculated in Class I Drag, current flight condition module.
2. Engine location for Class II fuselage drag added to account for engine exhaust coming out of the back of the fuselage.
3. Tailboom drag and friction coefficient given for each tailboom.
4. Jet engine and propeller engine nacelles are shown in a single table, to allow for hybrid airplanes.
5. Downwash gradient at M=0 and at infinity added for horizontal tail and V-tail.
6. Downwash gradient at M=0 can be locked and will bypass the AAA calculation.
7. Downwash at zero lift can be locked so that calculation is bypassed (e.g. from other software). AAA will correct for Mach effects.
8. Miscellaneous drag is allowed to be negative to manipulate the drag. This way drag benefits could be implemented.
9. Oswald Efficiency Factor, e, can be locked in the output, so that user defined data could be used and calculation is bypassed.

10. Prandtl Glauert Correction improved for Mach numbers near M=1.
11. Wing wave drag output variable added to Class II drag.

1.3 Performance

1. Sizing: available power/thrust changed to take-off power/thrust when reading off the matching plot.

1.4 Geometry

1. Elevon geometry added to wing geometry.
2. Variable tilt angle for the propeller possible.
3. Scaling also applied to the engines and moments of inertia.
4. Airplane wetted area module added.
5. Edit button added to airplane 3-view to allow changing font sizes.
6. Chord Length button is relabeled to include twist, thickness and sweep.
7. Sweep angle calculation for any chord wise position is added.

1.5 Propulsion

1. Thrust from Drag distributes power allowing different thrust/power level per engine, also accounting for hybrid engines (e.g. jet and prop combined).
2. Jet Parameters module added
3. Propeller tables are expanded to calculate more output parameters.

1.6 Stability and Control

1. Glider flight path angle in trim diagram under Class II Stability and Control Analysis is added and adjusted to make thrust zero.
2. Engine ineroperative taken into account for C_{n_β} and C_{y_β}
3. Separate window for $C_{T_{x_1}}$
4. New module: Rolling moment to see if airplane is roll trimmed.

5. New module: Yawing moment to see if airplane is yaw trimmed.
6. New module: Sideforce to see if airplane is sideforce trimmed.
7. New module: Lateral-Directional trim for straight line flight.
8. Trimmed Lift (Thrust from Drag) distributes power allowing different thrust/power level per engine and incorporates OEI and allows for hybrid engines.
9. Trim Diagram uses engine coordinates instead of thrust origin coordinates to make it more consistent to the other modules.
10. Longitudinal Trim for engine-out and glider aircraft added.
11. Trim Diagram and Trimmed Lift (T from D) in Class II analyses will calculate flight path angle if all engines are inoperative.
12. Popup a warning if output parameters are locked in Trimmed Lift (T from D)
13. Upper limit on lift coefficient axis in trim diagram is removed.

1.7 Dynamics

1. Elevons and differential stabilizer are added in the Lateral-Directional Transfer Functions.
2. Variable Incidence V-Tail can now be added in the single loop, double loop, bode plots control module.
3. Variable Incidence Vertical Tail can now be added in the single loop, double loop, bode plots control module.
4. Elevons added to the Roll Performance calculations in the Dynamics > Lateral-Directional > Flying Qualities module.

1.8 Loads

No Changes

1.9 Structures

No Changes

1.10 Cost

1. Propeller cost is split into cost per propeller and then summed.
2. Engine cost is split into cost per engine and then summed.
3. CEF is updated to include September of 2016.

1.11 General

1. Import newer versions of excel (.xlsx).
2. Export newer versions of excel (.xlsx).
3. Added file extension (.analys)
4. The Powerplant Configuration dialog window is separated into a Nacelle Dialog window, an Engine Dialog window and a Propeller/Fan Dialog window.
5. Upper limit of number of engines is increased from 10 to 500
6. Upper limit of number of stores is increased from 10 to 500
7. Upper limit of number of tailbooms is increased from 10 to 500
8. Upper limit of number of high lift devices is increased from 10 to 500
9. Upper limit of number of nacelles is increased from 10 to 500
10. Upper limit of number of landing gears is increased from 10 to 500
11. Upper limit of number of propellers is increased from 10 to 500
12. Upper limit of number of floats is increased from 10 to 500
13. Moved stores to its own configuration dialog window.
14. Updated the landing gear configuration dialog window.
15. Updated Configuration dialog window.
16. Updated Controls Configuration dialog window.
17. Updated Flap/Slat Configuration dialog window.
18. Updated Flight Condition dialog window.
19. Increased maximum number of nacelles, engines, propellers, landing gear, stores, pylons, tailbooms and floats.
20. Added electric engines as an engine configuration option.
21. Moved the fuel tank type from the Propulsion dialog window to the Structure Configuration dialog window.
22. Legends for plots automatically scale when text size is changed.
23. Control surface name is now shown in the window caption.
24. When the lifting surface is not selected in the configuration dialogue window, the associated control surface is automatically not selected either.
25. Tables store more decimals and do not round the numbers.
26. The number of elements in the table is automatically updated for all tables in real time. If multiple windows have the same table open, all numbers are updated.
27. Allow for 4K monitor support.
28. Y_{cg} added to the Flight Condition dialog window.
29. Sideslip angle added to the Flight Condition dialog window
30. Drag Polar Trendlines (trimmed and untrimmed) can be used in flight condition for trim diagram and longitudinal trim.
31. Landing Gear dialog window: only show nacelles and tailbooms if they are present
32. Allow a nacelle to be linked to a ducted fan.

33. User defined warning message in the Notes section for the project. If a one line warning is defined, it will popup when the project is opened for the first time. If no text is present, no warning. This is to write a user defined warning for the next user of the project.
34. Updated Help and more Go To buttons.

1.12 Other Improvements

The following AAA 3.7 airplane examples have been added and are available for download from www.darcorp.com:

- AAI Shadow 600
- Airbus A320-200
- Airbus A340-300
- Airbus A350-900
- Bede BD10
- Bede BD5B
- Beech King Air B200
- Beech Starship
- Beech T-6A Texan II
- BeechJet 400A
- Bell X-22A
- Boeing 720B
- Boeing 747-400
- Boeing 777-200
- Boeing B-47 Stratojet
- Boeing C-17A Globemaster III
- Bombardier Challenger 601
- Bombardier Global Express
- Canadair (Bombardier) CL-215
- Canadair (Bombardier) CL-415
- Cessna 162 Skycatcher
- Cessna 172R Skyhawk
- Cessna 310P
- Cessna 550 Citation II
- Cirrus SR-20 G1
- Cirrus SR-22
- Cirrus Vision Jet
- De Havilland DHC-2 Beaver
- De Havilland DHC-6 Twin Otter
- Diamond DA40-180
- Diamond DA42
- Eclipse 500
- Edgley EA-7 Optica
- Fairchild A-10A Thunderbolt II
- Fairchild T-46 Eaglet
- General Dynamics Gulfstream II
- Learfan 2100
- Lockheed C-141B
- Lockheed L-1049A Super Constellation
- McDonnell Douglas DC-10-10
- Northrop Grumman RQ-4A Globalhawk
- Piaggio P-180
- Pilatus PC-12
- Piper PA-28-180 Cherokee D
- Piper PA-34 200 Seneca I
- Rockwell OV-10A Bronco
- Rutan VariEze
- Saab 2000
- Saab 340
- Short Skyvan
- VFW-Fokker 614

More examples will be added over time, so keep visiting www.darcorp.com for updates.

2. Problem Fixes

This Section lists the problems found in AAA 3.6.2 and earlier versions, which are fixed in AAA 3.7.

2.1 Weight

1. Weight iteration displays the "Air Conditioning/Pressurization/Icing System data missing" warning even if all input and output parameters are filled in.
2. If no mission is defined the useful weight is not calculated.
3. Operational items are not necessary in Class II weight - fixed equipment for UAV.
4. Furnishings are not necessary in Class II weight - fixed equipment for UAV.
5. Y_{cg} of the dorsal fin is not copied from component C.G. to Empty Weight.
6. Paint weight in Class II – fixed equipment is not calculated if not all data is filled out.
7. $N_{Captian}$ and $N_{CoPilot}$ value is not updated into the field when selected the suggested value in the help menu.
8. AAA displays "Invalid floating point operation" if pylon weights are zero.
9. Pressurized cabin volume is not needed when the aircraft is not pressurized.
10. X, Y, and Z coordinate of Class II empty weight C.G. for glider will not calculate because powerplant weight is zero, even when no engine is selected in the configuration.
11. Class II UAV vertical tail Torenbeek weight does not calculate if horizontal tail is not on fuselage.
12. Operational items under Class II fixed equipment weight is not necessary for fighter and GA aircrafts, and the 'Operational Items' button is greyed out instead of pop-up window.
13. UAV cargo handling weight is negative if input is not defined.
14. Weight iteration module cannot be accessed with warning "Fuel System Data Missing", even though fuel system module has already been defined.
15. Unit change in X_{cg}, Y_{cg} and Z_{cg} variables are not transferred between table and input/output.
16. W_{crew} should not show up in weight sizing plot for UAV.
17. Unrealistic UAV weight if W_{cargo} is zero.
18. Incorrect calculation of Vought method landing gear weight for general aviation and fighter.
19. Class II engine weight cannot be calculated because powerplant configuration is not completely filled out.
20. Engine and pylon weight are not copied into Class II empty weight C.G.
21. Class II weight and inertias change for nacelle, floats, stores and tailbooms.

22. Class II air induction weight using the Vought method is not calculated for USAF and Navy propeller aircraft.
23. Vought weight factor for Class II fuselage and landing gear weight are the same and replace each other if entered in fuselage or landing gear weight.
24. Calculation of $W_{fur_{Vought}}$ includes both cargo and baggage weights.
25. Class II flight control weight gives a warning window saying "There is no aerodynamic control surfaces. The calculation can be performed, but the weight of aerodynamic flight control will be zero." even though an elevon is specified in the configuration.
26. Class II Air-conditioning/Pressurization/De-Icing weight incorrectly calculated for unpressurized military patrol/bomber/transport planes.
27. $\frac{L}{D}$ from Weights does not converge on an answer for the input if the cruise range or loiter time is long.
28. Dorsal fin Class II Center of Gravity calculation fixed.
29. Dorsal fin Class II Inertia calculation fixed.
30. Fuselage Class II Inertia calculates when not all input variables are present.
31. Surface Structure Factor of Surfaces inside Fuselage capped at 100%.
32. Vought furnishing weight is not negative when take-off weight is too low.
33. Class I Weight from weight fraction calculates without having to leave the module.

2.2 Aerodynamics

1. There is an invalid floating point error if the lift curve slope of a lifting surface is set to zero.
2. Vertical Tail immersed area is negative if the propeller z-coordinate is below a certain value or if the propeller does not immerse the vertical tail at all.
3. Lift-curve slope outputs do not calculate even with all inputs filled in.
4. Floating point error during calculation of Class II High Lift Device Drag.
5. Unnecessary inlet drag data in order to calculate Class II drag for glider because glider typically has no propulsion unit.
6. Floating point error on the calculation of Class II canard drag coefficient.
7. Class II airplane drag calculation results in negative induced drag in transonic regime.
8. For multi-engine aircraft, certain parameters in immersed area do not change even if the one engine is set to off.
9. Access violation error occurs when 'Go-to' button under $\Delta CL_{D_{noz}}$ is pressed.
10. Recalculation of input variables, namely $T'_{c/prop}$ and $T_{c/prop}$, in power effect lift.

11. Wrong variable in calculation of the $\Delta C_{D_{0\,power}}$.
12. Error in calculation of K_1 parameter in power effect lift.
13. Incorrect loop range in the calculation of horizontal immersed area.
14. Immersed area calculation is limited to the tip of the surface (wing, horizontal tail, vertical tail and V-tail) to prevent erroneous calculations over an imaginary surface.
15. Floating point error on the moment power effects calculation when the thrust equals zero.
16. Negative dynamic pressure due to power on the horizontal and the vertical tail.
17. Inconsistency between wing and canard module on the immersed area
18. Y-location of the immersed area calculations changed from y-coordinate of the a.c. to the y-coordinate of the propeller.
19. Class II windmilling airplane drag checks if the propeller is rotating or not.
20. Class II nacelle drag does not ask whether the engines are operating or not and still calculates the nacelle drag.
21. Divide by 0 error in the pitching moment due to power effects.
22. Goto error OpCLmaxAirplane when no HLD are used.
23. Recalculate All in Class II Drag not calculating certain parameters
24. OpDeltaCLWingFlapzeroAlpha in Aerodynamics > Drag > Class II Drag > Landing Gear removed when no HLD are used.
25. Error message when store is not attached and you try to go to Aerodynamic Center > Stores
26. $C_{y_{vee_\beta}\,@\,M=0.6}$ is allowed to have negative values.
27. For the drag of the V-Tail, in the plot effective AR was used. It is changed to Geometric AR.
28. Canard downwash added to non-linear wing lift calculation.
29. Ground effects added to non-linear wing lift calculation.
30. Removed singularity in pitching moment calculation due to power.
31. Vertical tail immersed area of multiengine props checks which propeller is immersing the vertical tail.
32. S_{W_i} becomes negative if the slipstream go outboard of the wing.

2.3 Performance

1. Switching certification from FAR 23 to FAR 25, EASA 25, Mil Spec or AS Spec cause access violation using the 'Go-To' button on $B_{DP_{L\_down}}$ under climb performance sizing module.

2. Stall speed reached through 'Go-To' button under performance stall speed sizing set thrust available to zero without warning message.
3. Invalid floating point operation in calculation of time and range of glide when altitude is zero.
4. Removed $RC_{23.65}$ variable from climb performance sizing module.
5. Warning message in Export to APP module if drag polar is not defined.
6. Class II drag polar trend line and C_L vs. C_D do not match up with the calculated C_{L_1} and C_{D_1} for 3-suface airplanes.

2.4 Geometry

1. There is no warning message when the 3-view is opened if there is no data for the wing, horizontal tail, vertical tail or canard.
2. The 3-view x-axis has a different number of pixels between the top view and side view.
3. The 3-view y-axis has a different number of pixels between the top view and front view.
4. Nacelles not defined even if all parameters are in AAA.
5. Propeller hub is pointing in the wrong direction even though it is located ahead of the C.G.
6. Wing-aileron geometry plotting does not fit in the screen.
7. Aeropack export feature uses the wrong temp folder.
8. Floating point error, division by zero, if the X_{apex_f} and X_{fus_1} parameters are equal.
9. Incorrect calculation of $h_{f_{0.25}}$ and $h_{f_{0.75}}$ parameters in fuselage geometry when airplane coordinate system is defined.
10. The calculated nacelle planform area is larger than the calculated nacelle wetted area.
11. Nacelles using the body coordinate system do not get drawn correctly in the Three-View.
12. Incorrect calculation for X_{c_f} in fuselage geometry.
13. Invalid floating point operation for a lifting surface with a tip chord of zero using the MGC Based Method
14. Invalid floating point operation error occurs if the control surface geometry and the outboard station goes to 100% for a crank lifting surface with a tip chord of zero length.
15. Nacelle disappear in the Airplane 3-View when Γ_n is chosen at +/-90degree.
16. Files that are opened that were created in 3.5.1 uncheck options that were previously checked when trying to export in AeroPack.
17. Error saying dorsal fin is undefined even if there is no dorsal fin for files created in 3.5.1 that are opened and try to export in AeroPack.
18. There is no warning message when the dihedral of the vertical tail is set to 0.

19. One panel vertical tail does not export to AeroPack correctly.
20. Offset is not limited to the span, giving negative Aspect Ratio and Wing Area.
21. The wing-aileron plot size has been adjusted to the screen size.
22. Scaling Error fixed
23. R_y and R_z are automatically scaled

2.5 Propulsion

No Changes

2.6 Stability and Control

1. Floating point error when plotting the trim diagram.
2. Parameters in trimmed lift (T=const) change color after the trimmed lift (T from D) is calculated. These two variable are C_{L_h} and δ_e, but values are the same.
3. Access violation occurs when 'Go To' button of h_{sp} / c_w under spoiler lateral directional control is pressed.
4. Access violation occurs when 'Go To' button of x_{sp} / c_w under spoiler lateral directional control is pressed.
5. No convergence in trimmed lift (T from D) calculation for glider.
6. Warning message for exceeding the limit in C_{l_β} corrected from $\frac{M_1}{\cos(\Lambda_{c/2})}$ to $M_1 \cos(\Lambda_{c/2})$
7. Ruddervator exceeding the maximum deflection warning fixed.
8. Floating point error when running Trimmed Lift (T from D) for unstable aircraft.
9. Pedal Force X_{ac_v} replaced by $x_{ac_{vee}}$ in input.
10. $C_{y_{\delta_{rv}}}$ sign corrected
11. Lateral Directional Trim calculation fixed calculation
12. Slotted spoiler rolling moment deflection angle input added to enable calculation
13. Trimmed Lift (T from D) does not give an error for transonic and supersonic speed when the zero lift high lift device drag coefficient is undefined.
14. Trimmed Lift: some airplanes do not trim if the horizontal tail is in the wake of the wing. Recalculate derivatives' to account for this.

2.7 Dynamics

1. The clear out button in the longitudinal flying qualities also clears the levels.
2. The plug spoiler type is not available for the spoiler lateral transfer function.

2.8 Loads

1. Removed the tailbooms warning under wing structural loads.

2.9 Structures

No Changes

2.10 Cost

No Changes

2.11 General

1. Error message occurs when loading .analysis file and cannot be reopen after saved.
2. Mission flight segment data loading from AAA 2.0 or before (.analys) are not read properly.
3. When launching AAA with an expired node-locked WibuKey, users do not get an expiration warning and AAA module buttons are not greyed out. Users can still get into modules but will get a WkbCrypt2 error pop-up when the Calculate button is pressed and no values are calculated.
4. Switching Horizontal Tail (also V-Tail and Canard) from Yes to No and then selecting cancel on the dialog window, erases the trim surface selections used in the Flight Condition Dialog window.
5. If a surface is removed, it automatically does not get exported to Aeropack.
6. Using a Go To button to go between two I/O windows that contains the same table results in a crash.
7. Dual screen causes cursor to jump to other screen when the calculator is opened if AAA is opened on the secondary monitor.
8. Flight condition data does not change when objects are added.
9. Temporary flight condition data used for recalculate instead of the saved data.
10. Disappearing airfoil type fixed.