DARcorporation

Design • Analysis • Research

What's New in AAA?

Version 3.0

February 2005

Section 1 shows the enhancements and modifications made to AAA. Major enhancements include new modules and calculations. The second section contains bug fixes.

1. Enhancements and Modifications

A module-by-module overview of the differences between AAA 2.5 and AAA 3.0 is listed below.

1.1 Weight

1. Center of gravity of wing, canard, vertical tail, horizontal tail, V-tail and tailbooms are calculated in Component Center of Gravity.
2. The Wing Weight Correction Factor in Class II Weight > Structure > Wing is now calculated from configuration settings instead of input.
3. All weight tables with C.G.-locations now allow switching of units between ft and inches and m and mm.
4. Class I Weight > Center of Gravity > C.G. Excursion no longer shows buttons for Feet and Inches (Meter and Millimeter). The units on the plot are now set by changing the units on the output X,Y,Z C.G. parameters using the Workpad feature.

1.2 Aerodynamics

1. Power effects are now controlled through the flight condition dialog. If a check mark is put in the flight condition dialog window, power effects due to propellers are included in the different calculations. Variables related to power effects show up on the different windows if the Power Effects box is checked.
2. Ground effects are now controlled through the flight condition dialog. If a check mark is put in the flight condition dialog window, ground effects are included in the different calculations. Variables related to ground effects show up on the different windows if the Ground Effects box is checked.
3. All calculations related to power effects and ground effects are made consistent so that calculations in different windows (for instance angle of attack dependent and component lift) give the exact same result.
4. Class II Drag: Gear Location factor in the table is no longer used. The location now follows from the Landing Gear Dialog window settings.
5. Dynamic Pressure Ratio on the vertical tail is calculated.
6. Ground effect on vertical tail downwash angle is calculated.
7. Wing downwash gradient due to canard.
8. Zero Lift and Zero Angle of Attack pitching moments now account for cambered airfoils on canard, horizontal tail an V-tail.
9. Effects of drooped ailerons (flaperons) are now added to all other modules in Aerodynamics. Before it was only used in Flap Sizing.

1.3 Performance

1. Sizing: Sport Pilot regulations are updated to reflect the final ruling.
2. Sizing: Power index for propeller airplanes is now calculated from speed.

1.4 Geometry

Flap geometry is added to the Wing > Aileron geometry

1.5 Propulsion

No new features

1.6 Stability and Control

1. Added Stick Free and Stick Fixed Static Margin calculation to Analysis
2. Steady State Drag Coefficient is now calculated from the Class II Drag trendline coefficients.
3. Thrust derivatives are now set to zero if there is no powerplant.
4. Power Effects on Trim Diagram is updated (now dependent on setting in the Flight Condition window). Including power effects (for propeller airplanes) will significantly slow the displaying of the trim diagram plot, because of the vast amount of calculations involved per angle of attack and elevator deflection.
5. Trimmed lift coefficients and pitching moments have been updated so that all modules generate the exact same results for angles of attack, lift coefficients, control surface deflections and pitching moments
6. Thrust derivatives for a jet powered airplane are added.
7. Effects of drooped ailerons (flaperons) are now added to all other modules in Stability and Control. Before it was only used in Aerodynamics > Lift > Flap Sizing.

1.7 Dynamics

1. Longitudinal > Transfer Function: when there are two real roots and one complex root, third oscillatory mode is only set with the real roots are opposite in sign. In all other cases the complex root is assumed to be the Phugoid.
2. Pitch attitude angle is now calculated from flight path angle and angle of attack instead of input.

1.8 Loads

No new features

1.9 Structures

No new features

1.10 Cost

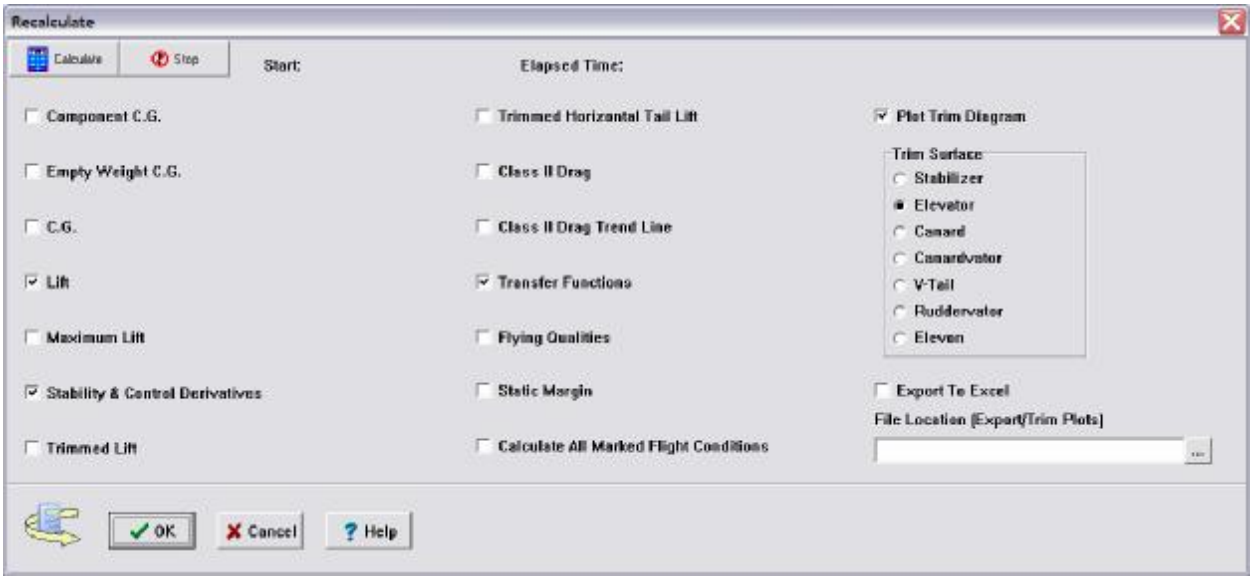
Cost Escalation Factor (CEF) is updated through December 2004.

1.11 General

1. The gear dialog window now indicates which gear is a main gear, nose gear or tail gear.
2. Use of power (thrust) setting and power (thrust) available variables has been made consistent.
3. Tables: double clicking on the column header will open the Work Pad. The user can enter notes, change units per column in the table.
4. Flight conditions can now be marked to include or exclude data in the File > Export option. This way only data for marked flight conditions will be exported to an ASCII file or Excel spreadsheet.
5. Per Flight Condition the user can indicate whether propeller propwash effects (power effects on) are included and whether ground effects are included in the calculation.
6. Export now also exports in SI units and in alternate units.
7. Recalculate all is added to the toolbar. It allows the user to recalculate:
    a. Component C.G.
    b. Empty Weight C.G.
    c. C.G.
    d. Lift
    e. Maximum Lift
    f. Stability ad Control Derivatives
    g. Trimmed Lift
    h. Trimmed Horizontal Tail Lift
    i. Class II Drag
    j. Class II Drag Trend Line
    k. Transfer Functions
    l. Flying Qualities
    m. Static Margin

    This can be done for each flight condition separately where the user can select which features need to be recalculated, or the user can choose to run through a series of flight conditions that are marked in the Flight Condition window. Trim diagrams can be

exported to WMF files and saved to the harddisk for each flight condition. Marked variables can be exported automatically to an Excel spreadsheet.



8. More alternate units are added to the variables.
9. Significant digits on many variables are adjusted to show more digits.
10. File > Export now also allows for export to Excel spreadsheets, before it only allowed export to ASCII files.

2. Bug Fixes

This section list all the bugs found in AAA 2.5 and earlier versions which are fixed in AAA 3.0.

2.1 Weight

1. Class I weight > Center of Gravity > Empty Weight > Detailed > Structure: the gear weights are not correctly summed, empennage weights are not summed correctly.
2. Class I weight > Center of Gravity > Total C.G.: table does not match table from C.G. Excursion

2.2 Aerodynamics

1. Transonic lift curve slope: Code error fixed.
2. Airplane lift coefficient at zero angle of attack: The parameter $\Delta C_{L_{o_{d\,f}}}$ did not account for $\Delta C_{L_{vee_{o_{d\,f}}}}$. This error has been fixed.
3. Wing aerodynamic twist: The parameter a_{o_1} was erroneously based on $\Lambda_{c/4_w}$. This has been fixed, and it is now based on $\Lambda_{c/2_w}$.
4. Graphics error fixed. Output parameters partially overlapped input parameters before.
5. The wing, horizontal tail, canard and V-tail gap correction factors (f_{gap}) were being calculated incorrectly. They depend on aspect ratio, which was incorrectly being multiplied by two. This error has been fixed, and the correction factors are now calculated correctly.
6. Power effects of a single propeller on twin vertical tails causes a floating point error.
7. Ground Effects: pitching moment coefficient of the wing-fuselage is based on airplane aerodynamic center, should be wing-fuselage power-off aerodynamic center.
8. Power Effects: V-Tail: down wash angle is not calculated.
9. If Miscellaneous Lift or Pitching Moment table is not filled out, Trimmed Hor. Tail Lift generated error messages.

2.3 Performance

No bug fixes

2.4 Geometry

Vertical tail geometry with rudder is not displayed properly in the Plot option.

2.5 Propulsion

No bug fixes

2.6 Stability and Control

1. In lateral-directional control, the $C_{l_{d_{rv}}}$ module contained outputs for $C_{L_{d_{rv}}}$. These calculations were also erroneous. This error has been fixed.
2. In the Class II trim module, $C_{L_{d_e}}$ and $C_{m_{d_e}}$ were calculated in a different manner than in the longitudinal control module. These calculations have been completely removed from the program as they are not necessary.
3. In the C_{Y_β} module under lateral-directional stability, the parameter for fuselage height at the V-tail intersection was mislabeled as h_{f_v}. This has been fixed, and the parameter is now labeled correctly as $h_{f_{vee}}$.
4. In the Longitudinal Control Module under $C_{L_{d_e}}$, the plot function performed incorrect iterations for c_e/c_w ratios greater than 46%. This error has been corrected.
5. Sideforce derivative due to yaw rate should be zero for a flying wing.
6. Geometric vertical tail volume coefficient used mean geometric chord instead of wing span.

2.7 Dynamics

Longitudinal > Flying Qualities: When no frequency and damping ratio are entered and calculate is pressed, text in level boxes disappears.

2.8 Loads

No bug fixes

2.9 Structures

No bug fixes

2.10 Cost

No bug fixes

2.11 General

1. When the Clear-Out button is pressed all output including output in tables are cleared. When the window is closed and opened again, all output data in the table reappears. This error has been fixed.
2. The Close and Theory buttons are off the window for monitors with resolution of 1024 pixels in width.
3. Import Geometry did not read in tailboom geometry
4. Import Geometry: number of segments of a body (fuselage, nacelles, stores) was incorrect if the apex of a body is defined as a point.