DARcorporation

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What's New in AAA?

Version 2.5

February 2004

DARcorporation is proud to announce the release of **Advanced Aircraft Analysis (AAA), Version 2.5**. New features and submodules will become quite evident to AAA users accustomed to Version 2.4 while dozens of improvements and modifications heighten the program's efficiency and precision.

AAA 2.5 added over 37,000 lines of code (AAA is now over 220,000 lines of code). More than 250 new output parameters are calculated.

Through customer feedback, AAA users have supplied ideas for new features. Some requests involve entirely new analysis modules while others seek the extension of existing ideas. All of these new features are described in Parts II and III of the User's Manual.

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

The AAA Manual describes the installation procedure and all modules. The manual is available in pdf format on the installation CD.

1. Enhancements and Modifications

A module-by-module overview of the differences between AAA 2.4 and AAA 2.5 is listed below.

1.1 Weight

1. More error checking is performed to see if all weights in tables add up to previously calculated weights.
2. Weight Sizing: plot is added to show the iteration process.
3. Class II Weight: Furnishings weight lower limit is set to zero (was 0.01 lb).
4. Class I Weight: Radii of gyration method is added to calculate the radii of gyration from given moments of inertia.
5. Weight Sizing: Stall segment is added to the mission profile.
6. UAV, experimental, sport pilot airplanes and gliders are added to the weight regression coefficients.
7. Class II Weight: V-Tail weight is added.
8. Class II Weight: moments of inertia now includes payload, crew weight, fuel etc and is flight condition dependent.

1.2 Aerodynamics

1. Effect of body width on lift curve slope is added.
2. Effect of working engine in the fuselage aft end is accounted for in Class II drag.
3. Trendline is by default trimmed drag. Added option to switch defaults.
4. Unselecting previously selected components in Class II Drag are not saved.
5. V-Tail aerodynamics is added.
6. Class II Drag: effect of operating or inoperative engine on nacelle drag is added.
7. Class I Drag: the program checks if the landing gear is retractable or not.
8. Class I Drag: a new module is added showing all drag polars at once: Gear Up, Gear Down, Flaps Up, Flaps Down, One Engine Inoperative and Current Condition.
9. Class II Drag: wetted areas for lifting surfaces account for dihedral.
10. Flap maximum lift coefficient can be plotted as a function of flap deflection and flap chord ratio.
11. Class II Drag: miscellaneous drag can now also be expressed as function of angle of attack.
12. Downwash angle and downwash gradient at the vertical tail are calculated.
13. Propeller slipstream immersed vertical tail area is now calculated in Power Effects.
14. Miscellaneous Lift Coefficient is added: lift coefficients as a function of angle of attack can be added. This lift coefficient is used in Trimmed Lift and in Horizontal Tail Lift.

15. Miscellaneous Moment Coefficient is added: moment coefficient as a function of angle of attack can be added. This moment coefficient is used in Trimmed Lift and in Horizontal Tail Lift.

1.3 Performance

1. Added clean stall speed in Performance Sizing.
2. Sport Pilot category requirements are accounted for in Performance Sizing.

1.4 Geometry

1. V-Tail and ruddervator geometry are added.
2. Volume method is moved to Stability and Control.
3. Scaling of geometry parameters is added. All length parameters are scaled with a scale factor. All areas and volumes are also scaled.

1.5 Propulsion

No Changes

1.6 Stability and Control

1. Volume Method is moved from geometry. Inputs are simplified and choice is given between geometric volume coefficient or volume coefficient based on C.G. and A.C.
2. Trim diagram allows for V-Tail, ruddervator and elevons.
3. Ruddervator, ruddervator tab and elevon derivatives are added in longitudinal control.
4. Ruddervator derivatives are added in directional control.
5. Class II trim allows for ruddervator and ruddervator tabs.

1.7 Dynamics

1. The transfer function window is not displayed by default. It is turned on now.
2. Flying qualities levels allow for notes and export.
3. In lateral-directional transfer function "None" can be selected to calculate airplane characteristic roots only (no effect of control surfaces)
4. Elevon transfer functions are added.
5. Ruddervator transfer functions are added.

1.8 Loads

Loads can now be calculated for a V-Tail configuration.

1.9 Structures

Structural properties can be defined for V-Tail configurations.

1.10 Cost

1. Cost escalation factor is updated to account for inflation throughout the year 2003, including December 2003.
2. Test Airplanes Cost: number of airplanes in RDTE phase is now calculated.
3. A recalculate button is added to the Total Acquisition Cost. This will recalculate Airframe Engineering and Design Cost, Program Production Cost, Test Operations Cost and Total Acquisition Cost. It is used to recalculate cost if the number of airplanes is changed for instance.
4. Program Production Cost: number of airplanes in program production phase is now calculated.
5. Program Production Cost: number of airplanes manufactured per month in program production phase is now calculated.
6. Airframe Engineering and Design in Acquisition Phase Cost: number of airplanes in program production phase is now calculated.

1.11 General

1. More parameters include alternate units.
2. Notes window is replaced with a work pad window, which includes the notes, calculator, alternate units, variable description and symbol, note colors, locking variables, flight condition dependency, and export feature.
3. A "Go To"  button is added to all parameters which are calculated. The "Go To" button allows the user to open the calculation window for that particular parameter. This replaces all the flow charts from Appendix A of the user's manual of previous versions of AAA. To go back to the original window click the go to button in the output section.
4. The Help system is expanded.
5. Sport Pilot category is added to the certification window.
6. The Help menu (top window bar) has a Support option. Under support an option for checking for program updates on the DARcorporation website is added.
7. Export to Microsoft Excel for Input/Output data and plots (default export is now Excel).
8. Function key F8 opens the work pad.
9. Work pad may be used for individual columns in tables.

2. Bug Fixes

This section list all the bugs found in AAA 2.4 and earlier versions which are fixed in AAA 2.5.

2.1 Weight

1. Class II Weight: Fighter. When switching back and forth between weight iteration table and empty weight C.G. the program warns about "baggage/cargo handling system data missing." This warning should not show.

2. Bug in iteration table did not make correct unit conversion for airplane center of gravity location.

2.2 Aerodynamics

1. Plotting of Class II Drag polar gives floating point error when minimum and maximum values are equal.
2. Wing angle of attack should be an output and airplane angle of attack an input in wing non-linear lift coefficient calculation.
3. Horizontal tail or canard outside the fuselage region should have a wing-fuselage interference factor of 1.0 for lift curve slope.
4. Horizontal tail downwash gradient for a tail below the wing plane is corrected.
5. Zero-angle-of-attack lift coefficient for horizontal tail, vertical tail and canard should be divided by 57.296.
6. Aerodynamic Center; nacelles, pylons, floats, stores: when selecting save, not all data on the current screen is saved.
7. Class II Drag wetted area of lifting surfaces: $(t/C)_r$ should have been at the wing fuselage intersection, not at the root.
8. Non-linear sideforce for vertical tail: not all output parameters are calculated.

2.3 Performance

No Changes

2.4 Geometry

Vertical tail geometric volume coefficient should be based on wing span instead of chord.

2.5 Propulsion

No Changes

2.6 Stability and Control

1. Horizontal tail angle of attack does not account for ground effect.
2. Lift curve slope did not account for exposed surface area for horizontal tail and canard.
3. The propeller inflow factor is now calculated the same as in Aerodynamics.

2.7 Dynamics

No Changes

2.8 Loads

Lift distribution should use aerodynamic twist instead of geometric twist.

2.9 Structures

No Changes

2.10 Cost

Cost Escalation Factor for the year 2003 is incorrect (shows 1.0).