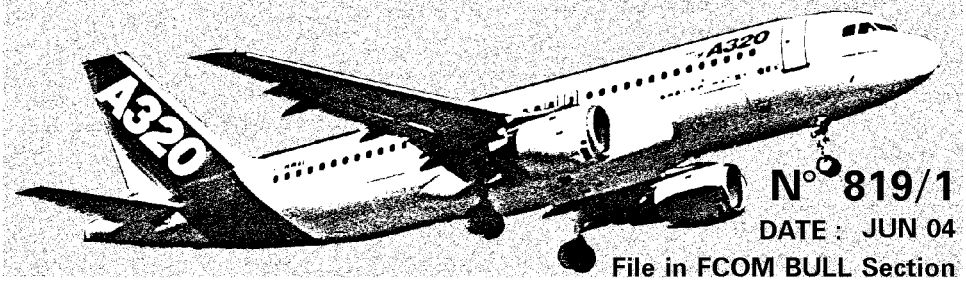

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File in FCOM BULL Section

SUBJECT : CHARACTERISTIC AND PROTECTION SPEEDS

INTRODUCTION

The different speeds displayed to the crew on the main cockpit interfaces : PFD, MCDU, ND are computed by the FACs, the FMGCs and the ADIRS.

PFD	MCDU PERF PAGE
FAC COMPUTATION Computed on current aircraft status and configuration.	FMGC COMPUTATION Computed for take off, go around and landing.
VLS F S "O" Green Dot Vαprot Vαmax Vsw (stall warning speed)	VLS of the selected landing configuration. F S "O" Green Dot

Each FAC computes its own speeds which are displayed on the relevant PFD.

FAC 1 on side 1
FAC 2 on side 2

Each FMGC computes its own speeds displayed on the relevant MCDU :

FMGC 1 on side 1
FMGC 2 on side 2

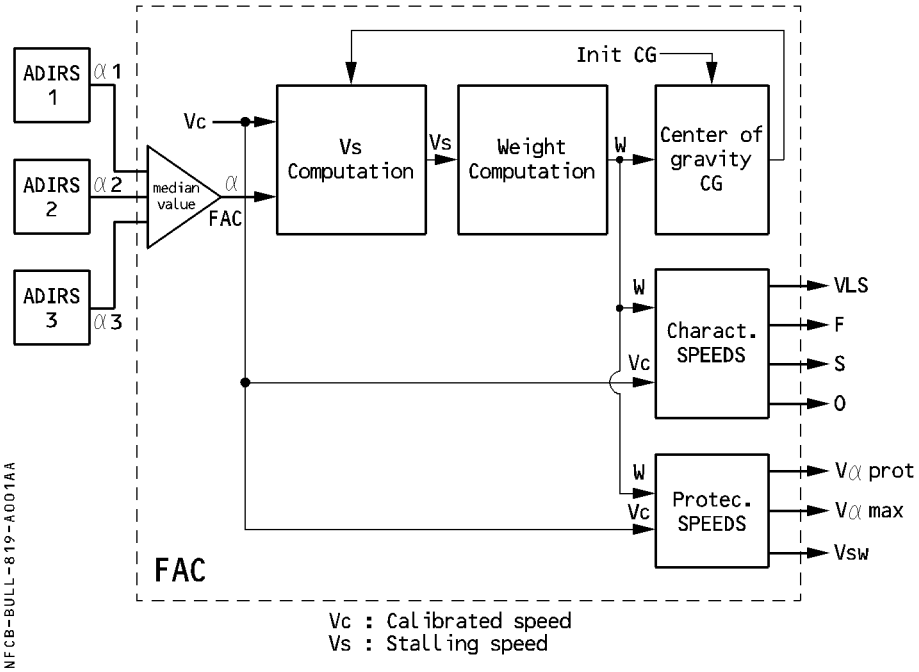
The algorithms used to compute the characteristic speeds are the same in both FAC and FMGC but as the inputs are different, the resulting values may differ.

CHARACTERISTICS SPEEDS COMPUTED BY THE FAC

The FAC computes its characteristic speeds with 2 main inputs from ADIRS (Angle of Attack (α) and calibrated airspeed (Vc)). It also uses THS position, SFCC data and FADEC data.

From these inputs, the FAC computes a stall speed Vs which is used to determine the aircraft weight.

The following sketch gives the basic architecture for FAC speed computation.

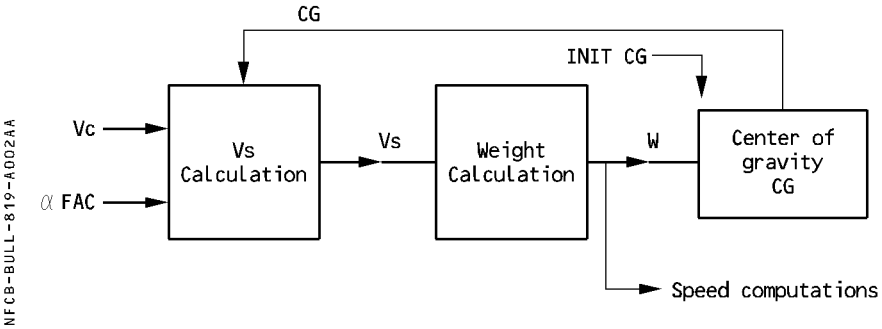


AOA DETERMINATION

The angle of attack value used to compute the characteristic speeds is the mean value of the 3 AOAs (Vote).

Accuracy of the AOAs is a paramount factor in the weight calculation.
0.3 degree of error in the AOA results in a 3 ton error in weight.

WEIGHT COMPUTATION



The weight is computed provided the following conditions are met.

- Aircraft altitude below 14600 ft and speed (Vc) below 240 kt
- Bank angle less than 5°
- Speedbrakes retracted
- No dynamic maneuver (vertical load factor lower than 1.07 g)
- No change of aircraft configuration and not in conf full.

When one of these conditions is not met, the last calculated weight value is considered and updated for the fuel consumption based on actual engine N1.

CHARACTERISTIC SPEEDS COMPUTATION

A320

VLS is computed from Weight and Vc and corrected for the current CG.

- If the current CG is forward of 15 %, 15 % CG is used to compute the speeds.
- If the current CG is between 15 % and 25 %, the speeds are computed using an interpolation between 15 % and 25 % CG.
- If the current CG is aft of 25 %, 25 % CG is used for speed computation.
  F, S, and Green dot are independent of CG.

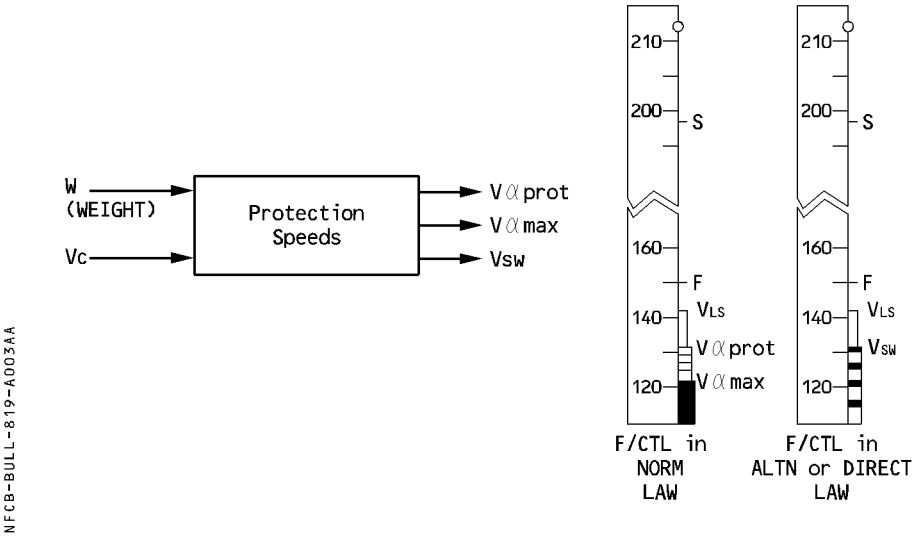
VLS, F, S and Green Dot are computed for a forward CG. No CG correction is applied for A319/A320 VLS as it has a negligible effect.

PROTECTION SPEEDS CALCULATED BY THE FAC

Vαprot and Vαmax are displayed in normal law.

The FAC does not trigger alpha prot and alpha max protection.
(The alpha prot and alpha max protection are activated by the ELAC).

Vsw, the stall warning speed is computed by the FAC in ALTN or DIRECT law. At Vsw speed, an audio warning (crickets – STALL synthetic voice) is triggered.



TOLERANCE OF FAC COMPUTED SPEEDS

Due to the data accuracy used to compute the characteristic speeds, and specifically the AOA accuracy, the precision of the computation is specified to be within 2.5 %.

During acceptance flight, the tolerances are as following :

Clean aircraft	Green Dot	± 5 kt
	VLS	± 4 kt
	Vαprot	± 5 kt
	Vαmax	± 5 kt
Conf full	VLS	± 3 kt
	Vαprot	± 5 kt
	Vαmax	± 5 kt

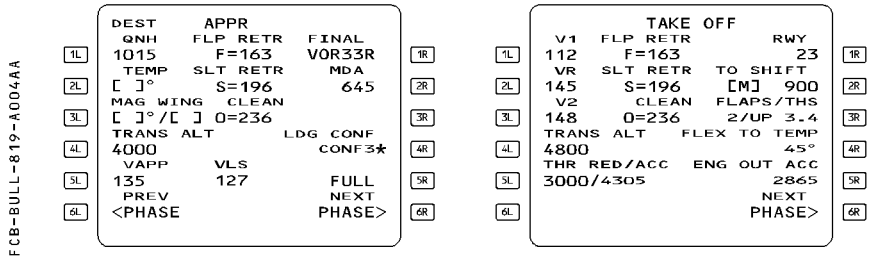
CHARACTERISTICS SPEEDS COMPUTED BY THE FMGC

Characteristic speeds computed by the FMGC are based on a predicted GW, CG (and selected configuration for landing) at a given time at landing for example.

GW and CG values are computed from entered ZFW and ZFWCG corrected for the predicted FOB and CG variation.

When the Approach phase is activated, the characteristic speeds are recomputed using the actual weight and CG.

The performance model used to compute the characteristic speeds, is accurate enough to provide speed errors of less than ± 2 kt from the certified speeds.



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THE MOST FREQUENT QUESTIONS ON SPEED COMPUTATION

– **Why are the characteristic speeds computed by the FAC subject to inaccuracy greater than FMGC computation ?**

Answer :

The precision of the AOA measurement is usually the cause of speed differences.
An error of 0.3 ° in AOA measurement causes a weight inaccuracy close to 3 tons.

– **Is the FMGC computation more accurate than the FAC computation ?**

Answer :

Algorithms are the same but the initial data are different.
The FAC computes current dynamic speeds.
The FMGS computes characteristic speeds for given phases (and configuration for landing).
Usually, the FMGC characteristic speeds for landing are more accurate due to the tolerance of FAC inputs, if the ZFW was correct initially.

Note : To determine the GW at landing, the FMGC uses the ZFW entered by the crew and adds the fuel on board.

A significant difference between PFD and MCDU characteristic speeds may also indicate an error in the ZFW as entered by the crew.

– **Why are there two characteristic speed calculations ?**

Answer :

· The computation done by the FAC is independent of any manually entered data and provides permanent speed values displayed on the PFD.

· During approach, the comparison of characteristic speeds allows the crew to detect any speed discrepancy which may affect approach and final phases ;

– **When a difference exists between computed speeds from FAC and FMGC, what are the best speeds to be relied on ?**

Answer :

Whenever differences are observed, Airbus recommends to rely on QRH values.
Refer to FCOM 4.06.20 p 7.