



AFI Flight Operations Safety Awareness Seminar (FOSAS)

Stall

ICAO/Airbus
Nairobi, 19-21 Sep. 2017

AIRBUS

Stall



Context: LOC-I around 28% of Accident



- + Accidents following failure to recover from stall still occur
- + Stall is also an issue for the transport aircraft environment



Agenda

Stall

**Stall
phenomenon**

**AoA Control /
Stall Recovery**

**Stall vs.
Appr to Stall**

**Procedure /
Training**

Agenda

Stall

**Stall
phenomenon**

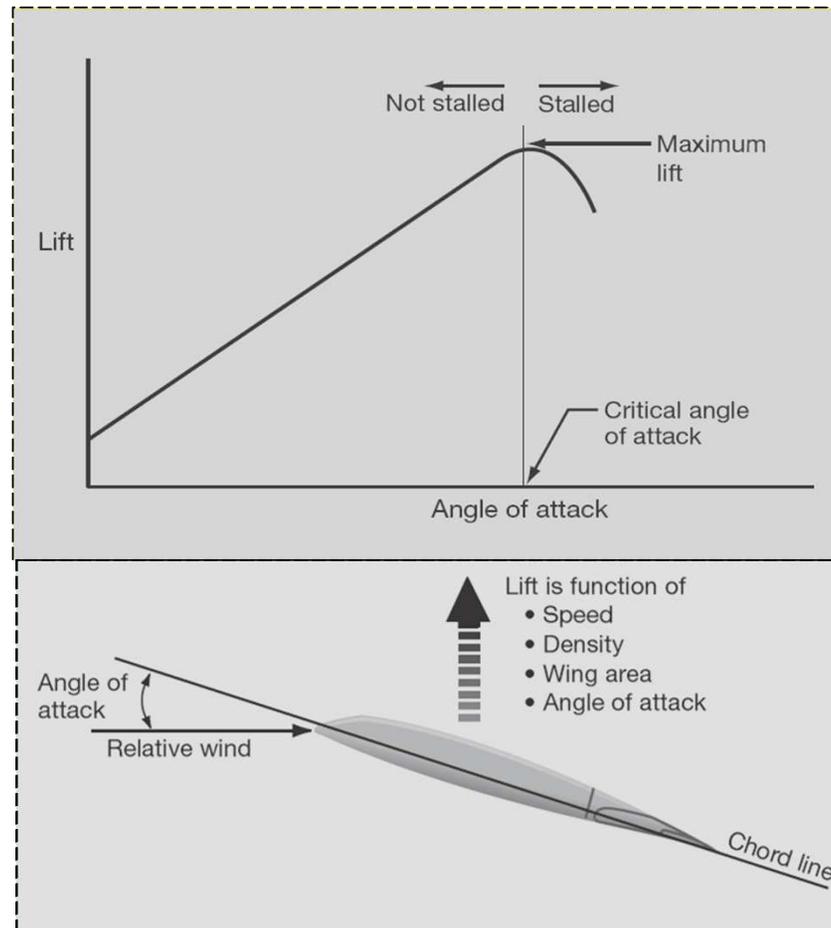
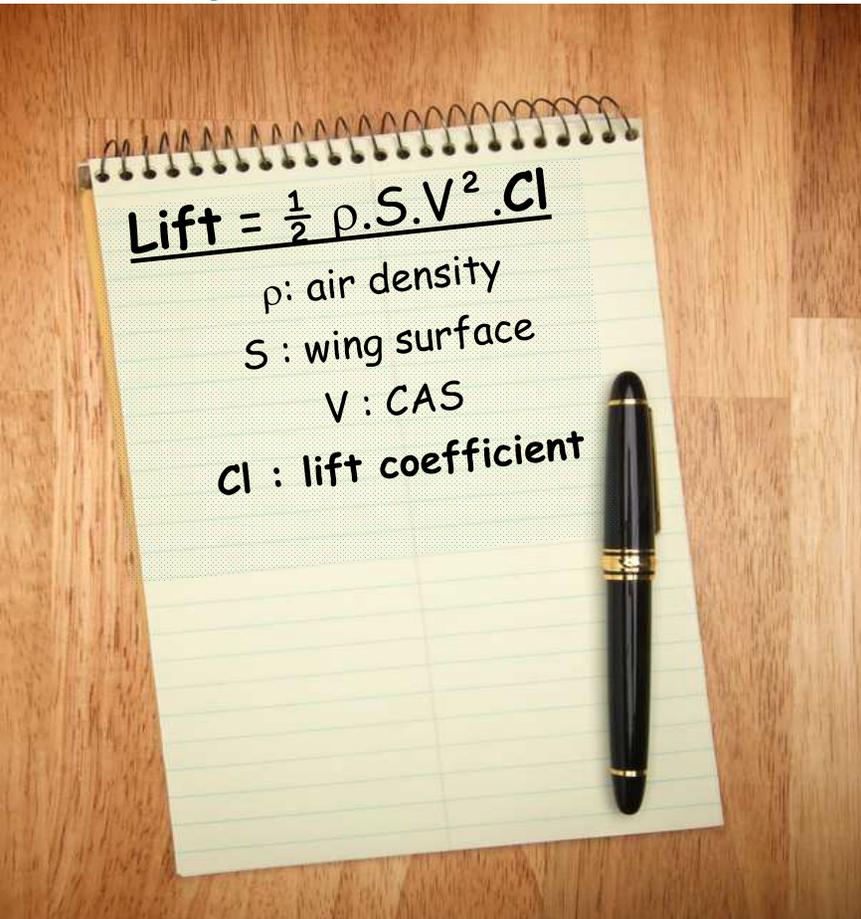
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Stall Phenomenon

Aerodynamic review



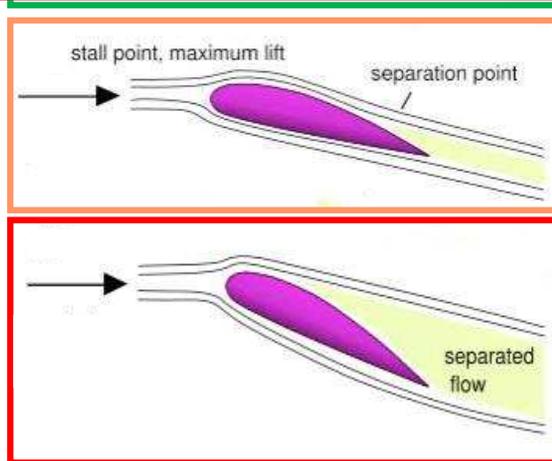
Stall Phenomenon



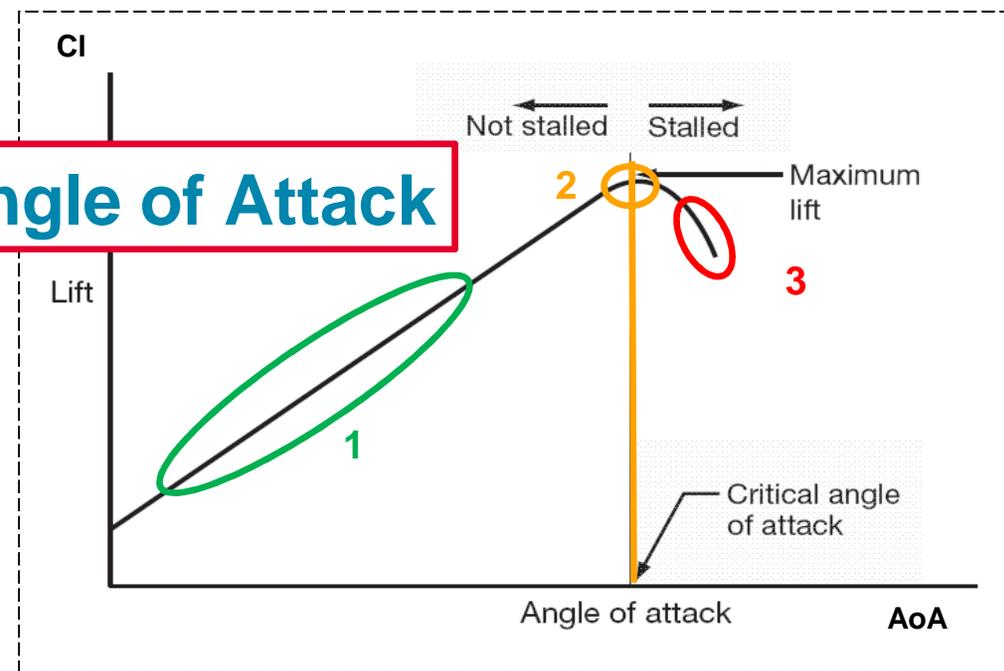
Lift Coefficient (Cl)

- + Cl has a direct relationship to AoA
- + Beyond the critical AoA, wing stalls

An Aircraft stalls for a given Angle of Attack



For a given configuration,
speed & altitude



Stall Phenomenon



➤ **Stall is an AoA problem only**

+ **It is not directly a speed issue**

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AoA Control / Stall Recovery



Pitch control influence

- + The elevators control **directly** the AoA
- + A nose down command has an immediate effect on AoA decrease

Engine below aircraft CG influence

- + Thrust increase induce AoA increase
- + Thrust reduction induce AoA decrease

Out of Normal Law

AoA Control / Stall Recovery



➤ When Aircraft is stalled

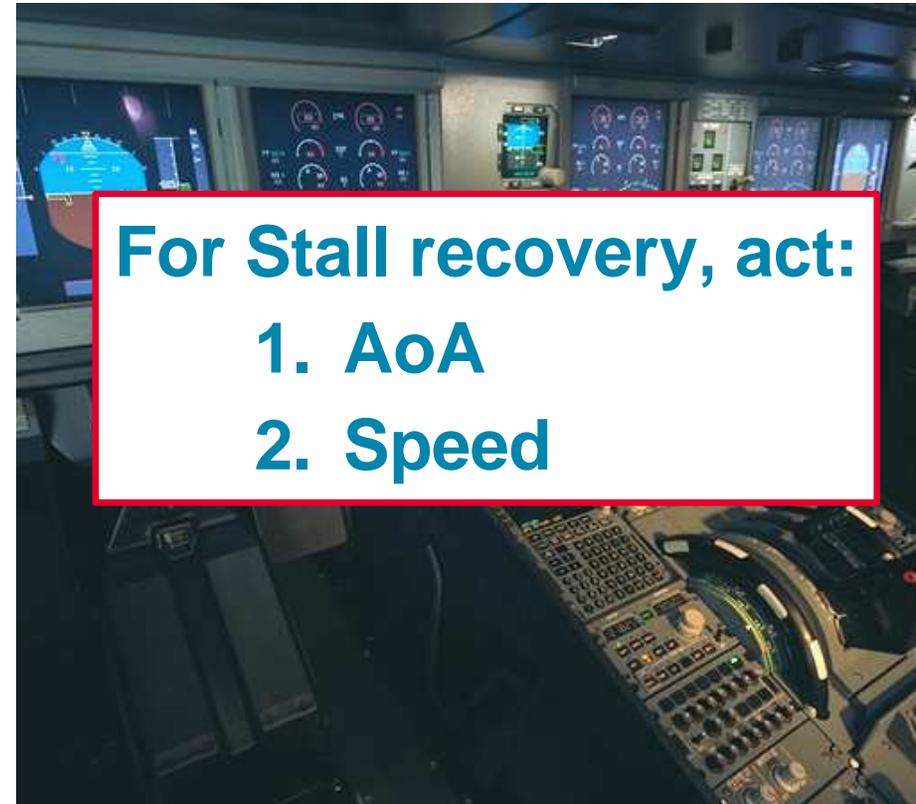
First: AoA must be reduced

- + Release back pressure on stick or column
- + Nose down pitch input may be needed

Note: Thrust increase has an adverse effect on AoA with engines below Aircraft CG

Second: When out of stall, increase speed if needed

- + Smoothly increase thrust due to pitch effect



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Stall vs. Approach to Stall



In the past

Old APPROAH TO STALL Training:

- + Controlled deceleration to stall warning, then
- + Power recovery with minimum loss of altitude

Difference between an APPROACH TO STALL and actual STALL is:

- + Not easy to determine, even for specialists

Accidents:

- + APPROACH TO STALL procedure was applied, whereas
- + The Aircraft was actually STALLED

Stall vs. Approach to Stall



APPROAH TO STALL Procedure focused on:

- + Thrust application
- + Minimum loss of altitude

Not appropriate for Recovery from actual STALL:

- + Possible inability to reduce AoA with the high thrust application
- + Recovery may even require thrust reduction
- + Recovery from a stall may require altitude loss

A SINGLE PROCEDURE was defined focusing on AoA reduction (covering Approach to Stall and Actual Stall)

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Procedure

Rationale

One single procedure to cover:

- + APPROACH TO STALL, and
- + ACTUAL STALL

Focus on AoA Reduction

Remove TOGA as first action

Spurious Stall Warning at Lift Off

[MEM] STALL RECOVERY

As soon as any stall indication (could be aural warning, buffet...) is recognized, apply the immediate actions:

NOSE DOWN PITCH CONTROL.....APPLY
This will reduce angle of attack

Note: In case of lack of pitch down authority, reducing thrust may be necessary.

BANK.....WINGS LEVEL

- **When out of stall (no longer stall indications) :**
THRUST.....INCREASE SMOOTHLY AS NEEDED
Note: In case of one engine inoperative, progressively compensate the thrust asymmetry with rudder.

SPEEDBRAKES.....CHECK RETRACTED
FLIGHT PATH.....RECOVER SMOOTHLY

- **If in clean configuration and below 20 000 ft :**
FLAP1.....SELECT

Note: If a risk of ground contact exists, once clearly out of stall (no longer stall indications), establish smoothly a positive climb gradient.

[MEM] STALL WARNING AT LIFT-OFF

Spurious stall warning may sound in NORMAL law, if an angle of attack probe is damaged. In this case, apply immediately the following actions:

THRUST.....TOGA

At the same time:

PITCH ATTITUDE.....15 °
BANK.....WINGS LEVEL

Note: When a safe flight path and speed are achieved and maintained, if stall warning continues, consider it as spurious.



Airbus Recommendations

OPERATIONS TRAINING TRANSMISSION - OTT

TO: All A318,A319,A320,A321,A330,A340,A350,A380 Operators

SUBJECT: ATA 00 – Undesired Aircraft State - Training Recommendations

OUR REF.: 999.0012/17 Rev 00 dated 10-FEB-2017.

APPLICABLE AIRCRAFT: This OTT is applicable to A318, A319, A320, A321, A330, A340, A340-500, A340-600, A350, and A380.

•Notice: This OTT provides Operators with recommendations on training techniques or training programs. These training recommendations aim to enhance the efficiency or safety of operations. It is each Operator's responsibility to distribute the information contained in this OTT to ensure application of the training recommendations in the Operator's own training department or any training organization where their crews are trained.

Training



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OTT content (stall)

Stall at Low altitude

- + Recognition of Stall indications
- + Application of Recovery procedure
 - Alternate Law
 - Clean, or Approach conf. in turn, or Landing conf.

Stall at High Altitude

- + Recognition of Stall indications
- + Application of Recovery procedure
 - Alternate Law
 - Clean

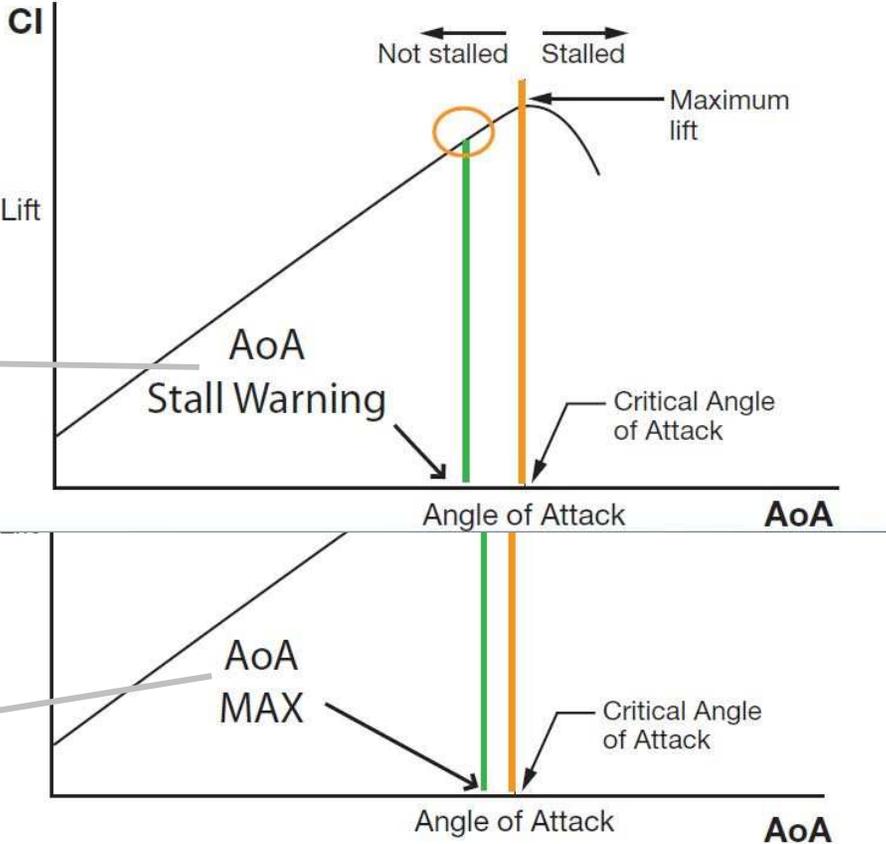
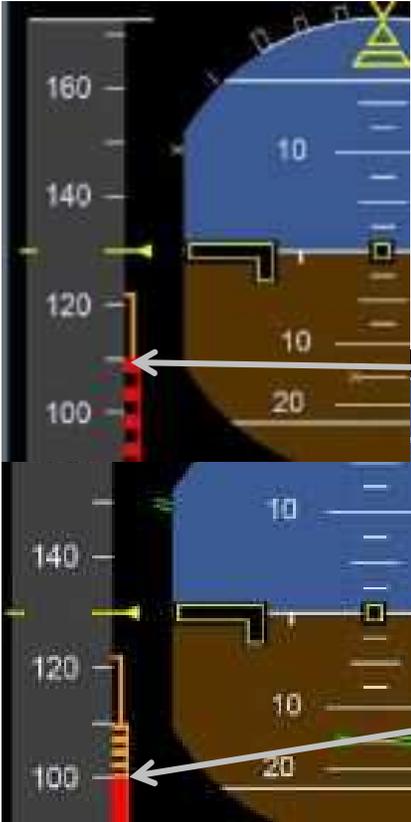
Training by a competent Instructor

Training conducted over a period not exceeding 3 years

Full credit across all Airbus FBW aircraft

AIRBUS

Training





Conclusion

Stall is:

- + An AoA problem only
- + NOT directly a speed issue

Single procedure to:

- + Cover ALL stall conditions
- + Get rid of TOGA as first action
- + Focus on AoA reduction

Refer to OTT 999.0012/17 Rev00 dated 10 Feb 2017

- + To train your pilots

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