# Fan Basics

DAE is in the business of providing Airmovers (Fans) that satisfy the specific requirements that our customers specify to us. Most of the time a customer will provide us with the following parameters:

1. Airflow
2. Pressure Drop or System Resistance
3. Electrical Supply
4. Space Envelope

From these four basics we can begin to make a fan selection. It is important to qualify that DAE has over 1200 existing fans from where we would begin to make a selection, HOWEVER it is our core capability to provide a custom product matching peak efficiency with the customer requirements.

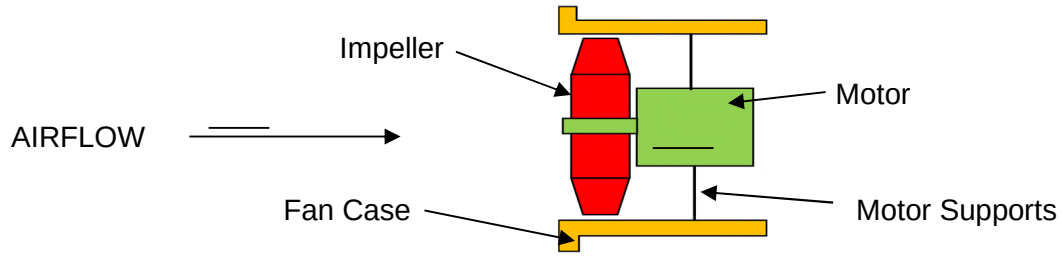
DAE manufactures three basic fan configurations and there are examples of each on display on our stand at the DSEI exhibition in London:

Axial Fans  Centrifugal Fans  Mixed Flow Fans

Each fan configuration has unique qualities that provide solutions to customer requirements.

## Axials

The term Axial comes from the air passage being parallel to the fan axis.
These can be simple **Tubeaxials** where the impeller is run in a tube

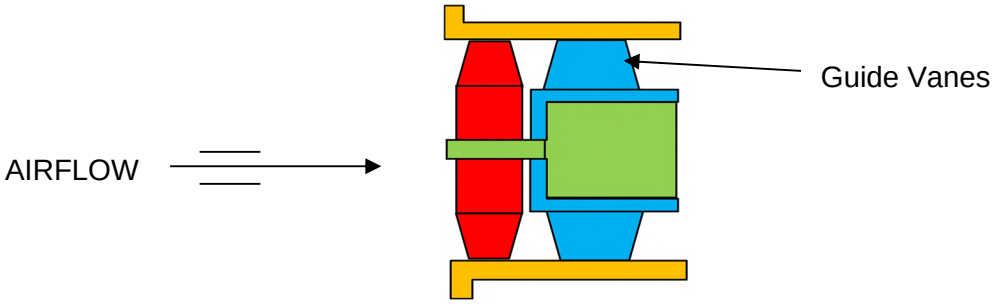



**TUBEAXIAL**



Inquire at: **https://daesystemsnc.com**
**email:** cs@daesyst.com **Phone: US +1-828 548-3192 _ UK +44 (0)7586 809 151**

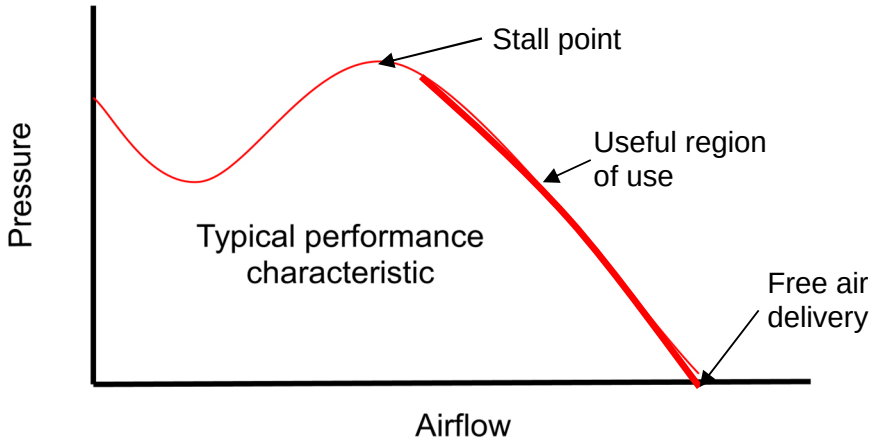
OR **Vaneaxials** where aerodynamic guide vanes are added, this gives the fan more pressure generation capability.




**VANEAXIAL**

Axial fans are the most common seen, they can be very compact with a large amount of power in a small package, and this is due to the motor being self cooled by the air that the fan is moving. Axial fans are good for high flow generation, the DAE range is up to 7000 cfm (cubic feet per minute) (3300 litres per second).

We test every fan we produce to demonstrate its performance characteristic, this takes the form of a Flow vs Pressure curve, a typical axial performance curve is shown below:




The aerodynamic geometry of axial fans causes the impeller blades to stall as the flow decreases, here the fan flow becomes unstable, noisy, and leads to low fan life. Selection should be on the straight portion of the fan curve.

**Typical applications for Axial fans:**
Avionics Cooling
Electronics Cooling
Crew and Equipment Cooling
Gunsmoke extract
Ventilation
Scavenge
Engine & Gearbox Cooling/Ventilation
Inflation



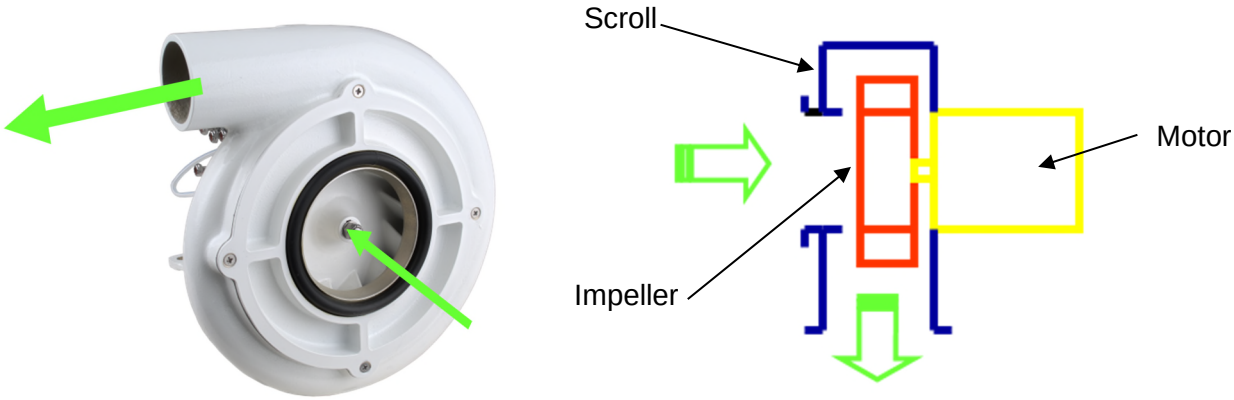
Inquire at: **https://daesystemsnc.com**
**email:** cs@daesyst.com **Phone: US +1-828 548-3192 _ UK +44 (0)7586 809 151**

**Axial Fans on display at DSEI**

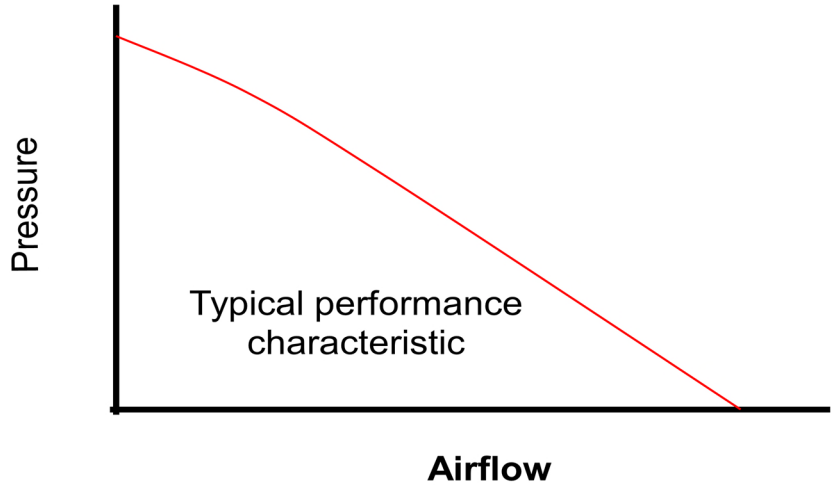
M2641A-6A
M4401D
M5921PA-1A
M7481E-1A

## Centrifugals

As the name suggests Centrifugal fans move the air by centrifugal action, the air enters the impeller at the centre and is centrifuged outwards in all directions at increasing speed, the air is then collected and entrained in a geometric shape known as the involute or scroll. This action increases the pressure and discharges the air at 90° from the inlet.




For Centrifugal fans the performance curve is typically closer to a straight line, meaning that the fan is safe to work across the entire flow range. Used more when higher pressures are required, DAE has Centrifugal fans that generate 60 inches water gauge (15kPa)






Inquire at: **https://daesystemsnc.com**
**email:** cs@daesyst.com **Phone: US +1-828 548-3192 _ UK +44 (0)7586 809 151**

The fan motor is not in the airstream and therefore not self cooled, this tends to make the motors larger in size for an equivalent power when compared to axial fans.

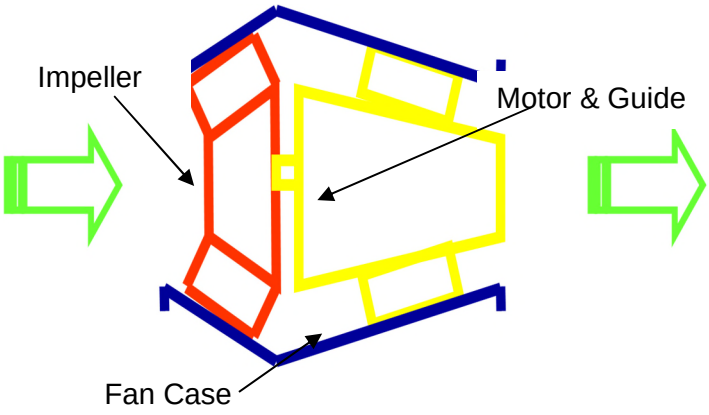
Centrifugal fans are very stable and robust; they can be used with changing system flows such as a filter. With the motor outside of the airstream, Centrifugal fans are perfect for handling air or gas is at high temperature.

**Typical applications for Centrifugal fans:**
NBC Filtration
Scavenge
Pressurisation
Inflation
Air conditioning systems
High back pressure systems
Varying back pressure systems (filters)
Radar systems

**Centrifugal Fans on display at DSEI**
C023-445B
C100

## Mixed Flow Fans

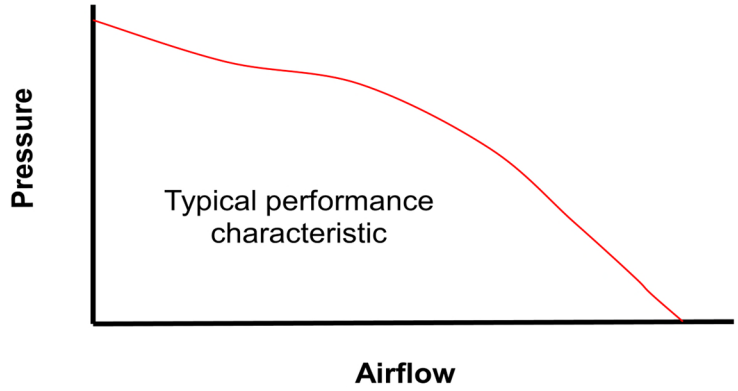
Mixed Flow fans combine the attributes of both Axials and Centrifugals. This is due to the geometry of the impeller, where the aerodynamically shaped blades are mounted on a conical hub as opposed to a parallel hub on an axial impeller. This gives the airstream a half centrifugal effect. The result is a combination of high flow and high pressure.



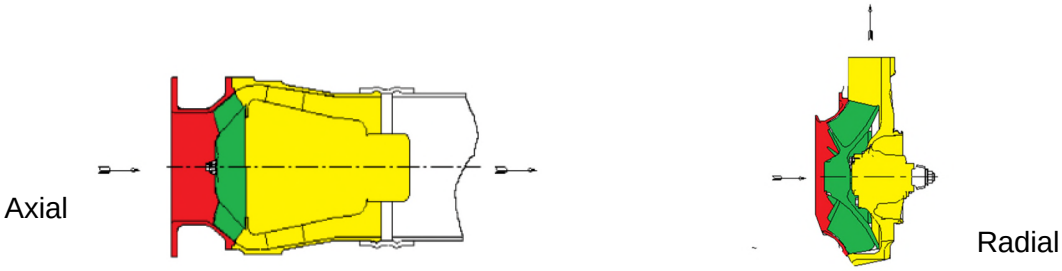



Inquire at: **https://daesystemsnc.com**
**email:** cs@daesyst.com **Phone: US +1-828 548-3192 _ UK +44 (0)7586 809 151**

Due to the Mixed Flow geometry the performance curve demonstrates a non-stalling characteristic, like the centrifugal fans the Mixed Flow can be used over the entire flow range. DAE Mixed Flows have a flow capability of 1800 cfm (850 l/s) and a pressure capability of 21 inches water gauge (5.25kPa)




Mixed Flow fans can be configured either axially or radially making them very versatile. The geometry also results in low noise levels compared to an equivalent axial fan




**Typical applications for Mixed Flow fans:**
Low noise specifications
Varying back pressure systems (filters)
Avionics Cooling
Electronics Cooling
Crew and Equipment Cooling
Gunsmoke extract
Ventilation
Scavenge (high efficiency)
Engine & Gearbox Cooling/Ventilation
Inflation
Pressurisation
Air Conditioning systems



Inquire at: **https://daesystemsnc.com**
**email:** cs@daesyst.com **Phone: US +1-828 548-3192 _ UK +44 (0)7586 809 151**

## Fan Summary:

Providing a fan is always going to be a trade off between Performance, Size, Weight, Noise, Efficiency, Cost, and Reliability.
So trying to keep this simple, think:
**Axial Fans for** – Flow, best power to weight/size ratio
**Centrifugal Fans for** – Pressure, variable resistance applications, robustness
**Mixed Flow Fans for** – Combining Flow and Pressure, Low noise, versatile, variable resistance

The fan is the end product but what we are really selling is our capability of solving our customer's problems. We have the expertise and experience to demonstrate our ability to enhance the customer's equipment to perform better, longer, quieter, combining ideas that they have not thought of.

## Drives

Most common drive for fans is an electric motor, but all the above fan types can be arranged to be driven by a direct shaft or belt driven or with a hydraulic motor. DAE has experience with the following:
AC supply 400Hz, 60Hz, 50Hz
AC supply Variable frequency
DC supply 24 - 28V – Brushed and Brushless motors
DC supply 270V – Brushless
Hydraulic Drive
Mechanical Drive

## Controllers

DAE manufactures Modular Fan Controllers for maximising performance and flexibility, with an input of 24 to 270V DC the fan speed can be regulated single, twin or infinitely to meet the application conditions. They can also provide outputs such as speed, health warning, soft start, locked rotor protection and temperature monitoring.

GOP204 on display

**Intelligent Master Controller (IMC)**
The master controller is connected upstream to the vehicle control systems through redundant CAN bus interfaces, and downstream to power relays, fans / blowers and sensors. Redundant vehicle power is run to the master controller and through a relay to all of the fans.

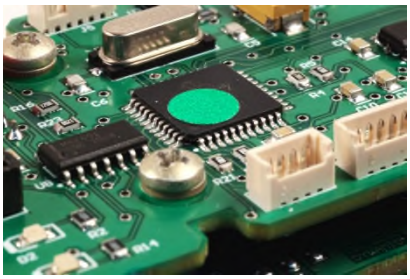
For example the IMC can individually activate or adjust fan performance based on sensor detection of fumes or particulates, or changes in altitude or temperature. The system can also change behavior based on commands from the vehicle; for example all of the fans can spin at maximum power when the weapon systems are firing, or shut down completely via when the vehicles fire suppression system is activated.

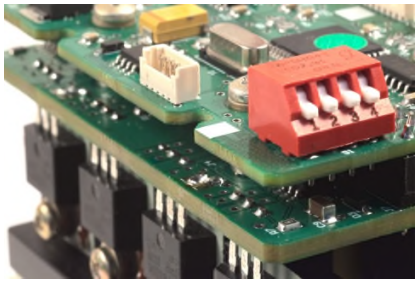


Inquire at: **https://daesystemsnc.com**
**email:** cs@daesyst.com **Phone: US +1-828 548-3192 _ UK +44 (0)7586 809 151**

The traditional architecture of building fans / blowers into a vehicle focuses on the vehicle's systems directly controlling each fan and blower. This requires cable runs from the vehicles control systems directly to each individual fan. Using the DAE intelligent master controller a complete fan system can be designed into specific areas of the vehicle; i.e. the engine compartment, the turret, the crew cabin. The vehicle systems need only run redundant cable runs for CAN bus to the DAE IMC's, which in turn control all of the fan characteristics in that subsystem. This simplifies design and maintenance.

The possibilities are limited only by the sensors available and the needs of the customer.





Steve Rayner
Aug. 2013



Inquire at: **https://daesystemsnc.com**
**email:** cs@daesyst.com **Phone: US +1-828 548-3192 _ UK +44 (0)7586 809 151**