Chapter 11

Aircraft Electrical

Aayush Bhattarai

Assistant Professor

Institute of Engineering (IOE)
Tribhuvan University

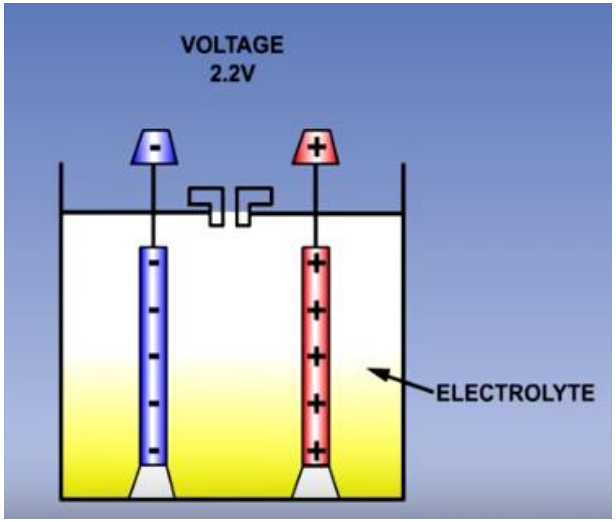
2019

1. Aircraft Batteries

- Two Types of Batteries
  - Lead Acid
  - Alkaline Battery
- Should Power Essential Loads
  - PFD
  - Standby Lightning Equipment
  - Essential Communications
  - Other essential equipment's for safe operation of flight.

Lead Acid

- Characteristics
  - On load Voltage (Nominal Voltage): 2.0 V
  - Off Load Voltage: 2.2 V
  - Positive Plate: Lead Peroxide, Negative Plate: Spongy Lead
  - Electrolyte: Sulphuric Acid
  - Container: Glass or Hard Plastic
  - Has filler cap on the top, to fill distilled water, acts as vent for release of Hydrogren, during discharge.

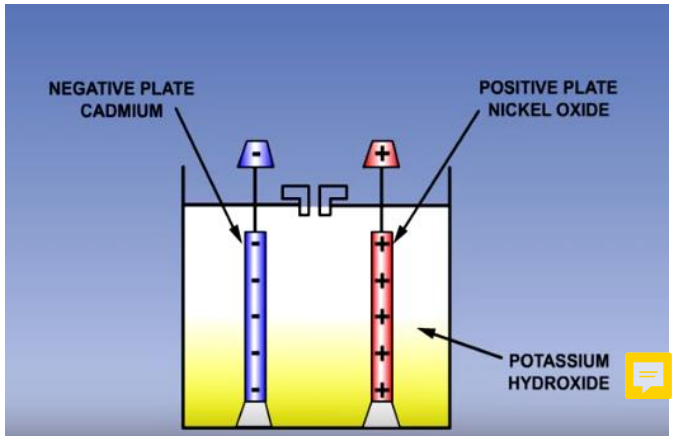


Lead Acid

- Characteristics
  - Charge State: Can be measured by Strength of Electrolyte Solution (Hydrometer)
  - Specific Gravity: 1.27 (Full Charge)
  - When active, acid becomes weaker and Specific Gravity decreases, as Specific Gravity Decreases, the Voltage of the battery decreases, the SG is generally 1.17 and volt supplied is 1.8.
  - If volt is decreased it should be recharged, to charge a voltage slightly higher than OFF LOAD voltage is supplied to the plate via Battery Charger generally 2.3 V.
  - Rate of Charging should be controlled, if quick, can cause rapid evaporation, leading to damage of plates.
  - Its performance is affected by temperature, in low temperatures, the battery has higher internal resistance, so the rate of discharge from the battery also decreases. So battery should be always kept ways.
  - Since the electrolyte is highly corrosive, subsequent spill or leak in an aircraft. Leads to extensive damage.
  - Neutralizing agent is Sodium Bicarbonate.

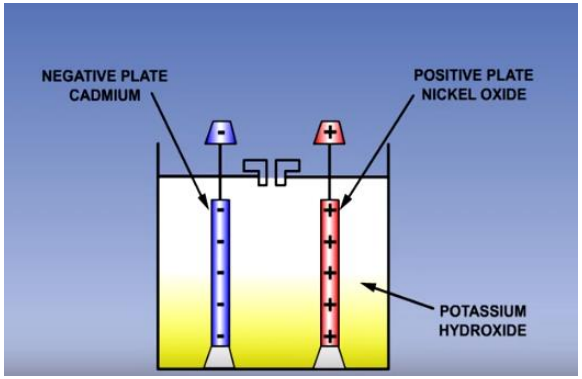
Nickel Cadmium

- Characteristics
  - On load and Off load voltage: 1.2~1.3 V
  - Positive Plate: Nickel Oxide, Negative Plate: Cadmium
  - Electrolyte: Potassium Hydroxide
  - Neutralizing Agent: Boric Acid
  - Very low internal resistance, sometimes, powers the starter of the APU.
  - To check the status, Capacity Test is performed every 3 months.
  - If capacity is less than 80%, then it should be recharged.

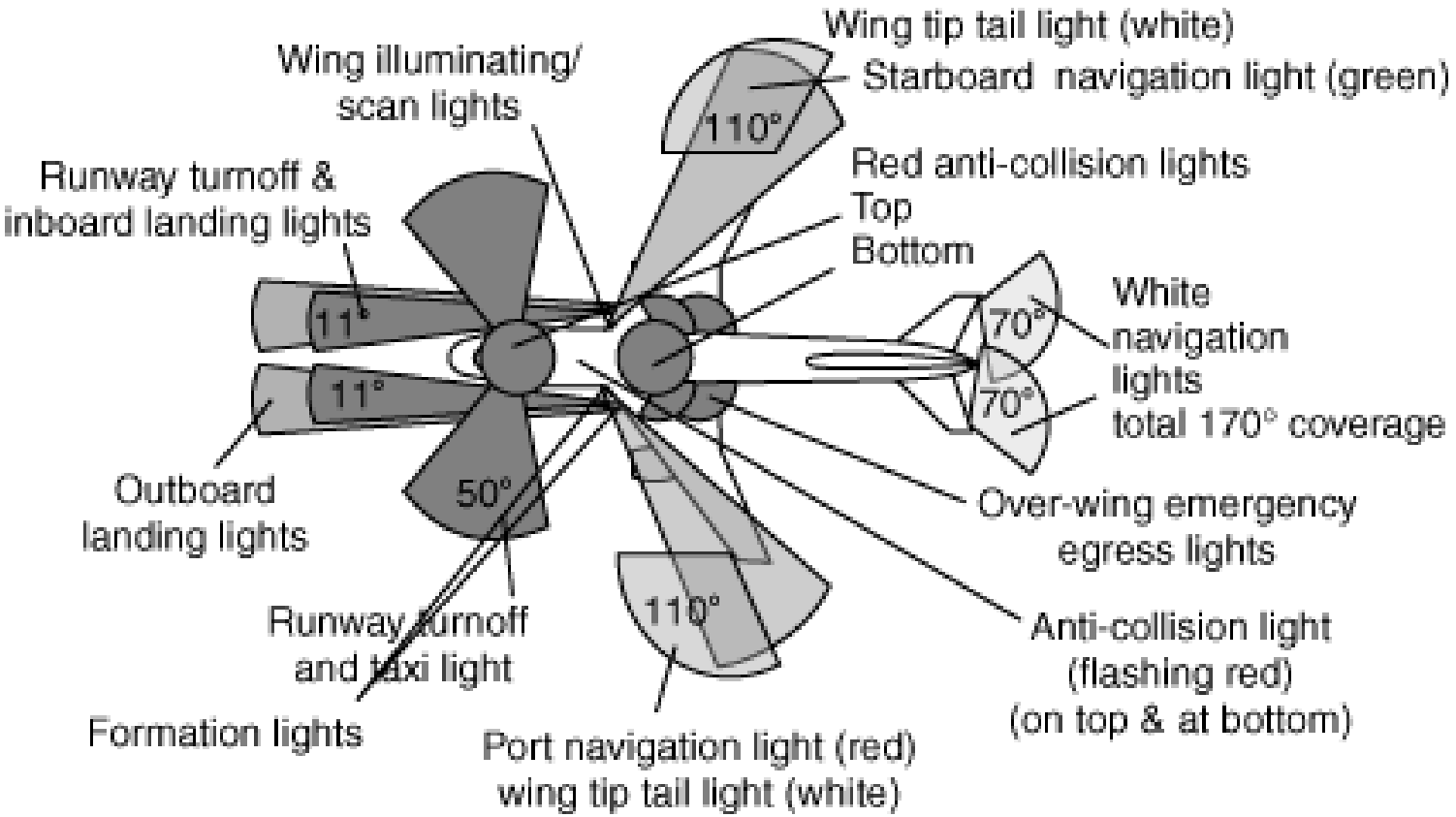


Nickel Cadmium

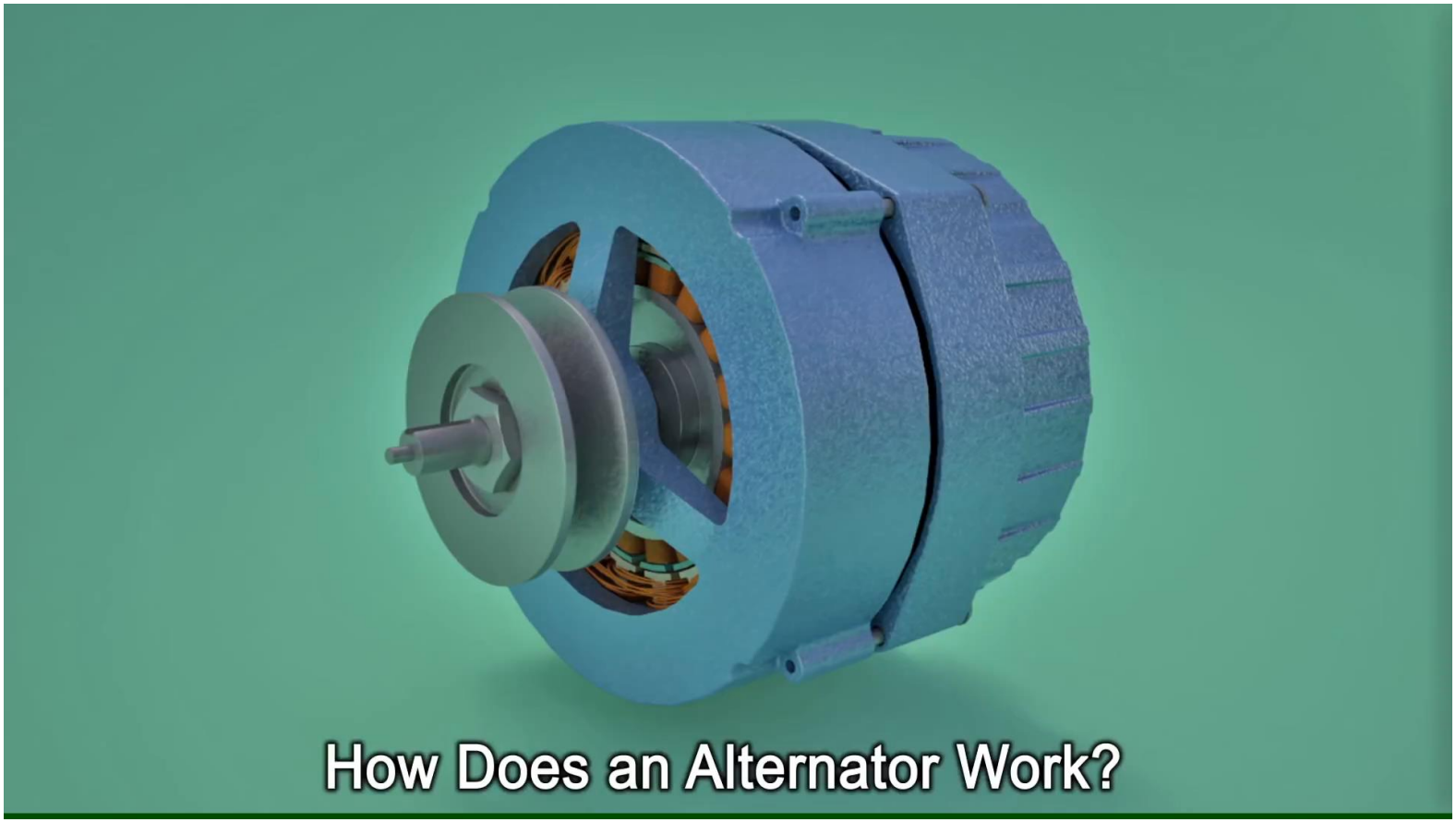
- Characteristics
  - Recharge is done after the engine starts
  - Battery charger is responsible for recharging.
  - Too quick charging may result in Heat Generation
  - Explosion leading to excessive heat generation of battery is known as Thermal Runaway.
  - For excessive heating, Ni-Cad is equipped with thermal sensor switch, which when senses excessive temperature than that of the pre-set temperature, it isolates the battery from the charger, and re-connects after the battery cools down.
  - Some battery charger are equipped in built Thermal Switches
  - Some battery charger are equipped with Pulse Battery Charger, which sends a charging current in pulse to the battery.



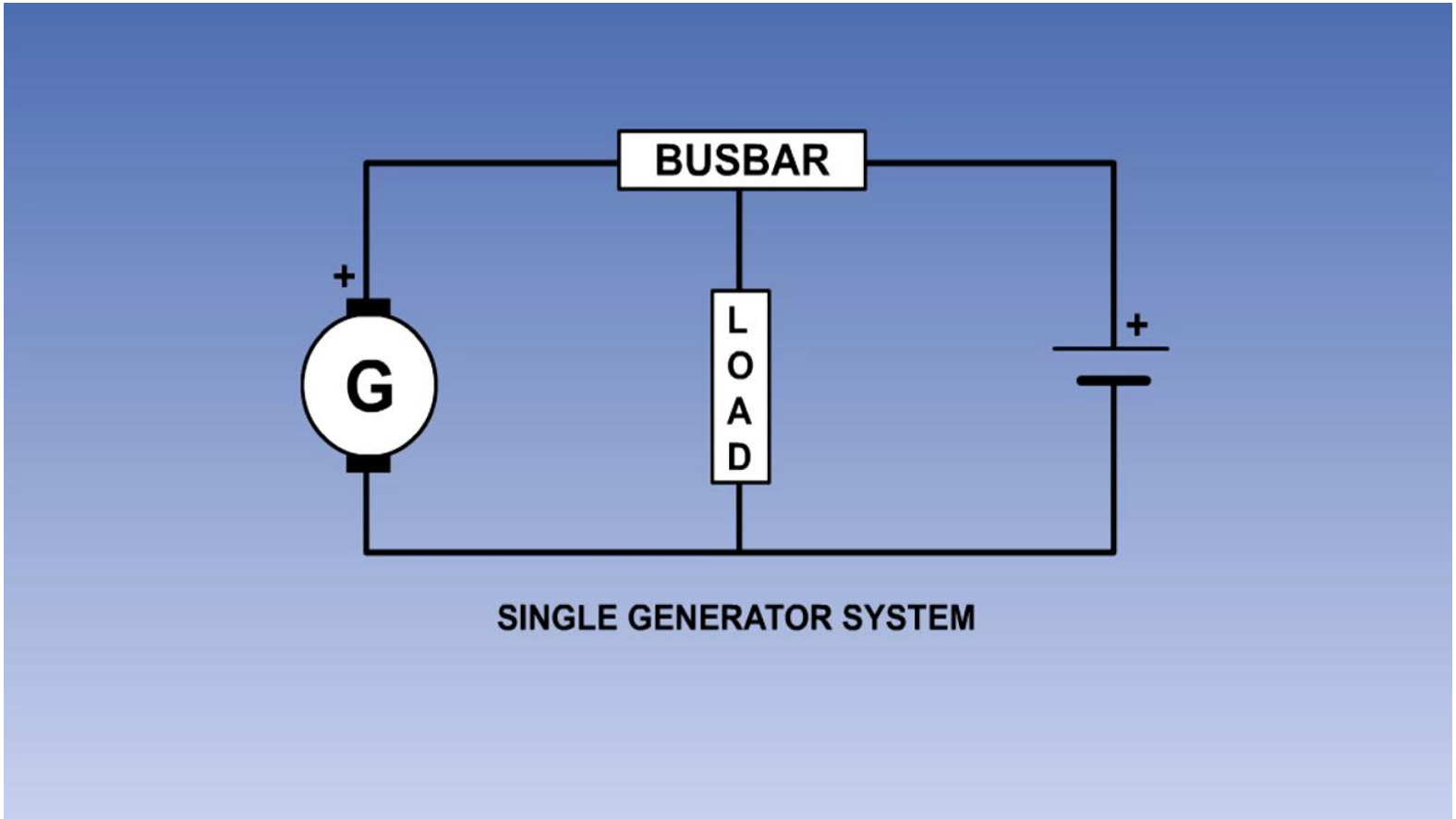
2. Aircraft Exterior Lights



2. Basic Alternator



Aircraft Electrical System-General Overview



SINGLE GENERATOR SYSTEM

External Power-Ground Power Unit

- AC or DC Supply, both Available.
- How Different is it from APU?

Emergency Power Generator- RAT or ADG