Basic Construction and Functions of Aircraft Parts

Figure 1: Parts of an aircraft
Figure 2 (a): Construction of a typical aircraft wing
Figure 2(b): Wing construction
Figure 3: Wing box cross-section
Figure 4: Typical wing spar configurations
Figure 5: Wing front spar (of C141 wing)
Figure 6: Typical wing rib configurations
Figure 1.3 Truss type fuselage structure

Figure 7: Fuselage structure types
Figure 8(a): Typical landing gear system
Figure 8(b): Internal construction of a shock strut
Typical Transport Aircraft Wing Structural Weight Distribution

- Engine 20%
- Interior: 15%
- System: 20%
- Airframe: 45%
  - 1) Wing 45%
  - 2) Fuselage 45%
  - 3) Tail 10%

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin stringers and spar caps</td>
<td>39%</td>
</tr>
<tr>
<td>Access doors, splicers and attachments</td>
<td>8%</td>
</tr>
<tr>
<td>Spar webs</td>
<td>7%</td>
</tr>
<tr>
<td>Ribs</td>
<td>5%</td>
</tr>
<tr>
<td>Bulkheads</td>
<td>8%</td>
</tr>
<tr>
<td>LE and TE</td>
<td>11%</td>
</tr>
<tr>
<td>Secondary structures</td>
<td>4%</td>
</tr>
<tr>
<td>Control surfaces</td>
<td>18%</td>
</tr>
</tbody>
</table>
Functions of Skin or Cover

1. It transmits the aerodynamic forces to the longitudinal and transverse supporting members by *plate and membrane action*.
2. It *develops shearing stresses* which react to the applied torsional moments and shear forces.
3. It *acts with the longitudinal members in resisting the applied bending and axial loads*.
4. It *acts with longitudinal in resisting the axial load with the transverse members* in reacting the hoop or circumferential load when the structure is pressurized.
5. In addition to these, it provides an aerodynamic surface and cover for the contents of the vehicle.

- Spar webs play a role that is similar to function 2 of the skin.

Functions of Longitudinals, Stringers or Stiffeners (Longerons)

1. They *resist bending and axial loads* along with the skin.
2. They *divide the skin into small panels* and thereby increase its buckling and failure stresses.
3. They *act with the skin in resisting axial loads* caused by pressurization.

- The spar caps in an aerodynamic surface perform functions 1 and 2.

Functions of Frames, Rings (Bulkheads)

1. Maintain cross section shape
2. Distribute concentrated loads into the structure and redistribute stresses around structural discontinuities.
3. *Establish the column length and provide end restraint for the longitudinal to increase their column buckling stress*.
4. *Provide edge restraint for the skin panels and thereby increase the plate buckling stress of these elements*.
5. Act with the skin in resisting the circumferential loads due to pressurization.