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Standardized Nomenclature for Ram-Air Parachutes

Introduction

This Technical Standard was initially adopted by the Parachute Industry Association (PIA) on January 23, 1984. It was last revised on January 23, 2019. Input concerning future revisions and additions should be submitted to:

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Definitions

Airlock: On a canopy, a valve which permits air flow more easily in one direction, and restricts airflow in the opposite direction. In most case, airlocks are installed in the nose of the canopy to permit air to enter during deployment and flight, and restrict air from flowing out the nose to ensure better pressurization in turbulent air.

Angle of,

> **Attack:** The angle formed between the flight path and the chord line. The Greek letter alpha (α) is used to denote the angle of attack. See Figure 3.
>
> **Trim:** The angle formed between the horizontal reference line and the trim line. The Greek letter theta (θ) is used to denote the angle of trim. The term "angle of trim" is used instead of the somewhat analogous aircraft term "angle of incidence." See Figure 1b.

Area,

> **Airfoil Section:** The finished cross sectional area of a given rib (airfoil) section. When ribs are not identical, the specific rib must be identified. Used for calculations of pack volume and internal volume of canopy.
>
> **Planform:** The product of the average chord times the average span of the canopy.
>
> **Projected:** The area of an inflated canopy as viewed from above, perpendicular to the chord line at the centerline of the parachute. Due to canopy curvature and cell inflation bulging the projected area is always smaller than the planform area.

Aspect Ratio: $Span^2/Area$, which for a rectangular planform reduces to Span/Chord.

Attachment Point: A loop of tape, webbing, or the functional equivalent, for attaching something to the surface of the canopy.

Pilot Chute: An attachment point for the pilot chute or pilot chute bridle, including any reinforcement to reduce the effects of abrasion, and also including any additional rib- or canopy- reinforcing tapes intended to distribute the load from the pilot chute to the canopy.

Suspension Line: An attachment point for a suspension line or control line. Some canopies use extensions of rib-reinforcing or flare-reinforcing load tapes to form line attachment points. See also **Flare, Suspension Line Attachment**. See Figure 1a.

Cell: The chamber formed by upper and lower surfaces and two adjacent loadbearing ribs. See Figure 4.

Channel,

Drawstring: A fabric or tape channel that encloses a drawstring, most often found on main canopy sliders.

Pilot Chute Reefing: A channel that runs through the center of the canopy, from upper surface to the lower surface, to allow the pilot chute bridle to connect to the slider.

Chord: The distance from the farthest forward point to the farthest aft point on an airfoil section. If the canopy airfoil sections are not identical, an average chord may be specified. Airfoil dimensions are assumed to be finished dimensions unless otherwise specified. See also **Span**, and **Line (Design), Chord.**

Connector Link,

Hard link: A link constructed of metal such as a Maillon Rapide Quick Link or L-Bar PS22002 used to connect Suspension Lines to the Harness Risers.

Soft link: A connector link constructed primarily of fabric, cord or tape used to connect Suspension Lines to the Harness Risers.

Construction,

Chordwise: A construction method in which upper and lower surfaces are assembled from panels which run from front to rear (chordwise) and are joined to the ribs and each other using a variety of sewn seams; the most common type of ram-air parachute construction.

Spanwise: A construction method in which the upper and lower surfaces are assembled from panels that run from side to side (spanwise) across the full width of the canopy. Personnel parachutes usually require three or four panels each for the upper and lower surfaces.

Crossports: Holes cut in the rib sections to balance the air pressure between adjacent chambers. See Figure 5.

Drawstring, Slider: A length of tape or line which may be pulled to collapse or remove a slider after deployment.

Flare, Suspension Line Attachment: An extension of a load bearing rib used on some canopies to distribute suspension line loads along the lower rib seams. A suspension line attachment flare may be integral with the rib or may be sewn to it. See Figure 5.

Line (Design),

Chord: A line drawn through the farthest forward point and the farthest aft point on an airfoil section. See Figure 3.

Reference, Horizontal: A line drawn at a right angle to the Vertical Reference Line. Usage is equivalent to the practice of using the aircraft longitudinal axis as an aircraft reference line. See Figure 1b.

Reference, Vertical: A line drawn through the connector links (gathered together) and the quarter chord point. See Figure 1b.

Trim: A line drawn through the farthest forward and farthest aft line attachment points (excluding control line attachment points). See Figure 1b.

Line (Rigging),

Cascade: A line attached with one end at the canopy and the other end to an intermediate point of an adjacent line. Contrast with **Continuous.** See Figure 6.

Continuous: A line attached with one end at the canopy and the other end at the riser with a connector link. Contrast with **Cascade**. See Figure 6.

Control: A line fastened to the trailing edge of the canopy, used to steer and modulate the forward speed and descent rate of the parachute. Also known as steering or brake line.

Flare: A control line intended primarily for flaring the canopy for landing, but which may also be used for steering; also known as **Secondary** control lines, in which case the remaining control lines are known as **Primary** control lines.

Brake-Toggle: When a control line is constructed in sections, that portion of the line between the toggle and the deployment set eye ("cat-eye"). See Figure 6.

Lower: When a control line is constructed in sections, that portion of the line between the deployment set eye and the upper portion. See Figure 6.

Upper: When a control line is constructed in sections, that portion of the line between the canopy and where it converges with other lines attached to the canopy. See Figure 6.

Identification System for:

Suspension lines: lettered "A," "B," "C," . . . from front to rear along each load-bearing seam. Numbered from outboard to inboard (outboard lines numbered "1"; see Figure 2b) or inboard to outboard (lines on center load-bearing seams numbered "1"; see Figure 2a).

Control lines: numbered by rib seam, including non-load-bearing ribs, from outboard to inboard. See Figures 2a and 2b.

Suspension: One of the lines that carries the load from the canopy surface to the risers. Control lines are usually not considered suspension lines. See Figure 4.

Pilot Chute Controlled Reefing (PCR): A parachute reefing system that uses the drag of the pilot chute to modulate the opening rate of the canopy.

Planform: The overall shape of the wing as viewed from above, perpendicular to the chord line.

Quarter Chord Point: a point on the chord line one quarter of the distance from the nose to the tail of an airfoil. See Figure 1b.

Removable Deployment System (RDS): A slider variation that permits the slider to be removed and stowed separately after deployment. "Full RDS" is a further variation that also permits the pilot chute, bridle, and deployment bag to be removed and stowed after deployment.

Rib: A section of fabric installed between the upper and lower surfaces of a canopy; used to establish the airfoil shape of the canopy. Rib numbering systems (for example, from outboard to inboard, or from inboard to outboard) vary from manufacturer to manufacturer. See Figures 2a and 2b.

Rib, crossbrace: A rib or partial rib installed at an angle other than a 90° angle to the upper and lower surfaces of a canopy. See Figure 4.

Rib, loadbearing: A rib to which suspension lines are attached, installed at a 90° angle to the upper and lower surfaces of a canopy. See Figure 4.

Rib, non-loadbearing: A rib without attached suspension lines, installed at a 90° angle to the upper and lower surfaces of a canopy. See Figure 4.

Rib, stabilizer: A stabilizer-end rib assembly with line attachments along the lower edge. See Figure 6.

Rigging,

Crown: A suspension line length pattern in which all "A" lines are the same length across the span of the canopy, all "B" lines are the same length across the span of the canopy, and similarly all "C" and "D" lines, etc.

Flat: A suspension line length pattern in which the lines in the center of the canopy are shorter than the lines farther outboard. In flight, the center part of the airfoil is flatter and creates more vertical lift than a crown-rigged canopy, which generates lift along the radius of the spanwise arc.

Setting,

Deployment: The position of the trailing edge when the control lines are pulled down to their deployment position.
Full-Flight: The position of the trailing edge when the control lines are fully extended.

Slider: A parachute reefing device (Figure 4) usually consisting of a rectangular section of canopy cloth reinforced on the edges with lightweight webbing or tape, and with a large grommet or D-ring installed at each corner. Sliders may have fabric removed from the rectangular section or may have fabric edge extensions installed to change opening characteristics. Slider variations include:

- Domed, with a planform similar to a flat rectangular slider, but with fabric pleated along the edges.
- Split, capable of being disassembled into halves after deployment.
- Spider, made of two lengths of webbing sewn in an "X," and usually used with pilot chute controlled reefing. See **Pilot Chute Controlled Reefing (PCR).**
- Removable. See **Removable Deployment System (RDS)**.

Slider Bumper: A small device, typically made from vinyl/silicon tubing, Type-3 or Type-4 tape, or Type-12 webbing, installed at the lower end of the suspension lines to prevent damage to the slider grommets caused by the slider contacting the connector links.

Slider Stop: A small piece of rigid material (metal, plastic, phenolic, etc.) normally covered in tape or light webbing, installed on the lower edge of a stabilizer panels to prevent a slider grommet from riding up over the stabilizer material and damaging the stabilizers or the slider.

Slider Stop Chafing Pad: A tape or fabric reinforcement installed on a stabilizer at a slider stop to reduce wear from abrasion.

Span: The distance from one side of a canopy to the opposite side. Measurements taken at various distances aft of the nose will yield different results; measurements taken across the upper surface will typically be longer than those taken across the lower. An average span, or separate leading and trailing edge dimensions, may be specified. Airfoil dimensions are assumed to be finished

dimensions unless otherwise specified. See also **Chord**. See Figure 4.

Stabilizer: A fabric panel installed at the end of a canopy, intended primarily to reduce wingtip vortices (much as an end plate on an aircraft wing), and to provide some directional stability. Some stabilizer designs are ram-air pressurized for additional rigidity. See Figure 6.

Tapes, Reinforcement: A tape installed in the canopy to provide additional strength or dimensional stability. Tapes are identified by location.

> **Cross Tapes:** A reinforcing tape that runs spanwise on the upper or lower surface to distribute loads through the canopy. With chordwise construction, a cross tape typically runs from a line attachment point to laterally adjacent line attachment point, although some may run from a suspension line attachment point diagonally to a control line attachment point. With spanwise construction, a cross tape may be rolled into a seam joining spanwise panels.
>
> **Leading Edge Tape:** A tape applied to or rolled into the leading edge of an upper or lower panel; may be continuous across the span of the canopy. See Figure 4.
>
> **Line Attachment Reinforcement Tape:** A tape sewn chordwise into a seam at a line attachment point.
>
> **Load Tape:** A tape applied to a rib section and used to distribute the load from a line attachment to the canopy. When applied in a "V" may also be known as a "**V-tape**." In some canopies, load tapes may extend through the lower seam to become line attachment points. See Figure 5.
>
> **Rib Leading Edge Tape:** A tape applied to or rolled into the leading edge of a rib section. See Figure 5.
>
> **Trailing Edge Tape:** A tape applied to or rolled into the trailing edge seam; usually continuous across the span of the canopy. See Figure 5.

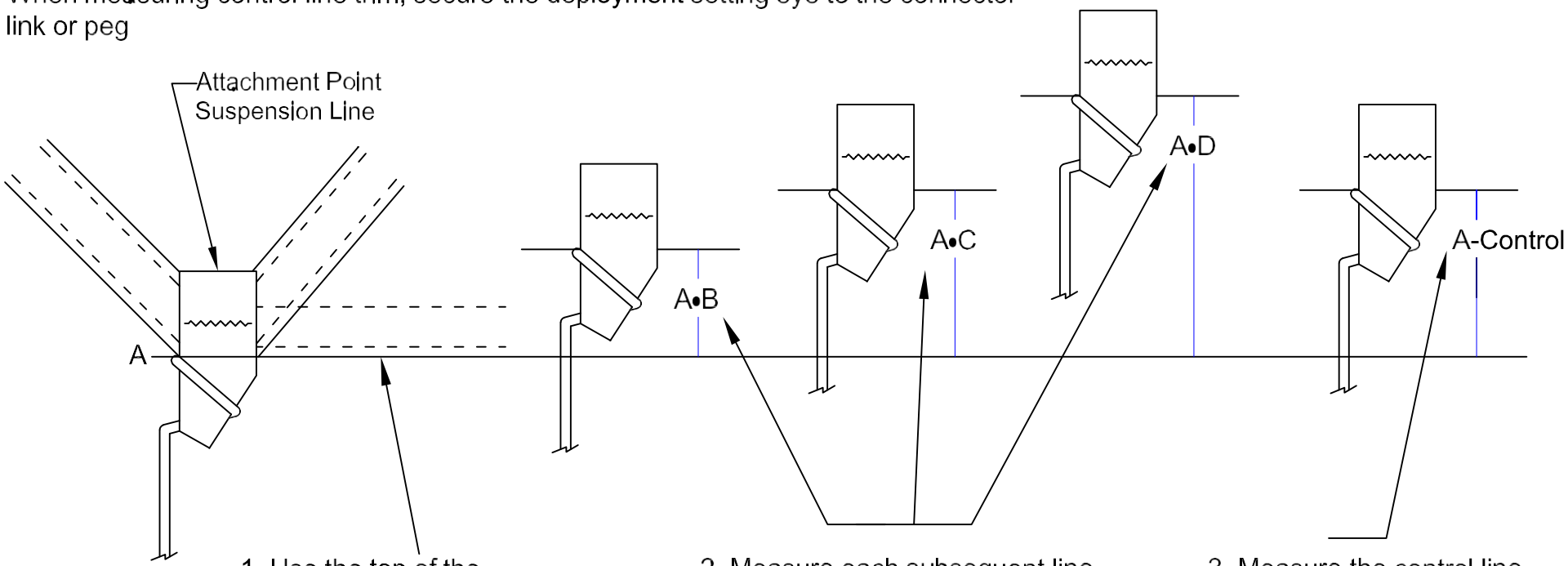
Toggle, Control: A grip attached to the end of the control line to allow the user an adequate handhold on the line. Most commonly consists of a tape/webbing loop or a hard plastic dowel; typically supplied as part of the container assembly. See Figure 6.

Trim: The arrangement of differential line lengths to produce a desired trim angle and anhedral. See also **Angle of Trim**. See Figures 1a and 1b.

Vent, Lower Surface: An opening in the lower surface to provide an alternate path for pressurization during deployment ("inflation vent") or depressurization during flight ("accuracy vent").

All lines measured pulled to equal tension (5•35 pounds typical, varies by manufacturer and line type) parallel to the "A" line, and secured to the same connector link or peg.

When measuring control line trim, secure the deployment setting eye to the connector link or peg



1. Use the top of the "A" line loop as an initial reference.

2. Measure each subsequent line differential betweenthe top of its loop and the top of the "A" line loop. "B", "C" and "D" lines shown, typical.

3. Measure the control line differential at the deployment setting.

Figure 1a. Measuring Line Length Trim

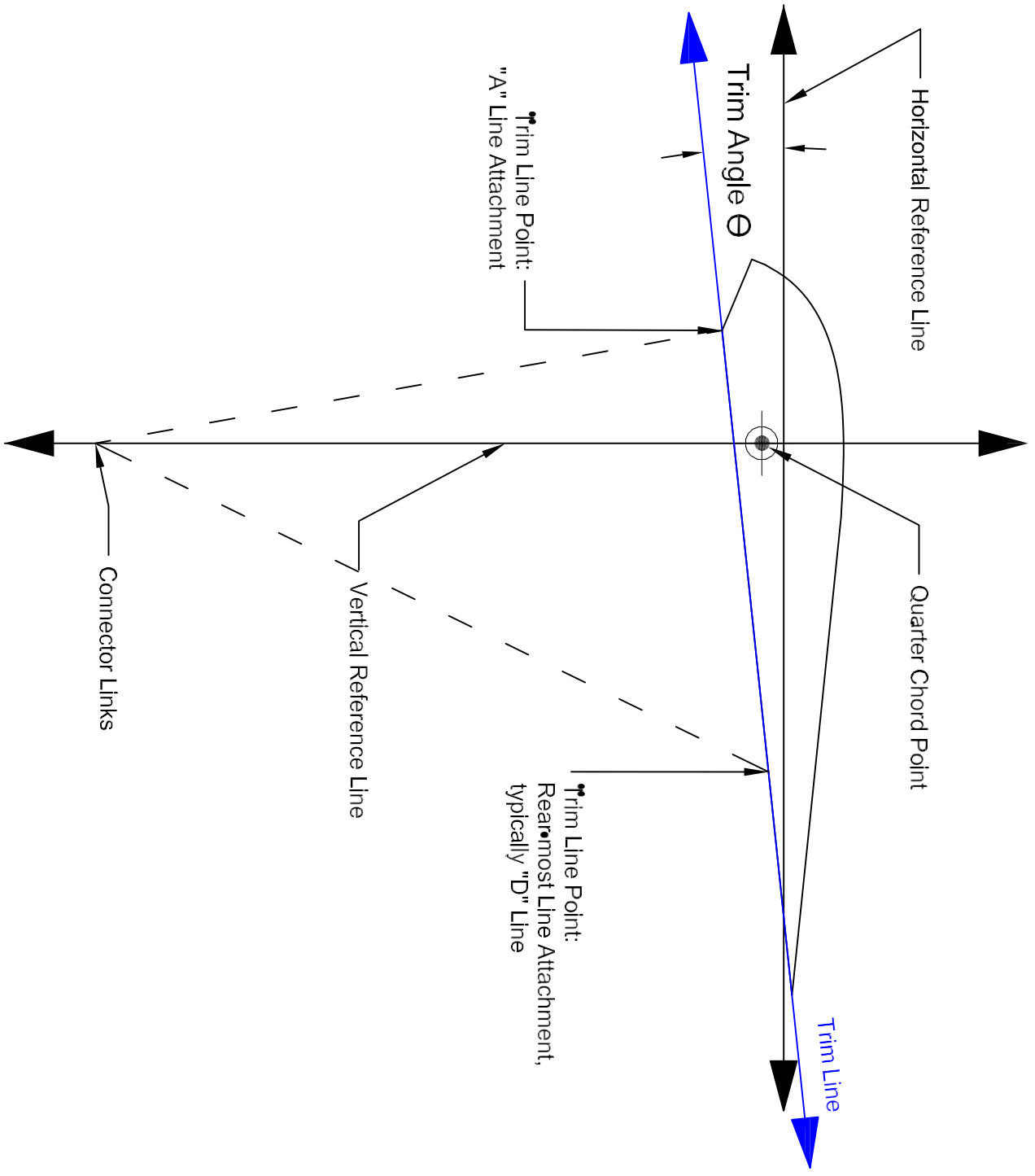


Figure 1b. Measuring Trim Angle

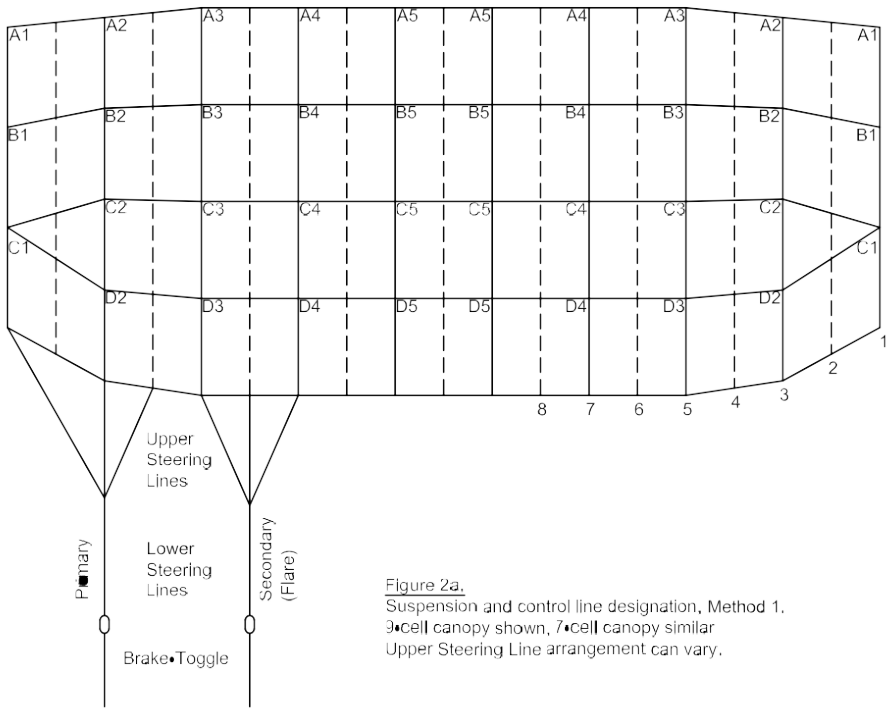


Figure 2a.
Suspension and control line designation, Method 1.
9•cell canopy shown, 7•cell canopy similar
Upper Steering Line arrangement can vary.

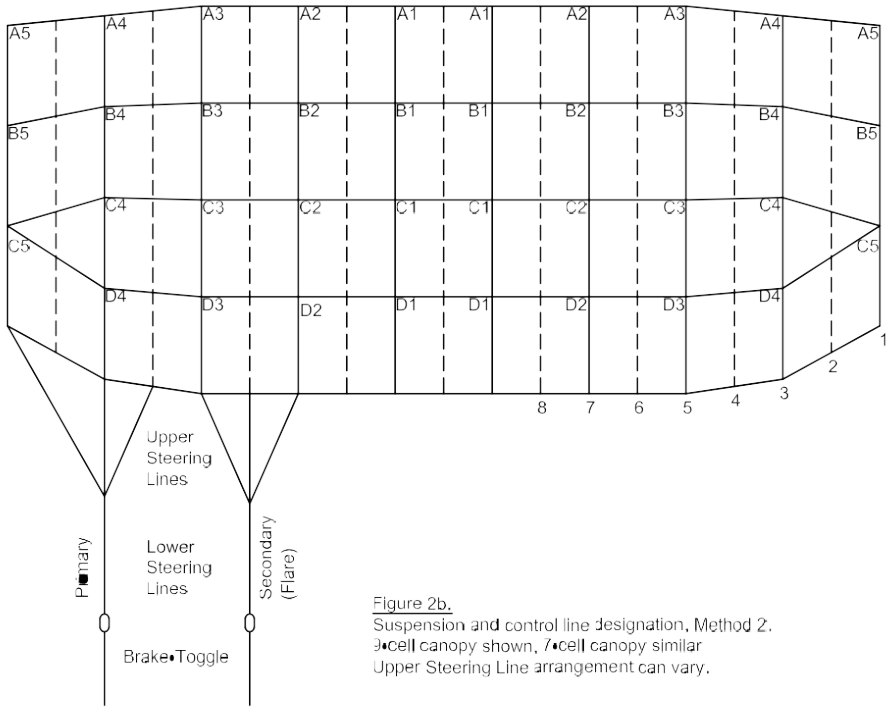


Figure 2b.
Suspension and control line designation, Method 2.
9•cell canopy shown, 7•cell canopy similar
Upper Steering Line arrangement can vary.

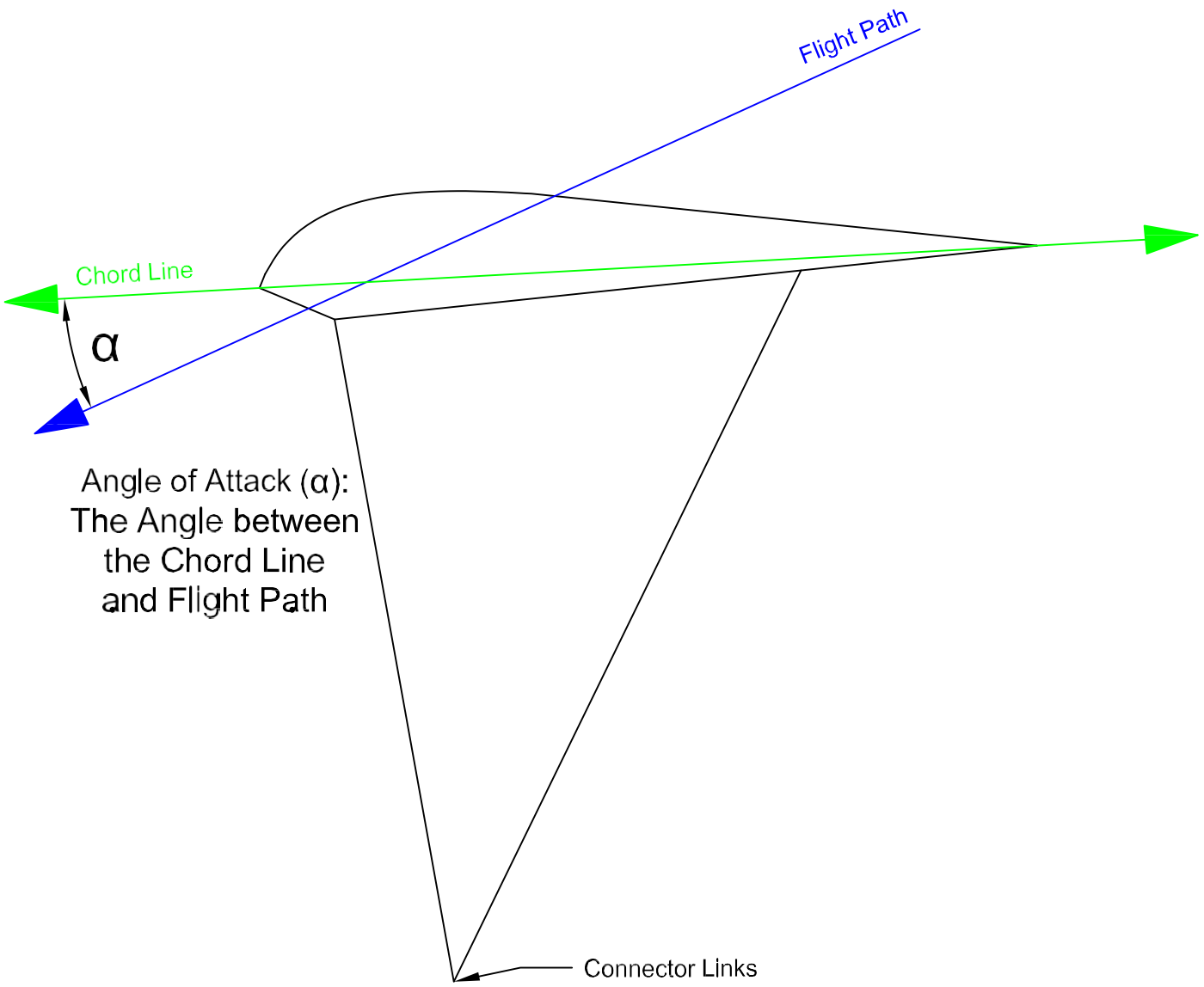


Figure 3. Angle of Attack

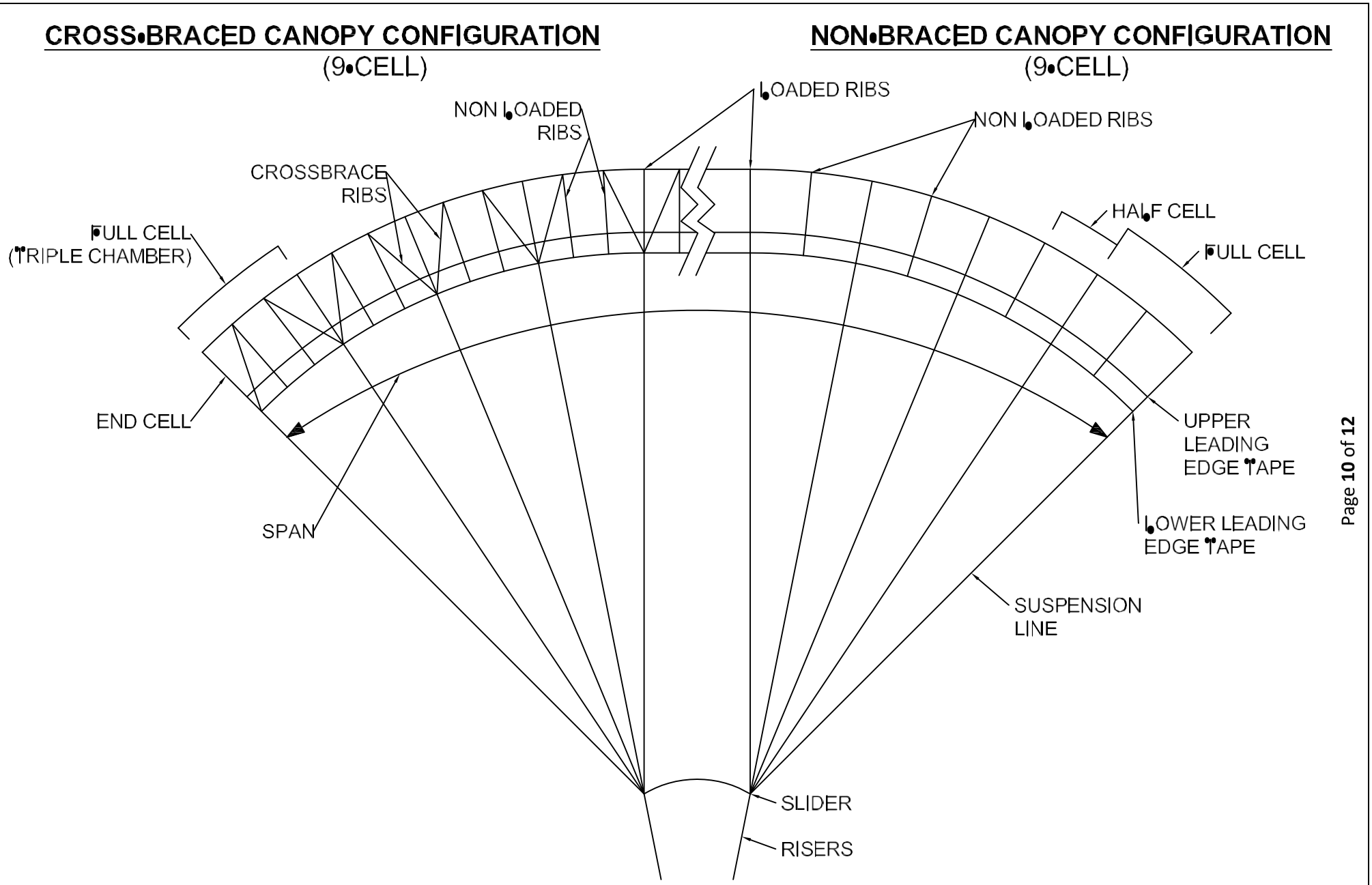
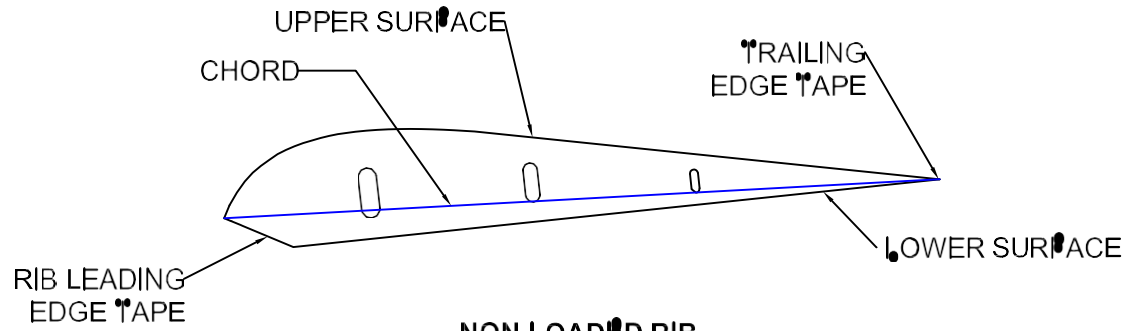
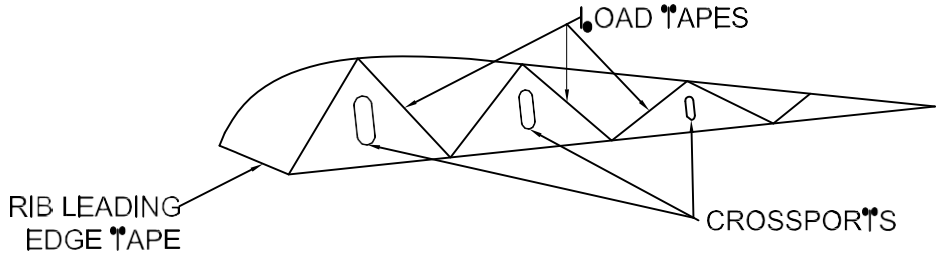


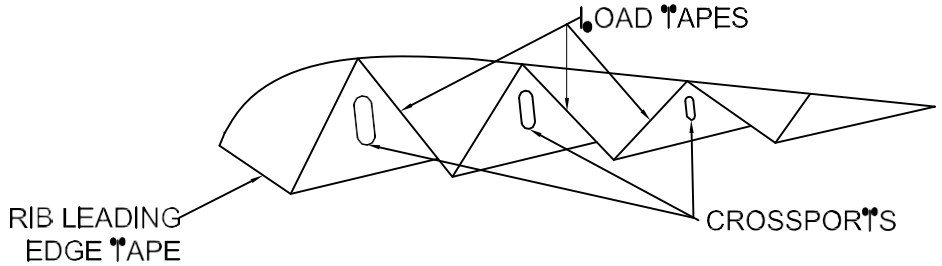
Figure 4. Canopy



NON LOADED RIB



LOADED RIB



LOADED RIB (FLARES)

Figure 5. Ribs

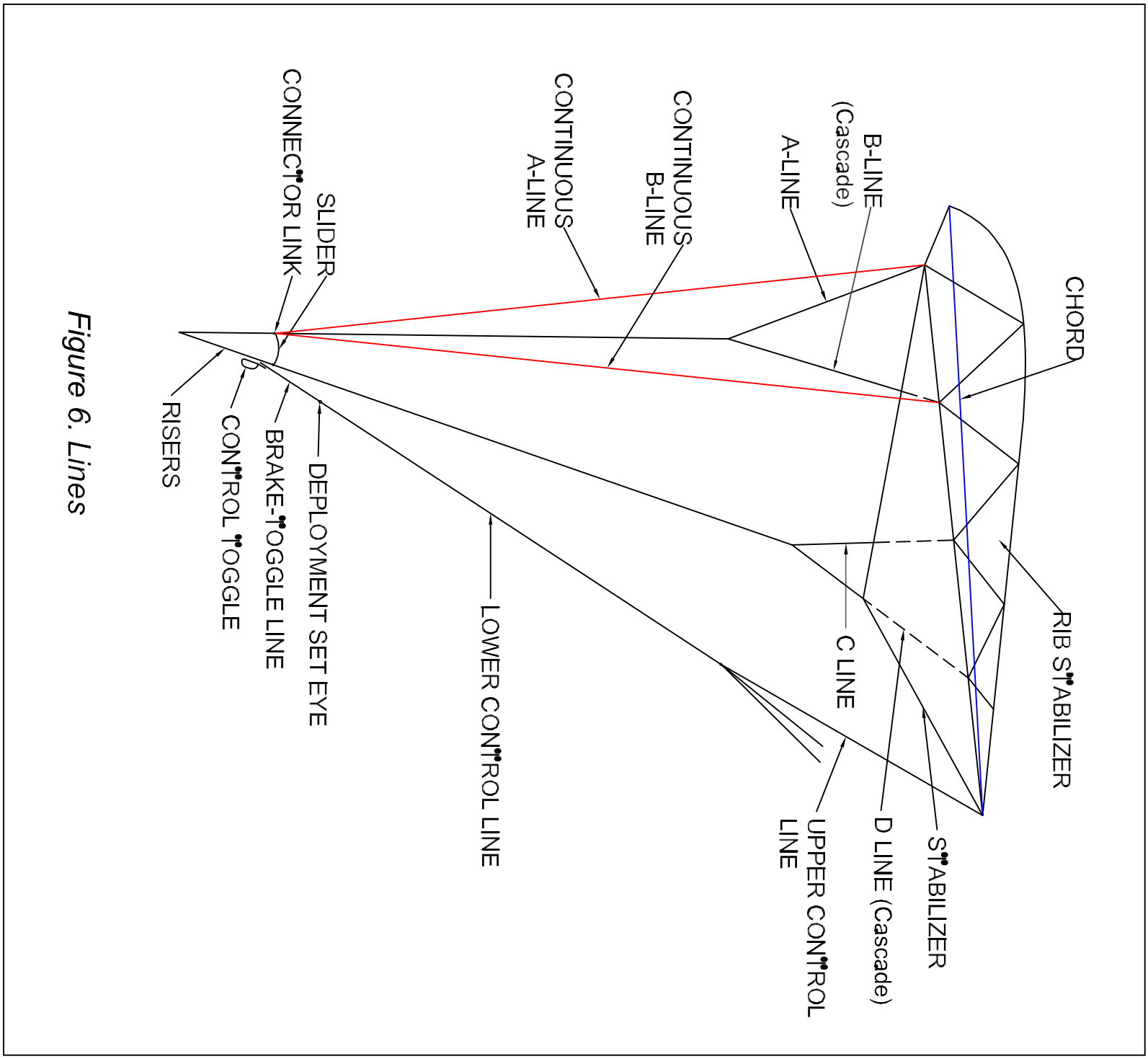


Figure 6. Lines