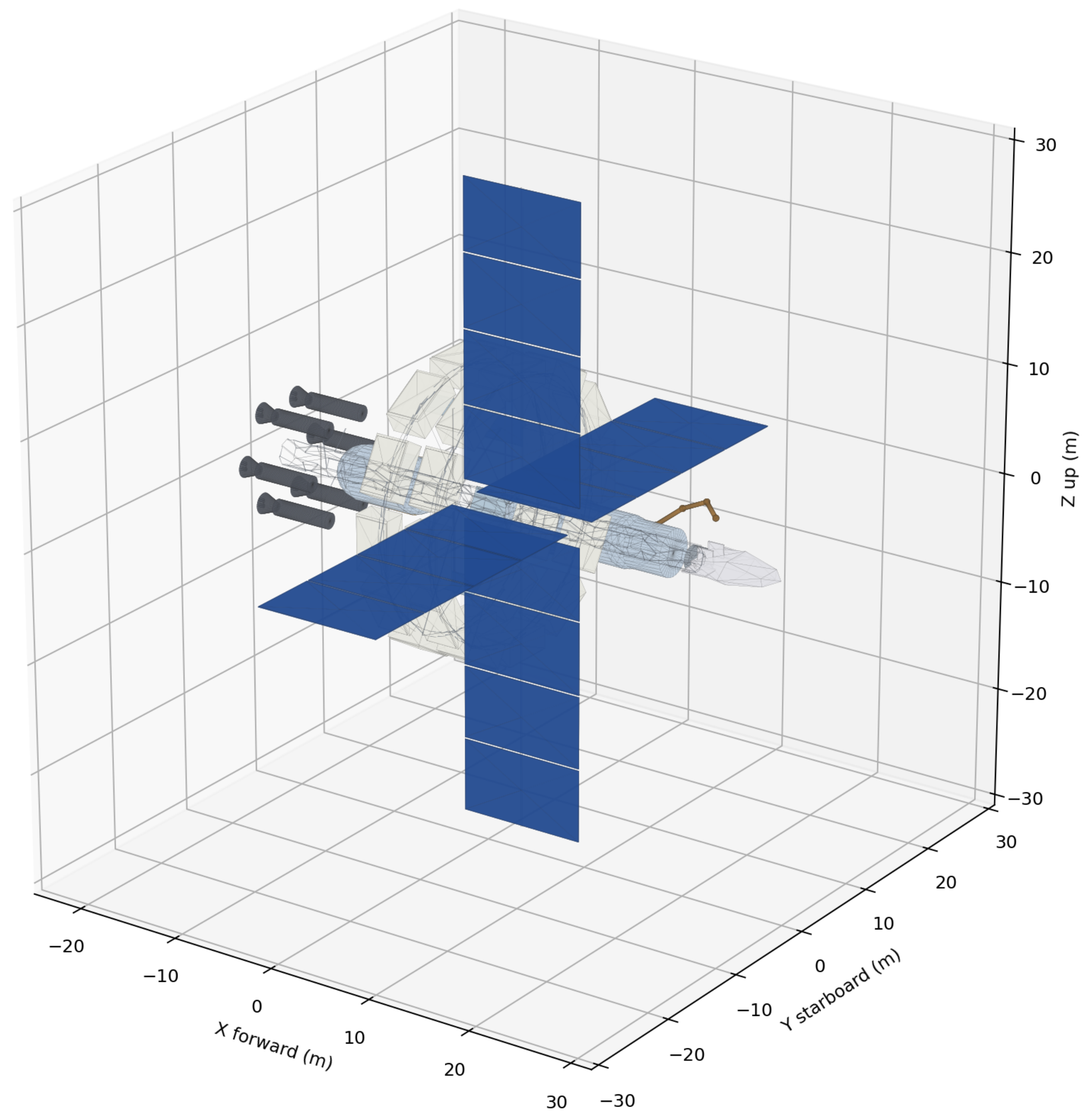
GRAPHIC / DRAWING AREA

ASTERION FCTA-1

NX CAD / NX CAM / ANSYS engineering portfolio tutorial

ASTERION FCTA-1 V0.4 — full subsystem assembly



NX / ANSYS TUTORIAL NOTES

PACKAGE PURPOSE

1. Use this booklet as the controlled drawing roadmap for rebuilding ASTERION in Siemens NX.
2. Create the master skeleton first, then parts, assemblies, arrangements and drawing sheets.
3. Use the analysis sheets to prepare ANSYS models and document convergence and correlation.
4. Treat all dimensions as conceptual portfolio baselines until independently verified.

KEY CHECK
The project demonstrates engineering workflow and traceability. It does not prove unrestricted travel or certified flight readiness.

LIMITATION
Native NX features, manufacturing tolerances and solver results must be created and reviewed on your own licensed software installation.

ASTERION FCTA-1 CAD/CAM/CAE	FULL TUTORIAL DRAWING PACKAGE TUTORIAL / CONCEPT	DRAWING NO.	SCALE	REV	SHEET	UNITS
		AST-TD-0001	NTS	A	01 / 28	mm

GRAPHIC / DRAWING AREA

SHEET	DRAWING	TITLE
03	AST-TD-0003	Coordinate system & master dimensions
04	AST-TD-0004	Station plan & interface map
05	AST-TD-0005	General arrangement - plan
06	AST-TD-0006	General arrangement - front
07	AST-TD-0007	General arrangement - side
08	AST-TD-0008	Isometric annotated assembly
09	AST-TD-0009	Exploded subsystem assembly
10	AST-TD-0010	Optimised primary truss
11	AST-TD-0011	Counter-rotating habitation ring
12	AST-TD-0012	Ring bearing and drive concept
13	AST-TD-0013	Solar wing assembly
14	AST-TD-0014	Radiator assembly
15	AST-TD-0015	Electric propulsion pod
16	AST-TD-0016	Modules, tanks and CG
17	AST-TD-0017	Docking interface
18	AST-TD-0018	Robotic servicing arm
19	AST-TD-0019	Skimmer general arrangement
20	AST-TD-0020	Skimmer sections and rib
21	AST-TD-0021	Thruster gimbal bracket
22	AST-TD-0022	Ring bearing housing
23	AST-TD-0023	Skimmer wing rib
24	AST-TD-0024	Lightweight bulkhead
25	AST-TD-0025	NX modelling workflow
26	AST-TD-0026	NX drafting workflow
27	AST-TD-0027	ANSYS model workflow
28	AST-TD-0028	CAM, verification and release

NX / ANSYS TUTORIAL NOTES

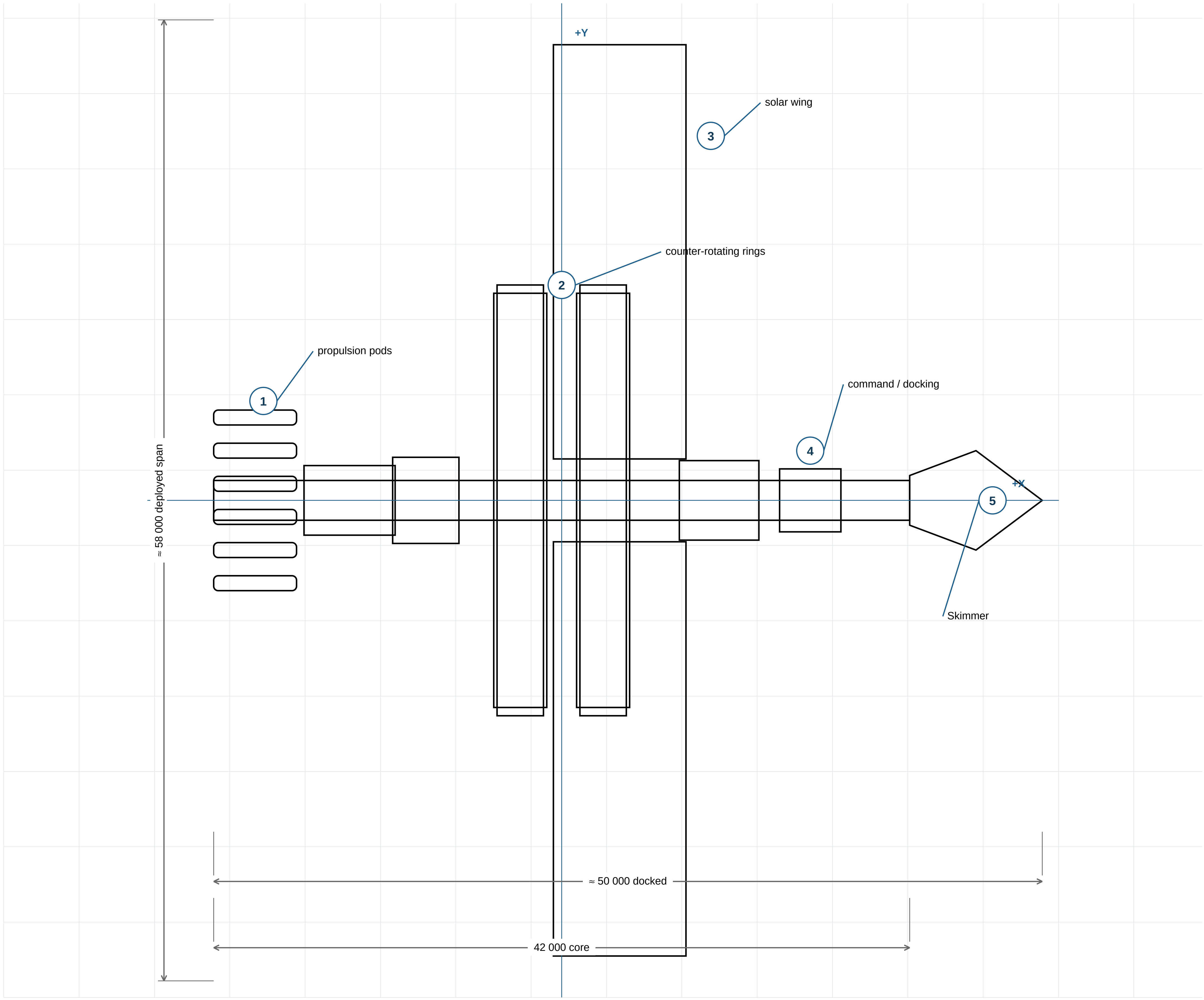
RECOMMENDED ORDER

1. Sheets 03-04 define the coordinate system and interfaces.
2. Sheets 05-09 establish the complete assembly architecture.
3. Sheets 10-20 define subsystem geometry and design intent.
4. Sheets 21-24 provide manufacturing demonstrator drawings.
5. Sheets 25-28 guide modelling, analysis, CAM and release.

KEY CHECK
Do not begin detailed parts before the master skeleton, station planes and interface coordinate systems are stable.

ASTERION FCTA-1 CAD/CAM/CAE	**DRAWING INDEX AND BUILD SEQUENCE** TUTORIAL / CONCEPT	DRAWING NO. **AST-TD-0002**	SCALE **NTS**	REV **A**	SHEET **02 / 28**	UNITS **mm**

GRAPHIC / DRAWING AREA



NX / ANSYS TUTORIAL NOTES

NX MASTER SETUP

1. Create part AST-0001-MASTER-SKELETON.prt in millimetres.
2. Set absolute axes: +X forward, +Y starboard and +Z up.
3. Create expressions for the 42 000 mm spine, 26 000 mm ring diameter and 58 000 mm deployed span.
4. Publish the global CSYS and all station datum planes through a MODEL reference set.
5. Use named expressions rather than typed dimensions in downstream parts.

KEY CHECK
All components must derive placement from the skeleton. Avoid edge-to-edge assembly constraints that break after geometry edits.

ASTERION
FCTA-1 CAD/CAM/CAE

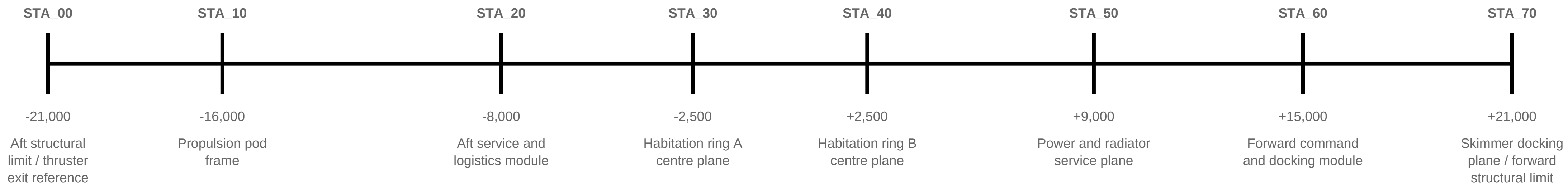
COORDINATE SYSTEM AND MASTER DIMENSIONS

TUTORIAL / CONCEPT

DRAWING NO.	SCALE	REV	SHEET	UNITS
AST-TD-0003	1:100	A	03 / 28	mm

Author: Samuelson G | Open-source portfolio baseline | Not flight-certified

GRAPHIC / DRAWING AREA



ID	PARENT	CHILD	LOCATION
IF-001	Primary spine	Aft service module	X=-12.8 m frame
IF-002	Primary spine	Forward command module	X=+9.5 m frame
IF-003	Ring support 1	Habitation ring 1	X=-2.5 m; R=12 m
IF-004	Ring support 2	Habitation ring 2	X=+2.5 m; R=12 m
IF-005	Propulsion frame	Propulsion pods 1-6	X=-16 m; R=4.8 m
IF-006	Power mast roots	Solar wings 1-4	X=+3.5 m
IF-007	Thermal boom roots	Radiators 1-6	X=-3.5 m; R=1.5 m
IF-008	Forward dock	Skimmer	X=+21.4 m
IF-009	Service module	Propellant tanks 1-4	X=-9 m
IF-010	Logistics module	Robotic arm	X=+15.8 m

NX / ANSYS TUTORIAL NOTES

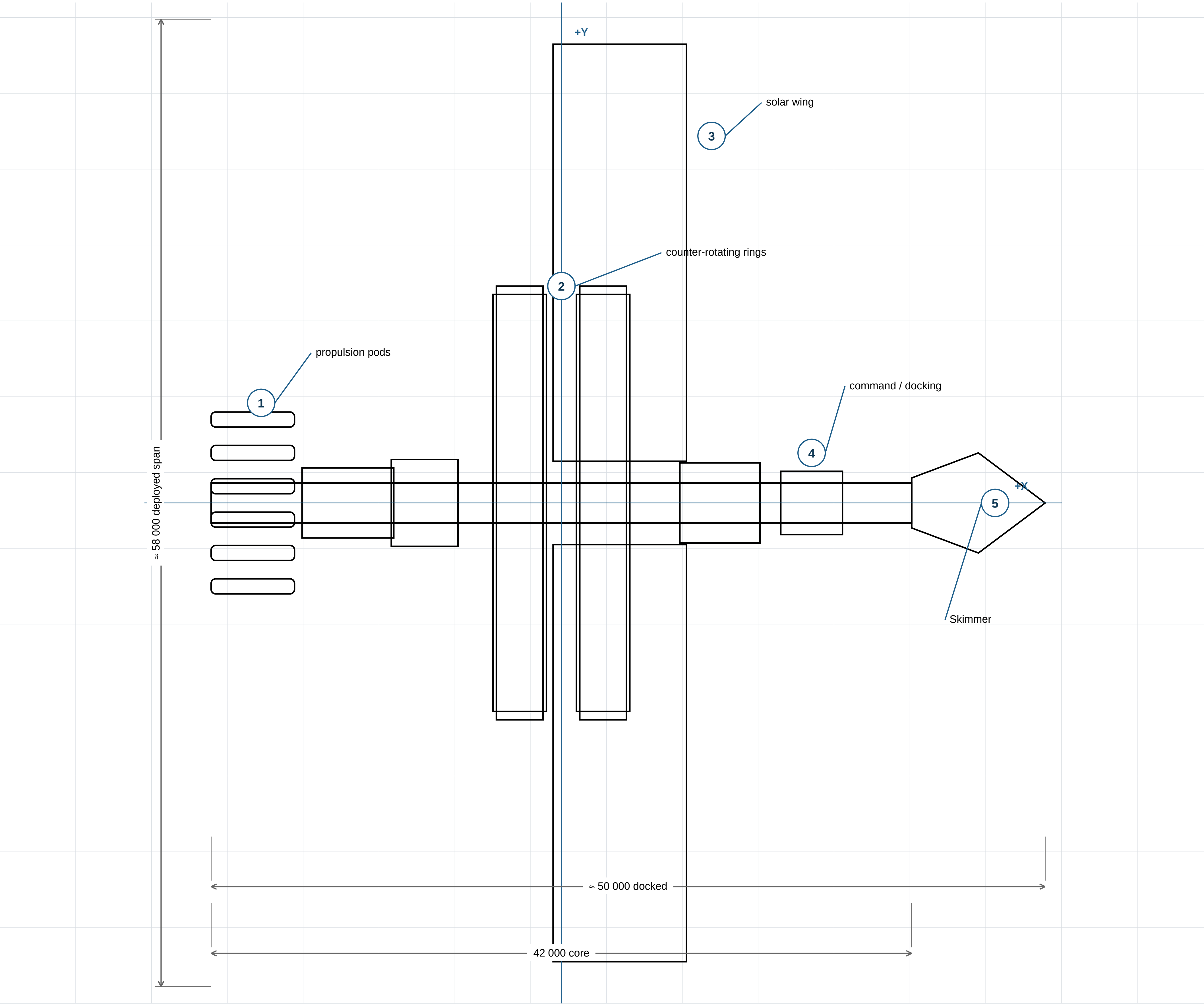
INTERFACE CONTROL

1. Create one datum CSYS at each controlled mechanical interface.
2. Name interface geometry IF-001 through IF-010 exactly as listed.
3. Publish mounting planes, axes and keep-out envelopes using WAVE links.
4. Record each interface load path before assigning bonded or remote couplings in ANSYS.
5. Create arrangements for deployed, docking-safe, maintenance and Skimmer-separated states.

KEY CHECK
A valid interface definition includes location, orientation, mechanical attachment, load types and analysis idealisation.

ASTERION FCTA-1 CAD/CAM/CAE	STATION PLAN AND INTERFACE MAP TUTORIAL / CONCEPT	DRAWING NO. AST-TD-0004	SCALE 1:100	REV A	SHEET 04 / 28	UNITS mm

GRAPHIC / DRAWING AREA



NX / ANSYS TUTORIAL NOTES

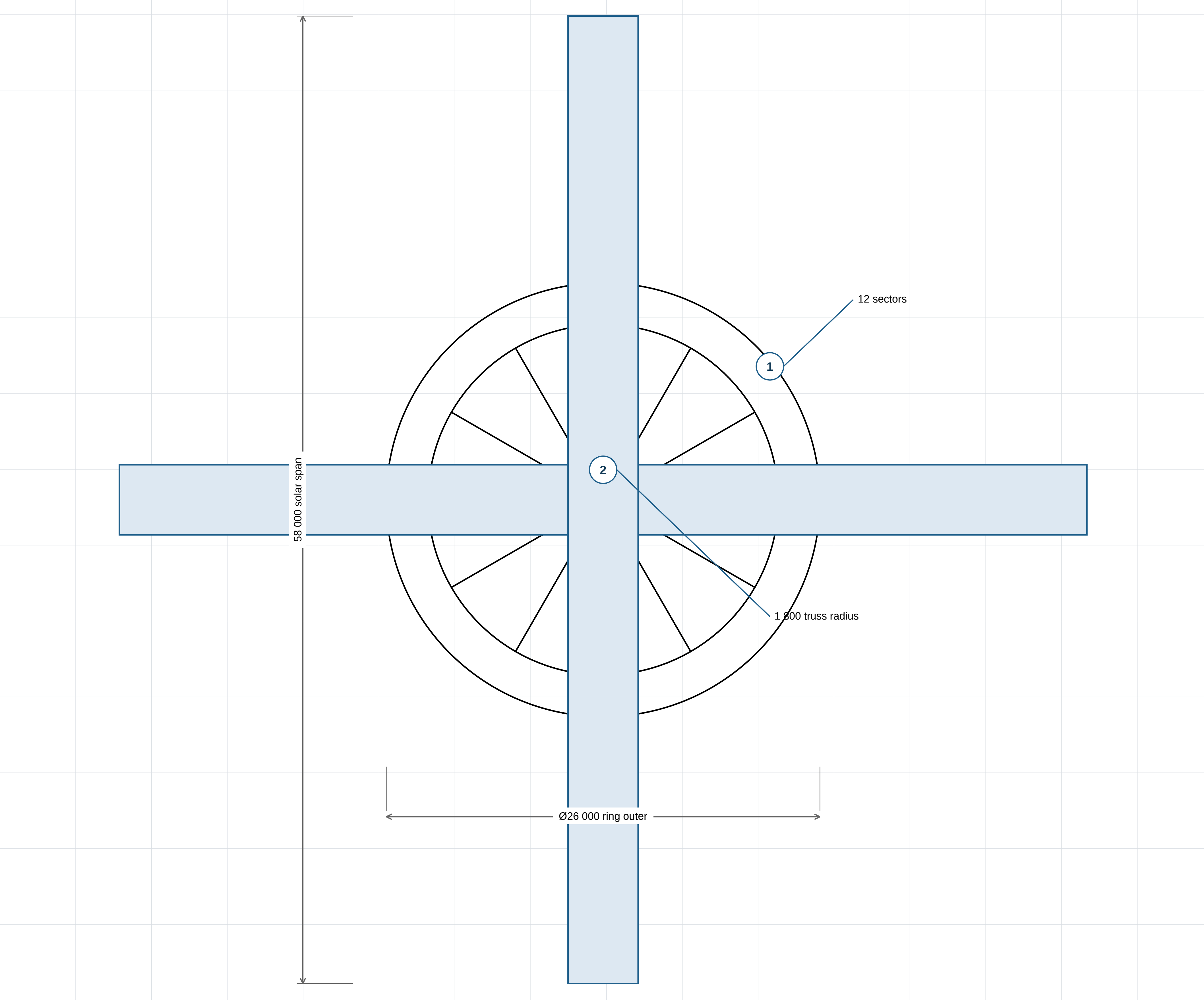
NX DRAFTING STEPS

1. Create an A3 or A1 drawing sheet linked to the top-level assembly.
2. Place a top view using the MODEL reference set and the cruise-deployed arrangement.
3. Apply a custom scale that fits the border without clipping the solar wings.
4. Add overall length, deployed span, station dimensions and subsystem callouts.
5. Use simplified representation for internal parts and small fasteners.

KEY CHECK
The plan view is the main interface-control drawing. Check solar deployment, ring clearance and Skimmer separation paths.

ASTERION FCTA-1 CAD/CAM/CAE	GENERAL ARRANGEMENT - PLAN VIEW TUTORIAL / CONCEPT	DRAWING NO. AST-TD-0005	SCALE 1:100	REV A	SHEET 05 / 28	UNITS mm

GRAPHIC / DRAWING AREA



NX / ANSYS TUTORIAL NOTES

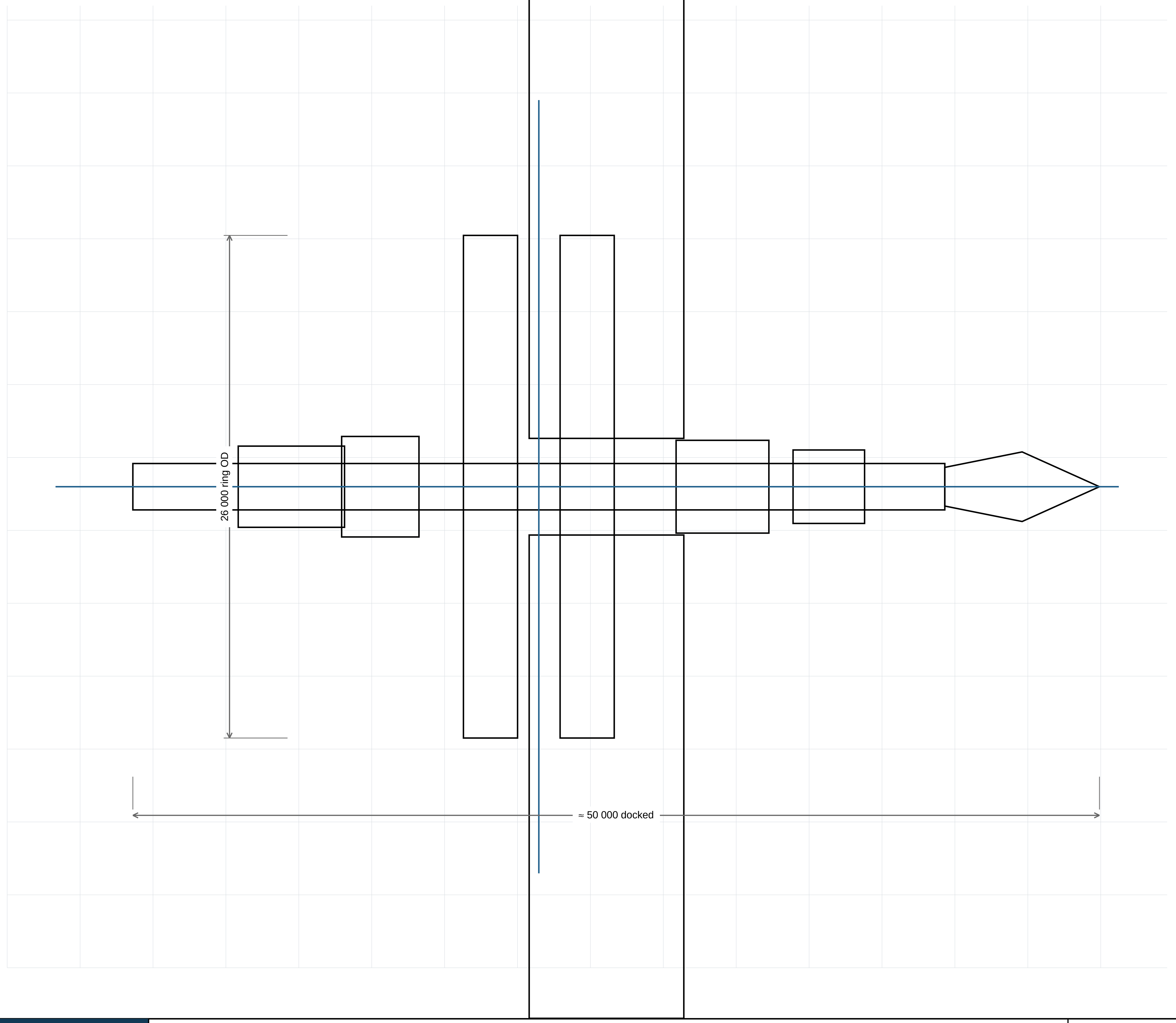
FRONT VIEW BUILD

1. Orient the view along -X so +Y is right and +Z is upward.
2. Display the ring sectors, spokes, inner bearing path and central octagonal truss.
3. Show the four-wing deployed cross and mark the 58 000 mm envelope.
4. Dimension the 26 000 mm outer ring diameter and 12 000 mm occupied radius.
5. Create a detail view for ring support and bearing hardware.

KEY CHECK
Counter-rotating rings share the same geometric axis but must remain separate rotating subassemblies.

ASTERION FCTA-1 CAD/CAM/CAE	GENERAL ARRANGEMENT - FRONT VIEW TUTORIAL / CONCEPT	DRAWING NO. AST-TD-0006	SCALE 1:100	REV A	SHEET 06 / 28	UNITS mm

GRAPHIC / DRAWING AREA



NX / ANSYS TUTORIAL NOTES

SIDE VIEW BUILD

1. Orient the view along -Y and retain the global X-Z coordinate convention.
2. Use hidden-line removal for the overall layout and add one sectional view through the service tunnel.
3. Dimension ring height, Skimmer height and the full docked length.
4. Add solar and radiator deployment envelopes with phantom line style.
5. Place centre-of-gravity symbols for dry and full-propellant cases.

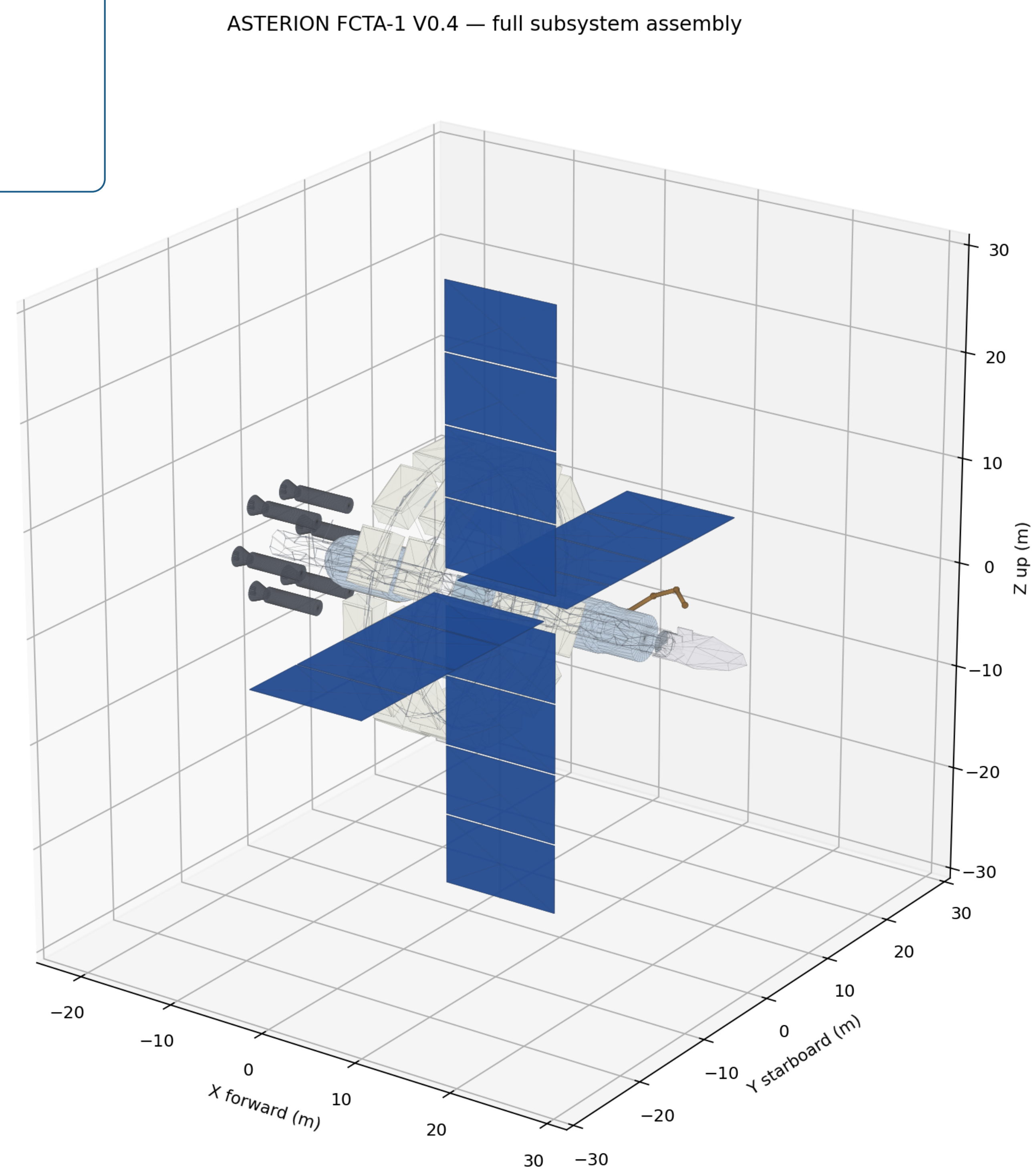
KEY CHECK
Use assembly arrangements rather than manually moving components between drawing views.

ASTERION FCTA-1 CAD/CAM/CAE	**GENERAL ARRANGEMENT - SIDE VIEW** TUTORIAL / CONCEPT	DRAWING NO. **AST-TD-0007**	SCALE **1:100**	REV **A**	SHEET **07 / 28**	UNITS **mm**

GRAPHIC / DRAWING AREA

SUBSYSTEM LEGEND

1 Central spine
2 Habitation rings
3 Solar wings
4 Radiators
5 Propulsion pods
6 Axial modules
7 Skimmer aeroshuttle



NX / ANSYS TUTORIAL NOTES

MODEL REVIEW

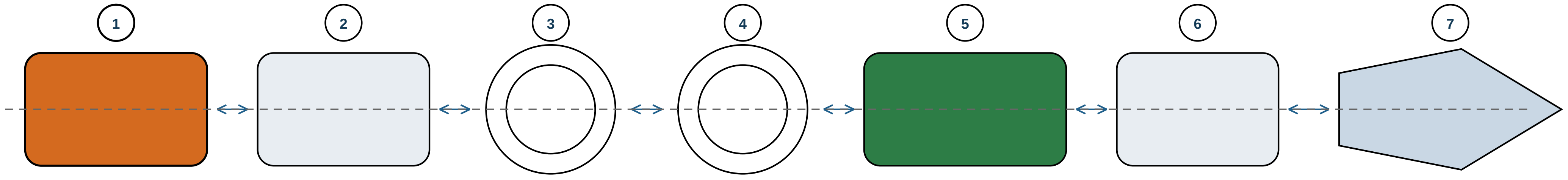
1. Use a lightweight reference set for portfolio screenshots and assembly review.
2. Apply distinct subsystem colours only in visualisation arrangements; preserve material-based colours in engineering arrangements.
3. Create saved views for plan, front, side, isometric and exploded configurations.
4. Run Examine Geometry and assembly interference checks before releasing images.
5. Export GLB for the web viewer and STEP/Parasolid for engineering exchange.

KEY CHECK
A presentation image is not a manufacturing drawing. Keep dimensions, tolerances and revision status on controlled drawing sheets.

ASTERION FCTA-1 CAD/CAM/CAE	ISOMETRIC ANNOTATED ASSEMBLY TUTORIAL / CONCEPT	DRAWING NO. AST-TD-0008	SCALE NTS	REV A	SHEET 08 / 28	UNITS mm

Author: Samuelson G | Open-source portfolio baseline | Not flight-certified

GRAPHIC / DRAWING AREA



Explode components along +X while preserving absolute station coordinate systems

NX / ANSYS TUTORIAL NOTES

EXPLODED VIEW

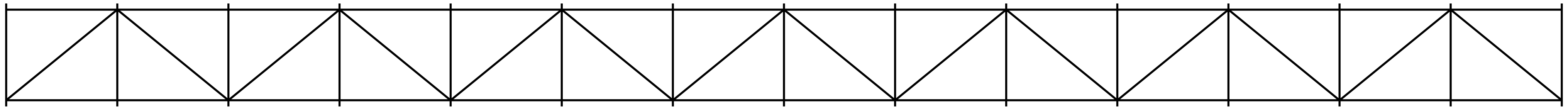
1. Create an NX exploded view under the top-level assembly, not by editing component constraints.
2. Explode along global +X while keeping rings and solar panels grouped as subassemblies.
3. Add trace lines from original to exploded positions.
4. Create a parts list filtered to major subsystem assemblies.
5. Add numbered balloons matching the BOM and assembly sequence.

KEY CHECK
Assembly order: primary structure → rings → axial modules → tanks → power/thermal → propulsion → docking → Skimmer.

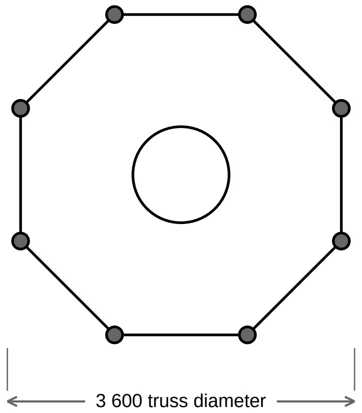
ASTERION FCTA-1 CAD/CAM/CAE	EXPLODED SUBSYSTEM ASSEMBLY TUTORIAL / CONCEPT	DRAWING NO. AST-TD-0009	SCALE NTS	REV A	SHEET 09 / 28	UNITS mm

Author: Samuelson G | Open-source portfolio baseline | Not flight-certified

SIDE ELEVATION - 2.5 m bays



OCTAGONAL CROSS-SECTION



V0.8 MEMBER SCHEDULE

Longerons	**Ø160 × 6**
Frames	**Ø130 × 5**
Diagonals	**Ø100 × 4**
Ring braces	**Ø90 × 4**
Propulsion struts	**Ø120 × 5**

TRUSS MODELLING

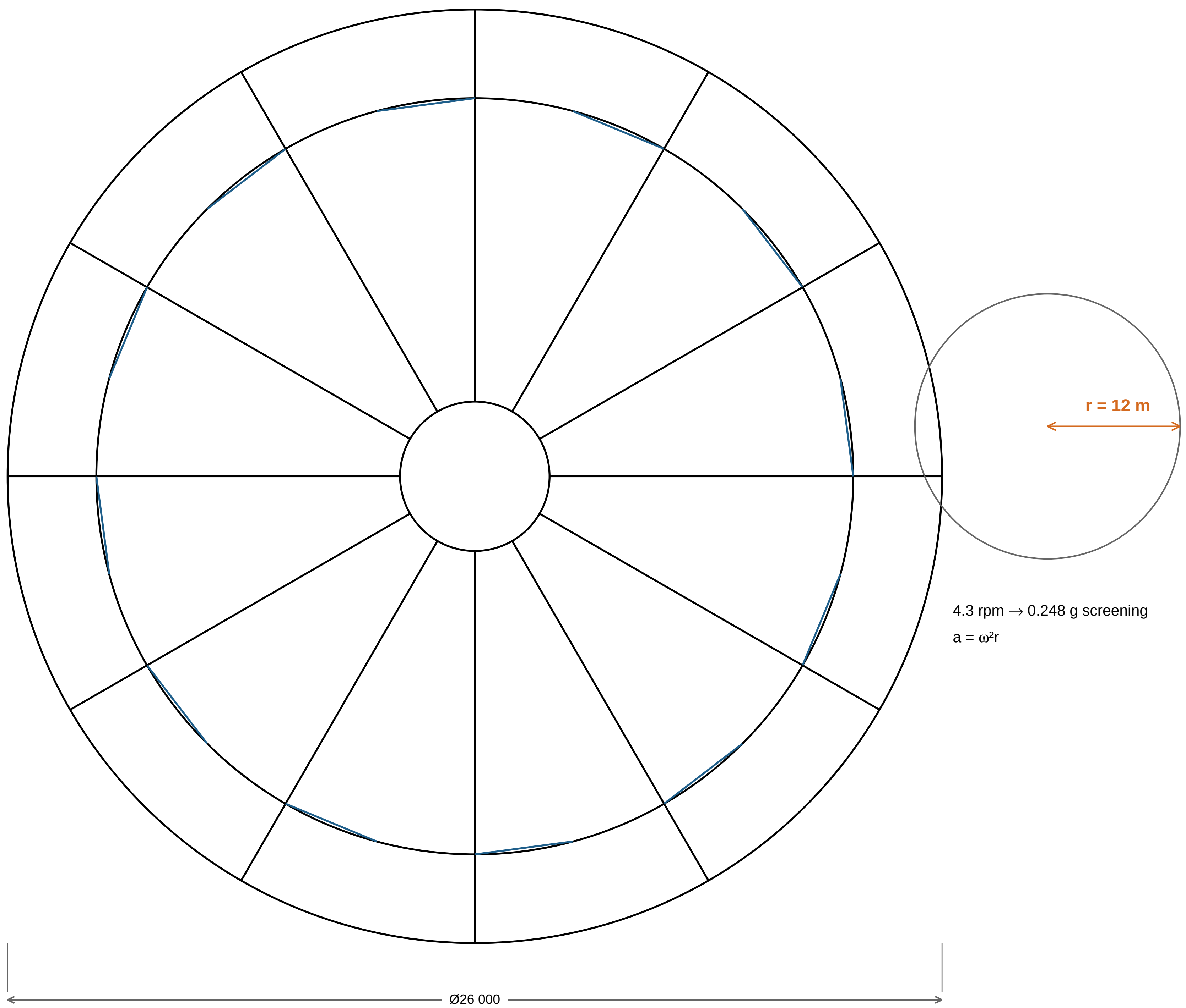
1. Create associative spine rails from eight skeleton points on a 1 800 mm radius.
2. Generate 2 500 mm bays and pattern octagonal frames along the X stations.
3. Build tube members as reusable Part Family components or structural frames.
4. Add ring torque braces, docking spreaders and propulsion load struts as separate design groups.
5. Export a line-body idealisation with section names for ANSYS BEAM188 modelling.

KEY CHECK
The selected H3 redesign uses 222 nodes, 648 beam elements and an idealised structural mass near 10.42 tonnes.

LIMITATION
Beam screening does not represent local joints, bolts, shell cut-outs, welds or bearing contact stiffness.

ASTERION FCTA-1 CAD/CAM/CAE	**OPTIMISED PRIMARY TRUSS - V0.8** TUTORIAL / CONCEPT	DRAWING NO. **AST-TD-0010**	SCALE **1:50**	REV **A**	SHEET **10 / 28**	UNITS **mm**

GRAPHIC / DRAWING AREA



NX / ANSYS TUTORIAL NOTES

RING SUBASSEMBLY

1. Create one master sector bounded by two radial datum planes separated by 30 degrees.
2. Model the pressure shell, local floor, equipment rails and shielding envelopes.
3. Pattern the sector 12 times around the +X axis inside a rotating subassembly.
4. Create a second ring subassembly with opposite rotational direction.
5. Assign uneven loading cases for crew, cargo and water-shield redistribution.

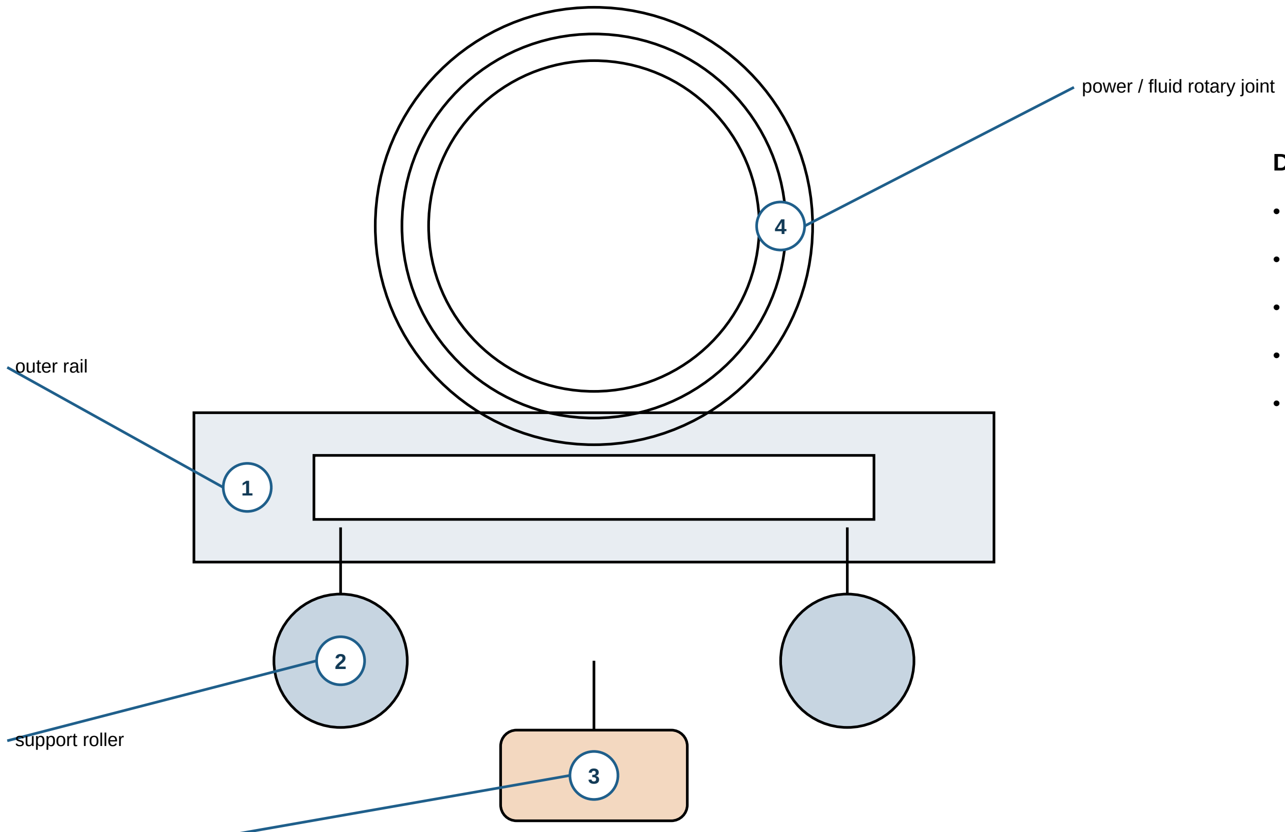
KEY CHECK
At a 12 m occupied radius and 4.3 rpm, the screening acceleration is approximately 0.248 g.

ASTERION FCTA-1 CAD/CAM/CAE	COUNTER-ROTATING HABITATION RING TUTORIAL / CONCEPT	DRAWING NO. AST-TD-0011	SCALE 1:50	REV A	SHEET 11 / 28	UNITS mm

Author: Samuelson G | Open-source portfolio baseline | Not flight-certified

GRAPHIC / DRAWING AREA

SECTION A-A - RING SUPPORT / DRIVE CONCEPT



DESIGN LOADS

- Radial: centrifugal sector loads
- Tangential: emergency braking torque
- Axial: docking / manoeuvre coupling
- Thermal: ring-to-spine differential growth
- Fault: one-ring braking only

NX / ANSYS TUTORIAL NOTES

DETAIL DEVELOPMENT

1. Create a sectional model at one of twelve bearing stations.
2. Separate radial support rollers, axial guide rollers and drive/brake rollers.
3. Model replaceable bearing cartridges and service access envelopes.
4. Add rotary electrical, data and coolant transfer envelopes around the hub.
5. Create local ANSYS contact models for roller loads and brake torque transfer.

KEY CHECK
Balanced braking applies opposite torques to the two counter-rotating rings. Also analyse a single-ring brake fault.

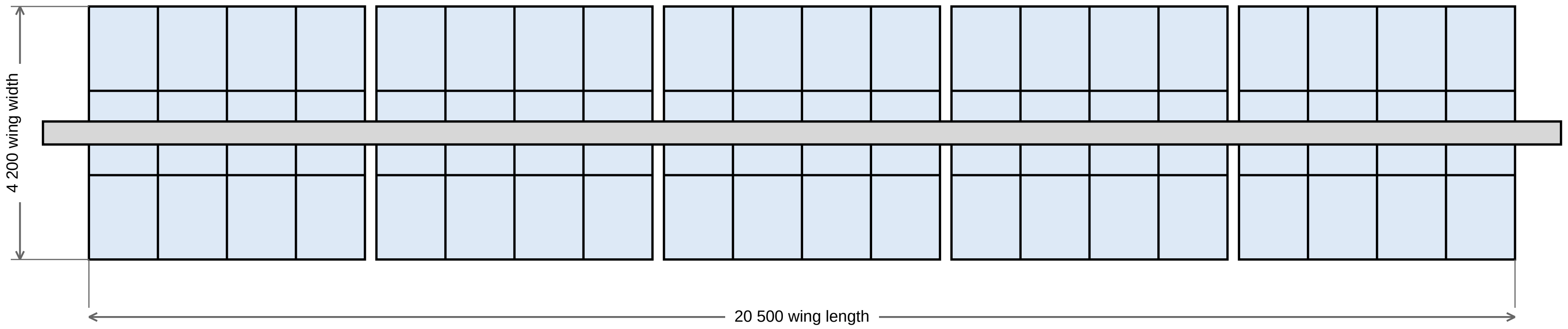
LIMITATION
The shown arrangement is conceptual and does not define certified bearing life, lubrication or pressure-boundary details.

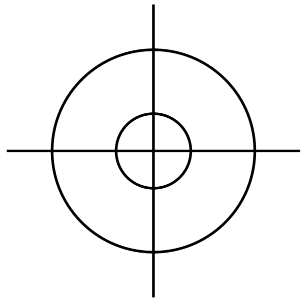
ASTERION FCTA-1 CAD/CAM/CAE	RING BEARING, DRIVE AND BRAKE CONCEPT TUTORIAL / CONCEPT	DRAWING NO.	SCALE	REV	SHEET	UNITS
		AST-TD-0012	1:10	A	12 / 28	mm

Author: Samuelson G | Open-source portfolio baseline | Not flight-certified

GRAPHIC / DRAWING AREA

DEPLOYED WING - 5 PANEL CARTRIDGES





HINGE / LOCK DETAIL

NX / ANSYS TUTORIAL NOTES

SOLAR WING MODEL

1. Create one wing master with five replaceable panel cartridges and a telescopic or folding mast.
2. Define the hinge axis at the controlled power-interface coordinate system.
3. Create stowed, deployment-step, cruise-deployed and feathered arrangements.
4. Use NX Motion joints to verify deployment without interference.
5. For ANSYS, analyse the mast as beams and the panel as equivalent orthotropic shells.

KEY CHECK

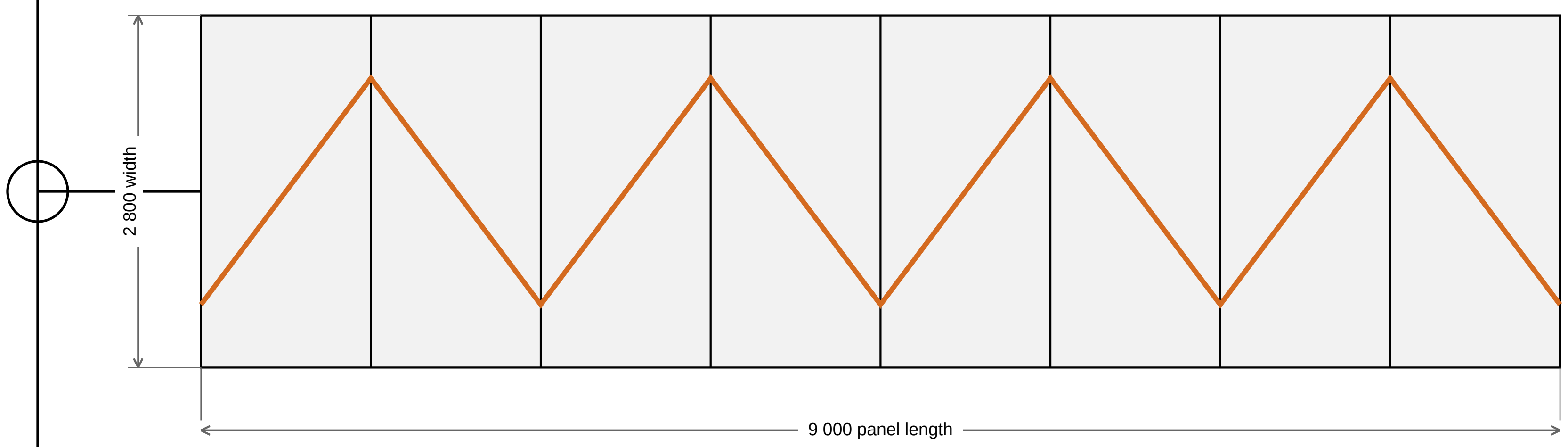
The four-wing system produces an approximately 58 m deployed cross-envelope. Verify plume and radiator clearance.

ASTERION FCTA-1 CAD/CAM/CAE	DEPLOYABLE SOLAR WING ASSEMBLY TUTORIAL / CONCEPT	DRAWING NO. AST-TD-0013	SCALE 1:25	REV A	SHEET 13 / 28	UNITS mm

Author: Samuelson G | Open-source portfolio baseline | Not flight-certified

GRAPHIC / DRAWING AREA

RADIATOR PANEL - SIX IDENTICAL ASSEMBLIES



SCREENING BALANCE

Q = εσA(T■ - Tspace■)

$A_{eff} = 144\ m^2$

$Q_{nom} = 120\ kW$

$T_{nom} \approx 361\ K$

1 panel failed ≈ 378 K

NX / ANSYS TUTORIAL NOTES

THERMAL MODEL

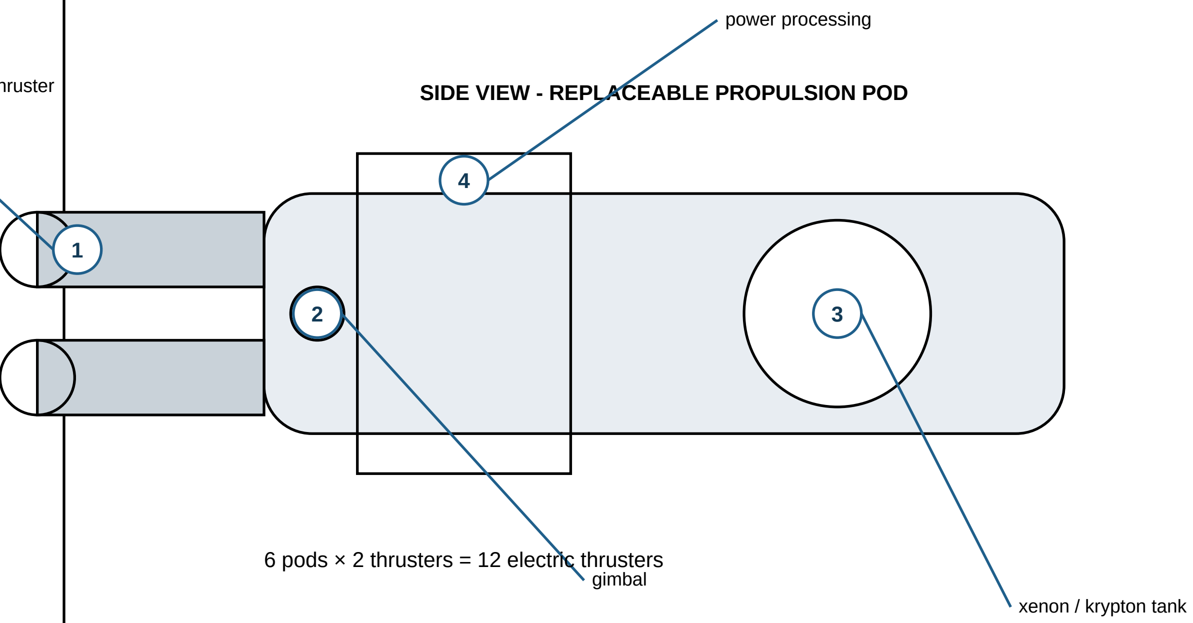
1. Model a 9 000 × 2 800 mm panel with segmented heat-pipe zones and a deployment boom.
2. Create fluid inlet/outlet interfaces and independent loop assignments.
3. Apply surface emissivity and deep-space radiation boundary conditions in ANSYS Mechanical.
4. Run nominal, one-panel-failed and transient load rejection cases.
5. Map temperature fields to the hinge and boom structural model for thermal stress.

KEY CHECK
Reduced-order screening predicts approximately 361 K nominal equilibrium for 120 kW across 144 m^2 effective area.

ASTERION FCTA-1 CAD/CAM/CAE	DEPLOYABLE RADIATOR ASSEMBLY TUTORIAL / CONCEPT	DRAWING NO. AST-TD-0014	SCALE 1:20	REV A	SHEET 14 / 28	UNITS mm

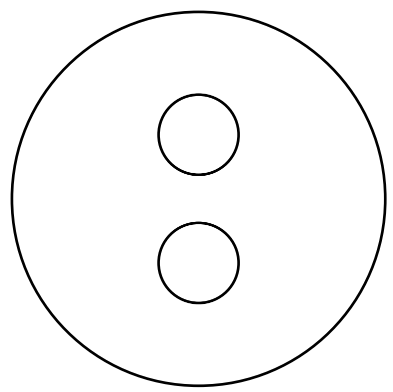
GRAPHIC / DRAWING AREA

SIDE VIEW - REPLACEABLE PROPULSION POD



6 pods × 2 thrusters = 12 electric thrusters

AFT VIEW



NX / ANSYS TUTORIAL NOTES

POD DEVELOPMENT

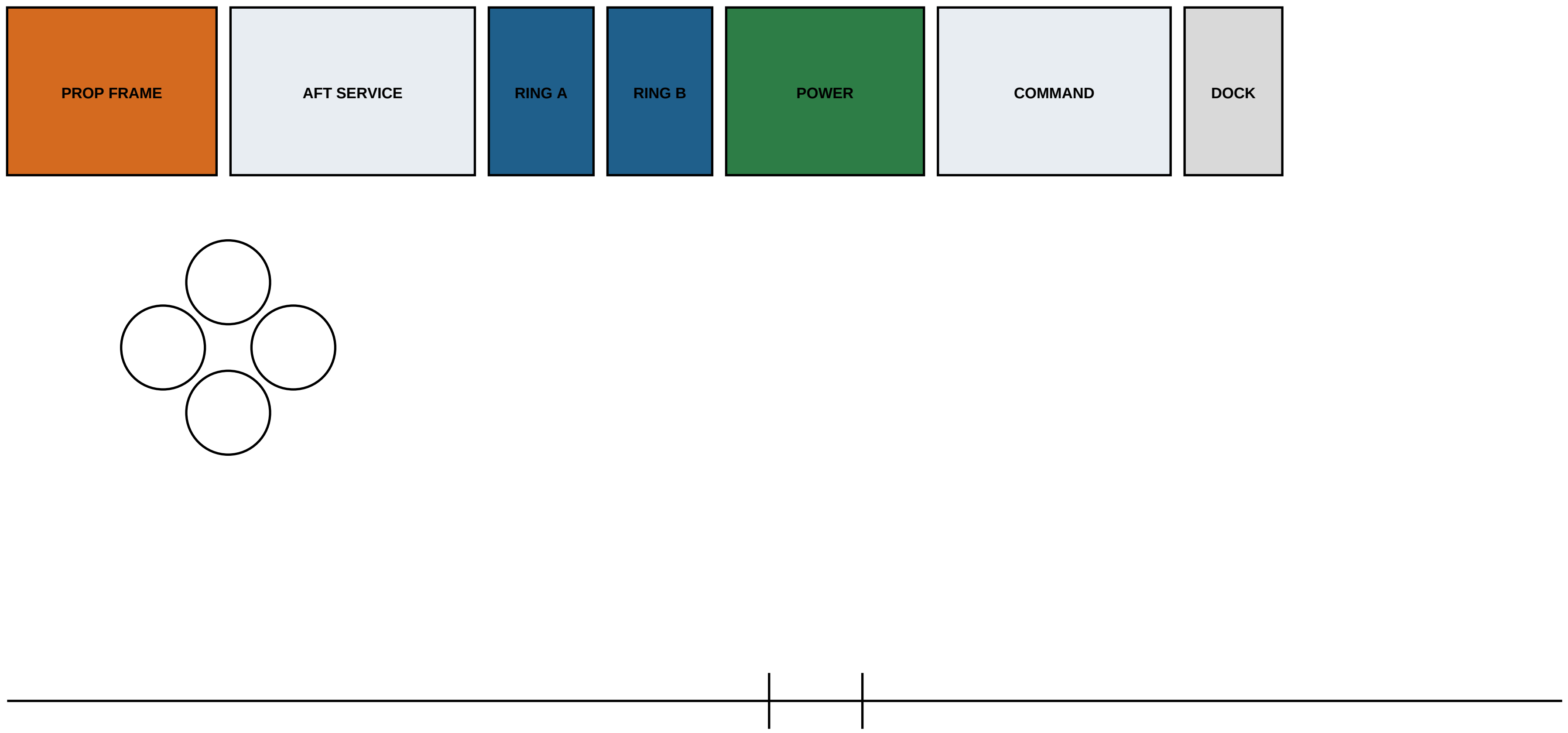
1. Create a replaceable pod assembly with two thrusters, gimbal, tank and power-processing unit.
2. Use the six propulsion interface coordinate systems for circular placement around the aft frame.
3. Add 3 degree nominal cant expressions and plume keep-out cones.
4. Create maintenance removal paths and connector access envelopes.
5. Apply thrust, gimbal torque, thermal gradient and handling loads to the local mount analysis.

KEY CHECK
Twelve 12 kW-class thrusters produce a 144 kW nominal propulsion demand in the project baseline.

LIMITATION
This is a portfolio-level future architecture, not a flight-qualified propulsion system or reactionless drive.

ASTERION FCTA-1 CAD/CAM/CAE	**ELECTRIC PROPULSION POD** TUTORIAL / CONCEPT	DRAWING NO. **AST-TD-0015**	SCALE **1:15**	REV **A**	SHEET **15 / 28**	UNITS **mm**

GRAPHIC / DRAWING AREA



NX / ANSYS TUTORIAL NOTES

MASS PROPERTIES

1. Create simplified module envelopes first, then replace them with detailed parts without changing interface datums.
2. Place four propellant tanks using a circular component pattern around the service spine.
3. Assign material densities and explicit non-geometric masses for equipment not modelled in detail.
4. Create loading arrangements for dry, reserve, half-full, full propellant and Skimmer-separated cases.
5. Compare NX mass and CG with the controlled CSV budget after every design revision.

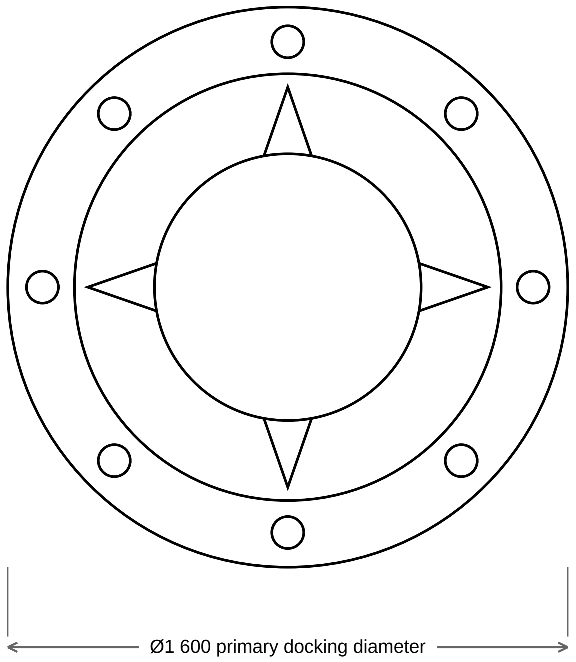
KEY CHECK
Baseline dry mass is about 50.5 t in V0.4 and 53.2 t after the V0.8 structural redesign.

ASTERION FCTA-1 CAD/CAM/CAE	**AXIAL MODULES, PROPELLANT TANKS AND CG** TUTORIAL / CONCEPT	DRAWING NO. **AST-TD-0016**	SCALE **1:50**	REV **A**	SHEET **16 / 28**	UNITS **mm**

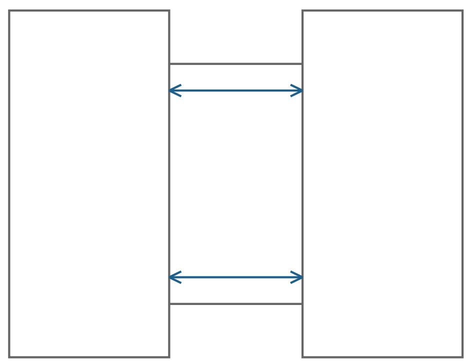
Author: Samuelson G | Open-source portfolio baseline | Not flight-certified

GRAPHIC / DRAWING AREA

FORWARD DOCKING INTERFACE



CAPTURE → SOFT DOCK → HARD DOCK



Local transient impact model required

NX / ANSYS TUTORIAL NOTES

DOCKING MODEL

1. Create capture-ring, soft-dock and hard-dock subassemblies around a 1 600 mm primary diameter.
2. Pattern eight load-spreader attachment points around the forward frame.
3. Define capture, latched, released and Skimmer-separated arrangements.
4. Create low-velocity contact and energy-absorber models for transient analysis.
5. Dimension interface axes and bolt-circle features from the controlled docking CSYS.

KEY CHECK
The V0.8 forward load spreaders reduce misaligned-docking displacement but local interface verification remains required.

ASTERION
FCTA-1 CAD/CAM/CAE

FORWARD DOCKING INTERFACE

TUTORIAL / CONCEPT

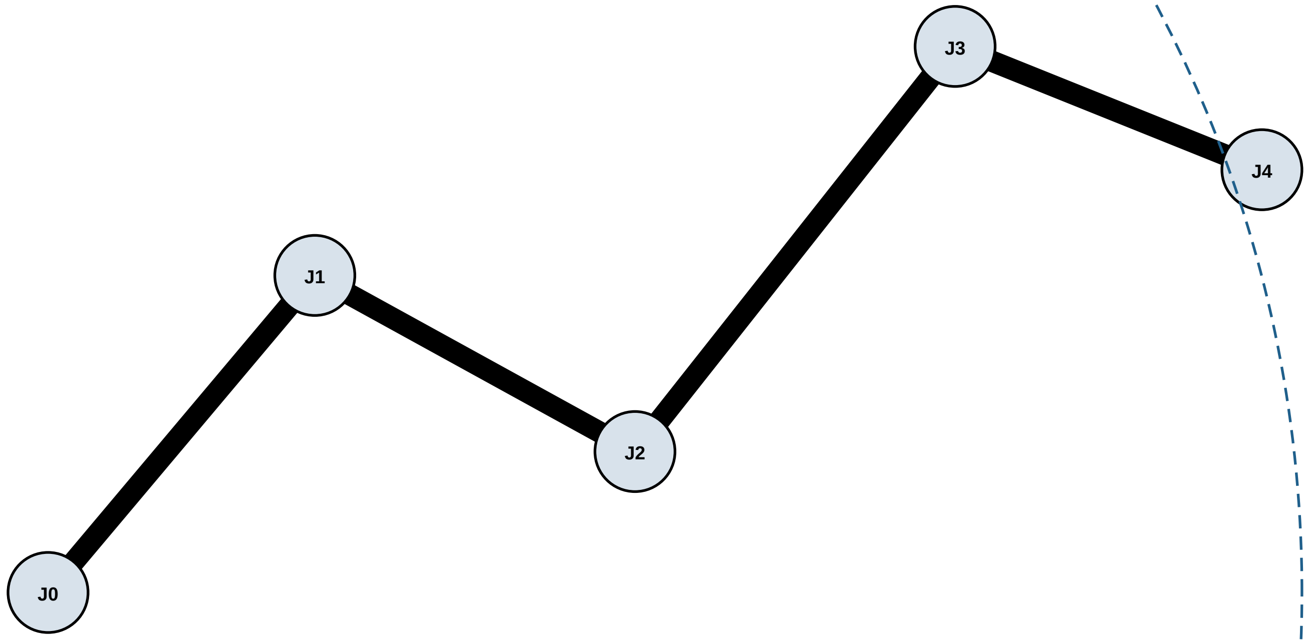
DRAWING NO.	SCALE	REV	SHEET	UNITS
AST-TD-0017	**1:5**	**A**	**17 / 28**	**mm**

Author: Samuelson G | Open-source portfolio baseline | Not flight-certified

GRAPHIC / DRAWING AREA

ROBOTIC SERVICING ARM - 4 DOF CONCEPT

Base at X = +15.8 m; use NX Motion revolute joints and collision envelopes.



NX / ANSYS TUTORIAL NOTES

MOTION TUTORIAL

1. Create the base, links, joints and end effector as separate reusable NX components.
2. Use revolute joints with angle limits and one home position expression.
3. Create a swept work-envelope body and maintenance reach studies.
4. Check collisions against solar wings, radiators, rings and Skimmer separation paths.
5. Export joint coordinates and inertias for multibody or transient structural analysis.

KEY CHECK
Keep the arm suppressed during primary structural solves unless its mass and loads are represented by a reviewed remote mass.

ASTERION
FCTA-1 CAD/CAM/CAE

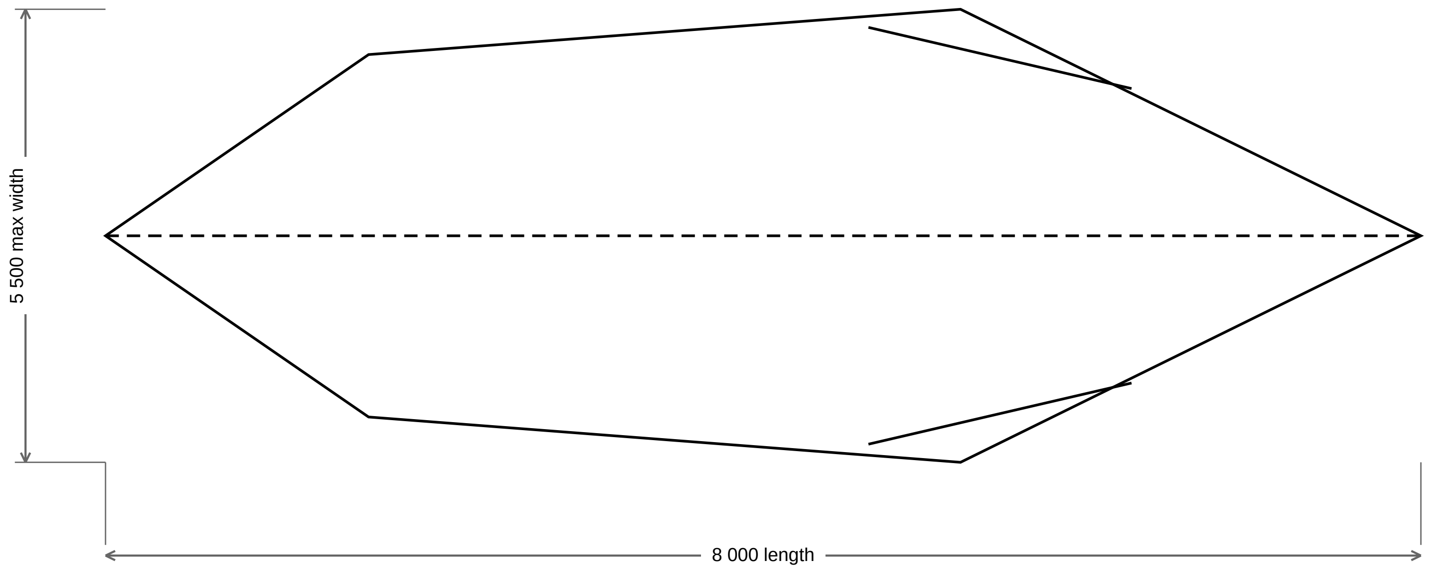
ROBOTIC SERVICING ARM
TUTORIAL / CONCEPT

DRAWING NO.	SCALE	REV	SHEET	UNITS
AST-TD-0018	NTS	A	18 / 28	mm

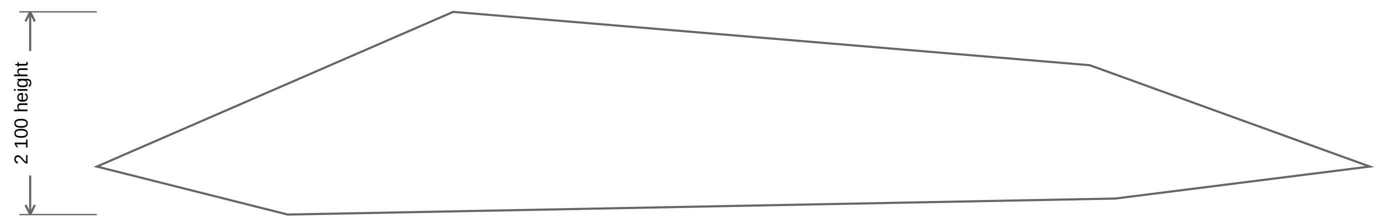
Author: Samuelson G | Open-source portfolio baseline | Not flight-certified

GRAPHIC / DRAWING AREA

PLAN VIEW



SIDE VIEW



AERODYNAMIC CASES

Mach 0.3 / 10 km

Mach 0.8 / 15 km

Mach 2.0 / 25 km

Reference area 24 m²

AoA sweep -5° to +15°

NX / ANSYS TUTORIAL NOTES

SURFACE MODELLING

1. Create longitudinal station planes and transverse section sketches.
2. Use Through Curves and Through Curve Mesh for the blended lifting-body outer mold line.
3. Apply bridge surfaces and curvature analysis to achieve smooth continuity.
4. Sew the surfaces, create a solid or shell, then add elevons, split rudders and docking structure.
5. Generate clean CFD surfaces by suppressing gaps, fasteners and internal details.

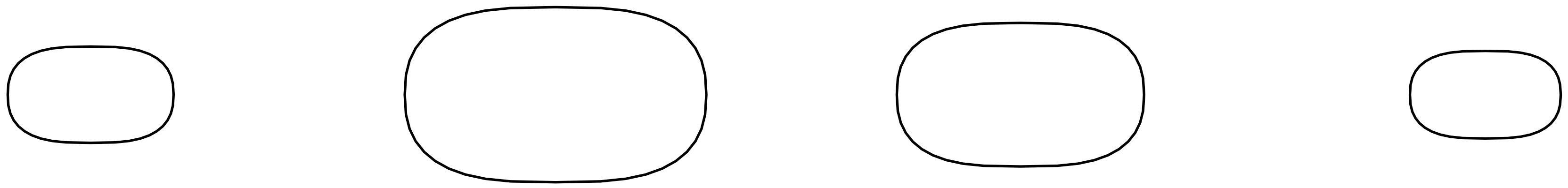
KEY CHECK
Reference dimensions: 8 000 mm length, 5 500 mm width and 2 100 mm height.

ASTERION FCTA-1 CAD/CAM/CAE	SKIMMER AEROSHUTTLE - GENERAL ARRANGEMENT TUTORIAL / CONCEPT	DRAWING NO.	SCALE	REV	SHEET	UNITS
		AST-TD-0019	1:20	A	19 / 28	mm

Author: Samuelson G | Open-source portfolio baseline | Not flight-certified

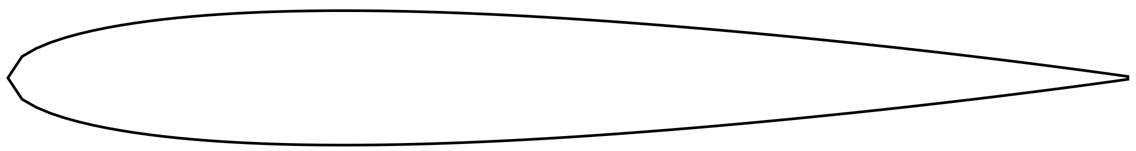
GRAPHIC / DRAWING AREA

A-A nose | B-B cabin | C-C wing | D-D aft



X/L = 0.20 | X/L = 0.45 | X/L = 0.70 | X/L = 0.88

AST-SK-4301 RIB PROFILE REFERENCE



220 mm demonstrator chord (drawing scale enlarged)

NX / ANSYS TUTORIAL NOTES

SECTION CONTROL

1. Create named section sketches A-A through D-D at stable X/L locations.
2. Constrain section width, height and centreline offsets using expressions.
3. Use curvature combs to identify local surface discontinuities.
4. Derive wing-rib geometry associatively from the outer mold line and structural reference surfaces.
5. Create datum schemes that allow rib CAM and inspection without relying on freeform edges alone.

KEY CHECK
The AST-SK-4301 220 mm chord rib is a manufacturing demonstrator, not a full-size flight rib.

ASTERION
FCTA-1 CAD/CAM/CAE

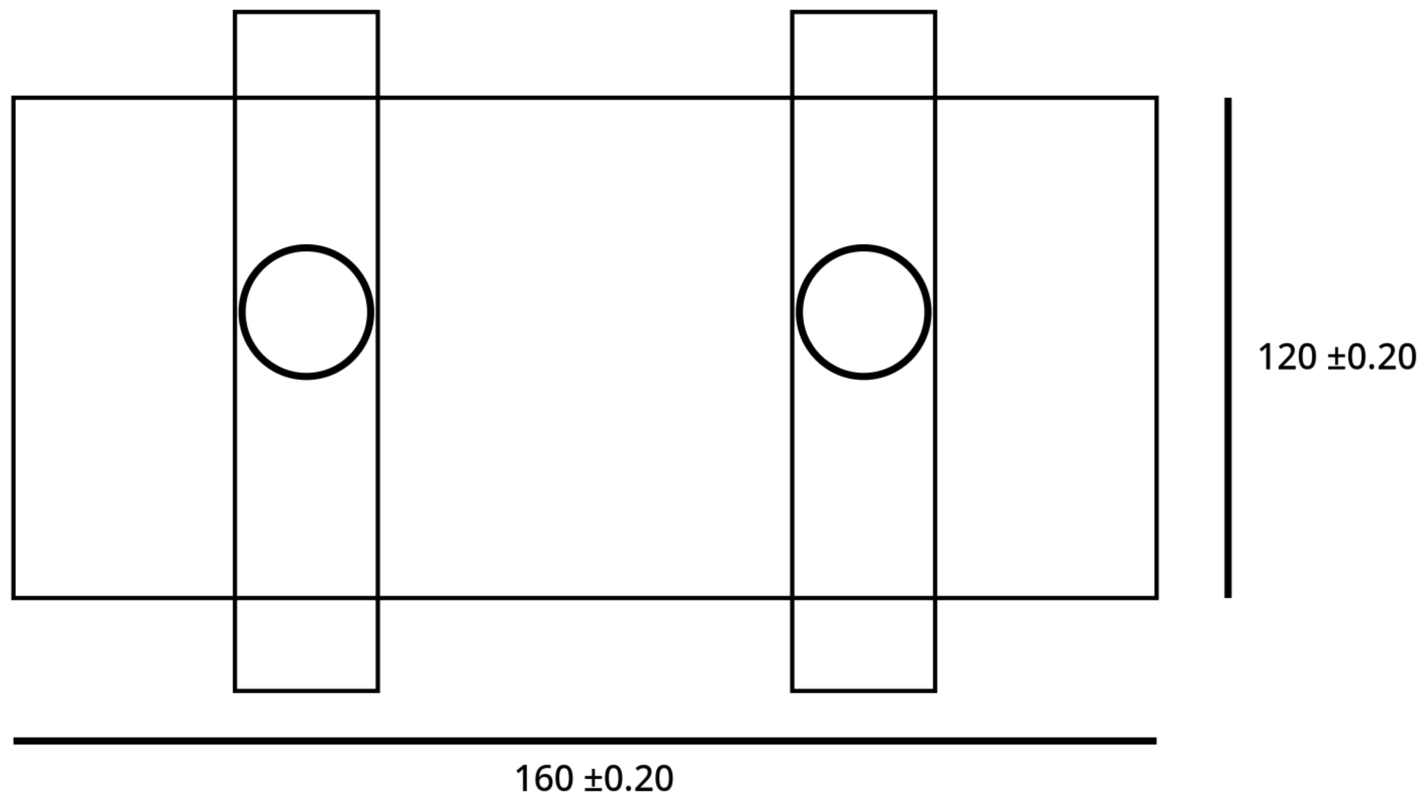
SKIMMER SECTIONS AND WING-RIB REFERENCE
TUTORIAL / CONCEPT

DRAWING NO.	SCALE	REV	SHEET	UNITS
AST-TD-0020	1:10	A	20 / 28	mm

Author: Samuelson G | Open-source portfolio baseline | Not flight-certified

GRAPHIC / DRAWING AREA

AST-TP-2101 THRUSTER GIMBAL BRACKET



MATERIAL: ALUMINIUM 6061-T6 DEMONSTRATOR
DATUM A: BASE FACE
BORE PAIR: Ø18 H7, POSITION 0.10 TO A|B
BREAK EDGES 0.5 MAX; DEBURR ALL FEATURES
GENERAL TOLERANCE: ISO 2768-mK

ASTERION FCTA-1 · V0.7 · UNITS mm

NX / ANSYS TUTORIAL NOTES

NX DRAFTING TUTORIAL

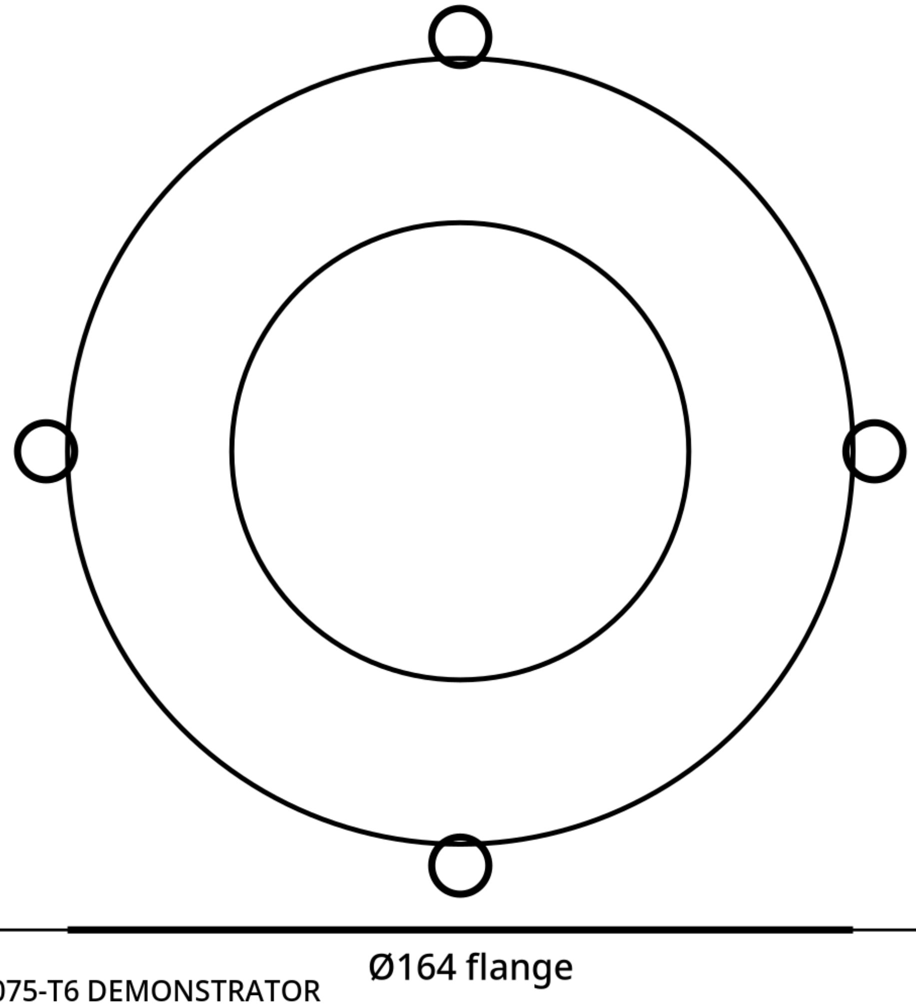
1. Open the native part and create a linked A3 drawing.
2. Place front, top, right and shaded-isometric views.
3. Define datum A on the base face and datum B on the mounting centre plane.
4. Dimension 160 × 120 overall size and both Ø18 H7 pivot bores.
5. Add position tolerance, general ISO 2768-mK note and deburring requirement.

KEY CHECK
Create the final drawing from the native parametric part. The embedded drawing is a conceptual reference sheet supplied with the project.

ASTERION FCTA-1 CAD/CAM/CAE	THRUSTER GIMBAL BRACKET - MANUFACTURING DRAWING TUTORIAL / CONCEPT	DRAWING NO.	SCALE	REV	SHEET	UNITS
		AST-TD-0021	1:2	A	21 / 28	mm

GRAPHIC / DRAWING AREA

AST-RG-3201 RING BEARING HOUSING



MATERIAL: ALUMINIUM 7075-T6 DEMONSTRATOR
BEARING SEAT: Ø95 H7
CONCENTRICITY: 0.04 TO DATUM A
4x Ø8.5 THRU ON Ø180 PCD
TURNING + 3-AXIS MILLING WORKFLOW

ASTERION FCTA-1 · V0.7 · UNITS mm

NX / ANSYS TUTORIAL NOTES

NX DRAFTING TUTORIAL

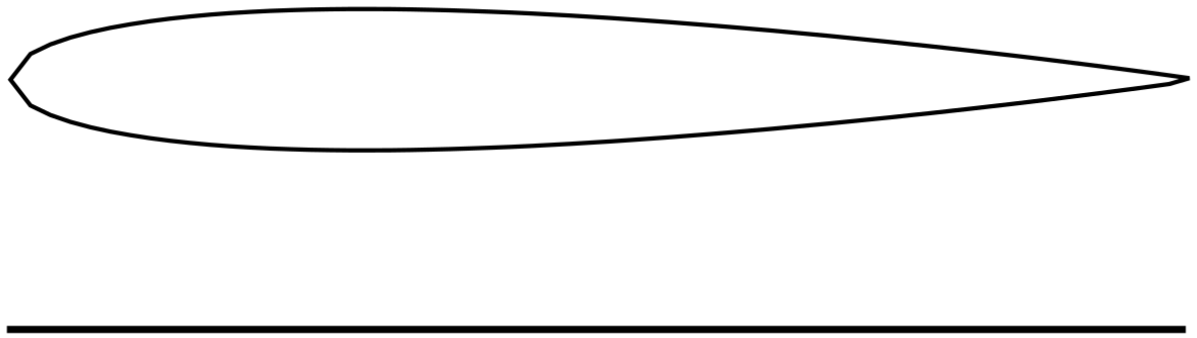
1. Create turned blank geometry before milling bolt features.
2. Place front view and section through the bearing seat.
3. Define datum A from the main bearing axis.
4. Dimension Ø95 H7 seat, Ø164 flange and 4 × Ø8.5 holes on Ø180 PCD.
5. Add concentricity and surface-finish controls to the bearing seat.

KEY CHECK
Create the final drawing from the native parametric part. The embedded drawing is a conceptual reference sheet supplied with the project.

ASTERION FCTA-1 CAD/CAM/CAE	**RING BEARING HOUSING - MANUFACTURING DRAWING** TUTORIAL / CONCEPT	DRAWING NO. **AST-TD-0022**	SCALE **1:2**	REV **A**	SHEET **22 / 28**	UNITS **mm**

GRAPHIC / DRAWING AREA

AST-SK-4301 SKIMMER WING RIB



MATERIAL: ALUMINIUM 2024-T3 PLATE
THICKNESS: 8.0 ±0.10
PROFILE TOLERANCE: 0.25 TO DATUM A
DATUM A: INBOARD MOUNTING FACE
FINISH CONTOUR WITH LOW-RADIAL-ENGAGEMENT PASS

ASTERION FCTA-1 · V0.7 · UNITS mm

NX / ANSYS TUTORIAL NOTES

NX DRAFTING TUTORIAL

1. Derive the rib profile from the Skimmer surface using associative curves.
2. Place profile, edge and enlarged leading-edge views.
3. Define datum A at the inboard mounting face.
4. Dimension 220 mm chord and 8.0 ±0.10 mm thickness.
5. Apply profile tolerance and low-radial-engagement finishing note.

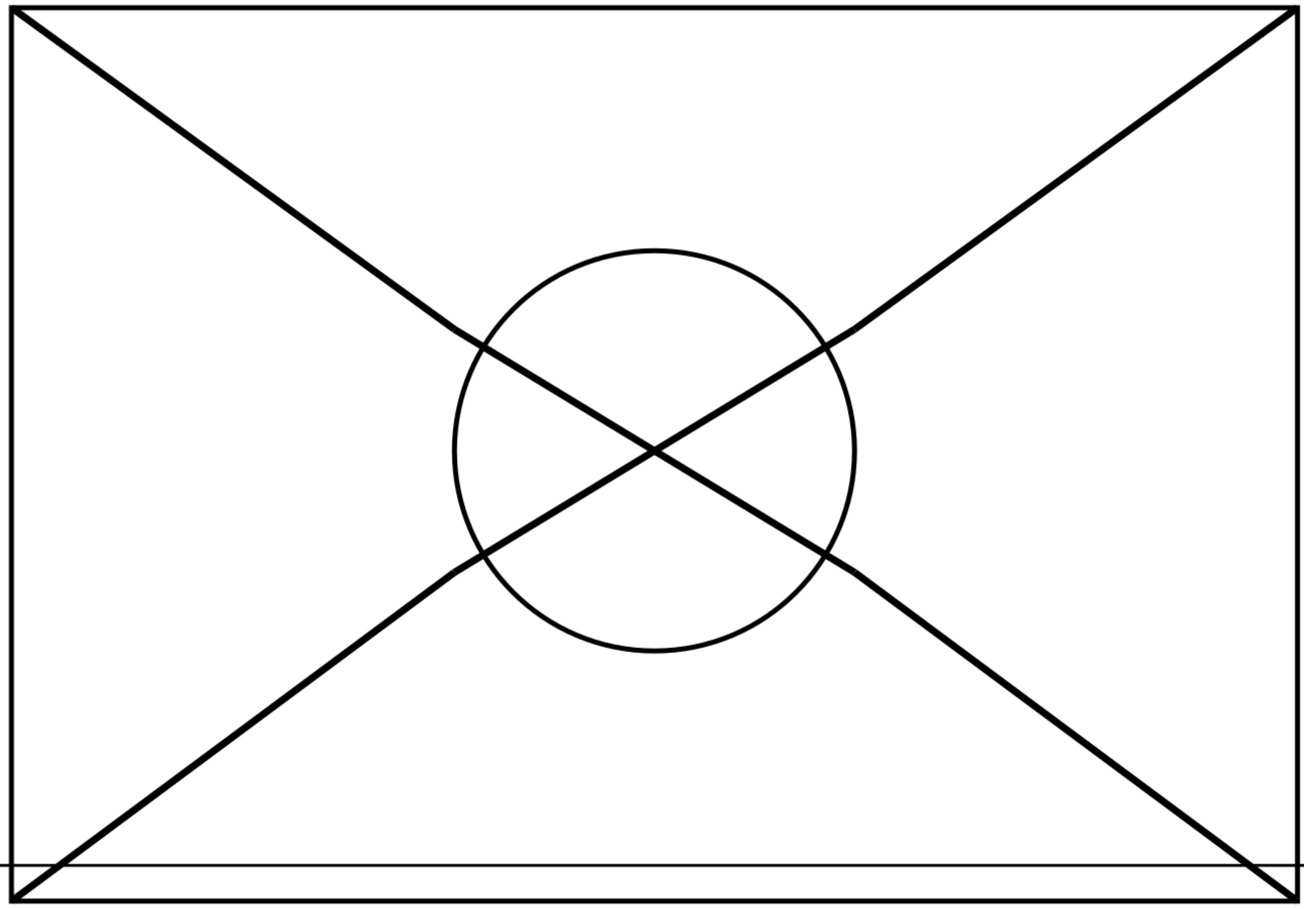
KEY CHECK
Create the final drawing from the native parametric part. The embedded drawing is a conceptual reference sheet supplied with the project.

ASTERION FCTA-1 CAD/CAM/CAE	**SKIMMER WING RIB - MANUFACTURING DRAWING** TUTORIAL / CONCEPT	DRAWING NO. **AST-TD-0023**	SCALE **1:2**	REV **A**	SHEET **23 / 28**	UNITS **mm**

Author: Samuelson G | Open-source portfolio baseline | Not flight-certified

GRAPHIC / DRAWING AREA

AST-ST-1401 LIGHTWEIGHT BULKHEAD



MATERIAL: ALUMINIUM 6061-T6 PLATE/DEMONSTRATOR
FINISHED THICKNESS: 12.0 ±0.15
DATUM A: AFT FACE; DATUM B/C: OUTER EDGES
REMOVE SHARP INTERNAL CORNERS WITH R3 MIN
VERIFY FLATNESS 0.40 AFTER MACHINING

ASTERION FCTA-1 · V0.7 · UNITS mm

NX / ANSYS TUTORIAL NOTES

NX DRAFTING TUTORIAL

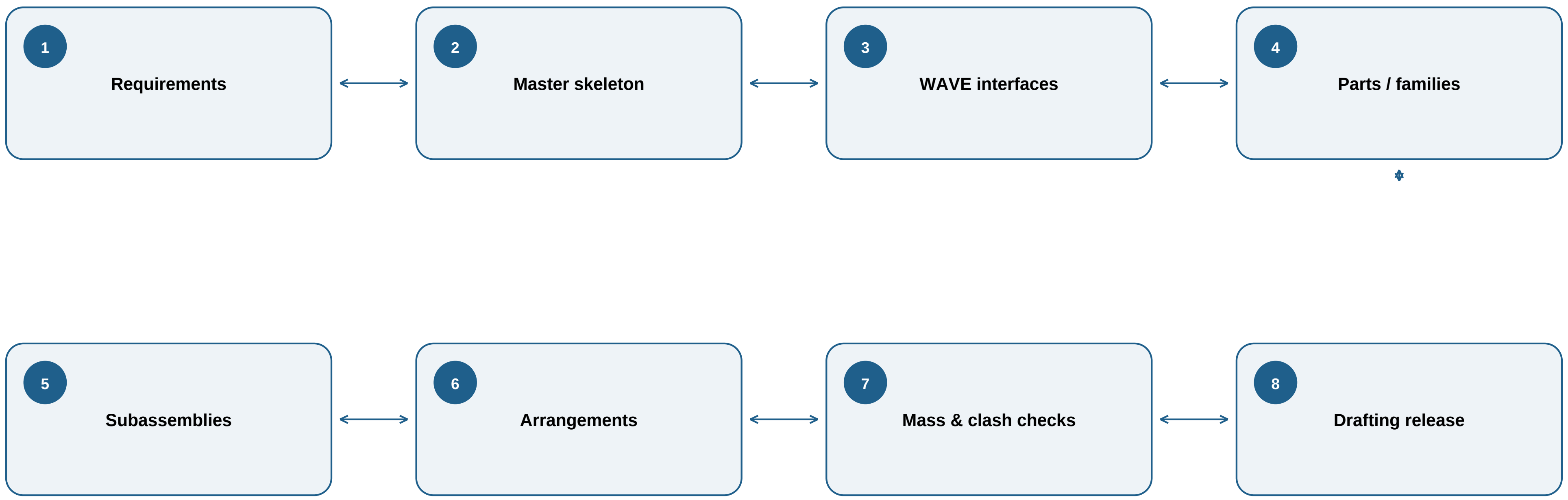
1. Create the outer plate, central opening and triangular lightweight pockets.
2. Place front, section and isometric views.
3. Define datum A on the aft face and datum B/C on outer edges.
4. Dimension 12.0 ±0.15 mm finished thickness and R3 minimum internal corners.
5. Specify 0.40 flatness after machining and an inspection sequence.

KEY CHECK
Create the final drawing from the native parametric part. The embedded drawing is a conceptual reference sheet supplied with the project.

ASTERION FCTA-1 CAD/CAM/CAE	LIGHTWEIGHT BULKHEAD - MANUFACTURING DRAWING TUTORIAL / CONCEPT	DRAWING NO. AST-TD-0024	SCALE 1:2	REV A	SHEET 24 / 28	UNITS mm

Author: Samuelson G | Open-source portfolio baseline | Not flight-certified

GRAPHIC / DRAWING AREA



NX / ANSYS TUTORIAL NOTES

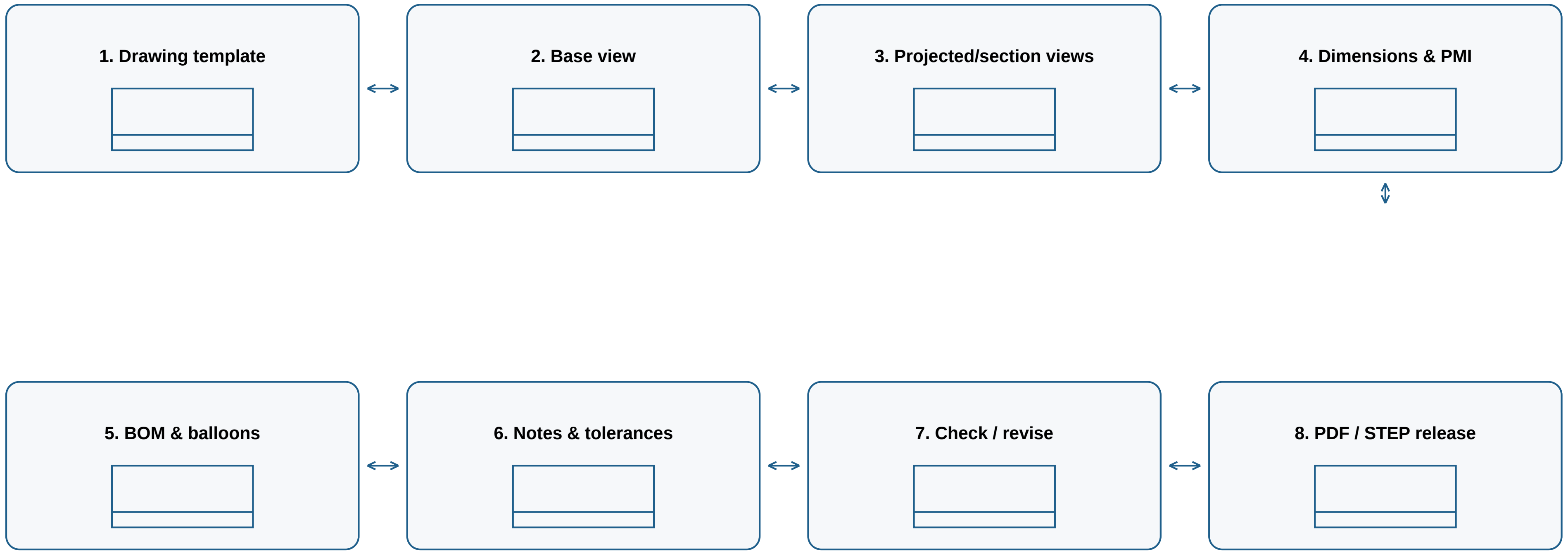
MODEL QUALITY GATES

1. Use controlled naming for parts, features, expressions, datums and reference sets.
2. Avoid broken WAVE links, circular inter-part dependencies and unreviewed promoted bodies.
3. Run Examine Geometry, mass properties and interference checks before release.
4. Use arrangements and reference sets to manage display complexity.
5. Export neutral geometry only after updating all linked parts and assemblies.

KEY CHECK
The master skeleton is the single source of truth for layout. Detailed components remain replaceable without re-defining the vehicle architecture.

ASTERION FCTA-1 CAD/CAM/CAE	SIEMENS NX MODELLING WORKFLOW TUTORIAL / CONCEPT	DRAWING NO.	SCALE	REV	SHEET	UNITS
		AST-TD-0025	NTS	A	25 / 28	mm

GRAPHIC / DRAWING AREA



NX / ANSYS TUTORIAL NOTES

DRAWING RELEASE

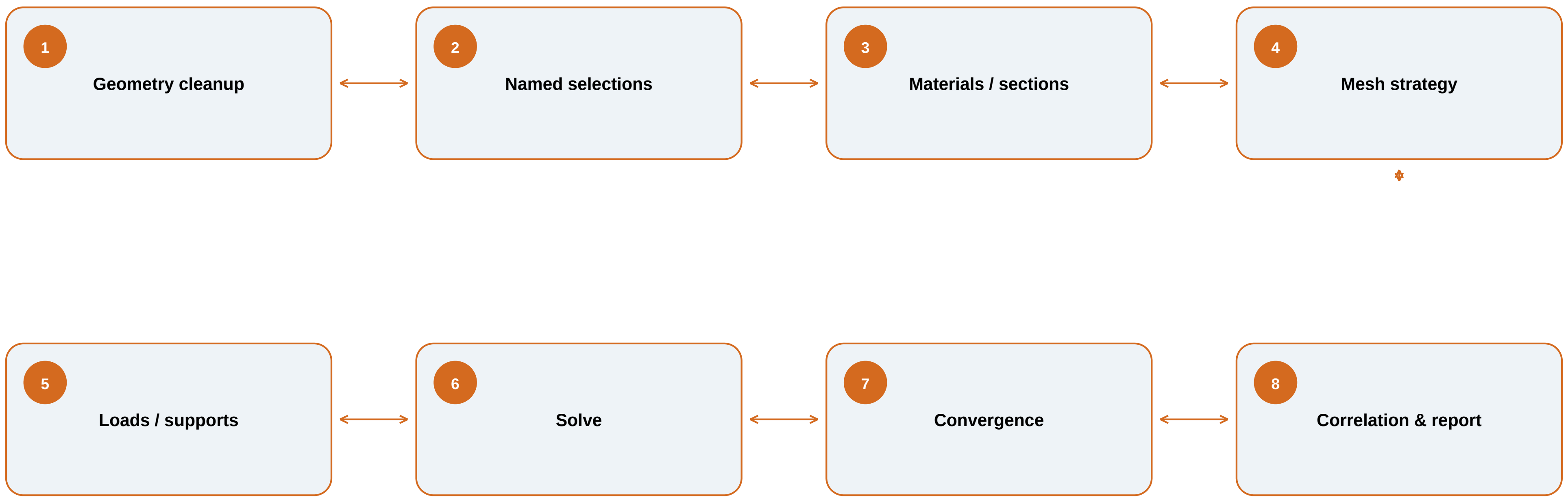
1. Start from a controlled border, title block, units and projection standard.
2. Use linked model views; never trace geometry manually.
3. Apply baseline, ordinate and hole-table dimensions where they improve clarity.
4. Use GD&T only where a functional datum scheme and inspection method are defined.
5. Perform independent check, update revision and export PDF plus neutral CAD deliverables.

KEY CHECK
A drawing is complete only when it defines geometry, interfaces, material, tolerances, finish, quantity, revision and verification method.

ASTERION FCTA-1 CAD/CAM/CAE	**SIEMENS NX DRAFTING AND RELEASE WORKFLOW** TUTORIAL / CONCEPT	DRAWING NO. **AST-TD-0026**	SCALE **NTS**	REV **A**	SHEET **26 / 28**	UNITS **mm**

Author: Samuelson G | Open-source portfolio baseline | Not flight-certified

GRAPHIC / DRAWING AREA



NX / ANSYS TUTORIAL NOTES

HOME-PC STRATEGY

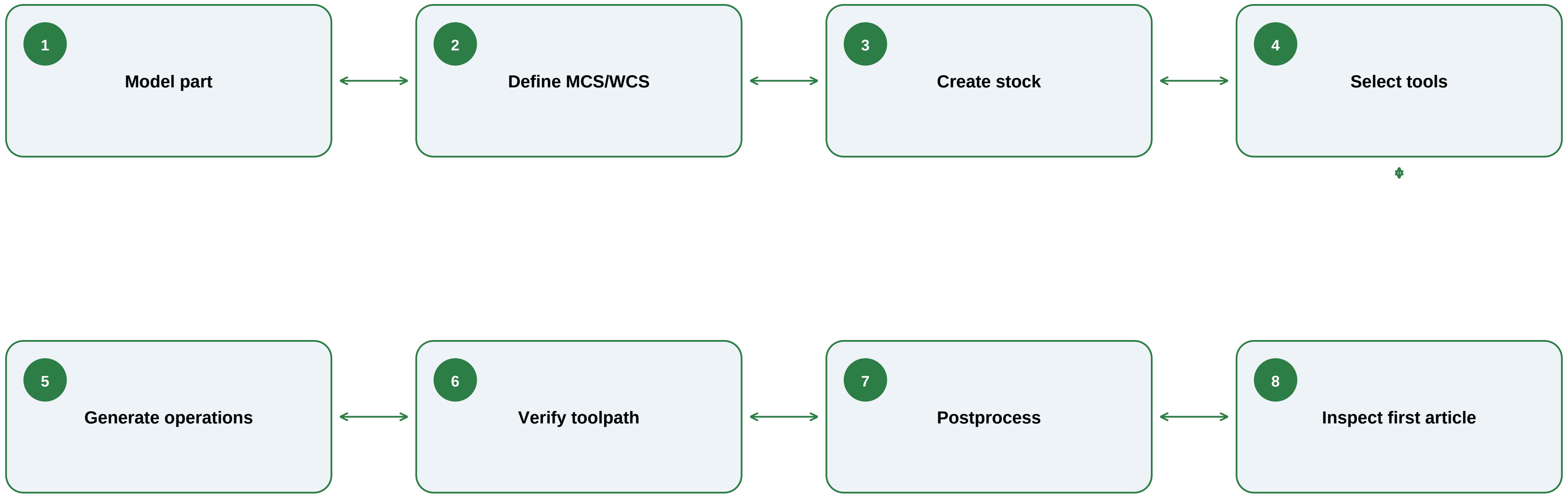
1. Use separate subsystem models instead of one fully detailed spacecraft mesh.
2. Represent the spine with beams, panels with shells and unmodelled equipment with reviewed remote masses.
3. Use symmetry, defeaturing, submodelling and named selections to control model size.
4. Run at least three mesh levels and target less than five percent change in governing results.
5. Compare every major result with a hand calculation or independent Python screening model.

KEY CHECK
Record solver version, mesh count, element types, contacts, boundary conditions, convergence history and result units.

LIMITATION
The project includes screening calculations and templates. Authoritative ANSYS results must be solved and archived on the user's PC.

ASTERION FCTA-1 CAD/CAM/CAE	ANSYS STRUCTURAL, THERMAL AND CFD WORKFLOW TUTORIAL / CONCEPT	DRAWING NO. AST-TD-0027	SCALE NTS	REV A	SHEET 27 / 28	UNITS mm

GRAPHIC / DRAWING AREA



AREA	RELEASE CHECK
CAD	Native parts/assembly update without errors
DRAWINGS	Views, dimensions, BOM and revision checked
CAE	Mesh convergence and correlation documented
CAM	Toolpath, holder and fixture collision checks passed
PROTOTYPE	Print/machining test measurements recorded
REPOSITORY	Claims, limitations, licences and checksums current

NX / ANSYS TUTORIAL NOTES

FINAL RELEASE

1. Verify every native NX part, assembly and drawing opens on the target NX release.
2. Archive ANSYS project files, screenshots, convergence tables and result exports.
3. Keep educational G-code clearly marked until the exact machine, postprocessor and work offsets are proven.
4. Publish STEP, STL, GLB, PDF, CSV and scripts alongside native evidence where licensing permits.
5. Update the artefact-status ledger so generated, executed and pending evidence are never confused.

KEY CHECK
This tutorial package is the drawing roadmap.
Native NX/ANSYS execution evidence remains the final portfolio completion step.

ASTERION
FCTA-1 CAD/CAM/CAE

NX CAM, VERIFICATION AND PUBLIC RELEASE

TUTORIAL / CONCEPT

DRAWING NO.	SCALE	REV	SHEET	UNITS
AST-TD-0028	NTS	A	28 / 28	mm

Author: Samuelson G | Open-source portfolio baseline | Not flight-certified