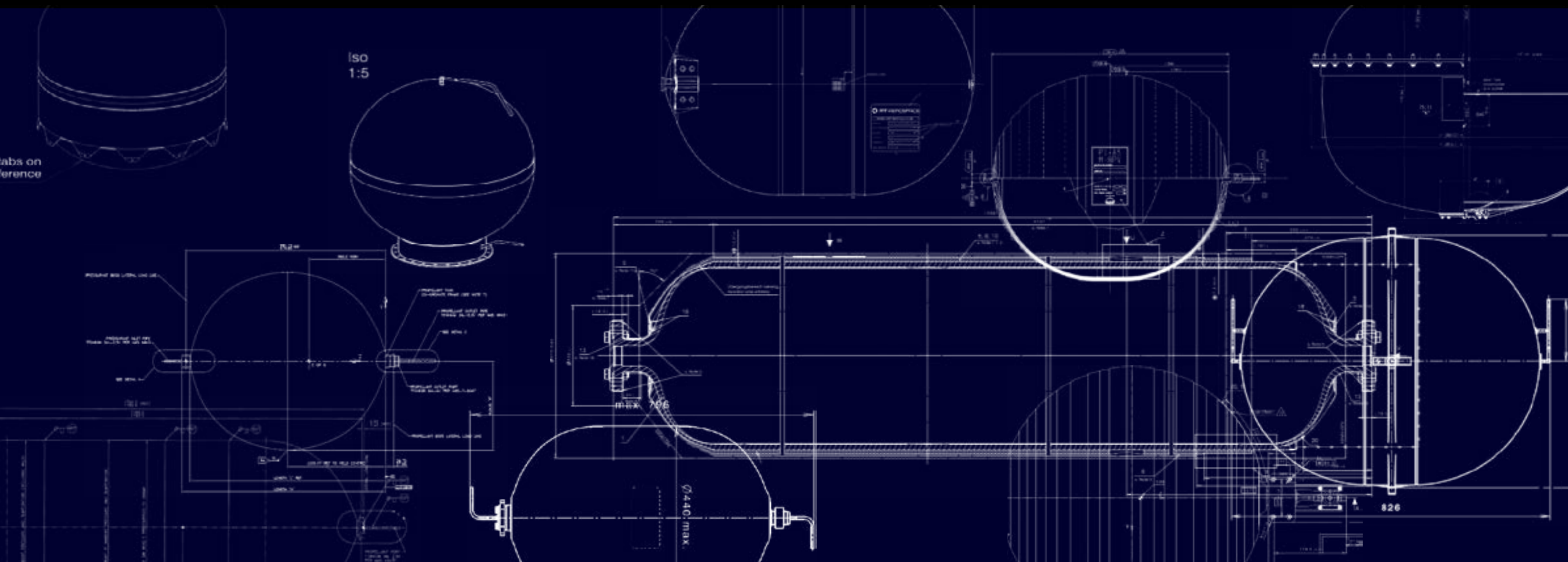


Spacecraft Propellant Tanks



Content

TANKS IN SPACE / HERITAGE 3

DIAPHRAGM TANKS

177 litre PTD Hydrazine (N ₂ H ₄)	4
222 litre PTD Hydrazine (N ₂ H ₄).....	5
96 litre PTD Hydrazine (N ₂ H ₄).....	6

PMD TANKS

166 litre PMD.....	7
--------------------	---

HIGH PRESSURE VESSELS

High Pressure Vessels (HPV)

Helium, Nitrogen & Xenon

60 litre S-XTA Xenon (Xe)	8
40 - 75 litre HeHPV Family (He).....	9
75 - 120 litre Helium Tank	10

High Pressure Vessels (HPV)

for Electric Propulsion (EP) /

Xenon Tank Assembly (XTA)

1-7 litre XS-XTA Family.....	11
40-120 litre S-XTA Family	12
600-900 litre L-XTA Family 1 /	
Electra- & NeoSat Platforms.....	13

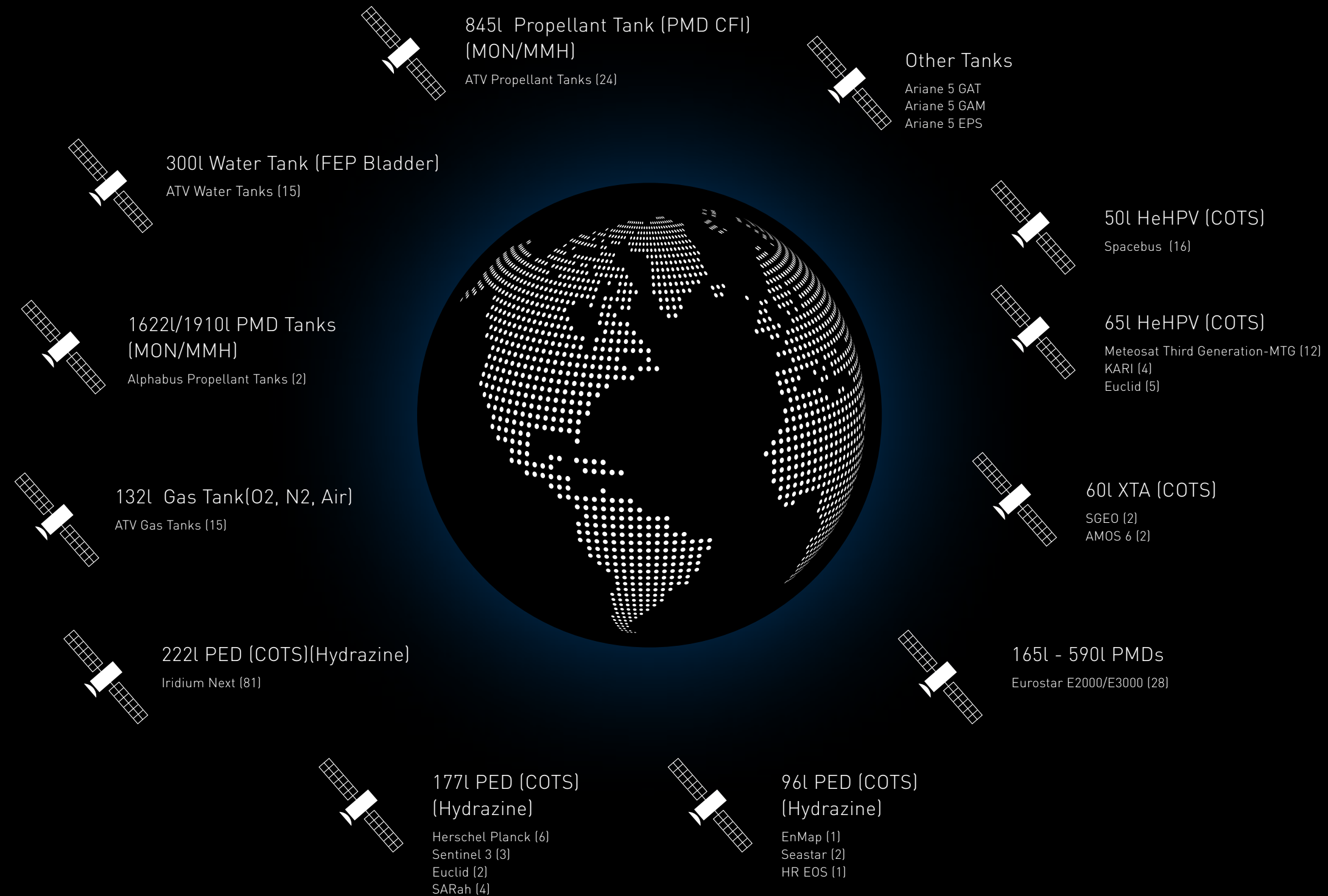
ATV PROGRAM

(Restart Activities Required)

296 litre Water Bladder Tank.....	14
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LIST OF ABBREVIATIONS..... 15

TANKS IN SPACE – HERITAGE



PTD-177

Monopropellant Diaphragm Tank – COTS



HERITAGE Herschel Planck, Sentinel 3

FLUIDS		N ₂ H ₄ (Hydrazine)
PRESSURANT GAS		He, N ₂
PROPELLANT MANAGEMENT		Diaphragm
MATERIALS	Shell	Ti-6Al-4V
	Tube	Ti-3Al-2.5V
	Diaphragm	EPDM
MOUNTING INTERFACE		equatorial trunnions

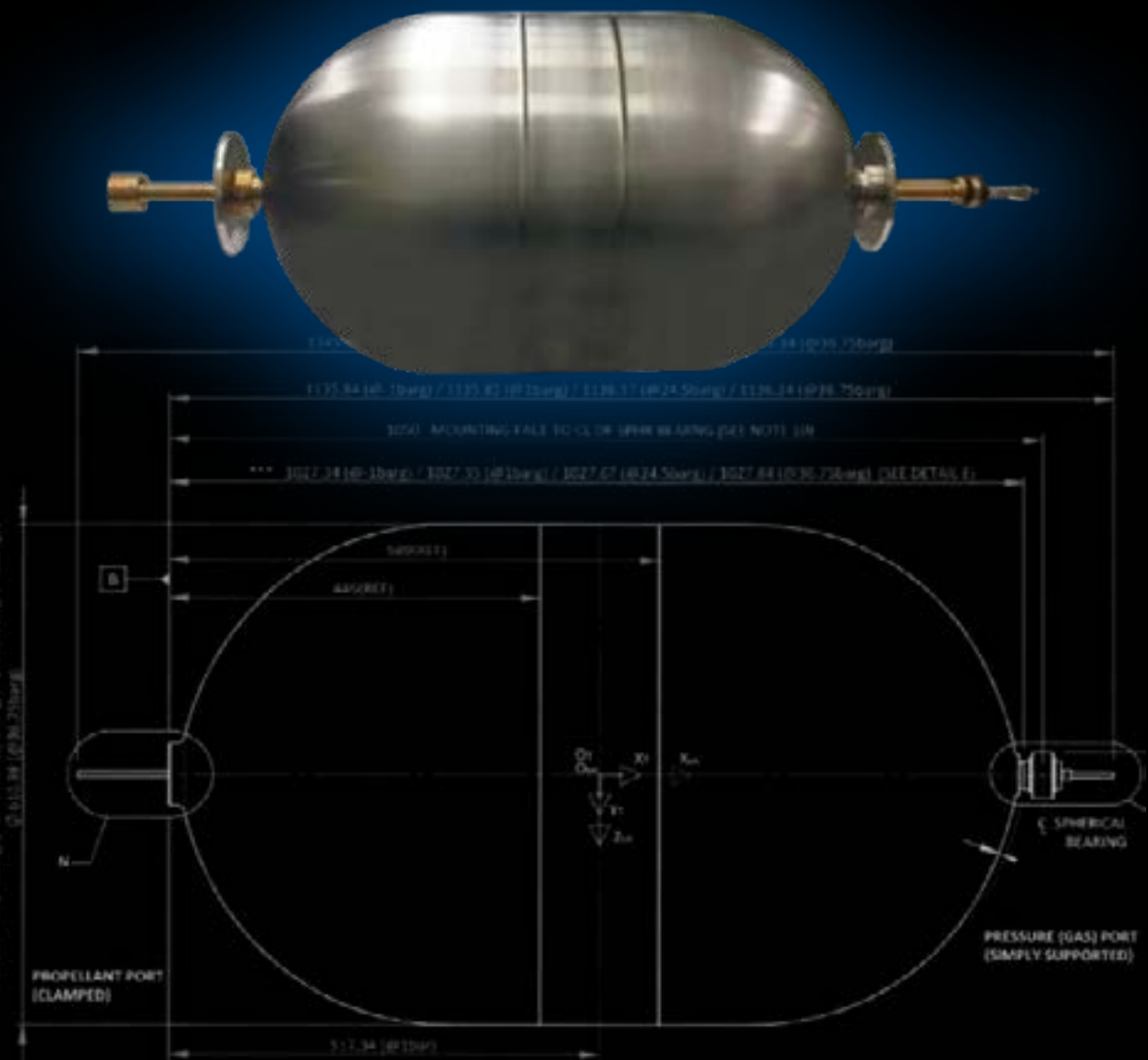
TOTAL VOLUME	177 l	10.801 in ³
PROPELLANT VOLUME	135 l	8.238 in ³
TEMPERATURE RANGE	0 / +50 °C	+32 / +122 °F
TANK DRY MASS	15,5 kg	34,2 lbs
DIAMETER	654,6 mm	25,77 in
LENGTH	827,0 mm	32,56 in

MEOP*	24,0 bar	348 psi
PROOF PRESSURE (x 1,50)	36,0 bar	522 psi
BURST PRESSURE (x 2,00)	48,0 bar	696 psi
BURST PRESSURE TESTED	55,5 bar	805 psi

* Maximum Expected Operating Pressure

PTD-222

Monopropellant Diaphragm Tank – COTS

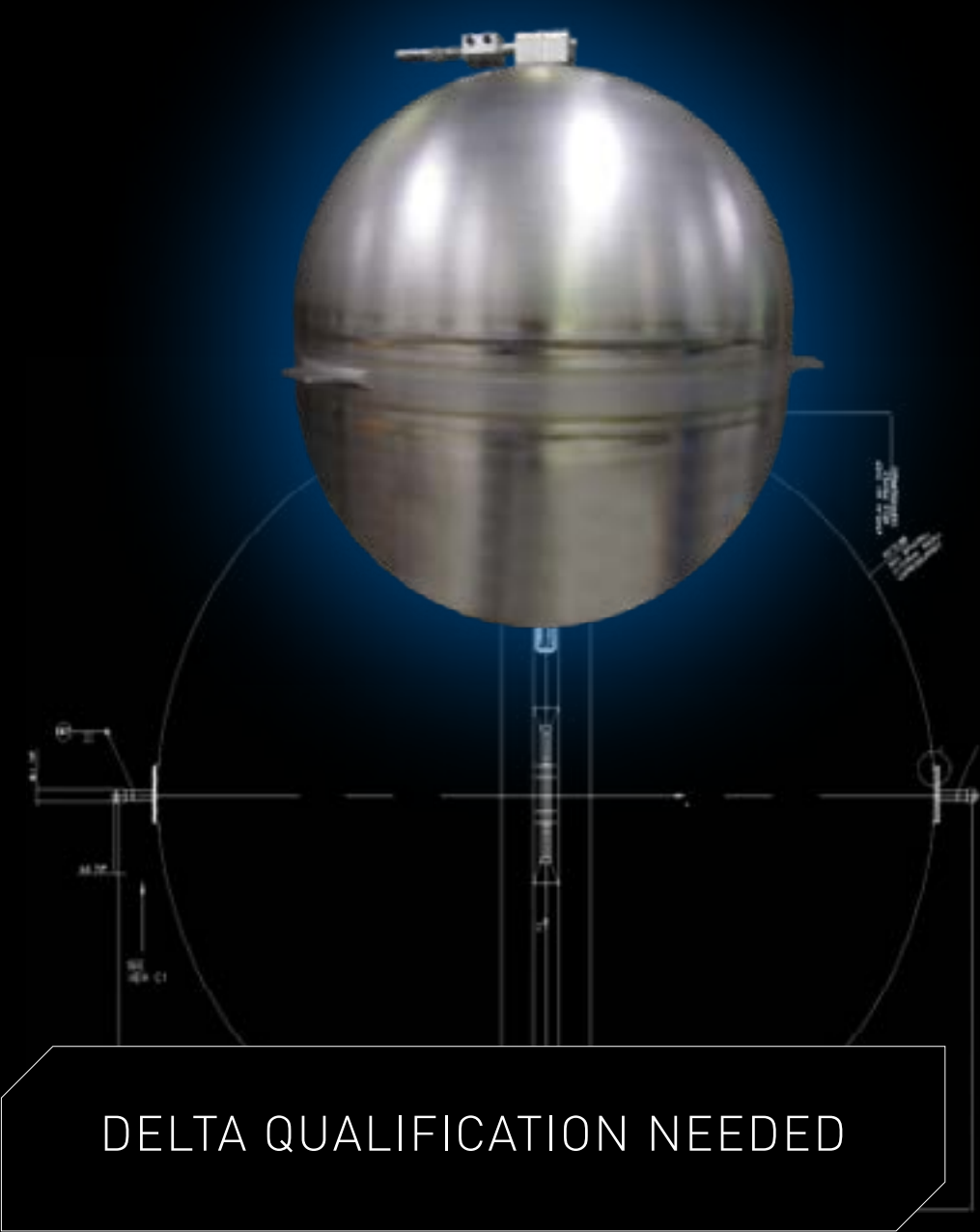


HERITAGE		Iridium NEXT
FLUIDS		N ₂ H ₄ (Hydrazine)
PRESSURANT GAS		He, N ₂
PROPELLANT MANAGEMENT		Diaphragm
MATERIALS	Shell	Ti-6Al-4V
	Tube	Ti-3Al-2.5V
	Diaphragm	EPDM
MOUNTING INTERFACE		polar
TOTAL VOLUME		221,0 – 222,8 l 13.486 – 13.596 in ³
PROPELLANT MASS		164 / 184 kg max 361,6 / 405,7 lbs
TEMPERATURE RANGE		+4 / +50 °C +39,2 / +122 °F
TANK DRY MASS		17,08 ± 0,2 kg 37,6 ± 0,4 lbs
DIAMETER		607,75 ± 2 mm 23,93 ± 0,08 in
LENGTH		1.027,35 / 1.022,35 mm 40,45 / 40,25 in
MEOP*		24,5 bar 355 psi
PROOF PRESSURE (x 1,50)		36,8 bar 533 psi
BURST PRESSURE (x 2,00)		49,0 bar 711 psi
RUPTURE PRESSURE TESTED		bar psi

* Maximum Expected Operating Pressure

PTD-96

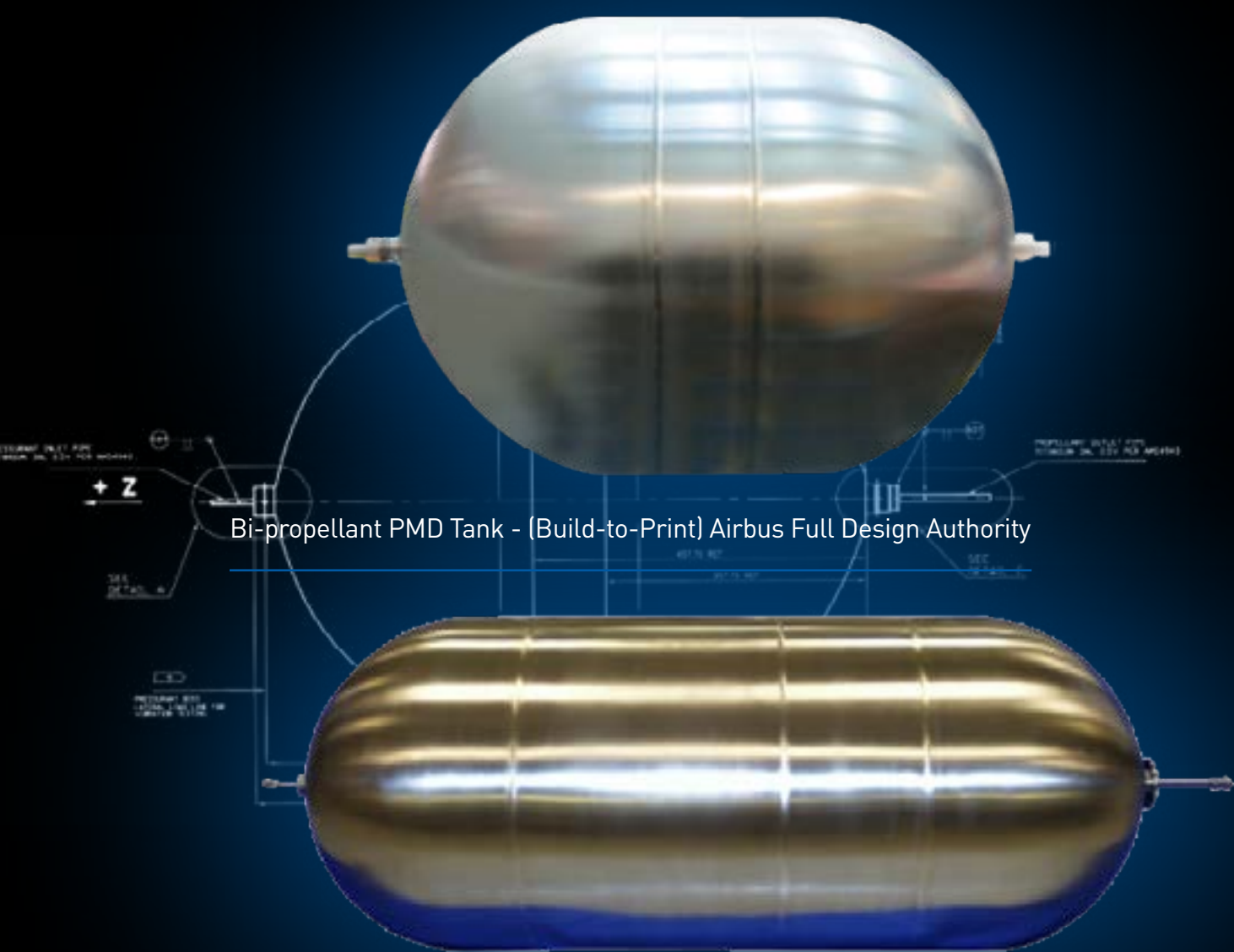
Monopropellant Diaphragm Tank – COTS with delta Qual



HERITAGE		Seastar, Goktürk, EnMap
FLUIDS		N2H4 (Hydrazine)
PRESSURANT GAS		He, N2
PROPELLANT MANAGEMENT		Diaphragm; 4,5:1 blowdown
MATERIALS	Shell	Ti-6Al-4V
	Tube	Ti-3Al-2.5V
	Diaphragm	EPDM
MOUNTING INTERFACE		equatorial mounting tabs
TOTAL VOLUME		96 l 5.858 in³
PROPELLANT MASS		55 / 68 / 71 kg 121 / 150 / 157 lbs
TEMPERATURE RANGE		0 / +50 °C +32 / +122 °F
TANK DRY MASS		8,2 kg 18,1 lbs
DIAMETER		545,0 mm 21,46 in
LENGTH		685,0 mm 26,97 in
MEOP*		24,0 bar 348 psi
PROOF PRESSURE (x 1,50)		36,0 bar 522 psi
BURST PRESSURE (x 2,00)		48,0 bar 696 psi
RUPTURE PRESSURE TESTED		72,1 bar 1046 psi

* Maximum Expected Operating Pressure

Eurostar Family PTP

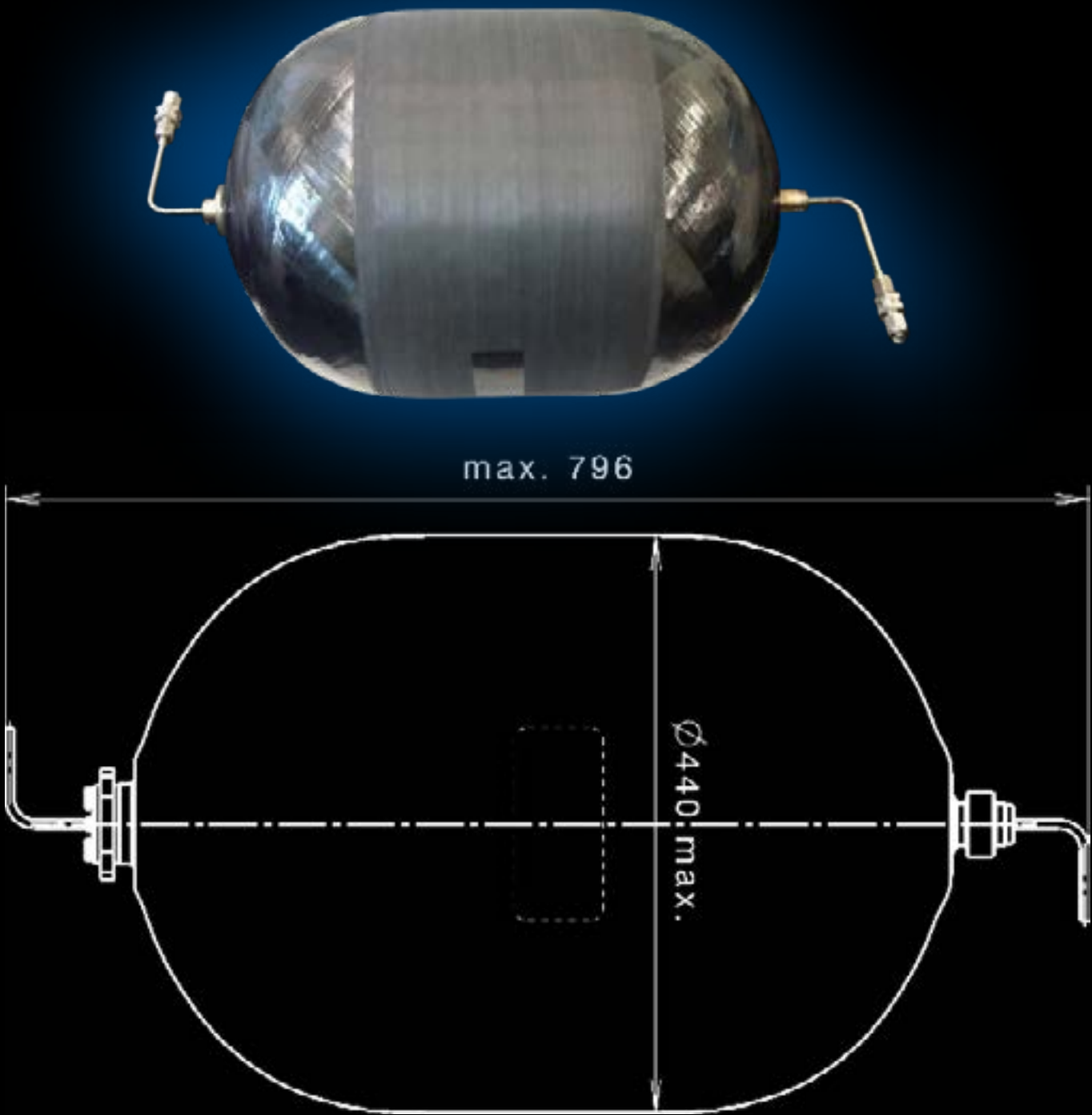


HERITAGE		GAIA, Eurostar 2000 & 3000
FLUIDS		MMH, N ₂ O ₄
PRESSURANT GAS		He
PROPELLANT MANAGEMENT		PMD
MATERIALS	Shell	Ti-6Al-4V
	Tube	Ti-3Al-2.5V
	PMD	Ti-6Al-4V
MOUNTING INTERFACE		polar
TOTAL VOLUME		165 l 10.069 in ³
TEMPERATURE RANGE		0 / +50 °C +32 / +122 °F
TANK DRY MASS		10,8 KG 23,8 LBS
DIAMETER		602,7 mm 23,73 in
LENGTH		856,0 mm 33,70 in
MEOP*		20,0 bar 290 psi
PROOF PRESSURE (x 1,31)		26,2 bar 380 psi
BURST PRESSURE (x 1,50)		30,0 bar 435 psi
BURST PRESSURE TESTED (19°C)		40,5 bar 587 psi

* Maximum Expected Operating Pressure

S-XTA-60

Xenon Tank - COTS



HERITAGE	SGEO, AMOS 6
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FLUIDS		XENON
MATERIALS	Shell	Ti-6Al-4V
	Tube	Ti-3Al-2.5V
	Overwrapped	Epoxy-based CFRP / T800
MOUNTING INTERFACE		polar

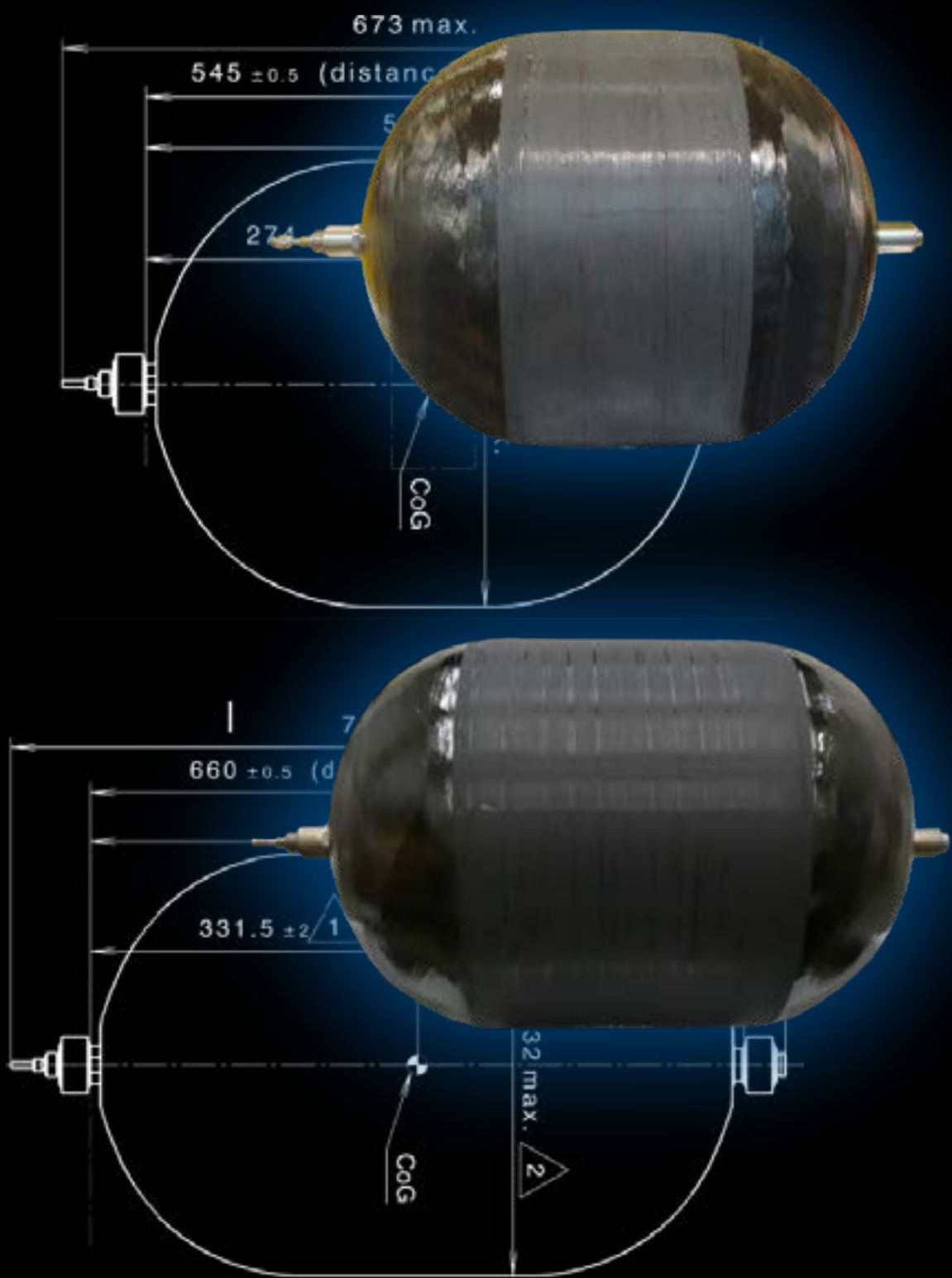
TOTAL VOLUME	60 l	3.661 in³
TEMPERATURE RANGE	up to 65 °C	up to 122 °F
TANK DRY MASS	11,7 kg	25,8 lbs
DIAMETER	440 mm	17,32 in
LENGTH	790,0 mm	31,10 in

MEOP*	187 bar	2.712 psi
PROOF PRESSURE (x 1,25)	233,8 bar	3.390 psi
BURST PRESSURE (x 1,50)	280,5 bar	4.068 psi
BURST PRESSURE TESTED	456,0 bar	6.614 psi

* Maximum Expected Operating Pressure

PVG Family 40 – 75 L

High Pressure Tank (HPV) – Helium/Nitrogen – COTS



HERITAGE		SpaceBus, MTG, Euclid, KARL
FLUIDS		Helium, Nitrogen
MATERIALS	Shell	Ti-6Al-4V
	Tube	Ti-3Al-2.5V
	Overwrap	Epoxy-based CFRP / T800
MOUNTING INTERFACE		polar
TOTAL VOLUME (unpressurized)		40 – 75 L 2380 – 4577 in³
TEMPERATURE RANGE		-30 / +60 °C -22 / +140 °F
TANK DRY MASS		8,5 – 14,4 kg 18,7 – 31,7 lbs
DIAMETER (max. pressurized)		432,0 mm 17,01 in
LENGTH (max. pressurized)		467 - 728 mm 18,38 – 28,66 in
MEOP*		310,0 bar 4.496 psi
PROOF PRESSURE (x 1,25)		387,5 bar 5.620 psi
BURST PRESSURE (x 1,50)		465,0 bar 6.744 psi
BURST PRESSURE TESTED		633,0 bar 9.181 psi

* Maximum Expected Operating Pressure

PVG Family 80-120

High Pressure Tank (HPV) – Helium/Nitrogen – COTS with delta Qual

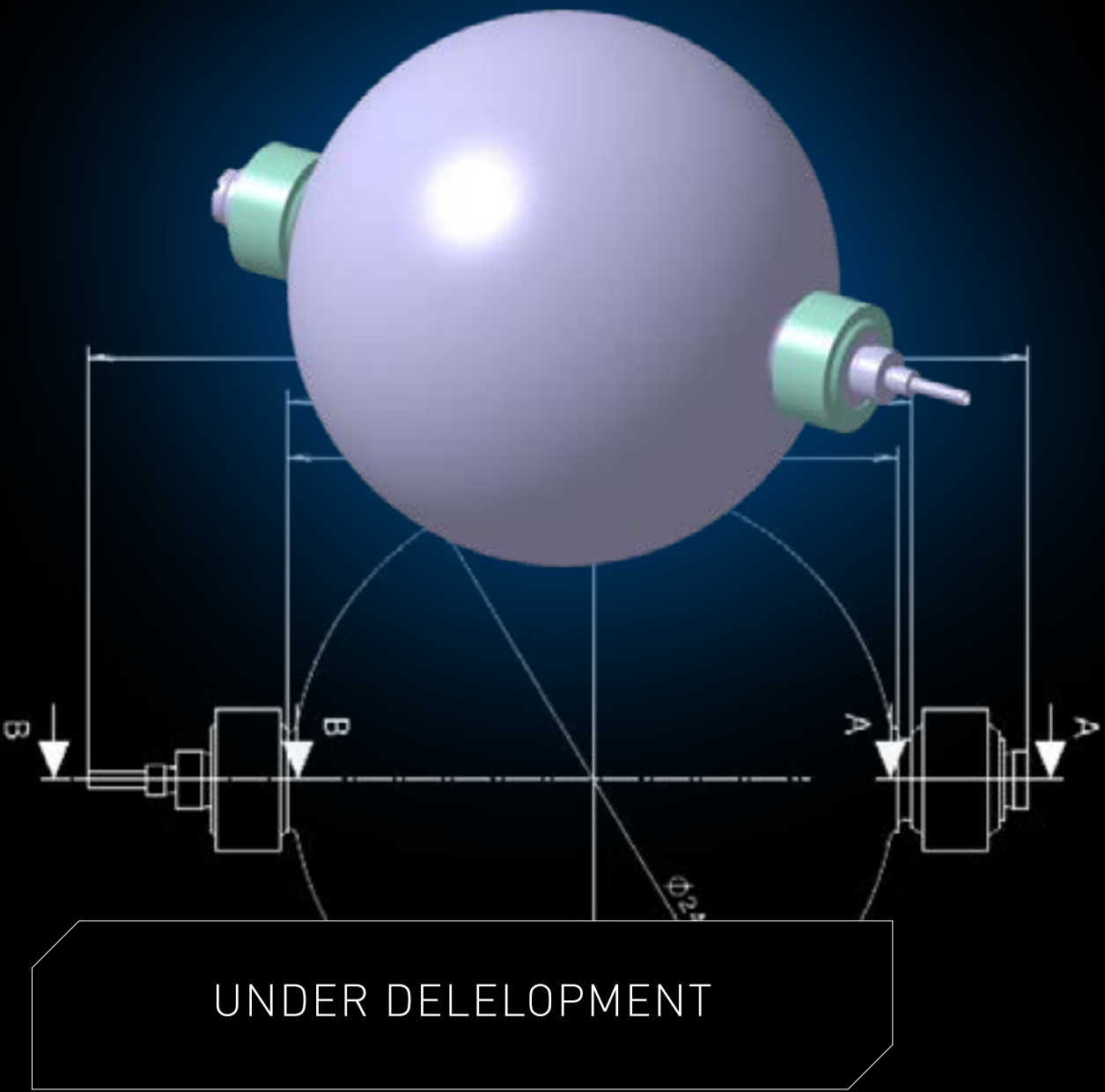


HERITAGE		Extension of 40-75 litre HeHPV Family
FLUIDS		Helium, Nitrogen
MATERIALS	Shell	Ti-6Al-4V
	Tube	Ti-3Al-2.5V
	Overwrap	Epoxy-based CFRP / T800
MOUNTING INTERFACE		polar
TOTAL VOLUME (unpressurized)	80-120 l	3.967 in³
TEMPERATURE RANGE	- 30 / +60 °C	-22 / +140°F
TANK DRY MASS	23,5 kg	51,81 lbs
DIAMETER (max. pressurized)	432,0 mm	17,01 in
LENGTH (max. pressurized)	? mm	? in
MEOP*	310,0 bar	4.496 psi
PROOF PRESSURE (x 1,25)	387,5 bar	5.620 psi
BURST PRESSURE (x 1,50)	465,0 bar	6.744 psi
BURST PRESSURE TESTED	633,0 bar	9.181 psi

* Maximum Expected Operating Pressure

XS-XTA / 1 – 7l Family

Xenon Tank



HERITAGE		
FLUIDS	Xenon	
MATERIALS	Shell	Ti-6Al-4V
	Tube	Ti-3Al-2.5V
MOUNTING INTERFACE		
TOTAL VOLUME	1 - 7 l	61 - 427 in³
TEMPERATURE RANGE	up to 55 °C	up to 131 °F
TANK DRY MASS	≤3,5 kg	≤7,7 lbs
DIAMETER	242 mm	9,53 in
LENGTH	≤386 mm	≤15,20 in
MEOP*	bar	psi
PROOF PRESSURE (x 1,5)	bar	psi
BURST PRESSURE (x 3,0)	bar	psi
BURST PRESSURE TESTED	bar	psi

* Maximum Expected Operating Pressure

S-XTA / 40-120L Family

Xenon Tank



MEOP [bar]	XeHPV			HeHPV, N2HPV			
	186			310			
	HeHPV Liner without boss area reinforcement						
	Volume [l]	Structural Mass [kg]	Xe Mass [kg]	Volume [l]	Structural Mass [kg]	He Mass [kg]	N ₂ Mass [kg]
	40	6.3	73	40	8.1	1.8	12.1
	60	8.9	110	65	12.4	2.9	19.6
	90	12.8	165	90	16.7	4.0	27.1
Two Bearings	per \$2.2	0.66		per \$2.2	0.66		

XeHPV Tank Sizes
Di=405 mm, Do=418.4 mm
MEOP*=186 bar



V=40 l
L=446 mm
m_{Struct_pred}=6.3 kg
M_{Xe_max}=73 kg



60 l
601 mm
8,9 kg
110 kg



90 l
835 mm
12,8 kg
165 kg



120 l
1072 mm
16,8 kg
220 kg

UNDER DEVELOPMENT

HERITAGE	Extension of 60 litre S-XTA	
FLUIDS	Xenon	
MATERIALS	Shell	Ti-6Al-4V
	Tube	Ti-3Al-2.5V
	Overwrapped	Epoxy-based CFRP / T800
MOUNTING INTERFACE	polar	

TOTAL VOLUME	40 - 120 l	2441-7323 in ³
TEMPERATURE RANGE	up to 65 °C	up to 149 °F
TANK DRY MASS	6,3 – 14,8 kg	13,89 – 32,63 lbs
DIAMETER	440 mm	17,32 in
LENGTH	446 – 1072 mm	17,56 – 42,20 in

MEOP*	187 bar	2.712 psi
PROOF PRESSURE (x 1,25)	233,8 bar	3.390 psi
BURST PRESSURE (x 1,50)	280,5 bar	4.068 psi
BURST PRESSURE TESTED	456,0 bar	6.614 psi

* Maximum Expected Operating Pressure

L-XTA / 300-900 Family

Xenon Tank – Electric Propulsion (EP)



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Image credit: ESA 2015
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FOR ELECTRA & NEOSAT/
SPACEBUS-NEO PLATFORMS

HERITAGE		under Qualification
FLUIDS		Xenon
MATERIALS	Shell	Ti-6Al-4V
	Tube	Ti-3Al-2.5V
	Overwrapped	Epoxy-based CFRP / T800
MOUNTING INTERFACE		equatorial skirt
TOTAL VOLUME	600 - 900 l	36.614 - 54.921 in³
TEMPERATURE RANGE	up to 50 °C	up to 122 °F
TANK DRY MASS	68 - 85 kg	149,9 - 187,4 lbs
DIAMETER	1.144 mm	45,04 in
LENGTH	979,3 – 1306 mm	38,56 – 51,42 in
MEOP*	187 bar	2.712 psi
PROOF PRESSURE (x 1,25)	233,8 bar	3.390 psi
BURST PRESSURE (x 1,50)	280,5 bar	4.068 psi
BURST PRESSURE TESTED	bar	psi

* Maximum Expected Operating Pressure

WTB-296

Potable Water Bladder Tank – (Re-start Activity required)



HERITAGE		ATV
FLUIDS		Water
PRESSURANT GAS		Air, N ₂
PROPELLANT MANAGEMENT		Bladder
MATERIALS	Shell	Stainless Steel
	Tube	
	Bladder	FEP
	Overwrap	Epoxy-based CFRP / T800
MOUNTING INTERFACE		equatorial
TOTAL VOLUME	296 l	18.063 in ³
FLUID VOLUME	280 l	17.087 in ³
TEMPERATURE RANGE	+5 / +50 °C	+41 / +122 °F
TANK DRY MASS	28,5 kg	62,8 lbs
DIAMETER	916,0 mm	36,06 in
LENGTH	750,0 mm	29,53 in
MEOP*	4,0 bar	58 psi
PROOF PRESSURE (x 1,50)	6,0 bar	87 psi
BURST PRESSURE (x 2,00)	8,0 bar	116 psi
BURST PRESSURE TESTED	min. 14,0 bar	min. 203 psi

* Maximum Expected Operating Pressure

List of Abbreviations

ABBREVIATION	DESCRIPTION
AA	Aluminium Association
ATV	Automated Transfer Vehicle
CFRP	Carbon Fibre Reinforced Plastic
COTS	Commercial Off The Shelf
EP	Electric Propulsion
EPDM	Ethylene Propylene Diene Monomer
FEP	Fluorinated Ethylene Propylene
GRD	Gas Retention Device
GTA	Gas Tank Assembly
HPV	High Pressure Vessel
HeHPV	Helium High-Pressure Vessel
MEOP	Maximum Expected Operating Pressure
MMH	Mono Methyl Hydrazine
MON	Mixed Oxides of Nitrogen
N ₂ HPV	Nitrogen High-Pressure Vessel
NTO	Nitrogen Tetroxide
PED	Positive Expulsion Device
PMD	Propellant Management Device
PTD	Propellant Tank Diaphragma
XTA	Xenon Tank Assembly