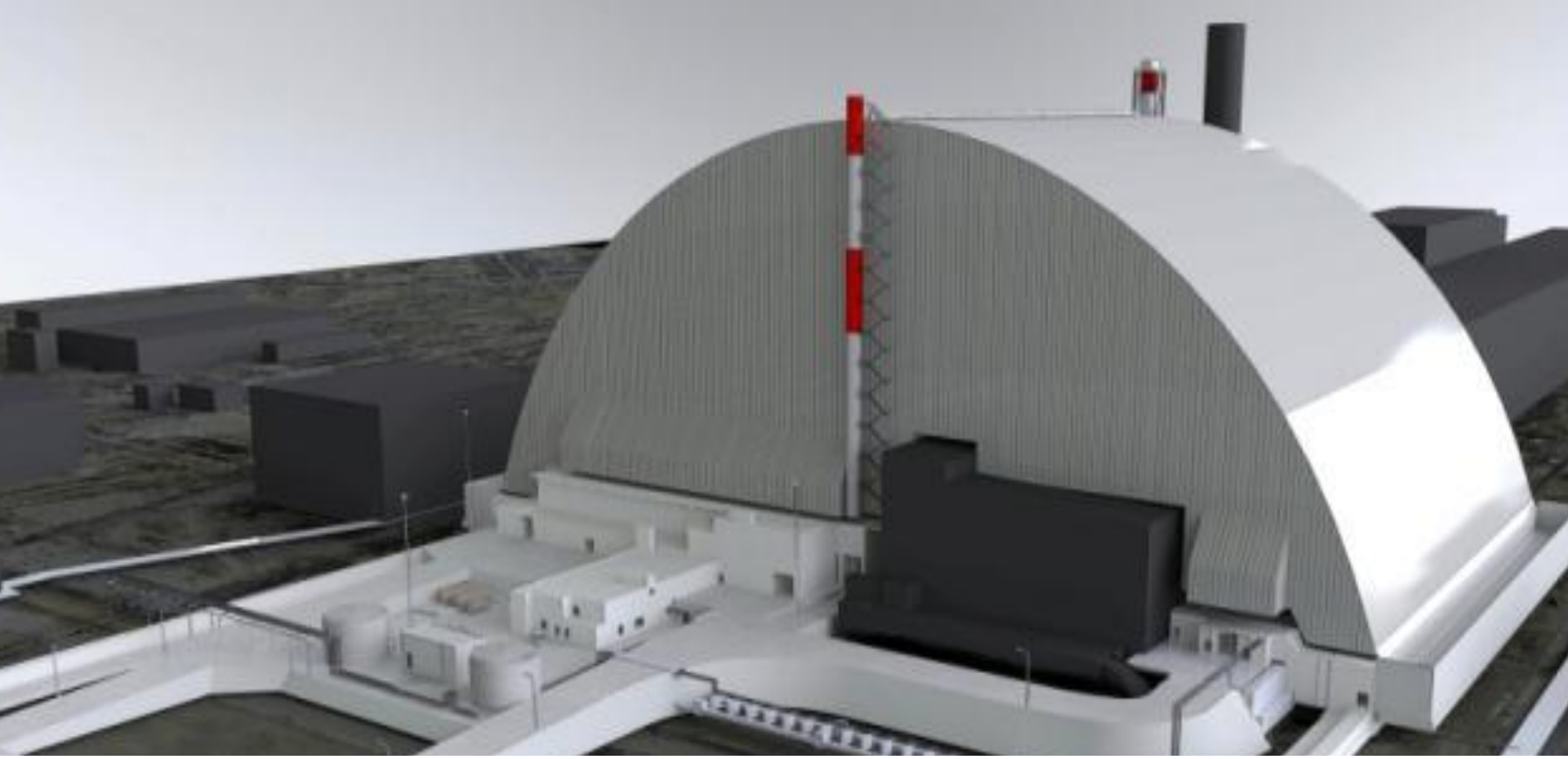

New Safe Confinement

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Purpose and background

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The purpose of the NSC construction is to create a barrier against dissemination of radioactive substances contained in the OS and to create conditions for further OS deconstruction operations.

The Project is financed from the Chernobyl Shelter Fund (CSF).

Engineering and construction are performed by the Contractor (JV NOVARKA) that consists of two French companies: VINCI Construction Grands Projets and BOUYGUES Travaux Publics.

Around 50 Ukrainian organizations participate in the NSC Project implementation.

Design

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NSC is designed for operation during 100 years and is resistant to seismic impact up to 6 points magnitude as well as tornado class 3.

In view of the radiation conditions this construction is performed under, the NSC facility is one-of-a-kind in the world

Protection of the environment from impact of radioactive materials contained in the Object Shelter is ensured by leak-tightness of the NSC.

Leak-tightness functions are performed by:

- the Annular Space – a gap between the internal and external claddings where the ventilation system maintains permanent overpressure relative to the Main Volume effectively preventing egress of radioactive substances into the environment;
- Elastic membrane that connects the Arch structure with the Object Shelter existing structures ensuring on one hand the leak-tightness and on the other – minimization of impacts from the Arch to the existing structures of the OS.

Design

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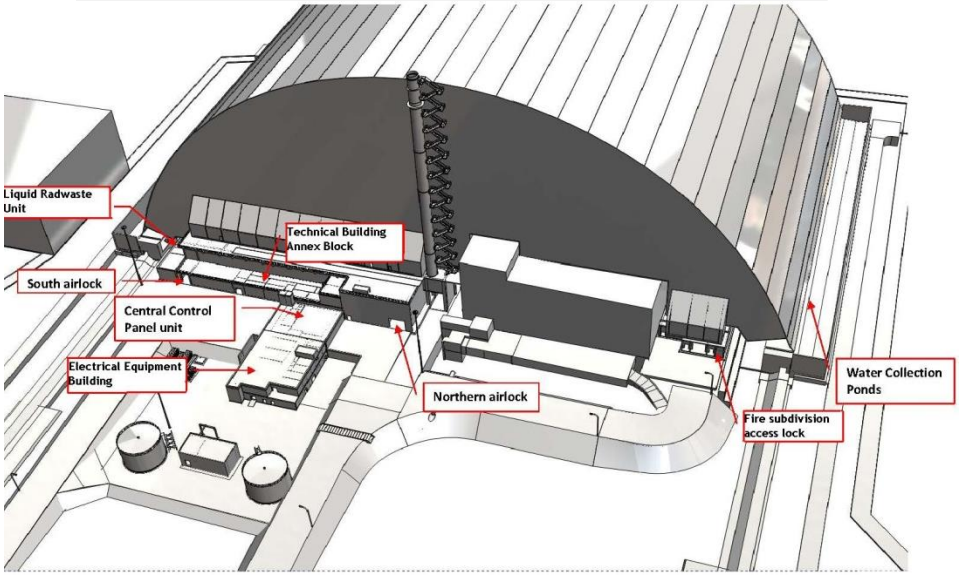
NSC main elements are:

- Arch
- Foundations
- Technological Building
- Auxiliary Facilities:
  - Electrical Equipment Building, Fire Water Pump Station with two 1500m3 fire tanks, Diesel Power Stations with diesel fuel stock tanks, North and South Storm Water Catching Basins, Storm Water Treatment Facilities.
  - NSC facility fully envelopes the OS and the territory directly adjacent thereto and is intended to perform the entire range of activities on conversion of the OS into an ecologically safe system.



Design

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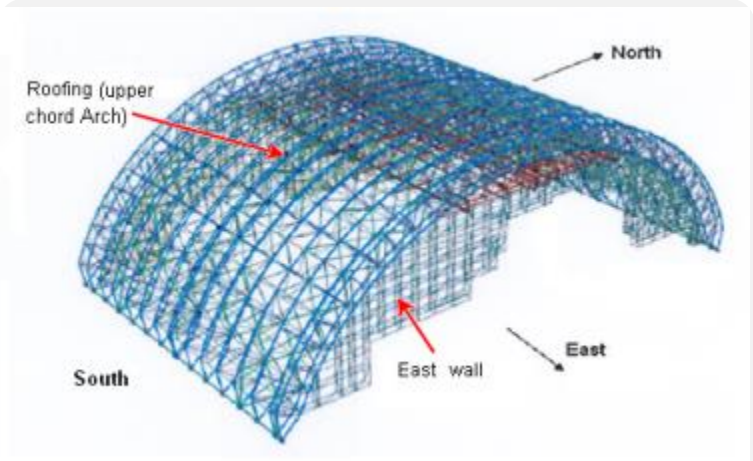

Height: 109 m

Length: 162 m

Width: 257 m

Arch total weight: 36,479 t

The NSC main load-bearing structure consists of 16 steel arch trusses with a span of 257.115m.

The distance between the external and internal cladding of the Arch is 13.80m. The distance between the external and internal cladding of the Arch West Wall is 9.60m.

Arch external cladding

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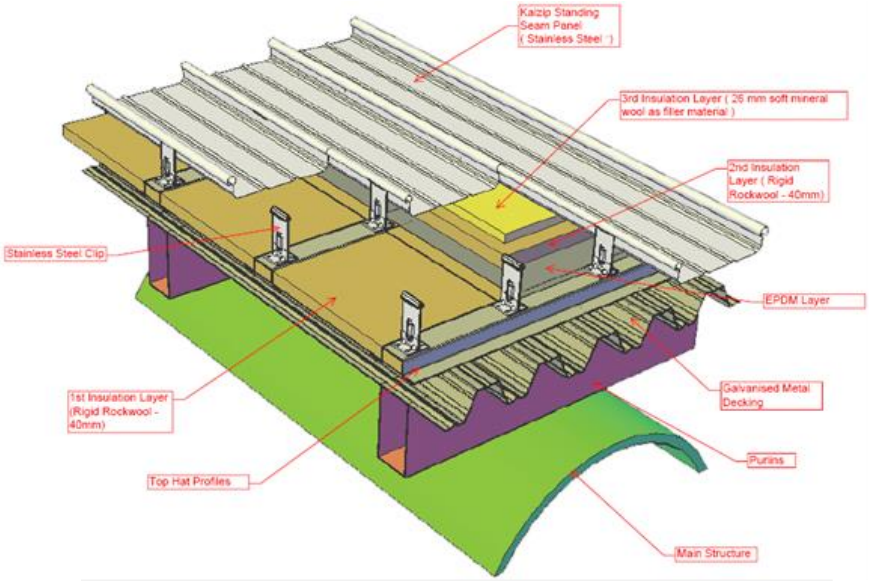
A multilayer system of physical barriers preventing dissemination of moisture and heat.

- Provides resistance to weather impact (rain, extreme snow, extreme wind) for the entire 100 year operation life of the facility;
- Withstands temperature fluctuations and impact of Tornado class 1.5 without causing the steel permanent strain;
- Withstands Tornado class 3, allowing steel permanent strain without destruction of the structure;
- Preserves integrity and insulating effect in case of internal fire;
- Maintains required properties under exposure to radiation reaching 0.1 Gy/h.



Arch internal cladding

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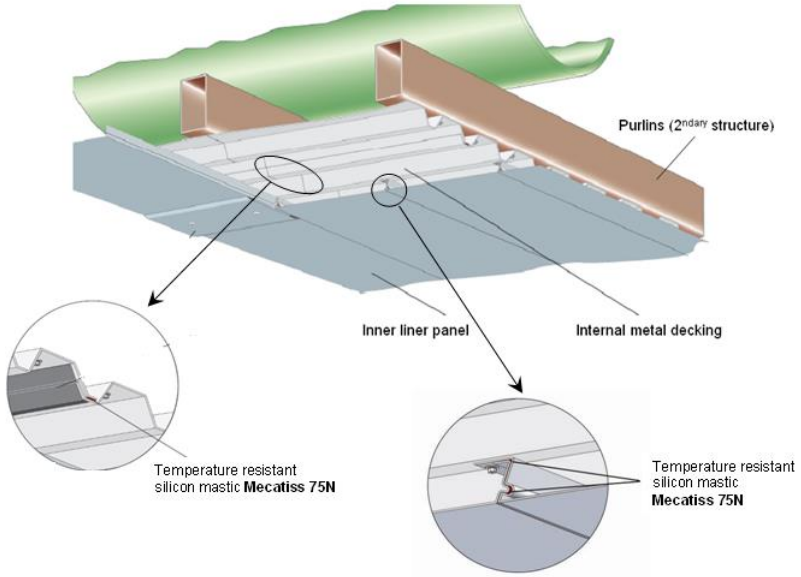
for Reconstruction and Development

A shell structure made of special 300 mm wide flat panels manufactured from corrosion-resistant steel.

- Prevents ingress of dust and particles from the Main Volume into the Annular Space;
- Limits impact of the internal fire to the Arch steel structures with minimum deformation;
- Maintains required properties under exposure to radiation reaching 0.1 Gy/h;
- Maintains its properties and functions during the entire 100 year operation life.



Arch assembly

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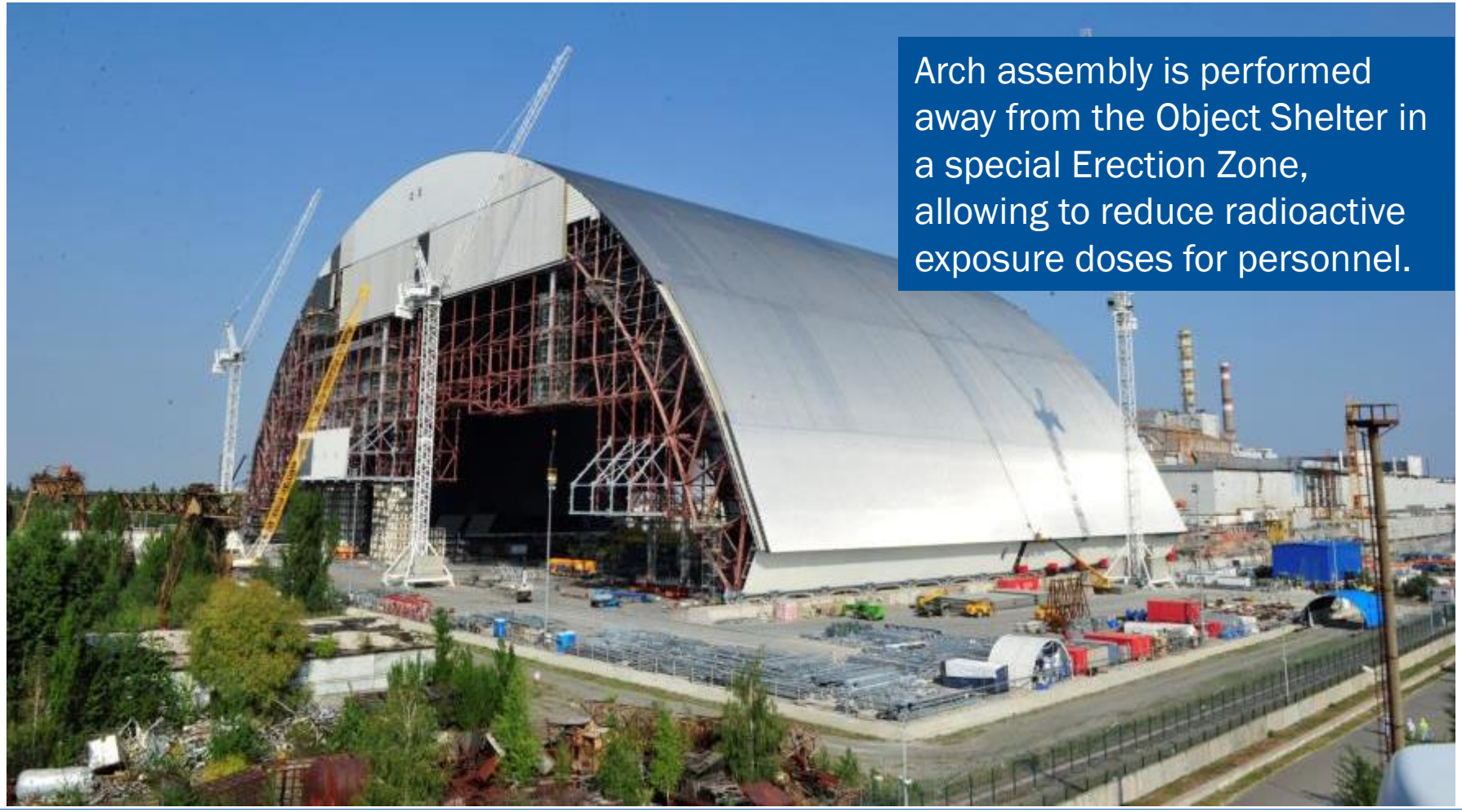
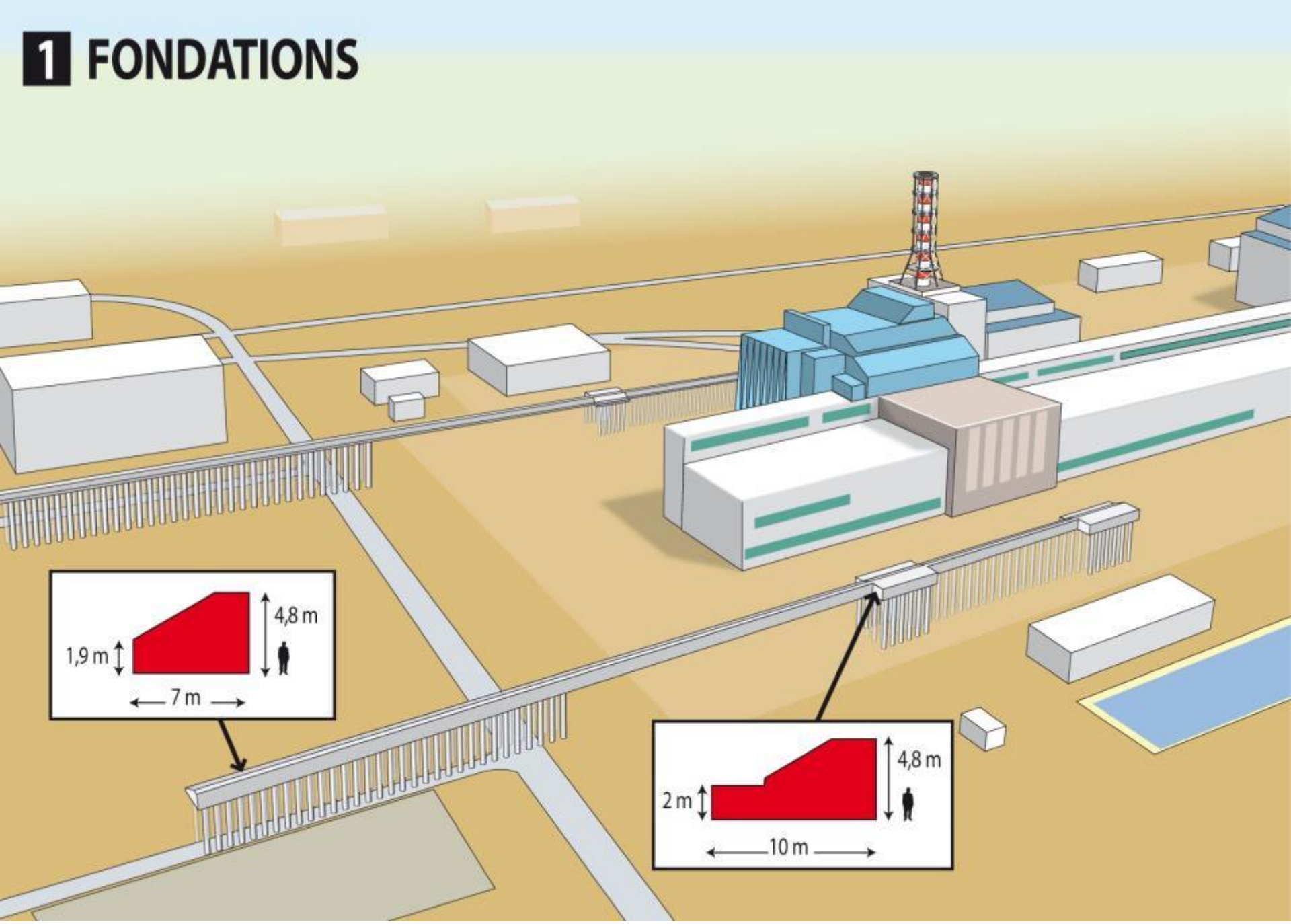


1 FONDATIONS



Service Zone Foundations

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The Service zone foundation is designed as two Ground beams arranged symmetrically with respect to the Arch axis on pile foundations, 175.275 m long each. The northern Ground beam consists of three expansion units, 58,635; 65.335 and 51.305 m long, which are separated by two expansion joints. The southern Ground beam consists of three expansion units 69,335; 54,635 and 51,305 m long.

Design of contraction joints envisions arrangement of shear key to exclude relative linear displacement of adjacent blocks both in vertical and horizontal plane in the “north-south” direction and ensure free movement along the foundation axis.

Ground beams will be supported by 1,0 m diameter reinforced concrete piles: 184 piles in the south Ground beam and 192 piles in the north beam.

The piles will be CFA made of reinforced concrete with diameter of 1,0 m and a length of 19,0 m. In extreme expansion units, the piles are located in 4 rows and 3 rows in the middle unit.

The Service zone foundations are connected to the Transfer zone foundations by expansion joints with connection tabs.

Transfer and Erection Zone Foundations

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In the Transfer zone, the foundation will consist of two Ground beams, each of them being 10,50 m wide and 121,81 m long, symmetrical relative to the Arch axis.

The foundation will be a strip one, willow depth, with 114,000 bottom level.

The foundations will be made as one unit, without any expansion joint.

Foundation of the Erection zone is designed as two Ground beams arranged symmetrically about the Arch axis on pile foundations, with 8,50 m wide Ground beam bottom and 209,91 m long each. The Ground beams are composed of three expansion units 52,81; 75,00 and 82,10 m long separated by two expansion joints. The Erection zone foundations will be supported by 1,00 m diameter steel tube piles.

Foundations

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Service Zone Foundations South Strip

Transfer Zone Foundations North Strip

NSC is complete with all necessary process systems

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- Radiation Monitoring
- Electrical Power Supply
- Heating, Ventilation and Air Conditioning
- Main Cranes
- Fire Protection
- Integrated Control System
- Access Control
- Communication and CCTV
- Water Supply and Sewage
- Structural Monitoring
- Radioactive Waste Management System

NSC Main Cranes System (MSC)

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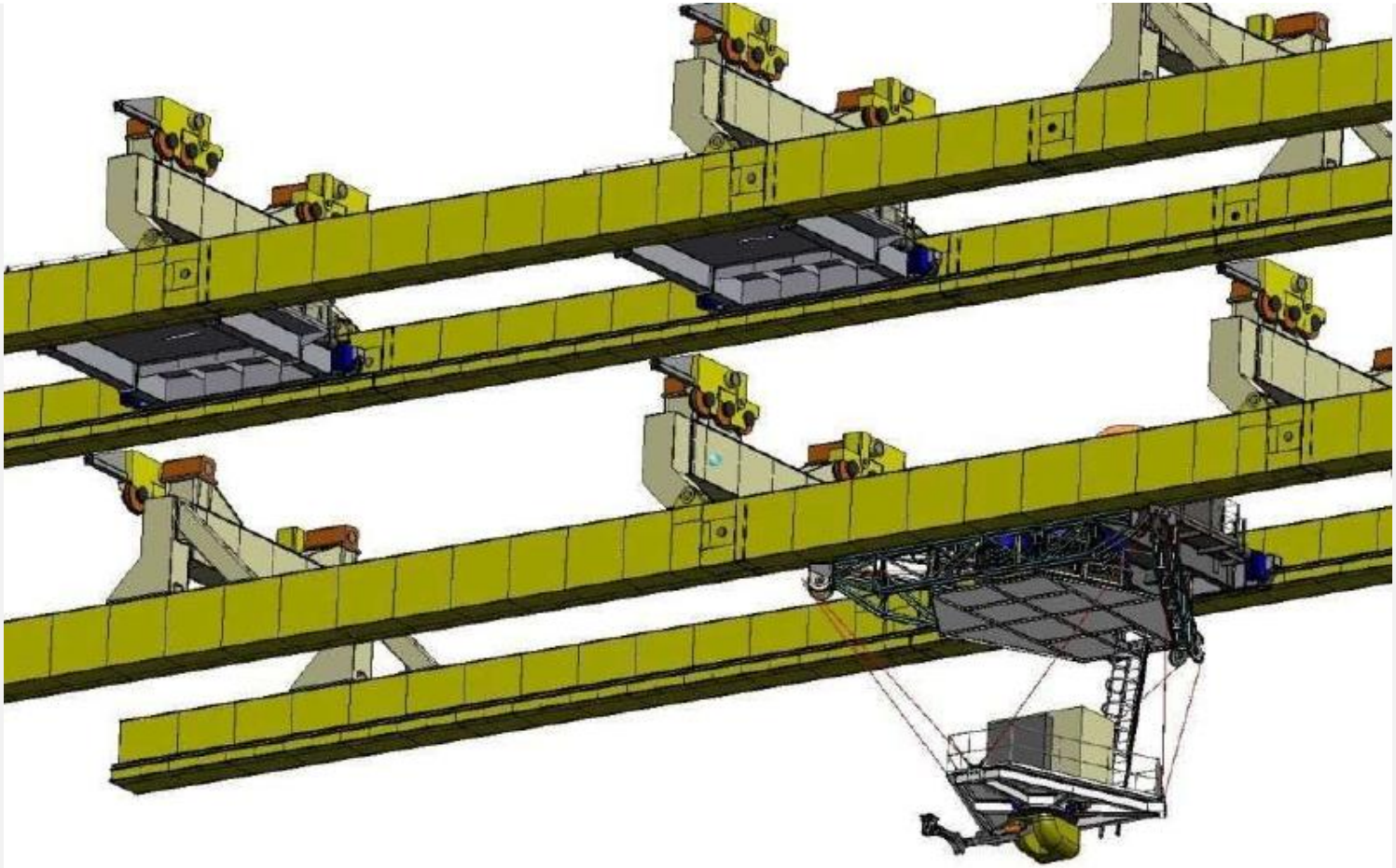

Main Crane System (MCS)

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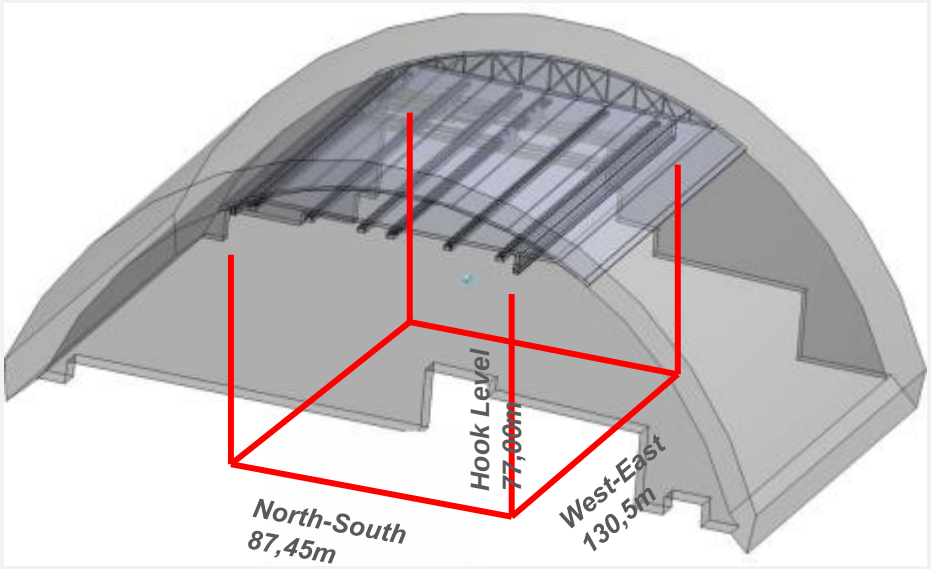

MCS is designed to ensure dismantlement/reinforcement of unstable structures of ChNPP Power Unit 4 and fuel containing materials and radioactive wastes management works

The main functional parameter of the NSC MCS is ensuring implementation of tasks connected with early and deferred dismantling of structures located within its operating range (catching area).

Main Crane System (MCS)

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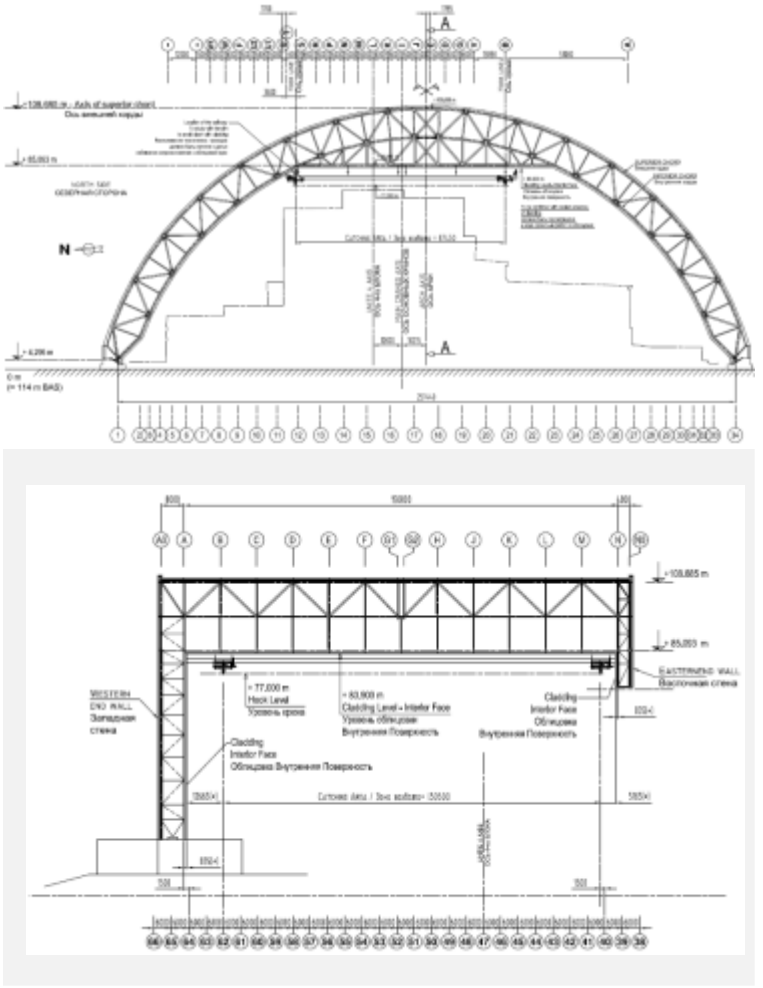
Main Cranes System catching area is between axes 40(+1.5 m) - 62 and rows “С (+2.4 m) – “Б” (not taking into account maintenance garages and the span of the MTP).

Hook lifting mechanism coverage area will be:

- For the classic carriage: from temporary lay-down area to +77,00 m.
- For the secure carriage: from temporary lay-down area to +75,20 m. The recovery drum will lift up to +10 meters and lower -15 meters in recovery from the working hook elevation.
- For operations, the Mobile Tool Platform lifts from elevation +35 m to elevation +70 m and operates from +35 m to +68 m.



Dimensions of the MCS vs. dimensions of Boeing 737

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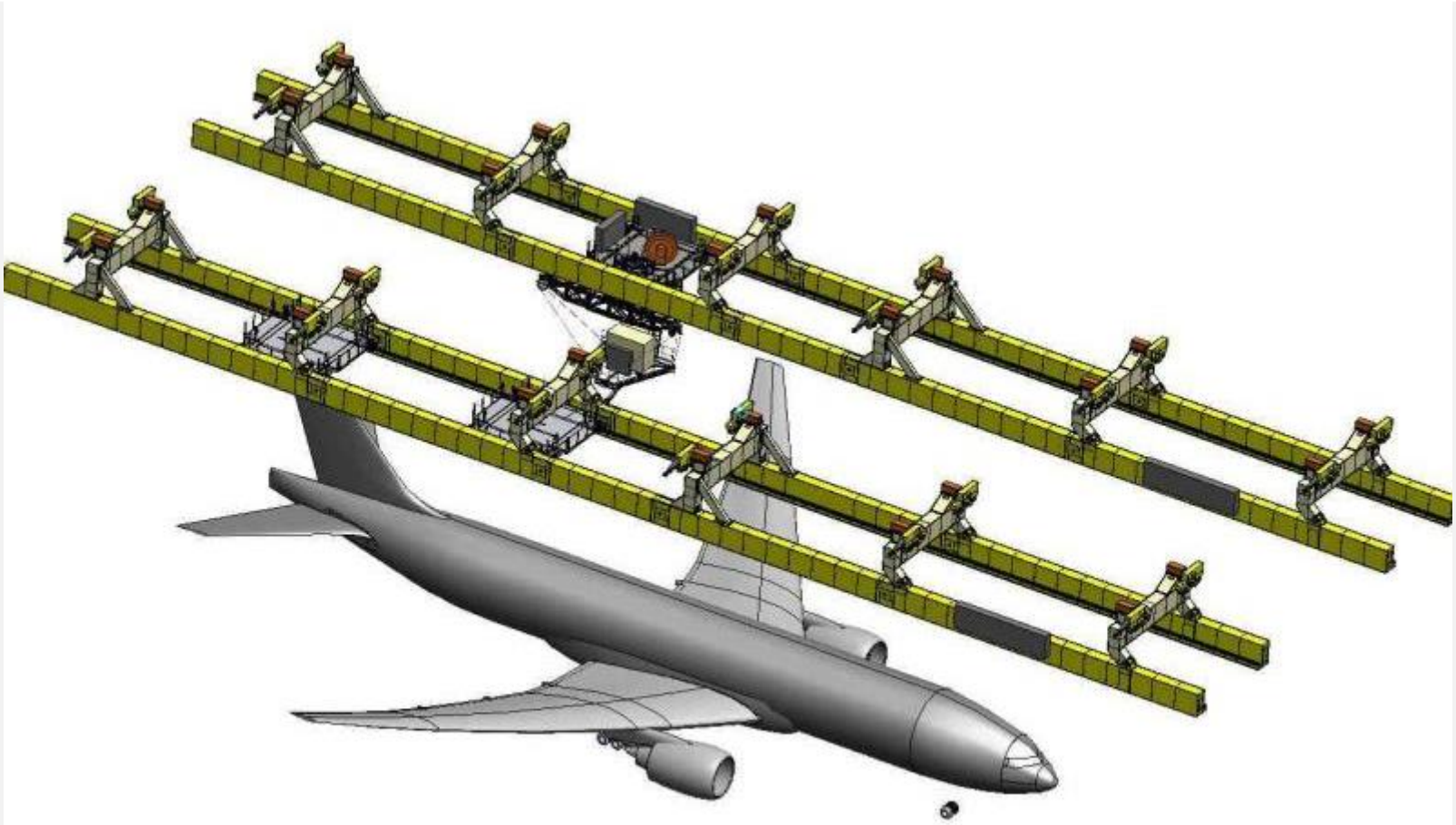

Main Crane System (MCS)

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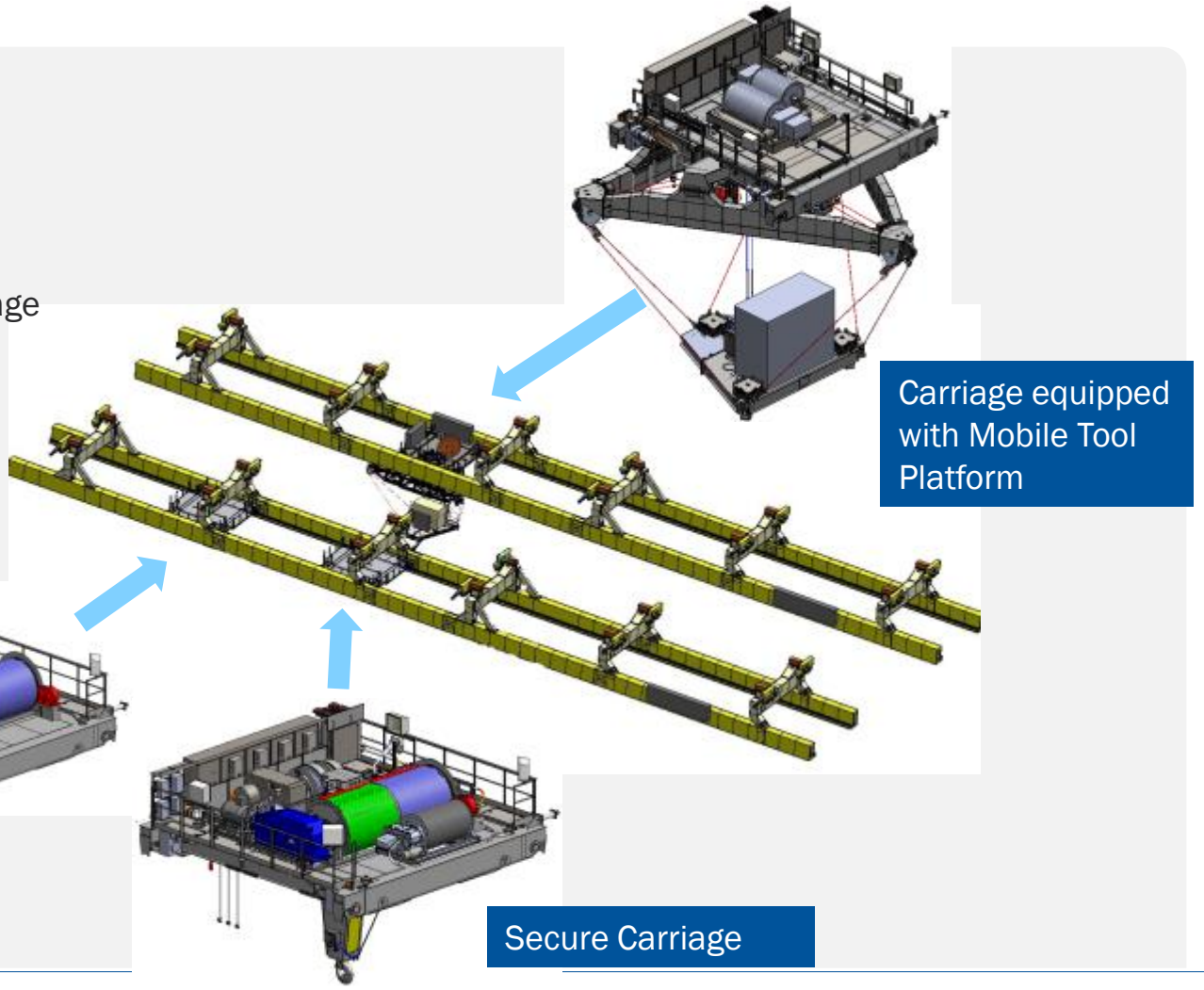
MCS configuration:

- 2 x 96 m bridges
- 1 x 50 ton classic carriage
- 1 x 50 ton secure carriage (for lifting of personnel the lifting capacity of the carriage will be limited to 40 t)
- 1 carriage equipped with Mobile Tool Platform (MTP)



Carriage equipped with Mobile Tool Platform

Classic Carriage

Secure Carriage

Classic Carriage

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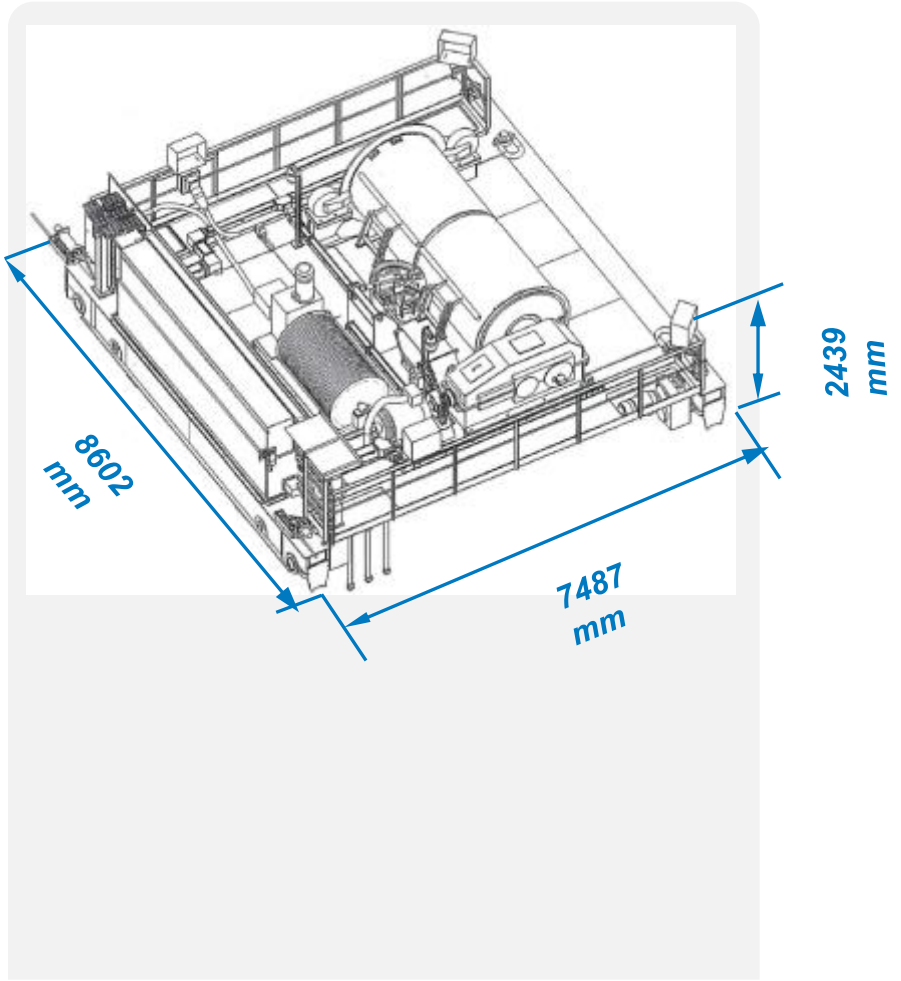
Specifiation:

- Capacity: 50 t
- Lifting speed: step speed adjustment from 1m/min up to 10 m/min,
- Loaded hook location relative to a defined position shall not exceed +/-50 mm.
- Hook lifting distance: from Lay Down Area level to elevation +77m
- Load weighing system with operator display (+/- 5% of full weighted value)
- Overload limiter that automatically shuts down the hoisting mechanism if the load mass exceeds passport lifting capacity of the crane by more than 15%. A possibility to disconnect the overload limiters during testing of the MCS shall be envisioned.
- Speed: step speed adjustment from 1 m/min up to 15 m/min,
- Carriage location relative to a defined position shall not exceed ±50 mm.



Secure Carriage

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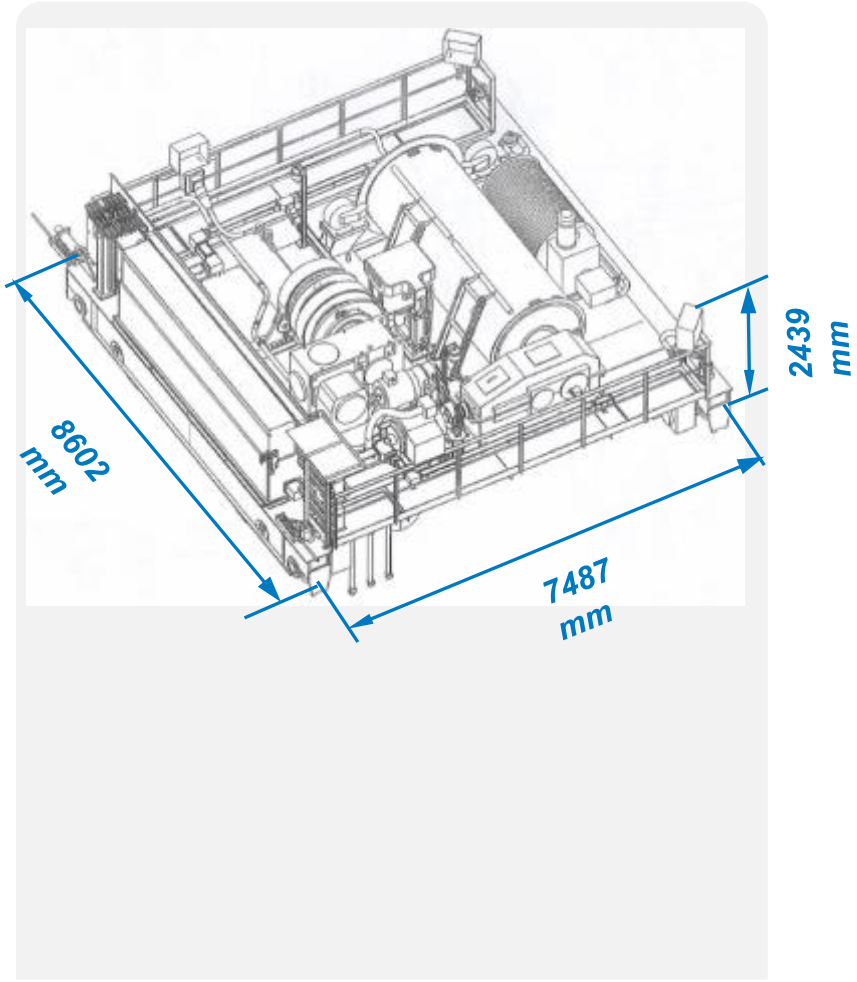
Specification:

- Carriage fitted with one main single layer cable-winding drum and one reserve multi-layer cable winding drum, each one with 50 T capacity
- For lifting of personnel the lifting capacity of the carriage shall be limited to 40 T
- The recovery drum will lift up to +10 meters and lower -15 meters in recovery from the working hook elevation
- Capacity: 50 T.
- Lifting speed: step speed adjustment from 1 m/min up to 10 m/min.
- Loaded hook location relative to a defined position shall not exceed +/- 50mm.
- Hook lifting distance: from Lay Down Area level to elevation +75,2m
- Load weighing system with operator display (+/- 5% of full weighted value)
- Overload limiter that automatically shuts down the hoisting mechanism if the load mass exceeds passport lifting capacity of the crane by more than 15%. A possibility to disconnect the overload limiters during testing of the MCS shall be envisioned.
- Speed: step speed adjustment from 1 m/min up to 15 m/min,
- Carriage location relative to a defined position shall not exceed ±50 mm.



Carriage equipped with Mobile Tool Platform

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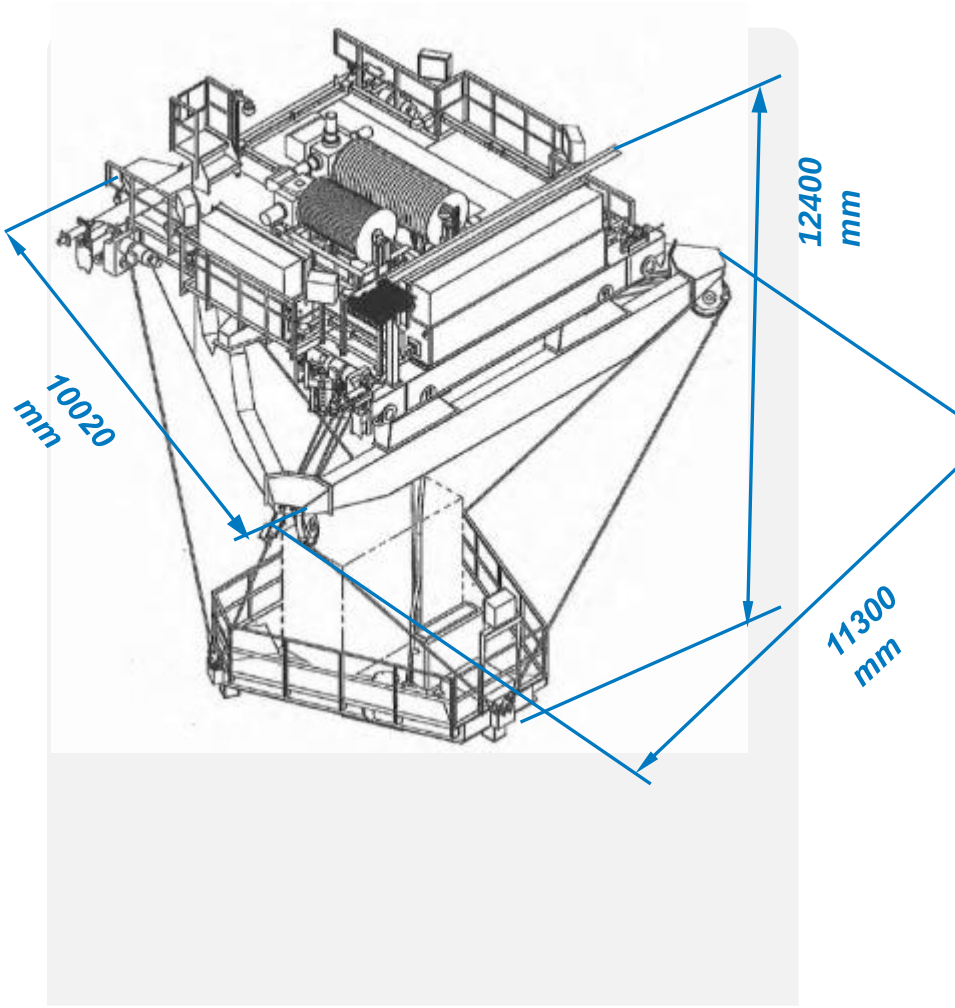
Specification:

- For operations Mobile Tool Platform lifts from elevation +35 m to elevation +70 m;
- The MTP tools operate within elevations from +35 m to +68 m;
- Concrete drill and jaw crusher fitted will be fitted on end of carrier arm 2.5m long
- Loads at the bottom platform at elevation 35m at the centre of the tensile truss connection triangle tooling dead weight between 10 000kg and 19 500kg shall be



Crane assembly

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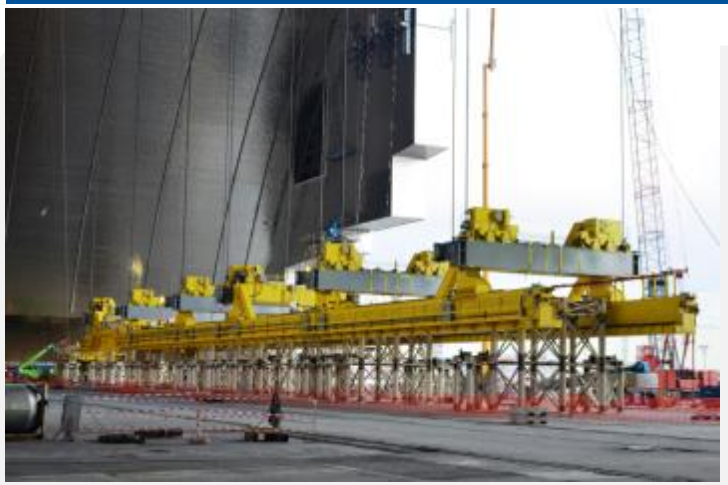
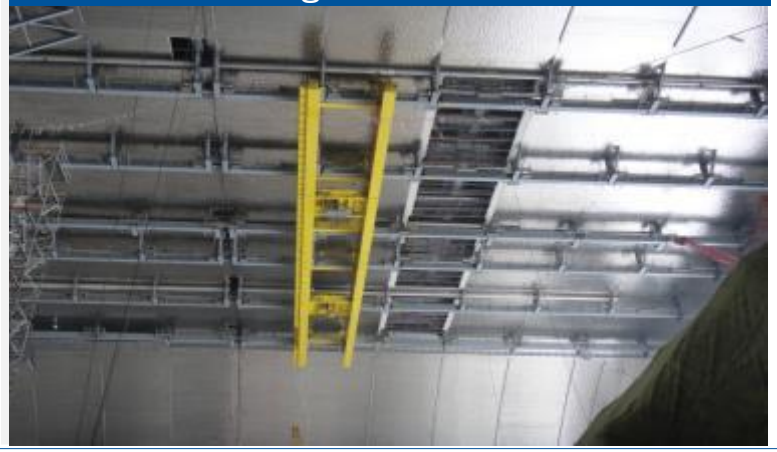
West Bridge lift



East Bridge assembly

Assembled West Bridge with Classic Carriage and Secure Carriage



MTP installation onto the East Bridge

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Arch sliding

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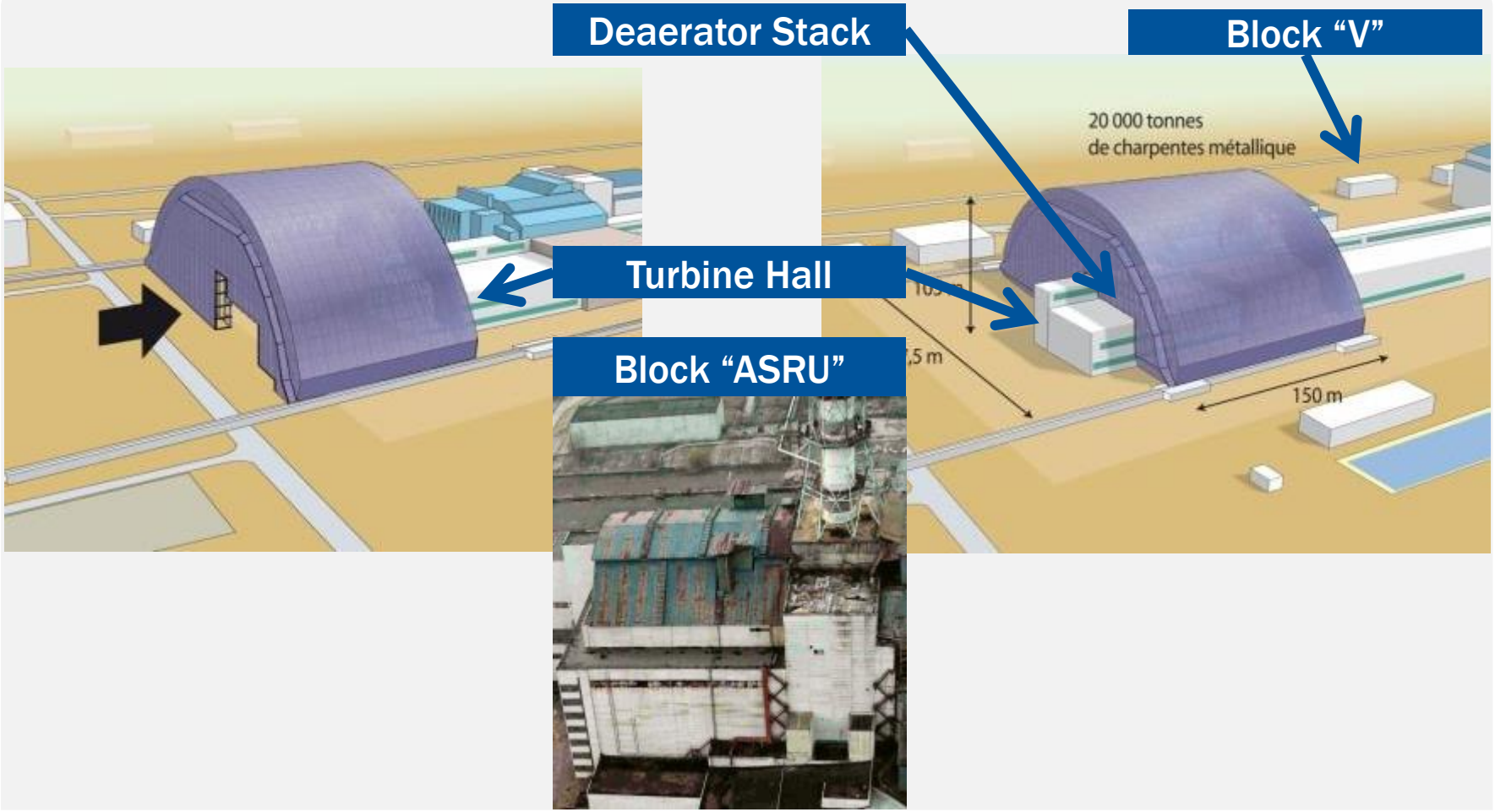

Sliding operation

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After completion of Arch assembly in the Erection Zone the Arch will be slid over the OS.

Arch sliding system includes the following components:

- Skid tracks;
- Jack boxes (shoes) including:
  - Hydraulic suspension jack (main jack) fitted with a lock-nut and a swivel;
  - Side shift;
  - Skidding surface;
- Connection bars;
- Power packs and their manifold boxes;
- Control computer;
- Laser control system.

General view of the components of sliding system

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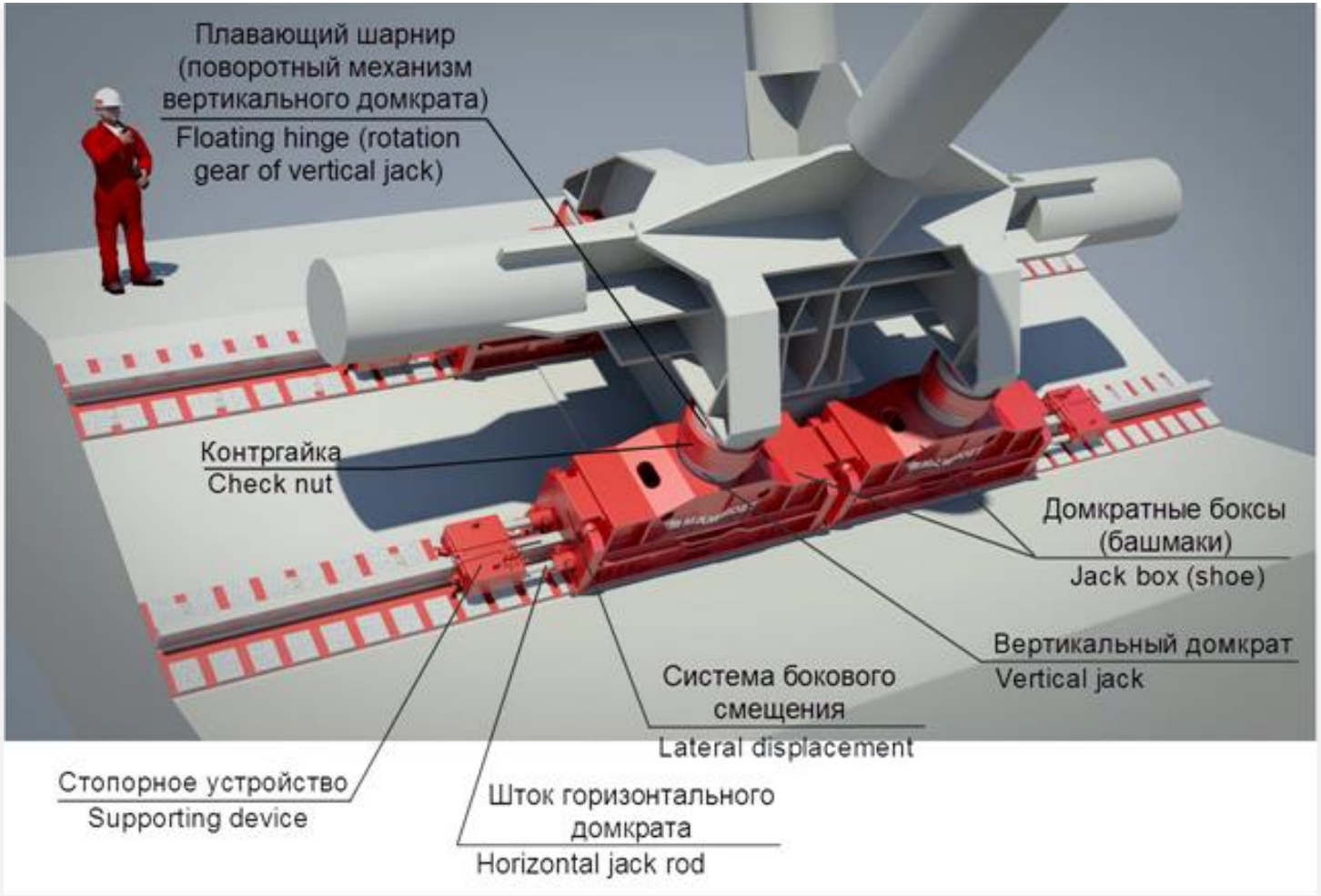

Push-pull units

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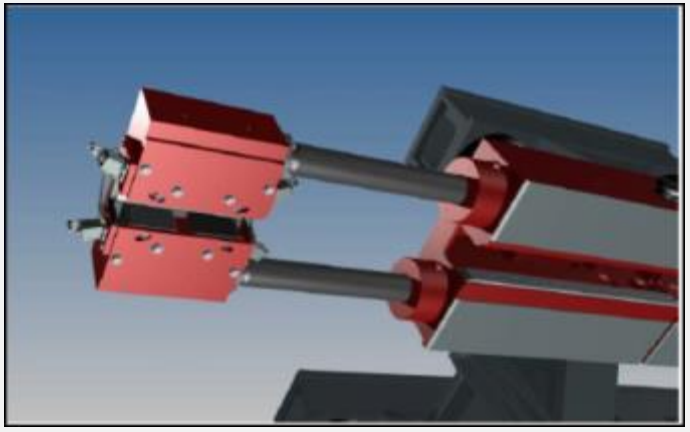

There are 4 push-pull units per arch supporting nodes for the arches A0, A, B, C, D, E, F, G1+G2, H, J, K, L, M and N+N0, i.e. a total of 14 x 4 x 2 = 112 push-pull units for the skidding of the whole arch.

Each push-pull unit consists of 2 hydraulic jacks with a stroke of 600mm and a gripper head (stop device), fixed on the retractable rod i.e. the total number of push-pull jacks of 224 units.

The combined capacity of the 2 hydraulic push-pull jacks is 125 T in pushing mode and 90 T in pulling mode.

Arch sliding procedure (1)

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Operation of Arch sliding system in each support node will be ensured by diesel driven power pack fastened by supports to one of the jack boxes (shoes).

The skidding process can be split into the following stages:

Step 1: Set-up in the Central Computer the maximum expected vertical loads relevant for the considered skidding phase;

Step 2: Check the weather forecast;

Step 3: Load transfer from temporary bearings to Arch sliding system:

Step 3a: Activate the suspension jacks to the load in increment (50% - 75% - 100%);

Step 3b: Visually check if all arch feet are free;

Step 3c: Jack-up the arch at +10mm;

Step 4: Jack-up to skidding level (see Figure 6.20):

Step 4a: Measurement of arch feet levelness with Laser Measurement System;

Step 4b: Correct the stroke of the suspension jack with measured unlevelness of the arch feet;

Step 4c: Set ‘Zero Level’;

Step 4d: Jack-up all arch feet to ‘Skidding Level’, by increasing the stroke of all suspension jacks by 50mm;

Arch sliding procedure (2)

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Step 6: Continuation of skidding:

Step 6a: Repeat step 5a;

Step 6b: Repeat step 5b;

Step 7: Arrival at final position:

Step 7a: Lock the push-pull units;

Step 7b: Lower the suspension jacks to zero level;

Step 7c: Measure deviation between actual and final position;

Step 7d: Correct the deviation using the push-pull units;

Step 7e: Transfer the load to the permanent/temporary bearings.

The speed of 10 m/h (or 11.2m/h without contingencies) is an average speed during the skidding process. As highlighted above, the skidding process is made of a succession of stages when travelling occurs and stages without travelling of the arch.

Arch sliding procedure (3)

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Based on the targeted speed of 10m/h, the duration of the skidding phases is as follows:

- Skidding of the complete arch to final position: 33 hours of uninterrupted operations (skidding distance = 330.0m).
- Skidding can be performed within the selected 72 hours meteorological window and thus with sufficient margin for additional contingencies.