**Appendix No. 3 – Preliminary Technical Requirements for the AFP System**

1. **Preliminary requirements for Automated Fibre Placement (AFP) system:**

The general description of the System:

* The subject of the order is a system for automated composite tape laying on a mould. The system is designed for laying pre-impregnated, thermoset, thermoplastic glass and carbon fibre unsaturated tapes.

The system design, the system should be composed of:

* A composite tape laying head,
* A mechanical device that moves the head in space, e.g. a robot's arm,
* A tape roller feeding and holding system,
* A laser heating system that allows production of parts with continuous fibre reinforced thermoplastic tapes,
* Software that allows for layering composite material according to definition of layers,
* A system control panel.

Head:

* It should be able to lay tapes of standard width: 0.25in,
* It should be able to lay carbon and glass fibre-reinforced tapes,
* It should be able to lay thermoset, thermoplastic and unsaturated reinforced tapes,
* It should be able to place tapes in the distance between separate tapes not larger than 2 mm,
* It should be able to place tapes on cylinder-shaped concave moulds with local radius/curvature of 310 mm,
* It should be able to place layers on a sandwich structure at the angle of ramps of 200-300 and the separator's thickness in the range from 12 mm to 75 mm,
* It should be able to cut tapes as set by the composite tape laying programme,
* In case of laying several tapes in parallel, the head must cut each tape separately,
* It should be able to program/control the head/roller clamp onto a mould, laying tapes on Nomex sandwich structures without any damage to the spacial structure of this material,
* It should lay tapes of 100 mm long.

Head moving device:

* It should be able to build composite parts of size 1.5m x 2m,
* It should have a collision avoidance system embedded, which stops the machine movement when applied load is reached.

Tape-feeding system:

* It should be able to feed a number of tapes and widths of tapes adjusted for the head work,
* It should be able to stop the machine work when a tape tears off, has finished or in case of tape jam.
* It should be able to cool material down to 150 C,
* It should have a manual function for feeding a new tape to the head

Software that programs laying composite material according to definition of layers:

* It should be able to operate independently as a "standalone” software installed on one selected PC,
* It should be able to program the automated layer placement system according to a set definition of a composite, mould geometry and set process parameters,
* It should be able to import a composite definition from the Catia CPD and Fibersim software,
* It should be able to export definition of layers to a laser projection system,
* It should be able to simulate accuracy of tape laying,
* It should be able to simulate a tape laying path,
* It should be able to optimise tape laying,
* It should simulate kinematics of a head with the head moving device for verification of movement accuracy, collision and process time.

System control panel:

* The system should include a stationary control panel based on PC and a mobile control panel,
* The stationary control panel should provide full system control and operation,
* The mobile control panel should perform checks and modifications of standard functions and settings of the tape laying system,
* The stationary control panel should have a built-in monitor where current parameters of the system work are displayed,
* The stationary control panel should have an interface, e.g. a keyboard and mouse that are used for programming the system and modifying work parameters,
* Both panels should be equipped with a button marked in red that immediately stops and shuts off the system,
* The stationary control panel should be connectible to the computer network and should exchange data through the computer network,
* The stationary control panel should allow for performing online remote diagnostics by the machine's supplier.

**2. The system expandability**

The system should be modular and have ability to be expanded with:

* The system of horizontal travel that can build parts of 8 metres in length,
* Mould /(mandrel) rotation system with a horizontal axis that allows production of axially symmetrical parts,
* Mould /(mandrel) rotation system with a vertical axis that allows production of axially symmetrical parts,

**3.Additional requirements**

* The system should hold certificate of conformity CE,
* The system should be supplied, installed and started by a supplier,
* The system sold within the order should be complete, operative and allowing production of sample composite parts after it has been installed,
* The system's manufacturer will train personnel in the scope of software and system operation after it has been started,
* The system's price should include all costs, i.e. the cost of all sub-assemblies, software, installations and personnel training,
* As part of an order, a supplier should supply operational material stocks for the term of the warranty,