Cryogenics: update on technical and procurement status

Alain Teissier
Cryoplant & Fuel Cycle Project Team Manager
Fusion For Energy

ITER Business Forum 2015, Cryogenics and Cooling Systems Workshop
27th March 2015
Duties:

- Cool down and warm up magnets, cryopumps and thermal shields in about one month.
- Maintain magnets and cryopumps at nominal temperatures over a wide range of operating modes.
- Accommodate periodic regeneration of cryopumps.
- Accommodate resistive transitions and fast discharges of the magnets.
Procurement sharing:
- LHe Plant: IO.
- LN2 Plant and Auxiliary Systems: F4E.
- Cryolines and Warm lines & Cryodistribution: IN-DA.
The LN2 Plant and Auxiliary Systems is made up of cold boxes, compressor stations, storage tanks, valve boxes and skids as per the following sub-systems:

- **LN2 plant:**
  - Two nitrogen refrigerators;
  - Nitrogen liquid and gas storage;
  - Nitrogen generator.

- **Two 80 K helium loops.**

- **Helium storage tanks:**
  - Gaseous helium tanks;
  - Liquid helium tanks;
  - Quench tanks.

- **Helium purification system:**
  - Helium heaters;
  - Gasbags;
  - Recovery compressor;
  - Impure gaseous helium storage;
  - Helium purifier.

- **Helium dryers.**

- **Heaters.**
Contracts for LN2 Plant and Auxiliary Systems procurement

• A contract was awarded to Air Liquide Global E&C Solutions France S.A. for:
  o Preliminary and final design, manufacturing, transport, supervision of installation, and testing of the LN2 Plant and Auxiliary Systems;
  o And a number of options, the main one for on-site installation.

• A second contract was placed with GTD Sistemas, Spain:
  o To cover the integration of the industrial control system delivered by Air Liquide into the ITER control framework.

• Further contracts may be placed for various on-site services during the installation, testing and commissioning phase.
Main procurement contracts for ITER Cryogenic System

<table>
<thead>
<tr>
<th>Procurement contract</th>
<th>Responsible for procurement</th>
<th>Contractor</th>
</tr>
</thead>
<tbody>
<tr>
<td>LN2 Plant and Auxiliary Systems</td>
<td>F4E</td>
<td>Air Liquide</td>
</tr>
<tr>
<td>LHe Plant</td>
<td>IO</td>
<td>Air Liquide</td>
</tr>
<tr>
<td>Cryolines group Y (“2 &amp; 3 process pipe” cryolines)</td>
<td>IN-DA</td>
<td>Inox India Limited</td>
</tr>
<tr>
<td>Warm Lines</td>
<td>IN-DA</td>
<td>Inox India Limited</td>
</tr>
<tr>
<td>Cryolines group X (“complex” cryolines)</td>
<td>IN-DA</td>
<td><em>Call for tender in progress (bids received)</em></td>
</tr>
<tr>
<td>Cryodistribution</td>
<td>IN-DA</td>
<td>Linde Kryotechnik</td>
</tr>
</tbody>
</table>

- As shown here above, all the main contracts have been placed, except one for which evaluation of the received bids is under way. Consequently, most business opportunities are now at subcontracting level in the frame of the signed tier-one contracts.
Contract execution: progress

• Contract execution is proceeding at a good pace, as demonstrated by some milestones achieved or planned for the cryoplant:
  
  o Final Design Review of the LHe plant and Preliminary Design Review of the LN2 Plant and Auxiliary Systems took place in 2014;
  
  o Manufacturing of the LHe Plant started in 2014;
  
  o The first Manufacturing Readiness Review of the LN2 Plant and Auxiliary systems was held in February 2015;
  
  o Final Design Review of the LN2 Plant and Auxiliary Systems is scheduled Mid-2015;
  
  o On-site installation will start in 2016.
Contract execution: organization

- A close coordination between IO, IN-DA and F4E is required to ensure a smooth progress of all those contracts which are closely interfaced, especially at the time of preparing on-site installation.

- So IO, IN-DA and F4E will work as a Cryogenics Integrated Project Team which will be in charge of managing all activities for the whole Cryogenics System jointly.
MITICA cryoplant

- MITICA experiment is part of PRIMA, a facility which will be installed in Padova by the RFX consortium.

- Aim: test a full scale ITER neutral beam injection system.

- A cryogenic plant is required to supply either supercritical or gaseous helium to the cryopump located in the injector.

- A call for tender in two phases has been launched by F4E: The competitive dialogue phase has just started.
Thank you for your attention

Follow us on:

www.f4e.europa.eu
www.twitter.com/fusionforenergy
www.youtube.com/fusionforenergy