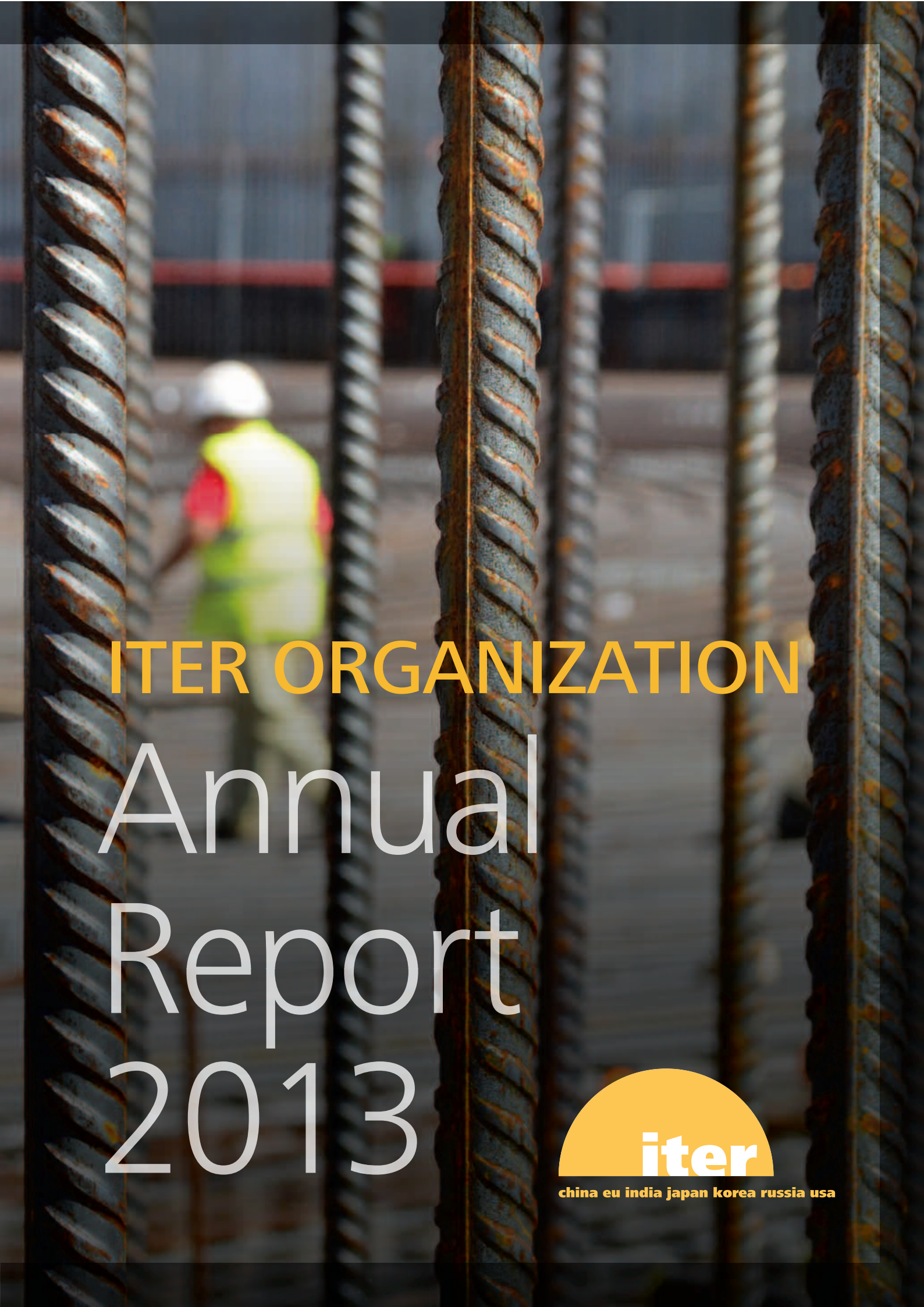
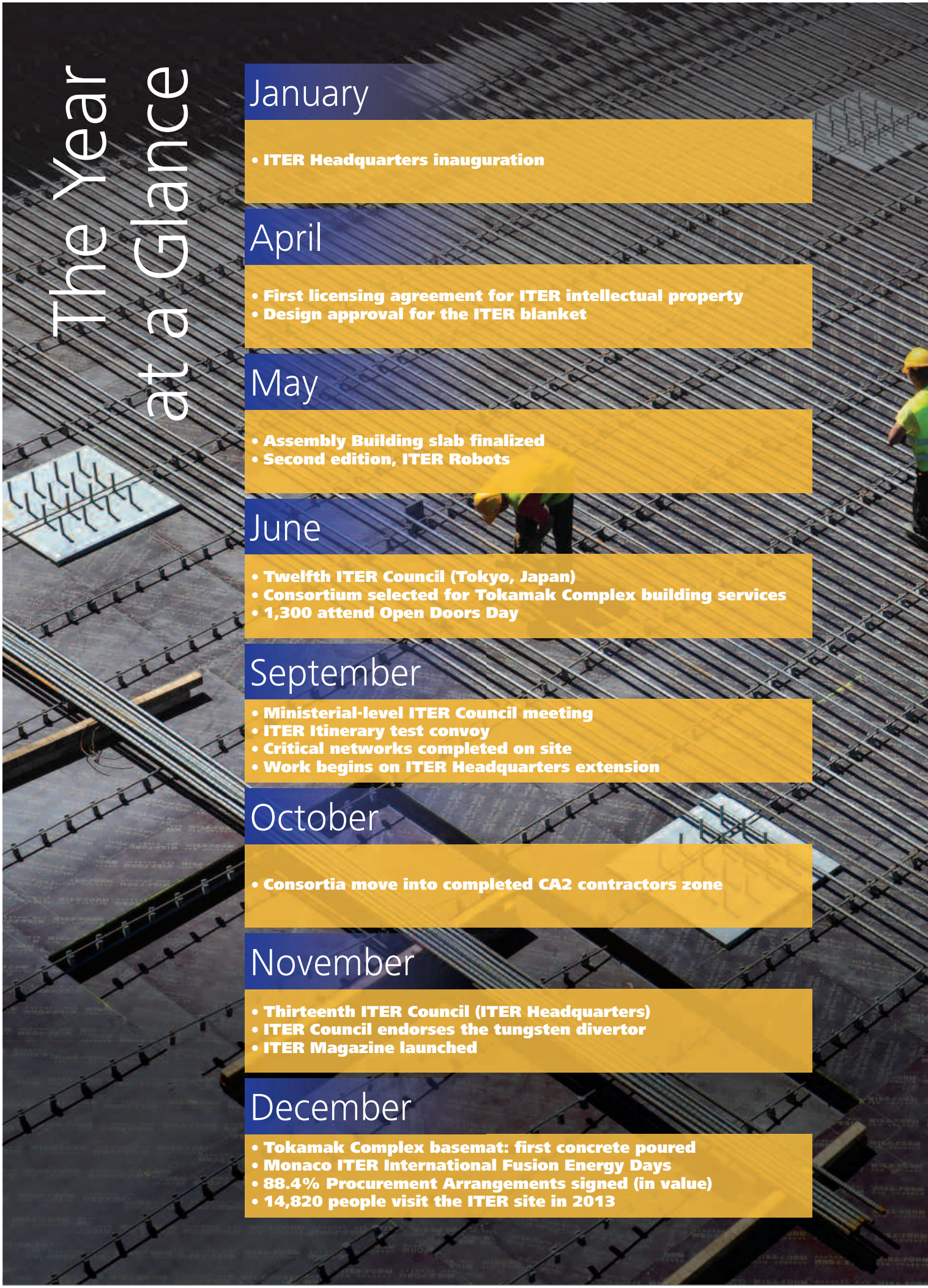


ITER ORGANIZATION

Annual Report 2013

iter

china eu india japan korea russia usa



The Year at a Glance

January

- **ITER Headquarters inauguration**

April

- **First licensing agreement for ITER intellectual property**
- **Design approval for the ITER blanket**

May

- **Assembly Building slab finalized**
- **Second edition, ITER Robots**

June

- **Twelfth ITER Council (Tokyo, Japan)**
- **Consortium selected for Tokamak Complex building services**
- **1,300 attend Open Doors Day**

September

- **Ministerial-level ITER Council meeting**
- **ITER Itinerary test convoy**
- **Critical networks completed on site**
- **Work begins on ITER Headquarters extension**

October

- **Consortia move into completed CA2 contractors zone**

November

- **Thirteenth ITER Council (ITER Headquarters)**
- **ITER Council endorses the tungsten divertor**
- **ITER Magazine launched**

December

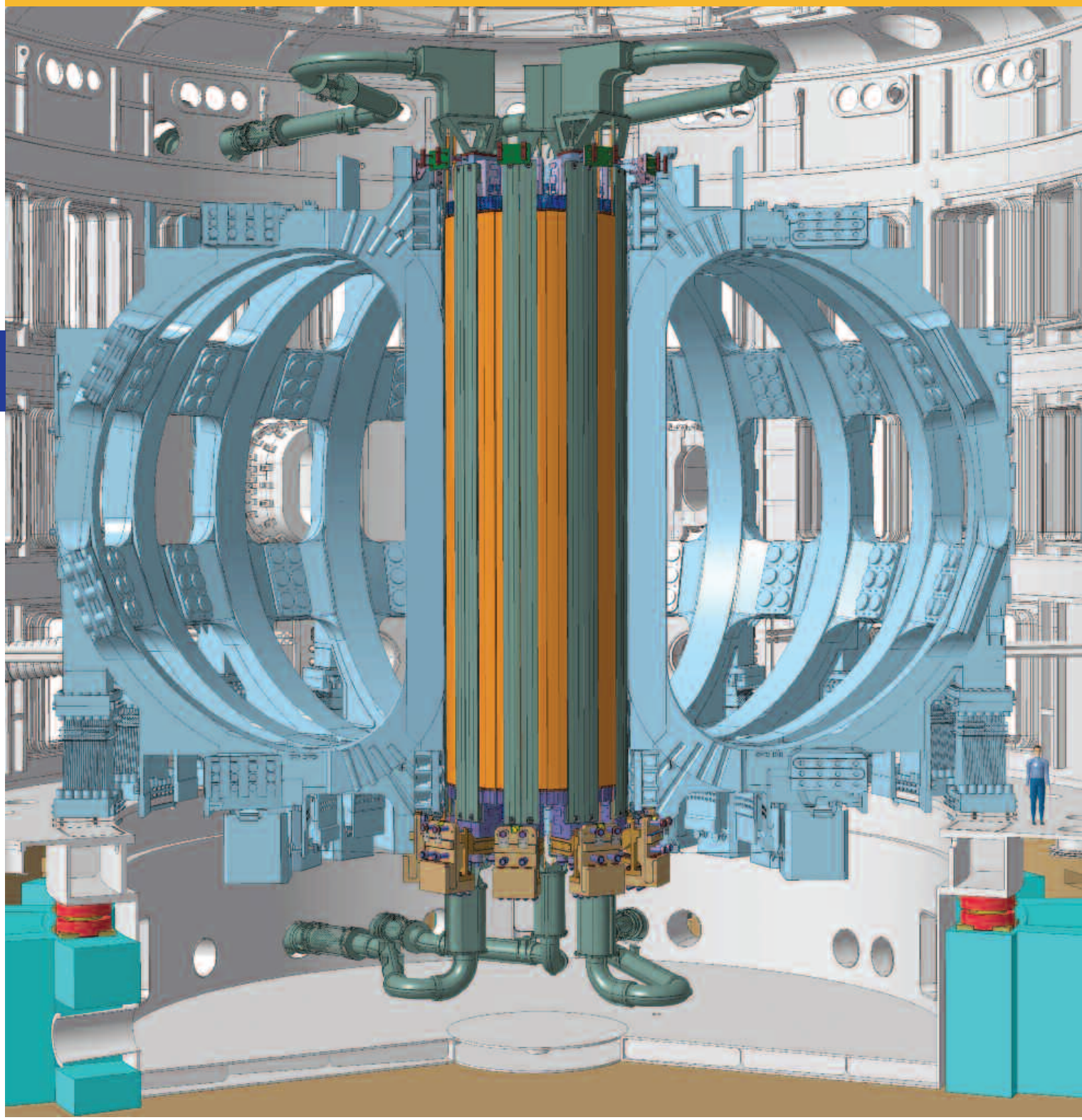
- **Tokamak Complex basemat: first concrete poured**
- **Monaco ITER International Fusion Energy Days**
- **88.4% Procurement Arrangements signed (in value)**
- **14,820 people visit the ITER site in 2013**

Contents

Very real progress was made in 2013 on the buildings, systems and components that will make up the ITER scientific installation. In Saint Paul-lez-Durance, France and in the 35 countries that are participating in the project, all efforts are converging toward one point… ITER assembly.

2013

ITER's most powerful magnet systems: the central solenoid (in orange) drives the current in the plasma, while the toroidal field coils (in blue) produce a magnetic field that will confine the plasma in the centre of the vessel.



Foreword from the Chair of the ITER Council

In November 2006, ministers representing the governments of China, the European Union, India, Japan, the Republic of Korea, the Russian Federation and the United States met in Paris to sign the international treaty that established the ITER Organization as the legal entity responsible for the construction, operation and decommissioning of the project.

Nearly seven years later, in September 2013, ministerial-representatives from the ITER Members met again, this time in Saint Paul-lez-Durance to reaffirm their common commitment to the realization of ITER as an indispensable step on the path to fusion energy.

ITER has reached a crucial moment of its development.

Behind us are years of planning, designing and decision-making as an international organization was created from the ground up, systems and components were brought to the necessary level of maturity for procurement to begin, and construction work began on the 180-hectare ITER site in the south of France.

Ahead, contractors will finalize the buildings of the ITER installation, components and systems will arrive en masse to the site for assembly and integration, and commissioning and testing of the plant and systems will get underway for First Plasma.

Two major technical decisions were taken during the year by the ITER Council that will positively affect Tokamak performance: the adoption of a full-tungsten divertor from the start of ITER operation and the inclusion of magnetic coils inside of the vacuum vessel for plasma control and vertical stability. I salute the valuable R&D carried out in fusion institutes the world over that contributed to the technical basis that made this decision possible. The decision on the tungsten divertor will have very positive cost benefits for the project.

The overriding challenge from now until the end of the Construction Phase will be to keep control over the cost and schedule of the ITER Project. These issues are closely linked, as every day of delay strains the project's budget. During the meetings of my two-year term as ITER Council Chair, the Council reiterated the importance of world-class management of the integrated schedule and risks – only through strong and effective project control and risk management will the ITER Organization establish confidence in the project's capacity to forecast in a credible manner and implement work according to plan.

In reaffirming their commitment to ITER, the ministerial-level representatives of the ITER Members reaffirmed their faith that, by working closely together, the ITER Organization and the ITER Domestic Agencies will solve issues one by one in order to reach the goal we all share – operating the ITER device and exploring new boundaries in plasma physics and fusion energy.

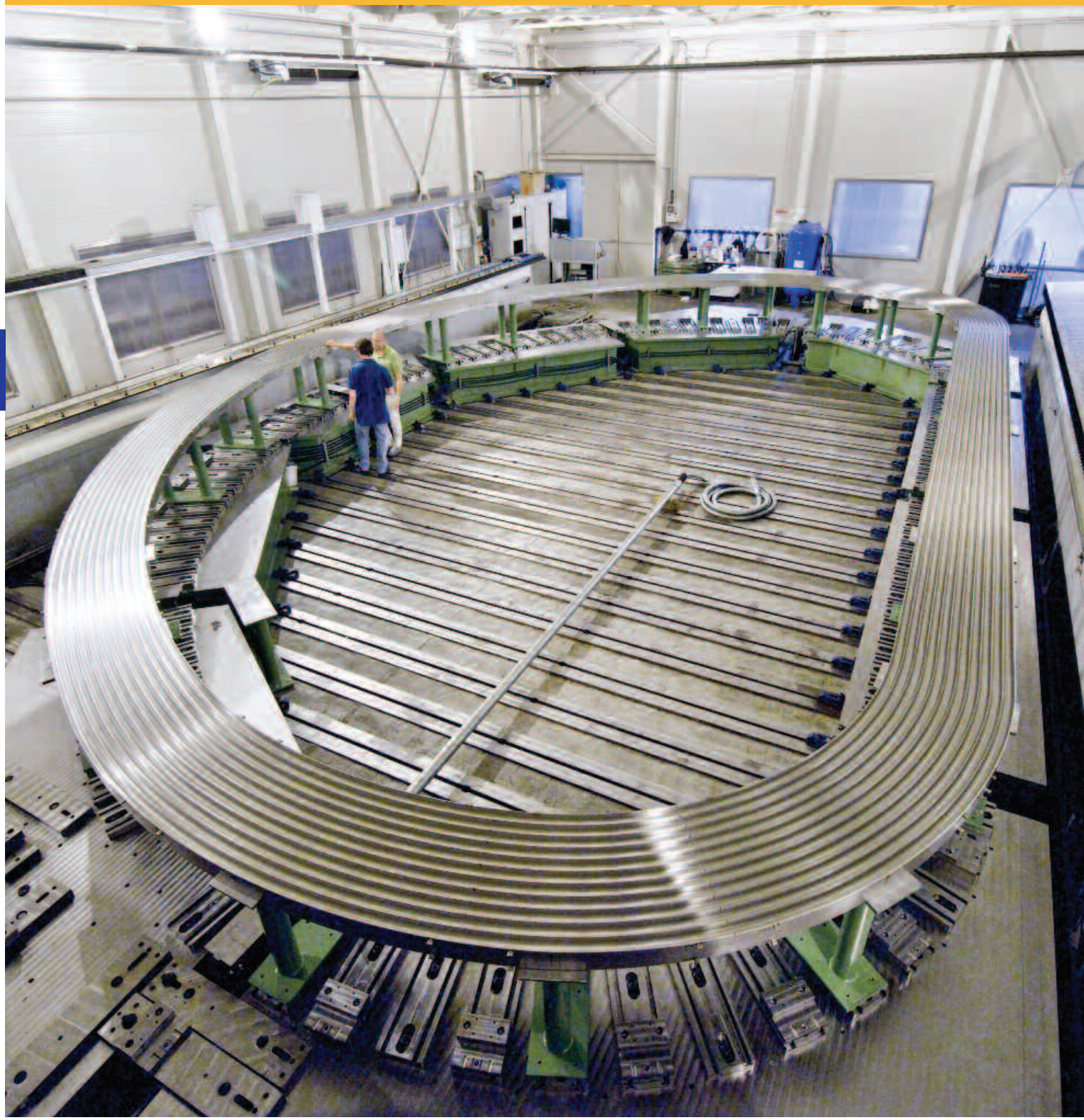
I wish the ITER Project every success.

Dr Hideyuki Takatsu
Chair of the ITER Council

ITER has reached a crucial moment of its development

2013

Seven radial plates inside each toroidal field coil will hold the superconductor in place. Below, a prototype radial plate at SIMIC in Italy. ***Photo: F4E/SIMIC***



Foreword from the Director-General

Very real progress was made in 2013 on the buildings, systems and components that will make up the ITER scientific installation. In Saint Paul-lez-Durance, France and in the 35 countries that are participating in the project, all efforts are converging toward one point: ITER assembly. Starting in 2014, completed components will begin arriving from factories around the world for installation into the machine or the plant.

Thirteen metres below the regular surface of the platform, work to complete the last part of the installation's seismic protection system – the concrete basemat slab of the Tokamak Complex – is underway. Buildings will rise steadily now; in the months to come construction is slated to begin on sixteen different structures, including the 60-metre-tall Assembly Building that will be equipped with heavy-lift cranes for assembly operations.

Over 88 percent of the work packages that make up the ITER scope have now been signed over to the Domestic Agencies and series manufacturing has begun in Member factories for major components and systems. For one of the project's longest procurement items (the toroidal field magnets) we are now nearing the end of a five-year industrial ramp-up to produce niobium-tin superconducting strand in quantities that had never before been attained. By the end of 2013, a total of 460 tons of niobium-tin strand had been manufactured by eight qualified suppliers to exacting ITER specifications.

As you will read in the pages that follow, the ITER Organization celebrated many firsts in 2013: the first licensing agreement for ITER intellectual property; the first test of the 104-kilometre ITER Itinerary that will bring the largest components from the Mediterranean Sea; the first shipment of dummy conductor for winding line qualification activities… Twice also, our brand-new ITER Headquarters was the theatre for significant events – the Headquarters building inauguration in January in the presence of dignitaries from the European Union and France, and the Ministerial-level ITER Council meeting held in September to publically reaffirm the importance of fusion and the role of ITER. Each time, it was the occasion to remind ourselves of the distance travelled since project implementation began.

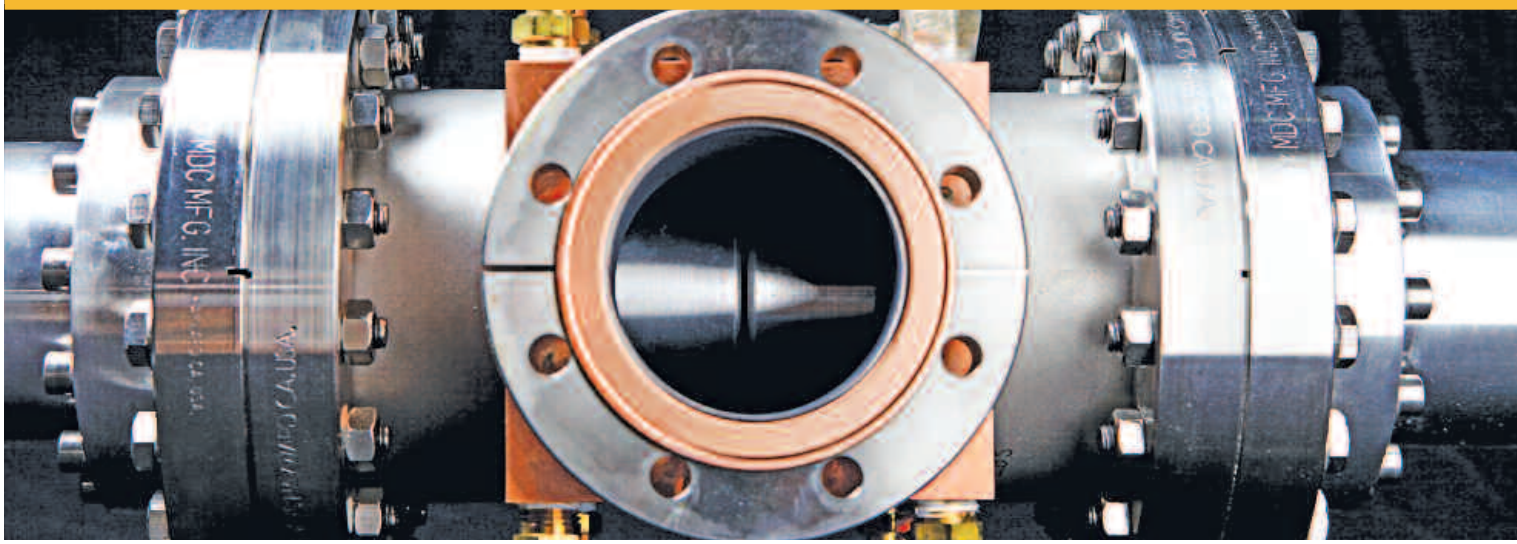
Against the backdrop of progress both here and abroad the most challenging issue we faced in 2013 was the project schedule. In close collaboration with the ITER Domestic Agencies, we are doing our utmost to collectively stop schedule slippage and to identify recovery actions. We have isolated the root causes for slippage – primarily delays in the resolution of interface issues, in the completion of designs and design reviews, as well as over-lengthy procedures for Procurement Arrangements and document approval – and we are undertaking remedial actions for each one. Sophisticated tools now permit the monthly tracking of schedule milestones and allow us to identify the areas that require proactive recovery measures.

In the constructive atmosphere of cooperation and dialogue that has come to define the ITER Project, with the ITER Organization and Domestic Agencies working as one team, we will strive to accelerate the pace of work and maintain the confidence of our stakeholders.

Late on 19 September 2013, from the cabin of a 352-wheel transporter that was slowly negotiating the last leg of its four-night journey to the ITER site, I could see the crowds of people that had come out to witness the first ITER test convoy. For some, it was their first contact with the exceptional nature of ITER. They had come out, many with children in tow, to celebrate human ingenuity and resourcefulness and the capacity of men and woman to join together to solve some of the most difficult problems our civilization faces.

With them and with you, I look forward to another year of progress in the realization of ITER.

Professor Osamu Motojima
Saint Paul-lez-Durance, June 2014


MDC MFG. INC.

Executive Summary

2013

Top left Applause at the groundbreaking ceremony for the Cryostat Workshop. Bottom left A waveguide pump-out tee intersection is one of many prototypes under development for the electron cyclotron transmission lines. *Photo: US ITER* Top On 6 September 2013 ministerial-level representatives from the seven ITER Members gather at ITER Headquarters to reaffirm the importance of ITER.

The year dawned for the ITER Organization with the inaugural celebration of its new Headquarters building in the presence of invited guests Günther H. Oettinger, European Commissioner for Energy, and Geneviève Fioraso, French Minister of Higher Education and Research.

For participants gathered in the fifth-floor Council Chamber, with its sweeping view of the construction site, it was the occasion to measure progress accomplished and to reaffirm support for the project as it enters a phase of unprecedented technical complexity and challenge.

During 2013 the first licensing agreement was concluded for ITER intellectual property; pouring started on the Tokamak Complex basemat; and detailed planning began for the installation, assembly, testing and commissioning activities for the ITER plant. Twenty-six signatures were concluded with the Domestic Agencies – the most ever recorded in one year – bringing the total committed in-kind value to 88.4 percent. And in an important technical decision that will result in cost savings for the project, the ITER Council endorsed the ITER Organization proposal to begin operations with a tungsten divertor.

The biggest challenge facing the ITER Project remains performance against the schedule. The first priority is to stem slippage; the second, to implement recovery actions. At the second Ministerial-level ITER Council meeting in ITER history, on 6 September 2013, representatives of the seven ITER Members recognized the challenges inherent to the first-of-a-kind nature of ITER, notably as regards schedule and cost containment, and reiterated their common effort towards the project's successful completion.

Organization

Preparing to manage construction and assembly

Organizational resources were reallocated in 2013 to reflect the drive toward building construction and assembly activities. Design and integration units were reinforced and a new directorate – Project Control & Assembly – was established to assure the coordinated direction of project controls and construction management. Two Chief Engineers now directly support the Department of ITER Project, which oversees all of ITER's technical directorates.

In the middle of the completed seismic foundations, work begins early in the year on propping and formwork for the next-level basemat.

The ITER Council convened for its regular annual meetings in Tokyo, Japan on 19-20 June (IC-12) and in Saint Paul-lez-Durance, France on 20-21 November (IC-13); the Thirteenth Meeting was the last for Council Chair Hideyuki Takatsu after a two-year term. An ITER Council was also held at Ministerial level on 6 September 2013, convened by EU Commissioner for Energy Günther H. Oettinger.

The Management Advisory Committee (MAC) and the Science and Technology Advisory Committee (STAC) met twice each during the year in support of the ITER Council; in addition, MAC held a special session to focus on schedule recovery issues. Following an independent assessment of management mid-year (the third for the ITER Organization), a report was issued to the Thirteenth ITER Council. The ITER Organization action plan in

response to specific recommendations for the improvement of project performance will be the subject of an extraordinary ITER Council meeting early next year.

In 2013, the Unique ITER Team (UIT) was strengthened through the establishment of regular week-long, in-person meetings during which the ITER Organization and Domestic Agencies met multilaterally and bilaterally to deliberate the most challenging issues affecting project performance. Decisions were taken and recorded by the ITER High Level Coordination Team, the top UIT forum. Within the ITER Organization, the Project Board met bimonthly as the top decision-making body.

ITER Project Baseline

Creating an achievable Annual Work Plan

Strong action was taken in 2013 to address delays in the ITER Project schedule.

A new categorization of Strategic Management Plan (SMP) milestones implemented in January allowed resources to be shifted to the items with the most negative float against the schedule. Milestones for the most critical items (buildings, magnets, feeders, cryostat) were tracked monthly and preemptive action was taken against forecasted delay. To improve the Schedule Performance Index, which measures the milestone achievement rate, the ITER Organization and the Domestic Agencies collaborated to develop a credible and achievable 2014 Annual Work Plan. Success in respecting the 2014 Annual Work Plan will serve as a basis for future forecasting and scheduling efforts.

Industrial activities are progressing on two vacuum vessel sectors in Korea. Pictured: the upper segment of sector #6.

A project-wide exercise to isolate the causes of less-than-optimum performance resulted in a list of issues and barriers. A management group was created to formulate actions for the items with the highest potential and an Issues and Barriers Management Team was created in August to make further proposals for action on the most urgent issues.

In 2013, the ITER Organization proposed the centralization of procurement and installation activities where reduced cost and risk and improved schedule performance could result. Due to agreements negotiated with the Domestic Agencies, significant cost savings and efficiencies are expected in the following areas: diagnostic upper and equatorial port plug structures, where a common supplier will be chosen; piping equipment (60 km of pipes plus valves and pipe supports), for which procurement will be managed centrally; and cable tray design and cable routing. Savings are also planned through the optimized management of large contracts such as design support (CAD) and the ITER cryoplant.

Construction

The bulk of contracts have been signed

Fourteen metres below the level of the ITER platform, work has started on the Tokamak Complex basemat, the B2 slab. Following months of propping, formwork and reinforcement activities, the first segment of the basemat was poured in December.

The mounds of dirt and the deep trenches that were a steady feature of the worksite in 2012 disappeared, as work ended on the critical networks and precipitation drainage networks. Contractors Area 2 was equipped with an infirmary,

a canteen, roads and parking areas, and the first construction consortium moved in to set up its modular offices. The steel superstructure of the Cryostat Workshop and the concrete foundations for the Assembly Building were both completed in 2013.

Concrete pouring for the Tokamak Complex basemat begins early on 11 December.

The European Domestic Agency signed a second major contract for the Tokamak Complex and eight other facilities in 2013. Paired with the civil works contract signed in 2012 (EUR 300 million), the EUR 530 million contract for the mechanical and electrical works of the Tokamak Complex completes the work package scope for the heart of the ITER facility. The selection process was also launched during the year for other major work packages; with the exception of the Hot Cell and radwaste facilities, which are not required for First Plasma, contractors will have been chosen for all construction work packages by next year. In 2014, the walls of the Complex will begin to rise.

Despite contract signature milestones, slippage against the building construction schedule reached 23 months in 2013; this delay leads the criticality of the ITER Project schedule. Design integration work for the Tokamak Complex was given top priority – the ITER Organization and the European Domestic Agency worked together to complete integrated building designs, resolve interface issues, close out design change requests, improve the timely supply of integrated CAD designs, and finalize the layout of embedded plates and penetrations. A new Building Design Integration Cell met weekly on these issues, and the higher-level Building Integration Task Force initiated activities to arrest further slippage and start on recovery actions.

The technical characteristics of the ITER Itinerary were successfully tested in September, one year in advance of the first ITER loads. Over four nights, a 352-wheel trailer and 600 ton dummy load made their slow and careful way along the 104 kilometres that separate the ITER site from the Mediterranean Sea. During ITER assembly, approximately 250 convoys are expected to travel the ITER Itinerary.

Licensing

Distilling a project-wide safety culture

The ITER Organization, as the nuclear operator of the ITER facility since 10 November 2012, made a priority in 2013 of developing a project-wide nuclear safety culture, ensuring that safety regulations were understood and applied, and conducting in-factory manufacturing audits at the Domestic Agencies. It launched a process to strengthen the ITER safety files on the subject of environmental policy by beginning the process to obtain 14001 certification in France in compliance with the French INB (Installation Nucléaire de Base) Order issued on 12 February 2012.

The examination of ITER's complementary nuclear safety stress report concluded in 2013 with only one recommendation from the French nuclear authorities (ASN): to study extreme climatic conditions. ASN continued its campaign of inspections both on site and abroad, carrying out four construction inspections and one factory inspection. The ITER Organization received notification during the year that the exemption requested from French regulations on pressure equipment (ESPN) for the neutral beam injector, the blanket and the ion cyclotron resonance heater was granted.

Procurement Arrangements

A record year

The ITER Organization continued in 2013 to sign over the work packages for ITER realization to the Domestic Agencies. Twenty-six signature ceremonies were celebrated, including two ahead of schedule, for 14 Procurement Arrangements and

12 Complementary Diagnostic Procurement Arrangements. The ITER Organization has concluded a total of 98 Procurement Arrangements, representing 88.4 percent of the total allocated in-kind value of the project.

Large contracts were concluded for CAD and engineering support; the central interlock system; resistive cryogenic thermometers for the ITER magnets; and the extension of ITER Headquarters. A proposal to focus resources within the ITER Organization on the management of the biggest-value contracts and to outsource the smaller-value contracts through a procurement service centre was adopted during the year.

Russian-produced poloidal field cable is jacketed and compacted at Criotec (Italy) before being spooled to await testing and a return to Russia for the next stage of poloidal field coil fabrication.

Manufacturing

Fabrication activities accelerate

After five-years of ramping up, the worldwide procurement of niobium-tin (Nb_3Sn) strand for the toroidal field conductors is concluding. Total production reached 460 tons in 2013 and one producing Domestic Agency, Korea, finished its share. Due to the strong pace of cabling and jacketing activities, finished unit lengths corresponding to approximately 12 toroidal field coils have been stored for coil winding. The first double pancake prototype was successfully wound and heat treated on the European winding line and radial plate fabrication advanced in both Europe and Japan.

Suppliers also registered over 170 tons of niobium-titanium (NbTi) strand for the poloidal field conductors and 25 tons of Nb_3Sn strand for the central solenoid. The first batches of dummy conductor were shipped for both poloidal field and central solenoid winding line qualification activities. The fabrication of correction coil and feeder conductors started, raw material procurement began for high temperature superconductor current lead mockups, and qualification activities progressed for the magnet supports.

Fabrication of the ITER vacuum vessel continued in Korea in 2013, where manufacturing activities for two sectors are underway; in Europe manufacturing qualification activities for the vacuum vessel progressed. In-wall shielding fabrication advanced in India, and mockups were successfully manufactured in Russia for the upper ports and in Korea for the thermal shield.

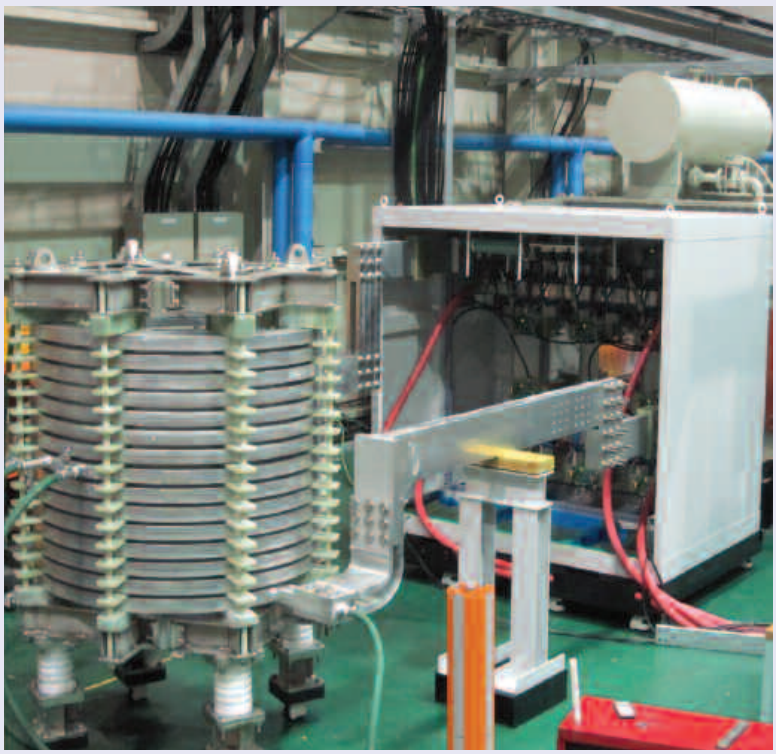
The manufacturing of full-scale prototypes for the ITER cryostat began in 2013 in India. For the Tokamak Cooling Water System drain tanks (some of the earliest installed components of the ITER plant), fabrication progressed steadily in the US. Important contracts were signed for the manufacturing of the torus pre-production cryo-pump, the contract for the blanket manifold prototype kicked off, and contracts for shield block prototypes will be launched in 2014. The European Domestic Agency also awarded the contract for the design, manufacture, installation and commissioning of the high voltage power supply systems for the European and Russian gyrotrons.

R&D

Validating concepts prior to manufacturing

Decisions were taken on two high-priority R&D issues in 2013 that will have a positive impact on machine performance: the ITER Council endorsed the adoption of a full-tungsten divertor for the initial ITER Operation Phase following a two-year qualification program; it also approved the inclusion of in-vessel coils into the Baseline for Edge Localized Mode (ELM) control and plasma vertical stability.

Work to develop a reliable disruption mitigation system continued, informed by improved modelling and dedicated experiments. Two main concepts are still under consideration: massive gas injection and massive "shattered" pellet injection. As part of an R&D program launched to develop an ITER-scale pellet injection system, fuelling experiments with prototype designs were successfully performed at the DIII-D Tokamak (US) and a 1:5-scale twin-screw extruder, capable of a high rate of fuelling, underwent initial tests.



Tests are carried out in Korea on the prototype AC/DC power converter for the ITER correction coils.
Photo: ITER Korea

The design and validation of ITER's heating systems continues to advance. Electron cyclotron gyrotron sources demonstrated good progress at ITER-relevant parameters and prototype development is underway for the electron cyclotron transmission lines. R&D continued for ion cyclotron radio frequency source high power tubes and transmission line components. Procurement activities are underway for the Neutral Beam Test Facility (NBTF), which will test the full-size ITER ion source, as construction on the buildings advances in Italy.

Important pre-manufacturing activities for ITER's electrical systems were successfully achieved: a Manufacturing Readiness Review was held in Korea for the steady state electrical network high voltage substation transformers; an AC/DC converter module and transformer successfully passed critical type tests in China for the poloidal field magnet power converters; and a full-scale thyristor valve was built and successfully tested for the ITER reactive power compensator. Major components for the coil power supplies were also built and tested in Russia.

Finance

Ensuring sound financial and budget management

The final total of commitment appropriations for 2013 was EUR 244.46 million (including EUR 3.89 million in the ITER Organization Reserve) to which EUR 13.45 million of de-commitment from previous years' contracts was added and against which commitments of EUR 227.76 million were made, leaving a balance of unused commitment appropriations of 30.15 million to be carried forward to 2014. The payment appropriations for 2013 were EUR 256.86 million (including EUR 28.17 million in the ITER Organization Reserve). Of this, EUR 192.18 million was paid leaving a balance of unused payment appropriations of EUR 64.68 million (see Financial Tables).

In 2013, 89 percent of the commitments and 84 percent of the payments planned for the year were effectively executed. The ITER Organization Reserve fund – a repository for cost savings – continued to be an important tool for mitigating project risks. New processes were set up during the year to assist the Domestic Agencies with European value added tax (VAT) issues.

The Financial Audit Board conducted two on-site audits during the year and confirmed that the ITER Organization 2012 Financial Statements gave a true and fair view of the financial situation of the Organization in compliance with Project Resource Management Regulations and International Public Sector Accounting Standards.

Staffing

Downward trend in average age

Following 149 appointments and 66 departures over the twelve-month reporting period, at year's end the ITER Organization had a total direct staff count of 515 (see Staffing Tables). Efforts to increase the proportion of younger staff and female staff began to bear fruit, as the average age (44.2) showed the first downward trend in years and the current percentage of female employees (21.4 percent) is the highest yet attained. Five postdoctoral researchers worked within the Organization in 2013 in the frame of the Monaco-ITER Postdoctoral Fellowship program.

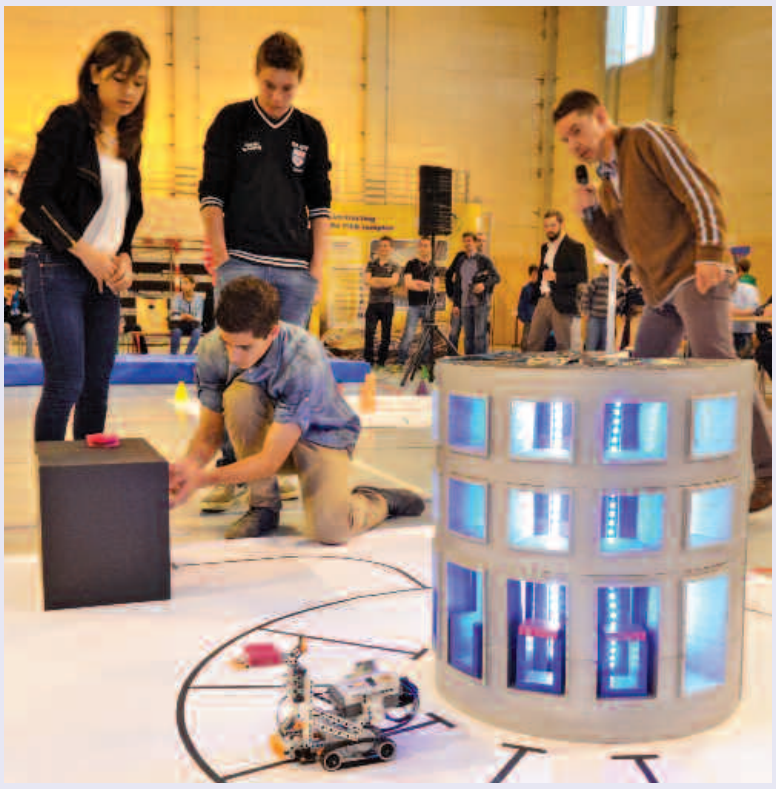
The organization chart was realigned during the year to reflect ITER Organization priorities: schedule and cost control, centralized construction management and design integration. Individual performance objectives were cascaded from ITER Organization strategic objectives and line management was reinforced. Management convened nine all-staff meetings throughout the year to keep staff informed of the strategic direction of the ITER Organization.

A new science and technology seminar series was launched within ITER to intensify scientific exchange, offer a forum for constructive peer criticism, and provide learning opportunities for younger members of staff.

External relations

Showcasing ITER at home and abroad

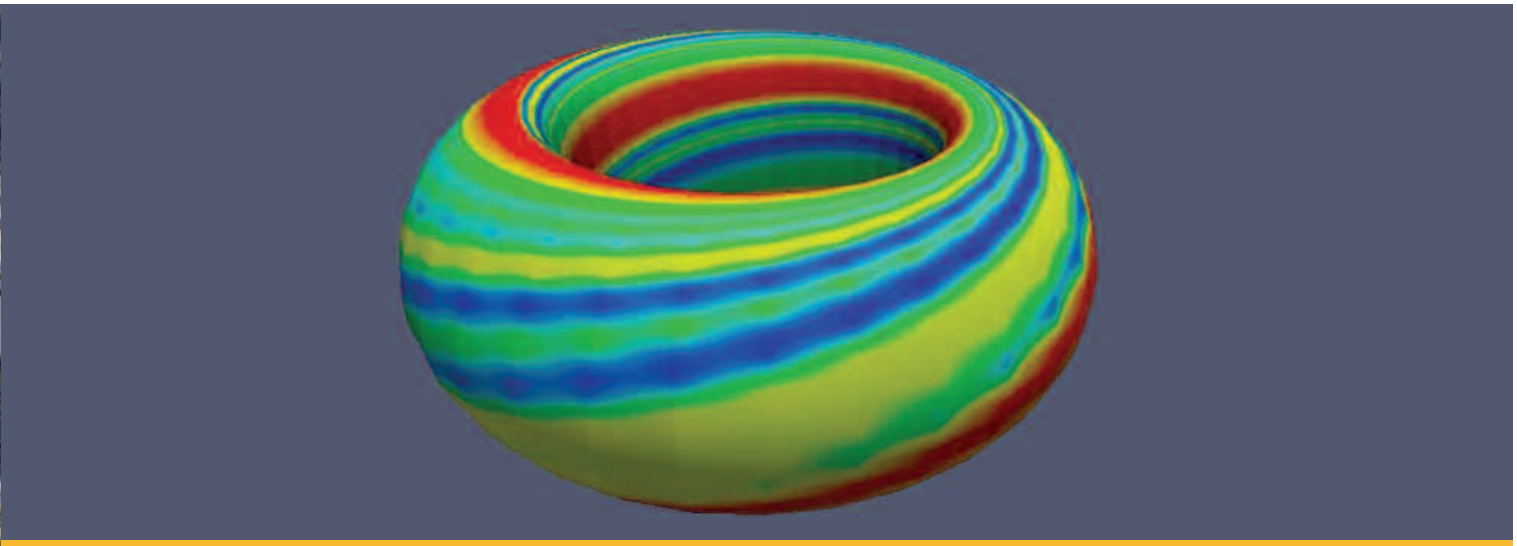
The ITER Organization continued to promote education and scientific collaboration in 2013 and made a concerted effort to open its doors to early-career professionals. It became a member of the European fusion education network, FuseNet, and welcomed 20 visiting researchers from the Domestic Agencies.



Aspiring engineers aged 13 to 18 participate in the ITER Robot Contest, held at a local high school, by designing Lego robots to perform ITER-like remote handling tasks.

Memorandums of Understanding were concluded in 2013 for cooperation in scientific fields with the Dutch Institute for Fundamental Energy Research DIFFER and the Eindhoven University of Technology (the Netherlands); Forschungszentrum Juelich FZJ (Germany); the Tohoku University School of Engineering (Japan); the United Kingdom Atomic Energy Authority UKAEA/CCFE (UK); the University of Genoa, Electrical, Electronic, Telecommunications Engineering and Naval Architecture as well as the University of Pisa, Department of Civil and Industrial Engineering (Italy).

The second Monaco ITER International Fusion Energy Days in December devoted three days to showcasing the challenges and opportunities of ITER to policy makers from the ITER Members, industry representatives, and high-level guests from the world of energy. The ITER Project was also present for the first time at the premium international event on energy – the World Energy Congress (WEC, Korea). Interest in the ITER Project continues to increase, with a record 15,000 visitors to the site in 2013.



2013 Highlights by Department

2013

Top left **The ITER construction platform in June 2013.** ***Photo: M.Postollec, O.Gillain - Engage*** **Bottom left** **The openings left in the Assembly Building basemat are for the tracks that will connect the building to the Cryostat Workshop; the four large cryostat segments – cylinders measuring 30 metres in diameter – will be delivered by rail.** **Top** **Significant progress has been made in understanding and quantifying the control schemes for plasma instabilities (modelled here) known as Edge Localized Modes (ELMs).**

Twice in 2013, ITER Headquarters was the theatre for significant events

Office of the Director-General (ODG)

The Office of the Director-General assists the ITER Director-General in the management of the ITER Organization. In 2013, ODG was responsible for coordinating project policy and monitoring policy implementation, coordinating strategic planning, maintaining external relations (including relations with the Host state and local government), developing and maintaining a comprehensive and integrated communications strategy, and interfacing with the ITER Council.

ODG is responsible for ensuring the timely, informed and smooth decision making of the Director-General in strategic planning activities and in the successful implementation of project policies and plans within the ITER Organization. The Office facilitates communication with the heads of delegation from the ITER Members by organizing the Director-General's mission calendar and specific meetings on the sidelines of ITER Council. It also organizes the ITER High Level Coordination Team, IHCT, and regular bilateral problem-solving meetings with the heads of Domestic Agencies.

The Office supports the Director-General's participation in international conferences and meetings such as the Symposium on Fusion Technology (SOFT) and the Fusion Power Associates annual meeting. It provides support for the ITER Organization Project Board meetings during which management discusses overarching issues such as safety culture, financial performance and risk management, as well as project culture, scope and performance. In order to strengthen the decision-making process as recommended by the 2013 Management Assessment, the Board's terms of reference were under review at the end of the year.

The Office took the leading role in organizing the inauguration of the ITER Headquarters in January, which was attended by EU Commissioner for Energy, Günther H. Oettinger, and the French Minister of Higher Education and Research, Geneviève Fioraso. It was also closely involved in preparations for the Ministerial-level ITER Council meeting in September.

The Principality of Monaco finances the second MIIFED conference in December, as part of a ten-year Partnership Arrangement with the ITER Organization. Above, HSH Prince Albert II of Monaco (centre).

Active effort was made to keep staff abreast of the strategic direction of the ITER Organization in 2013. After each ITER Council or advisory board meeting, the Director-General convened staff members to the Headquarters' amphitheatre to communicate on the outcome in order to ensure that the business units within the Organization were well-informed about the priorities and objectives set at the highest level. Following the 2013 Management Assessment, ODG began coordinating the ITER Organization response and action plan; early in 2014 these elements will be the object of a wide internal communication effort.

ODG supported initiatives designed to enrich the work environment at ITER and to develop a project and safety culture. Member Days – moments of culinary and cultural exchange that are widely appreciated by staff and representatives of the Domestic Agencies – were held several times in the ITER cafeteria. Also, a new staff-enrichment series was launched as planned in January. Held at least twice a month on a wide variety of topics, these one-hour science and technology seminars are open to all.

The second Monaco ITER International Fusion Energy Days (MIIFED) took place on 2-4 December, organized by the Office of Communication & External Relations. The three-day event attracted an international audience (355 participants) and was the occasion to spotlight the status of the ITER Project and ITER-related research. One full day was also devoted to industry to encourage interest, explain the ITER procurement process, and facilitate encounters between potential partners at a time when manufacturing is accelerating and an increasing number of work packages are being opened to tender.

High-level speakers from the world of energy (IAE, IAEA) at MIIFED 2013 helped to situate the importance of fusion research in the world energy landscape. As an energy project of the future, ITER's presence is increasingly solicited at conferences

and symposiums. In 2013 the ITER Project was invited to participate for the first time in the World Energy Congress (WEC, Korea), where the ITER Director-General participated in a panel on fusion energy.

Targeted outreach activities in 2013 aimed to further implant the ITER Project in its local context. Communication & External Relations launched a new general-interest publication in French called *ITER, le Magazine* that reports every two months on topics of interest to the local public (an English version – *ITER Mag* – also exists). Work also advanced toward an all new-ITER website planned for release in 2014; the first change early in the new year will be a new format for the ITER Organization's flagship publication *Newsline*.

The ITER Headquarters building is inaugurated on 17 January 2013.

A record 15,000 people visited the ITER site in 2013. The visit program is now coordinated by the Office of Communication & External Relations with the exception of a dedicated program run by Agence ITER France for French school children. A third annual Open Doors Day attracted 1,300 visitors to the site and a significant number of high-level visits from French and international delegations, as well as international media, were recorded in 2013.

The Office of the Director-General continued to act as the principal interface between ITER staff and the Provence-Alpes-Côte d'Azur International School in Manosque, where 53 percent of the children attending are from ITER families. Through regular meetings of the school's International Advisory Committee, at which all ITER Members are represented, the evolution of the school and the challenge of meeting the scholastic needs of the very diverse ITER population are discussed.

Legal Affairs (LGA)

Legal Affairs advises the Director-General and the departments, as well as the governing bodies of the ITER Organization (ITER Council, Management Advisory Committee, Council Preparatory Working Group, Test Blanket Module Program Committee). In 2013, Legal Affairs was involved in governance issues and international law; interpretation of ITER constitutive agreements; and support for the Test Blanket Module (TBM) program, notably in relation to the finalization of the Specific TBM Arrangements and as a participant in the TBM radwaste working group. In parallel, it continued to manage the nuclear liability issues with the Members and ongoing negotiations with the Nuclear Energy Agency concerning the inclusion of ITER in the Paris Convention.

In order to secure ITER Organization activities, Legal Affairs worked on addressing employee outsourcing issues with all directors and division heads and was responsible for drafting 16 agreements, 5 license agreements and 7 Memorandums of Understanding on international scientific collaboration with institutes of the ITER Members. Legal Affairs accompanied ITER construction by leading negotiations on the necessary notarial deeds and site agreements and providing support in relation to administrative authorizations such as building permits. Legal Affairs provided advice on the French laws and regulations to be observed by the ITER Organization in application of Article 14 of the ITER Agreement and interfaced with French authorities on these issues, in particular concerning working conditions on the worksite.

The legal team contributed to the protection of ITER Organization interests by managing pre-litigation and litigation cases and taking over the management of most insurance policies. It also provided advice on the implementation of privileges and immunities such as visa, value added tax (VAT) exemption and customs issues.

In order to raise staff member awareness on the ITER Organization legal framework in view of better protecting the ITER Organization's interests, Legal Affairs conducted trainings on the framework, the specific status of international civil servants, and on intellectual property. Some legal training was also provided on regulations applicable to the worksite and the ITER legal status in order to secure ITER Organization activities.

For the first time, the ITER Organization licensed intellectual property to a third party against royalties

"In a constructive atmosphere of cooperation and dialogue, we will strive to accelerate the pace of work and maintain the confidence of our stakeholders"
Director-General Motojima

The legal team was expanded by the arrival of a new legal officer specialized in intellectual property. Legal Affairs continued to manage intellectual property-related issues; in 2013 major achievements included the coordination of the intellectual property framework through the Intellectual Property Board and registration of the *www.iter.int* domain name with the Internet Assigned Numbers Authority. After complex negotiations, the ITER Organization and the International Atomic Energy Agency (IAEA) concluded an agreement covering the publication of scientific articles by staff in the journal *Nuclear Fusion* that allows ITER to retain the copyright. Also in 2013, the ITER Organization licensed intellectual property to a third party against royalties for the first time, an activity that is in compliance with the ITER Agreement. The fifth Contact Persons meeting for intellectual property took place in India in December.

Internal Audit (IAS)

The work of the Internal Audit Service is aligned to the business goals and objectives of the ITER Organization and audits are conducted according to a comprehensive risk-based plan that is updated periodically. In 2013, IAS carried out audits on quality assurance, contract administration, the training process, the budgetary process, the implementation of internal control standards, and the classification of transactions for the Financial Statements. It also performed advisory services as requested periodically by management. IAS followed up on the status of implementation of its recommendations; a large number were addressed and implemented during the reporting period by line management. An annual risk assessment exercise that had culminated in a three-year rolling audit plan for the Organization was carried out at the end of the year by IAS.

ITER Council Secretariat (ICS)

The ITER Council Secretariat provided administrative services to the ITER Council and its subsidiary bodies throughout the year in accordance with the Rules of Procedure of the ITER Council. In 2013, ICS supported the organization of the ITER Council's Twelfth Meeting in June and the Thirteenth Meeting in November, as well as the ITER Council held at Ministerial level in September. It helped to organize three Management Advisory Committee meetings: the Special Meeting (MAC-S2) on 18-19 March, the Fifteenth Meeting (MAC-15) on 21-23 May, and the Sixteenth Meeting (MAC-16) on 28-30 October. It also provided the Financial Audit Board with administrative support in relation to 2013 financial audit activities.

Bureau of International Cooperation (BIC)

The Bureau of International Cooperation provides support to the Director-General in all matters related to cooperation and coordination with the Members and their relevant domestic institutions. In 2013, the BIC communicated closely with the ITER Members to preclude delay on issues pertaining to schedule milestones, Procurement Arrangement signatures and the implementation plan for global logistics. Continued efforts to improve the visa issuance process in all ITER Member countries resulted in the following concrete results for ITER Organization staff: a one- to two-year, multiple-entry Chinese visa; a two-year, multiple entry Russian visa; and visa support for non-European citizens and Domestic Agency contractors in the framework of the ITER Project.

The BIC aided in the organization of the ITER Headquarters inauguration event, the ITER Council Ministerial-level meeting, and three Member Days that celebrated the culture of Russia, Japan and the US. It provided centralized management in the negotiation of more than 50 bilateral agreements (including Memorandums of Understanding) during the year. Finally, the BIC facilitated the allocation of desk space within ITER Headquarters for all Domestic Agencies, supported the balanced representation of all Members within the Staff Committee, and helped to reinforce Domestic Agency support in the recruitment of highly qualified candidates for ITER Organization positions.

The ITER Organization and the Domestic Agencies collaborated during the year to develop a credible and achievable 2014 Annual Work Plan

DEPARTMENT FOR ITER PROJECT (DIP)

The Department for ITER Project comprises the seven technical directorates that are responsible for the construction of the ITER scientific installation. The Department's objective is the timely construction of ITER within the given budgetary framework and in strict respect of all safety regulations.

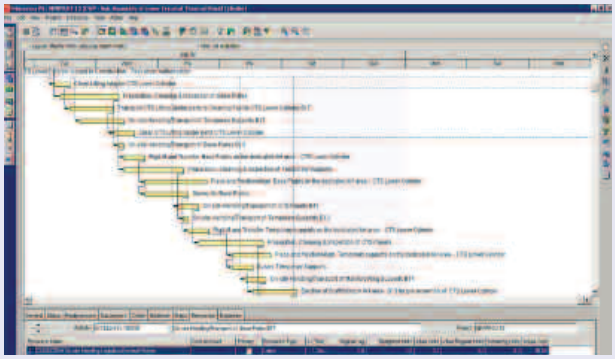
DIP spearheads the technical directorates by coordinating their work and securing overall technical integration. The Department reports regularly to the ITER Director-General, interfaces with the Domestic Agencies, and at all times tracks cost-saving and cost-containment solutions within its Directorates. In 2013, two Chief Engineers were appointed to assist and support the DIP director.

Directorate for Project Control & Assembly (PCA)

The Directorate for Project Control & Assembly was created in 2013 to assure the coordinated direction of project controls and construction management. It manages the ITER schedule, monitors schedule delay and recovery actions, performs risk analysis, and drives assembly and installation activities.

In 2013, the Project Controls Division focused on improving the efficiency and effectiveness of schedule control. It introduced a new categorization of Strategic Management Plan milestones that – with regard to the 2020 First Plasma reference date – tracks behind-schedule items (supercritical) or those at risk of falling behind (critical). This improved prioritization resulted in targeted ITER Organization and Domestic Agency action plans based on criticality.

Following MAC recommendations, Project Controls concentrated its resources on creating a realistic and achievable short-term schedule. Bottom-up Detailed Work Schedules for buildings, systems and components based on mature engineering integration data and supplier contract information were used to create the 2014 Annual Work Plan (AWP). The Division led the effort to improve the AWP development process, working within the Organization and with each Domestic Agency to identify a balanced number of high-level milestones for each system, harmonize labelling between Procurement Arrangement and contract milestones, and realistically reforecast and buffer the milestones for high confidence.



The ITER Organization starts work in 2013 on a detailed strategy and implementation plan for all assembly, installation and testing activities.

The Annual Work Plan will be the tool in 2014 for measuring and managing monthly progress, while the longer-term reference schedule will continue to be the metric for identifying the negative or positive float of the systems. Project Controls launched risk analysis in 2013 to assess the confidence level of the schedule and in parallel began work to create a realistic project schedule. This Realistic Schedule will be enriched through lessons learned in the achievement of the 2014 AWP.

The Assembly & Operations Division presented an overarching construction site management strategy in May and began work on a detailed strategy and implementation plan for all assembly, installation and testing activities. Major assembly framework contracts for industrial support are in the planning stages; under these umbrella contracts detailed work packages will be issued based on component delivery dates and on construction progress.

Industry-standard cost estimating software (Cleopatra) was introduced in 2013 to manage budgeting and costs, complementing Primavera (for scheduling) and Intergraph (for construction management). The ITER Organization is now equipped with a suite of management tools for the assembly and installation phase. Hundreds of construction work packages were reviewed during the year to ensure their compatibility with updated designs and schedules.

Specialists convened for a dedicated assembly workshop in December to review the ITER Organization approach to planning and scheduling the assembly and installation activities for ITER construction. The panel judged the approach to developing a resource-loaded assembly schedule sound; substantial additional

Approval of the Tokamak Complex concrete slab model in February opened the way for propping and formwork to begin in the Seismic Pit

work will now be required to complete the construction schedule and to update the integrated assembly plan.

Important progress was achieved in the design of ITER's remote handling systems in 2013. Europe concluded the Procurement Arrangement for Ex-Vessel Neutral Beam Remote Handling Equipment and the ITER Organization completed conceptual design reviews for two other systems: cask and plug remote handling and the remote handling supervisory control system. Japan successfully held the preliminary design review for the blanket remote handling system.

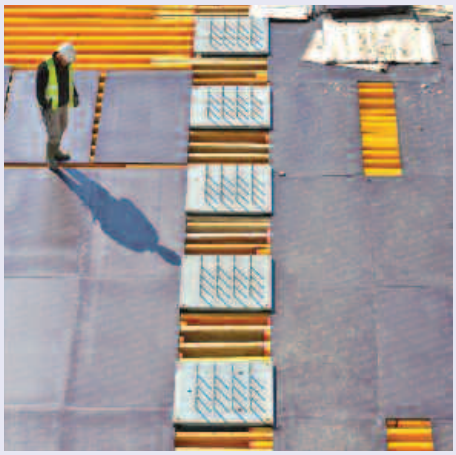
The Maintenance & Remote Handling Section continued to develop and validate standards for the integrated control architecture that will operate ITER's seven remote handling systems; prototyping is underway for a high-level control system. In 2013 the Section updated the Remote Handling Control System Design Handbook and produced a new version of its distributable software platform – the Remote Handling Core System – to reflect standardization efforts in the areas of synthetic viewing and network communication.

Work accelerated on the design of the Multi-Purpose Deployer; this lifting and handling tool will be required for early deployment in support of the tungsten divertor strategy. Work also began to organize and integrate ITER plant maintenance in view of the licensing process requirements for ITER operation. This included the issuing and approval of an ITER Plant Maintenance Policy.

Directorate for Central Integration & Engineering (CIE)

The Directorate for Central Integration & Engineering is responsible for technical integration, systems analysis and standards, Computer-Aided Design (CAD) files, and design activities for all components.

In the face of serious delay in the construction schedule, the activities of the CIE Directorate were re-centred early in the year to focus on strong corrective actions in the areas of design completion and design integration. The new CIE concentrated on the completion of integrated building designs, the efficient closure of Project Change Requests and design reviews, and the timely supply of integrated CAD designs.



Work on the Tokamak Complex concrete slab (B2) progresses in stages: propping and formwork (pictured), followed by the installation of 4,000 tons of steel rebar.

The priority was design integration work for the Tokamak Complex buildings. Resources were reinforced in the Project Engineering & Integration Division (formerly the Technical Integration Division) and six area managers and building integration engineers, all with strong experience in the design and construction of nuclear installations, were recruited to exercise authority over the integration activities of specific construction zones.

Approval of the Tokamak Complex concrete slab (B2) model in February opened the way for propping and formwork to begin in the Seismic Pit. The Division actively supported the Architect Engineer Engage in a several-month review of the safety margins in the rebar planned for the central area of the slab that concluded with adjustments to the rebar layout.

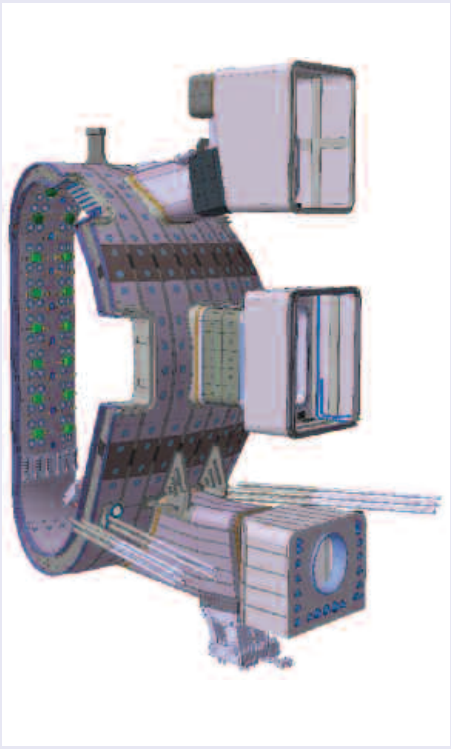
The integration of systems for Tokamak Complex levels B2, B1 and L1 was completed, including the resolution of clashes and the full integration of safety requirements. However it took longer than planned to fix constructability and finalize the tens of thousands of embedded plates that will be part of the floors, walls and ceilings of the buildings as well as optimize design construction related to penetrations. The Division reviewed approximately 500 changes proposed by Engage during the year.

The ITER Organization formed a new Building Design Integration Cell that met at least twice weekly to resolve integration issues and fix a reliable time schedule for delivering the documentation managing building interfaces. The Building Integration Task Force, strengthened by the participation of the European Domestic Agency in 2013, continued to convene throughout the year as a higher-level management forum to arrest further slippage and initiate recovery actions.

The Systems Engineering, Analysis & Standards Section contributed strongly to the completion of interface load reports between the building and the equipment inside the Tokamak Complex for the sizing of the embedded plates. It also aided with several Requests for Information from Engage that were critical for the completion of the building design and participated in the definition of the load and the detailed design of the interface between the building and the cryostat.

Pursuant to the ITER Council meeting held in June, systems integration activities were activated to assure integrated functional analysis for each system with its clients and integration among all the systems in order to properly evaluate the dynamic transient behaviour of each system in the time domain. Additionally, each area manager was invited to study the construction sequences and the required associated construction technologies to arrive at an achievable and reliable integrated schedule for the ITER Project covering engineering, construction and plant commissioning.

Forty-four openings, or ports, in the ITER vacuum vessel allow access for diagnostic and heating systems.



Following the STAC charge to resolve outstanding issues related to neutronics shielding, the Section proposed design solutions to resolve shielding issues for the toroidal field coils, ports and SIC (safety-important component) electronics and carried out an analysis of in-cryostat radiation. One of the software tools for monitoring radiation levels was the object of a licensing agreement for royalties in 2013 – a first for the ITER Project.

A new model for the nuclear analysis of the Tokamak main components (C-lite model) was completed and distributed to all Domestic Agencies and the nuclear community working for the ITER Project. This new model is more detailed and closer to the present design and has special features that allow quick and zooming analyses of specific areas.

The electromagnetic field maps (values and derivatives) have been updated, providing a database for the in-vessel components and for the equipment inside the Tokamak Complex. The global model for electromagnetic analysis of the in-vessel components was completed and distributed to all Domestic Agencies to allow them to quickly perform detailed analyses of specific equipment, such as the most severely loaded blanket modules.

The electromagnetic load on the magnet system was reviewed based on the plasma scenarios and the plasma transient events proposed by the Plasma Operation Directorate. An analytical tool for quick evaluation of the load and the interaction between magnet and conductive structures (vacuum vessel, blanket, etc.) has been developed. Good progress was also made in the preparation of system load specifications. Fifty System Load Specification reports were added in 2013 bringing the overall number to 120, or approximately 60 percent of the work scope. Strong support for the preparation of material technical documents and the control of material procurement specifications was provided for major Tokamak components (cryostat, vacuum vessel supports and bellows, vacuum vessel pressure suppression system, thermal shield).

Within the framework of issue and barrier management activities, a workshop was organized with the participation of Domestic Agencies to identify the risk of schedule delay related to the selection of codes and standards (C&S) for systems and components. Several actions were implemented in reply to Domestic Agency requests such as a centralized C&S database and a procedure for C&S selection and modifications.

Since its implementation in 2012, the Engineering Database has continued to grow and evolve. This in-house tool – a repository for ITER technical data – has already contributed to the identification of critical, project-wide quality issues and has provided a framework for their resolution. Key infrastructure improvements during the year include an application for configuration-controlled, room-by-room data called the Geographical Breakdown Structure and an application for the management of project changes.

Saving costs is the driving strategy behind the new approach in CAD design development

In an important technical decision that will result in cost savings for the project, the ITER Council endorsed the proposal to begin operations with a tungsten divertor

Improvements were developed for the Enovia CAD database now shared by all Domestic Agencies and the designers at the ITER Organization. Resources were assigned to support new processes and novel IT tools were deployed, including a Context Branch application that improves the efficiency of concurrent design users and contributes to cost savings. An additional Enovia structure is under development to support the CAD model approval process.

Actions were launched in 2013 to improve design maturity and efficiency. For all plant systems, the Design Office led a plan to accelerate the completion of piping and instrumentation diagrams; automatic and semi-automatic reports were developed to efficiently support the activities of the Building Integration Task Force; and a system for the management of diagrams and drawings was deployed.

A concerted effort was made during the year to monitor the performance of service contracts and improve the support of ITER technical responsible officers with CAD requests. Analysis is underway on the current ITER Organization CAD infrastructure with a view to meeting new plant design CAD requirements. Saving costs is the driving strategy behind the new approach in CAD design development.

Directorate for Tokamak (TKM)

The Directorate for Tokamak is responsible for completing the design, preparing procurement documentation, and monitoring hardware procurement and testing for the magnets, the vacuum vessel and the internal components.

The outstanding pace of engineering qualification activities during the tungsten divertor R&D program contributed to a successful tungsten divertor final design review in June and to the recommendation by the ITER STAC in October to adopt the all-tungsten option for the initial phase of ITER operation.

This significant decision, which received the support of the Thirteenth ITER Council in November, comes after more than two years of R&D supported by the Tokamak and Plasma Operation Directorates and the international physics community, as well as by experiments in tungsten behaviour at the JET Tokamak and high heat flux testing carried out at the ITER Divertor Test Facility in Russia where prototype modules manufactured by Europe and Japan performed encouragingly. The Directorate will continue to be closely implicated in ongoing R&D for the tungsten divertor.

This vessel is en route from Tennessee to Florida to enable the leak testing of US-made conductor.
Photo: US ITER

Design approval for the first-of-the-kind ITER blanket system in April testifies to the large amount of work accomplished by the Blanket Integrated Product Team since the preliminary design review in 2011. The first two of seven Procurement Arrangements for the blanket system were concluded with China and Korea for the blanket shield that will provide neutron shielding for the vacuum vessel and coil systems.

Manufacturing can now begin for the ITER blanket. The contract for the blanket manifold prototype kicked off in Europe and contracts for shield block prototypes will be launched in 2014. A sophisticated R&D program is underway in Japan for the development of remote handling tools to dismantle and precisely re-position the blanket first-wall panels, which are designed to be replaced once during the lifetime of ITER. Receiving notification in 2013 that the blanket is out of the scope of nuclear pressure equipment regulations in France was positive news for the manufacturing schedule.

Industrial activities progressed in Korea on ITER vacuum vessel sectors #1 and #6 and associated ports and port extensions. After the first cutting of ITER-grade steel plates last year, most manufacturing and quality control procedures (except for the ultrasonic testing of the T-ribs) were qualified and press forming, heat treatment, machining, welding and drilling operations were initiated. All segment manufacturing drawings, with one exception, were approved by the ITER Organization and the Agreed Notified Body.

The European Domestic Agency, which is procuring seven of the nine vacuum vessel sectors, reported that welding qualification trials have been launched at the

three selected fabrication workshops and qualification activities are ongoing for the hot forming and heat treatment of the plates, as well as for non-destructive testing. The manufacturing design of sector #5 – the first sector to be delivered – has been completed and fabrication activities for this sector will start in February 2014. Material procurement continues for plates and forgings.

Billets of niobium-tin alloy will be transformed into millimetre-thin superconducting strands for ITER's most powerful magnets. ***Photo: JASTEC***

In-wall shielding fabrication has progressed well in India and the first deliveries of ribs and blocks to Korea and Europe are expected in 2014; the manufacturing design is being completed for all vacuum vessel sectors. Korea awarded the contract for the fabrication of neutral beam port in-wall shielding for the port stub extensions.

Following the award in 2012 of the manufacturing contract to MAN Diesel & Turbo from Efremov Institute (Russia), preparation of the manufacture of the upper ports has begun with the development of the manufacturing design and fabrication of mockups. A manufacturing readiness review was held in July 2013.

The Domestic Agencies involved in vacuum vessel, port and in-wall shielding fabrication (Europe, India, Korea and Russia) met during the year to exchange their experiences and share problem-solving on complex fabrication issues; this constructive initiative will be repeated. Manufacturing of the ITER thermal shield will begin next year in Korea following the award of the design and fabrication contract in 2013. Work continues on the manufacturing design and the fabrication of mockups.

Satisfied by the considerable progress made in the development program for in-vessel coils, the STAC and the ITER Council moved in 2013 to recommend their inclusion in the ITER Baseline. Conductors for both vertical stability and ELM coils were manufactured in China and bending, forming and winding trials were performed successfully. Technical challenges remain to be resolved for the brazing of multiple conductors to their supports.

Fabrication of a real-scale cryostat mockup has begun in India: the cryostat base prototype and weld mockup successfully passed the first- and second-phase manufacturing readiness reviews and the first batch of cryostat steel plates shipped from France reached the manufacturer. Solutions were advanced during the year to resolve technical issues related to the cryostat base assembly which, if left unaddressed, would delay the schedule; these include in-pit welding optimization, additional tooling, and additional shifts. Two preliminary design reviews were held for the vacuum vessel pressure suppression system (VVPSS) tank and the main venting lines.

ITER magnet system procurement continued to move forward strongly in 2013. Niobium-tin (Nb_3Sn) strand production for the toroidal field coils reached 460 tons and Korea became the first Domestic Agency to complete its share in November. The cabling and jacketing of conductor unit lengths is underway in all Domestic Agencies; unit lengths registered in the Conductor Database now correspond to the amount needed to wind approximately 12 toroidal field coils.

Over 170 tons of niobium-titanium (NbTi) strand have been produced in China and Russia for the poloidal field conductors. In 2013, Europe completed the jacketing and compaction of the first copper dummy conductor made from Russian NbTi strands; this important qualification activity now opens the way to batch production. Two important milestones were achieved for the on-site Poloidal Field Coils Winding Facility during the year – the engineer integrator contract was awarded by Europe and the first batch of dummy conductor was received from China for winding line qualification activities. An agreement was also reached with China for the manufacture of poloidal field coil #6.

The focus in the toroidal field magnets procurement program is now shifting from conductor production to coil manufacture

The focus in the toroidal field magnets procurement program is now shifting from conductor production to coil manufacture. At the European winding facility in La Spezia, Italy, which opened in 2013 after seven months of commissioning, the first double pancake prototype was successfully wound and heat-treated. Commissioning is

Niobium-tin (Nb_3Sn) strand production for the toroidal field coils reached 460 tons in 2013

underway on the winding line in Japan and radial plate fabrication is advancing in both procuring countries. Japan and Europe signed the Procurement Arrangement for toroidal field coil magnet structures in December and the first order for material was placed in Japan. The Domestic Agencies, suppliers and representatives of the ITER magnet team meet regularly within the Toroidal Field Coil Working Group to resolve common issues and manage the large numbers of interfaces and tolerances between the winding packs and the coil structures.

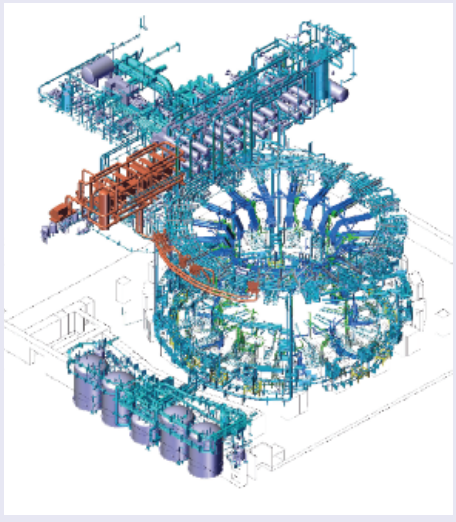
The final design review held in November for the central solenoid was an important milestone on the road to fabrication, as the final design can now be completed and the fabrication of the first mockup module launched. Japan has fabricated 25 tons of Nb_3Sn strand for the central solenoid; in 2013 it jacketed three lengths of dummy conductor and delivered them to the central solenoid module manufacturer in the US for fabrication of a mockup module.

Correction coil and feeder conductors entered production in China following the successful qualification of all manufacturing tooling and processes. Following the endorsement of the ITER Organization in October of high temperature superconductor (HTS) current lead mockups, raw material procurement has begun. Numerous contracts were placed for magnet instrumentation during the year and the Magnet Division shipped its first components to China for integration into prototype current leads. Qualification activities also progressed for magnets supports in China, including the completion of a full-size gravity support mockup and a multi-dimensional loading test frame; series manufacturing should begin in 2014.

Directorate for Central Engineering & Plant (CEP)

The Directorate for Central Engineering & Plant provides a fully qualified range of services and facilities required for the operation of the ITER Tokamak. The Directorate is responsible for the Procurement Arrangements, fabrication, and testing of a large number of systems: cooling water, cryogenics, hot cell, radwaste, fuelling and wall conditioning, tritium, vacuum, steady state and pulsed electrical power supplies, and magnet coil power supply.

The CEP Directorate led the effort in 2013 for organization-wide cost-cutting efforts in the procurement of ITER plant systems. The Directorate proposed pilot measures to centralize the procurement of bulk materials, to reduce the cost of design support (CAD) and to enhance the management of large contracts within CEP as firm-price contracts.



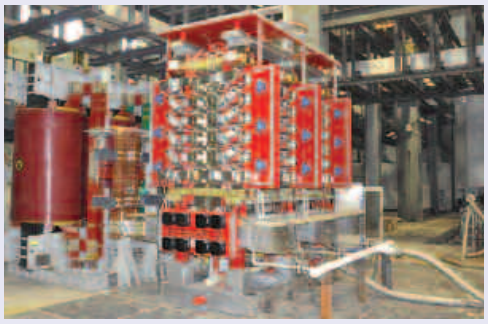
The Tokamak Cooling Water System includes major components such as pressurizers, heat exchangers, pumps, tanks and drying equipment, plus 33 kilometres of piping. ***Credit: US ITER***

For the Tokamak Cooling Water System (TCWS), a new approach was introduced for more cost- and time-efficient procurement and integration. While the US Domestic Agency maintains global responsibility for this system, agreement was reached to transfer the design, procurement and pre-assembly of TCWS piping and the completion of the final design to the ITER Organization. The advantages in terms of cost savings (decreased overhead and shipment), on-site integration, and facilitated interaction with the regulatory Agreed Notified Body make this novel approach a candidate for other highly integrated plant systems.

Manufacturing progressed for the five TCWS drain tanks in the US where welding and tank head fabrication is underway. India awarded the contract for final design and procurement of ITER's component cooling water, chilled water, and heat rejection systems and an aggressive schedule was established to meet the delivery deadlines for the buried cooling water piping, whose installation is scheduled to begin in 2014.

Following the contract award last year for the ITER cryogenic system liquid helium (LHe) plants, the detailed design phase kicked off. The liquid nitrogen (LN2) plant and auxiliaries contract was signed in December 2013; clarifications with bidders are underway for the cryolines and warm lines contract and the bidding phase is set to start for cryodistribution. Optimized management of the LN2 contract has moved EUR 2.5 million to ITER Organization Reserve fund.

The pre-conceptual design of Type B radwaste process equipment and its system integration work was completed for the full process: cutting, tritium removal, sampling, characterization, pre-packaging, inspection and the decontamination to be implemented in the Hot Cell building. For the Type A radwaste system, the conceptual design review was successfully performed in December. All the equipment and systems, including liquid and solid radwaste systems, were properly accommodated in the newly proposed Radwaste Building layout; the mobile waste process equipment, in particular, was converted to static equipment to fit the new layout.



This AC/DC converter bridge is part of prototypes built in China to test the power systems for ITER's poloidal field magnets before series production.
Photo: ITER China

A plan for the staged commissioning of the Tritium Plant, with a flexible licensing approach related to tritium handling, was commended by the STAC in 2013. Although the Tritium Plant is not needed for the initial phases of ITER operation, design work is underway to integrate plant systems. Through the implementation of value engineering activities, cost containment is expected for both the Tritium Plant and the Hot Cell.

In September, a Procurement Arrangement was signed with Europe for the first part of the Radiological and Environmental Monitoring System (requirements plus preliminary and final design); system hardware will be signed at a later date. Following the conceptual design review of the storage and delivery system, opportunities for reducing cost were identified and work on implementing these measures has started. A joint ITER Organization/European Domestic Agency task force was formed early in the year to address the functional and safety issues of the Hot Cell preliminary design. For the detritiation system, experiments and analysis confirmed that scrubber columns can be used in the place of molecular sieve dryer technology in order to increase the system's availability and reliability.

The Procurement Arrangement for the Glow Discharge Cleaning System was signed late in 2013 with China. Since the conceptual design review of 2011, the design of this system has evolved from a movable electrode concept integrated with the ITER in-vessel viewing system to a fixed electrode concept. Studies will be launched for the system's preliminary design in 2014.

After the early conclusion of the conceptual design review for the pellet injection system, a Procurement Arrangement was concluded with the US Domestic Agency in December. As part of an R&D program launched in the US to develop an ITER-scale pellet injection system, fuelling experiments with prototype designs were successfully performed at the DIII-D Tokamak and a 1:5-scale twin-screw extruder, capable of a high rate of fuelling, underwent initial tests. A full-scale prototype and further testing on the key technologies of this system are planned.

Subsequent to last year's conceptual design review of the disruption mitigation system, the US Domestic Agency and the ITER Organization agreed to explore the possibility of allocating the system outside of port plugs. The studies were carried out in collaboration with the Plasma Operation Directorate and a Project Change Request was filed to allocate ex-port plug space.

The Vacuum Section continued to provide cross-project support for vacuum and to maintain standards and quality for vacuum-related design and fabrication. Support for acceptance vacuum leak testing – both for the manufacture of ITER components and for qualification mockups – was provided and strong progress was made in the integration and interfacing of the vacuum systems with the buildings and cohabiting systems.

Two Procurement Arrangements were achieved in 2013: Warm Generation Lines with Europe and main Vacuum Auxiliary Systems with the US, which came after a successful conceptual design review. As part of the value engineering of the vacuum auxiliary systems, modularity was brought into the design, introducing cost savings to manufacturing and installation. The Vacuum team accepted delivery from the US Domestic Agency of the remaining test equipment required to confirm the vacuum leak-tightness of components as they arrive on site and during the construction of the machine.

Pilot measures were proposed to centralize the procurement of bulk materials, to reduce the cost of design support (CAD) and to enhance the management of large contracts

2013

In September an 800-ton convoy successfully travels along the ITER Itinerary, testing its robustness in advance of the first ITER loads.

Centralized cable tray design and cable routing inside the cryostat resulted in cost savings

The final detailed design of the neutral beam and MITICA (Megavolt ITER Injector and Concept Advancement) cryo-sorption pump was endorsed by an expert review panel that also commended the Vacuum Section for a re-worked design that can be manufactured in a shorter time and at significantly reduced cost. A series of contracts with industry were signed by the ITER Organization and Europe for the manufacturing of the torus pre-production cryo-pump, which will not only validate manufacturing processes but also serve as a spare for ITER's eight torus cryo-pumps. The first parts of this complex system have been successfully manufactured in preparation for the assembly phase.

The Electrical Engineering Division centralized cable tray design and cable routing inside the cryostat that resulted in cost savings. Design improvements were pursued for the cable tray systems of non-nuclear buildings and the Division worked to develop an industrial, time-saving approach to EMC (electromechanical compatibility) qualification of components. Improvements in the routing of 22 kV Steady State Electrical Network (SSEN) power cables and the decision to use aluminium instead of copper generated important cost savings. Within the scope of the engineering framework contract signed in 2012, a second work plan was agreed with the Korean firm KEPCO for the build-to-print drawings for the Tokamak Complex cable trays, manufacturing drawings and installation reports.

Three Procurement Arrangements were signed for ITER's electrical power distribution systems with Europe in 2013: SSEN and Pulsed Power Electrical Network (PPEN) Installation; Emergency Power Supply; and SSEN Components.

A Manufacturing Readiness Review was held in Korea for the SSEN high voltage substation transformers; these components will connect the SSEN AC distribution system to the 400 kV power line on site. The first of these units will arrive on site in 2014 to respond to the gradually increasing power needs during system commissioning.

A review panel endorsed the final design of the AC/DC magnet power converters for correction and vertical stabilization coils in 2013; review comments were properly addressed and fed into the final design of the AC/DC magnet power converters for central solenoid and toroidal field coils, safeguarding 2014 manufacturing milestones (Korean scope).

The R&D unit of high voltage ion cyclotron radio frequency power supplies is readied in India for testing.
Photo: ITER India

Important advancements were made by China in the design of the poloidal field magnet power converters: an AC/DC converter module and transformer successfully passed critical type tests at a purpose-built test platform at the Institute of Plasma Physics (ASIPP). The test results support further development and provide confidence in series production. For a second procurement package – the ITER reactive power compensator – a full-scale thyristor valve was built and successfully tested.

Full-scale prototypes of a DC busbar, fast disconnector switch, fast open switch and extra protection make switch (major components for the coil power supplies) were built and tested in the Efremov Institute in Russia. R&D activities provided validation of the components' final design, particularly the pyro-breaker, which repeatedly demonstrated that it can break the current safely when needed as a last resort.

The conceptual design of the in-vessel coil power supply busbar started in 2013 in an approach to engage all future parties at the earliest stage in order to pre-empt later changes. Space reservation in the Tokamak Building for the in-vessel coil power supplies was revised with the consideration of installation constraints to mitigate future risks. Simulation tools for validating the design and performance of the entire coil power supply system were also updated in 2013.

The CEP Directorate became the Plant System Engineering (PSE) Directorate at the end of the year, with enlarged responsibilities for CAD and design coordination and project engineering and integration. PSE will also have full responsibility for the design, procurement and testing of remote handling systems, supervising the development and implementation of maintenance and in-service inspection requirements and associated design criteria.

In 2013, the ITER Organization completed the bulk of contracts to the Domestic Agencies for the ITER diagnostic systems

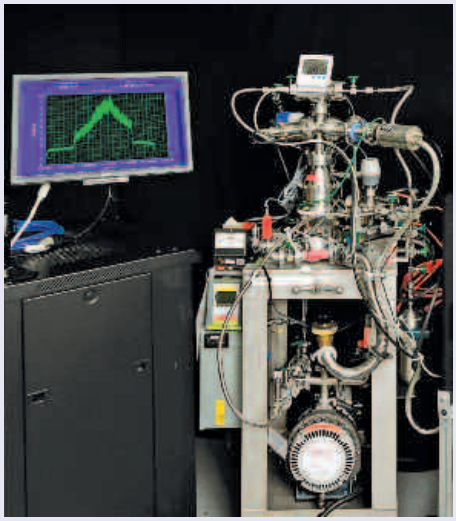
Directorate for CODAC, Heating & Diagnostics (CHD)

The Directorate for CODAC, Heating & Diagnostics has responsibility for the CODAC system (control, data access and communication); the central interlock and central safety systems; the integration of plant systems instrumentation and control (I&C); three heating and current drive systems that sustain the plasma conditions required for fusion; and the diagnostic systems, which measure the plasma conditions and allow optimization of the plasma performance. All these systems are essential to the correct and safe operation of the ITER Tokamak and the execution of the ITER physics program.

The Control System Division issued Version 7 of the standardization document package (the Plant Control Design Handbook, PCDH) in 2013. The Division also issued Version 4 of its CODAC Core System, with enhanced support for fast-control plant systems and improved operator interfaces. Fifty-eight organizations, including Domestic Agencies, fusion labs and contractors, are now using this software around the world. Training and user support continues and an infrastructure was established to track users and versions. In collaboration with the Electrical Engineering Division, an application has been developed for monitoring the power consumption on site and at Headquarters; this type of pilot application demonstrates the efficiency of the system in collecting, processing and archiving signals in accordance with CODAC procedures.

A major contract was signed for CODAC Operation Applications Engineering Services in 2013. This five-year contract will assist the CODAC Section and its contractors by providing support for the design and development of the high-level software applications required to operate ITER.

Progress was recorded in the development program for the machine protection and nuclear safety Instrumentation and Control (I&C) systems: the ITER Organization awarded the contract for the detailed design, qualification and supply of the central safety system for nuclear safety in June and the contract for the detailed engineering design, procurement and commissioning of the central interlock system in September.



A prototype of the residual gas analyzer, developed by Oak Ridge National Laboratory (Tennessee, USA), that will be used during a pulse to measure the partial pressure of gases in the ITER divertor and at mid-plane.
Photo: US ITER

In 2013, the ITER Organization completed the bulk of contracts to the Domestic Agencies for the ITER diagnostic systems, celebrating a second-round diagnostics Procurement Arrangement signature with Japan and 12 Complementary Diagnostic Procurement Arrangement signatures with China, Europe, India, Korea and Russia. Korea has now signed all of its diagnostic scope.

The design of the diagnostic systems – particularly challenging due to the extended plasma burn times expected in ITER, high energy bombardment, wall reflections, and the integration of the systems into the port plugs – progressed in all ITER Domestic Agencies. A common approach to the manufacture of ITER's 22 diagnostic port plug structures was finalized in 2013 with the signature of Memorandums of Understanding by India and Japan, adding to agreements signed last year with Europe and Korea. The procurement of the port plug structures will now be carried out in a joint tender approach, permitting cost efficiencies through the bulk buying of components. A solution developed for mirror cleaning is now in final testing.

Good progress was made during the reporting period in the demonstration of electron cyclotron gyrotron sources at ITER-relevant parameters. The European Domestic Agency switched from pursuing the development of a 2 MW source to a 1 MW source and, in December, awarded the contract for the design, manufacture, installation and commissioning of the high voltage power supply systems for the European and Russian gyrotrons. The third Procurement Arrangement of the gyrotron program was signed with Japan in September. All launchers (upper and equatorial) are in the final design phase and modelling and prototype development is underway for the electron cyclotron transmission lines. A dedicated test facility in Japan is playing a key role in the development of ITER-like control systems (based on the conceptual design developed by the ITER Organization and the European Domestic Agency) for the 24 gyrotrons that will provide heating power to the ITER plasma.

The design and validation of the ion cyclotron system also advanced. Interfaces were defined between the ion cyclotron transmission lines and the antennas, and component-level design reviews were held in the US for the components required for First Plasma. A test stand in the US supported high power tests on prototypes (gas barriers, straight lines).

This gantry machine permits final machining operations on two radial plates simultaneously. ***Photo: F4E/CNIM (Christophe Chabert)***

R&D on radio frequency source high power tubes progressed and both suppliers started design and manufacturing for amplifier chain components such as the tube and cavity; ITER team members participated in technical discussions to ensure that the development was in agreement with ITER requirements. In parallel, test stand preparation started in India. To prepare the next preliminary design review, the first version of the load specifications was written at ITER and the compliance matrix and design review documentation list was formally agreed between the ITER Organization and the Indian Domestic Agency. A Task Agreement for the final design of the ion cyclotron antennae was signed with Europe and the ITER Organization, and Europe placed a number of R&D contracts on radio frequency sliding contacts, Faraday screen bar prototyping, and preparation for the prototyping of the windows. A prototype of I&C was developed (both software and hardware) at the Institute of Plasma Research in India using the CODAC core system and following the PCDH; the I&C preliminary design review was also carried out. The interface sheets for the plasma control system, CODAC and the central interlock system were also fully defined during the year.

The newly commissioned ELISE test facility, a voluntary European contribution to the neutral beam program, began operation in Germany at the Max Planck Institute for Plasma Physics in Garching. Beam acceleration in hydrogen and deuterium was achieved with excellent results. Procurement activities are underway for the Neutral Beam Test Facility (NBTF) in Italy – the SPIDER testbed is in fabrication and factory acceptance tests should start in 2014.

As the main buildings of the NBTF near completion, plans were made for the launch of the installation phase in 2014. The designs of NBTF components, in particular for the MITICA testbeds, were brought to build-to-print level by the end of the year and will be presented early next year to a final design review. Manufacturing of the MITICA high voltage bushing progressed in Japan and the design of the 1MV power supply components are all near final designs reviews. India hosted a successful final design review for the acceleration grid power supplies for both SPIDER (part of NBTF) and for ITER's diagnostic neutral beam. Procurement will begin in 2014 for the first cryopump needed for the Neutral Beam Test Facility following the endorsement of its design in November.

Directorate for Buildings & Site Infrastructure (BSI)

The Directorate for Buildings & Site Infrastructure ensures that all ITER Project buildings and infrastructure are designed and constructed according to ITER Organization requirements in a timely and cost-efficient manner. BSI is responsible for the oversight of the five Procurement Arrangements with the European Domestic Agency relating to the construction of buildings and also directly procures and manages new-build work outside the scope of in-kind contributions. The Directorate is responsible for the day-to-day operation of all ITER facilities (excluding safety and security aspects). The Directorate also manages the global transportation contract for all ITER components as well as the on-site logistics of components up to the point of assembly.

In 2013, the anti-seismic bearings and their supporting pillars disappeared under the formwork and steel reinforcement that was progressively set into place for the B2 basemat slab that will support the Tokamak, Diagnostics and Tritium buildings. Activity was temporarily suspended in the middle of the 12,000 m² area while safety margins in the design of the central part of the slab were reviewed; reinforcement works in this area will resume in 2014. The first of fifteen B2 segments was poured in December.

The first of 15 Tokamak Complex basemat slab segments was poured in December

Large-scale deep excavation works on the platform came to an end in 2013 as ITER's critical networks and precipitation drainage networks were completed. Contractors finished the Assembly Building foundation slab and advanced without obstacle on the technical galleries that surround the Tokamak Building. Along the northern edge of the platform, the CA2 contractor zone opened in September and the first pre-fabricated office building was erected by the building consortium charged with constructing the Tokamak Complex. Following modifications made to the ITER site layout by Europe the ITER Organization submitted, and was granted, a modified building permit in 2013.

In April, the ITER Organization made part of the site available to the Indian Domestic Agency for the on-site assembly of the ITER cryostat. Work was initiated immediately and by the end of the year the imposing metal super-structure of the Cryostat Workshop was in place. Following the selection of the building contractor in June, work began on the ITER Headquarters extension. BSI also started the procurement process for the construction of two warehouses that will enable delivered components to be stored and managed within the perimeters of the ITER site; in parallel, work began to modify the legal agreement that provides land to the ITER Organization in order to incorporate the additional space needed for the warehouses.

Looking across the construction platform toward ITER Headquarters from the shadow of the Cryostat Workshop.

The European Domestic Agency awarded a large number of construction work packages in 2013, including contracts for the mechanical and electrical works of the Tokamak Complex (EUR 530 million) and for four large Assembly Building cranes. The kick-off of the Tokamak Complex civil works contract in April was an exciting development for ITER construction as this single contract covers the three buildings in the Seismic Pit as well as eight other facilities.

The ITER Organization and the European Domestic Agency collaborated closely during the year to freeze input data for concrete civil works and finalize the designs needed by contractors. Nevertheless, due to a large number of ongoing changes affecting the buildings, 23 months of slippage were identified in the schedule for construction. Factors contributing to the negative float included the large number of embedded plates and penetrations to be integrated into the building designs, interface clashes to resolve, and insufficient resources for building integration activities.

The number of construction workers is expected to increase to more than 2,000 at the peak of activity. In February, a partnership arrangement was signed with the French social security agency URSSAF PACA that lays out the terms of activities to prevent illegal labour practices – through information, education and regular inspection – on the ITER worksite.

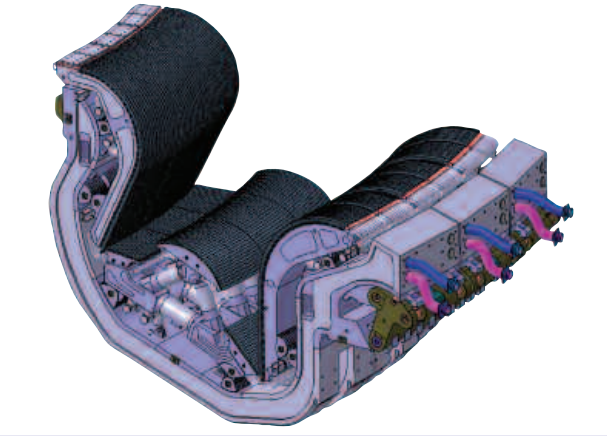
The logistics service provider DAHER organized a full-scale test of the ITER Itinerary in September – a 352-wheel trailer and a dummy load of concrete blocks successfully travelled over four nights along the 104 kilometres that separate the ITER site from the Mediterranean Sea. By replicating the dimensions and weight of ITER's largest components, this test convoy confirmed the robustness of the Itinerary approximately one year in advance of the first ITER loads.

Two Domestic Agencies, Korea and the US, concluded implementation agreements with DAHER during 2013; these agreements, which must be signed by all ITER Domestic Agencies, detail the specific conditions relative to the delivery of components from each ITER Member. BSI continued to manage the logistics service provider contract for the ITER Organization and will be closely associated in the planning operations for the shipment of the first ITER components in 2014.

A full-scale test of the ITER Itinerary was organized in September

Directorate for Plasma Operation (POP)

The Directorate for Plasma Operation supports ITER construction and operation in all matters related to physics performance projection and plasma control requirements, the assessment of plasma-related specifications for engineering systems, and the coordinated implementation of the Test Blanket Module Program.



In 2013, the ITER Council endorses the adoption of a full-tungsten divertor for the initial phase of ITER operation following a two-year qualification program.

At its October meeting, the ITER Council Science and Technology Advisory Committee (STAC) recommended the adoption of a full-tungsten divertor for the initial ITER Operation Phase. Approved one month later by the ITER Council, this landmark decision comes after a two-year R&D program that associated the Plasma Operation and Tokamak Directorates from ITER, experts from the International Tokamak Physics Activity (ITPA), industry, and operating tokamaks in Europe, Japan and the US where key experiments on the behaviour of tungsten were carried out.

At the final design review for the tungsten divertor in 2013, the European and Japanese Domestic Agencies reported that tests on tungsten divertor prototype modules at the ITER Divertor Test Facility in Russia exceeded requirements. Valuable physics input from experiments run at the European tokamak JET also contributed to STAC confidence that the technology and physics basis of the tungsten divertor option was sufficiently mature. In making its recommendation, the advisory board stressed the necessity of a robust disruption mitigation system; it also cautioned that additional care will be required during the non-nuclear phase to achieve high power and high current. The Directorate will continue to collaborate with the international fusion community on physics R&D supporting the preparations for ITER operation with all-metal walls, in particular an all-tungsten divertor.

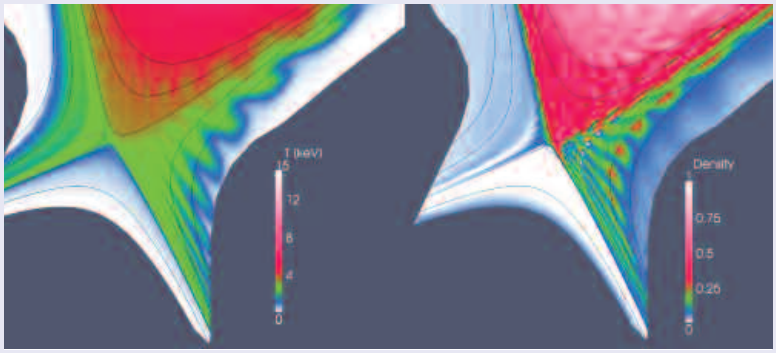
In light of the tungsten divertor decision and evolving schedules for the installation of some components, the ITER Research Plan was reassessed

In light of the divertor decision as well as evolving schedules for the installation of some components, the POP Directorate conducted a reassessment of the ITER Research Plan that defines the principal physics research activities to be carried out during ITER construction and gives an initial definition of the experimental program of ITER operation leading up to deuterium-tritium fusion power. This study identified the configuration of auxiliary systems (heating and current drive, diagnostics, fuelling systems, in-vessel coil systems) required for each phase of operation and developed a strategy for integrating constraints from licensing and from Tritium Plant commissioning with the experimental program so as to maintain an optimized path to deuterium-tritium operation.

Within the Test Blanket Module (TBM) program, all Members achieved substantial progress in the design of Test Blanket Systems and associated R&D in 2013. The first conceptual design review was held successfully for the components that will house the test modules (frames) and the substitute modules (dummies) in July. Significant strides were also made in the conception of common maintenance tools and in the integration of the systems into the facility. A proposal by the ITER Organization to take over design and procurement responsibilities for the Test Blanket System connection pipes from the TBM Leaders was endorsed by the ITER Council – this transfer of responsibility will result in both technical and cost optimization for the project.

The ITER Organization reviewed the Preliminary Safety Reports for each of the six Test Blanket Systems in 2013, with final approval of each report expected during 2014 in advance of the signature of the corresponding TBM Arrangements. Korea submitted the first draft TBM Arrangement to the ITER Organization; these will be due from all TBM Leaders in 2014. The working group on radwaste management made strides in estimating and classifying Test Blanket System operational and decommissioning radwaste during the year, but further collaboration will be necessary before an agreement can be signed between the TBM Leaders and the Host country.

A JOREK simulation of plasma temperature (left) and density profiles (right) during a burst of energy known as an ELM.



Understanding the magnitude and structure of Edge Localized Mode (ELM) energy bursts and quantifying the effectiveness of control schemes is an active field of research where significant progress was made in 2013

Following the conceptual design review held for the ITER Plasma Control System in 2012, POP continued its collaboration with the Control System Division, the Domestic Agencies and experts to develop the preliminary design. An action plan was presented at the 10th Integrated Operation Scenarios ITPA meeting in April describing how the experimental and modelling programs within the ITER Members can contribute to this effort.

The aims of the ITER integrated modelling program are to accurately predict performance for the efficient control of ITER plasmas; to support preparations for ITER operation; and, in the longer term, to provide the modelling and control tools required for exploitation. During the fifth Integrated Modelling Expert Group in October, the ITER Organization presented the ITER Modelling & Analysis Suite, a prototype framework for integrated modelling. Designed for use with both experimental and simulation data, the framework represents a significant step forward permitting the development of the first physics workflows that demonstrate a plasma simulator. Training opportunities will be offered to group members as the framework evolves.

Work on a robust and reliable disruption mitigation system continued in 2013 spearheaded by the US Domestic Agency, which has responsibility for the procurement of the system. Two main concepts are still under consideration: massive gas injection and massive "shattered" pellet injection. Experiments at the US tokamak DIII-D demonstrated significant progress in the control and dissipation of runaway electrons produced in the post-disruption phase. Valuable results were also obtained from studies in several tokamaks of radiation asymmetries observed during massive gas injection, and the improvements in understanding emerging from these experiments will inform the performance specification for the ITER disruption mitigation system.

Understanding the magnitude and structure of Edge Localized Mode (ELM) energy bursts and quantifying the effectiveness of ELM control schemes is an active field of research where significant progress was made in 2013. Positive results from experiments in using 3D magnetic field perturbations in a large number of experimental devices led the STAC to recommend the inclusion of in-vessel coils – including an array of 27 ELM coils – into the ITER Baseline. The robustness of this ELM control technique was demonstrated at DIII-D where ELM control was achieved without the operation of all coils, providing confidence that the capability for ELM control in ITER can be maintained even if several coils should fail during ITER's operational life.

The ITER Organization became a contracting party in 2012 to the International Energy Agency Implementing Agreement on Co-operation in Tokamak Programs (IEA CTP-IA); in 2013 a procedure was set in place for bilateral or multilateral collaborations with fusion research institutions under this Agreement and just over ten personnel exchanges involving ITER Organization staff took place. The Directorate also maintained wide-ranging R&D collaborations with the ITPA Topical Groups and with many Member fusion facilities to resolve the remaining physics design issues for ITER and to prepare for ITER operation. It was heavily involved in coordinating and preparing input documents and organizing two STAC and two TBM-PC meetings during the year, hosting the annual joint meeting of the ITPA Coordinating Committee and IEA CTP-IA, and participating in several major fusion conferences including the EPS Plasma Physics Conference, the APS Division of Plasma Physics Meeting and the International Symposium on Fusion Nuclear Technology. The Directorate also made significant contributions to training in fusion science and technology by continuing to accompany the five Monaco Fellows in their research work in support of ITER physics and design issues and by providing lecturers to several international fusion summer schools and fusion training courses.

The ITER Organization is a nuclear operator in France, a status conferring a specific set of obligations and responsibilities

DEPARTMENT FOR SAFETY, QUALITY & SECURITY (SQS)

The Department for Safety, Quality & Security supports the Director-General in all matters related to safety, quality assurance and security, regulatory requirements, and compliance with respect to Host country safety and security regulations.

Since 10 November 2012 – the date of promulgation for the decree that created the ITER Basic Nuclear Installation (Installation Nucléaire de Base, INB) – the ITER Organization has been a nuclear operator in France, a status conferring a specific set of obligations and responsibilities. In 2013 the focus of the SQS Department was to distil safety regulations throughout the project and reinforce the conditions for a common and all-permeating ITER Organization-Domestic Agency safety culture. The Department's role is one of information, training and oversight.

SQS intensified its collaboration with the ITER technical divisions on issues of nuclear safety and involved Domestic Agency experts in exchanges with the regulatory authorities. A specific workshop program was launched for technical personnel across the project to popularize knowledge of the ITER safety files and encourage the integration of safety in all activities. In compliance with the INB Order issued on 12 February 2012, SQS made plans to strengthen the safety files on the subject of environmental policy. It launched a process to obtain 14001 certification that it hopes to conclude mid-2015; this certification would be an additional gauge of optimization of the environmental impact for the ITER installation.

As a nuclear operator, the ITER Organization has the obligation to monitor the manufacturing processes of the components that qualify as Protection Important Components (PICs); in 2013 members of the Department performed on-site audits in Korea for the vacuum vessel and in the United States for drain tank manufacturing.

The French nuclear regulator ASN carries out four on-site inspections during the year.

The French Nuclear Regulator ASN made its first PIC inspection in 2013 on European manufacturing activities for the ITER vacuum vessel in Mangiarotti, Italy. It also carried out four on-site inspections in Saint Paul-lez-Durance for ongoing civil works. Representatives of the ITER Local Information Commission (CLI) were invited by the ITER Organization to participate in one of these visits – a gesture that was heralded by the CLI for its openness and transparency. Following observations made in 2012 by the ASN on the non-conformance notification process by sub-contractors, the system was considerably fortified; during on-site visits the authorities were able to confirm "real improvement" in the management of these reports.

Technical exchanges with ASN on the complementary safety assessment (stress test) submitted last year concluded in 2013 with only one recommendation to study particularly extreme climatic conditions such as tornadoes or hailstorms. Some technical prescriptions related to the ITER stress test will be issued by ASN in 2014. The ITER Organization received confirmation that the neutral beam injector, the blanket and the ion cyclotron resonance heater fall outside of ESPN nuclear pressure equipment regulations; approval from the Agreed Notified Body will not be necessary for these components as a result, which will contribute to the acceleration of manufacturing schedules.

Contact was initiated with the safety team at the European tokamak JET to discuss how JET's operating experience could enrich the ITER safety case; the precise form of collaboration remains to be decided.

The Quality Assurance Division continued to promote the close implication of all Domestic Agencies on issues of quality assurance and quality control. In 2013, the Division examined revised Domestic Agency quality programs and maintained an

The anti-seismic bearings and supporting pillars disappear under the formwork and steel reinforcement that was progressively set into place for the next-level slab.

ambitious program of audits to measure compliance with the terms of quality programs, Task Agreements and Procurement Arrangements. Quality Assurance provided support to all Domestic Agencies for procurement activities in complement to a third-party inspection contract. Audits were carried out within the ITER Organization to monitor the effectiveness of quality processes.

The Division continued to manage the ITER Organization Management and Quality Program (MQP) and to update MQP documentation. New documents were issued during the year on quality, procurement, security and export control. Faster review of Domestic Agency deliverable documents was introduced through improvements in the document review process. The ITER Organization-Domestic Agency Safety and Quality Assurance Working Group (SQAWG) met two times in 2013 as a forum for constructive collaboration on safety and quality issues.

Following the implementation of a new procedure governing the notification process for construction and manufacturing non-conformance reports, the Division trained all quality assurance personnel at ITER and in the Domestic Agencies. In addition, an electronic database for deviations and non-conformities was successfully developed with the collaboration of the Project Information System Section that will allow better tracking and follow-up for deviation requests and non-conformance reports.

The Occupational Health & Security Coordination Division (formerly the Health & Safety Control Division) has responsibility for preventing professional injury or illness and malevolent acts on the site. In January, a new contract for medical services was signed that provides first-aid and infirmary care by qualified on-site nurses for the duration of the Construction Phase. The ITER infirmary is now fully staffed and managed 237 consultations during the year. The security contract concluded last year became fully operational and a contract for emergency services is in the planning stages.

The focus in 2013 was to distil safety regulations and reinforce the conditions for an all-permeating ITER Organization-Domestic Agency safety culture

DEPARTMENT FOR ADMINISTRATION (ADM)

The Department for Administration provides services in the fields of human resources, procurement (in-kind and in-cash), finance and budget, information technology, organizational efficiency and document control. It comprises the Directorate for Finance, Budget & Management Systems and the Directorate for General Administration.

Directorate for Finance, Budget & Management Systems (FBM)

The Directorate for Finance, Budget and Management Systems is in charge of ensuring sound financial and budget management; preparing the lifecycle resource estimate of ITER; developing and maintaining information tools; and evaluating and improving the efficiency and effectiveness of management systems.

In 2013, the Finance & Budget Division worked closely with Project Controls and Procurement & Contract to ensure that the budgets of the ITER Organization corresponded to the planned milestones in the 2014 Annual Work Plan. The Division also closely tracked agreed commitment and payment budgets. Through dialogue and recovery actions with the technical directorates, the Division aided in the execution of 89 percent of the commitments and 84 percent of the payments planned for the year.

The principle reason for the difference between commitments and payments execution is the delay in contract execution. Following a survey in January, the Division identified Task Agreements (contracts signed by the ITER Organization or the Domestic Agencies for design or R&D work) as the area with the poorest performance. Finance & Budget supported the Directorates in clarifying the scope of Task Agreements and in monitoring implementation and performance in order to reduce payment underruns in this area.

Improvements were made in the areas of financial management, contract administration, and budgetary and control procedures

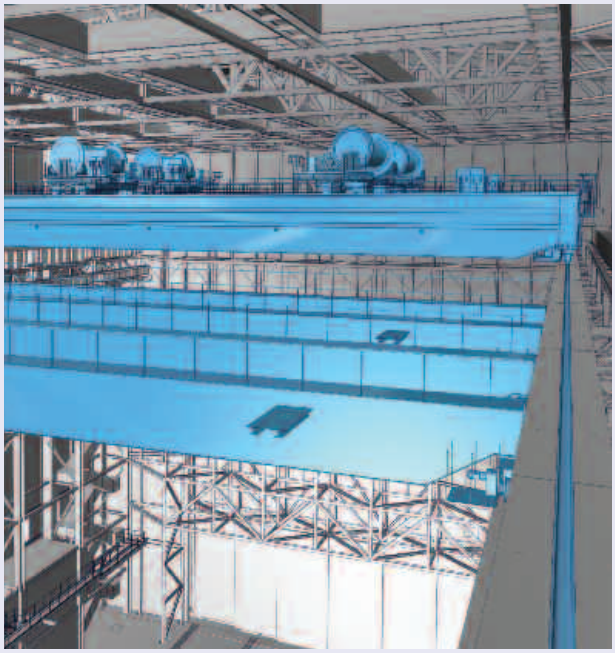
In 2013, the Division produced more than 60,000 transactions directly related to the verification and the execution of commitments and payments, representing an increase of almost 20 percent compared to 2012.

Finance & Budget produced the 2012 ITER Organization Financial Statements in February 2013. The seven-person Financial Audit Board (FAB) came twice to ITER Headquarters during the year – in April to audit the 2012 Financial Statements and in September to conduct an on-site audit of trial balance and internal control processes; these audits led to the certification of the accounts, an unqualified audit report, and a management letter. The FAB recognized improvements in the areas of financial management, contract administration, and budgetary and project controls.

In 2013, major steps were taken to design and set up new processes to help the Domestic Agencies with their European value added tax (VAT) issues. Both the internal ITER Organization system and the French web application (DEFI) have been implemented successfully.

The Project Information Systems Section (IT) finalized the installation of the new ITER Data Centre in 2013 with a modular architecture that is optimized for lowest running cost and maintenance, yet also scaled to meet the growing needs of the project. The previous installation continues to serve as a secondary data centre for critical services.

The Section supported the implementation of a new tool for construction management, SmartPlant®, by creating more than 30 interfaces with ITER's business systems; the rollout of this tool is planned in 2014 with the first assembly activities. IT managed the migration of the CAD database (Enovia V5), the replication system, and continued to enhance the quality and data integration of the Engineering Database.



Four overhead cranes will travel between the Assembly Building and the Tokamak Building during ITER assembly, moving heavy components with extreme precision.

Improvements to ITER's document management tool IDM created a more time-efficient experience for users. The introduction of a new search function, especially, greatly improved access to ITER documentation. Refinements to the data management tool SAP resulted in optimized processes for travel management, management appraisals and – in the realm of budgeting – account assignment. More than 1,000 business information reports were created or updated in 2013 and a new version of the Procurement Arrangement database was released that integrates with SAP for the automatic management of credit requests and credit notes.

After passing the milestone of its ten-millionth object in 2012, eight million new objects were added to the ITER Collaborative Platform ICP. The Section managed a strong increase in the number of wired network users and a near-doubling of wireless clients. The ITER Organization communication infrastructure, including video conferencing and mobile and fixed telephones, was optimized in terms of cost. Within the centralized IT infrastructure, improvements were made to virtualization, storage and deployment. The IT helpdesk handled 8,000 user support and video conferencing tickets in addition to requests related to hardware, software and loans.

The System Management Section continued to drive the improvement program at the ITER Organization to enhance organizational efficiency. In 2013, it led the effort to prioritize and coordinate a response to the project-wide issues and barriers identified by the ITER High Level Coordination Team (IHCT) and coordinated the Issues and Barriers Management Group that was formed to develop targeted response plans. In parallel, the Section carried out root cause analysis to identify the main factors causing schedule slippage/delay and cost increases; for specific issues, Task Forces were initiated to investigate recovery actions.

Early in the year, Systems Management launched a new project improvement initiative. The On-Line Learning Centre, developed with the support of IT, offers staff the chance to share expertise or knowledge for the benefit of the entire community. Over 100 videos were uploaded in 2013 on a wide range of subjects, including the first certification courses offered for newcomers. These modules are a time-efficient way for staff to integrate the ITER Organization or to enhance familiarity with procedures, processes and tools.

The Ideas Network continued to flourish and, in October, a recognition ceremony honoured staff members who had contributed suggestions that were successfully implemented. In addition, the Section monitored the successful and full implementation of the action plan responding to the recommendations from the 2011 Management Assessment.

Directorate for General Administration (GEA)

The Directorate for General Administration is in charge of the preparation of in-kind Procurement Arrangements in close collaboration with the Domestic Agencies; the placement of in-cash contracts through competitive way; staffing policy and management (recruitment, training, appraisal, salary, travel and social insurance); and document management.

Up to 80 operators, engineers and researchers will work from the ITER Control Room during operation.

Fourteen Procurement Arrangements and 12 Complementary Diagnostic Procurement Arrangements were signed by the ITER Organization in 2013 – the most ever completed within one year. Since the first signature in 2007, the ITER Organization has concluded 98 Procurement Arrangements representing 88.4 percent of the total allocated in-kind value of the project.

A web-based tracking system is now available through the Procurement Arrangement Database. This system, developed in conjunction with the Project Information System Section, centralizes access to all information and documents related to Procurement Arrangements and can generate a large number of reports – by date, by unit, by user – on demand.

In 2013, the ITER Organization concluded 844 contracts (including Task Orders and amendments), 55 Task Agreements and 463 purchase orders for a total contract value of EUR 338.9 million and a total commitment value of EUR 151.4 million. In collaboration with the Finance & Budget Division, efforts were made during the year to improve the monitoring and performance of Task Agreements and to clarify their scope as, in this area particularly, delays in contract closure often result in large variance between commitment and payment budgets.

The most important 2013 contracts in terms of value were related to CAD and engineering support for the directorates, covering a large spectrum of resources (mechanical, plant and CAD infrastructure). Other major contracts included central interlock system final design, procurement, commissioning and maintenance; resistive cryogenic thermometers for ITER magnets; and the contract for the extension of ITER Headquarters.

Particular attention was paid to the quality of the technical specifications and the clarity of the requirements within contracts. Overall, the Procurement & Contract Division, together with the technical teams, contributed to major cost savings through the successful negotiation of contracts and the simplification of the procurement process for both in-cash and in-kind.

In view of the large number of contracts managed by Procurement & Contract and a projected reduction in external support in future years, a proposal was made to outsource small-value contracts through a procurement service centre. This proposal, which was endorsed by the Project Board, will allow the ITER Organization procurement experts to focus on the management of large or complex contracts, creating work efficiencies and generating cost savings.

The Human Resources Division supported top management throughout the year to align the resources of the Organization to business needs, to reinforce line

26 signatures were concluded with the Domestic Agencies - the most ever recorded in one year

At the end of 2013, 515 people were directly employed as staff by the ITER Organization

management and to improve the management structure. The new Project Control & Assembly Directorate was created in March and two Chief Engineers were nominated in November. Individual performance objectives were cascaded from ITER Organization strategic objectives and contract renewal campaigns continued in 2013; approximately 130 contracts reached the end of their five-year term and renewal decisions were made based on a business and skill-mix needs analysis for each Directorate.

Human Resources managed 149 appointments and 66 departures. For 115 posted vacancies, the ITER Organization received 3,500 applications through the Domestic Agencies and conducted 400 interviews. At the end of 2013, 515 people were directly employed as staff by the ITER Organization and five postdoctoral researchers worked within the frame of the Monaco-ITER Postdoctoral Fellowship program. Human Resources also managed the integration of 20 visiting researchers from the Domestic Agencies and 15 student interns.

After peaking in 2012, the average age of ITER Organization staff members began to decrease in 2013 as a result of the active recruitment of younger staff and a significant number of staff departures within the age group 60 and above. At the end of the year, the average staff age was 44.2 and the percentage of female staff members was 21.4 percent – the highest yet recorded.

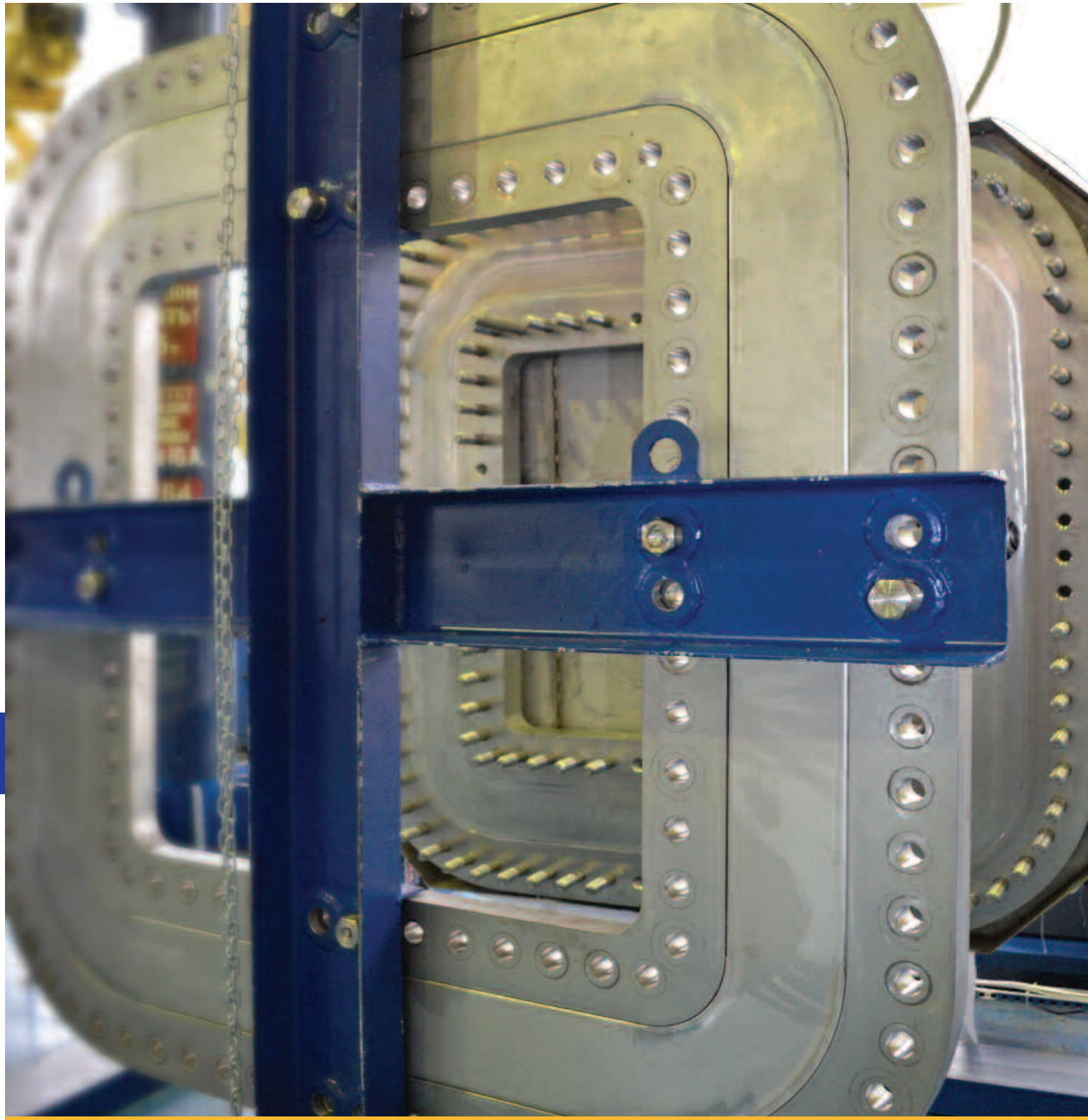
Training sessions were organized in 2013 to reinforce security and nuclear safety culture, strengthen managerial skills and scientific and technical knowledge, and enhance the project's management culture; these sessions benefitted 940 participants for a total of 3,800 hours. The Division supported social dialogue within the Organization through involvement with the Staff Committee, the Advisory Board on Pension and Social Insurance, and the Committee for Health & Safety. In addition, Human Resources coordinated the ITER Organization's relations with the French labour administration. In 2013, the ITER Organization Ethics Committee became fully operational.

The Document Control Section continued to oversee improvements to ITER's document management system (IDM) and provide training and support to users. The team kept the user community abreast of 10 new releases and 37 new features, including enhanced search capabilities, document track changes and bulk workflows. For the Intellectual Property (IP) Board, Document Control assisted as secretary in organizing all meetings and maintained the IP database.

The 200-square-metre ITER library is inaugurated in January.

The ITER library was inaugurated in January. Open daily to all staff, contractors and visitors, the library houses a collection that is particularly rich in the fields of nuclear fusion and plasma physics and offers on-line access to journals, e-books and the ITER library catalogue. A new archival facility now stores all technical documents dating back to ITER's early engineering design phase, historic agreements, and papers documenting 45 years of fusion research; as the project moves forward, the ITER archives will also store the operational records needed to meet regulatory requirements.

In 2013, Document Control continued to assist the Publication Board and oversee the process to manage the review and approval of scientific or technical material released for publication by the ITER Organization. In 2013, the Publication Board and the IP Board coordinated the implementation of a publication procedure and developed publication framework agreements with publishers. Successful negotiations with the International Atomic Energy Agency (IAEA) resulted in a framework agreement for the publication of scientific articles in *Nuclear Fusion*. In collaboration with IT a "pin board" has been designed, modelled after a program in place at the Culham Centre for Fusion Energy (home to the JET Tokamak). When implemented, this tool will allow for peer review of documents in advance of the Publication Board review process.



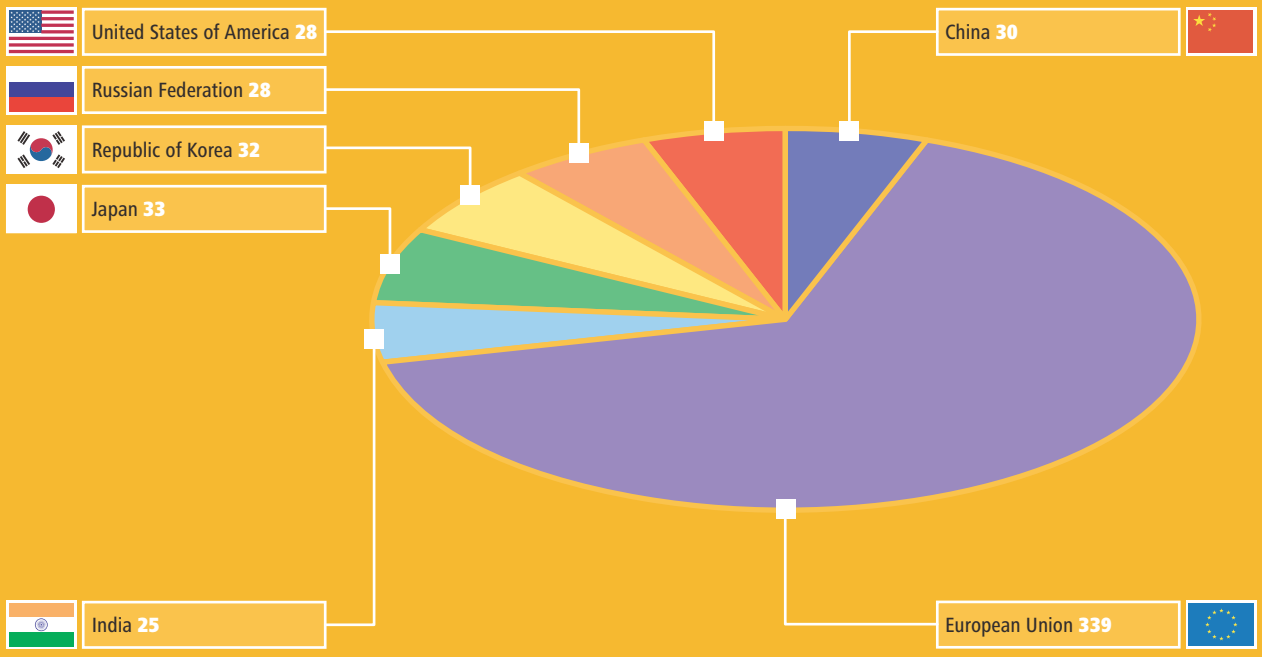
Staffing & Financial Tables

2013

Top left Gasket tests begin for the Port Plug Test Facility in Russia, where ITER port plugs will be submitted to vacuum, heat and functional testing prior to their installation in the machine. ***Photo: ITER Russia*** **Bottom left** A correction coil mockup rests above the vacuum pressure impregnation mould platform at ASIPP in China. Clamps have been attached to maintain the coil's shape while it's wrapped with insulation tape. ***Photo: ITER China*** **Top** The 90 x 130 metre Tokamak Complex Seismic Pit, captured from a worksite crane in September. ***Photo: F4E***

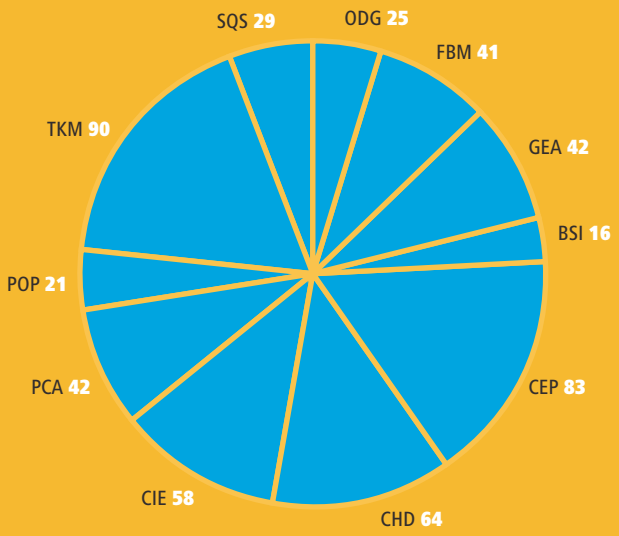
Staffing tables

Staff by Member	31/12/2012	31/12/2013
China	18	30
Euratom	312	339
India	30	25
Japan	35	33
Republic of Korea	30	32
Russian Federation	24	28
United States of America	28	28
Total	**477**	**515**



Staff by Department

as of 31/12/2013**	Professional	Support	TOTAL
ODG	**15**	**10**	**25**
ADM*	**34**	**51**	**85**
FBM	13	28	41
GEA	20	22	42
DIP*	**259**	**117**	**376**
BSI	12	4	16
CEP	54	29	83
CHD	45	19	64
CIE	33	25	58
PCA	31	11	42
POP	18	3	21
TKM	65	25	90
SQS	**19**	**10**	**29**
TOTAL	**327**	**188**	**515**



**In addition to Directorate totals, ADM and DIP totals (in bold) include Department-level staff.*

*** For the full names of organizational units, see pages 15-37.*

Financial tables

Commitments Execution – Cash and In-Kind Task Agreements and Secondments

Amount in kEUR

		Total Commitment Appropriations	De-commitments and Transfers of previous years' Commitments	Total Commitments 2013	Unused Commitment Appropriations carried forward to 2014
Title I	Direct Investment (Fund)	73,763	3,311	63,330	13,745
Title II	R&D Expenditure	7,703	1,888	4,288	5,302
Title III	Direct Expenditure	159,110	8,247	160,140	7,217
Total commitments		**240,576**	**13,446**	**227,758**	**26,264**

Without the IO Reserve

Payments Execution – Cash and In-Kind Task Agreements and Secondments

Amount in kEUR

		Total Payment Appropriations	Total Payments 2013	Unused Payment Appropriations carried forward to 2014
Title I	Direct Investment (Fund)	59,317	47,235	12,082
Title II	R&D Expenditure	15,264	12,794	2,470
Title III	Direct Expenditure	154,102	132,152	21,950
Total payments		**228,683**	**192,181**	**36,502**

Without the IO Reserve

Contributions from Members

Amount in KEUR

	Cash			
	Money	Task Agreements and Secondments	Procurement Arrangements	Total
Members				
Euratom	80,432	8,201	48,609	137,242
China	19,018	726	2,200	21,944
India	17,449	103	11,526	29,078
Japan	17,583	-	23,625	41,208
Republic of Korea	20,475	1,322	39,329	61,126
Russian Federation	18,581	1,042	11,380	31,003
United States of America	17,673	3,219	-	20,892
Total income	**191,211**	**14,613**	**136,669**	**342,493**

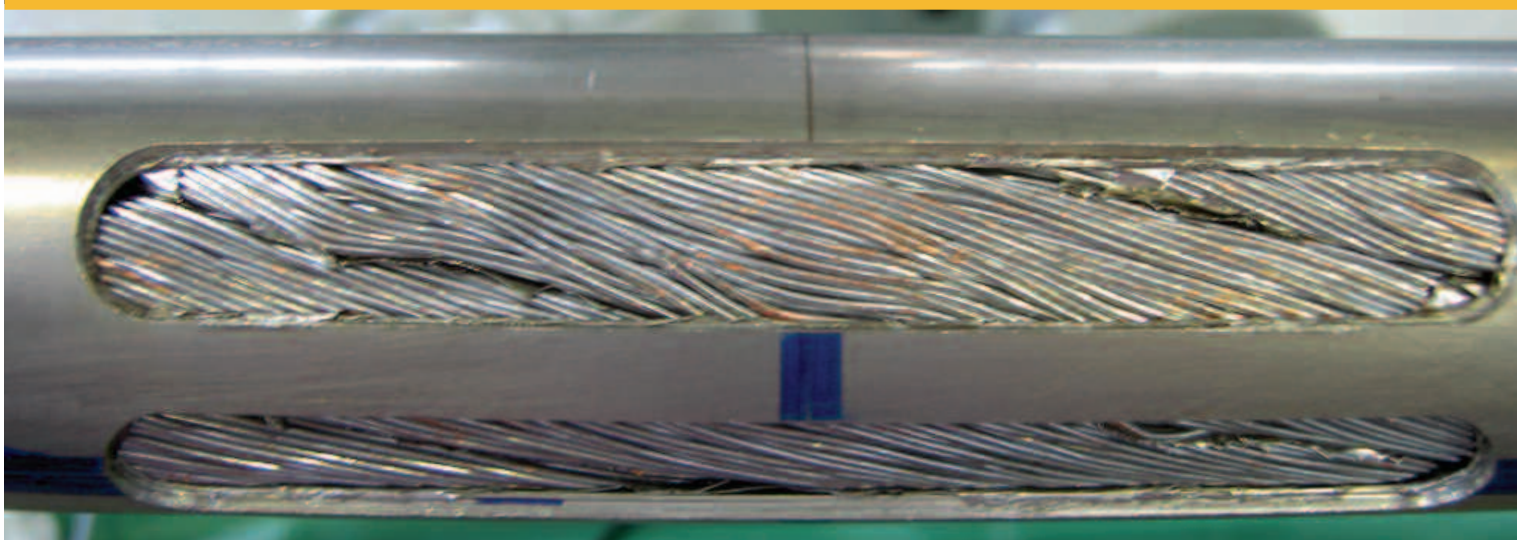
Cumulative In-Kind Payments through 31 December 2013

Total in-kind

	Payments IUA*				Payment in million EUR			
	Secondments	Task Agreements	Procurement Arrangements	Total	Secondments	Task Agreements	Procurement Arrangements	Total
Total In-Kind Member								
Euratom	16,727	19,291	68,550	104,568	25.78	30.82	110.78	167.38
China	-	2,140	3,735	5,875	-	3.41	6.10	9.52
India	-	2,826	11,543	14,369	-	4.41	18.85	23.26
Japan	594	-	58,464	59,059	0.87	-	93.75	94.62
Republic of Korea	271	4,718	26,490	31,479	0.40	7.49	43.77	51.66
Russian Federation	-	1,993	9,355	11,348	-	3.20	15.43	18.63
United States of America	1,531	11,679	8,350	21,560	2.31	18.60	13.36	34.27
Grand total	**19,124**	**42,647**	**186,487**	**248,259**	**29.36**	**67.95**	**302.04**	**399.35**

These tables show tabulations in million Euros which could cause minor differences due to rounding.

** ITER Unit of Account*



Domestic Agency Procurement Highlights

2013

Procurement Highlights key
- R&D and manufacturing milestones
- Major contracts
- IO-DA milestones

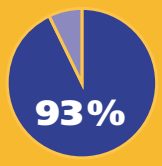
Top left Reinforcement work for the B2 slab begins in May. *Photo: F4E* Bottom left The jacketed cable for ITER's toroidal field coil double pancake prototype has two openings for helium access. In La Spezia, Italy, the first manufacturing step for the prototype – winding – is completed in August. *Credit: Credit: F4E/ASG Consortium* Top China delivers its first goods to ITER in June: 14.5 tons of dummy poloidal field conductor to be used in cabling and coil manufacturing process qualification.

ITER CHINA (CN-DA)

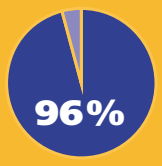
www.iterchina.cn

Procurement Arrangements

Thirteen PAs signed since 2007 representing…



93% in number



…and 96% of the total value of CN in-kind contributions.

CN awards

52 design or fabrication contracts related to ITER procurement have been signed with universities, laboratories and industry.

Chinese procurement highlights 2013

% of ITER system procured by China

Magnet Systems

Toroidal Field Conductor — **7.5%**
- 2 double pancakes completed and sample toroidal field conductor successfully tested at SULTAN

Poloidal Field Conductor — **62%**
- Phase II conductor production completed; 737 metres of dummy conductor for PF5 shipped to ITER
- 5 unit lengths produced for PF5; one sample successfully tested at SULTAN
- 1 unit length produced for PF2; testing underway
- Cooperation agreement reached: China will manufacture PF6

Magnet Supports — **100%**
- Joint work procedure qualification finished
- Full-size gravity support mockup and multi-dimensional loading test frame completed

Feeders — **80%**
- Phase II qualification of components underway
- Process qualification for current leads completed (except insulation)
- 2 CB (corrector busbar) unit lengths completed

Correction Coils — **100%**
- 8 conductor unit lengths delivered to the correction coil manufacturer
- All correction coil manufacturing drawings approved by the ITER Organization
- Winding procedure qualification successfully carried out and approved by the ITER Organization
- BCC (bottom correction coil) and SCC (side correction coil) model cases manufactured and procedures finalized
- Sample test results of extruded materials for SCC and top/BCC correction coil case manufacturing confirmed
- First correction coil MRR carried out by the ITER Organization

Power Systems

Pulsed Power Electrical Network — **100%**
- Contract placed for design and fabrication

AC/DC Converters — **55%**
- Main component prototypes fabricated (converter transformer, converter module and bypass, DC reactor, DC disconnector and local control cubicle)
- Type and routine tests of the main prototype components completed

Reactive Power Compensation — **100%**
- Fabrication and testing of thyristor valve prototype completed
- Contracts for major components (filter capacitor, filter resister, isolation switch, current transformer) signed in November

Blanket

- FDR completed for ITER blanket system

Blanket First Wall — **12.6%**

Blanket Shield — **50.2%**
- PA signed in November

Fuel Cycle

Gas Injection System — **100%**
- Interface review for gas injection system manifold completed
- PA amendment signed in December 2013

Glow Discharge Cleaning — **100%**
- PA signed in December

Diagnostics

Diagnostics — **3.22%**
- Diagnostic amendments signed for Radial X Ray Camera (RXC), Equatorial Port Plug Integration (EQ#12), and Remaining Neutron Flux Monitors
- Design contracts for RXC and EQ#12 Port Plug Integration signed in December

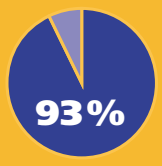
Abbreviations • **ANB** Agreed Notified Body • **CDR** Conceptual Design Review • **DA** Domestic Agency • **FDR** Final Design Review • **I&C** Instrumentation & Control • **IO** ITER Organization • **MRR** Manufacturing Readiness Review • **PA** Procurement Arrangement • **PDR** Preliminary Design Review

ITER INDIA (IN-DA)

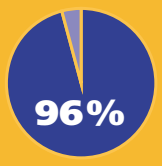
www.iter-india.org

Procurement Arrangements

Fourteen PAs signed since 2007 representing…



93% in number



…and 96% of the total value of IN in-kind contributions.

IN awards

15 design or fabrication contracts related to ITER procurement have been signed with industry and R&D organizations.

India procurement highlights 2013

% of ITER system procured by India

Cryostat and Vacuum Vessel Pressure Suppression System

Cryostat — 100%
- MRR completed for cryostat base section, lower cylinder and weld mockup
- Fabrication activities for cryostat base section in progress
- First batch of cryostat steel plates shipped to manufacturer
- Construction of Cryostat Workshop on the ITER site neared completion

Vacuum Vessel Pressure Suppression System — 100%
- PDR held for VVPSS tank and main venting lines

Cryogenic Systems

Cryolines — 100%
- Mechanical installation of prototype cryoline test infrastructure completed; commissioning in progress

Cryodistribution — 100%
- Contracts awarded for cold circulators and test auxiliary cold box

Heating & Current Drive Systems

Diagnostic Neutral Beam (DNB) Power Supply and Beam Line — 100%

Neutral Beam Test Facility Components — 2%
- FDR for acceleration grid power supply of SPIDER and DNB completed; manufacturing contract awarded
- Manufacturing of beam source and SPIDER beam dump in progress
- Manufacturing of components launched

Ion Cyclotron Radio Frequency Power Sources — 100%
- Manufacturing, factory acceptance testing and site acceptance testing completed for 1.5 MW dummy load
- Manufacturing and factory acceptance testing completed for high power tubes
- Integrated test for R&D local control unit completed
- Manufacturing activities for R&D amplifiers in progress

Ion Cyclotron Heating & Current Drive Radio Frequency Power Supply (8 out of 18) — 44%
- Integration of prototype power supply initiated

Electron Cyclotron High Voltage Power Supply — 30%

Electron Cyclotron Radio Frequency Gyrotron (2 gyrotrons out of 24*) — 8%
- Procurement and infrastructure-related activities for the gyrotron test facility launched
- Prototype filament power supply with custom requirements developed

Cooling Water System

Heat Rejection System, Component Cooling Water System, Chilled Water System — 100%
- Contract awarded for the final design and procurement
- Final design of Lot-1 piping completed; final design for the rest of piping and equipment started
- Manufacturing activities of pipes and fittings in progress

Vacuum Vessel

In-Wall Shielding Block Assemblies — 100%
- Procurement of all in-wall shielding materials completed
- Manufacturing of in-wall shielding plates, support ribs and brackets started
- Contract for third party inspection during in-wall shielding manufacturing placed

Diagnostics

Diagnostics — 3.2%
- Memorandum of Understanding signed for the purchase of port plug structures from a common manufacturer
- Diagnostic amendment signed for X-Ray Crystal Spectroscopy (XRCS) Survey System, Electron Cyclotron Emission (ECE) and Upper Port Plugs 09
- Preliminary design for XRCS sight tube, connection box for ECE and transmission line in progress

* 26 gyrotrons were originally planned for ITER; the number has been reduced to 24.

Abbreviations • **ANB** Agreed Notified Body • **CDR** Conceptual Design Review • **DA** Domestic Agency • **FDR** Final Design Review • **I&C** Instrumentation & Control • **IO** ITER Organization • **MRR** Manufacturing Readiness Review • **PA** Procurement Arrangement • **PDR** Preliminary Design Review

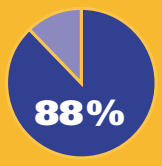
ITER JAPAN (JA-DA)

www.naka.jaea.go.jp/ITER/index.php

Procurement Arrangements

Twelve PAs signed since 2007 representing…

60% in number



…and 88% of the total value of JA in-kind contributions.

JA awards

Over 800 design or fabrication contracts related to ITER procurement have been signed with industry since 2007.

Japanese procurement highlights in 2013

% of ITER system procured by Japan

Magnet Systems

Toroidal Field Conductor — **25%**
- 100% strand, 100% cable and 91% conductor completed

Toroidal Field Magnet Windings (9 out of 19) — **47%**
- Winding line commissioning underway
- Radial plate fabrication advanced

Toroidal Field Magnet Structures — **100%**
- PA signed for all structures in December
- Meeting with supplier for toroidal field structure fabrication; qualification welding trials carried out
- First order for material placed

Central Solenoid Conductor — **100%**
- Central solenoid conductor sample successfully tested
- Manufacturing continued on the conductor to be used in the first of seven central solenoid modules
- Shipped to US-DA: first batch of dummy conductor

Heating & Current Drive Systems

ITER & Neutral Beam Test Facility (NBTF) High Voltage Bushing — **100%**
and accelerator — **33%**
- Manufacturing of large bore (1.56 m diameter) ceramic rings and their brazing with Kovar plates in progress

Neutral Beam Pressure Vessel, Magnetic Shielding — **24%**

Neutral Beam Power Supply System for ITER and NBTF — **59%**
- Contract awarded for manufacturing of all NBTF power supply components

Electron Cyclotron Radio Frequency Power Sources (8 gyrotrons out of 24*) — **33%**
- PA for Electron Cyclotron Radio Frequency Gyrotron signed in September
- Dedicated test facility established for the development of ITER-like control systems

Electron Cyclotron Equatorial Launcher — **71%**

Blanket

In-Vessel Blanket Remote Handling Equipment — **100%**
- PDR for Blanket Remote Handling System held
- R&D program underway to develop the tools

Divertor

Outer Target — **100%**
- High heat flux tests progressing; tests for first set of four plasma-facing units exceed design specifications

Tritium Plant

Atmosphere Detritiation System — **50%**
- R&D task on wet scrubber column system completed
- Support of ITER Organization PDR activity continued
- Discussions on procurement strategy continued

Diagnostics

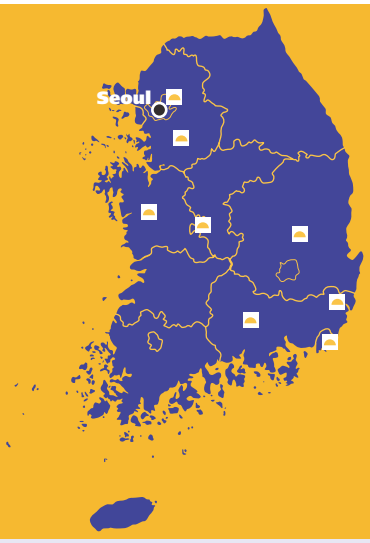
Diagnostics — **14.2%**
- Second round Diagnostics Procurement Arrangement signed in August
- Memorandum of Understanding signed for the purchase of port plug structures from a common manufacturer

* 26 gyrotrons were originally planned for ITER; the number has been reduced to 24.

Abbreviations • **ANB** Agreed Notified Body • **CDR** Conceptual Design Review • **DA** Domestic Agency • **FDR** Final Design Review • **I&C** Instrumentation & Control • **IO** ITER Organization • **MRR** Manufacturing Readiness Review • **PA** Procurement Arrangement • **PDR** Preliminary Design Review

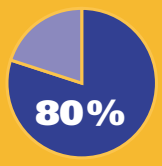
ITER KOREA (KO-DA)

www.iterkorea.org

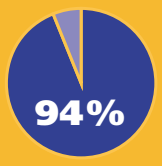


Procurement Arrangements

Eight PAs signed since 2007 representing…



80% in number



…and 94% of the total value of KO in-kind contributions.

KO awards

114 design or fabrication contracts related to ITER procurement have been signed with universities, laboratories and industry since 2007.

Korean procurement highlights 2013

% of ITER system procured by Korea

Vacuum Vessel

Main Vessel (2 of 9 sectors) — **20%**

- Press forming, heat treatment, machining, welding and drilling operations initiated
- Segment manufacturing drawings (with one exception) approved by ITER Organization and the Agreed Notified Body
- Inner shells of upper and lower poloidal segments welded

Equatorial Ports — **100%**

Lower Ports — **100%**

- Manufacturing for lower ports (stub extension) started
- Contract awarded for fabrication of neutral beam port in-wall shielding for the port stub extensions

Blanket

- FDR completed for ITER blanket system

Blanket Shield — **49.82%**

- Pre-qualification program and FDR completed
- PA signed in November

Power Systems

AC/DC Converter — **37.28%**

- Final design for correction coil upper/lower (CCU/L), correction coil side (CCS), vertical stabilization AC/DC converters completed
- Real-time digital simulator (RTDS) test bed developed
- MRR held for steady state electrical network high voltage substation transformers

In-Vessel Coils Power Supply (busbars) — **100%**

Magnet Systems

Toroidal Field Conductor — **20.18%**

- Strand manufacture for toroidal field conductor completed (93 tons over four years)
- 8 of 19 regular double pancakes and 2 side double pancakes produced

Thermal Shield

Vacuum Vessel Thermal Shield and Cryostat Thermal Shield — **100%**

- Thermal shield manufacturing contract awarded
- PDR for manifold and instrumentation held successfully
- Thermal shields material (304LN) purchased; manufacturing initiated

Assembly Tooling

Machine Assembly Tooling — **100%**

- Mockups for IOIS (Intermediate Outer Intercoil Structure) assembly tools manufactured

Tritium Plant

Tritium Storage & Delivery — **81.25%**

- R&D progress on the storage and delivery of tritium; storage vessels tested
- Conceptual design for storage and delivery system reviewed

Diagnostics

Diagnostics — **3.13%**

- Diagnostic amendments signed for Neutron Activation System and Upper Port Plug 18
- Final design for generic upper port plug structure approved

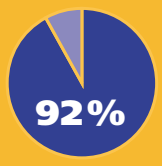
Abbreviations • **ANB** Agreed Notified Body • **CDR** Conceptual Design Review • **DA** Domestic Agency • **FDR** Final Design Review • **I&C** Instrumentation & Control • **IO** ITER Organization • **MRR** Manufacturing Readiness Review • **PA** Procurement Arrangement • **PDR** Preliminary Design Review

ITER RUSSIA (RF-DA)

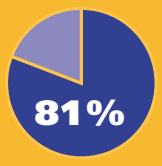
www.iterrf.ru

Procurement Arrangements

Eleven PAs signed since 2007 representing…



92% in number



…and 81% of the total value of RF in-kind contributions.

RF awards

About 30 Russian companies are currently under contract with RF-DA; each of these contracts "pulls" along a chain of contractors and subcontractors.

Russian procurement highlights 2013

% of ITER system procured by Russia

Power Systems

Switching Network, Fast Discharge Units, DC Busbar and Instrumentation — **100%**

- Continued testing of full-scale prototype for coil power supplies (DC busbar, fast disconnector switch, fast open switch and extra protection make switch)

Magnet Systems

Toroidal Field Conductor — **19.3%**

- 13 of 18 regular double pancakes (760-metre unit lengths) and 5 of 8 side double pancakes (415-metre unit lengths) completed
- Shipped to EU-DA: two 415-metre unit lengths
- Shipped to EU-DA: three 760-metre production lengths

Poloidal Field Conductor — **20%**

- Russian-manufactured cable is incorporated in Italy into the first copper dummy conductor for PF1
- First 110-metre European-Russian conductor qualification superconducting dummy manufactured
- Shipped to EU-DA: one 728-metre unit length for PF6 and one 414-metre unit length for PF1
- Contract for SULTAN sample manufacture signed with JSC VNIIKP (Russia) and ICAS (Italy)
- Contract signed for parameterization test

Poloidal Field Magnet 1 — **100%**

- Transportation pontoon arrived at shipyard; winding machine tested

Blanket

- FDR completed for ITER blanket system

Blanket First Wall — **40%**

- Manufacturing technology developed for beryllium first wall siding

Blanket Module Connectors — **100%**

Divertor

Dome — **100%**

Plasma-Facing Component Tests — **100%**

- High heat flux tests performed on plasma-facing tungsten-graphite divertor components from Japan at ITER Divertor Test Facility
- Small-scale models of full-tungsten divertor plasma-facing components tested (12 from Europe and 6 from Japan)

Vacuum Vessel

Upper Ports — **100%**

- Full-scale mockups fabricated (welding technologies; non-destructive radiographic examination; assembly, manipulation and correction jigs; equipment for dimensional control)
- First manufacturing documents and procedures approved by the ANB
- Selection of clean-area workshop for upper ports assembly underway
- Forming procedure qualification started at sub-suppliers with participation of the ANB
- Manufacturing drawings of single- and double-wall parts of the port stub extension (upper ports) completed
- Updated stress report analysis of port stub extension modules (upper ports)
- Manufacturing started on upper ports
- Second batch of 316(L)N-IG forgings for upper port structures manufactured
- Stainless steel 316(L)N-IG plates for upper port structure manufactured

Port Plug Test Facility — **100%**

Diagnostics

Diagnostics — **17%**

- Diagnostic amendments signed for Divertor Neutron Flux Monitor, Thomson Scattering, Equatorial Port 11 Engineering, and Upper Port Plugs 02 and 08 engineering
- PDR held for Neutral Particle Analyzers
- CDR held for equatorial Gamma Ray Camera
- Several contracts awarded for the High-Field-Side Reflectometer (HFSR) system
- HFSR samples of stainless steel waveguides with copper coating manufactured
- Mockups of in-vessel waveguide elements manufactured
- Contracts awarded for the Divertor Neutron Flux Monitor

Heating & Current Drive Systems

Electron Cyclotron Radio Frequency Power Sources (8 gyrotrons out of 24*) — **33%**

- Gyrotron manufactured to ITER parameters (1 MW / 1000 sec.) and tested
- Endurance tests on 2 gyrotrons demonstrated full compliance

* 26 gyrotrons were originally planned for ITER; the number has been reduced to 24.

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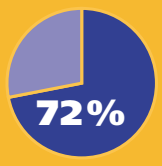
US ITER (US-DA)

www.usiter.org

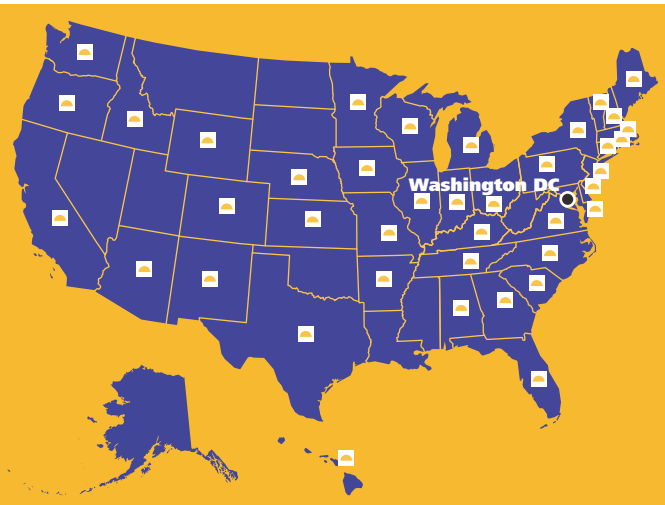
Procurement Arrangements

Thirteen PAs signed since 2007 representing…



72% in number

…and 97% of the total value of US in-kind contributions.



US awards

The US has awarded over 450 design or fabrication contracts to US industry, universities, and national laboratories in 40 states plus the District of Columbia since 2007.

US procurement highlights 2013

% of ITER system procured by the US

Cooling Water System

Tokamak Cooling Water System — **100%**

- Drain tank fabrication and inspections continued, with shipments planned for 2014
- Agreement signed in October: the ITER Organization will complete final design, procure and pre-fabricate piping on behalf of US ITER
- Design documentation review completed; documents transferred to the ITER Organization

Magnet Systems

Central Solenoid Modules, Associated Structure and Assembly Tooling — **100%**

- Module manufacturing building prepared
- Tie-plate feasibility studies completed
- Final design completed for winding, heat treatment and turn insulation stations; preliminary design completed for vacuum pressure impregnation; conceptual design completed for 4 K test facility
- Contracts placed for tooling stations
- FDR held for modules and structures

Toroidal Field Conductor — **8%**

- Strand production completed; quality control tests underway
- 800-metre dummy conductor completed and prepared for shipment
- Production cabling underway

Diagnostics

Port-Based Diagnostic Systems — **14%**

- 4 procurements for design/build of instruments in process
- Continued coordination of port plug sharing with ITER diagnostic partners
- PDR held for Residual Gas Analyzer
- CDRs held for Motional Stark Effect Polarimeter and Core Imaging X-ray Spectrometer

Heating & Current Drive Systems

Ion Cyclotron Transmission Lines — **88%**

- Demonstrated 6 MWs/line for 1-hour pulse
- Fabricated 50/50 hybrid splitter prototype, in-line gas barrier prototypes and 50-ohm and 20-ohm line components
- Contracts placed for test articles of coaxial components and gas barriers, tunable capacitors, radio frequency matching components and cooling gas circulation blowers, data acquisition systems
- PDR held for 50 ohm gallery components and I&C

Electron Cyclotron Transmission Lines — **88%**

- Cooling performance analysis, mode conversion loss reduction studies and alignment metrology and assembly studies underway
- Contracts placed for test articles of waveguide components and power loads, metrology services

Fuel Cycle

Vacuum Auxiliary and Roughing Pump Stations — **100%**

- Delivered vacuum test equipment for vacuum auxiliary system to ITER
- Initiated fabrication of prototype tritium-compatible vacuum roots pump, tritium-compatible vacuum screw pump and prototype roughing pump test stand components
- Continued fabrication of full-size prototype cryogenic viscous compressor (CVC) vacuum pump
- PA signed for Vacuum Auxiliary System (VAS) 2 Supply in May
- PDR held for VAS2 supply
- FDR held for VAS main piping

Pellet Injection System — **100%**

- Pellet and injection technology extended to > 20 Hz
- Reduction of large ELM transient heat loads by a factor of 12 demonstrated
- Long-term testing started on tritium-compatible propellant recycling loop
- PA signed for Pellet Injection System in December
- CDR held for pellet injection system level and flight tubes

Disruption Mitigation System* — **100%**

- Massive gas injection technology developed in the laboratory and tested on working tokamaks
- Shattered pellet injection technology tested in the laboratory and on a working tokamak
- Multiple barrel design under development

Tritium Plant

Tokamak Exhaust Processing System — **88%**

- Task Agreement for the preliminary design support signed with the ITER Organization

Power Systems

Steady State Electrical Network — **75%**

- 8 of 16 SSEN contracts awarded, including high voltage (HV) switches, 22kV switchgear, HV current transformers, HV circuit breakers, HV potential transformers, HV surge arresters, HV substation hardware and HV substation transformers

* The US is contributing 100% of the Disruption Mitigation System up to capped value.

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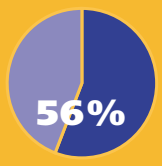
FUSION FOR ENERGY (EU-DA)

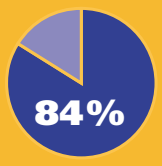
www.fusionforenergy.europa.eu

Procurement Arrangements

Twenty-eight PAs signed since 2007 representing…



56% in number



…and 84% of the total value of EU in-kind contributions.

EU awards

The EU has awarded 410 design or fabrication contracts (56 in 2013) related to ITER procurement to universities, laboratories and industry since 2007.

EU procurement highlights in 2013

% of ITER system procured by the EU

Buildings

Building Construction, Tokamak Pit Excavation and Drainage, Ground Support Structure, Seismic Isolation Pads — **100%**

- Assembly Hall foundation slab finalized
- First concrete for the Tokamak Complex basemat slab (B2) poured
- Completion of contractor's area 2 (CA2) and canteen parking lot
- Contract awarded for HVAC, electrical, I&C, handling items for the Tokamak Complex and surrounding buildings
- Design and build contract awarded for the Magnet Power Conversion buildings and Reactive Power Control building
- Design and build contract awarded for the cold basin and cooling towers, pumping stations, heat exchangers and water treatment facility area

Architect Engineer Services — **45%**

Construction design delivered for the first level of the Tokamak Complex

ITER Headquarters — **53.5%**

- Headquarters building inaugurated in January
- Construction of 3500m² extension initiated

Magnet Systems

Toroidal Field Conductor — **20.18%**

- 86.3 tons of toroidal field niobium tin (Nb_3Sn) strand produced
- Fabrication of six 760m unit lengths and two 415m unit lengths

Toroidal Field Magnet Windings (10 out of 19) — **53%**

- Series production launched on 70 radial plates and 70 double pancakes; 3 portal milling machines installed
- Qualification activities successfully completed: manufacture and testing of six helium inlet mockups; manufacture and testing of one electrical termination joint sample; laser welding and impregnation of one 3m double pancake mockup
- Success in the winding, reacting and first stage of transfer of the double pancake prototype (first full-size double pancake manufactured for ITER)

Pre-Compression Rings — **100%**

- Qualification of composite material and manufacturing processes launched

Poloidal Field Conductor — **18%**

- Two 400m copper dummies for PF1, two 720m copper dummies for PF6, and one 100m superconducting dummy for PF6 produced
- Qualification activities for conductor jacket weld carried out

Poloidal Field Magnets 2-5 — **100%**

- Engineering integrator contract signed and started
- Cooperation agreement reached: China will manufacture PF6

Heating & Current Drive Systems

Ex-Vessel Neutral Beam Remote Handling — **100%**

- PA for Ex-Vessel Neutral Beam Remote Handling Equipment signed in June

Power Supply Heating Neutral Beam — **35%**

- Main manufacturing activities for the source and extractor power supplies completed

Neutral Beam Test Facility (NBTF) — **64%**

- Construction progress on buildings

NBTF Components — **56%**

- First experiments on ELISE Test Facility (Garching, Germany); integrated commissioning completed
- Procurement of SPIDER beam source and vessel progressed; main vacuum vessel hardware completed and tested
- Contract signed for high voltage deck and transmission line for SPIDER

Neutral Beam Assembly, Testing, Active Compensation & Correction Coils — **100%**

Neutral Beam Source and High Voltage Bushing — **41%**

Neutral Beam Pressure Vessel, Magnetic Shielding — **76%**

- PDR held for beam line and beam source vessels, passive magnetic shield and active correction and compensation coils

Ex-Vessel Neutral Beam Remote Handling System — **100%**

Ion Cyclotron Antenna — **57%**

- Faraday screen mockups completed

Electron Cyclotron High Voltage Power Supply — **62%**

- Contract awarded

Electron Cyclotron Upper Launchers — **75%**

- Upper launcher entered final design phase

Electron Cyclotron Radio Frequency Power Sources (6 gyrotrons out of 24*) — **25%**

- Contract signed for procurement of a 1MW short pulse gyrotron

Vacuum Vessel

Main Vessel (7 of 9 sectors) — **80%**

- Manufacturing contract underway; material procurement launched for first three sectors; manufacturing design of sector 5 completed
- Design, CAD activities and stress analysis defined to support design changes

Ex-Vessel Remote Handling Transfer Cask System — **100%**

In-Vessel Remote Handling Viewing and Metrology — **100%**

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FUSION FOR ENERGY (EU-DA) – Continued

www.fusionforenergy.europa.eu

EU procurement highlights in 2013

% of ITER system procured by the EU

Divertor

Inner Vertical Targets — **100%**
- Manufacturing started on armour tiles and plasma-facing units
- Full tungsten divertor requirements integrated into technical specifications

Cassette Body and Assembly — **100%**
- 3 framework contracts awarded for procurement of divertor cassette bodies
- Conceptual design of support frame for transport of cassette body prototypes completed

In-Vessel Divertor Remote Handling Equipment — **100%**
- Competitive dialogue and subsequent tender phase concluded (evaluation pending)

Divertor Rail — **100%**

Blanket

- FDR completed for ITER blanket system

Blanket First Wall — **47.4%**
- Completion of first blanket first wall qualification prototype
- Contract signed for construction of a test facility for high heat flux testing of in-vessel components

Blanket Cooling Manifolds — **100%**
- Contract signed for the manufacture of a partial full-scale blanket cooling manifold prototype

Power Systems

- 3 PAs signed in 2013 for electrical power supply completes system scope

Steady State Electrical Network (SSEN) and Pulsed Power Electrical Network (PPEN): Detailed System Engineering Design and Installation — **100%**
- PA signed in December

Emergency Power Supply — **100%**
- PA signed in December

SSEN Components — **25%**
- PA signed in December

Fuel Cycle

Front End Cryo-Distribution: Warm Regeneration Lines — **100%**

Front End Cryo-Distribution: Front End Cryopump Distribution — **100%**

Cryopumps, Torus (6) and Cryostat (2) — **100%**
- Manufacture of cryopanels and thermal shields for pre-production cryopumps completed
- PA for Front End Cryo-Distribution Warm Regeneration Lines signed in September

Cryopumps, Neutral Beam — **100%**

Leak Detection — **100%**
- Updated leak detection and localization strategy agreed with the ITER Organization

Tritium Plant

Water Detritiation System — **100%**
- Contract awarded for the preliminary design of the water detritiation system (excluding tanks)
- Contract awarded for the final design and procurement of water detritiation system, large tanks

Hydrogen Isotope Separation System — **100%**
- Grant agreement implemented for R&D in support of the isotope separation system conceptual design

Cryoplant

Cryoplant: LN2 Plant and Auxiliary Systems — **50%**
- Manufacturing contract for LN2 plant and auxiliary systems awarded

Diagnostics

Diagnostics — **25%**
- Diagnostic amendment signed for Continuous External Rogowski (CER) coils; FDR held
- Framework Partnership Agreements signed for the Equatorial Visible/IR Wide-Angle Viewing System and the Bolometer
- Framework contract signed for neutron and gamma ray radiation testing services

Radioactive Materials

Waste Treatment and Storage — **100%**

Radiological Protection — **100%**
- PA signed for the Radiological and Environmental Monitoring System in September

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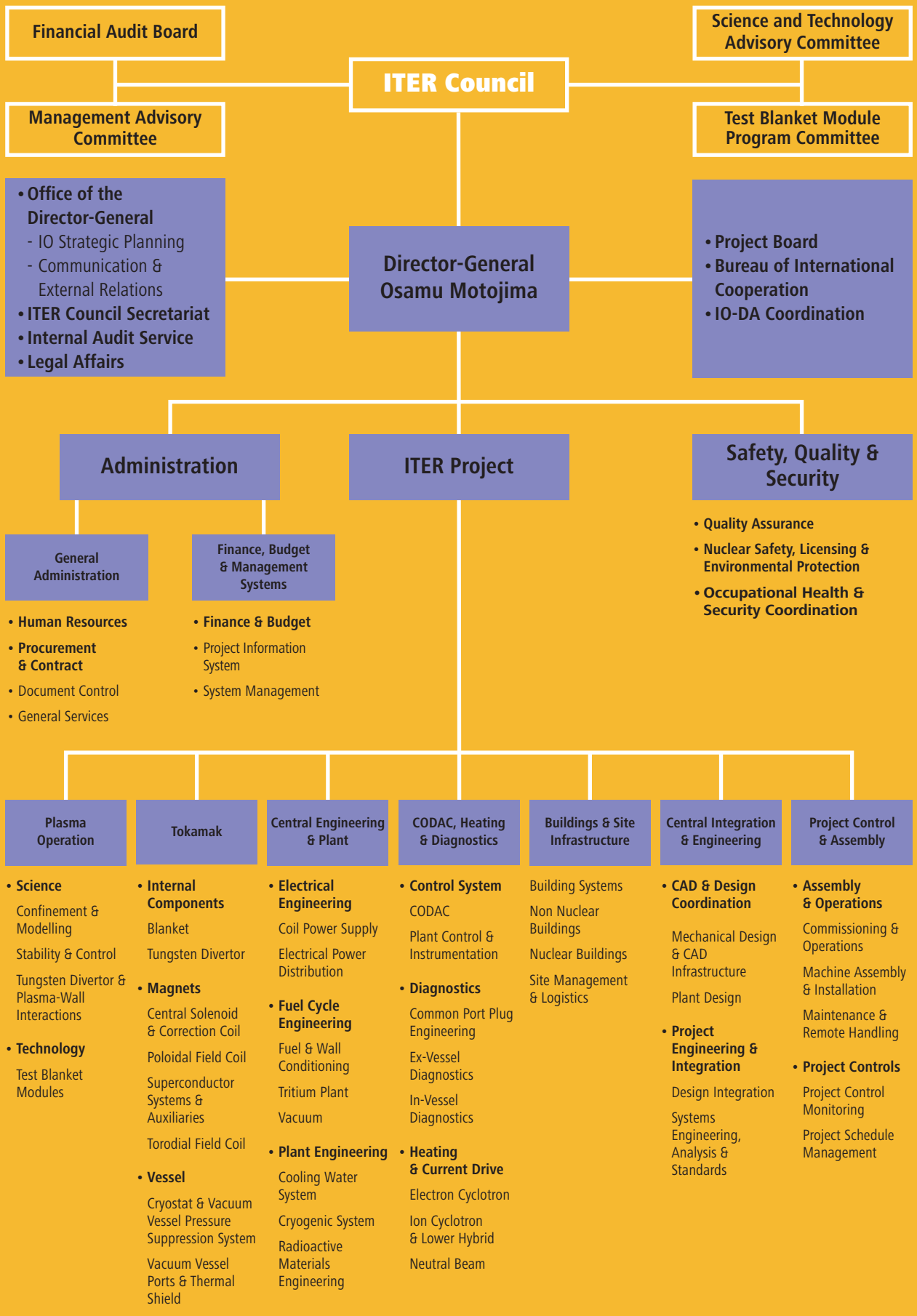
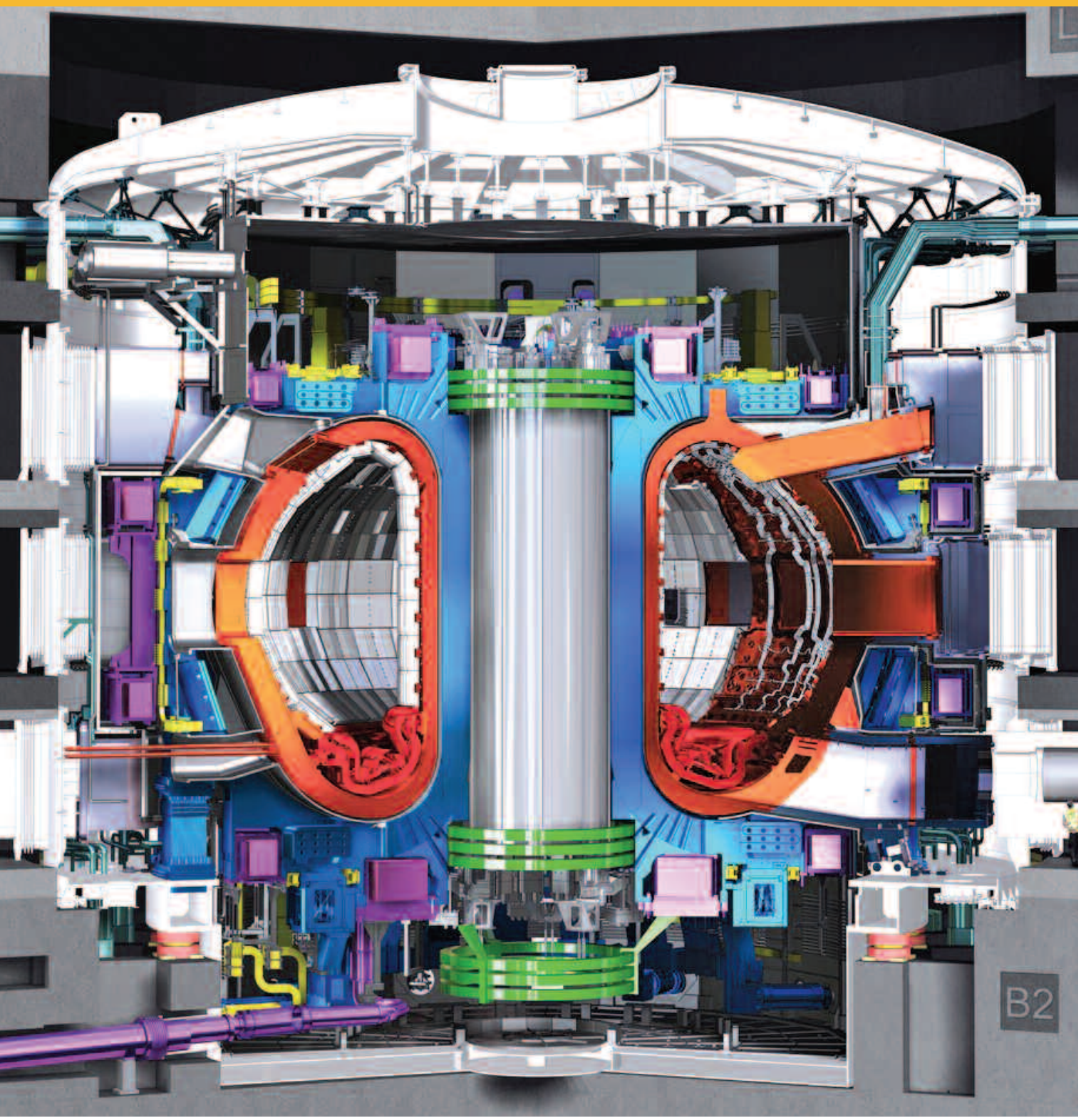
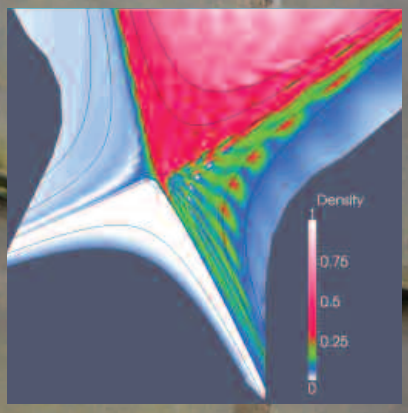
Organizational Structure

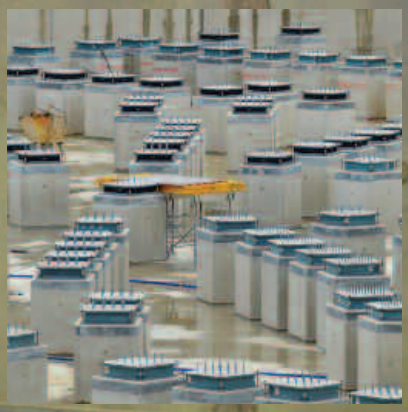


2013

The ITER Tokamak is a complex assembly of many major systems, one million components and – if one were to count every bolt and screw – an estimated ten million individual parts. Surrounding the central reaction chamber are all of the systems that will work in concert to create a 150-million-degree plasma: the powerful magnet systems, as well as heating and current drive, diagnostic, cryogenic, cooling, fuelling, vacuum and power supply systems.







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