

ITER Organization 2011 Annual Report

ITER Organization

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France

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The Year at a Glance

January
Completion of the 104-km ITER Itinerary

February
Excavation work ends on the
90 x 130 m Seismic Pit

15 March
The 30,000th visitor to the ITER site is a
16-year-old high school student from France

14-15 June
Eighth ITER Council held in Aomori, Japan

4 August
Last day of ITER's six-week Public Enquiry

9 August
First concrete poured in the Tokamak Pit

2 September
Staff celebrates ITER Day, commemorating the site
decision that brings the project to France

9 September
Positive outcome for ITER's Public Enquiry:
the Commission issues a favourable opinion

12-16 September
The ITER Organization hosts the 22nd Magnet Technology
Conference (MT-22) in Marseille, France

17 September
The first ITER Games take place in neighbouring
Vinon-sur-Verdon

15 October
Open Doors at ITER – 800 people visit the
construction site

October
Work begins on the retaining walls
of the Seismic Pit

17-18 November
Ninth ITER Council held in Cadarache, France

December
Work ends on the Poloidal Field Coils
Winding Facility

December
74.2% of the project's value committed
through Procurement Arrangements

December
The Seismic Pit basemat is completed

A milestone day for the ITER project: on 9 August 2011 work begins before dawn on the concrete foundations of the Tokamak Complex Seismic Isolation Pit.

ITER Organization 2011 Annual Report

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On segments of completed basemat, the Seismic Pit's retaining walls begin to take shape in October.

Foreword from the Chair of the ITER Council

The ITER Members – China, the European Union, India, Japan, Korea, Russia and the United States – worked closely together in 2011 to surmount many challenges and difficulties. Now in its fifth year, the international collaboration for ITER has reached cruising altitude: the Members know one another well and organizational tools exist to work constructively on the challenges that arise, as they will in any large, international scientific undertaking.

The ITER Organization accomplished important structural work in 2011 to improve the project's management, efficiency, and the processes for cost-control and planning. These changes were timely and necessary. The constraints of realizing the ITER Construction Phase on time and within budget are very great. As the global fusion program's flagship project, the eyes of the world are upon us.

The first concrete was poured for the ground support structure of the Tokamak Complex before dawn on 9 August 2011. Over the next years, 39 buildings and facilities will take their place on the ITER platform. Components of incredible complexity will leave production lines in our Members' factories and take to the sea in the direction of France, where they will be assembled, integrated into the machine, and commissioned. At every stage in the process, the ITER project will be at the vanguard of science and engineering, a powerful testimony to the capabilities of human ingenuity and the ability of nations to collaborate on issues such as energy supply that concern us all.

In the aftermath of the terrible earthquake that struck Japan in March, the ITER Members joined together to mitigate the disaster's effects on the ITER schedule. The close working relationship between the ITER Organization and the Domestic Agencies that was displayed in 2011 is truly the project's most valuable resource in meeting the challenges – expected or unexpected – of building ITER.

My two-year term as ITER Council Chair ended on 31 December 2011. Under my chairmanship the ITER

Baseline, the roadmap for the Construction Phase of the project, was adopted. It has been a very rich and rewarding experience personally, one that has capped a lifelong involvement in nuclear fusion and ITER.

I hope that you'll join me in following the ITER project closely during the exciting years ahead that will lead to the beginning of ITER operation.

Academician Evgeny Velikhov
Chair of the ITER Council





The year 2011 saw the completion of the first building on the ITER platform. In the Poloidal Field Coils Winding Facility, massive overhead cranes will carry charges of up to 100 tons during the assembly of ITER poloidal field coils.

Foreword by the Director-General

Another year has passed, bringing us closer to the aim we are pursuing.

Project-wide effort to finalize designs resulted in the signature of 18 Procurement Arrangements in 2011, each one representing the transfer of work from the ITER Organization to the Domestic Agencies. We will continue to make this a priority because delay in design completion has ramifications all along the procurement chain, affecting the signature of Procurement Arrangements, the conclusion of industrial contracts, and the schedules for manufacturing and delivery.

ITER construction advanced considerably during the year. In 12 months, the basemat, walls and seismic isolation system of the Tokamak Complex ground support structure took shape; the winding facility for ITER's poloidal field magnets was completed; and the structure of the Headquarters building erected. In pace with construction progress, the licensing of the ITER nuclear facility also passed several significant milestones in 2011, including a successful Public Enquiry held in 16 surrounding towns and villages.

The continuous effort to reinforce line management has put the ITER Organization in a strong position to move forward with transparency, clarity and responsibility. Timely decisions have been taken with a view to continued cost-cutting and efficiency, and our working relationship with the Domestic Agencies has been reinforced. Recommendations from the 2011 Management Assessment have also been positively addressed.

In March 2011, the east coast of Japan was hit by a terrible earthquake, followed by a giant tsunami that claimed tens of thousands of lives. As we grieved for the loss and pain of the Japanese people, we also evaluated the impact of the tragedy on our project. Efforts and ingenuity in Japan and at the ITER Organization, as well as strong support from the ITER Members, kept the project within the schedule boundaries of the ITER Baseline and led to the establishment of the new Level-0-Reference Schedule for monitoring the progress of the ITER project.

In facing all of these challenges, we relied on the expert counsel of the ITER Council subsidiary bodies –

the Management Advisory Committee (MAC) and the Science and Technology Advisory Committee (STAC). I wish to salute Academician Evgeny Velikhov, Chair of the ITER Council; Professor Gyung-Su Lee, Chair of the MAC; and Professor Yuanxi Wan, Chair of the STAC for their contributions to the effective managerial and scientific governance of the ITER project.

The torch of ITER was lit some thirty years ago by scientists, engineers, administrators, and politicians who believed that nations could collaborate to harness the energy of the stars and make it available to all mankind. We have been handed this torch, and our responsibility now is to turn the original vision into reality.

As we head into the future, let us remember that what we are building together is not an ordinary project. It is one that could change the course of civilization.

Professor Osamu Motojima
Cadarache, May 2012



Executive Summary

Upon completion of the 20,500-square-metre ITER Headquarters, 500 ITER employees will leave temporary accommodation on the CEA Cadarache and ITER sites for a more permanent "home."

Executive Summary

Schedule transparency, cost containment, and design completion were the priorities as the ITER Organization entered 2011.

Important efforts to reinforce the planning and scheduling strategy for the ITER project led to the implementation of new tools to improve the way the schedule is managed – tools for reporting, tracking, and mechanisms for the recovery of slippage.

The earthquake that struck Japan in March 2011 affected not only one of the Members, but the ITER project as a whole. Solidarity was shown by all ITER Members in seeking alternative plans for the fabrication of schedule-critical items; on the basis of these collaborative recovery efforts, the delay in the First Plasma was contained to one year. The revised date for First Plasma – November 2020 – remains within the boundaries of the ITER Baseline approved in July 2010 by the ITER Council.

Final “profile” blasting is carried out in May on the contours of the Tokamak Complex Seismic Isolation Pit.



Organization

Tightening project-wide collaboration

A restructuring effort to improve the strategic decision-making process of the ITER Organization was finalized in 2011. Recruitment campaigns for top positions ended as the respective heads of the Department for ITER Project, the Department for Administration, and the Directorates took up their posts (see Organization Chart).

Members of the ITER Council maintained plans to hold the Eighth ITER Council (IC-8) in Aomori, Japan only three months after the earthquake, gathering from 14-15 June 2011 in the capital of Aomori Prefecture. The Ninth ITER Council convened in Cadarache, France on 17-18 November 2011 (IC-9); this last meeting of the year was also the occasion to recognize the contribution of Academician Evgeny Velikhov, who completed his two-year term as Chair of the ITER Council on 31 December. The Science and Technology Advisory Committee (STAC) and the Management Advisory Committee (MAC) continued to meet regularly in support of the ITER Council. A Management Assessment was also performed during the year as part of biennial reviews stipulated by the ITER Agreement.

In 2011, several new coordination bodies played an important role in closely associating the Domestic Agencies in the strategic management of the project. The High-Level Coordination Meeting (IHCM), which brings together the heads of each Domestic Agency with top management at the ITER Organization, met by videoconference twice per month. The Bureau of International Collaboration, operational since March, also facilitated regular communication with the Members and their Domestic Agencies.

The ITER Council Working Group on Export Control, Peaceful Uses and Non-Proliferation met in September in Shenzhen, China: as the volume of transactions increases in the coming years, it is critical that systems for handling sensitive information be in place so as not to affect the project schedule. The ITER Organization provided training in export control to nearly all staff and also participated in training sessions organized at the Domestic Agencies. The Export Control Management Board, which deals with export control issues at the ITER Organization, met six times in 2011.

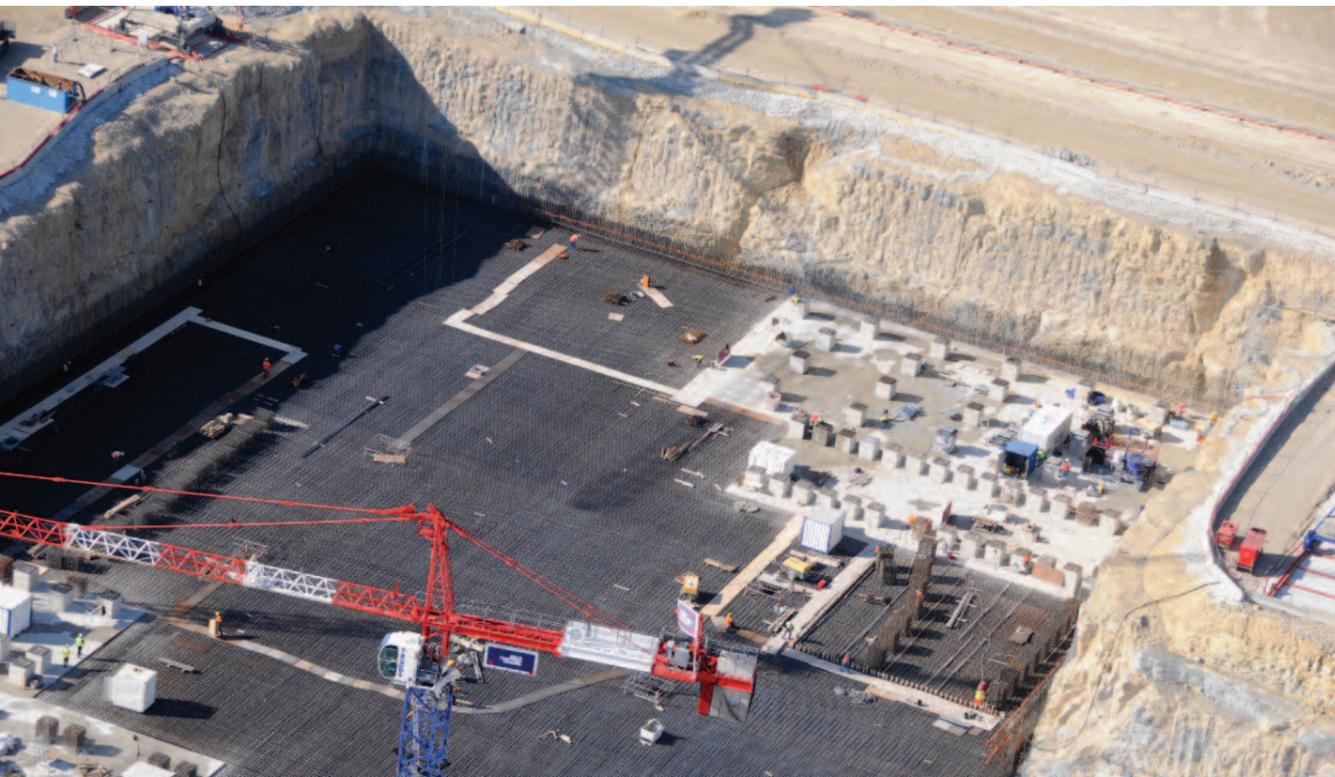
In conformity with the Rules on Intellectual Property Management and Dissemination of Information that were adopted at the Fifth ITER Council in November 2009, an ITER Intellectual Property (IP) Board was established in January to assess all aspects of intellectual property protection within the ITER project. The importance of



ITER Day: In September 2011, staff and management celebrate the 2005 decision by all ITER Members to establish the ITER project in Cadarache, France.

protecting intellectual property generated by the ITER Organization and the Domestic Agencies – and ensuring that knowledge generated is shared among contributing Members – will take on a particular significance as the project advances. The Board established a management procedure to define IP processes and tools; created an IP database; and promoted project-wide IP training. For the first time, two patent proposals related to inventions by ITER Organization staff were submitted to the Board for review.

Legal Affairs, which advises the Director-General and all Departments and Directorates on legal matters, contributed to intellectual property issues during the year, drafting the Intellectual Property (IP) Management Procedure, attending the IP Contact Persons meeting in China in September, and implementing the IP Annex of the ITER Agreement and internal IP rules. Legal Affairs was also involved in the definition of the principles for the delegation of authority within the ITER Organization; the resolution of outstanding intellectual property, liability and radwaste issues related to the Test Blanket Module Arrangement; and the negotiation of the Memorandum of Understanding for the implementation of the Neutral Beam Test Facility activities in Padua, Italy. Legal support was provided for construction activities, safety and security issues, CE marking, and export control. Legal Affairs also participated in the ongoing negotiations with the OECD Nuclear Energy Agency (NEA) on the issue of ITER Organization nuclear liability, and in the negotiations of several scientific collaboration agreements.



In one corner of the Seismic Pit where the basemat has set, workers begin to install the concrete plinths and rubber/metal seismic bearings that will support the weight of the Tokamak Complex and protect buildings and equipment from ground motion in the event of an earthquake.

In 2011, the Internal Audit Service (IAS) issued internal audits pertaining to the Director-General approval process, key inventory management, and the communication process. IAS also performed various management requests and consulting activities, followed up on prior internal audits, and performed an organizational risk assessment resulting in the formation of a three-year Internal Audit Plan.

The ITER Organization signed Memorandums of Understanding during the year with the University of Science and Technology of China to promote cooperation and the training of young fusion researchers; with the National Institute of Fusion Science in Japan for reinforced technical cooperation; and with the Commissariat à l’Energie Atomique et aux Energies Alternatives (CEA) for collaborative research actions in preparation for ITER operation, including the use of CEA’s fusion facility Tore Supra. ITER also initiated a collaboration with the European Erasmus Mundus doctoral program in magnetic confinement fusion where it joins 19 European partner institutions and 9 associated partners from China, Japan, Russia, and the US in offering training opportunities to a new generation of fusion scientists and engineers.

ITER Project Baseline Managing the schedule

Following the earthquake in Japan, efforts focused on maintaining the project schedule within approved funding. In June, the ITER Council formed a Special Task Group (STG) charged with mitigating the impact of the Japanese earthquake and developing a strategic plan for schedule performance recovery based on the input of both technical and policy-level representatives from the ITER Members. The Level-0-Reference Schedule that was presented to MAC in October limited the delay for First Plasma to one year (November 2020) while maintaining Deuterium-Tritium operation in 2027.

The ITER Organization updated lifecycle cost estimates for the Construction Phase of the project and proposed a strategy for the deferral of a number of subsystems or components to the Operation Phase (e.g., heating systems, some diagnostics, hot cell tools, tritium plant systems) to offset Construction Phase cost increases. IC-9 commended the use of deferrals to compensate shortcomings in the ITER Organization construction budget, which remains within the capped value of 4700 kIUA (ITER

Units of Account) without requiring additional Member contributions.

The development of Detailed Work Schedules began in 2011 for the ITER Organization and the Domestic Agencies. In parallel, a top-level summary called the Strategic Management Plan was developed with the agreement of all Domestic Agencies in November: this Plan defines key milestones and provides the basis for schedule performance reviews. These two schedule tools – Detailed Work Schedules and the Strategic Management Plan – will be linked to provide an important tool for the management of the schedule.

As a way to achieve significant savings during the Operation Phase, the ITER Organization proposed a change in the strategy for the divertor. Instead of pursuing the design of two divertors (carbon-fibre for the non-nuclear phase and tungsten for the nuclear phase), investigations into the feasibility of implementing tungsten from the beginning of operations were launched. Based on recommendations from STAC and MAC, the ITER Council recommended pursuing the two designs in parallel and delaying the decision on the tungsten divertor by one to two years.

On the subject of cold testing for the toroidal field coils, the ITER Organization is developing a schedule-compliant plan in line with STAC recommendations. It is also reviewing an alternative plan proposed by Japan, where an ongoing risk analysis may demonstrate sufficient confidence in the performance of the toroidal field coils without cold testing. These results will be reported to the ITER Council.

The ITER Organization adjusted the 2012 Annual Work Plan to the Strategic Management Plan. Annual Work Plans were introduced in 2010 to ensure close cooperation and joint planning between the ITER Organization and the Domestic Agencies.

Construction

First building completed

Construction activity progressed on schedule in 2011. Nearly 450 people were directly involved in the construction of the Poloidal Field Coils Winding Facility and the Headquarters building, and in excavation and foundation works for the Tokamak Complex Seismic Isolation Pit.

In the Seismic Pit, construction teams worked side by side on the reinforced basemat, retaining walls, and concrete plinths and anti-seismic bearings that will support the Tokamak Complex. The first-level basemat was completed in December. By year’s end, 300 of 493 plinths were in place and 150 seismic bearings installed.

The Poloidal Field Coils Facility progressed from two rows of concrete columns and a foundation slab in January to a fully completed structure by the end of the year, complete with heating and cooling systems, interior painting, and heavy-lift bridge cranes. The handover for this building from the building consortium to the European Domestic Agency is planned for January 2012. Work on the ITER Headquarters building, which will house 500 members of the ITER team from the third quarter of 2012 onward, advanced on schedule.

The ITER Organization delegated the overall management of the site in 2011 to Agence ITER France. Beginning 2012, however, the responsibility for facilities management, safety coordination and site security will be shared between the ITER Directorate of Buildings & Site Infrastructure and the Department of Safety, Quality & Security.

Licensing

ITER licensing advances

The ITER Organization passed several licensing steps in 2011 in its bid to become a Nuclear Installation in France (Installation Nucléaire de Base, or INB). The DAC safety files, first submitted to the nuclear regulator in 2008 and declared “receivable” in 2010, were the object of several recommendations on the part of the French Environmental Authority in March. This opened the way to the Public Enquiry, which was held in 13 surrounding towns and villages from 15 June to 4 August 2011. In a major milestone for the ITER project, the Enquiry Commission issued a Favourable Opinion to the Public Enquiry on 9 September 2011.

Also in September, examiners appointed by the Nuclear Safety Authority in France (ASN) completed a 15-month technical examination of ITER’s safety files. Their conclusions became the basis of discussion between the ITER Organization and the



The demanding environment of the ITER plasma is pushing laboratories and industries around the world to develop custom solutions for ITER.

Executive Summary

Groupe Permanent – a group of experts nominated by the ASN. The Groupe Permanent issued a favourable report at the end of the year.

In 2011, the ITER Organization joined with nuclear operators in France to examine ASN requirements for In-Service Inspection (ISI), part of the French Decree 99-1046 on pressure equipment issued during the year. The workgroup seeks to establish a common methodology for obtaining ASN approval for the exemption of ISI requirements for certain categories of components.

Procurement Arrangements

Transferring the work to industry

Since the first Procurement Arrangement signature in 2007, the ITER Organization has committed over 74.2 percent of the project's in-kind value. Procurement Arrangements have been signed in all technical departments at ITER and by all Members. Eighteen Procurement Arrangements were concluded in 2011, bringing the total to 65. The list included the cryoplant, the cryostat, the first diagnostic Procurement Arrangements, and the very last Procurement Arrangements for the ITER magnet system.

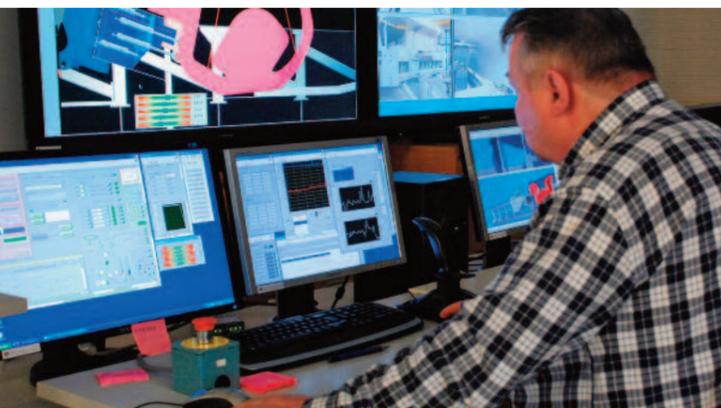
The IHCM conducted a review of Integrated Product Teams in 2011, concluding that these teams effectively facilitate the Procurement Arrangement process up to the signature, after which they should be dissolved.

Manufacturing

Producing components for ITER

Intense activity for the fabrication of superconductors – one of the longest lead items for the project – is underway in all procuring Domestic Agencies. Manufacturers registered 300 tons of niobium-tin

The pinpoint accuracy that will be required to install, or remove, the ITER divertor cassettes is practiced at the Divertor Test Facility in Tampere, Finland.



(Nb3Sn) strand for the toroidal field coils into the ITER Conductor Database. Cabling activities began in five Domestic Agencies and jacketing lines were qualified in China, Europe, Japan, and Russia. Production of niobium-titanium (NbTi) strand for the poloidal field coils continues in Russia. In China, the fabrication of an 800-metre poloidal field dummy conductor is underway for winding trials in Europe.

In 2012, manufacturing activities for the ITER magnets will enter a new phase, as shipments begin from conductor-producing Domestic Agencies to coil-winding Domestic Agencies.

In important qualification activities, Japan completed a one-third scale toroidal field double pancake winding, as well as a set of full-size prototype sections for the toroidal field coil cases. Companies in Europe and Japan successfully manufactured full-size radial plate prototypes for the toroidal field magnets. Winding trials were performed on empty central solenoid conductor jacket sections in the US.

Investigations continued in 2011 to elucidate the causes of unsatisfactory test results for central solenoid conductor samples. New tests showed significant improvement over 2010 results, and qualified one conductor sample for the lower central solenoid module where loads are the least demanding. The ITER Organization launched a comprehensive R&D program to develop a higher performance alternative conductor for testing in 2012 that relies on a different strand manufacturing process: referred to as "internal tin," this process has shown good resistance to mechanical bending loads in individual strand tests.

Full-scale manufacturing mockups were completed in 2011 for the vacuum vessel, the thermal shield, and in-vessel coils. Qualification activities also progressed for magnet feeders, High Temperature Superconductor (HTS) current leads, and correction coil cases. The prototype torus cryo vacuum pump is ready for final approval by the European Domestic Agency in 2012 and subsequent transfer to industry.

R&D

Testing ITER technologies in advance of operation

Tests were carried out during the year on candidate techniques for disruption mitigation in ITER – a choice between transient gas injection and mass pellet injection must be made within the next years. A method for leak localization that involves blanket multi-piping was shown to be a viable technique for localization of first-wall water leaks.

In 2011, the ITER Organization collaborated with the Korean tokamak KSTAR for the demonstration of



Approximately 500 construction workers were active on the ITER platform in 2011; at the peak of construction activity in 2014-2015, this number will rise to 3,000.

CODAC technologies. The ITER-CERN collaboration on machine protection and interlock systems is ongoing; as a result of combined efforts, a prototype interlock system was finalized during the year.

Progress was reported during the year on potential systems for edge localized mode (ELM) control. Experiments at ASDEX Upgrade demonstrated positive results with internal coils, while other techniques for ELM control – such as fast-gas pulses, edge heating and current drive and vertical plasma position oscillations – were explored at the KSTAR Tokamak in Korea.

Work on a facility dedicated to the high heat-flux testing of divertor components at the Efremov Institute in Russia ended in 2011. A second test bed, the Divertor Remote Handling test bed in Finland, was completed with the installation of a Cassette Toroidal Mover.

Finance

Responsible stewardship of public funds

The final total of commitment appropriations for 2011 was EUR 267.52 million to which EUR 8.83 million of de-commitment from previous years' contracts was added and against which commitments of EUR 183.83 million were made, leaving a balance of unused commitment appropriations of EUR 92.52 million to be carried forward to 2012. The payment appropriations for 2011 were EUR 227.97 million. Of this, EUR 183.25 million was paid and EUR 0.79 million transferred to income, leaving a balance of unused payment appropriations of EUR 43.93 million (see Financial Tables).

A shortfall in the execution of the 2010 budgets resulted in budget carried over for use in 2011 in cash commitments (EUR 2.1 million), cash payments (EUR 12.0 million), in-kind commitments (EUR 9.0 million), and in-kind payments (EUR 21.5 million). These carry-forward amounts were added to the budgets requested for 2011 and formed the total 2011 appropriations available for use during the year.

At the beginning of 2011, a number of potential immediate-term risks to the schedule became evident; as a result, a percentage of the annual budgets was withheld from distribution to the ITER Organization Directorates pending a detailed re-evaluation of the 2011-2012 budgets. When this assessment was completed toward the end of the first quarter of the year – and adjustments made to ensure adequate resources were available for critical-path areas – this budget holdback was allocated to the Directorates according to the most pressing schedule needs.

The Financial Audit Board visited the ITER Organization twice during the year. During its April audit of the 2010 accounts, the Board found that the ITER Organization 2010 Financial Statements gave a true and fair view of the financial position of the Organization, in compliance with the Project Resource Management Regulations and International Public Sector Accounting Standards. In a separate letter to management, the FAB also made several recommendations for the enhancement of internal control processes.

Staffing

Stability and excellence

In 2011, staffing levels stabilized: 471 people now work for the ITER Organization as a result of 39 recruitments and 26 departures (see Staffing Tables). Efforts were maintained during the year to improve the staff selection process. The ITER Organization continues to improve balance between directly employed staff and external contractors, and to strive toward proportionality in the nomination of staff from the ITER Members.

The ITER Organization issued a Code of Conduct and a revised version of its Staff Regulations in 2011. The ITER Staff Committee met 30 times during the year and held its annual elections in January. The Committee for Health and Safety held five internal meetings and also met with the French labour administration.

Highlights by Department

In the manufacturing facility for ITER's largest magnetic coils, overhead cranes will move elements of the coils through the three-stage winding and assembly process.

Highlights by Department

Office of the Director-General (ODG)

The Office of the Director-General aims to provide effective assistance to the ITER Director-General in the management of the ITER Organization. The Office is 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.

The Office of the Director-General placed particular emphasis in 2011 on the relations of the ITER Organization with its local environment. Construction activity on the platform is increasing; in just a few years exceptional convoys transporting ITER components will be a regular occurrence in the local landscape. Regular contact with local decision-makers is important for creating goodwill and a better understanding of the project.

The Director-General and the Head of Communication met with the mayors of surrounding communities and received several regional politicians for on-site visits. A first-ever Open Doors event was held in October for the local population as well as for ITER families: some 800 people were able to view construction progress during a one-hour, free bus tour. Another 250 people – sportsmen and women – participated in the first ITER Games that brought ITER staff into friendly competition with members of the sporting clubs of St-Paul-lez-Durance and Vinon-sur-Verdon, ITER's closest neighbours. Due to the success of both of these events, planning is already underway for 2012.

The first ITER Day on 2 September 2011 celebrated the anniversary of the site decision that brought the ITER project to Cadarache. Staff assembled in the near-completed Poloidal Field Coils Winding Facility to reflect on six years of progress; for many, it was also a way to see construction progress up close. A group boat tour was also

In 2011, lines were qualified in China, Europe, Japan and Russia for the jacketing of ITER's niobium-tin superconductors (pictured: Europe).



organized in Marseille for staff and families, one of several measures taken during the year to reinforce communication between ITER management and staff.

In an increase of eleven percent over the preceding year, nearly 13,000 people passed through the ITER Organization Visitors Centre in 2011. The Office of Communication received television crews from Spain, Switzerland, Canada, France, Russia, and Qatar and handled over 100 media requests. The *ITER Newsline* – ITER's weekly on-line newsletter that has been published since October 2006 – celebrated its 200th issue in November. In collaboration with the Assembly and Operations Division, Communication also produced a six-minute video on the first phase of ITER assembly. A Communication Strategy for the ITER Organization was endorsed by the ITER Project Board in July.

The Office of the Director-General continued to act as a liaison between ITER staff and the international school in Manosque, which was officially inaugurated as the Provence-Alpes-Côte d'Azur International School in January.

DEPARTMENT FOR ITER PROJECT

The Department for ITER Project (DIP) is composed of six technical directorates responsible for the construction of the ITER device. 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 and also interfaces with the Domestic Agencies. At all times, the Department tracks cost-saving and cost-containment solutions throughout its Directorates.

Directorate for Central Integration & Engineering (CIE)

The Directorate for Central Integration & Engineering is responsible for the assembly and operation of the ITER machine, the updating of Computer-Aided Design (CAD) files/design activities for all components, technical integration, and systems analysis and systems standards.

The year began in the DIP Directorate with a comprehensive evaluation of internal roles, responsibilities, and organizational structure with the aim of improving procedures, especially those pertaining to engineering processes. A CIE Task Force composed of representatives from Members' industry made suggestions that strengthened the CIE Directorate in five areas: cost estimating and scheduling; organization; interface control and



Close-up of a compacted sintered joint developed for the central solenoid magnet system. Individual superconducting strands, interspersed with copper strands, surround the central cooling channel. Photo: US ITER

management; system engineering; and design process simplification.

The Directorate tracked schedule milestones against the ITER Baseline and developed solutions for improving the usability of the planning and scheduling system. A simplified mechanism now measures monthly schedule performance against the Strategic Management Plan and generates a Schedule Performance Index that incorporates work performed both in the Domestic Agencies and by the ITER Organization – an important tool for identifying delays and slippage against the schedule.

The CIE Directorate, in concert with the Project Information System Section, led the effort on the development of an Engineering Database that will facilitate the management and accessibility of the huge amount of engineering data generated by the ITER project. The database links directly to the Design Office's CAD database so that updates are immediately reflected. This ambitious project will be ready for launch in early 2012.

Following the successful completion of the conceptual design review in March, the Port Plug Test Facility Procurement Arrangement was signed with Russia. In support of port plug design, R&D carried out during the year demonstrated the feasibility of the welding and cutting of the vacuum lip seal. The Assembly & Operations Division signed a second Procurement Arrangement in December – In-Vessel Remote Handling Blanket with Japan – for the remote replacement of blanket modules during machine maintenance.

In July, the Division participated in Korea's preliminary design review for assembly tooling. Preparatory work for two large assembly contracts also progressed: the vacuum vessel welding and

assembly contract (including the development of custom tools) and the contract for systems to support machine assembly and installation activities, materials management, maintenance, and operations. These should both be ready for signature in 2012.

Detailed planning work accelerated in 2011 for machine assembly and plant installation following the signature of a framework contract for engineering support. A series of actions were launched to study the feasibility of transferring certain on-site installation tasks from the Domestic Agencies to the ITER Organization in the interest of cost and schedule. In collaboration with Communication, the Assembly and Operations Division produced a six-minute video on the first phase of ITER assembly. A follow-up video is in the planning stages.

RAMI (Reliability, Availability, Maintainability and Inspectability) analyses were carried out in 2011 for diagnostics, central interlock and central safety systems, and the cryoplant. This brings the first iteration of RAMI analysis to a close: since 2008, some 27 ITER plant systems have undergone analysis. The next phase of RAMI and standardization will heavily involve the Domestic Agencies and suppliers.

An engineering support framework contract was prepared for signature in the area of machine operations' related systems and human factors. Once signed in 2012, this contract will cover the implementation of the ITER Human Factors Integration Plan, the definition of requirements for instrumentation and control for investment protection and safety functions, and the design of the ITER access control system.

The Divertor Remote Handling Test Platform was fully operational in 2011 following the installation of a Cassette Toroidal Mover to demonstrate the remote

Highlights by Department

installation and exchange of all ITER divertor cassettes. The Remote Handling Section launched a contract for a standard control room work cell to promote standardization across a wide range of remote handling maintenance tasks. The Section also held the conceptual design review for the in-vessel transporter, which will be used for the replacement and transport of blanket modules.

The CAD and Design Coordination Division managed the CAD design infrastructure, which involves 230 users on the ITER site and approximately 190 users at the Domestic Agencies. Compared to past years, the ITER Organization now transfers CAD models at an earlier stage to Domestic Agencies and industry, leaving greater freedom for design finalization. The Division worked to improve the CAD database structure and the data exchange process for better traceability and overall quality: the extraction of 3D models for transfer to the Domestic Agencies or suppliers is now accompanied by quality assurance measures and compliance with the CAD manual and consistency with configuration models is verified through quality reports issued by CAD and engineering contractors. To support ITER Organization design efforts, a call for tender was launched for an eight-year design support contract beginning mid-2012.

The Building Integration Task Force focused its efforts on ensuring that all the elements of the Tokamak Complex – including penetrations, pipes, ducts, and cable trays – were correctly defined in construction design documents for the start of tender design. The Task Force's efforts were very successful: by October, design integrations reviews had been held for every level of the Tokamak Complex and the

Taping of fourth-stage toroidal field cable at New England Wire Technologies, a contractor for US ITER. Photo: US ITER/New England Wire Technologies



floor-by-floor data was transferred to the Architect Engineer for the verification of all loads and forces in preparation for concrete pouring activities. Significant technical integration work was accomplished to resolve all issues.

The Technical Integration Division held an in-cryostat design integration review to verify all interfaces, met with the French nuclear regulator to discuss codes and standards for components that are part of the first confinement barrier, and prepared seismic reaction loads for the Architect Engineer.

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 internal components, the vacuum vessel, and the magnets.

Design activities continued in 2011 in pursuit of a single purpose: finalizing the designs of the “critical path” components needed for the first phase of ITER assembly. The Directorate held design reviews for the vacuum vessel pressure suppression system, diagnostic first wall, blanket manifold, wall-mounted blanket modules, and thermal shields. It also participated in the preliminary design review for the central solenoid that was held in the US in September. The last Procurement Arrangements for ITER's magnet system were completed in 2011 with the signature of Magnet Feeders with China and Poloidal Field Magnet 1 with Russia. The Directorate also concluded the Cryostat Procurement Arrangement with India.

The Internal Components Division launched the ITER Organization-Domestic Agency Divertor Meeting in 2011 to discuss quality and production issues, as manufacturing activities have begun in Europe, Japan, and Russia on the first divertor components. A facility for the heat-flux testing of the plasma-facing divertor components was completed in 2011 at the Efremov Institute in Russia.

Pending a decision on the strategy for divertor plasma-facing material, the Division pursued design work related to the tungsten (W) divertor in close collaboration with the Plasma Operation Directorate. Manufacturing activities for the carbon-fibre (CFC) divertor continue in Japan and Europe, awaiting firm conclusions on W-divertor performance issues.

The Blanket Integrated Product Team continued to coordinate the design of the 440 ITER blanket modules and attachments (30 main variants and more than 100 minor variants) – a tremendous effort that was endorsed during the preliminary design review at the end of 2011. Design finalization is

particularly challenging, as requirements must be met without affecting interfaces with components already under procurement.

On behalf of the French nuclear regulator, the Agreed Notified Body approved the design of the vacuum vessel regular sectors during the year. Pre-manufacturing activities are ongoing in Europe and Korea to verify manufacturing feasibility and develop manufacturing design and fabrication procedures. Procurement of plates and forgings is underway and the first 316L(N)-IG plates were received in Korea to begin qualification and production activities. During a last-stage Manufacturing Readiness Review held at the Indian Domestic Agency for the in-wall shielding blocks, clearance was given for the start of manufacturing. Pre-qualification activities for the cryostat manufacturing contract have also begun. The detailed design of the thermal shields progressed in 2011 based on returns from the final design review.

The production of niobium-tin (Nb₃Sn) superconducting strands for the toroidal field magnets is ongoing in all six procuring Domestic Agencies: global production now approaches the 300-ton mark, or two-thirds of the 460 tons required for ITER. Five Domestic Agencies began cabling activities during the year and jacketing lines were qualified in China, Europe, Japan, and Russia. Production of niobium-titanium (NbTi) strands for poloidal field coils 1 and 6 is underway in Russia; approximately 50 tons have been manufactured and a portion supplied as cable to Europe for jacketing. China began the production of 800 metres of poloidal field dummy conductor destined for winding trials in Europe.

Three companies successfully manufactured full-size radial plate prototypes for the toroidal field coils in 2011 – one in Japan and two in Europe. Construction of the European toroidal field winding facility is well advanced in La Spezia, Italy where tooling is being installed and commissioned. In 2011, Japan completed a one-third scale toroidal field double pancake winding (heat treatment and impregnation), as well as a set of full-size prototype sections for the toroidal field coil cases.

The Magnet Division organized the Conductor Meeting twice during the year with the Domestic Agencies and their industrial partners. Handover procedures from conductor-supplying Domestic Agencies to coil-winding Domestic Agencies were discussed and agreed.

Tests run on central solenoid conductor samples in 2011 showed significant improvement with respect to the tests carried out in 2010, but remained under specification. A proposition to use this conductor in



The mockup section of a toroidal field coil case. Photo: Toshiba, Keihin Product Operations, Yokohama, Japan.

the lower central solenoid module – where loads are the least demanding – was accepted. The ITER Organization is pursuing the development of a higher performance alternative conductor using internal tin strands that will be tested in 2012.

Important qualification activities were carried out in 2011 for ITER's smaller coils: the Chinese Domestic Agency selected a material supplier and a welding process for the correction coils, while in Canada and China suppliers successfully fabricated the largest stainless sheath mineral insulated conductor ever produced in the world during pre-qualification activities for ITER's in-vessel coils.

The ninth High Temperature Superconductor (HTS) working group met in Cadarache in March and fully endorsed the design of ITER's HTS current leads, allowing manufacturing of mockups to proceed at ASIPP, China. These manufacturing mockups will test the high voltage and thermal aspects of the design before the construction and testing of full-scale prototypes at the end of 2012. For ITER's magnet feeders, trial fabrication of critical components has ended and manufacturing preparation, including construction of special purpose facilities, is underway.

The ITER Organization, through its Magnet Division, organized the 22nd Magnet Technology Conference (MT-22) in Marseille in September. Over 1,000 participants and a record number of abstracts contributed to making the event a success.

Highlights by Department

Directorate for CODAC, Heating & Diagnostics (CHD)

The Directorate for CODAC, Heating & Diagnostics has responsibility for three systems essential to the correct and safe operation of the ITER Tokamak and the execution of the ITER physics program: control, data access and communication (CODAC), which gathers and analyzes data and sends signals to other Tokamak systems in order to control the plasma; the heating and current drive system, which adds heat and current to the plasma so that fusion conditions can be initiated and maintained; and diagnostic systems, which measure and optimize plasma performance.

The design and procurement of ITER's diagnostic systems moved forward significantly in 2011 with the signature of Diagnostic Procurement Arrangements with China, Europe, Korea, Russia, and the US. These Procurement Arrangements covered the procurement of five distinct diagnostic systems, as well as design work on the magnetic electronics and software that these systems will require. The preliminary design review for the generic port plug was also successfully completed in 2011.

The Heating & Current Drive Division concluded Procurement Arrangements with India for the Ion Cyclotron Heating & Current Drive Radio Frequency Power Supply and with Japan for the Neutral Beam High Voltage Bushing, bringing the CHD Directorate total to seven for the year.

Design work is ongoing for the Neutral Beam Test Facility (NBTF) components – these components are the same as those that will be used on ITER's heating neutral beams. Bilateral agreements were signed between the ITER Organization and the European Domestic Agency and between the European Domestic Agency and the Italian consortium Consorzio-RFX for the test facility, which will be constructed in Padua, Italy in 2012. Design reviews were held for the neutral beam front-end components, the SPIDER beam dump, the MITICA high voltage bushing, and the diagnostic neutral beam source and power supplies.

Europe, India, Japan, and Russia continue to develop prototypes for the ITER gyrotrons that will deliver heating power to the plasma. The first gyrotron Procurement Arrangement is expected in early 2012. Representatives from the four procuring Members participated in the conceptual design review in June for the electron cyclotron resonance heating system and the high-tension power supplies that will be required by the gyrotrons. The electron cyclotron subsystem preliminary designs are advancing: closure for the preliminary design of the upper launcher was achieved in 2011 and the

preliminary design review for the transmission line was held in December.

The CODAC Division released the 2011 edition of the ITER Plant Control Design Handbook, which is a comprehensive set of guidelines for end users. A new version of the CODAC Core System – a software package allowing the plant system developer to implement and test the local control system – was also released. Currently 42 organizations representing all ITER Members have requested and installed the CODAC Core System. The Division organizes regular hands-on training sessions for plant system developers at the Domestic Agencies and industry.

The CODAC Core System includes Mini-CODAC, which will be the official tool to execute factory acceptance tests, and which was successfully installed in 2011 to monitor the use of power on the ITER construction site. A two-year collaboration in CODAC is underway with the Korean tokamak KSTAR to test and demonstrate CODAC technologies. The Division also collaborated with ASIPP in China, CIEMAT in Spain, and ISPN in Portugal on demonstrations of the fast controller prototype.

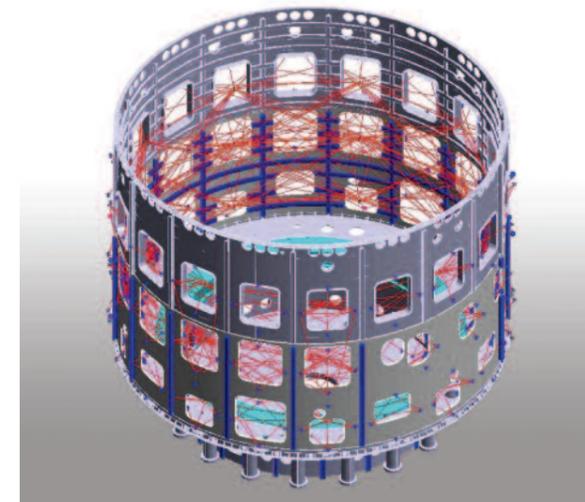
As a result of the ITER-CERN collaboration on machine protection and interlock systems, a prototype interlock system was finalized at the end of the year.

Directorate for Buildings & Site Infrastructure (BSI)

The role of the Directorate for Buildings & Site Infrastructure is to ensure that all ITER project facilities are designed and constructed according to ITER Organization requirements in a timely and cost-efficient manner. BSI works closely with the Licensing Cell and Safety Controls Section to implement processes and procedures that ensure compliance with the 1984 Quality Order and recommendations from the French nuclear regulator. The Directorate also interacts with the European Domestic Agency, responsible for the detailed design and construction of the site infrastructure and buildings, and Agence ITER France.

Due to the intensity of construction activities on the platform in 2011 and the tight deadlines for the completion of construction designs for other buildings, the Directorate handled an increasing number of requests for engineering data from the Domestic Agencies, the Architect Engineer for buildings, and other departments and divisions at ITER. The BSI Directorate strived to improve the workflow of the Request for Information (RFI) process: during the year more than 700 RFIs from the Architect Engineer were processed.

Members of the BSI Directorate played a lead in the Building Integration Task Force created in April,



Sophisticated measuring systems will be used during ITER assembly to ensure that the principal components and systems are aligned within tolerances of 1-3 millimetres.

which focused its efforts on ensuring that all the elements of the Tokamak Complex were correctly defined in construction design documents for the start of tender design. Identifying possible cost savings related to buildings continued to be a significant preoccupation for the Directorate.

The excavation of the Tokamak Complex Seismic Isolation Pit to 17 metres was completed in April. During the eight-month excavation process, contractors removed 210,000 cubic metres of topsoil and rock and completed final rock profiling and substrata investigations. Excavation works for the Hot Cell Facility were also finalized during the year.

Work began in May on the ground support structure and seismic isolation system for the Tokamak Complex – the first nuclear building construction on the platform. First, a thin layer of concrete “blinded” the rock face of the Tokamak Pit and created a level surface for nearly 3,500 tons of steel reinforcement. In an important milestone for the ITER project, the first concrete was cast for the Tokamak Complex basemat on 9 August 2011. Twenty-one 12-hour “pour days” in all, spaced between August and December, were necessary to complete this 1.5-metre-thick lower foundation.

Approximately 300 out of 493 concrete plinths were in place by year's end. The Tokamak Complex seismic isolators, or bearings, were delivered to the worksite and 150 installed. Work on the concrete retaining walls of the Tokamak Complex began in October. The final design review for the civil engineering works of the Tokamak Complex was completed – this tender is planned for signature at the end of 2012.

Under a Site Adaptation contract awarded by the European Domestic Agency, work began in 2011 on

road networks, on-site drainage, and infrastructure for a new contractors' area. Procedures for safety, security, and access to the site for the more than 3,000 workers expected in 2014 will also be managed under this contract. The French electricity network RTE started on the installation of the 400kV switchyard during the year under the management of Agence ITER France for the Host state.

Work progressed as planned on the permanent Headquarters office building that is scheduled for delivery in July 2012. The BSI Directorate began to make plans for the future catering service, the allocation of office space, and furnishings in time for five-hundred ITER staff to move into the building during the third quarter of 2012.

The year ended on a very positive note with the on-time completion of the Poloidal Field Coils Winding Facility in December. This first building on the ITER platform is a very visible sign to the outside world that ITER construction is underway. As part of the building contract, the facility was equipped with a 25-ton overhead crane and an additional 50-ton overhead crane plus spreader beam.

As the management of the ITER site by Agence ITER France came to an end in 2011, a Site Management Section was created as part of the BSI Directorate. The overall management of the ITER site – including facilities management, safety coordination, and site security – is now undertaken by BSI and the Department for Safety, Quality & Security. During the meeting of the Site Support Agreement Liaison Committee, agreements were signed relative to the access of Agence ITER France to the Headquarters worksite, and to the use of the CEA security services by the ITER Organization.

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 the following systems: cooling water, cryogenics, hot cell, radwaste, fuelling and wall conditioning, tritium, vacuum, and the steady state and pulsed electrical power supplies.

Procurement accelerated in the CEP Directorate in 2011 with the successful conclusion of six Procurement Arrangements. The Switching Network, Fast Discharge Units, DC Busbar & Instrumentation Procurement Arrangement was signed with Russia; AC/DC Converters with Korea; Vacuum Auxiliary Systems (early delivery) with the US; AC/DC Converters and Reactive Power Compensation &

Highlights by Department

Harmonic Filter with China; and Liquid Nitrogen (LN2) Cryoplant and Auxiliaries with Europe.

The Cooling Water Section focused on the final project change requests and the verification of design documents for the cooling water system, which must be ready for the first commissioning phase of the ITER Tokamak. The cooling water preliminary design review is scheduled in early 2012 for both the Indian and US Domestic Agency scope. The final design review for four large drain tanks, part of the Tokamak Cooling Water System, was held during the year by the US Domestic Agency – these tanks will be the first components delivered to the ITER site in 2014.

The signature of the Cryoplant Procurement Arrangement in June was a major milestone for the Cryogenic System Section. Conceptual design reviews were held for the cryolines in February and for cryodistribution in July. The Call for Tender for the direct procurement of the liquid helium (LHe) cryoplant was launched in the autumn 2011, with contract adjudication expected in 2012.

The Hot Cell and Radwaste Services Integration Section continued to optimize the design of a safe Hot Cell Facility for ITER and visited other facilities to benefit from their experience. It also completed the layout of the Radwaste Facility during the year. The Radwaste Treatment and Storage Section continued with the development of the conceptual design of the radwaste management system and provided support to the ITER licensing process.

Work continues on an effective disruption mitigation strategy for ITER. Although the vacuum vessel and in-vessel components have been designed to withstand about 3,000 disruptions during their lifetime, high energy loads during disruption can reduce the lifetime of plasma-facing components such as divertor targets and first-wall panels. Testing is ongoing at the DIII-D Tokamak for a pellet injection design technology developed in the US. A choice between transient gas injection and mass pellet injection must be made within the next few years.

The design of the Tritium Plant detritiation system is advancing through external support contracts. In Japan, the facility conducting R&D for wet scrubber technology (used to remove tritiated gases from atmosphere streams by scrubbing them with water) was damaged by the earthquake in March, resulting in some delay in this program.

The architectural layout for the Tritium Plant was finalized through the detailed integration of all systems in specific accordance with safety requirements. In order to fulfil very stringent fire safety requirements, an additional 17 rooms have been implemented in the layout to accommodate electrical cubicles for safety and non-safety related electrical control and instrumentation.

As part of an R&D program on leak localization, a method using blanket multi-piping was developed and proven as a viable technique for localization of first-wall water leaks. The Vacuum Section signed its first Procurement Arrangement in 2011 for vacuum

auxiliary systems, part of the early delivery items for ITER. Work also advanced during the year on the prototype torus cryo vacuum pump, which should be ready for final approval by the European Domestic Agency in 2012 and subsequent transfer to industry. A temporary vacuum laboratory on the CEA site was installed to support the final acceptance tests of procured vacuum components.

More than 50,000 cables serving the Tokamak Complex were identified and registered into the Cable Database in 2011; this concludes an important effort launched after the 2007 Design Review that had pinpointed the absence of such a centralized database. A cost-saving proposal for joint ITER Organization-European Domestic Agency cable procurement was endorsed during the year.

The Coil Power Supply Section performed the oversight of Procurement Arrangement activities and significant integration tasks, including the identification of the building interfaces and the update of the 2D drawings, Configuration Management Models, and plant instrumentation and control design. A set of analysis tools was successfully developed by the Section for the validation of the electrical system operation performance.

The Electrical Power Distribution Section followed up on work to complete the detailed design of the pulsed power electrical network at the European Domestic Agency and prepared documents for the associated material Procurement Arrangement with the Chinese Domestic Agency. The preliminary design for the steady state electrical network – the first ITER plant system to be installed at the end of 2013 – is finished. The Section also prepared an ITER policy for electromagnetic compatibility in line with the lightning protection policy and cabling rules.

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.

Research and development in support of ITER's physics objectives continued in 2011. Significant experimental results were achieved in the suppression of edge localized modes (ELMs) – those outbursts of edge plasma that can cause damage to the plasma vessel if they are not controlled. In important results corroborating the ITER design, experiments on the German tokamak ASDEX confirmed ELM stabilization with internal coils. The KSTAR Tokamak in Korea also

explored other schemes of ELM control that could be potentially applied in ITER, including injection of fast-gas pulses (mimicking pellet pacing in ITER), edge heating and current drive, and vertical plasma position oscillations. The POP Directorate is conducting a detailed analysis of several aspects of ELM control in order to provide an improved physics basis for the estimation of ELM energy losses in ITER scenarios and to optimize the ergodization of the plasma edge while minimizing the impact on confinement in the plasma core.

Work continues on the development of a Disruption Mitigation System (DMS) for ITER. A prototype fast-gas injector, referred to as a DMS gun, is being used at the French Tore Supra Tokamak to attempt to generate magnetohydrodynamic (MHD) activity during the current quench phase of disruptions. Complementary studies have also been performed in the Russian T-10 Tokamak to investigate the stimulation of MHD activity by high pressure gas injection during the disruption current quench.

Exploration of ITER plasma scenarios continued in 2011 in support of system design activities and ITER licensing activities. The Directorate identified mitigation measures for possible limitations in the performance of the central solenoid conductor; these measures confirmed that the project's mission goal of long pulse Q=10 operation can be achieved even if some limitations are encountered in the central solenoid performance. The specification of toroidal field ripple in ITER was finalized during the year allowing the final distribution of ferromagnetic inserts within the vacuum vessel shell to be specified.

Work progressed on the design of the tungsten divertor in close collaboration with the Directorate of Tokamak. Following STAC recommendations, ITER will pursue the two divertor options in parallel – carbon-fibre composite high heat flux components in the divertor for the non-nuclear phase followed by tungsten high heat flux components for the nuclear phase, or tungsten high heat flux components from the start of operations. Research activities are therefore strongly focused on solving critical issues such as the melting behaviour of tungsten under uncontrolled events and the consequences this will have on plasma operation. Support was also provided on the design of the beryllium first wall (improved heat load specifications and a database of plasma equilibria) to allow optimization of the shape of first wall panels. The Directorate performed detailed studies of first wall erosion and material transport processes to investigate options for different materials (stainless steel, tungsten) in localized regions of the first wall.

An army of standing columns like this one, topped with flexible pads, will support the weight of the 360,000-ton Tokamak Complex.



Highlights by Department

Major progress was made in the Integrated Modelling Program, where a contract for the development of the integrated modelling infrastructure was signed with an EU consortium. During the third Integrated Modelling Expert Group meeting in 2011, progress made within the infrastructure contract was discussed and recommendations made for further coordination with the Domestic Agencies.

A significant step forward was taken in the development of the ITER plasma control system with the implementation of Task Agreements in 2011 for the conceptual design of the plasma control system by an international collaboration of fusion experts.

The International Tokamak Physics Activity (ITPA) continued to spearhead internationally coordinated physics research in support of ITER in 2011. It celebrated its tenth year in December during a joint meeting of the ITPA's Coordinating Committee and the International Energy Agency (IEA) that was attended by representatives from all major fusion facilities. In October, the POP Directorate hosted its first ITPA topical group meeting (Transport and Confinement Topical Group) in Cadarache.

The coordination of the Test Blanket Module (TBM) program for ITER remained a focus of activity for the Technology Division in 2011. Integration of the TBM Systems into the port cells and the Tokamak Complex was a significant activity throughout the year. In addition, input was provided to the Buildings Task Force to ensure that the TBM Systems can be successfully accommodated in the ITER facility. Coordination of Domestic Agency and ITER Organization activities continued through Port Management Group meetings held every six months. During an on-site workshop in June, participants reviewed the interfaces between the TBM systems and ITER instrumentation and control.

Work to finalize the generic TBM Arrangement also progressed during the year; however, a common understanding remains to be found on intellectual property rights and issues of liability and waste management. The TBM Arrangement will be used as a template for specific bilateral agreements with all Members who provide TBM Systems for testing at ITER.

Five new Monaco Fellows took up their appointments in late 2010 and early 2011 within the framework of the Monaco-ITER Partnership Arrangement. The third selection competition for postdoctoral fellows was launched in December for the group that will begin their research programs at ITER in late 2012. The 5th ITER International Summer School took place in Aix-en-Provence, France in June, jointly organized by the POP Directorate and the Université de Provence.

DEPARTMENT FOR SAFETY, QUALITY & SECURITY

The Department for Safety, Quality & Security (SQS) 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.

The ITER Organization passed several important licensing milestones in 2011. In March, the project received an Advisory Opinion from the French Environmental Authority on the DAC nuclear licensing files (Demande d'Autorisation de Création), which contained several recommendations. The experts asked the ITER Organization to rewrite parts of the non-technical summaries in order to make them more accessible to the general public; they also requested a more detailed Impact Study. The updated DAC files became the basis on which the local public formulated its opinion on the ITER project during the Public Enquiry, which was held from 15 June to 4 August 2011.

During the six weeks of the Public Enquiry, the DAC files were available for consultation in the town halls of 13 neighbouring towns and villages. The SQS Department answered hundreds of questions from the general public, local environmental groups, and the six appointed members of the Enquiry Commission. After analyzing written comments and the answers provided by the ITER Organization, the Enquiry Commission issued a Favourable Opinion on 9 September 2011. This positive outcome to the Public Enquiry is a major step toward the full licensing of ITER as a Nuclear Installation under French law.

The technical examination of the ITER safety files, a parallel licensing procedure that had been underway since mid-2010, ended in September. Examiners appointed by the Nuclear Safety Authority (ASN) in France summarized their conclusions in a 300-page report that was submitted to a group of experts nominated by the ASN known as the Groupe Permanent. Two crucial rounds of discussion were held between the Groupe Permanent and the ITER Organization in November and December 2011; based on these discussions the Groupe Permanent issued a favourable report at the end of the year. After a last stop at the Mission de Sûreté Nucléaire et de Radioprotection (MSNR), the way will be open for the final green light from the French government: the Authorization Decree, or Décret d'autorisation de création.

During the Public Enquiry, a workgroup from the ITER Local Information Commission (CLI) analyzed the DAC files and formulated several remarks and

requests for additional study on specific environment and safety issues. With both the French regulatory authorities and the local CLI members, the SQS Department strived to maintain a relationship of confidence through its responsiveness to demands for information and through the pertinence and quality of its documents.

The SQS Department continued to work with the ASN on Nuclear Pressure Equipment (ESPN) regulations applicable to ITER. In June, the ITER Organization received an ASN letter concerning In-Service Inspections (ISI) – that is, the monitoring of ESPN component performance during the lifetime of ITER. The ITER Organization has joined with other nuclear operators in France to form a working group that will determine a common methodology for requesting compensatory measures for exemption from ISI. Approval from the ASN on this methodology will be sought in 2012.

In July, ASN was on site to audit the ITER Organization's supervision of construction works in the Tokamak Complex Seismic Isolation Pit. The positive conclusions contained in the ASN report underlined the robustness of the quality system developed by the ITER Organization in full consistency with French Quality Order (10 August 1984).

As manufacturing has started all over the world, the ITER Organization-Domestic Agency Safety and Quality Assurance Working Group (SQAWG) continued to promote common safety and quality assurance practices through to the supply chain. Training sessions are planned with the technical responsible officers from the ITER Organization and the Domestic Agencies to review the main features of the ITER licensing process, the organization set into place to meet the requirements of the French Quality Order (mandatory requirements for all safety-relevant activities), and examples of procedures that exist. The ITER Organization also concluded a third-party inspection contract in 2011 to complement the quality control activities of the SQS Department on behalf of the ITER Organization, Domestic Agencies, and suppliers and subcontractors.

The continued development of the ITER Organization Management and Quality Program (MQP) was also a priority for the Department in 2011. MQP establishes the overall framework for the execution of the ITER project, covering all management, safety and performance activities.

The Committee for Health and Safety met five times in 2011. Among the topics discussed were safety provisions set in place by the ITER Organization for the overall management of the ITER site, after its transfer from Agence ITER France on 1 January 2012.



The 257-metre-long Poloidal Field Coils Winding Facility was completed in 2011.

In parallel, the Security Coordination group prepared plans for site security. A contract was awarded to APAVE for health, safety, and environment supervision on the construction site and an agreement signed with CEA related to procedures in the event of emergency situations. The Health & Safety Control Division provided training in health and safety matters to staff and contractors during the year.

DEPARTMENT FOR ADMINISTRATION

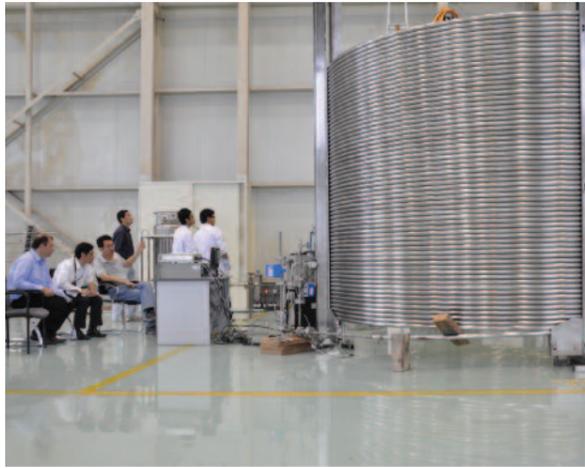
The Department for Administration (ADM) provides services in the fields of human resources, in-kind and in-cash procurement, finance and budget, project management, information technology, and document control. It comprises the Directorate for Finance, Budget & Management Systems and the Directorate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

The Department was reorganized in 2011 to simplify procedures and practices. Two critical questions were the drivers behind the reorganization: "What are the best practices in other laboratories and industry?" and "What can the Department do differently to help the rest of the Organization succeed?"

Directorate for Finance, Budget & Management Systems (DFI)

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

The ITER Organization finalized the list of Additional Direct Investment (ADI) items – capital costs that had not been included as part of the 2010 ITER Baseline – early in the year. MAC developed a set of guidelines for the evaluation of responsibilities and credit values associated with these ADIs and stressed that they must be financed from within the



In October, the Institute of Plasma Physics at the Chinese Academy of Science (ASIPP) completed the assembly and testing of its first 760 m toroidal field dummy conductor for ITER. Photo: ITER-China

capped ceiling for ITER construction of 4700 kUUA. On the basis of these guidelines, future ADI risks will now be accounted for.

Schedule performance was a priority for the entire Organization in 2011. A new schedule management system was introduced to improve the integration of data arriving from Domestic Agencies and industry into the ITER Organization planning mechanism. The direct upload of data from Detailed Work Schedules has improved the accuracy of data input for scheduling purposes and considerably simplified planning activities. A monthly, high-level performance report called the Strategic Management Plan is generated from this data, providing a powerful tool to management for minimizing potential delays.

Following the natural disaster in Japan in March, the Administration Department had the responsibility of re-estimating the ITER project schedule and cost Baseline to reflect potential impact. This project-wide effort was completed in September. Lifecycle costs for ITER through the Construction Phase were submitted to the ITER Council at its November meeting and endorsed.

In close collaboration with the Domestic Agencies, the Project Management Division drafted and updated the 2012 Annual Work Plan, a document detailing the specific work scope, activities, and milestones planned in conformity with the Strategic Management Plan. It was agreed by the Ninth ITER Council in November that approval for Annual Work Plans would henceforth be left under the responsibility of the Director-General.

The Finance & Budget Division prepared the 2011 Financial Statements, which were audited by the Financial Audit Board and approved by the ITER Council. The Financial Audit Board met twice in

Cadarache and made recommendations to further improve internal controls, internal processes, and transparency. More than 70,000 financial transactions were performed by the Finance & Budget Division during the year including budget allocations, budget transfers, commitments, payments, reconciliations, and verifications.

Cost containment activities for 2011 focused on the implementation of measures that had been decided in 2010 and on the pursuit of further savings. Cost savings realized in the areas of in-kind contributions and ITER Organization operational costs were transferred to a new ITER Organization Reserve Fund. A proposition for the use of these funds was presented to MAC and the ITER Council. Since the approval of the ITER Baseline in 2010, several cost risks have been identified that need to be offset by the realization of cost-savings, possible de-scoping, or deferrals.

The Finance & Budget Division developed a lifecycle commitment and payment budget plan for the Construction Phase of the project in cooperation with all departments and divisions. The Division also made a preliminary projection of costs for the Operation Phase for which both risks and costs savings were taken into account. In response to a Financial Audit Board recommendation for enhanced internal control processes, the Division drafted a policy of internal control standards and an implementation plan that was approved by the Project Board.

During the fourth quarter, the decision was made to transfer the Project Management Division to the CIE Directorate, under which all scheduling, cost, and risk activities will be managed from 2012 forward. A new section was created in the DFI Directorate – the Systems Management Section (SMS) – to improve organizational efficiency. An Organizational Efficiency Steering Committee formed at the end of the year from representatives of all directorates will provide senior management with suggested actions items for improvements and will follow up on recommendations made by the Management Assessor in its 2011 report.

The Project Information System Section (IT) consolidated its activities and systems in order to implement a planned cost saving of 45 percent for 2012, effectively transitioning from a rapid build-up of an efficient IT environment to a rationalization of all processes. New contracts with savings above 50 percent were placed for mobile and fixed telephony and printing. The SAP environment, the ITER Organization's principal administration tool, was further stabilized during the year and for the first time the annual financial accounts were prepared

based on SAP data. At the same time, SAP system support costs were reduced by 33 percent.

A new computational cluster with 400 cores was implemented to allow faster turnaround time for neutronics calculations. The CAD database replication (Enovia V5) was put into full use in 2011. A more efficient remote access methodology (PC over IP) was introduced and tested successfully in Europe and the US, allowing for a tenfold increase in loading and saving times for CAD designers working remotely. IT also implemented an Engineering Database following specifications from the CIE Directorate. Data migration and process fine-tuning is underway for launch in 2012.

Directorate for General Administration (DGA)

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

The ITER Organization signed 18 Procurement Arrangements in 2011 involving all technical directorates and Domestic Agencies. Included were "critical path" items such as magnet feeders and the cryostat. Sixty-five Procurement Arrangements have now been signed, representing 74.2 percent of the project's in-kind value.

In 2011 the Procurement & Contract Division concluded 678 contracts (including Task Orders and amendments), 10 In-cash Task Agreements, and 906 purchase orders for a total value of EUR 191.3 million and total commitment value of EUR 95.7 million. Single source contracts were reduced to 2.8 percent: a full 84 percent of contracts were awarded through competitive procedures. Following Financial Audit Board recommendations, the Division implemented additional controls into the financial process and worked to develop awareness among the technical teams with regard to the execution of contracts. In parallel, instructions and procedures for procurement were improved to increase control over the process.

In a significant project milestone, the contract covering the connection of ITER to the French electrical grid was signed with French electricity provider RTE. Progress was also made toward the selection of the company for the global transport of ITER components from their manufacturing sites all over the world to Cadarache. In January, a Memorandum of Understanding was signed between the ITER Organization and the directors of all seven Domestic Agencies that provides for the shared use

of this resource. Work advanced on the contracts for liquid helium plants, vacuum vessel welding, and cable management.

The Human Resources Division managed 39 staff recruitments (of which 28 were newcomers to the ITER Organization) and 26 departures during the year, bringing the end-of-year total to 471. Approximately 400 people worked as experts, interns, visiting researchers, or external contractors for the ITER Organization. The Division launched a comparative study in 2011 to ensure that external specialized services are used in the areas where they are most cost-efficient and effective compared to staff resources. Efforts were maintained to improve the staff selection process and the balance of staff coming from the seven ITER Members. The proportion of non-European staff arrivals increased in the 12 months covered by this report; non-European candidates represented over 20 percent of recruitment interviews. The Division implemented the Manpower Resourcing Policy with the Directorates during the year and established a strategy for the renewal or termination of employment contracts ending in 2012 and 2013.

An ITER Organization Code of Conduct was issued for staff in March to provide official guidance in matters of professional ethics and to serve as reference for third parties with regards to the standards of conduct that they are entitled to expect when dealing with the ITER Organization. The ITER Council endorsed a revised version of Staff Regulations; modifications in these Regulations were explained to staff in all departments and directorates during information sessions. Training sessions in safety culture, export control, intellectual property management, and project management represented 9,000 hours (1,000 attendees) in 2011. In order to facilitate rapid decision-making and improve organizational efficiency, and in response to a Financial Audit Board recommendation, a policy was introduced for the delegation of authority on human resource and procurement and contract matters in the absence of the Director-General.

The Document Management Section introduced an Internal Correspondence Management system to ensure that ITER Organization paper documents be properly archived. Proposals for improvement to the ITER Document Management (IDM) system were also introduced to reduce delay and improve efficiency; IDM improvement will remain a priority activity in 2012. The Section contributed to the implementation of the ITER Intellectual Property database and to procedures and systems that allow controlled exchanges of documentation between the ITER Organization and the Domestic Agencies.

Staffing & Financial Tables

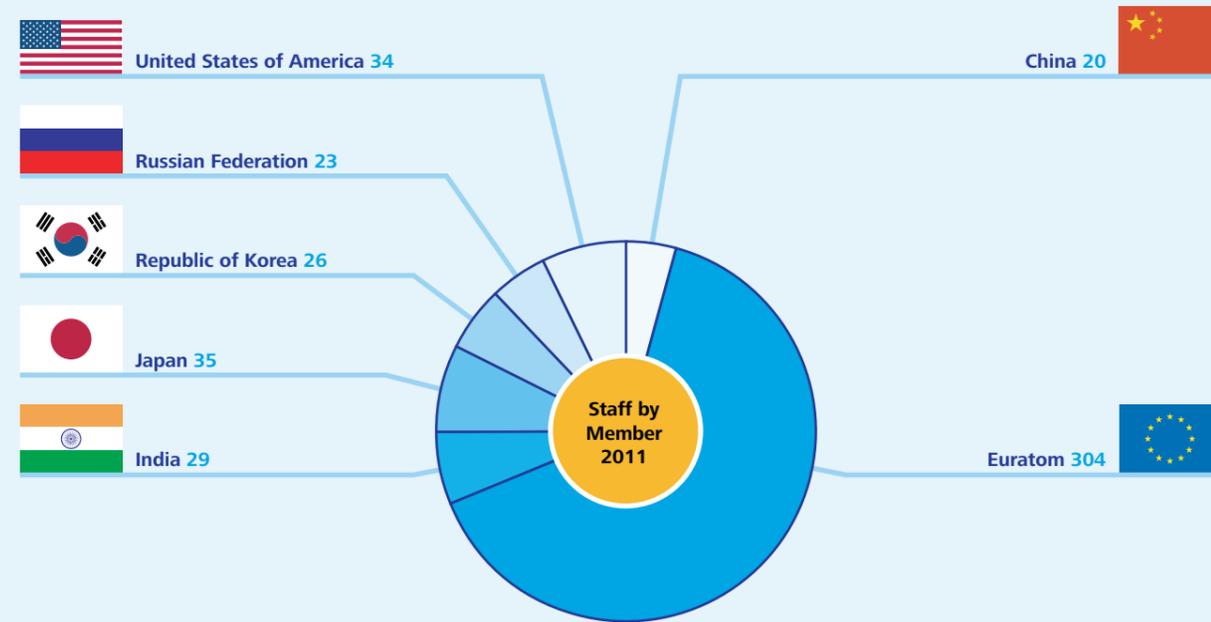
The ITER Organization is staffed by men and women from all over the world.

Five hundred directly employed staff and 350 external contractors currently work for the project in Cadarache, France.

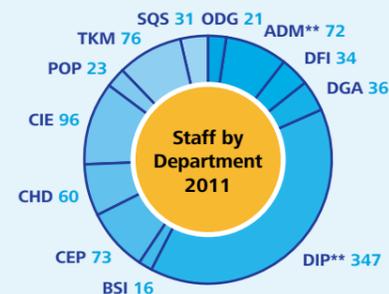


Annex 1 Staffing

Staff by Member	31/12/2010	31/12/2011
China	20	20
Euratom	309	304
India	28	29
Japan	32	35
Republic of Korea	27	26
Russian Federation	22	23
United States of America	31	34
Total	469	471*



Staff by Department as of 31/12/2011	Professional	Support	Total
Office of the Director-General (ODG)	12	9	21
DEPARTMENT FOR ADMINISTRATION (ADM)**	36	36	72
• Finance, Budget & Management Systems (DFI)	15	19	34
• General Administration (DGA)	20	16	36
DEPARTMENT FOR ITER PROJECT**	233	114	347
• Directorate for Buildings & Site Infrastructure (BSI)	12	4	16
• Directorate for Central Engineering & Plant (CEP)	47	26	73
• Directorate for CODAC, Heating & Diagnostics (CHD)	43	17	60
• Directorate for Central Integration & Engineering (CIE)	53	43	96
• Directorate for Plasma Operation (POP)	21	2	23
• Directorate for Tokamak (TKM)	55	21	76
DEPARTMENT FOR SAFETY, QUALITY & SECURITY	20	11	31
TOTAL	301	170	471



* The Human Resources Division managed 39 staff recruitments (of which 28 were newcomers to the ITER Organization) and 26 departures during the year.

** ADM and DIP totals include Department-level staff not shown in the Directorate subtotals.

Annex 2 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 2011	Unused Commitment Appropriations carried forward to 2012
Title I Direct Investment (Fund)	93,177	-0,290	37,592	55,296
Title II R&D Expenditure	27,314	2,456	18,741	11,029
Title III Direct Expenditure	147,026	6,668	127,502	26,193
Total commitments	267,517	8,835	183,835	92,517

(*) Amounts in k Euros, which could cause minor differences due to rounding.

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

Amount in kEUR(*)

	Total Payment Appropriations	Write-offs and Transfers of Special Account items	Total Payments 2011	Unused Payment Appropriations carried forward to 2012
Title I Direct Investment (Fund)	41,226	-	20,734	20,492
Title II R&D Expenditure	23,982	0,330	18,149	5,503
Title III Direct Expenditure	162,766	0,459	144,370	17,937
Total payments	227,974	0,789	183,252	43,932

(*) Amounts in k Euros, which could cause minor differences due to rounding.

Contributions from Members

Amount in kEUR(*)

Members	Cash		Procurement Arrangements	Total
	Money	Task Agreements and Secondments		
Euratom	68,863	13,675	42,392	124,930
China	17,291	1,614	-	18,905
India	16,163	0,544	1,735	18,442
Japan	20,679	-	11,339	32,018
Republic of Korea	16,193	2,476	0,631	19,299
Russian Federation	17,523	1,288	-	18,811
United States of America	-0,066	7,438	-	7,372
Total Income	156,645	27,035	56,096	239,777

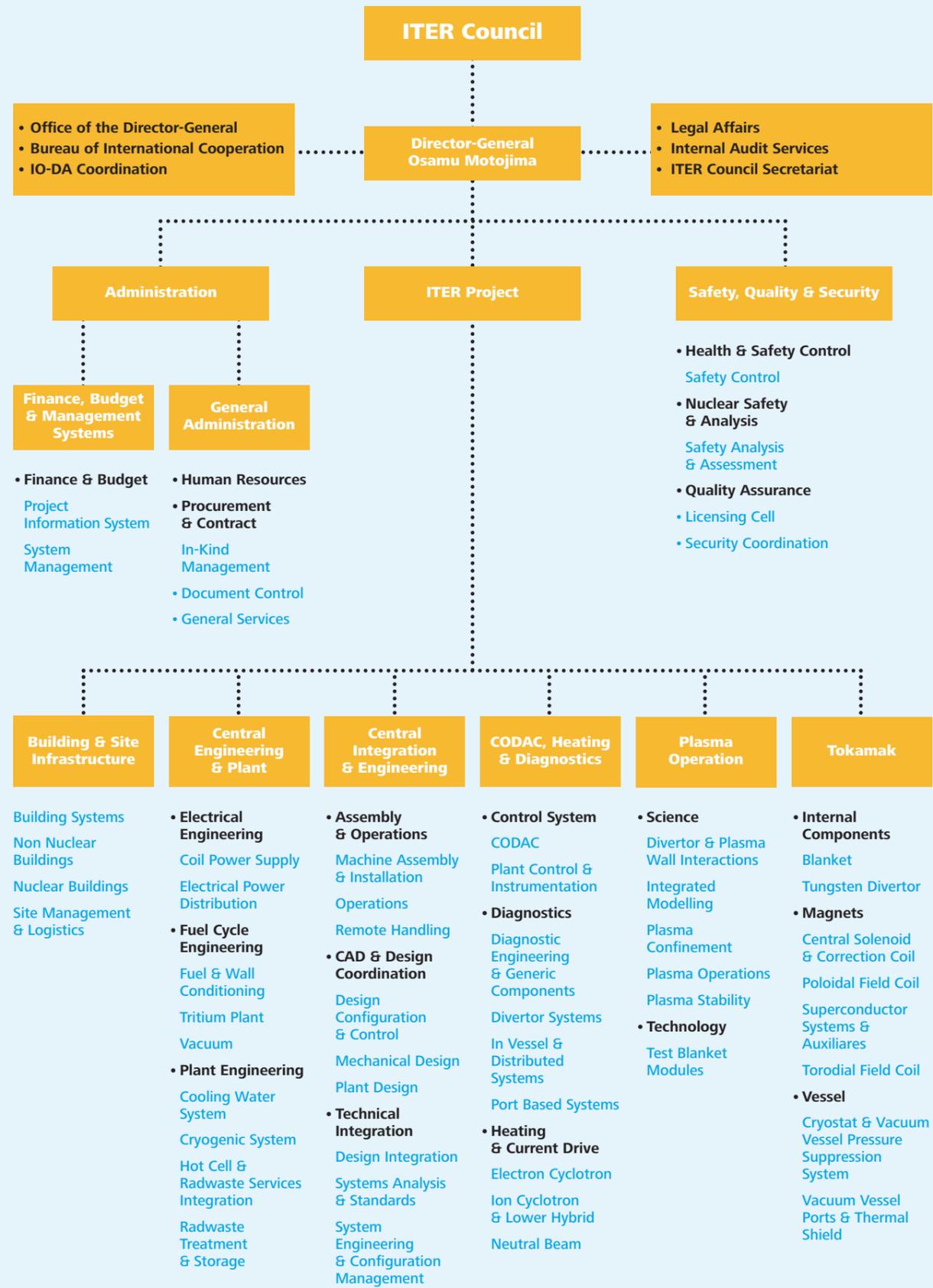
This table shows tabulations in million Euros, which could cause minor differences due to rounding.

Cumulative In-Kind Payments through 31 December

Members	Payments in IUA				Payments in million EUR			
	Secondments	Task Agreements for Credit	Procurement Arrangements	Total	Secondments	Task Agreements for Credit	Procurement Arrangements	Total
European Union	13,731	10,848	31,170	55,750	20.88	17.00	49.05	86.93
China	-	1,403	-	1,403	-	2.20	-	2.20
India	-	2,572	2,300	4,872	-	4.00	3.60	7.59
Japan	594	-	25,170	25,764	0.87	-	39.25	40.12
Republic of Korea	271	3,244	1,500	5,016	0.40	5.07	2.34	7.81
Russian Federation	-	1,078	-	1,078	-	1.69	-	1.69
United States of America	1,531	7,243	2,500	11,274	2.31	11.34	3.88	17.53
Totals	16,128	26,389	62,640	105,157	24.46	41.31	98.12	163.88

This table shows tabulations in million Euros, which could cause minor differences due to rounding.

Organizational Structure



The three projects that transformed the ITER platform in 2011: the Poloidal Field Coils Winding Facility (top); the Tokamak Pit excavation and foundation work (centre); and the ITER Headquarters (right).