ITER Organization

2010 Annual Report

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Below: An artist's conception of the future Tokamak Complex. *Image: ENGAGE*

ITER Organization 2010 Annual Report

On the Cover: The ITER Organization entered an important phase of its three-year history in July 2010, when construction began on the scientific buildings and facilities that will house the ITER experiments. *Photo: Altivue/AIF*

From the Chair of the ITER Council

Academician Evgeny Velikhov

The dream of the fusion community is taking shape!

In finalizing its set of Baseline documents in 2010 ITER has fulfilled an important objective. The ITER Baseline forms a very solid scientific and technological base upon which we can chart the course for the years to come and address challenges as they arise. I would like to congratulate the ITER Organization and the Domestic Agencies for their close and fruitful cooperation in the establishment of these documents and also the ITER management led by former Director-General Kaname Ikeda for this important accomplishment.

Wishing the ITER project every success: Academician Velikhov at ITER's Foundation Stone ceremony in November 2010.

Since the return of heavy construction equipment to the site in July, the transformation of the ITER platform has been constant. To the outside world, this visible progress is a clear sign that the ITER project has overcome its start-up difficulties and that the count-down to First Plasma is underway. In less than nine years, we will be commissioning the ITER Tokamak for its first "shakedown" runs with pure hydrogen.

Much hard work lies ahead. A key to meeting the very tight schedule and cost targets for the Construction Phase of ITER will be strong leadership. To this end, the ITER Council was pleased to welcome Prof. Osamu Motojima as the new Director-General of the ITER Organization in July. At the initiative of the new Director-General, positive changes are already taking place in the management of the project. Continued strong collaboration between the ITER Organization and the Domestic Agencies is also absolutely essential.

All Members remain fully committed to the ITER project. Time after time by working together we have overcome adversity, and I know that we will continue to do so in the future. Too much is at stake not to: without ITER there is no fusion, without fusion there is no solution for the energy needs of humanity. As the gap between energy supply and demand began to widen in 2010, this truth became all the more evident.

In closing, I must mention that, sadly, the ITER Council lost one of its key collaborators in 2010. Dr. Toshihide Tsunematsu from Japan, Vice-Chair of the ITER Council and member of the Management Advisory Committee for many years, passed away in September. We will keep him in our minds and hearts as we move forward, knowing that he, too, has contributed to the project whose success has such important ramifications for the world.

I invite you to read about ITER progress in the 2010 Annual Report that follows and to join me in wishing the ITER project every success!

Academician Evgeny Velikhov
Chair of the ITER Council

From the Director-General

Professor Osamu Motojima

The date of 28 July 2010 will remain in the annals of ITER history. On this day the ITER Members agreed on the Baseline for the technical scope, schedule and cost of the project, clearing the way for construction to begin. I wish to express my appreciation to all of the people involved with this collaborative undertaking—whether working at the ITER Organization, at the Domestic Agencies, or as a Member delegate.

"Together, what we aim to achieve is not only the success of ITER but also the success of fusion." Professor Osamu Motojima, Director-General of the ITER Organization

The schedule ahead is an ambitious one: achieving First Plasma in November 2019 and Deuterium-Tritium operation in or before March 2027 will require all of our concerted effort. We must work closely with the Domestic Agencies to keep to this schedule and to the cost cap, while at the same time conducting a project-wide campaign to reduce costs. The ITER Council has established a ceiling for the Construction Phase of the project that cannot be exceeded; savings in one area will thus serve to finance as yet unforeseen needs. We must be committed to bold and ambitious measures as the only way to bring down the overall cost of the project.

In view of the large-scale construction and assembly project that lies ahead, I have undertaken to restructure the management of the ITER Organization. My motto has been "Simplify every thing and every process." The number of departments has been reduced from nine to three and top candidates have been recruited. The benefits for the project of this reorganization will be felt in terms of strengthened leadership and increased reactivity and, of course, in terms of cost savings.

The beginning of extensive construction activities on the ITER platform was a very palpable sign of ITER progress in 2010. Progress was also measurable at the Domestic Agencies where high-tech manufacturing contracts were placed in all ITER Members, and the first actual hardware for the ITER Tokamak was completed in Japan. Design completion for components on the schedule's critical path remains a project priority: 17 Procurement Arrangements were signed during the year, and many more prepared for signature in 2011.

The ITER Organization was closely supported in 2010 by the ITER Council advisory boards—the Management Advisory Committee (MAC) and the Science and Technology Advisory Committee (STAC). I would like to thank the Chair of the ITER Council, Evgeny Velikhov; the Chairman of the MAC, Professor Gyung-Su Lee; and the Chairman of the STAC, Professor Wan Yuanxi for their excellent contribution, and that of their teams, during this pivotal year.

I am implementing the process of hiring new staff on the basis of excellence and professionalism. At the same time, I would like to open ITER's door to younger people who will in fact take on a lot of the responsibility for fusion in the future. Shortly after my appointment as Director-General, the youngest staff members of the ITER Organization each hoisted an ITER Member flag in a ceremony celebrating the international nature of the project. Out of a collection of nations with different and sometimes conflicting history, culture, and work habits, ITER has become a "large family." Together, what we aim to achieve is not only the success of ITER but also the success of fusion.

Professor Osamu Motojima
Cadarache, April 2011

Foundation work begins in October 2010 at the site of the future ITER Headquarters. *Photo: AIF*

Executive Summary

Executive Summary

The highlight for the ITER Organization in 2010 was the approval of the ITER Baseline. This set of documents detailing the technical scope, schedule and cost for the project through the start of Deuterium-Tritium operation in 2027 received the support of all Members during the Extraordinary ITER Council on 28 July 2010, effectively ushering the ITER project into the Construction Phase.

Concurrent to the approval of the Baseline, the ITER Council appointed Professor Osamu Motojima from Japan as the second Director-General in the history of the ITER Organization, replacing Kaname Ikeda who had led the ITER project since November 2005.

Professor Osamu Motojima is appointed Director-General of the ITER Organization on July 28, 2010.

Organization

The ITER Organization implemented a simplified, task-force oriented management structure in 2010, better adapted to the needs of the large-scale construction project ahead. The position of Principal Deputy Director-General was eliminated, and the number of departments downsized from nine to three; the Departments for Administration; ITER Project; and Safety, Quality & Security report directly to the Director-General. Senior staff members meet regularly as part of the newly formed ITER Project Board to act promptly on developments within the project, and for a more strategic approach to planning and budgeting the Project Office was fused with the Department for Administration. The revised ITER management structure will be fully operational in June 2011 (see Organizational Chart).

The ITER Council met in Suzhou, China on 16–17 June 2010 (IC-6) and in Cadarache, France on 17–18 November 2010 (IC-7). In addition to these two statutory meetings, an Extraordinary ITER Council was held on 28 July 2010 to conclude discussions on the ITER Baseline. Academician Evgeny Velikhov and Dr. Toshihide Tsunematsu[1] began their terms as Chair and Vice-Chair of the ITER Council on 1 January 2010. The ITER Council advisory bodies—the Science and Technology Advisory Committee (STAC) and the Management Advisory Committee (MAC)—met regularly throughout the year.

Collaboration between the ITER Organization and the Domestic Agencies remains the cornerstone of ITER progress. In 2010, in addition to the monthly ITER Organization-Domestic Agency Coordination Group, a High-Level Coordination Meeting (IHCM) was created to report directly to the Director-General on matters of policy implementation. The heads of each Domestic Agency participate in this high-level meeting, which will be an important tool for efficient collaboration throughout the Construction Phase of the project.

The ITER Organization and the Domestic Agencies furthered cooperation during the year on the control of sensitive information, intellectual property management, and the creation of a world-class integrated modelling infrastructure for ITER. The Council Working Group on Export Control, Peaceful Uses and Non-Proliferation finalized lists of items subject to export control; in future years, this group will meet on an ad-hoc basis to work on non-proliferation and peaceful uses issues. During 2010 more than 400 staff members received mandatory awareness training on export control. The contact group charged with Intellectual Property Management and Dissemination of Information discussed progress on a common database, document management, and the launch of an obligatory training program on intellectual property issues for ITER staff. The Integrated Modelling Expert Group monitored progress on the development of computational plasma physics tools in support of plasma operations and plasma research.

In addition to performing audits and providing consulting services to the Director-General, in 2010 the ITER Organization Internal Audit Service (IAS) followed up on management's corrective action plans pertaining to prior years' internal audits, conducted the annual risk assessment resulting in the formation of the 2011 Audit Plan, and issued an IAS Report of Internal Audit Activities for 2009–2010. The Legal Affairs Office, which advises the Director-General on all legal matters, recruited a second staff member in 2010.

Five Monaco-ITER Postdoctoral Research Fellows took up their positions in 2010. This is the second group to conduct research in fusion science and technology at ITER under funding provided by the 2008 Partnership Arrangement between the ITER Organization and the Principality of Monaco. The first Monaco ITER International Fusion Energy Days (MIIFED), also foreseen in the Partnership Arrangement, took place in November, jointly organized by the ITER Organization, the Principality, and the International Atomic Energy Agency (IAEA).

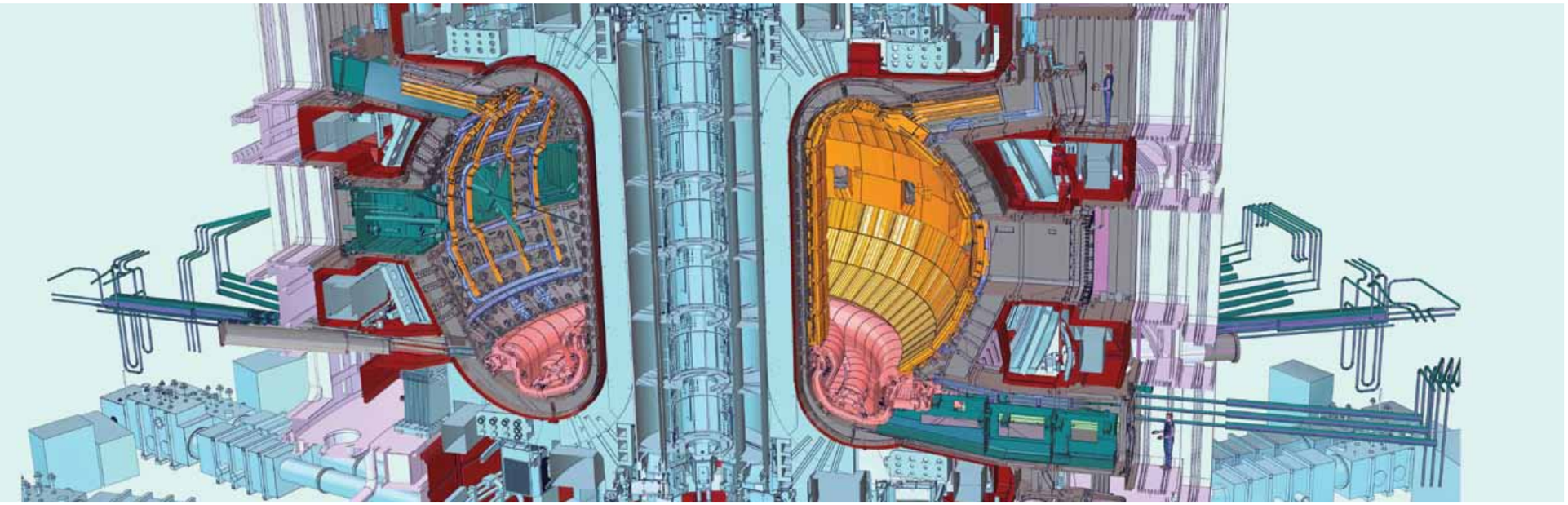
Construction Progress

In May, the ITER Organization signed the Procurement Arrangement for the construction of all buildings with the European Domestic Agency—the largest single procurement in ITER history. The European Domestic Agency, in turn, selected the Architect Engineer consortium that will complete building designs and monitor construction activity. Approximately 150 engineers moved to the ITER site in June to begin work within the framework of this important contract.

In July, the ITER site was officially transferred from the Commissariat à l'Energie Atomique et aux Energies Renouvelables (CEA) to the ITER Organization for the duration of the ITER Agreement. Buildings and infrastructure completed under the management of Agence Iter France—including the latest JWS3 office building adjacent to the current ITER Headquarters—were also transferred for ITER use.

Cranes and construction workers returned to the ITER platform in 2010. Three construction projects were launched in July/August: the Poloidal Field Coils Winding Facility and the Tokamak Complex excavation and ground support works under the management of the European Domestic Agency, and the

1 Dr. Tsunematsu passed away in September. A member of MAC since its inception in 2007 and Vice-Chair of the ITER Council, this eminent scientist will be greatly missed by the fusion community. Hideyuki Takatsu was named to succeed him as ITER Council Vice-Chair.



The ITER Tokamak is a one-of-a-kind device and one of the most challenging machines ever engineered.

The Foundation Stone: Bringing a Sun to Cadarache.

construction of the permanent ITER Headquarters under the management of Agence Iter France. In October, the ITER Organization concluded a Global Insurance Contract for building construction and assembly with a group of leading insurers.

The 104-kilometre ITER Itinerary between the Berre l'Etang port on the Mediterranean Sea and the ITER site was completed in 2010, and now stands ready for the test-runs that will prepare for the arrival by sea in 2012 of the first ITER components. Three years and EUR 110 million were invested by the Host State in this large-scale undertaking.

On 17 November 2010, in the presence of representatives from every ITER Member, the ITER Organization celebrated the unveiling of the Foundation Stone for the Headquarters building.

Licensing

ITER will be the first fusion device to pass a nuclear licensing procedure. Significant progress was made toward this goal in 2010 when the seven-volume, 5,200-page DAC safety files (short for Demande d'Autorisation de Création) were declared "receivable" for examination by the French authorities in December. The next stage in the licensing process is the Public Enquiry, which will be launched in 2011 to guarantee local community support for ITER.

The ITER Local Information Commission (CLI) remained active in 2010. This Commission is an independent body that acts as an interface between ITER and the local population on questions of nuclear safety, radioprotection and the installation's impact on personnel and the environment. ITER management attended the CLI's regular meetings, answering questions and providing information in response to queries. Preparations are underway for the Public Enquiry that will be held in 2011.

The Agreed Notified Body in charge of the conformity assessment of the ITER vacuum vessel as nuclear pressure equipment gave its approval in July for the Modified Reference Design, opening the way for the manufacturing of the ITER vacuum vessel to begin.

ITER Project Baseline

As requested by the ITER Council at its fifth meeting (IC-5) in November 2009, a project-wide effort in the areas of scheduling, cost assessment and risk analysis allowed the ITER Organization to establish a reference schedule that was acceptable to all Members; the Improved Updated Schedule that received the support of MAC in March set the "early" date for First Plasma at November 2019 and the date for Deuterium-Tritium operation at March 2027. These dates served as the foundation for further development of the project Baseline.

History will retain the date of 28 July 2010: during an extraordinary meeting of the ITER Council the Members unanimously approved the Baseline as presented by the ITER Organization and established a cap of 4700 kIUA (ITER Units of Account) for ITER construction. The ITER Council noted that the challenging target dates would require strong focus to achieve; at the same time, the ITER Council encouraged exploration of ways to advance Deuterium-Tritium operation to 2026.

Following approval of the Baseline, the ITER Organization led a project-wide campaign on cost containment and cost savings. A cost-saving working group identified savings within the ITER Organization budget and reported its initial findings to the seventh ITER Council meeting in November. Recommendations included cuts of 15 percent in external specialized services, reduced mission costs and organizational savings. A cost containment task force that focused on reductions in the area of in-kind procurement with the Domestic Agencies recommended 22 measures, including a different approach to cold testing the ITER magnets, alternative methods to controlling Edge Localized Mode (ELM) disturbances, the centralization of the global cable procurement and CODAC, and a new evaluation of the required diagnostics for ITER. The ITER Council charged STAC with the analysis of the technical and scientific implications of these measures.

The ITER Organization proposed an Annual Work Plan as a tool to manage the project Baseline. This document clearly sets forth the scope of work to be conducted by the ITER Organization and the Domestic Agencies, the schedule for completing this scope, and the ITER Organization resource requirements to conduct the work. An expert Assembly & Installation Working Group was also formed by MAC to analyze the ITER Organization's assembly plan proposals in order to increase confidence in the schedule and costs in this critical area of activity.

Procurement Arrangements

The ITER Organization signed seventeen Procurements Arrangements in 2010 for a record amount of 610 kIUA; over 60 percent of total procurement value for the construction of ITER has now been committed through 47 Procurement Arrangements. Procurement Arrangements were prioritized in 2010 according to the Integrated Project Schedule and progress checked regularly for those areas on the critical path. Integrated Product Teams were formed during the year for remote handling and magnets.

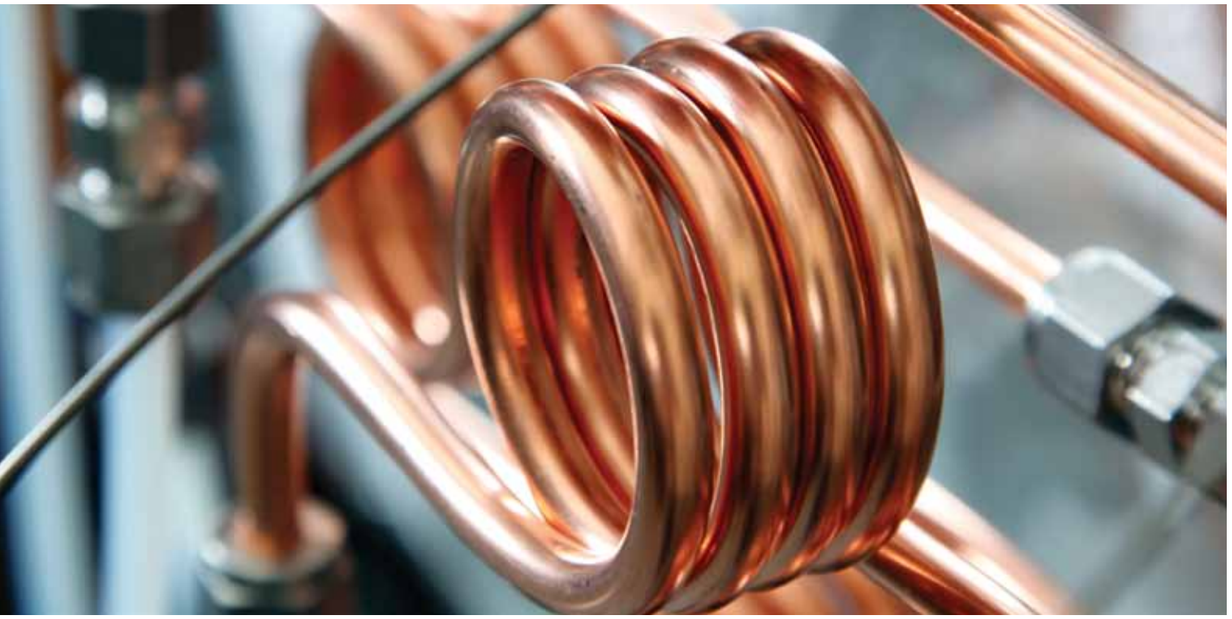
Measures were taken to accelerate and finish design activities for the vacuum vessel, cryostat, and central solenoid coils and to simplify project change request and design review processes. The timely completion of design activities is absolutely critical to keeping to the overall ITER project schedule.

The ITER Organization was charged by the seventh ITER Council meeting in November to finalize the list of Additional Direct Investment (ADI) items not part of the ITER Baseline. These "unapproved ADIs" include the implementation of ELM control coils, magnet cold testing and quality control. Following the completion of this list in early 2011, any additional ADI expenditure will be financed from savings elsewhere.

Manufacturing

Worldwide manufacturing activities for ITER are accelerating. The first IUA credit was granted to Japan for the completed manufacture of 17 tons of Nb3Sn-based strands, 2.4 kilometres of superconducting cables, and one 760 metre-long copper dummy conductor. This manufactured material is the first actual hardware produced for the ITER machine. The first completed components are scheduled to arrive at the ITER site in 2012.

The six procuring Domestic Agencies are actively producing niobium-tin (Nb3Sn) strand for ITER's toroidal field coils; production also began in 2010 for the niobium-titanium (NbTi) superconducting strand required for ITER's poloidal field coils. The advancement of Nb3Sn strand manufacture is a significant accomplishment for the ITER project: it took 19 months for all six procuring Domestic Agencies to sign Procurement Arrangements, and the ITER Organization has had to pioneer



These copper cooling coils are part of a heat treatment furnace and gas management system used by US ITER to prepare samples of critical superconducting components for ITER magnets. *Photo: US ITER/ORNL*

reporting, document handling, and quality assurance procedures to ensure that strands produced by a large number of manufacturers achieve ITER's required performance. Cumulated Nb3Sn production passed the 100-ton mark in September, representing 21,000 kilometres, or 25 percent, of total needs for the toroidal field coils. The Safety and Quality Assurance Working Group continued to be an important forum for communicating on safety and quality assurance concerns with the Domestic Agencies and their supply chain.

Sample testing in one area—central solenoid superconducting cables—revealed unsatisfactory results late in the year. Engineers at the SULTAN facility in Switzerland found that the cables lost their current-carrying capacity over time to a point well beyond that experienced in an earlier model coil test. The exact cause of the degradation in the conductor sample is under investigation.

Important qualification activities continued in 2010 in the areas of magnets, fuel cycle, and heating and current drive. Two prototypes of the 10 kA High Temperature Superconductor (HTS) current leads for the ITER correction coil feeders were successfully tested in China. Japan achieved the jacketing of the first toroidal field dummy conductor using copper strands. A small prototype for the ITER roughing system involving a novel cryogenic viscous flow compressor was completed in the United States. The United States also successfully replicated the low-field-side pellet flight tube mock-up for ELM pacing. India, Russia, Japan and Europe continue to develop prototypes for the ITER gyrotrons.

R&D

The ITER Organization signed a Memorandum of Understanding during the year on technical cooperation with the National Fusion Research Institute (NFRI) of Korea. The Memorandum provides for tests on the KSTAR Tokamak in the areas of cryoplant and cryodistribution systems, superconducting magnets, CODAC, leak detection, and heating and current drive technologies. A joint KSTAR-ITER Simulator Centre will be established for integrated modelling and analysis of plasma simulations.

Construction and procurement began on the PRIMA Neutral Beam Test Facility in Padua, Italy that will mitigate risk for ITER's neutral beam system. Procurement continued for the ELISE experiment in Garching, Germany; it is now expected that this radio-frequency-driven negative ion source will be operational in 2012.

Staffing

Recruitment stabilized in 2010. Sixty-three directly employed staff members were hired, bringing the total to 469 (see Staffing Tables). Efforts were made during the year to improve the staff selection process. The ITER Organization will continue to redistribute the balance of staff coming from the seven Members and to reduce contractual costs by improving the balance of subcontracting versus direct hire. Tighter control policies were instituted on mobile phone usage and mission costs.

The ITER Staff Committee met ten times during the year. The Committee for Health and Safety initiated relations with the French labour administration, and formalized its operational Charter.

Finance

The final total of commitment appropriations for 2010 was EUR 222.69 million to which EUR 4.52 million of de-commitment from previous years' contracts was added and against which commitments of EUR 216.04 million were made, leaving a balance of unused commitment appropriations of EUR 11.16 million to be carried forward to 2011. The payment appropriations for 2010 were EUR 200.65 million. Of this, EUR 166.32 million was paid and EUR 0.80 million transferred to income, leaving a balance of unused payment appropriations of EUR 33.53 million (see Financial Tables).

The resources of the ITER Organization comprise in-kind contributions from the Members (90 percent) in the form of hardware deliveries through Procurement Arrangements, and in-cash contributions (10 percent). During 2010, the in-cash contributions included credits for staff seconded by the Members, and Task Agreement credit allocations.

The Financial Audit Board, made up of seven independent experts from the ITER Members, returned twice to ITER in 2010. During its April visit, the Board found that the 2009 ITER Organization Financial Statements correctly reflected the financial activities of the Organization, and that they were in compliance with both the Project Resource Management Regulations and the International Public Sector Accounting Standards (IPSAS). During its September visit, a workshop was held on the implementation of IPSAS in the interest of financial clarity in budgeting and reporting.

Management Systems

Improving the efficiency and quality of management systems remained a top priority in 2010 in order to guarantee the sound operation of the project.

The ITER Organization developed and implemented an Earned Value Management system to measure and report ITER cost and schedule performance. Beginning January 2010, performance was measured against this standard; later in the year, input was adapted to include a fully integrated schedule and resource estimate based on the 2019 First Plasma Baseline. Approximately 100 members of staff were trained during the year in the use of Earned Value Management. MAC noted the progress made in the area of System Engineering Management following the recommendations of the Technical Integration Review (TIR) Subgroup.

The ITER project now has a powerful tool for collaborative design work across large distances: the rollout of the Enovia Replication System was successfully completed in 2010.

International School

Work begun in 2008 on the buildings for the International School of Manosque[2] was completed in August 2010. Twenty-seven nationalities are represented among the 410 students; approximately half are children of ITER staff. In 2010, the School's first six candidates successfully passed the International Option French Baccalaureate (OIB).

The International Advisory Council for the school, comprising parent representatives, delegates from the ITER Members, the ITER Director-General and French authorities, met twice during the year to discuss curriculum and organizational issues.

The project's innovative design and environmental sustainability were recognized in November 2010, when the International School of Manosque was named one of 60 exceptional OECD establishments.

2 In January 2011, the international school will be inaugurated as the Provence-Alpes-Côte d'Azur International School.

The new international school in Manosque is attended by 410 students from 27 nations.

Work progresses in December 2010 on the first ITER building: the Poloidal Field Coils Winding Facility. *Photo: F4E*

Highlights by Department

Highlights by Department

ODG *Office of the Director-General*
CIE *Office for Central Integration and Engineering*
PRO *Project Office*
TKM *Department for Tokamak*
CHD *Department for CODAC, Heating & Current Drive, Diagnostics*
CCS *Civil Construction and Site Support Office*
CEP *Department for Central Engineering and Plant Support*
SAS *Department for Safety and Security*
FST *Department for Fusion Science and Technology*
ADM *Department for Administration*

Interest in the ITER project continues to increase as the world is faced with rising demands for energy and the imperative of keeping polluting emissions to a low. The first Monaco ITER International Fusion Energy Days (MIIFED) in November aimed to spotlight how fusion and ITER can help to meet the challenges ahead.

Office of the Director-General (ODG)

The Office of the Director-General coordinated high-level contacts between the Director-General and the ITER Members, Domestic Agencies, Heads of Delegation and important delegations from many countries. Among the 11,445 visitors to the ITER site in 2010, a sharp rise in the number of international delegations and embassies was noted. The Office of the Director-General also liaised with the International School of Manosque on matters related to ITER staff concerns such as the curriculum and the school's capacity.

The ITER Organization website, including the French version (*www.iter.org/fr*) released in July, was viewed on average by 73,000 people each month—a 27 percent increase over 2009. Press interest in the ITER project also remained steady; the Office of the Director-General coordinated the visits of 72 journalists in 2010.

Regular contact with ITER's immediate neighbours including municipalities and educational institutions was a priority in 2010. Outreach activities brought 3,000 French school children and university students to the ITER site during the year.

The first Monaco ITER International Fusion Energy Days (MIIFED) took place in November. MIIFED aims to spotlight what is at stake today in the world of energy and to offer a clear perspective on how fusion and ITER can help to meet the challenges of the coming decades. The conference, jointly organized by the ITER Organization, the Principality, and the International Atomic Energy Agency (IAEA), will take place every two years.

Office for Central Integration and Engineering (CIE)

The CIE Office completed the Technical Configuration Baseline in 2010, part of the overall ITER Baseline that was adopted by MAC in May and the ITER Council in July.

Before adopting the Baseline, the MAC mandated an Assembly & Installation Working Group to examine the feasibility of the assembly and installation plan, with a view to determining the level of confidence in achieving First Plasma in November 2019. Composed of specialists with expertise in the field of tokamak and fusion-related devices, the working group analyzed the technical feasibility and schedule of machine assembly and installation, testing and commissioning. In its report to the ITER Council advisory bodies MAC and STAC in May, the Assembly & Installation Working Group expressed support for the ITER Assembly Plan. The working group also recommended that ITER take an increased role in on-site plant installation activities for systems where this is currently a Domestic Agency responsibility.

Following the adoption of the Baseline, CIE Office efforts focused on cost containment, on procedure simplification and on the implementation of the system engineering plan.

The CIE Office simplified the change management procedure, introducing an accelerated system for minor changes as well as shortening and reducing the number of Change Control Board meetings. The Office also launched a new Project Change Request database tool, the PCR Management System (PCMS), which automated and streamlined much of the project change administration.

In addition, the role of the Technical Coordination Meeting was strengthened to provide a regular forum for decisions on design and engineering matters, often related to ongoing Project Change Requests.

The CIE Office successfully concluded the rollout of the Enovia Replication System to all Domestic Agencies. This enables the use of a common design platform by the ITER Organization, Domestic Agencies and industry. The replication of Enovia allows external designers to work directly on a shared CAD database, resulting in more accurate design work, fewer errors and the elimination of costly reconciliation and reworking required of designs created in isolation.

The Nuclear Safety & Environment Division completed the DAC safety files in March, and over 5,200 pages of documentation were sent to the French regulatory authorities. The Division prepared guidelines on Safety Importance Classification (SIC) and completed the SIC classification of components. In July, the results of the benchmarking of the ITER nuclear analysis model were published. The analysis concluded that the shielding provided by the blanket, vacuum vessel and thermal shield is sufficient with respect to the requirements of the toroidal field coils.

RAMI (Reliability, Availability, Maintainability and Inspectability) analysis of ten ITER systems was undertaken in 2010, bringing to twenty-seven the number of systems analyzed since 2008. This process is aimed at ensuring that all systems will be reliable during ITER operations and will maintain performance with the best possible availability. This is critical if ITER is to complete its experimental mission and in particular if it is to reach Deuterium-Tritium operation within the required schedule.

A Remote Handling Integrated Product Team (IPT) was formed during the year to improve collaboration between the ITER Organization and the Domestic Agencies on remote handling issues. The Remote Handling Section completed the preliminary layout of remote-video systems for the Hot Cell Facility and reached an agreement on procurement. It also completed its first hazard analysis in the context of a conceptual design review.

The Russian Scientific Research and Development Cable Institute JSC VNIIKP completes 760 metres of copper dummy conductor as part of the qualification process for the manufacture of ITER's toroidal field conductors. *Photo: RF-DA*

The Divertor Remote Handling Test Platform (DTP2) in Finland is operating successfully; this mock-up will verify the remote handling procedures for divertor components. The Remote Handling Section launched design tasks for a remote handling tool to be used for the maintenance of neutral beam line components, and for a generic vacuum cleaner that will be integrated into remote handling equipment and the Hot Cell Facility.

Effective November 2010, the CIE Office was renamed the Directorate for Central Integration & Engineering. The Document Control Centre (DOC) was moved to the Directorate for General Administration.

Project Office (PRO)

The focus in 2010 for the Project Office was the completion of the Performance Management Baseline, part of the full Project Baseline for the Construction Phase of the ITER project. Following recommendations made by the MAC and by the ITER Council at the end of last year, the Office worked in close cooperation with the Domestic Agencies to establish a realistic "early date" and a "late date" for First Plasma. Substantial effort was made in the areas of project controls, planning, scheduling, cost estimating and risk analysis.

The Improved Updated Schedule that resulted established reference dates that were acceptable to all Members: First Plasma in November 2019 and Deuterium-Tritium operation in March 2027. The Updated Schedule obtained the support of MAC in March as "technically credible and achievable, in line with delivery dates that the Domestic Agencies assess to be realistically achievable."

The Project Office revised resource estimates to reflect the costs associated with the extension of the schedule from 2018 to 2019, and the completion of the 10 percent cost reduction recommended by an independent cost review in 2009. The schedule and cost contingency analysis associated with the "early" and "late" finish schedules was also completed. Concerning risk management, the Office updated the risks previously identified by the ITER Organization and the Domestic Agencies and associated mitigation strategies.

In June, the Performance Management Baseline—including the Project Plan and Resource Estimate, the Overall Project Schedule, and the Overall Project Cost—was submitted to the ITER Council, representing the culmination of two years of dedicated effort by the Project Office. Approval of the Baseline was postponed, however, due to funding issues within the European Member. At the Extraordinary ITER Council meeting on 28 July 2010, the ITER Baseline was approved unanimously by the ITER Members, launching the Construction Phase of the project. The ITER Council strongly encouraged optimization of the schedule in order to advance Deuterium-Tritium operation to 2026, if possible, and also capped ITER construction costs at 4700 kIUA.

Following this important achievement, the Project Office shifted its emphasis from Baseline development to performance management. The Project Office drafted and updated the 2011 Annual Work Plan to provide a detailed definition of work to be performed by the ITER Organization and the Domestic Agencies, milestones, and associated credit values. The Annual Work Plan also identifies critical path and near-critical path activities and provides a summary of ITER Organization resources to accomplish the work. The Office conducted routine schedule performance reviews for the ITER Organization and Domestic Agencies based on earned value information. Some delay has been identified in non- or near-critical areas of the project schedule and every effort is being made to recover these delays.

In response to concerns raised at the June ITER Council, the Project Office also developed a cost containment and reduction initiative to be conducted in collaboration with the Domestic Agencies. The ITER Organization-Domestic Agency coordination group is targeting the approval of all Project Change Requests for in-kind contributions in order to meet the ITER Council funding cap. The cost estimating group worked with departments to implement the 100 kIUA Construction Phase reduction demanded by MAC. The risk management group continued to monitor the implementation of risk mitigation strategies throughout the year and completed the Risk Management Plan and Risk Assessors Handbook.

To improve efficiency, the Project Office replaced several scheduling, cost estimating, project control and risk management contracts during the year with a single project management support framework contract.

Effective November 2010, the Project Office was moved to the Department for Administration (Directorate for Finance, Budget & Control). The In-Kind Management Section was moved to the Directorate for General Administration (Procurement Arrangement & Contract Division).

Department for Tokamak (TKM)

With an eye to the project schedule, procurement-related activities remained the focus for the Tokamak Department in 2010. The Department held design reviews for critical path items such as the blanket, cryostat, thermal shield, and magnet feeders. Management adjusted resources to keep to the schedule for these high-priority items.

Eight Procurement Arrangements within the scope of the Tokamak Department were signed during the year: the Central Solenoid with the United States; the Divertor Inner Target and the Toroidal Field Pre-Compression Rings with Europe; the Thermal Shield with Korea; High Heat Flux Testing of Plasma-Facing Components with Russia; and Magnet Correction Coils, Magnet Supports, and Conductors for Correction Coils and Feeders with China. Completion of the cryostat design remains a priority for the Department; other priority areas are the magnet feeders and the blanket. To date, the Tokamak Department has concluded 29 Procurement Arrangements.

On the basis of the Modified Reference Design chosen in 2009 as the reference design for the ITER vacuum vessel and blanket, the Department finalized the vacuum vessel models and drawings and delivered them to the procuring Domestic Agencies in May. In July, the Agreed Notified Body, on behalf of the French nuclear regulator, gave its preliminary approval for the Modified Reference Design. This milestone opens the way for manufacturing to begin.

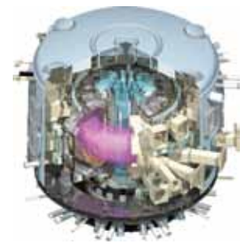
Cost containment activities related to tokamak systems were discussed intensively during the year as part of the ITER Organization's global efforts towards cost reductions. The Tokamak Department can report two successful examples of cost containment. First, through successful collaboration within the Blanket Integrated Product Team, a reduction in the number of procuring Domestic Agencies for the ITER blanket was proposed and accepted into the Baseline. This measure will reduce both duplication and cost without changing the overall schedule for the blanket. Second, the Japanese and United States Domestic Agencies agreed to select JK2LB as the central solenoid jacket material following a successful program of cost reduction led by the ITER Organization. The Department continues to participate in a review of proposed cold testing for the central solenoid magnets—another area with important potential for cost savings.

Manufacturing of niobium-tin (Nb3Sn) superconducting strand accelerated during the year. The Chinese Domestic Agency successfully qualified its Nb3Sn strand for the toroidal field conductor in October; toroidal field strand manufacture is now underway in the six procuring Domestic Agencies. The cumulated production of Nb3Sn strands passed the 100-ton mark in September representing approximately 25 percent of the total strand needs for ITER's toroidal field coils. A new Magnet Integrated Product Team was formed during the year; this will be the first ITER Integrated Product Team to focus on procurement support and manufacturing activities. Collaboration continued in 2010 with the CERN laboratory on superconducting strand testing.

The Japanese Domestic Agency continues to lead superconductor manufacturing for ITER. In June, the ITER Organization approved the first credit in ITER units of account (IUA) for the completed manufacture of 17 tons of Nb3Sn-based strands, 2.4 kilometres of superconducting cables, and one 760 metre-long copper dummy conductor. This material produced by industrial suppliers successfully underwent all required quality control tests. This credit request is the first for actual hardware produced for ITER. In another milestone, Japan achieved the jacketing of the first 780 metres of toroidal field dummy conductor using copper strands.

The Chinese and Russian Domestic Agencies successfully tested niobium-titanium (NbTi) conductor samples in 2010. NbTi superconducting wire production for ITER's poloidal field coils is now underway. In order to define the test procedures and the acceptance criteria for the manufacturing of the ITER poloidal field coil conductor, the ITER Organization commissioned ENEA (Italy), in collaboration with CEA/IRFM (France), to study, design and produce two prototype samples.

Sample testing of the first central solenoid superconducting cables late in the year revealed unsatisfactory results. Engineers at the SULTAN facility in Switzerland found that the cables lost



A cutaway of the ITER Tokamak with the hot plasma, in pink, in the centre.

Part of the Russian contribution to ITER conductors will be produced here, in this JSC VNIIKP jacketing line workshop near Moscow. *Photo: RF-DA*

their current-carrying capacity over time to a point well beyond that experienced in an earlier model coil test. Required to withstand 60,000 current pulses during plasma operation, the conductor test revealed degradation after only 6,000 pulses. The exact cause of the degradation in the conductor sample is unknown; however, this is a serious issue that must be resolved. The ITER Organization is planning tests to find out whether the unsatisfactory performance is a result of the sample configuration, the sample preparation, or the conductor design itself.

Effective November 2010, the TKM Department was renamed the Directorate for Tokamak.

Department for CODAC, Heating & Current Drive, Diagnostics (CHD)

Work on the design and procurement activities for ITER's heating and current drive, diagnostic, and control systems progressed in 2010. The CHD Department concluded six Procurement Arrangements: Heating & Current Drive Radio Frequency Power Sources, Diagnostic Neutral Beam Line, and Neutral Beam Test Facility Components (SPIDER and Calorimeter) with India; Ion Cyclotron Transmission Lines, and Electron Cyclotron Main Transmission Lines with the United States; and Neutral Beam Test Components with Europe. This brings to eight the number of Procurement Arrangements signed by the CHD Department.

The Neutral Beam Test Facility endorsed by the ITER Council during 2009 entered its construction and procurement phase in 2010. The new test facility, PRIMA, will be built by contributing parties Europe, Japan and India at the Consorzio RFX in Padua, Italy. Kick-off meetings for the ITER Task Agreements on the facility's design and on neutral beam ex-vessel components were held early in the year. PRIMA will comprise two test beds: SPIDER, for the development of the ion sources required for the ITER neutral beam injectors and the testing of essential aspects of the diagnostic neutral beam accelerator; and MITICA, which will be used to test the prototype of a full-size megavolt heating neutral beam injector prior to ITER operation.

In a related development, procurement for the ELISE experiment continued; it is now expected that this radio-frequency-driven negative ion source in Garching, Germany will begin operation in 2012. ELISE will be half the size of the future ITER ion source; success on this test bed will greatly reduce the risk associated with the final development of the full-size ITER ion source at the SPIDER test facility.

The design of the ion cyclotron antenna for ITER began in 2010, monitored by an ITER Task Agreement with the European Domestic Agency. A concept for improved layout for the matching ion cyclotron systems—heating and current drive radio frequency power sources procured by India and transmission lines procured by the United States—is under investigation. The conceptual design phase for the electron cyclotron resonance heating system is underway and India, Russia, Japan and Europe are developing prototypes for the ITER gyrotrons. The Heating & Current Drive Division held the conceptual design review for the ion cyclotron antenna and the final design review for the high-voltage bushing during the year.

In the Diagnostic Division, the emphasis in 2010 was on design review activities. In April, representatives from five Domestic Agencies plus external experts participated in a review of ITER's in-vessel diagnostic systems during which integration issues with the vacuum vessel and blanket instrumentation were addressed. The Division also successfully concluded the preliminary design review for the generic upper port plug. Design work on the generic diagnostic equatorial port plug began in March.

Seven conceptual design reviews were held for diagnostic systems during the year. Procurement activities are accelerating; the creation of a Diagnostic Integrated Product Team will help streamline procurement preparation for diagnostic systems. The Division also continued to work with the Integrated Project Schedule in order to determine lower risk paths for diagnostic elements up to First Plasma.

The CODAC Division provides common standards for ITER's control systems, including the Instrumentation and Control (I&C) systems that lie within the scope of each plant system. The Division released the 2010 update of the Plant Control Design Handbook (PCDH) with standards applicable to plant system I&C, as well as the first version of the CODAC core system for I&C early in the year. The Division trained the Domestic Agencies in the use of these tools, and also conducted a successful dissemination campaign for the Process Control Design Handbook. The I&C Integrated Product Team formed last year continued to be an important medium for the Division's standardization efforts.

The ITER-CERN collaboration on Machine Protection and Interlock systems was launched in 2010, as were outside contracts for the development of I&C. CODAC completed the conceptual design of the Central Interlock System and prepared a set of rules and guidelines for the design and implementation of the Plant Interlock Systems developed by the different Domestic Agencies. During the year, CODAC proposed a strategy for Nuclear Safety Control Systems to ITER management. In addition, the Division took on out-of-scope activities such as cubicle and signal assessments. To formalize this extended scope of activities, a new section—the Plant Control and Integration Section—was formed within the CODAC Division.

In conjunction with colleagues from DIII-D, the Division developed a CODAC application for visualizing simulated plasma shots; the Real-Time Plasma Boundary Display System will be a precious tool for ITER physicists in their modelling activities. The Division also hosted a well-attended EPICS collaboration meeting in June. EPICS open-software tools and applications are widely used by the worldwide physics community and were selected last year as the middleware platform for ITER's control system.

Effective November 2010, the CHD Department was renamed the Directorate for CODAC, Heating & Diagnostics. Information Technology (IT) was moved to the Directorate for Finance, Budget & Control.

Civil Construction and Site Support Office (CCS)

The major milestone for the twelve months covered by this report was the signature of the largest procurement in the history of the ITER Organization. The Procurement Arrangement for Building Construction, signed in May with the European Domestic Agency, covers the construction of 39 buildings plus site infrastructure. For the CCS Office, this fifth and last Procurement Arrangement opens the way to the final design and construction of all buildings.

In a second important development for ITER construction, the European Domestic Agency concluded the selection process for the Architect/Engineer who will be charged with

Conduit punching trials are conducted for helium penetrations on the central solenoid coils. *Photo: US ITER/ORNL*

the completion of the construction designs for buildings, site infrastructure and power supplies on the platform, and the monitoring of construction activity. The European Consortium ENGAGE (Assystem, France; Atkins, UK; Empresados Agrupados, Spain; and Iosis, France) will assist the European Domestic Agency for the duration of the Construction Phase, or an estimated eight years.

The European Domestic Agency also signed a contract with the French company APAVE for the safety-related services legally required under French law for construction sites. APAVE will be involved in the coordination of worksite activities and in the verification of designs from a safety perspective. The CCS Office was intensely involved with both of these contractors during the first few months following their arrival on site to ensure that all ITER requirements were clear and comprehensible.

In July, the French Commissariat à l'Energie Atomique et aux Energies Renouvelables (CEA) officially handed over the land of the ITER site to the ITER Organization. The notarial deed, effective as of 26 July 2010, transfers the responsibility for the ITER site to the ITER Organization for the duration of the ITER Agreement (24 October 2042).

The ITER Organization signed a similar agreement with Agence Iter France for the transfer of the buildings and infrastructure for ITER use. The two parties also agreed on the extension of services provided under the Site Support Agreement; Agence Iter France will continue to provide support in running the site up to the end of 2011. The Site Steering Committee met for the first time in July and elected members to the Site Operations and Safety Committee that will manage the coordination of operations, supervision of occupational health and safety issues, logistics support and security control for the site. The Committee includes members from the European Domestic Agency, the CCS Office, the SAS Department, and Agence Iter France.

Following the selection of the contractor for the Poloidal Field Coils Winding Facility by the European Domestic Agency, the CCS Office, in conjunction with the Domestic Agency, successfully completed the documentation required for the building permit application and submitted the application in March. The European Domestic Agency also awarded contracts for the excavation works and ground support works for the Tokamak Complex that comprises the Tokamak, Diagnostic, and Tritium Buildings. In May, Agence ITER France awarded the design-build contract for the construction of the 20,500 m2 permanent ITER Headquarters building.

The year 2010 marked the beginning of construction on the ITER platform for the ITER permanent Headquarters, the Poloidal Field Coils Winding Facility and the Tokamak Complex excavation and ground support works. These works involved several hundred people during the third and fourth quarters of 2010. The number of workers is now expected to steadily increase and reach over 3,000 during the peak of construction activity in 2013–2014. Industrial suppliers have started to produce the 500 anti-seismic bearings that will be installed on the lower basemat plinths of the Tokamak Complex before structural work begins.

Throughout the Construction Phase, close cooperation will be necessary between the CCS Office, the European Domestic Agency, its building contractors, and the Architect Engineer ENGAGE. This year, the CCS Office joined the European Domestic Agency team and 150 engineers and designers from the ENGAGE Consortium in the new office building (JWS 3) adjacent to the temporary ITER Headquarters.

Effective November 2010, the CCS Office was renamed the Directorate for Buildings & Site infrastructure (BSI).

Department for Central Engineering and Plant Support (CEP)

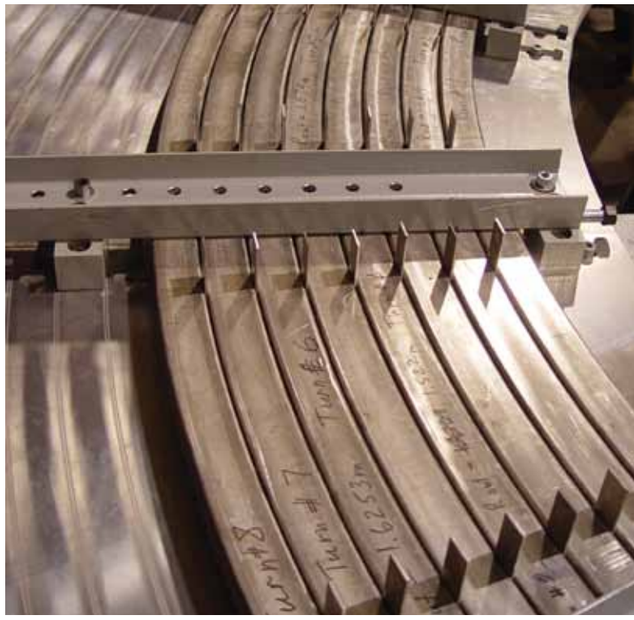
The CEP Department held a large number of design reviews for plant systems in 2010; procurement and manufacturing activities can now begin. The Procurement Arrangement for Component Cooling Water System (CCWS), Chilled Water System (CHWS) and Heat Rejection System (HRS), and the Procurement Arrangement for Lower Pipe Chase Cryolines were signed with the Indian Domestic Agency, bringing to four the total number for the Department.

The conceptual design review for the ITER cryoplant in October was a major milestone for the Plant Engineering Division, preparing the way for procurement of the world's largest cryoplant system in 2010. The Division completed the first phase of cryogenic tests on the KSTAR cryoplant and cryodistribution systems in conjunction with the Korean Domestic Agency and National Fusion Research Institute. The conceptual design work for the auxiliary cold boxes also progressed well. Members of the Department participated in the pre-qualification of cryoline manufacturers at the Indian Domestic Agency.

Preliminary design work on the Tokamak Cooling Water System (TCWS) began in 2010 following the award of the contract for TCWS design and fabrication by the United States Domestic Agency. Preliminary design activities for the CCWS, the CHWS and the HRS cooling water systems also started at the Indian Domestic Agency with the support of external engineers.

The Plant Engineering Division participated in the Hot Cell Facility operability study in conjunction with the Remote Handling Section and UKAEA. Simulations of operation and maintenance scenarios showed that the Hot Cell Facility design is consistent with maintenance requirements. The Division launched a risk management task aimed at identifying and mitigating the main risks associated with the Hot Cell Facility. 3D CATIA models for both Type A and Type B radwaste management systems were developed and submitted to the project.

The Fuel Cycle Engineering Division transferred the latest design for the neutral beam injector cryopumps to the European Domestic Agency for the final design phase. Work on the build-to-print design of the torus cryopumps continued; value engineering has reduced projected fabrication costs by 30 percent while increasing the pumps' reliability and manufacturability. A new design concept for the ITER roughing system was developed that involves a novel cryogenic viscous flow compressor. In 2010, the vacuum team at the United States Domestic Agency completed a small prototype that is now ready for proof-of-principle demonstration and design optimization. The ITER vacuum system has one of the highest numbers of interfaces with other systems; in 2010 the Division identified a large number of interfaces to be controlled for leak-tightness and cleanliness during construction to ensure the integrity of the ITER machine.



During central solenoid winding trials conducted at the University of Tennessee Magnet Development Lab, which is under contract to US ITER, the conductor required a force of seven tesla to bend. *Photo: US ITER/ORNL*

In 2010, the first industrial contract for leak localization simulations was awarded. A second contract was awarded to investigate laser spectroscopic methods of leak localization. The United States Domestic Agency reported its first results on the proof of principle for the plug flow method for leak localization; this is a prime candidate for locating helium leaks in the magnet system and cryostat.

The Division closely monitored support contracts on highly tritiated water technology and on the conceptual and preliminary design of the detritiation system during the year. A contract for the conceptual design of the tritium transport package was successfully completed. Hazard and Operability (HAZOP) studies were carried out for several fuel cycle systems and for systems with a requirement for tritium confinement. The Division completed the configuration models for the Tritium Plant Building and defined interfaces between the Radiological and Environmental Monitoring System and buildings. The selection of hydride material for the design of the Tritium Plant storage and delivery system was made with the Korean Domestic Agency.

The Fuel Cycle Engineering Division held discussions with the South West Institute of Physics, China for a newly developed test facility for the validation of transient gas injection analysis. A new inboard high-field-side pellet flight tube layout, enabling pellet injection at machine mid-plan, was developed during the year. In September, the Oak Ridge National Laboratory replicated the low-field-side pellet flight tube mock-up for ELM pacing and successfully performed the pellet injector laboratory test: a pellet was shot through a mock-up of a curved guide tube that will be used to deliver the frozen pellets into ITER plasmas. New gas injection lines have been successfully

The ITER vacuum vessel will be twice as big and sixteen times as heavy as any previous tokamak.

implemented at the upper and divertor levels, and three additional gas valve boxes at the divertor level were included in the Baseline. A new gas injection location at the upper level was investigated to minimize the interference with gas puffing.

The Electrical Engineering Division, responsible for site electrical power distribution and magnet coil supplies as well as policy on electrical earthing, lightening protection, and cable engineering, is supported by a variety of external contracts. The Division completed the preliminary design for the electrical distribution networks in 2010 in conjunction with the European Domestic Agency. More than 120 Interface Control Documents and associated Interface Sheets now officially record the electrical needs for the various plant systems. The main cabling rules were established in accordance with Electro-Magnetic Compatibility (EMC) and safety requirements. Cabling diagrams for many plant systems were drafted with the support of the Design Office. An EMC workshop was organized to agree on the basic concepts for ITER-scale facilities that resulted in an update of the Electrical Design Handbook.

The Conceptual Design Review of the coil power supply systems was successfully completed. In the near future, four Procurement Arrangements are planned for signature.

Effective November 2010, the CEP Department was renamed the Directorate for Central Engineering & Plant.

Department for Safety and Security (SAS)

Major steps were taken in 2010 towards the official licensing of the ITER facility in France as a Nuclear Installation (Installation Nucléaire de Base, or INB). The SAS Department submitted a new version of the DAC nuclear licensing files to the French authorities in March, following a year-long, department-wide effort to update these documents in accordance with requests from the Nuclear Safety Authority (ASN) in France. The safety files (or DAC files, short for Demande d'Autorisation de Création), constitute a fundamental legal document providing an in-depth description of the ITER installation, including the Preliminary Safety Report (RPrS), a detailed Impact Study and other required licensing files—in all, over 5,000 pages of documentation.

ITER is the first fusion device to pass nuclear licensing procedures. Since beginning these files in 2007, the ITER Organization has observed the regulations of France as the Host country and, more specifically, its 2006 Law on Nuclear Transparency and Security. In December, the Department received notification of the "receivability" of the files, opening the way to the detailed examination of the documents by the French Nuclear Safety Authority (ASN) and its technical advisors, the IRSN (L'Institut de Radioprotection et de Sûreté Nucléaire). This is a major licensing milestone for the project that prepares the way for the Public Enquiry to be held in 2011. During the Public Enquiry, the public within a defined radius of the ITER installation will consult the ITER safety files and can enquire about environmental and safety aspects of the project.

The ITER Local Information Commission (CLI) met twice during the year. Established in 2009, it is composed of elected members to institutions, international experts, and representatives from the local communities, environmental groups, trade unions, and business and health professionals. The ITER CLI has the responsibility of monitoring and providing information to the public about matters related to nuclear safety, radiological protection and the impact of ITER's nuclear activities on the public and the environment. The SAS Department provides regular updates to the ITER CLI about safety and licensing issues. In 2010, the CLI began an examination of the ITER Impact Study; the SAS Department established a hotline to answer any Commission questions in a timely manner.

Safety and quality assurance issues continued to be a focus of collaboration between the ITER Organization and the Domestic Agencies. The ITER Safety and Quality Assurance Working Group (SQAWG) met twice during the year to address issues related to Procurement Arrangements, manufacturing, the delivery and assembly of components, as well as licensing requirements and nuclear safety. Sessions of the mandatory training on the French Quality Order (10 August 1984) continued at the ITER Organization and abroad; in the Domestic Agencies, the accent was placed on communicating safety requirements throughout the supply chain. The ITER Committee for Health and Safety continued to meet during the year.

In 2010, the SAS Department continued discussions on the applicability of Nuclear Pressure Equipment (ESPN) regulations to the ITER vacuum vessel with the French authorities. The Quality Assurance Division now has a representative in the COLEN Committee, which is charged with these questions.

Effective November 2010, the SAS Department was renamed the Department for Safety, Quality & Security (SQS).

Department for Fusion Science and Technology (FST)

The FST Department made significant contributions to the completion of the ITER Baseline documentation in 2010. In particular, the ITER Research Plan and the Physics Work Program 2011–2013 were adapted to the project schedule that sets the date for First Plasma at November 2019 and a target date for full Deuterium-Tritium operation at March 2027. The Department continued to act as the liaison between the ITER Organization and the STAC, and supported the project's licensing activities by providing input related to plasma effects for the safety files.

Members of the Department participated in all activities of the International Tokamak Physics Activity (ITPA) and served on the project committees of principal tokamaks. Maintaining close relations with the larger physics community remains essential to ensuring support for the ITER project. The ITPA website is now housed on *www.iter.org*. ITPA Topical Groups use this area to store and exchange presentations and data with the more than 600 members of the ITPA community.

As coordinator of the Test Blanket Module (TBM) program, the FST Department planned and hosted a workshop on the impact of TBMs on ITER plasma physics. Experts concluded that while TBM impact on low-performance plasmas is small, it may be more significant on high-performance plasmas. The group recommended a) obtaining more reliable predictions of the effect of magnetic field perturbations; b) maintaining current TBM design characteristics while attempting to reduce ferromagnetic mass; and c) closely studying possible TBM-induced disturbances during the initial ITER operational phase in order to take any countermeasures necessary for the subsequent ITER phases.

Significant progress was achieved in the definition of interfaces between the six planned Test Blanket Systems and ITER systems and facilities. Work carried out by TBM teams in the Domestic Agencies was monitored through regular meetings of the Port Management Groups. The TBM Program Committee, whose role it is to make recommendations to the ITER Council, met twice; in an important step for the TBM program, the framework was established for TBM Arrangements (TBMA) to be signed between the ITER Organization and each of the six TBM Leaders.

The ITER integrated modelling program, launched last year, continued to develop in 2010. The Integrated Modelling Expert Group met for a second time with participation from each of the ITER Members. The group endorsed a revised description of the Integrated Modelling Program that provides support for plasma operations and plasma research. In cooperation with ITPA, the physics assumptions used for ITER modelling were verified experimentally at several tokamaks.

FST conducted simulations of main ITER plasma scenarios during the year to verify the design of poloidal field coils and their power supplies, to provide input for plasma-facing components, and to optimize the heating and current drive mix for ITER operation. The Department performed analysis of plasma vertical stabilization with the goal of finalizing the design of in-vessel coils, and also made progress in the study of non-axisymmetric magnetic fields. Improved plasma simulation capability has enabled more accurate calculations. In the area of plasma-wall interaction, FST was able to conclude that from the point of view of burning plasma core-plasma purity, beryllium armour is not necessary on diagnostic port plugs and TBM frames. Bare stainless steel, which offers a simpler and less expensive technical solution, may be used.

There was significant progress in 2010 on the development of a Disruption Mitigation System (DMS) for ITER. Representative disruption/vertical displacement event scenarios, elaborated for the Baseline design, confirmed that the vertical force under the condition of loss of vertical position control is within the design limitations for the vacuum vessel. Two DMS subsystems are envisaged: massive gas injection to mitigate the energy loads during the thermal quench phase, and repetitive gas injection for runaway electron suppression. In 2010, the Department launched experimental programs for testing this new suppression scheme with tokamaks Tore Supra, T-10, and ASDEX-U. It also studied the conceptual designs for two candidate fast-gas delivery systems capable of a response time of less than 10 ms. A Plasma Control Group, within which the conceptual and engineering design of the Plasma Control System will be carried out, was formed within the Instrumentation & Control Integrated Product Team.

The Department represented the ITER Organization at the 23rd IAEA Fusion Energy Conference in Korea. It also chaired the program committee for the first Monaco ITER International Fusion Energy Days (MIIFED) that took place in November. FST managed the recruitment of the second group of Monaco Postdoctoral Fellows from a large pool of highly qualified applicants; the five researchers took up their appointments in late 2010. The first group of Fellows has made significant

Across the excavation worksite in December 2010, the first concrete pillars of the Poloidal Field Coils Winding Facility are seen in the distance. *Photo: F4E*

research contributions benefitting the project in the areas of plasma diagnostics, plasma-wall interactions, plasma control and superconductors.

Effective November 2010, the FST Department was renamed the Directorate for Plasma Operation (POP).

Department for Administration (ADM)

The Administration Department, comprising Procurement Arrangement and Contract, Human Resources, Finance and Budget, Document Control, and Information Technology (IT), worked in 2010 to improve the tools and processes used by the management of the ITER Organization.

The Department introduced new features to the data management tool, SAP, such as an electronic invoice workflow system to improve the efficiency and rapidity in the payment of invoices, and the registration of in-kind financial transactions with the Domestic Agencies that now enables the tracking of these contracts in the same manner as cash contracts. In 2010, the responsibility for the implementation of SAP was transferred to IT, reducing support costs by 50 percent.

The Department uploaded the complete list of ITER Organization Task Agreements, both planned and actual, to the Cobra Earned Value Management tool during the year. It also introduced an in-kind budget, separate from the cash budget, for Task Agreements for credit and for Secondment Agreements in order to assist departments and directorates in controlling and achieving their budget targets.

Seventeen Procurement Arrangements were signed by the ITER Organization in 2010 for an annual record amount of 610 kIUA. This included the signature of the single largest procurement for ITER—the Building Construction Procurement Arrangement with the European Domestic Agency. A total of 47 Procurement Arrangements have now been signed representing 60 percent of the in-kind project value.

In 2010, the Procurement and Contract Division concluded 791 contracts, 18 cash Task Agreements and 1285 purchase orders. The Division continues to decrease the percentage of single-tender contracts. During its sixth meeting (June 2010), the ITER Council welcomed the progress made, and encouraged further reduction in not only the percentage, but also the number and value of these contracts.

The ITER Organization signed the Global Insurance Contract for the buildings and assembly with a group of leading insurers in October. This was an important step in securing the risk management of the ITER project, as the contract will provide a stable contractual environment for the ITER Members during construction and assembly. The Administration Department also completed the framework for a second large insurance contract the will be signed in 2011: the Global Transportation Contract will provide for the use of one single Logistic Service Provider for the transport of all ITER components.

Through its on-line job portal, the Human Resources Division managed the recruitment of 63 staff members bringing the total of staff to 469 as of 31 December 2010. The ground floor of the new temporary office building (JWS3) adjacent to ITER Headquarters provided much needed space for ITER employees.

Staff continued to have access to training courses during the year for a total of 13,000 hours (1,600 attendees). The courses, lasting on average one day or less, included mandatory sessions in export control and intellectual property management as well as corporate sessions in software packages, project management, and communication. This year the Human Resources Division also introduced a new internship policy.

The ITER Council endorsed the Manpower Resourcing Policy that aims to achieve a better balance between ITER staff and contracted employees. Work also began on an internal Code of Conduct that the ITER Organization will issue as part of the development of internal control standards. This document, when released, will provide ITER employees with guidance in matters of professional ethics and behaviour.

The Finance and Budget Division issued the 2009 Financial Statements early in the year. In April, the Financial Audit Board (FAB) carried out its second on-site audit and declared the accounts to give a true and fair view of the ITER Organization's financial transactions in 2009. The Board returned to the ITER site for a September interim visit to prepare for the audit of the 2010 accounts. A workshop was held on the implementation of International Public Sector Accounting Standards (IPSAS) during the FAB visit to address the clarity of the ITER Financial Statements and possible areas for improvement. Action was taken during the year to resolve budget underruns potentially affecting milestones in the project schedule. In certain cases, resources were reallocated according to the schedule needs of the project.

The Document Control Centre introduced a knowledge preservation program that is modelled after similar programs at other large scientific institutions. It aims to create a systematic approach to identifying, acquiring, preserving and sharing project knowledge, and includes interviews with key staff members and the inventory, safe storage, and accessibility of printed matter belonging to ITER Organization history. Control processes for its publications and the management of intellectual property were also initiated during the year.

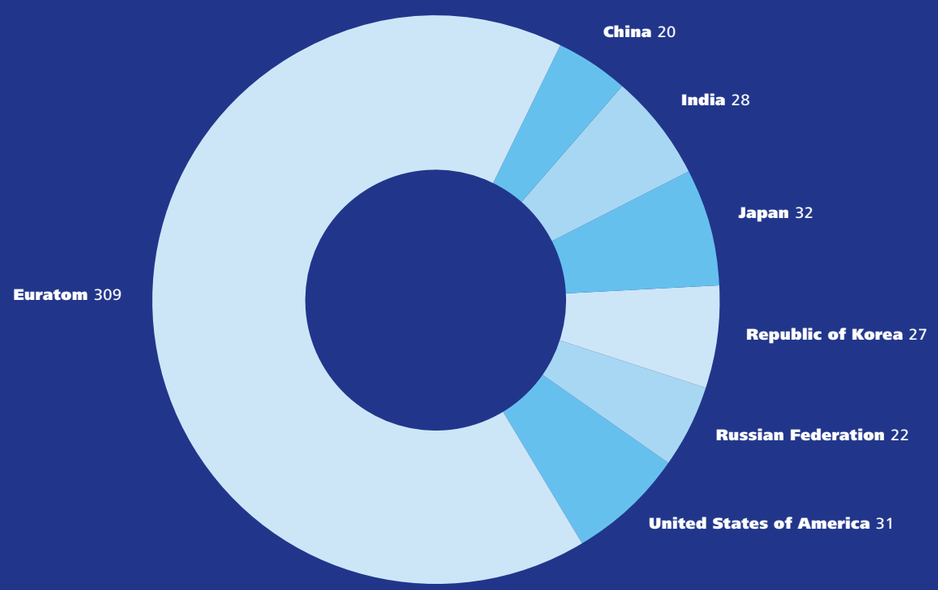
The IT team continued to support network, server, and data storage needs for ITER Organization activities. The Helpdesk handled 7,000 user support requests in 2010, of which a significant number were for video conferencing support.

Effective November 2010, the ADM Department was renamed the Department for Administration. General Services (Logistics) was moved to the Directorate for General Administration.

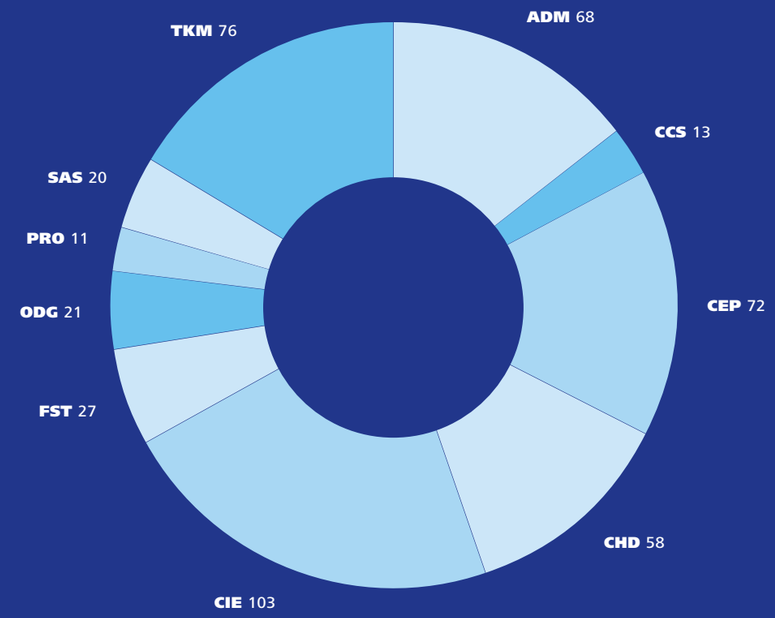
To create the Seismic Isolation Pit, home to the future ITER Tokamak Complex, diggers will excavate an estimated 210,000 cubic metres of soil and rock from the ITER platform.

Staffing & Financial Tables

Staffing Tables



Staff by Member	31.12.2009	31.12.2010
China	17	20
Euratom	281	309
India	28	28
Japan	28	32
Republic of Korea	24	27
Russian Federation	23	22
United States of America	29	31
Total	**430**	**469**



Staff by Department (as of 31/12/2010)	Professional	Support	Total
Department for Administration (ADM)	33	35	68
Civil Construction and Site Support Office (CCS)	10	3	13
Department for Central Engineering and Plant Support (CEP)	46	26	72
Department for CODAC, Heating & CD, Diagnostics (CHD)	41	17	58
Office for Central Integration and Engineering (CIE)	61	42	103
Department for Fusion Science and Technology (FST)	24	3	27
Office of the Director-General (ODG)	12	9	21
Project Office (PRO)	6	5	11
Department for Safety and Security (SAS)	11	9	20
Department for Tokamak (TKM)	57	19	76
Total	**301**	**168**	**469**

Financial Tables

Commitments Execution—Cash and In-Kind Task Agreements and Secondments (all figures in million Euros)

	Total Commitment Appropriations	De-commitments and Transfers of Previous Years' Commitments	Total Commitments 2010	Unused Commitment Appropriations carried forward to 2011
Title I: Direct Investment (Fund)	18.55	-	18.13	0.42
Title II: R&D Expenditure	28.08	1.26	26.17	3.18
Title III: Direct Expenditure	176.05	3.25	171.74	7.56
Total	**222.69**	**4.52**	**216.04**	**11.16**

Payments Execution—Cash and In-Kind Task Agreements and Secondments (all figures in million Euros)

	Total Payment Appropriations	Write-Offs and Transfers of Special Account Items	Total Payments 2010	Unused Payment Appropriations Carried Forward to 2011
Title I: Direct Investment (Fund)	10.88	-	6.90	3.98
Title II: R&D Expenditure	30.61	0.19	23.09	7.33
Title III: Direct Expenditure	159.16	0.61	136.33	22.22
Total	**200.65**	**0.80**	**166.32**	**33.53**

Contributions from Members (all figures in million Euros)

	Cash			
Member	**Money**	**Task Agreements and Secondments**	**Procurement Arrangements**	**Total**
China	12.01	0.60	-	12.60
Euratom	55.72	9.53	6.66	71.91
India	11.93	2.44	1.86	16.23
Japan	12.01	-	27.91	39.91
Republic of Korea	12.01	2.60	1.71	16.31
Russian Federation	12.01	0.41	-	12.41
United States of America	11.15	3.92	3.88	18.95
Total	**126.81**	**19.49**	**42.02**	**188.32**

Cumulative Credits Notified to the Members (in IUA)

Member	Secondments	Task Agreements for Credit	Procurement Arrangements	Total
China	0	380	0	380
Euratom	11,731	4,178	4,290	20,199
India	0	2,227	1,200	3,427
Japan	594	0	17,980	18,574
Republic of Korea	271	1,675	1,100	3,046
Russian Federation	0	261	0	261
United States of America	1,426	2,632	2,500	6,558
Total	**14,022**	**11,352**	**27,070**	**52,445**

Cumulative Credits Notified to the Members (in million Euros)

Member	Secondments	Task Agreements for Credit	Procurement Arrangements	Total
China	0.00	0.59	0.00	0.59
Euratom	17.72	6.48	6.66	30.86
India	0.00	3.45	1.86	5.31
Japan	0.87	0.00	27.91	28.78
Republic of Korea	0.40	2.60	1.71	4.71
Russian Federation	0.00	0.40	0.00	0.40
United States of America	2.15	4.07	3.88	10.10
Total	**21.14**	**17.59**	**42.02**	**80.75**

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

Organizational Chart

This new organizational structure, approved by the ITER Council in November 2010, will be fully operational in June 2011.

Financial Audit Board

Management Advisory Committee

ITER Council

Science and Technology Advisory Committee

Test Blanket Module Program Committee

Office of the Director-General

- IO Strategic Planning
- External Relations
- Communication
- Others
- ITER Council Secretariat
- Internal Audit Service
- Legal Affairs

Osamu Motojima
Director-General

Project Board

Bureau of International Cooperation

- DDG China
- DDG EU
- DDG India
- DDG Japan
- DDG Korea
- DDG Russia
- DDG USA

IO-DA Coordination

Department for Administration
DDG & Director: Richard Hawryluk

Directorate for General Administration

- Human Resources
- Procurement & Contract
- Document Control
- General Services

Directorate for Finance, Budget & Control

- Finance & Budget
- Project Management
- Project Information System

Department for ITER Project
DDG & Director: Remmelt Haange
Chief Scientist: Valery Chuyanov

Directorate for Plasma Operation

- Science
- Technology

Directorate for Tokamak

- Magnet
- Vessel
- Internal Components

Directorate for Central Engineering & Plant

- Electrical Engineering
- Fuel Cycle Engineering
- Plant Engineering

Directorate for CODAC, Heating & Diagnostics

- Control System
- Diagnostics
- Heating & Current Drive

Directorate for Building & Site Infrastructure

- Building System
- Site Management & Logistics
- Nuclear Buildings
- Non-Nuclear Buildings

Directorate for Central Integration & Engineering

- Assembly and Operations
- CAD & Design Coordination
- Technical Integration

Department for Safety Quality & Security
DDG & Director: Carlos Alejaldre

- Health & Safety Control
- Nuclear Safety & Analysis
- Quality Assurance

Route de Vinon sur Verdon
13115 Saint Paul Lez Durance
France

www.iter.org