2013 . 07

# DYNATOM代邦核讯

SHAPING THE NEW KEY TO ENERGY

## CANADA IS BACK !

## 加 拿 大 归 来 ！

## IN THIS ISSUE / 本期热点

# CONTENTS

EDITORIAL STAFF
/ 编辑团队

EDITORS / 编辑
Arnaud Lefevre-Baril / 百力
Bessie Wang / 王文贝

NEWS / 新闻
Qi Jia / 戚佳

TECHNICAL ARTICLES / 科技文章
Bessie Wang / 王文贝

EVENTS / 展会会议
Qi Jia / 戚佳

DESIGNER / 设计师
FangHua Design Inc/ 芳华设计公司

DYNABOND POWERTECH SERVICE / 代邦核讯 联系方式

Room 1509, Zhongyu Plaza, A6 Gongti North Road, Chaoyang District, Beijing, China

PHONE / 电话
+86-10-64681222

FAX / 传真
+86-10-64654957

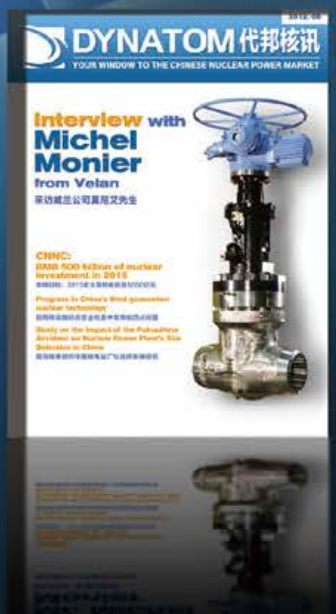
EMAIL / 邮箱
info@dynabondpowertech.com

WEBSITE / 网站
www.dynabondpowertech.com

# DYNATOM 代邦核讯

YOUR WINDOW TO THE CHINESE NUCLEAR POWER MARKET




## Our Readers:

- Hundreds of decision makers in the Chinese nuclear market
- All procurement departments from major nuclear utilities
- Government bodies
- Safety authorities and technical safety units
- Research institutes
- Component manufacturers
- Newly graduated engineers
- More than 15,000 subscribers from 77 countries around the world who are focused on the Chinese market

## Take Action Now!

**Full page**

US $525 / month*

**Half page**

US $263 / month*

**One-quarter page**

US $132 / month*

*Payment is on a yearly basis.

## Contact us today:

Tel: +86-10-64681222 ext. 156
Email: info@dynabondpowertech.com
Mailbox: Dynabond Powertech Service Co., Ltd.
1509 ZhongYu Plaza, A6 Gongti North Road, Chaoyang District,
100027 Beijing, P.R. China

## Our Sponsors:

Cameco · L3 MAPPS · HAMON · GEA · Kabelwerk EUPEN AG cable · vallourec · BUREAU VERITAS · UNIVERSITY OF MARYLAND A. JAMES CLARK SCHOOL OF ENGINEERING


Arnaud Lefevre

# The Six main reasons why foreign companies will fail in the Chinese market

From 2013 until 2020, one trillion Yuan (around 160 billion USD) will be invested in the nuclear power industry.

70 to 90 percent of the nuclear power plants will be localized.

The remaining market is to be shared between 220 foreign companies which supply safety related equipment, and less than 50 others dedicated to other sectors of the industry.

Most of these 270 companies will be kicked out of the market.

We will reveal the transformations in the market that impact the business of foreign companies in China:

**F**ailing to prepare a long-term strategy

**I**gnoring the local requirements from the Safety Authority

**A**ccelerating the creation of a local office

**S**preading a negative message which affects local opinion

**C**utting off the investment in market intelligence and competition analysis

**O**bstructing the Chinese partner from going global

## Chapter 1: Failure to prepare a long-term strategy

Most of the European and North American companies came to China for the same reason: to be involved in projects signed by Areva, Westinghouse, Rosatom and AECL.

AECL did not have new CANDU projects in China, and the Canadian industry, while highly experienced, left the Chinese market to this year. The industry is looking to return to China with a new project.

This example coincides with the French and German companies behind Areva, US businesses involved with Westinghouse, and Russian companies with Rosatom.

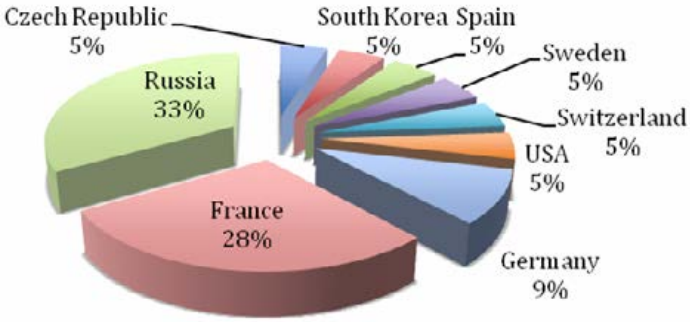
We outlined eight recommendations prior to your development in China:

1. **T**op three in the Global Market
2. **A**greements signed between China and your country
3. **C**larify your expectations within 18 months
4. **T**ransfer your technology
5. **I**nvest in a local entity
6. **C**ollaborate with the EPC
7. **A**udit the budget for your expansion
8. **L**egitimize your Title

### 1.Top three in the Global Market

The first question to be asked is about your global ranking: Are you globally in the top three of your line of business?

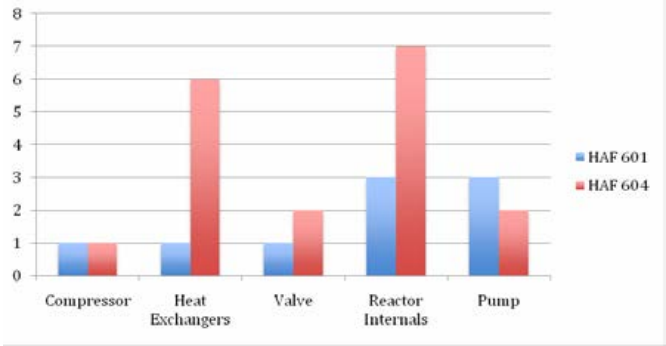
The list of HAF 604 certificates from the National Nuclear Safety Authority (NNSA) indicates companies which only supply Class 3 safety related components, and therefore do not offer any technological edge in the market, they are particularly from the following countries:




*Above: percentage of manufacturers per country, exporting Class 3 equipment to China*

Most of these enterprises obtained their certificate between 2008 and 2009 for the Ling Ao project (The Russian companies are only involved in the Tianwan project).

Since 2008, a growing number of local competitors have been certified, and their number will increase to reach at least three entities.




*Above: Companies that provide only "class 3" equipment to China.*

Why is this number three? This is the basic number for any tender according to the Chinese law, and the safety authority has received a guideline to keep this number of three local competitors in order to guarantee the localization of equipment.

If you are not considered to be in the top three globally, do not go to China.

## 2.Agreements signed between China and your country

Most of the countries involved in nuclear power signed a bilateral cooperation agreement with China.

There are around 133 international bilateral agreements signed between China and 30 countries (non included IAEA).

According to our experience during the last five years, only state owned companies, or entities working for government projects are aware of the variety of agreements signed.

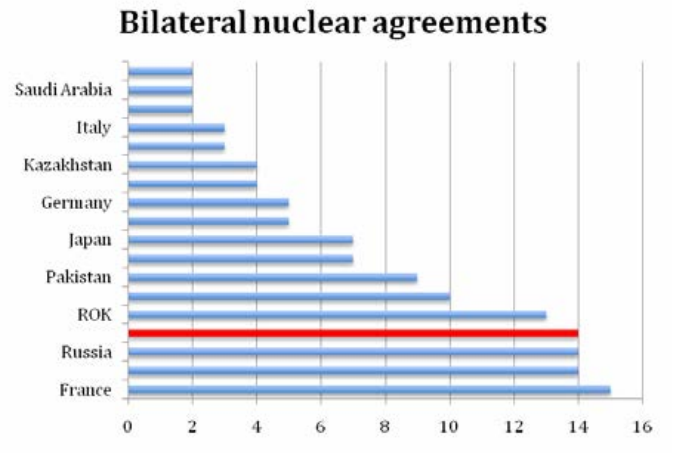
Most private companies do not investigate the range of the agreements, and just focus on the construction of nuclear power plants, rather than accompanying ongoing agreements.

The diplomatic relations between both countries must be followed. The recent crisis in the Sankaku-Diaoyu Islands has a direct impact on Sino-Japanese commercial relations in every sector, including nuclear.

In 2008, during the France-China crisis, the order was similar: to halt any project until the French government would kneel.

In another domain, the recent victory of Kepco in the United Arab Emirates has indicated to China that Korea has become a strong international competitor.

China is therefore closing its market to new entrants despite a strong commitment of Korean companies in China.




*Above: Number of Bilateral agreements focused on nuclear cooperation, including two agreements with Euratom*

If you do not follow the agreements and the diplomatic relations between your country and China, start your homework!

## 3.Clarify your expectations within 18 months

Despite the fact that China will be the largest nuclear market for the next twenty years, opportunities for foreign companies are still limited.

If you plan to develop your business in China, you need to take into account the time needed to set up an office (the factory will be discussed later):

•In Beijing, be close to CNNC and SNPTC.
•In Shanghai, be close to SNERDI for the AP1000 projects.
•In Shenzhen, be close to CGNPC.

Forget Wuhan, Chengdu, Qingdao and Hangzhou and remain close to your clients: Proximity is power.

If you plan to go back and forth between your country and China, expect a meeting every three months maximum if you are just developing your business for the first time on the mainland.

Most companies expect their first order within one year, which is not realizable even if the following conditions are respected:

•**Your product does not need HAF604:** HAF604 requires eighteen to two years to be granted by the NNSA. If you do not need the HAF, the competition is greater.

•**Your product interests the management of the SOE:** You have to spend time with the engineers in charge of the procurement who assess the technical features of your product. If a young engineer thinks that your product has no advantage, nobody will take the risk to sign the agreement. If anyone in the decision process refuses to take a risk, the result will be the same, even if you have a strong technological advantage. A major North-American company delayed the delivery of its distributed control system by two years for a large number of reactors. The new entrants could not persuade the buyer to modify the technology for the actual and next reactors. The decision process was frozen.

•**Your product is required by an SOE or an institute:** any budget for new purchase will be reviewed and granted before the Chinese new-year (around the mid of January). Any deal should be prepared between February and August and be signed the year after.

•**Your company has already established historical relations with the industry:** many SOEs have established commercial relations with the suppliers of Daya Bay/Ling Ao and Sanmen/Haiyang and have

been trained by their suppliers for many years. New entrants will need to raise the standard such as transfer of technology, or lower the price.

**•You closed a first deal and the payment was made fast.** Companies such as CNEIC in charge of the import-export business for CNNC need an approval for payment from the Tax bureau. It takes between three to four months to have the approval before making the first payment. This is usually done after every agreement. Your cash flow will be affected.

Your company needs at least 18-24 months to be noticed by the end user. You will foresee the first deal (negotiation, signature and first payment) between the 24-36 months.

## 4.Transfer your technology

Much bidding in China requires transfer of know-how. Recently a leading French-German consortium had to accept the delivery of the know-how for Fuqing 5/6 while the US competitor withdrew from the bid due to this significant requirement.

In other fields, such as fuel cycle (enrichment, reprocessing, manufacturing), Areva, TVEL, CFM and WEC transferred the line of production to Baotou and Yibin.

Your company has to accept a partial transfer of technology, however it is important to create a black box if you want to protect your patent.

We advise every businessman to read the excellent (and free) digital book by James McGregor, NO ANCIENT WISDOM, NO FOLLOWERS: The Challenges of Chinese Authoritarian Capitalism.

The registration of your intellectual property in China is mandatory, but the enforcement of the law is rarely efficient compared to what exists in the US and Europe. Do not expect any compensation if your partner or competitor is a SOE.

Many cases of dispute can be found on China Law Blog (http://www.chinalawblog.com/)

Transfer or not transfer? Your expansion in China will require this step. You will bring a technology and know-how that will create either a competitor or a long time partner, that will depend how you decide to play with your expertise.

If your strength is in developed countries, such as Europe and North America, you can start the process. However if your company is just starting its first international exposure, you will certainly create a competitor.

Most of the newcomers in key technology markets are required to transfer their technology immediately in order to gain access to the market.

If your strategy does not secure sustainability for your factory between the third and fifth years of business, do not enter the market.

## 5.Invest in a local entity

In June 2013, there were twenty Joint Ventures (JVs) and ten wholly owned foreign enterprises (WOFEs) that received HAF 601 from the NNSA.

| |
|---|
| Dalian Deep Blue Pump Co., Ltd. |
| Jiangsu BiaoxinJiubaotian Industrial Co., Ltd. |
| Shanghai KSB Co., Ltd. Shanghai Electric |
| Dalian Hermetic Pump Co., Ltd. |
| YantaiTaihaiManoir Nuclear Equipment Co., Ltd. |
| DongfangAreva Nuclear Pump Co., Ltd. |
| Nanjing Sun Tola Ripple Tube Co., Ltd. |
| CNNC SUFA Technology Industry Co., Ltd. |
| Shenzhen Shiyingda Pipeline Co., Ltd. CNNC 23 |
| CGNPC Inspection Technology Co., Ltd. |
| Shanghai Cable Factory |
| Dalian Danai Pumps Co., Ltd. |
| Shanghai YidianFoxbolo Co., Ltd. |
| Neway Valve Suzhou Co., Ltd. |
| Shanghai neles-jamesbury valve Co., Ltd |
| Jilin Zhongyi Nuclear Pipe Manufacture Co., Ltd |
| THT （SipingJuyuanHanyang Plate Heat Exchanger Co., Ltd） |
| AREVA Dongfang Reactor coolant pumps Co., Ltd |
| China Nuclear Industry 23rd Construction Corporation |
| Sichuan HuaDu Nuclear Equipment Manufacture Co., Ltd |

Above: List of current HAF 601s for Joint Ventures.

More companies, in particular from France, continue to invest in Guangdong province due to their proximity to CGNPC, such as Valinox, CNIM, Site and ACPP.

The investment from international firms with a local partner fails most of the time. The common strategy is to create an entity, expand in the Chinese market and contain it.

This is WRONG.

Any Chinese entity wants to expand globally.

However most of the JV are contained to the Chinese market and therefore you will create a frustrated partner who ultimately becomes your competitor.

The strategy in China must be seen as an expansion to new markets.

China has solid advantages in markets that you have not accessed, and your business should monitor the meetings organized by the ministry of foreign affairs and other countries. You can anticipate the next move of your local partner in the overseas market just by looking at websites that display routine information that are critical to your strategy:

The Ministry of Foreign Affairs
http://www.fmprc.gov.cn/mfa_chn/
http://www.fmprc.gov.cn/eng/wjdt/wsrc/
The list of Embassies in China and information on their relation with China.
http://www.embassiesinchina.com/
By monitoring such information, you will foresee where your partner wants to expand and anticipate the risk of creating a competitor: join him with your own resources in new markets.

In the case where your company has established a WOFE in China, monitoring is also a MUST in order to become a partner of the EPC.

If you do not monitor the activities of the Chinese agencies in the overseas market, you cannot foresee the next move of your partner and competitors.

## 6.Collaborate with the EPC's engineering team

How many times have we heard that Chinese engineering companies have used your drawings and other technical information to copy your know-how? All the time.

Let's be very clear about this issue: everybody does the same.

France is the one example: the French industry spent time in the seventies and eighties in the USA to copy any kind of information for the French program, and continued in Belgium for the reprocessing and fuel cycle.

The Japanese and Koreans used the same behavior in France and the USA during the nineties.

We could even continue with India and the CANDU technology.

That is not the subject of this article.

The winners in China are companies that will cooperate with the EPC.

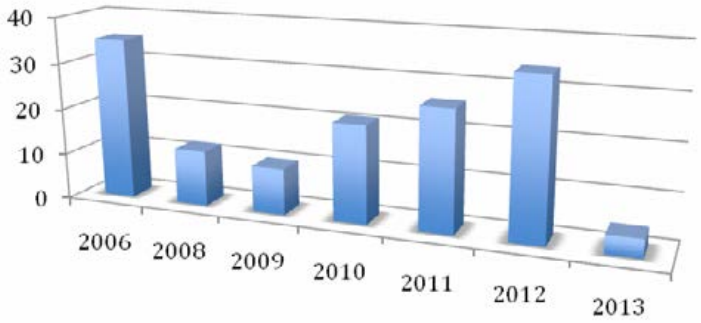
The losers will only sell equipment.

However our sole responsibility is to guarantee that China will have the best and safest technology and to avoid another Fukushima.

One of the top engineering companies from Belgium has implemented this philosophy. The company specializes in cooling towers. When its CEO was in Beijing, he met the two best EPCs from CNNC and CGNPC and told them: "We build the best, the highest, the safest and most advanced cooling towers in the world and we want to partner with you and share our technology".

This company has since trained both groups who want to keep this Belgian partner for all their national and international projects. This company became a strategic partner for the Chinese nuclear program.

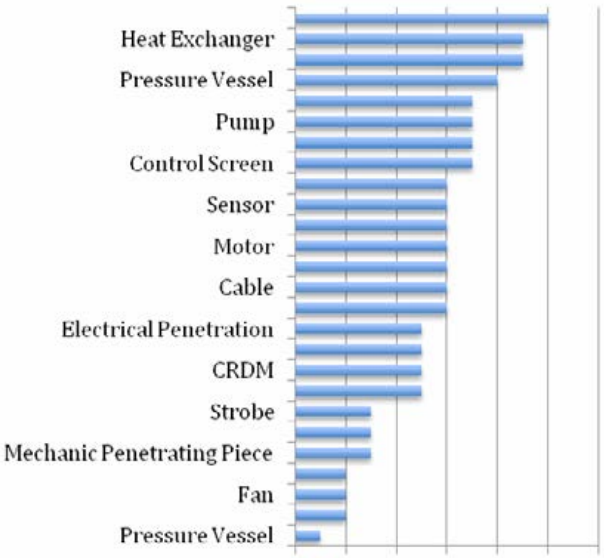
Foreign companies do not track the certifications awarded to local EPCs. These certifications will allow the manufacturing partner to sell equipment according to the specifications of the EPC. The number of certificates increased between 2009 and 2012 (our data shows only the first quarter of 2013).




*Above: HAF 601 certificates awarded to Engineering Companies for Design*

Most of the certificates awarded are related to Classes 1&3 for mechanical equipment, which indicates to manufacturers of Class 2 that either they should increase their sales force, or cooperate with the EPCs to widen their spectrum.

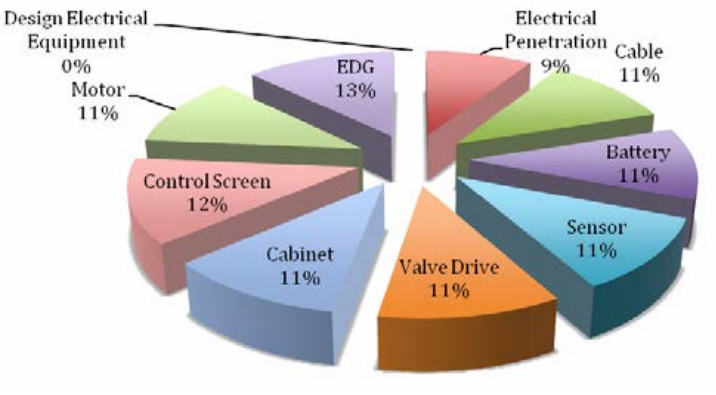
What are the main areas of design targeted by the EPC? The table below shows basic data (contact our research department for more information):




*Above: Range of HAF 601 certificates awarded by the NNSA to Engineering companies since 2006*

What will happen in the case of there being no cooperation between your company and the EPC? You would not have the opportunity to educate the EPC on the best standards available on the market, and you could expect a local SOE to benefit from the outcome.

If you do not cooperate with a local EPC, you increase the risk of more local competition emerging and seeing your specification denied during the tenders.




*Above: HAF 601 certificates for Design of Electrical Equipment awarded to Chinese engineering companies.*

**1. Audit the budget for your expansion**

Dozens of websites, consulting firms and even your finance department determine the budget for expanding your business in China.

That is Wrong.

Take as an example a professional runner who trains for local, regional, national and international competitions. For each competition the athlete will focus on the outcome of the specific event. A competition in Ohio compared to the Olympic Games does not have the same effect on the mindset of the athlete. The best experts in that "market" would review their preparation, information on the competition, the weather, and equipment.

The Chinese nuclear power market is the Olympic Games: this will be the most important and most competitive market in the world for the next twenty years, and Chinese companies retain the field advantage.

The main problem is that foreign companies see China as the Olympics, but they invest and prepare their business as for a local competition.

Let's compare two cultures: the European and the US.

Europe: most of the companies willing to expand in China are small and medium sized, and still think as small and medium size. Their budgets are the main concern, not the outcome.

I remember a company requiring us to come to its factory to discuss the market, they did not ask any questions and promised to follow up, but since then, when I meet the sales manager at exhibitions I hear complaints that there is no business or future will be uncertain.

This strategy to "suck" information and try to do everything is used by many companies looking to save money before expanding in China.

USA: most of the companies have too much red tape, bureaucracy and every step must be explained before any action is taken. In the 19th century, the fathers of the USA's industrial development, such as Vanderbilt, Rockefeller, Carnegie, Morgan and Ford used bold actions to win markets. Nowadays the industry is just waiting for "corporate assessment".

What are the expenses needed in China?

- Trips to the major provinces where nuclear power is developed.
- Marketing support.
- Technical support.

Budget for entertainment (much lower than what is currently used in Europe and the USA).

And that is it.

The problem is not only the budget; you need to have the right person to implement your strategy. Most foreigners are not willing to spend money to travel twice a week in China, spend twelve hours a day with clients and spend weekends with them as new friends.

That is not part of the foreign culture, which is: to work from Monday to Friday, and stay with family at the weekend. If this

is your way of working, the Chinese market is not for you.

How do you forecast the budget needed for the right strategy to implement in China?

Use the same budget you would use to hire the best person in your top market in your own country. China is like the USA and Europe, this is a top country.

You want to underpay your employee? They will learn from you then leave for your competitor.

You want to limit your dinner and entertainment with your clients? They will never become your friends.

You want to read China Daily and Google news to find information about your field? You will not have a clue of what is really happening in the market.

If you do not forecast the cost of your development in the Chinese market proportionally to your expectations, but limit the investment to an arbitrary budget, you will not get any results within 24 months.

**2. Legitimize your title**

The representative you will send to China is not usually the decision maker.

Your company will send a salesman, even create a local team who has to report and follow up the expansion of your business. The most "appropriate" persons at headquarters will take the decision.

Ebay, Yahoo, Home Depot, Groupon failed in China due to this strategy or due to their lack of trust of local managers.

Until last year, a major French company based in Beijing had only one role: to report to headquarters. There was no decision making process in the Beijing office. The company is changing rapidly because the US competitor based in Shanghai has a local strategy with technology that will get half of the Chinese market.

If you send someone, the person should be experienced, internationally oriented and understand the Chinese market - or at least have a good approach to the local business manner.

The EPC and end user will organize the meeting according to the rank of the person you send.

I recently met a company that has the right strategy: Daher Group. The representative in China is from the family business; the representative from the nuclear company is the decision maker. The process can go very fast to expand and answer the customer's need.

In the same way, the head of L3-Mapps, a world leader in simulators, travels to China and can decide immediately what action to take.

If your representative or project manager is not the decision maker, the Chinese counterpart will look for your competitors.

What have we learnt in this article?

Most companies come to China with a tactical versus a strategic approach:

1. **T**op three in the Global Market
2. **A**greements signed between China and your country
3. **C**larify your expectations within 18 months
4. **T**ransfer your technology
5. **I**nvest in a local entity
6. **C**ollaborate with the EPC's engineering team
7. **A**udit the budget for your expansion
8. **L**egitimize your Title

The preparation of your team's entrance to China requires strong marketing, technical and sales support that must be initially approved by your headquarters for a stated period of 36 months.

Your company must clarify its outcome in China, understand the local needs, foresee the global expansion of Chinese nuclear power and have the right person to handle a long run.

Next month: Chapter 2, Ignoring the local requirements from the Safety Authority

DYNABOND
Powertech Services

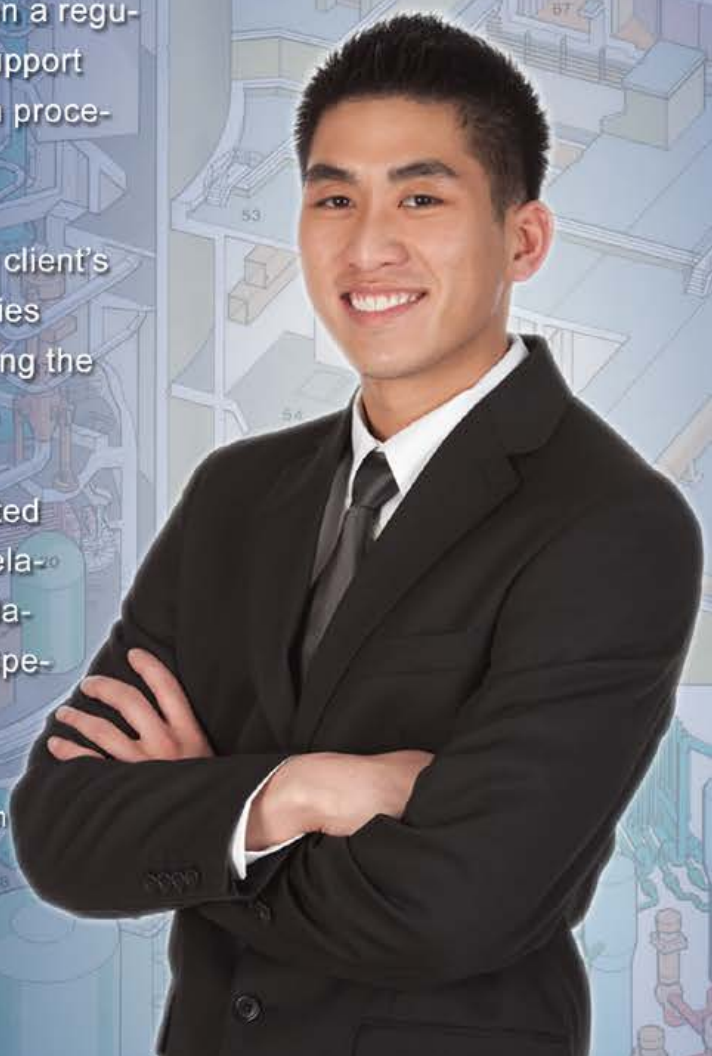
Our Expertise:

# Technical Consultancy

With over five years experience in the field, Dynabond Powertech Service has a dedicated team specialized in the certifications HAF 604 (regulation concerning Imported Civilian Nuclear Safety-related Equipment) and HAF 601 (regulation on the Supervision and Management of Design, Manufacture, Installation and Non-destructive Testing of Civil Nuclear Safety Equipment). Compliance with these is necessary in order to meet with all regulation requirements of the Chinese Nuclear Power Industry.

Our Services:

- Planning – We design a complete strategy for registration, translate every document and adjust the application according to the safety authority's requirements.
- Analysis and clarification - Communication on a regular basis with the regulators and technical support units in charge of the application supervision procedures, and application review process.
- Onsite inspection - Our engineers assist our client's quality control managers to answer all inquiries during the factory visit, in particular concerning the HAF 601 procedures.
- Administrative support - Our team is connected with buying and authorizing bodies. These relationships are beneficial when obtaining regulatory compliance – a necessity for gaining a special import permit.



For more Information contact us: info@dynabondpowertech.com
http://www.dynabondpowertech.com/en/service/certificate-for-civil-nuclear-equipment

# Restructuring of Atomic of Energy of Canada Limited — Nuclear Laboratories

## 2007

Prior to restructuring, Atomic Energy of Canada Limited (AECL) consisted of two divisions: the Nuclear Laboratories and the CANDU Reactor Division. The primary responsibility of the CANDU Reactor Division was the design, sale and service of AECL's CANDU reactor technology.

The Nuclear Laboratories, comprised mainly of Chalk River Laboratories in Chalk River, Ontario, and Whiteshell Laboratories in Pinawa, Manitoba, were responsible for nuclear science and technology priorities for safety, security, health, the environment, waste management and clean energy technologies, as well as the production of medical isotopes.

In November, 2007, the Minister of Natural Resources announced a review of AECL to determine whether its structure as a Crown corporation best equipped it, its employees and ultimately the Canadian nuclear industry to participate fully in the global nuclear market.

## 2009

The review was completed in 2009. It concluded that AECL should be restructured and that:

1. The business model for AECL must be changed to allow Canada to fully participate and compete in the global nuclear market; and

2. Chalk River Laboratories would benefit from strong partnership to drive innovation and renewal, and due consideration should be given to alternative management models, such as a government-owned, contractor-operated approach in which ownership of the existing facilities would rest with the Government, with the operation of those facilities contracted to one or more third parties.

Based on these conclusions, the Government announced in May, 2009, its intentions to restructure AECL to better equip the company to compete and, in doing so, put in place the conditions for the nuclear industry to succeed. A two-stage process was launched to pursue that objective, while looking to minimize taxpayers' financial exposure.

As the first step, the Minister of Natural Resources invited investors to submit proposals for AECL's CANDU Reactor Division. Proposals were assessed based on how well they meet the Government's nuclear policy objectives to:

- ensure safe, reliable and economic options to address Canada's energy and environmental needs;
- control costs to the Government while maximizing the return on the Government's investment in nuclear energy; and
- position Canada's nuclear industry and its workforce to seize domestic and global opportunities.

## 2011

In October 2011, the Government sold the assets of AECL's former CANDU Reactor Division to Candu Energy Inc., a wholly owned subsidiary of SNC-Lavalin Group Inc. The transaction met the stated objectives.

## 2012

In February, 2012, the Government publicly launched the second phase of the restructuring of AECL, focused on the Nuclear Laboratories. A Request for Expression of Interest on the future of the Laboratories was issued to determine stakeholder willingness to share in financial risks, managing, partnering and contracting. The Government received 46 responses from various stakeholders, including private sector organizations, academics, local governments and industry associations.

Based on stakeholder input, financial modeling, governance and other analyses, the Government is restructuring the

Nuclear Laboratories to:

- focus the mandate of the Laboratories on decommissioning and waste management; science and technology (S&T) to meet core federal responsibilities; and enabling the CANDU fleet and technology;
- transition to full cost recovery for S&T services to third parties; and
- strengthen accountability and bring private sector rigour and efficiencies to the management of all facilities and services.

The Government will also assess the value of investing federal tax dollars in longer-term nuclear innovation. As part of that assessment, industry will be invited to put forward proposals for a forward-looking, industry-driven nuclear innovation agenda for consideration.

Throughout the restructuring of the Laboratories, the Government will continue its role in maintaining safety, security and environmental stewardship in all aspects of the nuclear industry. The Canadian Nuclear Safety Commission (CNSC), Canada's independent nuclear regulator, will continue to regulate all parts of the entire nuclear industry in Canada.

## 2013

In the coming months, the Government of Canada will engage in a competitive, collaborative procurement process, including a Request for Proposals, for the management and operation of AECL's Nuclear Laboratories. The Government is seeking to implement a Government-owned, Contractor-operated (GoCo) model, as is done in other jurisdictions, such as the United States and the United Kingdom.

Under the new management model, the Laboratories will focus on three key objectives:

1) Managing its radioactive waste and decommissioning responsibilities accumulated during the more than 60 years of nuclear research and development at Chalk River and at Whiteshell Laboratories.

2) Ensuring that Canada's world-class nuclear science and technology capabilities and knowledge continue to support the federal government in its nuclear roles and responsibilities — from health protection and public safety to security and environmental protection.

3) Providing access to industry to address its need for in-depth nuclear science and technology expertise. This will include ongoing access to the Laboratories, at fair market rates that ensure cost recovery, for owners and operators of CANDU reactors as well as the CANDU and broader nuclear supply chain in Canada.

Media may contact:

David Provencher

Office of Canada's Minister of

Natural Resources

613-996-2007

Or:

Media Relations

Natural Resources Canada

Ottawa

613-992-4447

**NRCan's news releases and backgrounders are available at www.nrcan.gc.ca/media**

# INTERVIEW

## Interview with Harshad Patel, Director of BCI

# Interview with Harshad Patel,

Director of BCI

*Email: harshadp@bc-instruments.com Phone: 905 939 7323*

## DPS:Could you tell us about your background, when did you join BCI?

**Harshad Patel:** I obtained a BE in Mechanical engineering from SP University in India and a Master of Science in Mechanical Engineering from Texas A&M university in the USA. I have been a Professional Engineer in Ontario since 1980.

I was hired in 1979 as Quality Assurance Manager at BC Instruments. Since then I have held several positions with the company from Design Engineer, Project Manager, and Section Manager, to Director of the company.

I am the President of B.C. Instruments India, also a Director and minority part owner of both companies in Canada and India. I and have been with the company since its garage days.

## DPS:Who created BCI?

**Harshad Patel:** BCI was created in April 1971 by Bruno and Britta Conzelmann who started a small business in their garage. BC Instruments, named after its founders, had only one machine to start with and had nine employees when I joined.

*Channel Closure Plug Inspection Tool*

## DPS:When did you start your business in nuclear power? Was BCI originally created for the nuclear power industry?

**Harshad Patel:** BC Instruments started production in the aero space field in 1971; our first customer was Leigh Instruments.When I joined, we thought about a new way of earning money and to take our knowledge to another activity. In 1979, the nuclear market looked very interesting and we decided we could produce many useful things for nuclear reactors, pumps, and others parts of the plants.We started by being accredited with CSA Z299.2 and later ISO 9001, AS9100 and ASME SECTION III, pressure vessel approval. BCI performs calculations for instrumentation parts for nuclear reactors and prepares and registers drawings of pressure vessel branches with the TSSA.

## DPS:How many people work in your factory?

**Harshad Patel:** Today, we employ 135 people in two manufacturing facilities totaling 58,000 square feet. In addition to our plants in Schomberg, we opened BC Instruments India Private Limited in 2004 located in Gujarat State, it now employs 80 people.

## DPS:Can you tell us what kind of products you manufacture?

**Harshad Patel:** We manufacture high precision components and sub-assemblies for aerospace, nuclear energy,defense, medical, electronic and other related industries. B.C. Instruments (BCI) is a precision machine shop, and our strength is in our skilled and experienced people.Some major products, including turned and milled parts areoffered from stainless steel,aluminum, titanium, carbonsteel, tool steel and castings. For instance,we make fuel channel shield plug assemblies, feeder connection components like hubs, seal rings and flanges, also nuclear class 1 fittings, adaptors & thermo wells.

## DPS:Do you also design the products?

**Harshad Patel**: I design nuclear instrumentation parts like adaptors and thermowells.Since 1980I have designed nuclear class 1 and 3 components including butt-weld adaptors, thermowells, liquid level gauges, and a hyper domic sample station for CANDU reactors. I also bring my knowledge of the other products related to nuclear. There are many ways to use our products in different sectors such as medical. When a new design is required, I can sometimes give advice about a product, then we work to create the design, so it's not just about me, it's also team work.

## DPS:Have you ever been required to manufacture a component that was no longer available in the market and had to perform some reverse engineering?

**Harshad Patel**: Yes we have done reverse engineering by making drawings from the sample supplied and analyzing materials for the strength required.We always study new products, but when we receive an order from customers we come up with better ways to help them, and to improve the nuclear market. We are always upgrading our equipment.

## DPS:Which nuclear projects have you been involved in?

**Harshad Patel**: I looked after Nuclear Projects for all CANDU reactors, such as Pickering, Bruce Power and Darlington in Ontario, Gentilly in Quebec, Point Lepreau in New Brunswick, the Wolsong Project in South Korea, Embalse Project in Argentina, the Cernavoda Project in Romania and the Qinshan Project in China.

## DPS:These projects are CANDU related. Do you have specific requirements for CANDU that are different from a PWR?

**Harshad Patel**: The main reactor is different. As CANDU uses heavy water,all heat transfer, boilers and turbines can be the same for both reactors, but there still little difference between the two reactors. Even though the aims are the same;I expect that the PWR will be improved to produce green energy so we will need to change our future production. We have supplied sample components for AECL's Advanced CANDU Reactor "ACR 1000", a newly designed third-generation nuclear reactor.

## DPS:In that regard, do you follow the ASME Boiler and Pressure Vessel code Section III or do you have other standards?

**Harshad Patel**: Mostly we follow ASME section III for pressure vessels and for materials ASME section II. In addition, BC Instruments is registered to AS9100B/ISO 9001:2008 and the N285.0 code for pressure retaining systems and components in nuclear power plants.

## DPS:You have a specialty in Electron Beam Welding; could you tell us the main advantage of this welding in nuclear?

**Harshad Patel**: We are using it to weld nickel plate to seal discs for nuclear applications. You know the disc is fragile, and in nuclear, when you make a mistake everything can cause severe damage. We can see this process will be a safe way to protect workers.

## DPS:Have you been involved in international projects?

**Harshad Patel**: Yes, most of our work is shipped outside Canada. I have been in charge of many other projects, such as in Romania, Argentina, and South Korea. My job is worldwide, not only in Canada.

*BC INSTRUMENTS INDIA PVT. LTD.*

## DPS:You have a factory in Schomberg, Ontario, and another one in Anand, Gujarat in India. Is there any specific reason you expanded to India?

**Harshad Patel:** I come from India and I know how to work with Indian people; India is a big country too and it's the best gate for entering the Asian market. In India we are currently doing aerospace and medical work, including nuclear medicine. We expanded to India because our customers also moved to Asia and wanted low cost products.

**DPS:Could you tell us about your experience in Argentina?**

**Harshad Patel:** For Argentina, BCI has supplied nuclear class 1 adaptors, thermo wells and fueling machine components.

**DPS:Do you still maintain relations with the operators and safety authority in Argentina?**

**Harshad Patel:** Yes, were cently supplied pressure vessel parts through safety authority registration in Ontario (TSSA).

**DPS:China plans to export its nuclear power plants to Argentina, but they will be PWR based, how would you be involved, do you have any strategy to be involved in the supply chain?**

**Harshad Patel:** We have CNC precision machining strength and if drawings are supplied we can manufacture for any project including PWRs or any industry. About China, we don't have a specific strategy; we'll apply our knowledge to answer their expectations in the argentine nuclear market.

**DPS:Did you face some difficulties in your negotiation with the Chinese or was everything done under the AECL umbrella?**

**Harshad Patel:** In case of TQNPC, for spare parts, we had no problem and payment was through LC.TQNPC visited our factory many times and we have kept close relations since. In past most of the work was done under the AECL umbrella.

**DPS:Since 2007, China has been the biggest nuclear market in the world, did you receiveany requirements from your clients in China, and did you change your human resources structure to develop a team dedicated to this market?**

**Harshad Patel:** We have not developed a dedicated team but my project engineer graduated in mechanical engineering in China and speaks Chinese.We are assessing this new market and plan to develop our sales force within all the new projects. We also are working with Chinese agents.

**DPS:Do you plan to serve the needs ofthe Chinese market from your Indian or Canadian entity?**

**Harshad Patel:** We would consider using both locations depending on the type of equipment. For aerospace and medical we will use India, however for the nuclear market we still handle the business from Canada.

INNCH INTERNATIONAL

——The FIRST&ONLY International Forum Specialized in Nuclear IT Industry

**Endorsers:** G.I.I.N. 法国核工业协会

# NITF Nuclear Information Technology(China)Forum 2013

**August 8th-9th, 2013**
**Shanghai, China**

## Conference Highlights

1. Predict and Analyze the Trends of China's Nuclear Industry Informatization
2. Analyze China's Nuclear Industry Informatiztion Features and Challenges
3. Informative Project Showcases from the Nuclear Power Plants
4. Updates on China's Nuclear Software Self-reliance and Localization
5. Latest Nuclear Informatization Related Technologies and Products Showcase
6. Pre-arranged Face-to-face Meetings with Your Target Clients
7. Precious Experiences from Industry Leaders Regarding the NPP Informatization Cases in and abroad

**10+** Nuclear Operators

**20+** Countries

**30+** Eminent Speakers

**150+** Delegates

**100+** Face-to face Meetings

## Steering Committee

**Taghrid ATIEH**
Head, INIS Unit
Nuclear Information Section,Department of Nuclear Energy
**IAEA**

**Sang-Hyung PARK**
General Manager
Information Technology Office
**KHNP**

**Yican WU**
Leader, FDS Team
Director, Insitute of Nuclear Energy Safety Technology
**Chinese Academy of Sciences**

## Join Us Now!

**Please Contact:**

Tel:+86(0)21 51920620
Fax:+86(0)21 51920621
Email:info@innchinc.com
Web:www.innchinc.com/NITF2013

# HAF602 Regulations

# HAF602 Certifications

Measures on the Administration of Training, Examination and License Issuance to NDT Inspectors for Civil Nuclear Pressure Retaining Equipments

(Promulgated by
The National Nuclear Safety Administration
On June 6, 1995)

## Chapter I. General

### Article 1

The measures on the administration are specially formulated according to the requirements of provision 3 of article 6 and provision 4 of article 7 of the “Regulations on Safety supervision of Civil Nuclear Pressure Retaining Equipments" (HAF 601).

### Article 2

This measure of administration defines the basic requirements to be followed for the training, examination and license issuance to non-destructive testing inspectors in performing seven NDT methods such as ultrasonic, X-ray, eddy current, magnetic particle test, penetrant, visual inspection and leakage detection, etc. of civil nuclear pressure-retaining equipments.

### Article 3

The national nuclear safety authority conducts regulatory supervision over the training, examination and license issuance to NDT inspectors undertaken by the administrative department for civil nuclear pressure retaining requirements.

## Chapter 2. Organizations and Duties & Responsibilities

### Article 4

The administrative department should establish technical qualification committee of non-destructive testing inspectors for civil 11Llclear pressure retaining equipments, the committee members should at least include the representatives from the administrative department and its subordinate relevant departments, most of the members should be the NDT experts having obtained class-Ill certificate, included among them should be experts on nuclear safety and engineering. The 11ame list of qualification committee members should be submitted to the National Nuclear Safety Administration for the record.

### Article 5

The main duties and responsibilities of the technical qualification committee of NDT inspectors for civil nuclear pressure retaining equipments are as follows:

(1) To organize the formulation of regulations on the technical qualification of NDT inspectors for civil nuclear pressure retaining equipments, establish the examination questions base of various NDT methods. Work out rules for implementation of practical skill examination, prepare the training and examination programs for technical qualification of NDT inspectors for civil nuclear pressure retaining equipments, and submit to the National Nuclear Safety Administration for the record;

(2) To review and approve the establishment of' training & examination center of the department of its own, and submit to NNSA for the record;

(3) To inspect the training and examination work;

(4) To be responsible for the qualification and certificate issuance to qualified inspectors who pass the examination and submit to NNSA for the record;

(5) To be responsible for the arrangement arid document recording and keeping of the relevant materials of inspectors seeking certificate (the relevant materials include the working units, ages, educational levels of inspectors applying for certificate, the time of NDT work engaged, the NDT methods to be trained, types of certificate, serial number, date of certification, results of examination, and the justification materials for extension of validity term and qualification renewal, etc.).

### Article 6

The training & examination center should satisfy the following conditions:

(l) It must be equipped with sufficient numbers of qualified personnel specialized in non-destructive testing and nuclear engineering and safety;

(2) It must be equipped with the corresponding infrastructures, basic facilities and NDT equipments and materials to satisfy

the need for training and examination of NDT inspectors for civil nuclear pressure-retaining equipments.

### Article 7

The major duties and responsibilities of training & examination center are as follows:

(I) The examination qualification verification and admission of personnel applying for examination;

(2) Training and examination of NDT inspectors;

(3) To submit the dossier materials of' examination qualified inspectors to the technical qualification committee of the administrative department; and keep dossier materials of unqualified inspectors on file;

(4) Be responsible for unified identification of test blocks or test pieces approved by qualification committee of administrative department, and keeping the relevant approval materials on file;

(5) Be responsible for submitting the schedule arrangement of training and examination in written form to the National Nuclear Safety Administration 10 days before the training is started.

## Chapter 3. Level Classification, Qualification Verification for Persons Appling for Examination, Training and Examination

### Article 8

The technical qualifications of NDT inspectors for civil nuclear pressure retaining equipments can be classified iiit0 3 levels, i.e. level-I, level-II and level-III. Level-I is the junior level, level-II is the intermediate level, while level-III is the senior level. The technical qualifications are conducted according to the different levels respectively.

### Article 9

The technical competence and duties and responsibilities of each level of NDT inspectors are as follows:

(1) The level-I NDT inspectors should have the capability in conducting non-destructive testing according to specifications under the guidance and supervision of level-II, III inspector s. They also should be able to adjust and use instruments and equipments, perform testing operation, record testing results and make preliminary assessment of testing results according to the criteria.

(2) The level-II inspectors should be able to work out technical specification with given process, install and calibrate instruments and equipments, practically carry out non-destructive testing work, interpret and assess the testing results according to the cod.es, criteria and specification, prepare and issue testing result reports, understand the scope of' application and Limitations of corresponding NDT methods, train and instruct level-I Inspectors and persons who have not obtained certificate.

(3) The level-III inspectors should be in full charge of the determination of on-destructive testing techniques and prioresses, code of regulations, criteria, and specification to be followed. They also should be responsible for the complete supervision and management of performance of NDT, the interpretation and assessment of testing results according to the codes, criteria and specifications. They should be able to design special NDT methods, techniques and processes, and coordinate with relevant departments to formulate acceptance criteria when there is no acceptance criteria available, and should have the practical knowledge in materials, structures and production processes and generally understand the other NDT methods, and be able to train the level-I and II inspectors for corresponding NDT methods.

### Article 10

The persons applying for examination must be qualified for the following conditions:

(1) The persons applying for examination should have the educational levels and practical experiences according to the requirement set up in Table I and Table 2, the qualified persons must receive training for a certain period before applying for examination.

(2) The persons applying for examination should provide eyesight certificate issued by the hospital, the, eyesight requirement is as follows:

1) the eyesight of naked eyes or corrected vision should be I.0 or above,

2) the color distinguishing vision of the persons applying for examination should be such that they can distinguish the color contrast associated with non-destructive testing meth.ods,

(3) The persons applying for technical qualification certificate of NDT of nuclear pressure retaining equipments must obtain the ”Generic Technical Qualification Certificate" for corresponding methods and levels.

### Article 11

The training and examination held for NDT inspectors for civil nuclear pressure retaining equipments should be carried out strictly in accordance with the training and examination programs formulated by the administrative department.

### Article 12

The training and examination programs should include contents related to nuclear facilities in addit.ion to the special knowledge of non-destructive testing.

Table I. The Requirements For Level-I and of Practical Experiences II inspectors

| Testing methods to be qualified | Technical level | Graduate college of science & engineering | Graduate from senior middle school or secondary school | Graduate from junior middle equivalent school or with |
|---|---|---|---|---|
| X-Ray Testing (RT)<br>Ultrasonic Testing (UT)<br>Magnetic Particle Testing (MT) | I | half a year | one year | two years |
| | II | one year | two years | one year |
| Eddy Current Testing (ET)<br>Penetrate Testing (PT)<br>Leakage Testing (LT)<br>Visual Inspection Testing (VT) | I | three months | half a year | one years |
| | | half a year | one year | one and half years |

* The inspectors applying for level-II exanimation should have valid level-I technical qualification certificate for the corresponding testing methods, otherwise, the practical experiences should be doubled.

Table 2. The Requirements of Practical Experiences For Level-III Inspectors

| Educational level | Graduate from college of science and engineering | Graduate from technical secondary school or equivalent level |
|---|---|---|
| Practical experience | Two years | Four years |

* The inspectors applying for level-III examination should have valid level-II technical qualification certificate for the corresponding testing methods, the time period of practical experiences from table: above is that after obtaining the level-II qualification certificate for the same testing methods. At least half of the practical experiences should be spent in non-destructive testing of civil nuclear pressure retaining equipments.

(1) The requirement to training contents for level-I, II NDT inspectors:

1) The relevant knowledge about civil nuclear facility systems. Including: main principle, main systems and equipments of nuclear electricity generation (e.g. nuclear power plant pressure vessel, primary pump, steam generator, pressurizer, main piping, etc.), the roles of NPP main systems (e.g. primary circuit system, chemical and volume control system, emergency core cooling system, residual heat removal system, safety injection system, containment spray system, component cooling water system, auxiliary feedwater system, service water system, etc.), the main difference between nuclear electricity generation and fossil-fired power generation (so as to present the particularity of civil nuclear facilities in respect to the material selection and the damages which the special operation environment of civil nuclear facilities may cause to the equipments and components) and the characteristics of manufacturing processes and structures of the above mentioned major equipments.

2) The relevant knowledge about nuclear safety, including: the system of national codes on nuclear safety and its applicability, the

relevant codes on nuclear safety, the basic requirements and corresponding principle in respect to the safety of' civil nuclear facility (e.g. defense-in-depth principle, concept and roles of these barriers, the safety functions implemented by various systems and equipments), and the concept of equipment safety classification.

3) The relevant knowledge of quality assurance for civil nuclear facilities, including: the concept of quality assurance for civil nuclear facilities, especially the quality assurance requirements during the manufacturing and installation of equipments, the regulatory requirement concerning the calibration, operation of NDT equipments, the recording of NDT results and the issuance of NDT reports, etc.

4) The NDT technical training specially designated for civil nuclear pressure retaining equipments should include: the special structures of civil nuclear pressure retaining equipments, the effects that special in-service operation environment has on the implementation of NDT activities, the important role of automated NDT process (e.g. the in-service special inspection equipments for pressure vessel and its safety ends, the automatic eddy current testing of steam generator heat transfer tubes) in the in-service inspection of civil nuclear facilities, the special requirements to ultrasonic transducer during the in-service inspection process (e.g. the material irradiation embrittlement and the effects of irradiations on its electro-acoustic performance, etc.).

5) In order to ensure the quality of civil nuclear pressure retaining equipment NDT activities undertaken by the NDT inspect.ors. In addition to the training on the basic knowledge and operation skills for special NDT techniques, the training should also include the corresponding training on the standards of NDT in civil nuclear facilities, especially the knowledge about the internationally recognized standards of NDT for civil nuclear facilities;

6) The knowledge of radiation protection while working in the nuclear radiation environment.

(2) The requirements to the training contents for level-JII inspectors: The level-lll inspectors are senior NDT inspectors, the training of level-lll NDT inspectors should also include the following contents in addition to that designed for the training of level-I and II inspectors mentioned above:

1) The material selection principle for main civil nuclear facility equipments, the types, specifications and performances of the materials selected for the major nuclear power equipments, the mechanisms of defect occurring with these materials during the manufacturing process and under the special operation environment of civil nuclear facilities, and the natures of possible defects,

2) The safety functions to be realized by various major nuclear systems, as well as the safety class of the main equipments of these systems,

3) The characteristics of quality facilities, the major elements manufacturing and installation equipments, assurance system for civil nuclear of quality assurance system for the of civil nuclear pressure retaining

4) Internationally recognized non-destructive testing standards for nuclear requirements,

5) The rules for radiation protection while working in nuclear radiation environment, and the limit values of dose received.

(3) The training hour requirements for level-I and level-II inspectors are given in Table 3 and Table 4.

(4) Normally the numbers of' training hour for level-lll inspectors is not specified.

The experiences lll participating international society activities, inter-industries academic exchanges or topic researches and training courses can be regarded as the evidences of competence for technical qualification of level-lll inspectors.

### Article 13

The non-destructive testing inspections for civil nuclear pressure retaining equipments should pass two examinations, i.e. "General Examination" and "Examination of Non-destructive Testing Techniques for Civil Nuclear Pressure Retaining Equipments".

### Article 14

The contents and level required by" General Examination" should be consistent with the corresponding requirements set by other administrative departments. The examination for each specific NDT method should include the following aspects: basic knowledge, methodology and practical ability.

(1) The requirement of "General Examination" for level-I and level-II inspectors:

1) The examination of "Basic Knowledge" and "Method Knowledge" is to examine the extent to which the inspectors have understood and mastered the basic knowledge defined in training and examination programs.

The depth and scope of examination questions should be in accordance with the scope defined in the training and examination programs formulated by the administrative department.

The numbers of examination questions with regard to each type of testing method should be at least up to the amount specified in Table 5.

Table 3. Training Hours for General Qualification

| Testing method/Technical level | Level-I | Level-II |
|---|---|---|
| X-ray Testing (RT) | 64 hours | 120 hours |
| Ultrasonic Testing (UT) | 64 hours | 120 hours |
| Magnetic Particle Testing (MT) | 48 hours | 64 hours |
| Eddy Current Testing (ET) | 64 hours | 120 hours |
| Penetrant Testing (PT) | 48 hours | 64 hours |
| Leakage Testing (LT) | 48 hours | 64 hours |
| VisuaJ Testing (VT) | 40 hours | 56 hours |

Table 4. Training Hours for the Qualification of Testing of Civil Nuclear Pressure Retaining Equipments

| Testing method/Technical level | Level- I | Level- II |
|---|---|---|
| X-ray Testing (RT) | 64 hours | 120 hours |
| Ultrasonic Testing (UT) | 64 hours | 120 hours |
| Magnetic Particle Testing (MT) | 64 hours | 56 hours |
| Eddy Current Testing (ET) | 64 hours | 120 hours |
| Penetrant Testing (PT) | 40 hours | 56 hours |
| Leakage Testing (LT) | 40 hours | 56 hours |
| VisuaJ Testing (VT) | 40 hours | 56 hours |

*The Training hours in the Tables refers to the total numbers of hours in training courses of both theory and practice, the training hours can be adjusted in the light of the average educational level of training participants, but should not be less than that defined in Tables.

*As far as the training on generic testing technique is concerned, the numbers of hours spent in practice operation for the former five methods should not be less than l/3 0f the total hours, whereas the numbers of hours spent in practice operation for the latter two methods should not be less thanl/2 of the total hours.

2) The examination of practice ability is to examine inspectors' ability in operating instruments and equipments, analyzing the testing information obtained and correctly interpret testing results and ensuring the reliability and validity of testing results (e.g. familiarization withand using calibration blocks, image quality indicator (IQI), the sensitivity test piece and comparison test blocks, etc.), and the ability intesting and quality level evaluating of common test objects (e.g. casting,forging, rolled blocks, etc.).

(2) The requirements of "General Examination" for level-lll inspectors:

1) The examination on "Basic Knowledge" (common for all testingmethods) is mainly to examine the extent to which the inspectors who apply for examination have understood and mastered the theory and application knowledge about other NDT testing methods (level-ll examination questions), and the extent to which they have mastered the knowledge about material performance, product manufacturing process,the nature of defects aswell as the mechanism of defect formation, andthe regulations on NDT technical management, the numbers of questionshould not be less than 40.

Table 5. The Requirement to the Numbers of Questions inGeneral Examination for Level-I/II Inspectors

| Testing method/Technical level | No. of Examination Questions |
|---|---|
| X-ray Testing (RT) | 40 |
| Ultrasonic Testing (UT) | 40 |
| Magnetic Particle Testing (MT) | 30 |
| Eddy Current Testing (ET) | 30 |
| Penetrant Testing (PT) | / |
| Leakage Testing (LT) | 30 |
| VisuaJ Testing (VT) | 30 |

2) The examination on "Method extent to which the examination Knowledge" is mainly to examine the applicants have understood the relevant knowledge about the categories of NDT methods to be applied, and the relevant codes, criteria and specifications pertaining to this NDT method.The numbers of examination questions should not be less than 40.

3)The examination on “Practice Ability" requires the examination applicants to at least work out non-destructive testing procedure for aspecific NDT object.

4)"Oral Examination" is mainly to examine the comprehensive ability ofaspects as the theory, methods andpractical operation.

### Article 15

"The Examination on Civil Nuclear Pressure Retaining Equipments Testing Techniques" should include the following three aspects for each non-destructive testing method: basic knowledge, method knowledge andpractice ability.

(1) The purpose of examination for level-I/II inspectors is to examine the extent to which the examination applicants have understood and mastered the knowledge and skills of civil nuclear pressure retaining equipment NDT, the practical ability to test special products and objects of' nuclear industry, the special specifications and level assessment method as wellas basic knowledge about civil nuclear facilities.

1) The depth and scope of' Examination on "Basic Knowledge" and"Method Knowledge" should be in accordance with the scopes defined in the training and examination programs formulated by examination committee, the numbers of examination questions should be at least up that specified in Table 6.

Table 6. The Amount of Examination Questions Required For Technical Examination on Civil Nuclear Pressure Retaining, Equipment NDT

| Testing Method | No. of Examination Questions | |
|---|---|---|
| X-ray Testing (RT) | 30 | 40 |
| Ultrasonic Testing (UT) | 30 | 40 |
| Magnetic Particle Testing (MT) | 25 | 30 |
| Eddy Current Testing (ET) | 25 | 30 |
| Penetrant Testing (PT) | 30 | 40 |
| Leakage Testing (LT) | 30 | 40 |
| Visual Testing (VT) | 25 | 30 |

2) The examination on practical ability is to examine the ability ofapplicants in operating special non-destructive testing instruments usedfor the civil nuclear pressure retaining equipments and the ability in performing testing and correct assessment of testing results obtained according to the NDT standards and technical requirements.

(2) The requirement of examination for level-III inspectors:

1) The contents of examination on “Basic Knowledge" and "MethodKnowledge" should include such aspects as the special materials selected for civil nuclear pressure retaining equipments, manufacturing processes for special products, special in-service operation environment and the mechanism of defect occurring; civil nuclear facility systems,quality assurance and NDT standards specially for nuclear pressure retaining equipments; the NDT instruments, operation techniques aswell as the necessary protection and safety monitoring knowledge, etc.

The depth and scope of contents should be consistent with the requirements for Level-III inspectors defined in the training and examination programs formulated by the administrative department. The numbers of examination questions should not be Less than 40.

2) The examination on "Practice Ability" requires that the examination applicants work out appropriate non-destructive testing procedure forspecific testing objects of civil nuclear pressure retaining equipments.

3) “Oral Examination" should examine the comprehensive ability of examination applicants in such aspects as the theory, methods and practical operation of civil nuclear pressure retaining equipment NDT.

## Chapter 4. Assessment of Examination Results and Qualification Certificate

### Article 16

The overall assessment method of examination results is as follows;

The overall assessments of ”General Examination" and " Examination on NDT Techniques of Civil Nuclear Pressure Retaining Equipments" should be conducted separately. If the inspectors pass the "General Examination"and obtain qualification certificate, the other administrative department should admit and exempt them from re-examination on the general knowledge and skills.

The examination results of each course should be given a mark in a 100-point system.

The overall assessment of the results of various examinations should take consideration of weighing factors which are determined in Table 7.

Table 7. The Weighing Factors for Overall Assessment of Examination Results of Level-I/II/III Inspectors

| Type of Examination | General Examination | | | Examination on NDT Techniques of Civil Nuclear Pressure Retaining Equipments | | |
|---|---|---|---|---|---|---|
| Level | Basic Knowledge Method Knowledge | | Practice Ability | Basic Knowledge Method Knowledge | | Practice Ability |
| **I** | 0.4 | | 0.6 | 0.4 | | 0.6 |
| **II** | 0.5 | | 0.5 | 0.5 | | 0.5 |
| **III** | 0.35 | 0.35 | 0.3 | 0.3 | 0.3 | 0.4 |

The scores of basic knowledge, method knowledge and practice ability examinations should be at least over 70. The examination applicant is qualified only with his or her overall assessment score over 80.

If the doubts are raised during oral examination over the technical quality and ability of level-III examination applicants, the qualification committee should make review of the comments put forward by examination center and then give treatment solution in written form.

### Article 17

If examination on two or three subjects of "General Examination" and "Examination on NDT Techniques of Civil Nuclear Pressure Retaining Equipments" (refers to the examinations on "Basic Knowledge and Method Knowledge" and “Practice Ability" for level-I/II inspectors; three examinations of “Basic Knowledge"', “Method Knowledge" and "PracticeAbility" in the case of "General Examination" for level-III inspectors; the two examinations of “Basic Knowledge and Method Knowledge" and“Practice Ability" in the case of "Examination on NDT Techniques of Civil Nuclear Pressure-Retaining Equipments" for level-III inspectors) all have scores of over 70, but the overall score does not reach 80 (not qualified), the make-up examination can be conducted within one year for parts of examinations with scores below 80. However, in the case that make-up examination still can not lead to a qualified overall score,it is required to conduct re-examinations for all subjects.

The applicants seeking reexamination should reapply for examination according to application procedure. In the case that applicants is not qualifiedin the qualification examination, the applicant must wait for two month before he or she can participate the reexaminations. If the applicant were found to have fraudulent conduct, he or she would not be allowed to participate reexamination for two years.

### Article 18

After the applicants pass the examination and get qualified, the committee form the corresponding administrative department in charge of technical qualification of NDT inspectors for civil nuclear pressure retaining equipments will make review and verification

and issue certificates. The certificate should be stamped with a seal at the right lower side of portrait of certificate holder, which says“The Qualification Committee of NDTInspectors for Civil Nuclear Pressure Retaining Equipments".

### Article 19

The term of validity of certificate and its extension are defined as follows:

(1) The term of validity of certificate is five years;

(2) The term of validity of certificate can be extended once, with the extension of five more years. The inspectors requesting extension of validity should make application one month before the expiration date of certificate and provide the proof of qualified health condition and the proof that the time period when he or she is out of NDT service is not more than one year, the extension application should be approved by qualification committee after review and verification.

(3) The certificate should be revoked for the following cases:

- Major negligence of duties during NDT activities;

- Being away from the NDT work for more than one year.

### Article 20

The requirement for qualification of certificate renewal is as follows:

(I) When the extension of certificate expires, the certificate holders should make application to the qualification committee for renewal qualification.

The qualified certificate holders will be granted with a new certification for the term of validity. The applicants of renewal qualification should provide two kinds of proof for the extension of' the term of validity as specified in provision 2 of article 19.

(2) The inspectors applying for renewal qualification should receive a certainperiod of retraining, the duration and contents for such retraining may refer to the requirement of qualification for the first time, but can be reduced in the light of actual circumstances.

(3)The renewal qualification examination is a simplified form of examination approved by the qualification committee, which includes the following contents:

I) For level-I/II inspectors: The examinations of practical operation concerning "Generic Techniques" and the necessary "NDT Testing Techniques for Civil Nuclear Pressure Retaining Equipments" should be conducted according to the simplified regulation.

2) For level-III inspectors: Written examination with 20 questions about"Generic Techniques" or the necessary applied technique knowledge of "NDT Techniques for Civil Nuclear Pressure Retaining Equipments" should be conducted.

The applicants whose examination scores are over 80 will be qualified for renewal qualification, arid be granted with a certificate of new validityterm.

## Chapter 5.Supplementary Articles

### Article 21

The definitions of the terms used in these measures of administration (management) are as follows:

Technical Qualification Identification: The technical qualification identification is the implementation and operation process of the regulations concerning the qualification review, training, examination and certificate issuance to NDT inspectors. During the process the corresponding technical qualification certificate will be issued to inspectors whose corresponding technical qualification has been determined. This process is started with the selection of applicants participating training and examination and ended with the issuance of technical qualification certificate.

Examination on NDT Techniques for Civil Nuclear Pressure Retaining Equipments: This examination is the specially required supplementary examination conducted on the basis of "Generic Examination”, in the light of the particularity of nuclear pressure retaining equipments. The contents of examination include the use of special NDT equipments for nuclear pressure retaining equipments, calibration knowledge; the knowledge about special testing processes and techniques as well as the production process of products; the knowledge about mechanism of damages to be tested underin-service operation condition; the knowledge about nuclear safety, specificcodes, criteria and special NDT processes and the preparation of technical specifications, etc.

### Article 22

This measure of administration becomes effective as from the date of promulgation.

### Article 23

This measure of administration is to be interpreted and revised by the National Nuclear Safety Administration.

# Events Calendar


## August

### The 24th International Conference and Fair for Measurement Instrumentation and Automation

Date: 2013/08/27-2013/08/30
Add: China International Exhibition Center
Contact: Ms. Zhang
Tel: 86-10-82800630
Website: www.miconex.com.cn

### 2013 China (Shenzhen) International Exposition on Energy Conservation Equipment and Technology

Date: 2013/08/27-2013/08/29
Add: Shenzhen Exhibition Center
Contact: Jia Wei
Tel: 13926508790
Website: http://ajnjp.com

### Nuclear Information Technology (China) Forum 2013

Date: 2013/08/08-2013/08/09
Add: Shanghai
Contact: Deng Aiwen
Tel: 86(21)51920620-8300
Website: www.innchinc.com/nitf2013

### The 9th China(Beijing) International Air Compressor and Compressor Exhibition

Date: 2013/08/08-2013/08/10
Add: China International Exhibition Center (old one)
Contact: Qian Shuyang
Tel: 13671112698
Website: www.compressor-expo.com

### The 5th China (Shanghai) International Petrochemical Technology and Equipment Exhibition

Date: 2013/08/20-2013/08/22
Add: Shanghai
Contact: Zhang Tao
Tel: 13611176718
Website: http://sh.cippe.com.cn/2013/cn/

### Guangzhou International Power & Electric Expo

Date: 2013/08/19-2013/08/21
Add: China Import and Export Commodities Fair Exhibition A area
Contact: Chen Weijun
Tel: 18825031607
Website: http://www.gzpee.com/

### The 9th China (Beijing) International Air Compressor and Compressor Exhibition

Date: 2013/08/08-2013/08/10
Add: China Beijing International Exhibition Center (old hall)
Contact: Qian Shuyang
Tel: 13671112698

Website: http://www.gzpee.com/

### 2013 Guangxi Electric Wire & Cable and Accessories Exhibition

Date: 2013/08/09-2013/08/11
Add: Nanning International Exhibition Center
Contact: Gu Hongchao
Tel: 13877135502
Website:www.nanchunhz.com/newsview-336.aspx

## September

### The 10th China-Asean Expo Special Exhibition Section of Power Industry

Date: 2013/09/03-2013/09/06
Add: International Convention and Exhibition Center, Nanning, China
Contact: Mo Yujuan
Tel: 13517677479
Website: http://www.caexpo.org/

### China International Nuclear Power Equipment Exhibition 2013

Date: 2013/09/02-2013/09/04
Add: China International Exhibition Center, Beijing
Contact: Li Shiyou
Tel: 13801178558
Website: http://www.cine010.com.cn/en/Index/

### 2013 China International Electric Power Equipment and Smart Power Grids Building Exhibition

Date: 2013/09/02-2013/09/04
Add: China International Exhibition Center, Beijing
Contact: Li Shiyou
Tel: 13801178558
Website: http://www.epchina010.com//en/Index/

### 2013 8th Anural Shandong International Industry Fair

Date: 2013/09/16-2013/09/18
Add: Jinan International Exhibition Center
Contact: Liu Huizhen
Tel: 18963097168
Website: http://www.gyz-xz.com/

### The 4th Suzhou International Metalworking and CNC Machine Tool Exhibition

Date: 2013/09/23-2013/09/25
Add: Suzhou International Exhibition Center
Contact:Suzhou Glory Exhibitions Co.Ltd,.
Tel: 86-512-62804023
Website: www.metaltechexpo.com/lxwm.asp

## Ocotober

### Shanghai 8th International Petroleum Petrochemical Natural Gas Technology Equipment Exhibition

Date: 2013/10/28-2013/10/30
Add: Shanghai New International Expo Center
Contact: Chen Bin
Tel: 18964077791
Website: http://www.sippe.org.cn/en/index.asp

### The 10th China (Beijing) International Metallurgy Industry Expo

Date: 2013/10/16-2013/10/18
Add: China International Exhibition Center (Beijing)
Contact: Liu Chunli
Tel: 13651168649
Website: http://www.bcime.com/

# Technical Articles

## L-3: Simulators for NPP Engineering

## Cameco Fuel Manufacturing

# SIMULATORS FOR NPP ENGINEERING

Full Scope Simulators (FSS) have long been an indispensable part of the licensed training program for nuclear power plant control room operators. Traditionally relatively complex and time-consuming to create and validate, and inextricably linked to the design and operational data of the reference plant that they reproduce, simulators have typically been planned as a single deliverable occurring relatively late in the plant design process. As a complete, integrated dynamic representation of the behaviour of a plant's process and control systems in their various states of operation, upstream simulation's value is gradually being recognized for non-traditional applications such as initial learning, procedure development and verification, design verification and Human Factors Engineering. Nevertheless, the structured integration of simulation into the planning of the power plant design and training cycle has been somewhat slow. This paper looks at the opportunities for simulation in the entire plant life cycle and includes examples of experience from recent L-3 MAPPS projects in which simulation has played a wider role.

## Introduction

Nuclear power plant simulation has traditionally focused on plant-specific Full Scope Simulators (FSS) with the primary objective being licensed operator training. The initial development and delivery of the vast majority of the FSSs have taken place either late in the plant construction cycle or following commercial operation. The development of an FSS has typically taken two to three years with a single integral delivery at the end of the project. The availability—or for that matter the need—for any kind of staged or incremental delivery of the evolving simulation or its use outside of operator training has been very limited.

The confluence of Nuclear New Build (NNB), widespread use of digital control systems (DCSs), powerful model development and training delivery tools and extremely inexpensive computation is leading to a paradigm shift in how and when simulations are created and used. In particular, the convergence of "simulation engineering"—the development and validation of an FSS by a simulator vendor—and "engineering by simulation" towards leveraging the investment in model development has the potential of detecting latent design defects and thus reducing risk and optimizing plant design and cost.

## Nuclear New Build

The primary requirement for FSS for NNB is that training starts 12 to 24 months before fuel loading. This provides both a challenge and an opportunity for the FSS.

Figure 1 shows the schedule for the development cycle of a typical nuclear power plant and its associated FSS. The development of the FSS is inextricably linked to the design and operational data of the reference plant that it reproduces. Simulation of the plant process begins as much as 44 months before fuel loading. The primary challenge is related to the fact that the simulator development, and in particular integration and validation, takes place in parallel to the basic and detailed design of the DCS and well ahead of plant commissioning. Periodic updates following the actual plant commissioning and commercial operation typically take place 12 to 24 months after initial delivery.

There are consequences to this parallel development. These consequences include the fact that the plant detailed design is incomplete, that limited DCS verification and validation (V&V) has taken place at the time of FSS integration and that the turnaround time to solve plant design issues discovered during simulator testing can be long, as it is driven by the plant schedule and the DCS supplier's quality process. The concept of a data freeze does not apply—change is inevitable during the FSS project and must be managed by the simulator developer. Above all, the simulator becomes a de facto V&V tool for plant design verification and virtual commissioning.

The opportunity is that this virtual commissioning through simulation can be a valuable tool for detecting and correcting latent errors that would otherwise need to be addressed during the actual commissioning of the plant (or later).

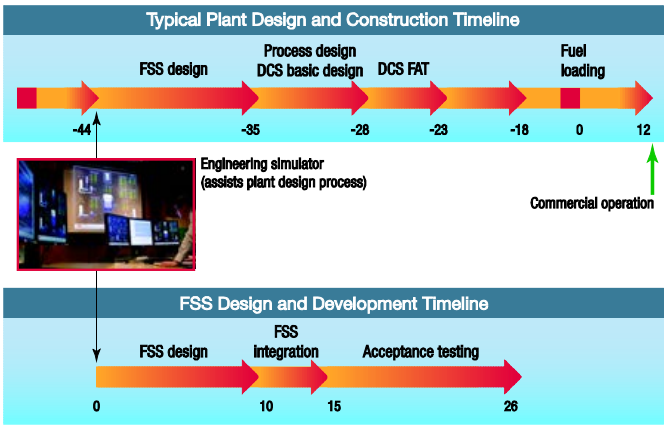



Figure 1: Plant and simulator development

L-3 MAPPS' experience with several new build programs (e.g. Olkiluoto 3 (OL3) (Finland), Ling Ao Phase II (China), Hongyanhe Phase I (China)) has shown that a large number of plant issues will in fact be detected during simulator testing. Typical issues include programming errors that are introduced during either the basic or detailed DCS design phases, inconsistent signal interfaces between different DCS products and between the control system and plant components, and inadequate parameterization at the time of simulator testing.

Figure 2 shows an example of the distribution of simulator discrepancies detected and resolved during testing of an L-3 MAPPS FSS for a NNB. As can be seen, the vast majority of discrepancies are related to plant (rather than simulation) issues that would otherwise be detected only during actual plant commissioning and operation.

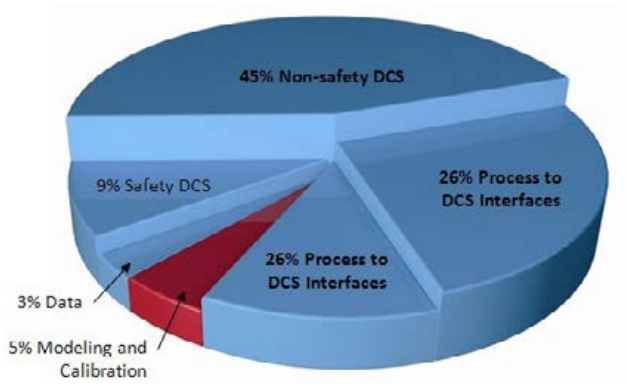



Figure 2: Distribution of descrepancies found during FSS testing

Nevertheless, the effort required to discover, correct and validate the plant design changes by the plant or DCS vendor can have a harmful impact on the FSS schedule and the power plant owner's licensed operator training program. The way to mitigate this effect is to include the virtual commissioning in the overall planning and development cycle of the plant. This requires that the simulator be considered within the big picture of the plant construction schedule. If this is not done, the FSS development schedule and training will be compromised and the plant commissioning schedule will be put at risk.

## Engineering Simulation

Virtual commissioning is one example of the use of an Engineering Simulation (ES). One of the important criteria is the use of the same detailed, high-fidelity models of the plant systems that will eventually be developed for the FSS. Unlike the Nuclear Plant Analyzers of the 1990s which focused on primarily NSSS modeling and transient analysis, the ES relies on a plant model that is a complete, integrated, dynamic representation of the behaviour of all the plant systems controlled by the DCS (or DCSs) in their various states of operation. In fact, the primary difference between an ES and an FSS is simply a reduced hardware footprint and the absence of a need to fully reproduce the control room environment.

A second important criterion is related to the DCS itself. For the purposes of V&V, the implementation of the DCS in the simulator should ideally be based on running the same DCS application software that runs on the actual plant controllers. This requires a binary equivalent machine emulation (or virtual stimulation) from the DCS vendor (see www.mapps.l-3com.com/simulator-distributed-control-systems.html for a definition of DCS simulation techniques).

The use of a complete plant model allows a level of V&V that is not possible on a typical DCS test facility. It also allows the use of the ES for plant procedure development and validation. L-3 MAPPS has delivered the OL3 ES that is used for V&V testing and procedure development and validation.

Although the integrated ES described above has obvious advantages for V&V testing, there are two important disadvantages. The first is that the ES is available relatively late in the plant construction. This is partially because it has been derived from the FSS development and above all because the V&V testing can only begin once the detailed design of the DCS is complete and the DCS application software is available. The second is that there has been no prior, simulation-based opportunity to minimize discrepancies at either the system or basic design level before preparation of the DCS application software.

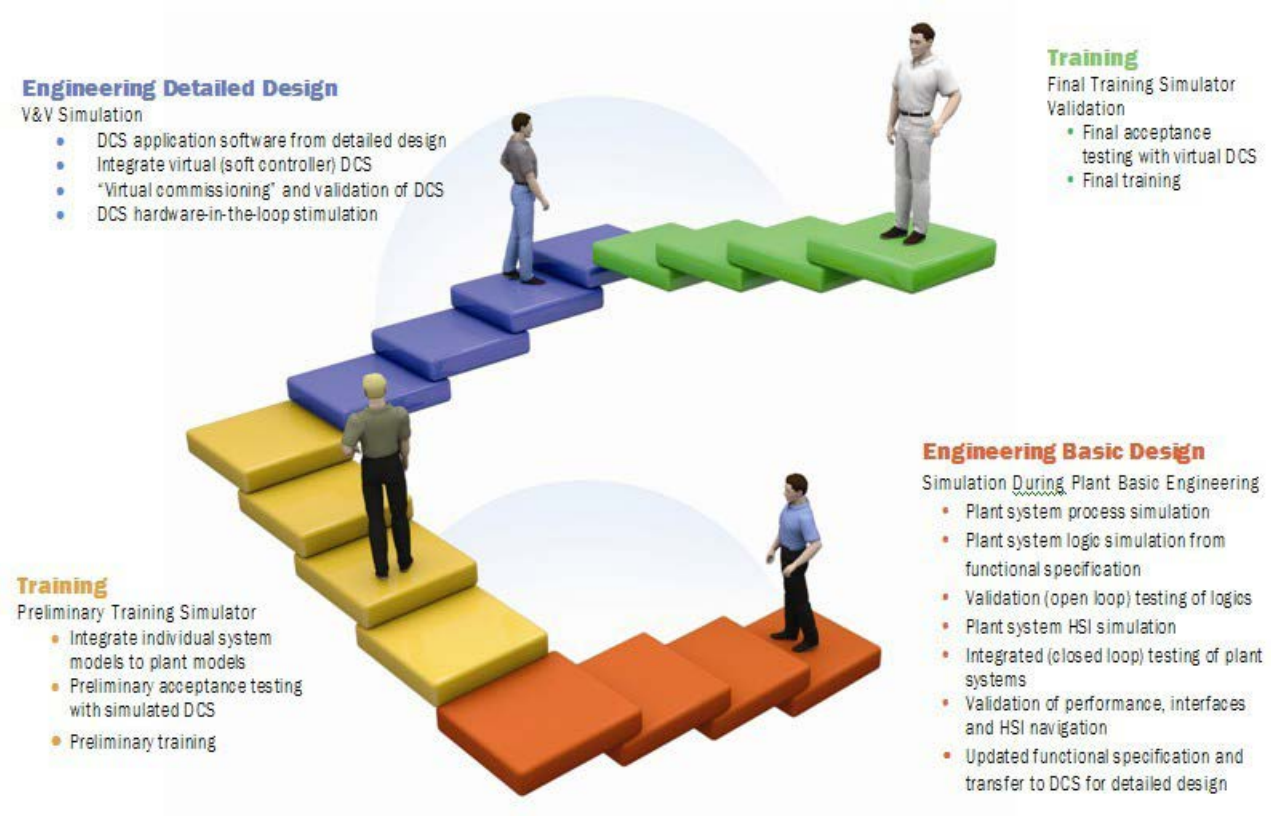



Figure 3: Two-phase approach

The solution is to perform incremental simulation-based testing on a system level in parallel to plant system design. See Figure 3. This upstream integration of the ES into the plant design process makes it possible for simulation to achieve its full potential.

Though the benefits seem obvious, the industry has truly embraced the technology only in recent years. One reason is that simulators have traditionally been viewed as training devices with computational limitations. This is no longer the case. Another reason may be the perception that the data required for simulation will not be available soon enough to support early development of the individual simulations. In fact, the data that is required to start simulation of a particular system is the same data that is required to start the basic I&C design for the system. This essentially consists of the general system performance and safety requirements and P&IDs. This information is generally found in the preliminary system design manuals. Generic component data can be used until such time as vendor data is available from the detailed design.

This strategy of continuous evolution of the simulation (from system level to plant model to V&V simulator to FSS and data-driven updates from basic design to equipment specification to DCS application software) requires state-of- the-art configuration control mechanisms for the simulation toolset in order to ensure an efficient workflow. L-3 MAPPS' Orchid® simulation tools, and in particular the Orchid® Modeling Environment (Orchid® ME), are specifically designed to ensure configuration control. Orchid® ME is a client-server application designed to support large development workgroups working in a constantly changing environment. Orchid® ME includes many features that are unique among model builders including individual and shared workspaces, a check-in/check-out mechanism, versioning control over simulation schematics and component libraries, integrated source data referencing and validation, visual comparison tools for all sources including simulation schematics, support for geographically distributed workgroups and automated testing, data gathering and regression analysis features.

## SOFIA

SOFIA (Simulateur d'Observation du Fonctionnement Incidentel et Accidentel) is an example of another ES with a different set of goals. SOFIA has been developed jointly by L-3 MAPPS, AREVA and the Institut de Radioprotection et de Sûreté Nucléaire (IRSN). SOFIA includes separate simulations of four different

types of French nuclear power plants including a Generation III+ EPR™. The SOFIA ES at IRSN is shown in Figure 4.

Figure 4: SOFIA at IRSN

The simulators run within the Orchid® simulation environment, and most of the models have been developed with Orchid® ME. Each simulation includes a plant model that supports a scope of simulated operations equivalent to an FSS. All the simulators include the CATHARE 2 code for modeling of the NSSS. CATHARE 2 is a system code for PWR safety analysis, accident management, definition of plant operating procedures and for research and development. It is also used to quantify conservative analysis margins and for licensing. The EPR version also includes simulation of the core neutronics with Orchid® Core Builder. Unlike an FSS, SOFIA does not reproduce a specific control room environment but rather uses a DCS-like HMI interface that allows the user to carry out all procedures available to operators.

SOFIA serves both training and engineering functions. As a training simulator, it is used to provide training in elementary plant systems and operating strategies during incident and accident situations to design and commissioning engineers, nuclear safety authority inspectors and IRSN safety specialists.

As an ES, it is used to perform studies related to complex accident sequences that require an overall plant model, to design and validate procedures, to support the safety analysis of planned plant modifications and to develop emergency procedures and drills.

Figure 5: CAER's Reconfigurable Main Control Room Simulator

A key technology difference between the OL3 ES and SOFIA is the use of a simulated version (instead of an emulated version) of the DCS. This difference reflects the different objectives of the two simulators. The objective of the OL3 ES is the V&V of the actual DCS application software destined for the plant. One of the goals of SOFIA is validation of system design modifications at the basic design level, particularly in terms of control strategies, operating procedures analysis and improvement, preliminary safety analysis and plant engineering and emergency response training. In this case, a key requirement is the ability to rapidly develop and test alternate control strategies using Orchid® development tools and support for multiple software configurations.

## Human Factors Engineering

Another example of where upstream simulation is playing a vital role is in Human Factors Engineering (HFE). The Center for Advanced Engineering Research (CAER) has set up a research facility that includes a Reconfigurable Main Control Room Simulator (RMCRS). It is specifically designed to support research into Generation III/III+ control room design, human factors studies for new power plants and digital I&C.

In this case a specific plant-referenced simulation is less important than a simulation that supports the full operating envelope including major transients that an operator may see. L-3 MAPPS has provided an EPR plant model with typical HMI displays that are used as the operator interface and the software tools that allow the user to modify or test new displays. The RMCRS is shown in Figure 5. The simulator includes sophisticated eye-tracking technology and event-logging software for the collection and analysis of human performance data.

CAER's plan includes the study of the impact of I&C system

failures on operator performance by interfacing an actual AREVA TELEPERM XS digital safety system to the plant model.

Similarly, Idaho National Laboratory (INL) is using simulators as part of the Human Systems Simulation Laboratory (HSSL) to develop and test newer digital control room designs, especially in terms of digital control room upgrades of existing plants. INL is currently conducting research to support the upgrade of the main control room at the San Onofre Nuclear Generating Station (SONGS), a two-reactor plant operated by Southern California Edison Company. The existing SONGS simulator software, already using L-3 MAPPS' platform and models, is complemented by L-3 MAPPS' Orchid® Touch Interface using touch-screen technology to provide a virtual representation of the control room hard panels. The software development tools will enable INL to create and study different panel prototypes. The prototypes will be evaluated using operator-in-the-loop testing, and basic operator performance principles will be disseminated to the industry. Utilities will then work with their plant vendors to apply research-derived principles as design recommendations for their specific needs.

## New Training Applications

Licensed operator training has traditionally used a combination of classroom fundamentals and procedure-driven, FSS-based operations training. However, the industry is facing the challenge of training an emerging, new generation nuclear workforce. Simulation can also be used upstream of operations training to facilitate understanding of the physical process and interactions that take place during power plant operation and transients. L-3 MAPPS is coupling 2-D and 3-D visualization technology and simulation to bring real-time, simulation-driven, animated physical systems allowing immersive, participatory learning in the classroom. The visualization can either be coupled to generic power plant simulation that provides fundamental training or to an FSS. See Figure 6.

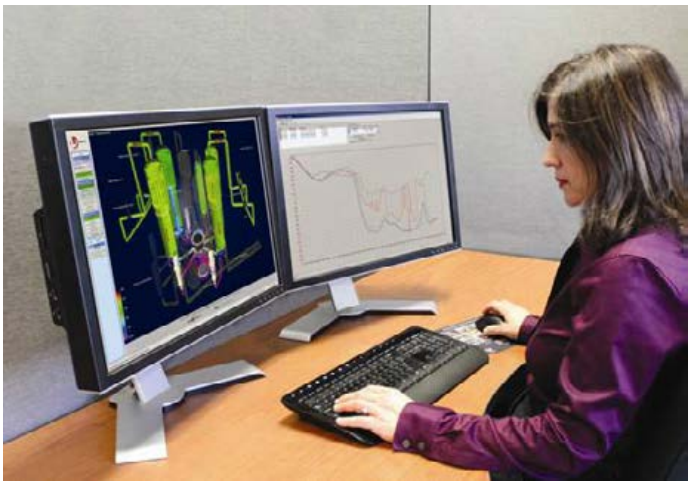


Figure 6: 3-D Transient Fundamentals Trainer

## Conclusions

FSSs have traditionally been used to deliver operations training. However, the accuracy and depth of today's models and the plant data that they encompass provide opportunities for leveraging the investment in the models for their use in engineering. The structured integration of simulation into the plant engineering process is a means of reducing cost and risk by integrating simulation-based V&V early in the development cycle. An efficient workflow requires simulation tools with state-of-the-art workgroup and configuration control features. Simulation is also a means of providing fundamental learning to the new generation nuclear workforce through hands-on, immersive visualization and learning.



MAPPS

**L-3 MAPPS**

**8565 Côte-de-Liesse**

**Montréal, Québec**

**Canada, H4T 1G5**

**Tel: +1-514-787-4999**

**Fax: +1-514-788-1442**

**Email: power.mapps@L-3com.com**

**www.L-3com.com/MAPPS**

# Hamon Thermal


Natural draft cooling towers: more than 300 references worldwide.

Hamon, World Leader in Engineering and Contracting, active since 1904.
The Group has an unrivalled experience in development and implementation of cooling technologies for the power sector and other energy intensive industries. With numerous references in each cooling tower type, it has been confronted to any type of application.
Hamon active R&D gives you the assurance of a state-of-the-art product.

## Hamon, the reliable choice.

**HAMON THERMAL EUROPE (FR)**
Perspective Seine, Bâtiment C
84, rue Charles Michels
93284 Saint-Denis, France
Tel. +33 1 55 87 78 78
info.htef@hamon.com

**HAMON THERMAL AND ENVIRONMENTAL TECHNOLOGY (JIAXING) COMPANY LTD.**
1st Floor of Building No.7,
No.1369, South City Road
314000 Jiaxing, Zhejiang, China
Tel. +86 573 8261 1908,1918
info@hamonjiaxing.com

Integrated
solutions
for a clean
environment

HAMON

# Cameco Fuel Manufacturing (CFM)

Cameco Fuel Manufacturing (CFM) is a leading supplier of Fuel Assemblies and Reactor Components for the PWR and PHWR reactors. Having more than 50 years of experience with Candu, PWR, research and related nuclear reactor technology, CFM specializes in cold working, fabricating, welding, brazing and machining of zirconium and its alloys, in addition to other specialty metals utilized in the global nuclear industry.

Our invaluable in-house experience building nuclear fuel manufacturing plants in Canada and abroad has allowed CFM has successfully transfer technology to several nuclear fabrication plants, primarily in those countries which have purchased Candu reactors from Canada.

CFM has current agreements to provide manufacturing and consulting services to companies in Europe and Asia and our engineering and technical teams assist our clients with nuclear fuel product and reactor component manufacturing process development on a contract basis.

CFM has developed the unique ability to manufacture a wide variety of in-core reactor components. All of these devices have exceptional quality standards and comprehensive technical specifications. They have proven themselves to stand up to the rigors of the industry in-core and as part of larger control systems even after decades of use. Many of these components have been built for Candu reactors worldwide but also for many custom applications as specified by clients on a project-to-project basis. For example, CFM has supplied over 500,000 meters of PWR fuel cladding tubing.

Some of our devices, such as the shut off absorber rods are safety related; others constitute key fuel channel components such as calandria tubes. Many in core components are manufactured to ASME Pressure vessel code standards and precise technical specifications. Our Engineering and Technical teams are well positioned to review specific applications and provide valuable expertise and advice and suggestions about the best course of action for your project.

Our rigorous commitment to high quality nuclear standards combined with our extensive experience and unique capabilities makes Cameco Fuel Manufacturing a Supplier of Choice in the global nuclear industry.

Cameco Fuel Manufacturing has experience in the supply of over 30 standard in core components. And, over the last 30 years has completed well over 1000 projects to supply nuclear components to many global customers from China to Argentina.

Cameco Fuel Manufacturing's Reactor Component group has been manufacturing assemblies including neutron flux monitoring units for 23 years for both Canadian and international clients. CFM is a well-respected nuclear component supplier and has the capability in house to produce the vast majority of the customized zirconium alloy tubing used in the manufacture of these units. This allows CFM total control over the precision of the stock material.

CFM's Quality system performance expertise in the controlled atmosphere welding of metals for nuclear application has made us the preferred contract supplier for many reactor monitoring and reactivity control assemblies. Our welding capabilities cover multiple processes from resistance and laser welding to precision Gas Tungsten Arc welding. Most assembly joints in neutron flux detector assemblies are full penetration precision welds performed using the gas tungsten arc process including tube butt welding of zircaloy tube diameters down to 3.9 mm with wall thicknesses as thin as 0.2 mm.

Cameco Fuel Manufacturing maintains a dynamic and governing Quality program maintaining the following certifications: (attached for information.)

ISO 9001:2008

ISO 14001:2004

Certificate of Authorization – Technical Standards and Safety Authority – Supply and upgrading of Materials for the manufacture of pressure retaining components.

Certificate of Authorization – Technical Standards and Safety Authority – Fabrication of Class 1, 1C, 2, 2C, 3, 3C Welded and Non-Welded Category H Fittings. Fabrication of Parts, Appurtenances, Welded and Non-Welded Supports; Without Design Responsibility

CSA Z299.1-85

CFM has experience in projects to manufacture reactor sets of shut off, adjuster and control rods for in core use on control systems and safety related systems. These are complex sets that can require approximately 18 months to manufacture.

The shutoff rods are used in core in the Candu reactor to terminate the fission process should any of the operating parameters exceed the reactor trip set points. . Shutoffs are constructed of stainless steel and cadmium in the form of tubes. Cadmium being the neutron absorbing material.

The shutoff rods are normally positioned above the reactor in a ready position. They are operated by a winch like gearbox that can pull the shutoff rod clear above the reactor. Gravity is the operating mechanism for shutoff rod insertion.

The adjuster absorber rods are utilized to shape the neutron flux in core.

An interesting benefit obtained from the adjuster rods is that they are loaded with cobalt 59 which, after a period of time in core, turns to cobalt 60 which is used for medical and industrial purposes. If cobalt is not used then the adjusters are made of a very precise quantity of stainless steel in varying diameters and wall thickness of the tubes. The adjusters are designed to be inserted fully into the reactor at full power. Similar to the shutoff rods the adjuster rods are operated by a winch and gearbox mechanism.

The neutron flux detector assemblies enable reactor power to be calculated by measuring the intensity of the neutron flux at various positions within the reactor.

These in core neutron flux detectors are self-powered as they generate a very small electric current proportional to the flux which is amplified to a level that the station control computers can read.

Neutron flux detectors are typically positioned throughout the reactor core in positions to accurately read the flux throughout the core. CFM has manufactured well over 1000 flux detector assemblies since 1980.

Cobalt adjuster element is shown below. The reactor core may contain 400 to 500 of these small bundles containing cobalt 59 pellets.


## Specialty Welding Capabilities

CFM Produces custom Tubing and Component Products from Zirconium, Stainless Steel Alloys, and other Alloys

Shown below is the head of the neutron flux monitor assembly. This device is approximately 15 meters long as it enters the reactor vertically. Each core has a number of strategically positioned detectors throughout the core.

Shown below is an example of the liquid zone control, which is also used to control neutron flux in core. This is a well-sealed pressure vessel unit positioned throughout the core. Notice the large diameter seam welded pressure vessel tubing. CFM manufactures both welded and seam welded tubing in diameters from 8mm to 175 mm OD. Wall thickness can be controlled to within 5 microns depending upon the diameter.

## Complete Assemblies


Shown below is the drive mechanism or “gearbox” that is utilized to winch the control rods, shutoff rod and also adjuster absorber rods from the core of the reactor. CFM also manufactures these electro mechanical drive mechanisms.

## Tubing for Large Components

# NEWS

# Highlights

## Small Modular Reactors (SMRs) gaining popularity

An ACP100 SMR project has been formally signed between Ningdu county, Ganzhou city in Jiangxi province and CNNC China New Energy Company, Limited (CNEC). It will take 36 months to construct and has a total investment of RMB 16 billion. This SMR signing with CNEC follows the project in Hengfeng county, Shangrao city in Jiangxi province.

Besides Xiangxi province, Fujian, Hunan and Jilin provinces are also earmarked for SMR projects. The provinces that have signed contracts or publicly declared interest in constructing the SMR are all inland provinces, except Fujian province (Zhangzhou, Putian). Jiangxi and Hunan are China's first inland provinces to possess million-killowatt nuclear power projects.

An expert in the industry told a reporter, "The core capacity of the SMR is small and the requirements of the hydrology, geology and population density are not as strict as for the large nuclear power plants, so choosing inland or coastal areas is not significant."

In China, many nuclear power enterprises including CNNC, CNEC and CGN are speeding up their R&D and promotion of the SMR and beginning site selection, as well as making contact with local government. At present, the ACP100 project launched by CNNC is developing faster than others and has made clear agreements with Fujian, Jiangxi and Hunan provinces. The nuclear heating reactor of the shell integration lead by CNEC will be constructed in Bashan, Jilin province.

According to information disclosed at the second design meeting on the demonstration project of Putian ACP100 SMR in Fujian province, the Putian SMR project will start the pouring of the first nuclear FCD in June 2014 and CNPE will organize each side to complete the preliminary design before December 2013. In addition, CNNC signed a strategic cooperation agreement with Hunan provincial government last year in which 6 sites are planned to be selected in Hunan province with a total installed capacity of 6 million kW. CNNC strives to build the first inland SMR project during the 12th Five-Year Plan period and achieve the anticipated goal by the end of 14th Five-Year Plan period.

Source: http://paper.people.com.cn

## China Sets Price Benchmark for Nuclear Power

China announced Monday it will implement a national power price benchmark for its new nuclear plants, replacing more complicated pricing rules set for individual sites. The National Development and Reform Commission set a benchmark price of about 7 cents per kilowatt hour for reactors online after Jan. 1, according to the state-controlled China Daily newspaper. Experts quoted by the publication said the benchmark will make the plants more profitable than under previous pricing schemes based on plant costs and local thermal power prices. In parts of the country where fossil generation is cheaper than the new nuclear benchmark, reactors will be required to sell power at the rate set for fossil plants. The country's primary agency for setting economic policy also will allow variations in the benchmark price for demonstration plants.

China is far and away the world leader in new nuclear plant development, with 28 reactors currently under construction, according to the World Nuclear Association. The country has 17 operating reactors and plans to quadruple its nuclear generation to 58 gigawatts by 2020.

Source: http://nuclearstreet.com

## Nuclear steam valve actuator to be localized

At the recent special meeting on "localization of the nuclear steam valve actuator"which was jointly held by Shanghai Electric Group and CNPEC, experts and users recognized the localization program of the high pressure valve actuator on million-kilowatt nuclear power plant steam turbines. After evaluation, its technical performance was consisted with the imported products.

The valve actuator is a key component of nuclear steam turbines, which mainly relies on imports. After implementation, the localization will break the monopoly of foreign products, greatly reducing the cost of Shanghai Electricity's nuclear

power products, enhance the market competitiveness and also significantly reduce the costs of plant operation and maintenance.

Source: http://news.bjx.com.cn

## Equipment manufacturers welcome the opportunity to benefit directly

China's nuclear power construction is entering a rapid development period. According to market participants, stocks related to the nuclear assembly manufacturing industry are expected to benefit directly, and thus usher in appropriate investment opportunities.

According to industry analysts, the compound growth rate of China's installed capacity for nuclear power will reach around 20% in the next ten years. In accordance with the general roles in constructing NPPs, 50% of the investment will be used for the purchase of the equipment. At present, the largest investment in the domestic nuclear power market is the nuclear power equipment, and the competition is not fierce. But Zhang Peng,an analyst of Zhejiang Securities, believes that the opportunities of the nuclear power sector are still in the sub-sub-industries. Since construction of nuclear power has long industrial chain characteristics, according to the preliminary estimation, just one nuclear power plant project will need more than 300 kinds of systems, involving numerous industries.

Analysts have also pointed out that investment should focus on nuclear power technology innovation. Due to the safety of nuclear power being strictly ensured, the newly-built or newly approved NPPs in China will based mainly on third-generation nuclear power technology. At present, some critical equipment such as steam valves and charging pumps has not been obtained domestically. If there is a breakthrough in these areas allowing the complete replacement of the imported products, then the cost will be very prominent, and be reflected in the investment opportunities of related stocks.

Source: http: //www.heneng.net.cn

## Nuclear power construction in China will speed up again

A Chief engineer from a nuclear power design institute was interviewed recently. He holds that the next few years will become the rapid development period for nuclear power construction in China. It is expected that half a trillion of investment will be provided for nuclear power equipment. Enterprises will benefit from the high profit of the nuclear power equipment.

Mr. Wang, a market participant, said: in the next ten years, the compound growth rate of nuclear power's installed capacity will reach about 20%. In the next ten years, the construction of nuclear power projects will see an other peak; about six to seven NPPs will be newly built each year. As a general rule, 50% of a nuclear power plant's investment will be used for equipment and total investment of nearly 50 billion RMB will be used for equipment per year. Newly-built and newly-approved plants will focus on the third generation nuclear power technology. At present, the localization rate of the third generation nuclear power technology is only 50%. It is expected to reach 70% in the future.

Source: http://www.snerdi.com.cn

## Nuclear power enters a period of rapid development

Japan's Fukushima nuclear accident was a dark moment for global nuclear power. As time has passed, with the push for energy generation and environmental protection, China's nuclear power development has once again become a strategic choice of domestic energy. In the next five to seven years, hundreds of billions of RMB will be provided to the nuclear power industry.

Approval of new nuclear power projects are expected to start in the second half of 2013 and the long-term target is expected to increase the installed capacity from 58 million kilowatts to 70 million kilowatts. China will continue to actively and steadily develop nuclear power in the future. Due to high demand for safety and strict qualification management for each aspect of the nuclear industry, generally only a small number of large state-owned enterprises hold licenses so the nuclear power industry has a stronger monopoly as a whole. Equipment manufacturing is a relatively strong market segment, but due to a high technical threshold, the market is dominated by three major domestic power generation equipment giants (Shanghai Electric, Dongfang Electric and Harbin Electric) and China First Heavy Industries in the main equipment field of nuclear safety class 1.

DYNABOND
Powertech Services

Our Expertise:

# Consulting and Business Development

Dynabond Powertech Service provides operators within the Chinese nuclear power industry with a dedicated, high-quality alternative to their in-house business functions of strategic business development, marketing and product channel growth.

We deliver invaluable local market knowledge, know-how and operating expertise within China. This provides our clients with a cost-effective, low-risk/high-gain market entry capability into China's Nuclear Power Industry.

## Our Services:

- Lobbying – We establish long-term relationships with the main holdings (CNNC, CGNPC, SNPTC) and other operators (CPIC, Huaneng, Datang) while also operating alongside the procurement departments of the engineering companies and the research and design institutes - in particular CNPE, CNPEC, SNERDI , SNPEC and NPIC.

- Sales representation – We assist our clients to sell their technology to Chinese firms, and enhance sales action during the bidding and negotiation processes.

- Sourcing – We undertake groundwork for negotiating long-term contracts with Chinese component manufacturers in order to source for our nuclear power clients worldwide. We also provide our clients with the ideal platform for localization of nuclear based products

For more information contact us: info@dynabondpowertech.com
http://www.dynabondpowertech.com/en/service/sales-representative

Relevant enterprises have optimistic attitudes towards the future of the nuclear power business. Shanghai Electric said that its nuclear island equipment market share will strive to reach 50% by the end of the 12th Five-Year Plan Period. Nuclear power conventional island equipment will occupy a 40% market share through improving profitability and mastering independent intellectual property rights.

Source: http://www.heneng.net.cn

## ACP1000 experimental validation making significant progress

On July 11, relevant experimental studies of the ACP1000 passive residual heat removal system (referred as PRS) were officially launched after review. The system was self-developed by CNNC with independent intellectual property rights of third generation nuclear power technology. Li Xiaoming, the assistant general manager of CNNC attended the launch ceremony.

This ceremony was organized and held by China Nuclear Power Institute (CNPE), CNNC Nuclear Power Business Division. Experts and representatives from the Environmental Protection Department of Nuclear and Radiation Safety Center, CNNC, China Nuclear Power Engineering Co., Ltd, Fujian Fuqing Nuclear Power Co., Ltd, Nuclear Power Institute of China and other units attended and heard reports on the situation of the experiment preparation as well as had an on-site viewing of the experimental device. After discussion, they agreed that the experiment can be officially launched.

The official launch experiments show that CNNC ACP1000 experimental validation has made an important step forward and ACP1000 safety performance will be further verified. This experiment project studies the secondary side passive residual heat removal system. The purpose of the study is to:

- verify the operational ability and characteristic of the PRS system in the accident condition of station blackout of the ACP1000 reactors and failure of the auxiliary water supply pneumatic pump;

- test the design capabilities of the prototype accident water cooling tank and prototype emergency RHRS cooler;

- provide experimental data for design improvements.

CNPE spent two years designing, constructing and debugging the simulation experiment set that reaches as high as 60 meters. In order to try to simulate a variety of prototype thermal physical phenomena, the experimental device uses a real-time simulation design that has equal height and pressure asthe prototype. Through nearly one-month of intense work of debugging, a number of correct debugging experimental data reached steady-state conditions. The data preliminary indicates that the PRS system, especially the emergency heat removal cooler, possessed a strong heat exchange capability.

Source: http://www.heneng.net.cn

## Uranium exploration depth in China reaches 2,818 m

China National Nuclear Corporation (CNNC) announcedon July 17th in Fuzhou, Jiangxi province that China’s first scientific deep uranium drilling broke the previous1,200 meter record by reaching a new level of 2,818.88 m. This breakthrough has filled the gaps of China’s uranium deep prospecting technology, which is of far-reaching significancefor improving the level of protection of domestic natural uranium and meeting the developmentneeds of nuclear power.

This deep prospecting technology breakthrough was obtained from Xiangshan Uranium base in Fuzhou, Jiangxi province, which is known as China's "Uranium City". Since the drilling began on July 21, 2012, CNNC and Beijing Geological Research Institute of Uranium Geology has achieved a drilling depth of 2,818.88 m through the deep drilling "point" of size which is only twice the normal disc in 283 days. Its core recovery has reached 99% or more, which maximizes the access to the mineralization conditions and environmental information in the deep earth. It has also made "geological CT scans” forChina's largest uranium ore field.

Apart from the prospecting depth breaking the record, the intelligence, digital level of theindependent research and development of drilling equipment has filled the domestic blank in the drilling process, it also made the first discovery of the polymetallic ore tha tcontaines uranium, lead, zinc and copper, as well as creating the hyperspectral recognition technology of core mineralization and alterationand other results for the first time.

The continental scientific drilling is called "the telescopedeep inside the earth." For a long time, China's uranium exploration depth was around 500 meters, leaving a deep prospecting technology gap compared with France, Germany, Canada and other foreign countries. This deep prospecting breakthrough technology has greatly expanded the space for exploring uranium resources in China, but also lays a foundationfor China to further dig for underground resource treasures below3, 000 meters.

Source: http://www.china-nea.cn

## Components of the first AP1000 new fuel elevator in china was delivered

On July 13, the first batch of components, such as the guide rail, guide bracket, has been successfully delivered to Haiyang NPP.

The first AP1000 NPP new fuel elevator made in China is one of the most important equipments of the system of fuel-handling, which is composed by the guide rail, fuel compartment, load weighing system, winding engine and the electronic control unit. The main purpose of it is to lower the new fuel assemblies to the bottom of the fuel storage pool from the ground level of the auxiliary factory in order to bring convenience of the fuel manipulator to operate with the long handle tools.

There is no ready-made experience to draw upon during the manufacturing period due to the new fuel elevator is the first localization equipment in China. Under the condition of tight schedule and heavy tasks, JPMO supervision staff initiative to give up weekend time to rest, and actively organizeand coordinate closely with the manufacturer to finish the delivery of the first part of the new fuel elevator, which bring valuable time for subsequent equipment installation of HY1 Unit.

Source: http://www.heneng.net.cn

## China’s nuclear power development may exceed expectations

At the 9th Annual China Nuclear Energy Congress 2013, XuYuming, Deputy Secretary-general of China Nuclear Energy Association, said that the development of China’s nuclear power is expected to reach a higher level than the expectations.

The plan that Mr. Xu referred to is the Medium-and Long-Term Development Plan of Nuclear Power (2011-2020) which was discussed and adopted by the State Council last October. The plan put forward that the installed capacity of NPPs in operation and the ones under construction will reach 58 million kW and 30 kW respectively.

Analysts believe that, the size of China’s nuclear power total investment will reach as high as several trillion RMB if the installed capacity of China’s NPPs under construction reaches 88 million kWin 2020. If localization rates for the nuclear island, conventional island and the auxiliary equipment are 70%, 80% and 90%,the nuclear power equipment companies in China will share more than RMB 300 billion.

Qilu Securities believes that the major domestic nuclear power equipment manufacturers with advanced technology will be the biggest beneficiaries. Currently the companies possessing the capacity of nuclear island equipment are mainly CFHI, China National Erzhong Group, Shanghai Electric Heavy Machinery, while Shanghai Electric, Dongfang Electric and Harbin Electric focus on equipment manufacturing for conventional island.

As China’s nuclear power construction peaks, the original production system has failed to meet the demand; meanwhile, the technological research and development also need to be promoted by the market competition mechanism. In order to stimulate thevitality of the market, the National Nuclear Security Administration approved five private enterprises to obtain nuclear equipment design and manufacturing certificates including Sichuan Huadu, KINWA, Qingdao Lanshi, Wuxi Huaertai and Jiangsu Haishi Pumps.

A privatization trend for nuclear power equipment manufacturing is apparent. In the future, quality private listed companies will become industry upstarts.

Source: http://www.heneng.net.cn

# Company News

## Shangshang Cable Group has developed AP1000 Third-Generation Cables

Jiangsu Shangshang Cable Group held a press conference in June regarding the results of the ACP1000 third-generation cables used for inside containment. Leaders and experts attended the conference from SNPTC, the National Energy Administration, the Ministry of Environmental Protection, China Machinery Industry Federation, Shanghai Electric Cable Research Institute, and the National Centre for Quality Supervision and Testing of Electric Wire and Cables.

Strict requirements were put forward for the design of the performance of the third-generation cable of AP1000 NPPs: low smoke, halogen-free, flame retardant, 60-years life span (to meet the 60-years life span requirement of third-generation nuclear power), resistant to high doses of radiation (resistance of Beta radiation dose reaching as high as 270 Mrad), resistance to high temperature environments in case of accident (be able to perform the security function under the 260$^0$C high temperature shock). At present, there is no similar cable in the world which meets such requirements.

Jiangsu Shangshang Group has overcome various technical difficulties in order to solve these problems. After two years of manufacturing cable samples, Shangshang Group successfully passed the qualification test of thermal aging, radiation aging and LOCA aging. Now, the company possesses the core technology of the product, which won the manufacturing approval issued by the National Nuclear Security Administration. The development and research of the third-generation AP1000 cable fills gaps in the world's nuclear power industry and has laid a foundation for China to enter the international nuclear power market.

Source: http://www.heneng.net.cn


President Ding Shanhua delivered a speech on AP1000 Cable Delivery Ceremony Source: www.CMEN.cc

## CEEC produced the nuclear secondary filter with the largest diameter

On May 24th, the secondary filter with the largest caliber in China was successfully manufactured by Jiangsu Equipment Company of the Energy Engineering Group Co.Ltd. (CEEC). The filter smoothly passed the CGN's supervision, inspection and acceptance, and will soon be sent to the construction site of Yangjiang NPP unit 3.

The diameter of the secondary filter reaches 2.8 meters which is currently the the largest caliber among similar products in the nuclear power industry. CEEC Jiangsu Equipment has accumulated valuable experience for future production of large-diameter secondary filters in accordance with the safety products' quality requirements of strictly controlling procurement, production processes, quality, packaging and other aspects. CGN supervision and related equipment experts spoke highly of the company for manufacturing this batch of products. They believe that CEEC has taken a solid step forward during the process of complete localization.

It is reported that the secondary filter products are the main equipment of the condenser circulating water system. It is used to filter the cooling water and remove debris that may block the tube plate or the cooling pipe, ensuring the normal operation of the condenser, other heat transfer equipment and its rubber ball cleaning device.

Source: http://np.chinapower.com.cn

## CNPRI helps Hongyanhe Unit 1 begin commercial operation

China Nuclear Power Technology Research Institute (CNPRI) is a fully-owned subsidiary of China Guangdong Nuclear Power

Group (CGN). CNPRI has developed the complete set of RIC system which is the first self-developed project in China and the important local control system of the nuclear plant's water. Both systems successfully helped Hongyanhe Unit 1 to be put into commercial operation. It is of great significance to promote the independent innovation of key technology of nuclear power in China.

The full name of the RIC system is "in-core instrumentation system", which can provide information of the core outlet coolant temperature and core neutron fluence rate. It's an important tool in the process of NPP training and plays a crucial role before and during the plant's operation. This system combines many advanced technologies in the fields of nuclear electronics, electrical, instrument control, automation and computer digital computing. It also possesses great importance for the safe operation of NPPs and analysis and evaluation of accident monitoring. These RIC results have achieved localization for the first time, breaking the long-term monopoly of foreign companies in the RIC market.

Hongyanhe NPP is located in a severe cold area of Liaoning Province with an extreme minimum temperature of 28.7$^0$C. This is the first time China has designed such an NPP fora cold region. According to the unique geographical conditions and climate characteristics, scheme optimization and adaptive adjustment of the equipment modification have been made and important local control system for the nuclear plant water has been put into service. There was the problem of the outlet temperature of equipment cooling water being too low caused by low temperature of seawater in winter.

The important local control system for nuclear plant water was successfully applied to the complex programmable logic device technology in the NPP safety system. The overall performance of the product has reached international level, providing a role model for a safe nuclear power system which could be used overseas.

Source: http://www.heneng.net.cn

## CPI Shandong NPP Unit 1 finishes system equipment classification work

Shandong Haiyang NPP Unit 1, which is a project of China Power Investment Corporation (CPI), has completed its first list compilation regarding the process, electricity and I & C and other pieces of system equipment. It has built up a set of standards for all systems, which not only meet international standards but also the AP1000 NPP equipment management needs.

Shandong attaches great importance to nuclear power equipment classification work which is a basis of the nuclear power plant. The device list is based on the equipment classification principle of Westinghouse, where equipment is divided into critical Class I, Class II, non-critical level and RTF (run to failure). It is the first to complete the equipment classification among AP1000 units in China.

Source:http://www.heneng.net.cn

## TWBB completes manufacturing of seven transformers for the biggest NPP project in China

On June 17, it was learnt from Baoding TianweiBiaobian Electric Co. that seven main transformers of 442WVA/500KV had been manufactured. They were produced by a subsidiary of TWBB (TianweiBiaobian (Qinhuangdao) Transformer Co.). It is an independently developed product of TWBB. At present, the first batch of four main transformers has been delivered to Qinhuangdao, Shandong province.

It is reported that Haiyang NPP is the world's first batch of nuclear power projects that adopts the AP1000 nuclear power technology, and also an independent third-generation nuclear power relying project in China. Currently, unit 1 & 2 of phase one are under construction. Unit one will begin to generate power in 2014. The "passive-type pressurized water reactor nuclear power technology" which was applied in phase one has the advantage of not producing carbon dioxide, sulphur dioxide and other waste gases.

During the production process, TWBB set up a special leading group, made production plans, cleared management responsibility and increased inspection and assessment efforts - as well as comprehensively controlling the quality-related elements, enhancing process control, strengthening the focus on self-inspection, mutual inspection, special inspection and joint inspection.

Over the years, TWBB has always attached great importance to nuclear power products. Because of the most demanding features of the transformer that is used in nuclear power projects, the company has seized two cores of magnetic flux leakage control and local overheating control in order to ensure long-term safe and reliable operation and has also made

detailed calculations. TWBB also used the advanced analysis and verification transformer software to verify the calculation results of the electromagnetic fields and wave contrast and to determine the most appropriate type of core and windings, insulation, tanks and electromagnetic shielding structure, so as to achieve the best field, temperature field, leakage magnetic field distribution.

Source: http://www.heneng.net.cn

## Baosteel Special Metals have completed the first batch of S32101 product contract used for nuclear power

The S32101contract on duplex stainless steel used for nuclear power has been completed by Baosteel Special Metals. The product will be used in Sanmen NPP in Zhejiang province and Haiyang NPP in Shandong province. This successful case expands the new stainless steel market used for nuclear power.

S32101 is an excellent kind of resource-saving duplex stainless steel with high strength and corrosion resistance. It is designated for manufacturing CA20 security modules used for third generation AP1000 and CAP1400 reactors.

Through smelting and hot-rolling process optimization, Baosteel Special Metals produced 10 mm thick medium plate. Among them, S32750 has successfully replaced the imports with the thinnest specifications of 6.35 mm, which fulfill the requirements of nuclear power in China. So far, Baosteel duplex stainless steel finished S32101, S32304, S32205 and S32750 product series, thin and wide specification plate products in the domestic industry has acquired pioneering advantages.

Source: //www.heneng.net.cn

## Dongfang Electric delivered Fuqing NPP Unit 3 steam generator 1

On July 7th,Steam Generator 1 of Fuqing NPP Unit 3 was delivered. It was manufactured for CNNP Fujian Fuqing Nuclear Power Co., Ltd by Dongfang Electric (Guangzhou) Heavy Machinery Co. which belongs to Dongfang Electric Group. This steam generator is the seventh one based on G2+ technology to be manufactured by Dongfang Electric for Fujian Fuqing Nuclear Power Company.

So far, Dongfang Electric has provided a total of six steam generators for Fuqing NPP Unit 1&2.

Source: http://www.heneng.net.cn

## DEC signed a contract on Lufeng AP1000 nuclear island CRDM

On July 2, a supply contract was signed on a project of CGN Lufeng AP1000 nuclear island key equipment—nuclear control rod drive mechanism (referred as CRDM) at State Nuclear Power Engineering Company(SNPEC) in Shanghai. Leaders and experts from project owners, SNPTC, SNPTC Shanghai Nuclear Engineering Research & Design Institute, Westinghouse and DEC attended the signing ceremony.

After nearly three years of technical clarification and negotiation with DEC, this project has finally been signed, overcoming many business and technical obstacles. This is the trial-product for CRDM to fully complete the G2+ CPR1000 project and has become an important breakthrough in business and technology after gaining approval from the owners, and supervision departments from NNSA. It marks that the CRDM manufacturing of DEC has stepped into the third generation area and “3G” nuclear power AP1000 will become mainstream in the future. The management is very strict since high manufacturing and difficult technical requirements, and the owners, drawing designers, technical support, nuclear safety regulators and many other stakeholders are involved in the execution of the contract, so the project is of great significance for DEC’s CRDM manufacturing technology upgrading and future development of the nuclear island industry.

Source: http://www.dongfang.com

## Fuel assemblies of CNNC Jianzhong Ningde NPP Unit 2 passed review

Recently, the first furnace fuel assemblies and related components of Ningde NPP unit 2, manufactured by the CNNC Jianzhong Nuclear Fuel Co., Ltd passed factory acceptance.

The inspection team composed by Ningde Nuclear Power Co., Ltd examined and accepted the fuel assemblies for CNNC Jianzhong. The team inspected the documents and witnessed the on-site product packing. After the inspection, the inspection team reached the consensus that the products met the technical conditions stipulated in the contract and related requirements. They agreed to adopt the factory acceptance.

Source:http://www.cnnc.com.cn

# International Cooperation

## SNPDRI and SDIPCI renewed cooperation agreement with EDF

On June 4th, the State Nuclear Power Technology Corporation-owned enterprises, the State Nuclear Electric Power Planning Design & Research Institute (SNPDRI) and Shandong Electric Power Engineering Consulting Institute Corporation (SDIPCI) renewed their cooperation framework agreement with EDF in Beijing. Under the agreement, all sides will carry out extensive cooperation in the fields of large-capacity and high-parameter unit power generation technology, conventional island nuclear power, renewable energy, environmental protection, energy conservation, commissioning and other areas.

Since the first cooperation framework agreement was signed in 2004, Chinese and French companies have cooperated in many areas and achieved positive results - especially the aspects of technical talent exchanges and project development. The renewal of this agreement will further consolidate and expand the existing cooperation, explore new areas of cooperation and contribute to the development of Sino-French electric power cooperation to achieve further exploration.

SNPDRI, as an important member of SNPTC, it enjoys the highest level of design qualification, and its principal parts participate in the R & D of "China's major projects on large-scale advanced PWRs and high temperature gas cooled reactors" as well as cutting-edge technological research of high-capacity thermal power and the smart power grid. The institute has maintained strong performance in nuclear power, thermal power, grid and new energy, and planning, consulting, surveying, design, EPC, technical R&D and running technical support. It has provided many high quality technical services for electricity engineering projects in South Korea, Turkey, India, Zambia and other countries. EDF, as the French national power company, is a world-class competitive large enterprise in the field of nuclear power, and thermal, hydro and renewable energy. After this renewal of the agreement, the two sides will join forces to write a new win-win cooperation chapter through complementing each other's strengths.

Source: http://www.heneng.net.cn

## China delivers first product to ITER

The Institute of Plasma Physics Chinese Academy of Sciences (abbreviated as ASIPP) has delivered the poloidal field conductors' procurement package PF5 conductor to the International Thermonuclear Experimental Reactor (ITER) in Casarache, France. This is China's first product delivered to the

ITER site.

ASIPP has undertaken manufacturing of a total of 64 conductors of the PF procurement package for ITER. The ITER PF conductors are different in that their exterior is square but the interior is round and its manufacturing process is complicated. Through efforts of the department of supervinducting magnets and power saving technology research, ASIPP completed the pipe welding, armor and welds NDT, conductor forming and closed circle technology R & D.

Researchers have carried out a variety of acceptance testing. Approval was given in March 2013, in accordance with the PF technical requirements, ASIPP packaged PF5 conductor. On April 25, the conductors were shipped from ASIPP at Hefei, reaching ITER headquarters in Shanghai on June 3 after 500 kilometers by road. Upon arrival, people from ITER's magnets departments and European nuclear fusion energy agencies detected the conductor crates.

In the mid-1980s, the United States, France and other countries initiated the ITER program at a cost of 4.6 billion Euros, aiming at constructing the world's first controlled thermonuclear fusion experimental reactor to generate clean energy. This process is similar to the process of energy generated by the sun, so the controlled thermonuclear fusion experimental device is also knownas "artificial sun". China is one of seven members participating in this program and has undertaken nearly 10% of the procumbent package for the ITER device.

Source: http://www.ipp.cas.cn

## CNI23 signs MOU on NPP Construction with AVENG Group in South Africa

On June 17, the Executive Director of South Africa AVENG Group, Rob Adam and his three members visited China Nuclear Industry 23 Construction Co., Ltd (CNI23). The Party Secretary and Deputy General Manager of CNI23, Zhang Kai, welcomed them and expressed good wishes for their cooperation. The two sides launched an in-depth discussion on new ways for further cooperation. General Manager of the international division, Feng Manjun, Deputy Manager, Heyi and relevant departments attended the meeting.

At the seminar, the two sides reached a consensus on cooperation. Mr. Feng signed an MOU with Rob Adam on NPP construction, marking that they have formed a new pattern of cooperation and created good conditions for the joint development of the international engineering market. After the meeting, Rob Adam and his entourage also visited the company's showroom, 3D design studio and welding training workshop.

AVENG Group is one of South Africa's largest infrastructure construction companies, listed on the Johannesburg Stock Exchange(JSE) and has over 30,000 employees in more than 30 countries. AVENG covers a wide range of the whole industry's chain of infrastructure construction and has results in building construction, engineering, mining, water conservancy, transportation, electricity, energy, railways, steel and manufacturing. As early as in 2011, CNI23 expanded cooperation and exchanges with AVENG Group. On August 17, 2011, CNI23's first international nuclear construction management training started in Beijing, and 22 senior managers from AVENG Group become its first batch of students. Since 2012, the Director of AVENG Group, Danny Quan, has maintained international business correspondence with CNI23, and launched many friendly exchanges on nuclear power construction project cooperation.

Source: http://www.heneng.net.cn

## SNPTC and Lockheed Martin promote I & C cooperation

On June 10, the State Nuclear Power Automation System Engineering Company, a subsidiary of the State Nuclear Power Technology Corporation, signed a contract with Lockheed Martin on RPS Prototype Co-Development and Equipment Manufacturing (RPS refers to a reactor protection system). The two sides will jointly develop a new generation of digital

control system of nuclear reactor safety levels on the basis of the NuPAC platform developed in the first phase. The General Manager of SNPTC, Gu Jun, and Vice President of Lockheed Martin, Michael Bennett, witnessed the contract signing ceremony together.

The NuPAC is a new generation of reactor protection systems based on FPGA (Field Programmable Gate Array) which was jointly developed by SNPTC and Lockheed Martin. In May 2013, the Nuclear Regulatory Commission (NRC) officially released the NuPAC additional information requirements assessment letter (RAI), indicating NRC's affirmation of the design concepts and processes of NuPAC and it will further enhance the NRC review priority.

Mr. Gu Jun and Mr. Bennett spoke highly of the cooperative team in the first phase of cooperation during the talks. Both of them said they would further strengthen communication, provide adequate support and, timely and effective resolutions for problems that may arise during the R & D process.

On June 11, Mr. Gu and his entourage also visited the R & D base, located in the city of Scranton, Pennsylvania and listened to work reports from the R & D research team organized by the State Nuclear Power Automation System Engineering Company and LMT. They discussed in depth the technical risks, NRC forensics matters, equipment qualification and the other issues.

Source: http://www.heneng.net.cn

## CNF signs contract with PCI on AP1000 pipe automatic welding head renovation

On June 14, China Nuclear Industry Fifth Construction Co., Ltd. held a communication meeting with US PCI Energy Services Ltd. (PCI). At the meeting, PCI and CNF signed a contract on "AP1000 pipe automatic welding head renovation"

Given AP1000 LBB pipeline welding must use argon arc welding

and the weld thickness and the large diameter of part of the pipeline, CNF decided to carry out a narrow gap weld for part of the LBB welding. CNF need to renovate the company's existed narrow gap welding head based on the actual site conditions. After four months of communication, the two sides reached a basic agreement of intent. After this, the President of PCI, Chad Gigliotti and Manager of the nuclear power product line, Scott Achtor, came to Shanghai, negotiated and signed the contract with CNF.

Vice president, Liang Xucui, chaired the meeting and discussed the articlesof the contract one by one. Finally, the two parties completed the amendments.

At the meeting, CNF thanked PCI for their contribution to the successful main pipeline installation of Sanmen NPP Unit One. The two sides also discussed in depth the costs of technical support of main the pipeline installation and the world nuclear power development.

Deputy General Manager, Deng Xiaoliang, Manager of the nuclear island installation branch, Li, JIan, Seniro representative of China business development of Westinghouse Electric Co., Ltd attended the meeting. Haiyang NPP general contracting department participated in the meeting via video.

Source: http://www.heneng.net.cn

## Lockheed Martin extends Chinese nuclear cooperation

Lockheed Martin and China's State Nuclear Automation System Engineering Corporation (SNPAS) have extended their cooperation in the development of reactor protection systems for Chinese nuclear power plants.

Lockheed Martin's nuclear systems and solutions division and SNPAS - a subsidiary of State Nuclear Power Technology Corporation (SNPTC) - signed an agreement in late 2010 to cooperate on the development of safety systems for use in the CAP1400, a Chinese derivative of Westinghouse's AP1000 design. A dedicated development facility was set up near Scranton, Pennsylvania in early 2011, since when a technical development team from SNPAS has been on-site.

The two companies have now signed an agreement, the terms of which have not been disclosed, to prototype, manufacture and qualify reactor protection systems. They will develop nuclear safety instrumentation and control platform based on field programmable gate array (FPGA) technology. This platform will specifically address safety and regulatory concerns related to software common-cause failures in digital nuclear safety systems. These systems will monitor and detect potential failures in the system. Lockheed Martin said that the platform can be applied in both new plant construction and in upgrades at existing plants.

Construction of the first CAP1400, at Shidaowan in China's Shandong Province, is scheduled to begin in April 2014. SNPTC will take the lead with 55% of the project company. The other stakeholder will be Huaneng Nuclear Power Development Corp, a subsidiary China Huaneng Group, one of China's largest power companies. The partners hope their first CAP1400 will begin operation in 2018.

Lockheed Martin has been supplying safety-critical instrumentation and control systems for naval and civilian nuclear projects for more than 50 years. It has been providing digital systems for over 30 years. Its systems are currently operating on all of the USA's nuclear-powered submarines and aircraft carriers.

Source: http://www.world-nuclear-news.org

## Alstom will provide turbine and generator packages for China AP1000s

French engineering company Alstom and China's Dongfang Electric Company (DEC) have signed a cooperation agreement on the supply of turbine and generator packages for future Chinese AP1000 projects.

Under the agreement, turbine and generator packages related to future AP1000 projects supplied by DEC will be based on Alstom's Arabelle technology. Alstom describes the agreement as strategically important for both companies.

China resumed nuclear power plant construction in 2012 after a hiatus following the Fukushima accident of March 2011, and Westinghouse's AP1000 design is the mainstay of the country's future construction plans with some 38 units at various stages of planning and development - four currently in advanced stages of construction at Sanmen and Haiyang. Alstom boasts over 20 years' involvement in China's nuclear power market, supplying over half of all the turbine and generator packages in the country in collaboration with DEC, although turbine rotors for the Sanmen and Haiyang AP1000 units were supplied by Mitsubishi Heavy Industries of Japan.

The agreement was signed by Alstom chairman Patrick Kron and DEC chairman Wang Ji at a ceremony in Chengdu. The first contract under the new agreement is expected to be signed "shortly", Alstom said.

The Alstom-DEC deal also marks the first introduction of Alstom's LP69 long last-stage blade module in China. Last-stage blades are part of the low pressure module in a steam turbine generator which converts heat energy from steam into electricity in a nuclear power plant, with longer blades contributing to

increased power output. Alstom's 69 inch (175.3 cm) LP69 blade lays claim to being the world's longest last-stage blade in commercial operation in nuclear power plants, although the company is also marketing a 75 inch (190.5 cm) last-stage blade, the LP75.

Source: http://www.world-nuclear-news.org

Nuclear steam turbine rotor  Source: World nuclear news

## GEA focuses further on core business and pursues separation from segment GEA Heat Exchangers in medium term

GEA Group, the Düsseldorf-based mechanical engineering group, focuses with even greater emphasis on its leading position as system provider to the food industry and other technologically sophisticated process industries. The segment GEA Heat Exchangers ("HX") is no longer be counted as core business by GEA. GEA has hence decided to separate from this business in the medium term and is reviewing all options for a separation from the HX segment.

This is the outcome of a comprehensive technological and strategic portfolio review launched by GEA last year.

The aim of the review was to identify the core business areas which bear the greatest synergy potential. Those businesses are to be systematically further developed and serve as the foundation for the sustained future growth of the GEA Group.

"Efficient deployment of our human and financial resources is central to GEA's continued successful development going forward. This means we have to focus as we expand our business," said, Chairman of the Executive Board of GEA Group Aktiengesellschaft. "The in-depth review of all business units has shown that our technologies for the food industry and their deployment in alternative sectors hold very substantial growth potential. Their markets are highly stable and are driven by long-term global megatrends. We therefore plan to sustainably increase the proportion of Group revenue accounted for by food technologies in the medium term to around 70 to 75 percent."

The HX segment is highly profitable and has a strong market position. There are only limited potential synergies between HX and the other business units in the GEA Group portfolio; however, as their business profiles differ. The scope for Group-wide use of technologies and capabilities is limited. In light of this, GEA firmly believes that the HX business will be able to develop even better within a new ownership structure.

Source: http://www.gea.com

DYNABOND
Powertech Services

Our Expertise:

# Market Research and Intelligence

Over the last six years, Dynabond Powertech Service has developed extensive expertise in all segments of the nuclear industry.

We meet with major players in the Chinese nuclear industry
We research local, specialized and foreign media
We analyze regional and national statistics available solely in Chinese
We survey most of the exhibitions related to energy in China

Our market research team gathers vital information about the current state of the Chinese nuclear market, technology transfer activities, initiatives from international companies and about how local companies are evolving their R&D operations.

Our Services:

- Due Diligence: Assessment of nuclear operators, holdings, engineering companies and local manufacturers in order to guarantee that:
  - Our client's products and services precisely fit local needs
  - Products and services offerings are accurately represented
  - A track record for delivering high quality solutions demon strating financial,operational and strategic plans are in place to ensure sustained market viability
- Market Vision: Analysis of key technological developments, market trends, nuclear industry players and deployment success.
- Identifying Ideal Customers: Segmentations of vertical markets and identification of the most lucrative opportunities for your products and services within the three major nuclear holdings: CNNC, CGNPC and SNPTC.

For more information contact us: info@dynabondpowertech.com
http://www.dynabondpowertech.com/en/service/market-research

# NPP News

## Hongyanhe Unit 1 enters commercial operation

The first of four reactors being built at the Hongyanhe NPP in Liaoning province in northeast China has begun commercial operation. It becomes China's seventeenth operating nuclear power unit.

The four CPR-1000 units under construction at Hongyanhe (Image: CGNPC)

The 1080 MWe Chinese-designed pressurized water reactor officially entered commercial operation on 6 June after completing commissioning tests. The unit is said to be capable of supplying about one-quarter of the electricity demand for nearby Dalian City.

Hongyanhe 1 is the first of four CPR-1000 reactors currently being built at Hongyanhe. Its construction started in August 2007. Cold testing of the nuclear island of the unit was successfully completed in October 2012 and it achieved first criticality on 16 January. The unit was connected to the grid on 17 February.

Construction of the three other units there is progressing, with heat function tests at unit 2 nearing completion, and installation works at units 3 and 4 now 66% and 40% complete respectively. All four units should be in operation by the end of 2015.

The construction of Hongyanhe 1 has been completed with an equipment localization rate of about 75%. This is expected to increase to over 75% for unit 2, and to reach 80% in units 3 and 4.

The Hongyanhe plant is the first to be built in the northeast of China. It is owned and operated by Liaoning Hongyanhe Nuclear Power Co, a joint venture in which China General Nuclear Power Co (CGNPC) and China Power Investment Corp (CPI) each hold a 45% stake, with the Dalian Municipal Construction Investment Co. holding the remaining 10%.

Source: http://www.world-nuclear-news.org

The four CPR1000 units under construction at Hongyanhe

Source: world nuclear news

## RPV hydrostatic test of Hainan Changjiang NPP Unit 1 completed

On July 10, CNNC Hainan Changjiang NPP Unit 1 reactor pressure vessel successfully completed the hydrostatic test. All the data meet the design specifications and subsequent manufacturing work of the hydrostatic test has been carried out.

Nuclear Power Institute of China (NPIC) is responsible for the design and procurement of the pressure vessel, and Shanghai Electric Nuclear Power Equipment Co., Ltd. is in charge of the manufacturing. Both sides of the procurement and supply have taken a variety of special measures including risk prevention, process security and station supervision to ensure the hydraulic pressure test and other major processes can be finished once for all when entering into the equipment manufacturing stage. The manufacturing process was completed one month in advance through project planning, risk prevention and other means. Next people will conduct safety end beveling machine processing, the inspection of the final size and other works for the Unit 1 pressure vessel.

Hainan nuclear power has been closely involved during project management, advance planning, providing efficient response and the full-driven device management mode. The company's leadership promoted the progress of the project effectively through regular coordination and timely decisions.

Source :http://np.chinapower.com.cn

## Shandong Haiyang NPP Unit 1 will generate power in 2014

Haiyang NPP is the world's first project that adopts AP1000 nuclear power technology and also China's independent third-generation project. At present, units 1 & 2 are under construction, and 43 milestones of the project have been successfully completed. Haiyang NPP strives to realize power generation in 2014.

If you walked into Haiyang NPP construction site, two stands of the "cylindrical body" are particularly noticeable; these are the nuclear island of unit 1 & 2. Not long ago, the steel containment was successfully capped here, thus, Haiyang NPP entered the equipment installation phase. The engineer of Shangdong Nuclear Power Co., Yao Peng said, "Currently, the interior construction work of unit 1 has been completed and now the equipment installation work is ongoing. Large nuclear power equipment inside such as pressure vessels, steam generators and voltage regulators has been installed. Interior construction

of Unit 2 is also underway."

After completion, the outermost layer of the cylinder will be the shielding wall. This is a cast-in-place reinforced concrete structure, which is an important part of the shielding building. The nuclear shielding wall is constructed by dividing it into 19 layers. The sub-assembly line has been adopted to ensure the overall project construction quality and progress. According to an engineer of Shandong Nuclear Power Co., Qin Chao, at present, the shielding wall construction has become standardized, and after construction, it will be 52 meters high and one meter thick, with a total size of 6,600 kilometers. It is understood that a total investment of more than 100 billion RMB has been provided for Haiyang NPP, of which 40 billion is expected to be invested in the construction of two million-kilowatt PWRs for which the annual generating capacity will be up to 17.5 billion kWh, this will further optimize the power structure of Shandong province and become an important driving force of economic development.

Source: http://np.chinapower.com.cn

## CNNC Fangjiashan NPP Unit 1 completes core welding

On July 12, the welding work of the in-core neutron flux monitoring system was successfully finished. This project of CNNC Fangjiashan NPP Unit 1 was started on April 20 and lasted 80 days. After inspection, the qualities of the 250 welding lines were all qualified, which laid a solid foundation for the subsequent cold test node.

The in-core neutron flux monitoring system features a narrow operating space which is difficult to weld under high quality requirements. The work was successfully completed with full tracking by Qinshan Nuclear Power Base project management department and close cooperation of each participating unit.

Source:http://news.bjx.com.cn

## New NPP to be built in Huangbu

The nuclear power project located in Huangbu town, Huidong county, Huizhou city in Guangdong province is progressing. On July 8th, the inauguration ceremony of China Guangdong Nuclear Huizhou Nuclear Power Co. was held in Huizhou. Huizhou Municipal Government and CGN signed a supplemental agreement to deepen cooperation. Both sides exchanged views on further deepening the strategic cooperation with CGN and actively promoting the development of nuclear power and other clean energy.

Mayor of Huizhou, Mai Jiaomeng, said Huizhou will establish a long-term cooperation relationship with CGN and both sides should actively promote construction of the clean energy projects. Also, each side should further strengthen its responsibility to implement the supporting plan and go all out to promote clean energy projects. He said that the Municipal Party Committee and Municipal Government will give their full support to the projects' construction, and do their best to provide efficient, high quality services for the clean energy projects. He hopes both sides will further deepen cooperation and push the project construction both the upstream and downstream.

It is reported that Huizhou nuclear power plant is located in Huangbu Town, Huidong County, facing the northwestern coast of Red Bay. This nuclear power plant will adopt the AP1000 technology with cooling water coming from the Red Bay.CGN is in charge of the sediment and shoreline stability thematic research work during the nuclear power plant's feasibility study stage. It has provided technical support for water intakes of the nuclear power plant in Huizhou and layout programs for the large pier.

Source: http://www.heneng.net.cn

## Chinese-developed control rod driving system of PWR NPP making progress

The control rod driving system is one of the key pieces of equipment of an NPP. Under the support of the national sci-tech support plan and after two years work, China General Nuclear Power Corporation (CGN) has finished the localized research on the G2+ control rod driving system for its R & D project for a one million kilowatt PWR NPP control rod driving system. By combining experience and feedback from operating NPPs at home and abroad, and adopting a series of innovative designs, all the performance and life tests have been finished. The independent design and manufacturing of the G3 1700MWe NPP nuclear control rod driving system has also been completed and will now carry out the relevant test. At present the project has declared 13 patents. Parts of the products have been supplied to more than ten domestic NPP units and will gradually replace imported products. The NPP control rod driving system is expected to achieve localization though the support of national sci-tech support plan.

Source: http://www.china-nea.cn

## Liaoning Xudapu NPP phase 1 starts manufacturing steel safety shell

On July 16, Shandong Nuclear Power Equipment Manufacturing Co., Ltd. (referred to as National Nuclear Equipment), Liaoning Nuclear Power Co., Ltd. and China Nuclear Power Engineering Co., Ltd. held a meeting at Haiyang, Shandong province. At the meeting, the manufacture of the steel safety Shell of Xudapu NPP phase 1 was officially launched.

At the meeting, Party Secretary of National Nuclear Equipment, Tian Jun, firstly made a brief introduction to the company's profile and ability. Zhou Jianhu, Deputy General Manager of Liaoning Nuclear Power Co. expressed appreciation for the achievements regarding the AP1000 relying project during the process of localization. He hopes that National Nuclear Equipment can apply its experience and methodology accumulated in previous equipment manufacturing and site installations to the construction of Xudapu project. He added that they will strengthen cooperation and communication with National Nuclear Equipment.

Source: http://www.heneng.net.cn

## Shidaowan CAP1400 PWR project gets first approval

According to insiders of SNPTC, Shidaowan NPP has firstly gained approval of the CAP1400 PWR project, in which the pre-construction work is allowed to be carried out, including foundation excavation.

This CAP1400 PWR is different from the HTR demonstration project which started construction on December 21. The deputy director of the Energy Research Institute of Shandong Academy of Sciences, Xu Chongqing, said that the installed capacity of HTR is only 200,000 kW which focuses on4th generation nuclear power technology for industrial trials. However, the CAP1400 PWR project is an expansion project of Shidaowan NPP. It is mainly used for commercial operation.

The CAP1400 PWR project, with stand-alone capacity of 1.4 million kW, adopted the AP1000 nuclear power technology route. The long-term capacity of Shidaowan NPP will reach 900 million kW with a construction period of 20 years.

Shidaowan was approved this year, a signal that the nuclear power construction is progressing fast. According to the National Development and Reform Commission, 3.24 million kW of nuclear power will be added, which means that three units will be in full production this year.

It was learnt that Ningde unit 1 and Hongyanhe unit 1 have entered the grid commissioning phase. According to the plan, these two million-kilowatt units will be put into full operation this year.

According to the insiders of SNPTC, there are still six units awaiting approval - including Shandong Haiyang Unit 3, Zhejiang Sanmen Unit 3, Fujian Fuqing Unit 5, Guangdong Yangjiang Unit 5, Guangdong Lufeng Unit 5 and Liaoning Xudapu Unit 1.

Source: http://np.chinapower.com.cn

## Sanmen NPP unit 2 hoists chilled water module

On July 18, the nuclear island chilled water module for Sanmen NPP unit 2 was smoothly hoisted into position. It was constructed by China Energy Construction Group and lays a solid foundation for the following installation of the template.

A total of two chilled water modules have been installed in Sanmen unit 2 nuclear islands. Each module weighs 48 tons with dimension of 8.9 meters long, 4 meters wide and 3.5 meters high. The hoisting operation is quite difficult due to far amplitude and irregular shape. In order to safely and efficiently finish the hoisting task, the project department of Zhejiang Thermal Power Company developed a special hoisting operation plan including well-done safety technology clarification and supervision and control of the whole process.

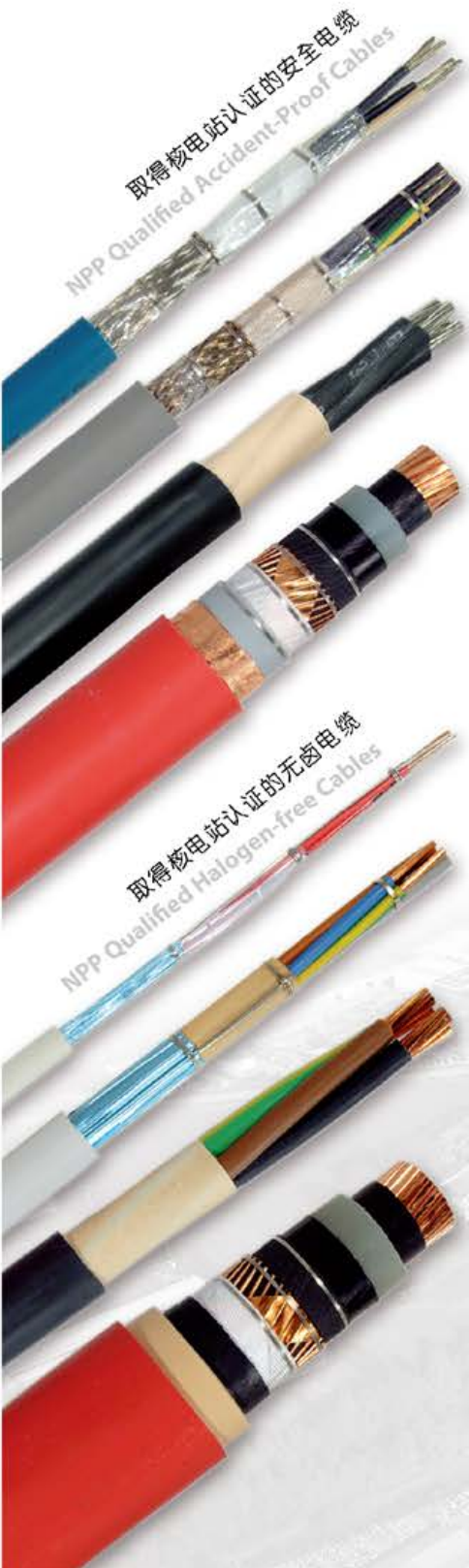
Source: http://finance.ifeng.com

Kabelwerk **EUPEN** AG
cable

Kabelwerk ***EUPEN*** AG is an independant and fully integrated manufacturer of Electric Cables & Wires, employing 930 people in its factories in Belgium.
The product range includes MV & LV Power Cables, Instrumentation & Control Cables, Telecommunication Cables (Copper, Coaxial, Fibre Optics) and last but not least Halogen-free Fire Safety Cables.

Within the last product family, ***EUPEN*** also stands for 30 years experience in manufacturing 1E-LOCA qualified cables and cables for use outside containment of Nuclear Power Plants.

Kabelwerk EUPEN AG 是一家完全整合型的独立的电缆和电线生产商，仅比利时工厂就拥有员工930人。
它的产品涵盖中低压电缆、仪控电缆、通信电缆（铜芯电缆，同轴电缆和光纤）及无卤消防电缆。
EUPEN在1E级LOCA认证电缆和核电站安全壳外使用的电缆方面，已经有30多年的制造经验。




www.eupen.com/
cable/nuclear
/index.html

# 目录 CONTENTS

EDITORIAL STAFF
/ 编辑团队

EDITORS / 编辑
Arnaud Lefevre-Baril / 百力
Bessie Wang / 王文贝

NEWS / 新闻
Qi Jia / 戚佳

TECHNICAL ARTICLES / 科技文章
Bessie Wang / 王文贝

EVENTS / 展会会议
Qi Jia / 戚佳

DESIGNER / 设计师
FangHua Design Inc. / 芳华设计公司

DYNABOND POWERTECH SERVICE
/ 代邦核讯 联系方式
北京市朝阳区，工体北路甲 6 号，中宇大厦 1509
PHONE / 电话
+86-10-64681222
FAX / 传真
+86-10-64654957
EMAIL / 邮箱
info@dynabondpowertech.com
WEBSITE / 网站
www.dynabondpowertech.com

我们的专业:

# 商情调查

在过去的六年里，代邦能源在核能各个领域积累了丰富的专业知识。

会见中国核工业巨头
通过本地、国外和专业的媒体进行日常调研
通过专有途径获取中国本土核电数据并进行分析
参加调研在国内外举办的众多中国能源关联展会

我们的市场调研团队对于中国核电市场、相关技术转移、国际竞争者的动态以及本地竞争者的研发业务等掌握了全面、关键的信息。

我们的服务

- 尽职调查 – 对核电运营商、控股人、工程公司和本地制造商进行评估以确保:
  - 您的产品和服务符合本地需求
  - 产品及提供的服务能够被准确的展示和表达
  - 为提供高品质解决方案而进行的跟踪记录，确保财务、经营和战略计划有序进行，保证持续的市场可行性。
- 市场洞察力 – 对关键技术的发展、市场趋势、核工业主要参与者以及相关部署进行分析。
- 理想客户定位 – 根据您的产品和服务对中核集团、中广核集团和国家核电三大主要核控股企业进行市场纵向分割，为您识别最佳盈利机遇。

想要获得更多信息请联系我们: info@dynabondpowertech.com
http://www.dynabondpowertech.com/en/service/market-research

# 重建加拿大原子能有限公司核实验室

## 2007 年

在重组前，加拿大原子能有限公司（AECL）由两个部门组成：核实验室和 CANDU 反应堆部门。CANDU 反应堆部门主要负责 AECL 的 CANDU 反应堆的设计，销售和技术服务。

实验室主要包括分别位于安大略的 Chalk River 实验室和位于马尼托巴 whiteshell 实验室。这两个实验室主要负责与安全保障，健康问题，环境问题，废物管理和清洁能源等相关的核科学技术，及生产医用同位素。

2007 年 11 月，自然资源部部长宣称对 AECL 进行审查，以确定其公司结构与员工是否匹配 AECL 作为国营公司的身份以确定加拿大的核工业是否最终全面参与到全球核电市场。

## 2009 年

审查于 2009 年完成。结论是 AECL 应该重组，内容如下：

1. AECL 的商业模式必须改变，以允许加拿大在全球核电市场充分参与和竞争；

2. Chalk River 实验室将受益于强有力的伙伴关系，以推动创新和重建，并应给予适当考虑可供选择的其它管理模式，如政府全资拥有，承包经营等方式。在承包经营方式中，现有的设施所有权将归属于政府，这些设施的运作将承包给一个或多个第三方。

根据以上结论，在 2009 年 5 月政府宣布重组 AECL，更好的优化公司结构，使其更具竞争力。通过重组，核工业实现成功的条件就会落实到位。为了实现此目标，政府部门推出了一个分为两阶段的过程方案，也同时希望能够尽量减少纳税人的财务风险。

作为第一步，自然资源部部长邀请投资者提交关于 AECL 的 CANDU 反应堆部门的建议。建议将在他们如何满足政府的核政策目标的基础上进行评估：

- 确保安全，可靠和经济的方案，以解决加拿大的能源和环境需求；
- 满足政府核能投资回报最大化的同时控制政府成本；
- 定位于加拿大核工业，并确保其员工能够抓住国内和全球的市场机会。

## 2011 年

2011 年 10 月，政府将 AECL 的前 CANDU 反应堆部门的资产出售给坎杜能源公司，它是 SNC-Lavalin 集团有限公司的全资子公司。本次交易符合既定目标。

## 2012 年

2012 年 2 月，政府公开推出 AECL 重组的第二阶段，主要集中在核实验室。一份关于未来实验室的征求意向书被公布来确定利益相关者是否有意愿来分担财务风险，管理，合作和承包。政府收到 46 份来自不同的利益相关者的回复，包括私营机构，学术界，地方政府和行业协会。

基于利益相关者的投入，金融建模，治理和其他分析，政府将重组核实验室使其：

- 重点在于实验室退役和废物管理；科学与技术（S & T）能否满足核心的联邦责任；满足 CANDU 舰队和其技术；
- 过渡到收回第三方 S & T 服务的全部成本；
- 加强问责制和私营部门的所有设施和服务管理的严密性和效率。

政府也将评估从长期来看缴纳联邦税对于核创新产生的价值。作为该评估的一部分，核工业将被邀请提出具有前瞻性，产业带动核创新议程审议的建议。

FCG 1 号机组电动辅助给水泵完工发运

在整个实验室的重组过程中，政府都将在安全维护，安全保障和环境管理等核工业各方面继续发挥其作用。加拿大核安全委员会（CNSC）和加拿大独立核监管机构将继续规范加拿大整个核工业的各个层面。

## 2013 年

在未来数月，为了 AECL 的核实验室的管理和运作，加拿大政府将投身于有竞争力的，协同的采购过程，其中包括建议征求书。加拿大政府正在寻求落实政府拥有，承包商经营（GOCO）的商业模式，正如等美国和英国其他司法管辖区所做的那样。

根据新的管理模式，实验室将专注于三个主要目标：

1. 管理 Chalk River 和 whiteshell 实验室在超过 60 年的核研究和发展过程中所积累的放射性废物和退役责任。

2. 确保加拿大的世界一流的核科学，技术能力和知识能够继续支持联邦政府担任好其在核工业领域所扮演的角色并发挥好其责任 – 保护健康，保障公共安全和环保。

3. 提供行业准入，以解决其对深入的核科学和技术专业知识的需要。这将包括正在进行重组的实验室，要求其以公平的市场价格来确保其成本的回收，不仅为了 CANDU 反应堆的业主和经营者，也考虑到了更广泛的加拿大核产业供应链。


核主泵试验台

## 媒体可联系：

David Provencher
自然资源部长
加拿大办事处
613-996-2007
或：
媒体关系加拿大自然资源部（渥太华）
613-992-4447
更多相关信息请查阅 www.nrcan.gc.ca/media

Ressources naturelles Canada　Natural Resources Canada　Canada

# 本月专访

## 加拿大 BCI 公司总监 Harshad Patel 先生专访

# 加拿大 BCI 公司总监 Harshad Patel 先生专访

Email: harshadp@bc-instruments.com Phone: 905 939 7323

## DPS：请介绍一下您的背景，您是何时加入 BCI 的?

**Harshad Patel:** 我获得了印度 SP 大学机械工程工学学士和美国德克萨斯农工大学机械工程理科硕士双学位。1980 年开始我作为一名专业工程师在安大略省工作。1979 年我进入 BCI 公司担任质保经理一职，后来连续担任设计工程师、项目经理、部门经理、公司总监等职务。现在我不仅是 BCI 印度公司的总裁，而且是印度和加拿大公司的股东理事。BCI 公司刚起步时，我就在这里工作了。

## DPS：BCI 是谁成立的?

**Harshad Patel:** 1971 年 4 月，Bruno 和 Britta Conzelmann 在自家车库成立了一家小公司。公司以这两个创始人命名，即 BCI，我加入时它只有一台机器和 9 名员工。

## DPS：BCI 公司是何时进军核电领域的? 公司成立的初衷就是要进入核电行业吗?

**Harshad Patel:** 1971 年 BC 仪器公司主要生产航空航天领域产品；Leigh 仪器公司是我们的第一个客户。我加入公司后，我们开始开拓市场，希望将我们的产品拓展到其它领域。1979 年，核电市场呈现较好的发展趋势，我们决定为核反应堆、泵、核电站其它设施生产部件产品。我们先后获得了 CSA Z299.2, ISO 9001, ASMEIII 等认证。BCI 严格遵守 TSSA 标准，对反应堆测量仪表进行计算，并起草压力容器支路的相关图纸设计。

## DPS：BCI 工厂有多少名员工?

**Harshad Patel:** 我们有两个制造工厂，总占地面积为 5.8 万平方英尺，员工 135 名。我们的工厂坐落在伯格，2004 年我们在印度古吉拉特邦成立了 BCI 印度公司，拥有雇员 80 名。

## DPS：贵公司生产哪些产品?

**Harshad Patel:** 我们生产高精密部件和组件，产品领域涵盖航空、核能源、国防、医学、电子和其他相关行业。BCI 公司是一家精密机械厂，我们的优势在于我们有一支技术过硬、经验丰富的团队。像车床部件、轧机部件等一些主要产品是由不锈钢、铝、钛、碳钢、工具钢、铸件等材料制造而成。我们制造燃料管道屏蔽塞组件、供料机通道口部件（如毂、密封圈、法兰）、核 1 级配件、适配器、温度计套管等。

## DPS：您是否参与产品的设计工作?

**Harshad Patel:** 我参与核电仪表部件的设计工作，如适配器、温度计套管等。从 1980 年以来我一直参与 Candu 反应堆核 1 级和核 3 级部件的设计工作，如平式焊接适配器、温度计套管、液位计等。我还将其它产品的相关知识融入到核电产品。我们的产品可以应用到不同的领域中，如医学领域。每当需要设计新产品时，我会积极贡献我的想法，当然我还有一支强大的团队辅助我。

## DPS：有没有客户要求你们生产在市场上已经销声匿迹的产品，因此你们必须进行逆向工程的工作?

**Harshad Patel:** 是的，我们有从产品样本出发然后进行设计绘图，并根据客户需要进行材料分析。我们不停研究新产品，当有订单时，我们为客户提出更好的方案，以更好的为核电市场服务。我们从未停下更新产品的脚步。

## DPS：贵公司参与了哪些核电项目?

**Harshad Patel:** 我们参与了所有的 CANDU 反应堆项目，如安大略省的 Pickering 核电站、Bruce 核电站和 Darlington 核电站，位于魁北克的 Gentilly 核电站，新不伦瑞克省的 Point Lepreau，南韩的 Wolsong 项目，阿根廷的 Embalse 项目，罗马尼亚的 Cernavoda 项目和中国的秦山项目。

管道封闭塞检测工具

燃料管道屏蔽塞组件

## DPS：这些都是 Candu 项目。那么 Candu 项目与压水堆项目的区别有哪些？

**Harshad Patel:** 最主要的区别在于两个核电项目的反应堆，Candu 采用的重水堆。不过总体来讲，两种核电项目采用的传热设备、锅炉及汽轮机都是一样的。我期望压水堆能够得到改进，制造更多的绿色能源，这样我们也会对我们以后的产品做出改进。我们为加拿大原子能公司的先进 CANDU 反应堆（ACR 1000）提供了样本部件，它是新设计的第三代核反应堆。

## DPS：贵公司的产品是否遵循 ASME III 标准，亦或其它标准？

**Harshad Patel:** 我们大多数产品遵循的是 ASME III 和 ASME II。我们应用于核电站的承压系统和部件遵循的是 AS9100B/ISO 9001:2008 和 N285.0 标准。

## DPS：BCI 的电子束焊接技术非常卓越，您能否向读者介绍一下在核电领域中这种焊接技术的优势有哪些？

**Harshad Patel:** 这种技术用于核电密封盘的镍镀层焊接，密封盘非常易碎，而在核电行业中任何一个小小的失误都会产生严重后果。这种焊接技术可以安全有效的保护工作人员。

## DPS：BCI 是否参与了国际项目？

**Harshad Patel:** 是的，我们大多数项目来源于国外。我负责的是全球项目，而不仅仅局限于加拿大，如罗马尼亚、阿根廷、南韩等。

## DPS：BCI 有两个工厂，一个在加拿大安大略省的伯格州，另一个位于印度古吉拉特邦的安纳德，那么 BCI 当初为什么会开拓印度市场呢？

**Harshad Patel:** 我来自印度，知道如何与印度人打交道。印度是一个大国，进入印度市场有助于帮助 BCI 开启进入亚洲市场的大门。我们在印度的业务涉及航空、医学，包括核医学。我们选择在印度建厂的原因是我们的客户分布在亚洲，因此在印度建厂可以减少产品的成本。

## DPS：您可否介绍一下您在阿根廷的业务？

**Harshad Patel:** BCI 出口阿根廷的产品有核 1 级适配器、温度计套管和加料机部件。

## DPS：BCI 与阿根廷的核电站运营商或安全局是否还保持联系？

**Harshad Patel:** 是的，近期我们注册了 TSSA，往阿根廷出口了压力容器部件。

## DPS：中国计划向阿根廷出口压水堆核电项目，BCI 是否计划参与该项目？BCI 将如何吸引中方成为其供应商？

**Harshad Patel:** 我们的优势是我们采用的是 CNC 精密加工，如果有设计图纸，我们可以生产任何行业所需要的产品，包括压水堆项目在内。我们现在还没有针对中国－阿根廷项目制定的计划，不过我们可以向中方提供我们在阿根廷项目中积累的经验。

## DPS：在于中方合作过程中是否有遇到困难？BCI 公司与中方的所有活动是否是在 AECL 的授意下完成的？

**Harshad Patel:** 我们向秦山第三核电有限公司供应部件，对方通过信用证付款，整体合作非常顺利。秦山第三核电有限公司多次来我厂参观，我们之间建立了密切的合作关系。过去，我们与中方的合作都是在 AECL 的授意下完成的。

## DPS：自 2007 年开始，中国跃居成为全球最大的核电市场，那么 BCI 有没有收到来自中国客户的新的要求？你们有没有构建新的人力资源来专门负责中国市场？

**Harshad Patel:** 目前我们还没有专门的团队来负责中国市场，不过我的项目工程师毕业于中国的大学，学的是机械工程，他会将汉语。现在我们正在对中国核电市场进行评估，并计划建立一支销售队伍来负责新兴项目。同时，我们与中国代理建立了合作关系。

## DPS：你们是否计划凭借加拿大公司和印度公司来满足中国市场需求？

**Harshad Patel:** 我们会根据所需的设备类型来考虑供货地点。如印度公司负责航空和医学设备，加拿大公司负责核电市场。


BCI 印度有限公司

# 民用核安全设备无损检验人员资格管理规定

# （HAF602）

# 民用核安全设备无损检验人员资格管理规定（HAF602）

根据《民用核安全设备监督管理条例》，特制定《民用核安全设备无损检验人员资格管理规定（HAF602）》。现予公布，自 2008 年 1 月 1 日起施行。

1995 年 6 月 6 日国家核安全局批准发布的《民用核承压设备无损检验人员培训、考核和取证管理办法（HAF602）》同时废止。

国家环境保护总局局长　周生贤

国防科学技术工业委员会主任　张庆伟

二〇〇七年十二月二十八日

主题词：环保 法规 无损检验人员 令

民用核安全设备无损检验人员资格管理规定（HAF602）

## 目 录



## 第一章 总 则

第一条　为了加强对民用核安全设备无损检验人员的管理，保证民用核安全设备质量，根据《民用核安全设备监督管理条例》，制定本规定。

第二条　本规定适用于民用核安全设备无损检验人员的考核和管理工作。

民用核安全设备无损检验方法包括超声、射线、磁粉、渗透、涡流、目视、泄漏检验等。

第三条　从事民用核安全设备无损检验活动的人员，依据本规定参加考核并取得资格证书后，方可从事相应方法和级别的民用核安全设备无损检验活动。

第四条　民用核安全设备无损检验人员由国务院核行业主管部门按照国务院核安全监管部门的规定统一组织考核，经国务院核安全监管部门核准，由国务院核行业主管部门颁发资格证书。

## 第二章 机构及职责

第五条　国务院核安全监管部门负责核准民用核安全设备无损检验人员的资格，核准在国内从事无损检验活动的境外人员的资格，并组织对民用核安全设备无损检验人员及相关考核活动的监督检查。

第六条　国务院核安全监管部门设立民用核安全设备无损检验人员资格核准委员会，其主要职责是：

（一）制定相关管理办法；

（二）对民用核安全设备无损检验人员资格鉴定委员会成员实施备案；

（三）审查民用核安全设备无损检验人员的资格。

第七条　民用核安全设备无损检验人员资格核准委员会由国务院核安全监管部门及其派出机构、技术后援单位的代表以及特聘专家组成。

核准委员会委员应当具有 5 年以上相关管理工作经验或者高级专业技术职称，能准确理解并严格执行国家有关法律、法规和标准。

第八条　国务院核行业主管部门负责设立民用核安全设备无损检验人员资格鉴定委员会，其主要职责是：

（一）组织制定考试大纲；

（二）编制有关无损检验方法的考试题库；

（三）审查报考人员的资格和考核结果；

（四）管理有关档案；

（五）具体负责发放民用核安全设备无损检验人员的证书。

第九条　民用核安全设备无损检验人员资格鉴定委员会由国务院核行业主管部门、各相关行业协会、核安全设备无损检验相关单位、技术后援单位的代表以及特聘专家组成。

资格鉴定委员会二分之一以上成员应当为已取得III级证书的无损检验方面的专家。资格鉴定委员会的成员名单送国务院核安全监管部门备案。

第十条　承担民用核安全设备无损检验人员资格考核工作的单位应当具备下列主要条件：

（一）具有与拟从事的考核活动相适应的考核场所、档案室、检验设备和仪器；

（二）具有相应的专业技术人员和管理人员；

（三）具有健全的考核管理制度。

第十一条　民用核安全设备无损检验考核单位的职责主要包括：

（一）制定考核工作程序；

（二）具体组织资格考核；

（三）管理检验设备、仪器、试块或者试件；

（四）管理报考人员的档案资料。

## 第三章　等级划分和资格考核

第十二条　民用核安全设备无损检验人员的资格等级分为Ⅰ级（初级）、Ⅱ级（中级）和Ⅲ级（高级）。资格考核按照不同的等级、方法分别进行。

第十三条　Ⅰ级无损检验人员可以承担下列工作：

（一）调整和使用仪器设备；

（二）在Ⅱ级或者Ⅲ级人员监督指导下，根据操作规程进行无损检验活动，并记录检验结果；

（三）依据标准对检验结果进行初步评定，但不得出具无损检验结果报告。

第十四条　Ⅱ级无损检验人员可以承担下列工作：

（一）根据确定的工艺，编制技术操作规程；

（二）安装和校准仪器设备，具体实施无损检验活动；

（三）依据法规、标准和规范评价检验结果；

（四）编写和签署无损检验结果报告；

（五）培训和指导相应无损检验方法的Ⅰ级无损检验人员。

第十五条　Ⅲ级无损检验人员可以承担下列工作：

（一）确定无损检验技术和工艺，监督和管理无损检验活动；

（二）依据法规、标准和规范评定检验结果；

（三）编制特殊的无损检验工艺；

（四）没有验收准则可供引用时，协助有关部门制定验收准则；

（五）培训相应无损检验方法的Ⅰ级和Ⅱ级人员。

第十六条　报考人员应当具备下列条件：

| 考核的检验方法 | 技术等级 | 无损检验专业大专以上 | 理工科大专以上 | 高中、中专或者相当学力 | 初中 |
|---|---|---|---|---|---|
| 射线检验（RT）<br>超声检验（UT）<br>涡流检验（ET）<br>泄漏检验（LT） | Ⅰ | 三个月 | 六个月 | 一年 | 三年 |
| | Ⅱ | 六个月 | 一年 | 二年 | 八年 |
| | Ⅲ | 四年 | 五年 | 八年 | / |
| 渗透检验（PT）<br>磁粉检验（MT）<br>目视检验（VT） | Ⅰ | 一个月 | 三个月 | 六个月 | 三年 |
| | Ⅱ | 三个月 | 六个月 | 一年 | 八年 |
| | Ⅲ | 四年 | 五年 | 八年 | / |

（一）学力和实践经历要求：

其中，申请报考Ⅱ级的人员应当具备相应检验方法的Ⅰ级人员有效技术资格证书；不具备相应检验方法的Ⅰ级人员有效技术资格证书的，其实践经历时间应当加倍。

报考Ⅲ级人员的实践经历时间为获得相应方法Ⅱ级资格证书后的时间。上述经历应当至少有一半时间是从事民用核安全设备无损检验活动的。报考Ⅲ级的人员应当持有 2 个以上有效Ⅱ级资格证书，且应当含有所申请报考方法的核Ⅱ级资格证书；申请 UT、RT 和 ET 的Ⅲ级人员还应当具有 PT 或者 MT 的Ⅱ级资格证书，申请 PT、MT、LT 和 VT 的Ⅲ级人员还应当具有 UT、RT 或者 ET 的Ⅱ级资格证书。

已经取得其他机构相应方法资格证书的人员，在满足了相应级别的学力和实践经历要求的情况下，可以报考同等级别的民用核安全设备无损检验人员资格考核。

（二）报考人员应当具备一定的视力条件：

1、裸视或者经过矫正的视力要求达到 5.0 以上；

2、报考人员的辨色视力应当达到能区分与无损检验方法有关的颜色对比度。

（三）近 3 年未被吊销资格证书。

第十七条　申请报考的人员应当向民用核安全设备无损检验人员资格鉴定委员会提交下列主要证明文件：

（一）学力证明；

（二）聘用单位出具的培训经历和实践经历证明；

（三）医院出具的视力证明；

（四）已持有的资格证书。

第十八条　民用核安全设备无损检验人员资格鉴定委员会应当对报考人员进行资格审核，并自收到相关证明文件之日起 10 个工作日内告知报考人员是否可以参加资格考核。

第十九条　民用核安全设备无损检验人员Ⅰ、Ⅱ级资格考核包括笔试和操作考试，Ⅲ级考核包括笔试、操作考试和综合答辩。笔试采用闭卷模式，笔试成绩有效期为 1 年。

民用核安全设备无损检验人员资格考试试题内容与范围按照相应方法的各级考试大纲的规定执行。

第二十条　笔试内容包括“通用考试”和“核安全设备专业考试”两部分。

通用考试主要考查报考人员的无损检验基础知识，检查报考人员对考试大纲中规定的基础知识的理解和掌握程度。

民用核安全设备专业考试是考查报考人员将有关无损检验技术应用于民用核安全设备的能力，包括民用核安全设备的有关知识和相关法规、标准和规范。专业考试至少包括下列内容：

（一）Ⅰ级和Ⅱ级人员考试内容应当包括：核安全方面以及民用核安全设备系统的有关知识；民用核安全设备质量保证方面的有关知识；民用核安全设备用特殊的无损检验技术以及在核辐射环境中工作时的辐射防护知识；无损检验操作技能；相应的民用核安全设备用无损检验的标准知识，尤其是国际公认的核设备用无损检验标准知识。

（二）Ⅲ级人员的考试内容，除前述对Ⅰ级和Ⅱ级人员所进行的考试内容以外，还应当包括：主要民用核安全设备的选材原则、材料型号、性能，以及这些材料在制造过程中和运行环境下可能产生缺陷的机理和性质；各主要系统所执行的核安全功能，以及这些系统中各主要设备的核安全级别；民用核安全设备相关的无损检验新技术和新工艺。

第二十一条　操作考试主要是考查报考人员正确应用无损检验仪器进行操作，出具检验结果并对结果进行评价的能力。

第二十二条　综合答辩主要是考查报考人员对民用核安全设备无损检验理论、方法和实践操作等方面的综合应用能力。

第二十三条　民用核安全设备无损检验人员考核单位应当在考试结束后的 10 个工作日内，将民用核安全设备无损检验报考人员的资格考核申请、相关资料以及考试结果报民用核安全设备无损检验人员资格鉴定委员会。资格鉴定委员会对考试结果进行审查，并将审查结果报国务院核行业主管部门。

第二十四条　民用核安全设备无损检验报考人员有舞弊行为的，由民用核安全设备无损检验人员考核单位取消其考试资格，并停考 1 年。

## 第四章　资格核准、证书颁发与管理

第二十五条　国务院核行业主管部门应当将审查通过的报考人员的下列主要材料送国务院核安全监管部门核准：

（一）民用核安全设备无损检验报考人员的资格考核申请；

（二）学力证明；

（三）由符合第十条规定的考核单位出具的考核成绩；

（四）民用核安全设备无损检验人员资格鉴定委员会审查意见；

（五）已持有的资格证书复印件。

国务院核安全监管部门应当自收到前款规定的材料之日起 20 个工作日内完成核准工作，并将核准结果送国务院核行业主管部门；核准通过的，由国务院核行业主管部门自收到核准结果之日起 15 个工作日内颁发相应的资格证书。

第二十六条　民用核安全设备无损检验人员资格证书包括下列主要内容：

（一）人员姓名及聘用单位；

（二）考试合格项目及资格等级；

（三）有效期限；

（四）证书编号。

第二十七条　民用核安全设备无损检验人员考试合格项目的有效期

限为 5 年。无损检验人员连续脱离无损检验专业工作 1 年以上，该项目自动废止。

第二十八条　资格证书有效期届满后拟继续从事民用核安全设备无损检验活动的人员，应当在证书有效期届满 6 个月前向民用核安全设备无损检验人员资格鉴定委员会提出更新申请，并提交下列主要材料：

（一）聘用单位推荐信；

（二）医院出具的视力证明；

（三）连续脱离无损检验专业工作未超过 1 年的证明；

（四）聘用单位出具的未发生过责任事故、重大技术失误的证明。

资格鉴定委员会对前款规定的材料进行审查核实后，申请人方可参加更新证书考核。

Ⅰ、Ⅱ级更新证书考核为操作考试，Ⅲ级更新证书考核包括操作考试和综合答辩。

第二十九条　考核合格并经民用核安全设备无损检验人员资格鉴定委员会审查通过后，由国务院核行业主管部门将更新证书考核结果连同更新证明材料送国务院核安全监管部门核准。

经核准的民用核安全设备无损检验人员资格证书有效期可以延长一次，延长有效期为 5 年。

第三十条　民用核安全设备无损检验人员的聘用单位，应当加强对本单位无损检验人员的管理，保证其在资格证书限定的范围内进行有效的无损检验活动。

第三十一条　民用核安全设备无损检验人员不得同时在两个以上单位中执业。

无损检验人员变更聘用单位的，应当向民用核安全设备无损检验人员资格鉴定委员会提出无损检验人员资格证书变更申请，由发证机关更换新的资格证书，并告知国务院核安全监管部门。更新后的证书有效期适用原证书的有效期。

第三十二条　已取得国外相关无损检验资格证书的境外单位的无损检验人员，需经国务院核安全监管部门核准后，方可在中华人民共和国境内从事民用核安全设备无损检验活动。

## 第五章　监督检查

第三十三条　国务院核安全监管部门负责对民用核安全设备无损检验人员的考核活动进行监督检查。

第三十四条　国务院核行业主管部门负责对民用核安全设备无损检验人员考核单位的考核工作进行检查。

检查内容包括考核单位的质量保证体系运行情况、组织机构、场地和设施、人员师资力量、考试大纲及实施细则、考试管理制度、考试计划及实施、文件和记录管理等方面的内容。

第三十五条　民用核安全设备无损检验人员考核单位有义务配合国务院核安全监管部门和国务院核行业主管部门的监督检查工作，并如实反映情况，提供必要的资料，不得拒绝和阻碍。

第三十六条　无损检验结果报告的编制和审核应当由具备相应资格的无损检验人员担任，并经其聘用单位批准后方为有效。

## 第六章　法律责任

第三十七条　民用核安全设备无损检验人员有下列行为之一的，由国务院核安全监管部门责令其停止民用核安全设备无损检验活动，并由国务院核行业主管部门吊销其资格证书：

（一）违反操作规程导致无损检验结果报告严重错误的；

（二）伪造检验数据，出具虚假检验结果或者结论的；

（三）同时在两个以上单位执业的；

（四）有其他违反国家核安全法规行为的。

第三十八条　民用核安全设备无损检验人员超出资格证书限定范围从事无损检验活动的，由国务院核安全监管部门责令其停止无损检验活动，依据《民用核安全设备监督管理条例》第四十九条的规定对聘用单位予以处罚。

第三十九条　伪造、变造民用核安全设备无损检验人员资格证书的，依据《中华人民共和国治安管理处罚法》第五十二条的规定，处 10 日以上 15 日以下拘留，可以并处 1000 元以下罚款；情节较轻的，处 5 日以上 10 日以下拘留，可以并处 500 元以下罚款。

第四十条　民用核安全设备无损检验人员考核单位有下列行为之一的，由国务院核行业主管部门或者国务院核安全监管部门责令限期整改；情节严重的，停止其资格考核工作：

（一）考核单位条件变化，不满足规定的要求；

（二）不按照本规定的要求进行考试；

（三）资格考核工作质量低劣；

（四）严重违规，弄虚作假。

第四十一条　民用核安全设备无损检验考核单位有关工作人员有下列行为之一的，由考核单位停止其资格考核工作，并依据有关法律法规予以处罚：

（一）泄露考试内容的；

（二）考试过程中有徇私舞弊行为的；

（三）玩忽职守，导致考场纪律混乱，考试结果失实的；

（四）其他严重影响资格考核公正性的。

## 第七章　附　则

第四十二条　本规定自 2008 年 1 月 1 日起施行。1995 年 6 月 6 日国家核安全局批准发布的《民用核承压设备无损检验人员培训、考核和取证管理办法（HAF602）》同时废止。

# 会议展会


## 8 月

### 2013 第二十四届中国国际测量控制与仪器仪表展览会

时间：2013/08/27-2013/08/30

地址：北京·中国国际展览中心

联系人：张小姐

联系方式：86-10-82800630

网址：www.miconex.com.cn

### 2013 中国（深圳）国际节能设备与技术博览会

时间：2013/08/27-2013/08/29

地址：深圳会展中心

联系人：贾伟

联系方式：13926508790

网址：http://ajnjp.com

### 中国核电信息技术高峰论坛 2013

时间：2013/08/08-2013/08/09

地址：上海

联系人：邓艾文

联系方式：86(21)51920620-8300

网址：www.innchinc.com/nitf2013

### 2013 第九届北京国际空压机及压缩机展览会

时间：2013/08/08-2013/08/10

地址：中国国际展览中心（老馆）

联系人：钱 树 洋

联系方式：13671112698

网址：www.compressor-expo.com

### Cippe2013 第五届中国（上海）国际石油化工技术装备展览会

时间：2013/08/20-2013/08/22

地址：上海新国际博览中心

联系人：张涛

联系方式：13611176718

网址：http://sh.cippe.com.cn/2013/cn/

## 广州国际发电机组、动力设备及能源装备展

时间：2013/08/19-2013/08/21

地址：中国进出口商品交易会展馆 A 区

联系人：陈微均

联系方式：18825031607

网址：http://www.gzpee.com/

## 2013 第九届北京国际空压机及压缩机展览会

时间：2013/08/08-2013/08/10

地址：北京中国国际展览中心（老馆）

联系人：钱树洋

联系方式：13671112698

网址：http://www.compressor-expo.com/

## 2013 年广西电线电缆及附件展览会

时间：2013/08/09-2013/08/11

地址：南宁国际展览中心

联系人：辜洪潮

联系方式： 13877135502

网址：www.nanchunhz.com/newsview-336.aspx

# 9 月

## 第十届中国 - 东盟博览会核电工业展

时间：2013/09/03-2013/09/06

地址：中国．南宁国际会展中心

联系人：莫玉娟

联系方式：13517677479

网址：http://www.caexpo.org/

## 2013 中国国际核电装备展览会

时间：2013/09/02-2013/09/04

地址：中国国际展览中心

联系人：李仕友

联系方式：13801178558

网址：http://www.cine010.com.cn/Index/

## 2013 中国国际电力设备与智能电网展览会

时间：2013/09/02-2013/09/04

地址：中国国际展览中心

联系人：李仕友

联系方式：13801178558

网址：http://www.epchina010.com//Index/

## 2013 第八届山东国际工业装备展览会

时间：2013/09/02-2013/09/04

地址：济南国际展览中心

联系人：刘慧贞

联系方式：18963097168

网址：http://www.gyz-xz.com/

## 第四界苏州国际数控机床及金属加工工业展览会

时间：2013/09/23-2013/09/25

地址：苏州国际展览中心

联系人：苏州国华展览有限公司

联系方式：86-512-62804023

网址：www.metaltechexpo.com/lxwm.asp

# 10 月

## 第八届上海国际石油石化天然气技术装备展览会

时间：2013/10/28-2013/10/30

地址：上海新国际博览中心（龙阳路 2345 号）

联系人：陈斌

联系方式：18964077791

网址：http://www.sippe.org.cn/index.asp

## 第十届中国（北京）国际冶金工业博览会

时间：2013/10/16-2013/10/18

地址：中国国际展览中心

联系人：刘春丽

联系方式：13651168649

网址：http://www.bcime.com/

# 科技文章

## 核电站工程仿真机

加拿大 CFM 有限公司

# L-3 核电站工程仿真机核电站工程仿真机

对于核电站控制室操作员而言，FSS（全范围仿真机）是他们执照培训项目中不可或缺的部分。参考电站的设计验证、操作数据分析等一贯相对复杂且耗时，所以仿真机往往在核电站设计程序中后期单独交付。仿真机的功能在于能够全面体现核电站各个操作环节的操作步骤和控制系统，人们逐渐认识到了其非传统意义的价值，如主动学习、程序开发和验证、设计验证及人因工程等。然而，将仿真程序系统的融入核电站的设计和培训环节这一进程还非常缓慢。本文将着重讲述仿真机在核电站运行周期各阶段的不同应用，并附上他们应用于L-3 MAPPS 项目的几个实例加以辅证。

## 简介

以往的核电厂全范围仿真机（FSS）专门用于电站操作员培训。FSS 系统的初步开发和交付大多发生在核电站建设后期或商业运行之后。FSS 系统的开发及最终全部交付需要 2—3 年的时间，因此后期升级版的仿真机系统分批交付的可能性较小，且很难对仿真机培训之外的功能进行拓展应用。

如今新建核电站大量云集，数控系统广泛应用，强劲的模型开发及培训结果交付设备及工具、价格低廉的计算功能等引发一场典范转移，人们开始关注仿真系统建立的方式及应用时间。供应商负责“仿真工程”FSS 系统的研发和认证，而“工程仿真”主要是在模型开发阶段达到杠杆投资的目的。二者的结合不仅具备探测潜在设计缺陷的功能，还将会减少风险和成本，并最优化核电站设计。

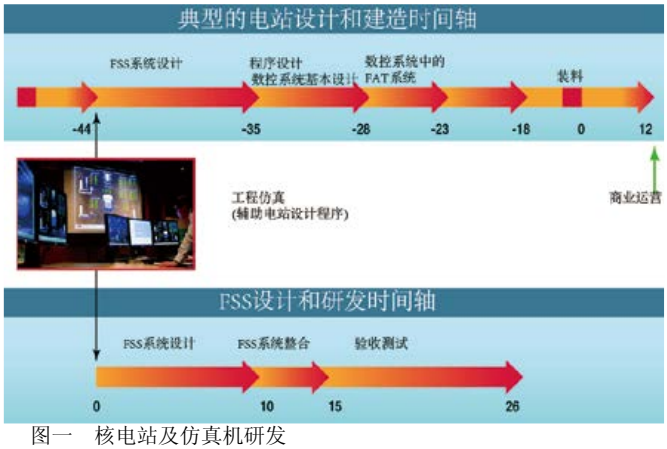
## 新建核电项目

新建核电项目的 FSS 系统需要在装料的 12 到 24 月前进行培训，对于 FSS 系统而言，这既是挑战也是机遇。

图一是核电站及 FSS 系统研发周期的计划安排。因此 FSS 系统的研发与该系统需要模拟的参考电站的设计及运行数据紧密关联。核电站的模拟程序最早可在装料的 44 个月之前进行。而 FSS 面临的主要挑战在于仿真系统的开发、整合及验证环节与数控系统的基本设计和细节设计将同时进行，并且均发生在核电站运营之前。在核电站商业运行后，仿真系统和数控系统首次交付后的 12 到 24 个月后，周期性的系统更新将得以启动。

两个系统并行开发也有不足之处，因为此时核电站的细节设计尚未完善，在 FSS 系统进行整合时，受核电站计划安排和数控系统供应商对质量控制环节的把控等因素，只有部分数控系统得以检验确认，且在仿真测试环节发现的电站设计问题将需要较长的时间来解决。冻结数据这种方案是行不通的，数据变动是 FSS 项目的必要环节，并且这种变动需要由仿真机研发者掌控。因此，仿真机实际上起到了验证核电站设计和虚拟运行的作用。

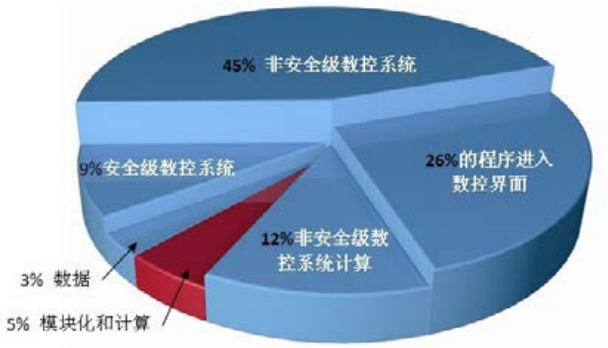
而应用 FSS 系统的优势在于，原本只有在电站运行后才能发现并解决的问题，通过模拟运行就可以提前探测潜在问题并予以更正。




图一　核电站及仿真机研发

L-3MAPPS 仿真系统在众多新建核电站中均有应用，如芬兰的 OL3 核电站，中国岭澳二期和红沿河一期等电站项目。通过实际应用表明大多核电站缺陷和不足在仿真测试环节就能够发现。出现的典型的问题包括 DCS 系统在基本和设计环节发生的程序错误问题，不同 DCS 产品或控制系统和电站部件之间出现信号界面相互矛盾，在仿真测试环节发现参数不够精确的问题。

图二展示了 L-3 MAPPS 的 FSS 系统在新建核电站项目的仿真测试环节探测到的仿真问题及解决进程。如图所示，大部分差异是与核电站而非模拟本身相关，这些问题原本只能在电站运行后才能被发现。




图二：FSS 系统测试阶段差异分布图

然而，在核电站或 DCS 供应商发现问题、解决并验证这些问题就需要对设计做出变动，这势必会对 FSS 的计划安排和培训系统造成影响。若要减轻影响，则需要将模拟运行放在核电站整个的研发环节中。如果不这样做，那么 FSS 系统的研发安排和培训功效将会减弱，核电站的运行计划也会受到潜在影响。

## 工程仿真

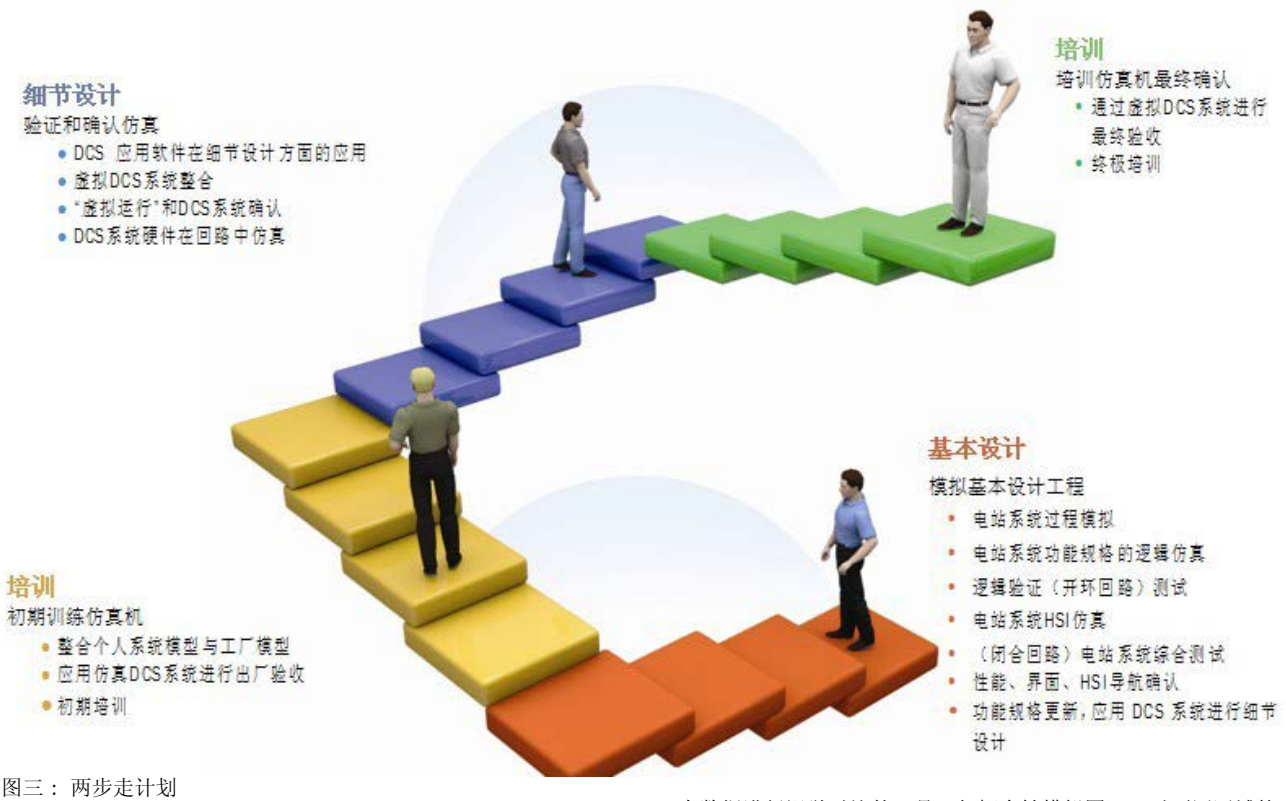
虚拟运行是工程仿真的应用之一，其中一个重要的准则就是核电站系统所需的高仿真模型将会用于 FSS 系统的研发。20 世纪 90 年代的核电

站分析仪着眼于核反应堆及其系统的模型和瞬时分析，而工程仿真的核电站模型要求具备各个数控系统在不同运行阶段的所有的相关动态信息。实际上工程仿真系统与 FSS 系统的区别在于 FSS 的硬件足迹的减少及无需全部再现控制室环境。

工程仿真的另外一个重要准则是与数控系统相关。工程仿真系统具有验证功能，而仿真系统中的数控系统原则上应该和实际核电站的数控应用软件相同。这就需要数控系统供应商提供具备二进制或同等设备仿真系统，又叫做虚拟仿真（更多 DCS 仿真技术请登录 www.mapps.l-3com.com/simulator-distributed-control-systems.html）。

完整的电站模型能够达到的验证程度在典型的 DCS 测试设备上无法实现。而且这种电站模型还可以应用工程仿真进行程序研发和验证。L-3 MAPPS 交付的 OL3 工程仿真具备验证和确认测试功能，程序研发和验证功能。

虽然上文提到的工程仿真在验证确认方面具备明显优势，但还是有两大不足。首先，工程仿真只在电站建设后期才能应用，部分原因在于它是在 FSS 系统研发中生成的，只有在 DCS 系统的细节设计完成后和 DCS 系统应用软件的细节设计完成后才能进行验证和确认测试。第二个原因在于在 DCS 应用软件的准备阶段前期无法通过仿真技术减少在系统设计或解除设计层面存在的差异。




图三： 两步走计划

针对以上不足的解决方案是在系统层面和电站系统设计上实施以仿真为基础的递增负荷测验（如图三）。这种将工程仿真整合到电站设计程序的上行一体化方案可以发挥仿真系统的最大潜能。

这种技术是在近期才被核工业完全接纳。一方面原因是过去仿真机仅仅被看作是依赖于计算机进行的培训工具，如今这种看法已被颠覆。另一个原因是仿真机所需要的数据不足以支撑单个仿真机的早期研发。实际上对某个系统进行仿真所需要的数据与该系统的基本数控（I & C）设计所需的数据是一致的，而这种信息在系统初期设计手册中都有体现。在供应商为细节设计提供数据后，才需要收集相关的部件数据。

仿真软件需要配备最先进的配置控制机制以保证对仿真机的持续改进，包括系统、电站模型、验证和确认仿真、全范围仿真，及从基本设计到设备规格和 DCS 应用软件的数据驱动更新等的改进。L-3 MAPPS 的 Orchid® 仿真工具，特别是 Orchid® 建模环境（简称 Orchid® ME）是专为确保配置控制而研发的。Orchid® ME 是一款在持续变动的环境中对大型研发工作组进行支持的客户机－服务器应用程序。与其它建模工具不同的是 Orchid® ME 还拥有以下功能，如独立工作区、工作共享区、签入／签出机制、对概念性模拟图的版本管理、元件库、源数据参考和确认、对所有数据进行视觉对比的工具（如概念性模拟图）、对不同区域的工作组的支持工作、自动测验、数据收集和回归分析等。

## SOFIA 模拟机

SOFIA（突发事故运行模拟机）也属于 ES（工程仿真），不过应用目的不同。SOFIA 是由 L-3 MAPPS，阿海珐和法国辐射防护和核安全研究院（IRSN）共同研发设计的，可以对 4 种法国核电站进行独立模拟，如三代加 EPR™。图四为法国辐射防护和核安全研究院的 SOFIA 工程仿真机。

图四：法国辐射防护和核安全研究院的 SOFIA 仿真

该模拟机在 Orchid® 模拟环境下运行，大部分建模模型已在 Orchid® 建模环境下研发出来。每个模拟都包含一个能够支持模拟运行的电站建模，建模范围等同于全范围仿真机（FSS）。所有仿真机应用 CATHARE 2 编码建立 NSSS（核反应堆及其系统）模型。CATHARE 2 是一套系统编码，不仅可以用于压水堆安全分析、事故管理、定义电站运行程序及研发，而且可以用作保守边际分析量化处理和用于申请执照。EPR 版本的仿真机还可以通过 Orchid® 堆芯建模模拟堆芯中子学。与 FSS 不同的是，SOFIA 并不会复制出一个专门的控制室环境，而是通过应用类似 DCS 系统的人机界面让使用者模拟电站实际操作者能够进行的所有操作程序。

SOFIA 有培训仿真和工程仿真两大功能。培训仿真机用于对设计工程师、调试工程师、核电安全机构检查员、IRSN 安全专家提供核电站初级系统培训，及在电站发生事故时的操作战略培训。工程仿真机需要建立一个完整的核电站模型对复杂的事故次序进行分析，进行程序设计和确认，支持核电站改造计划的安全性分析，设计应急程序和安全演习等。

图五：CAER 可重构主控制室仿真机

OL3 工程仿真与 SOFIA 的不同之处在于对 DCS 系统进行的是仿真而不是仿效。这种不同反映出了这两种仿真机的不同功能目标。OL3 工程仿真机的目的是对实际的 DCS 应用软件进行验证和确认。而 SOFIA 的目标是对基本设计方面的系统设计改进进行验证和确认，如控制策略、操作程序分析和改进、初步安全性分析、核电站工程和应急措施培训等，因此这就需要应用 Orchid® 研发工具快速研发并测试可以替换的管理战略，并对多重软件配置进行支持。

## 人因工程

上行仿真系统发挥重要作用的另一个原因在于它的 HFE 系统（人因工程）。CAER（高级工程研发中心）建立了一套研究设备，如 RMCRS（可重构主控制室仿真机），用于支持三代或三代加控制室的设计工作、新电站的人因工程学研究和数字仪控研究。

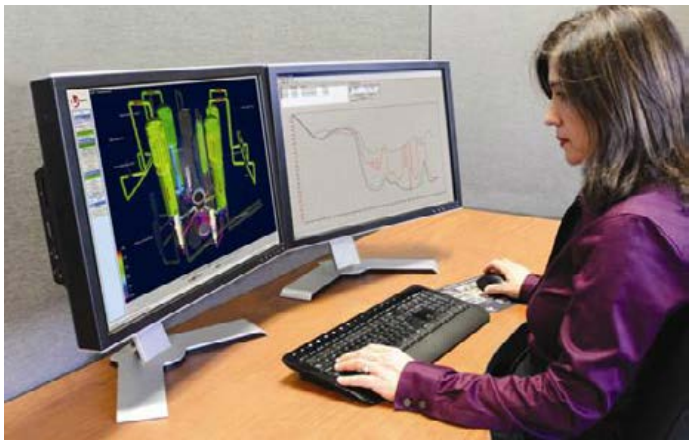
因此以某种核电站作为参考的模拟机就不如以整个核电站的操作程序为基础的仿真机更能发挥重要作用，该仿真系统还可以对操作员在实际操作中遇到的重要瞬态进行模拟。L-3 MAPPS 的 EPR 核电站模型为用户提供操作员实际可以进行的人机界面和软件，用户可以对新的显示器进行更改和测试。图五为可重构主控制室仿真机。改仿真机有一套精良的眼球追踪技术和用于收集并分析人因数据的日志软件。

CAER 的计划还包括研究因实际的 AREVA TELEPERM XS 数字安全系统连接到电站模型上引发的仪控系统故障对操作员操作行为的影响。

爱达荷国家实验室的 HSSL 实验室（人因仿真实验室）也采用仿真机来进行数字控制室的更新研发设计和测试工作，包括已有核电站的数字控制室更新。爱达荷国家实验室现正在对圣奥诺弗雷核电站的主控制室更新项目做研发，该核电站的两个反应堆由南加州爱迪生公司负责运行。该反应堆现有的仿真软件采用的是 L-3 MAPPS 的平台和模型，现在安装了 L-3 MAPPS Orchid® 触摸界面，该界面应用触摸屏技术为用户视觉再现了控制室仪表板。这套软件可以帮助爱达荷国家实验室研发不同的仪表控制盘原型。这些原型将会同由核电站运行商进行测试，基本的操作原理也会在核能行业中得以传播。公用事业单位将会与他们的核电站供应商合作将通过研发得出的原理进行设计。

## 新培训应用软件

持证操作员培训体系包括课堂基本培训和全范围仿真机为基础的，以程序为主的操作性培训。然而，现在核能行业面临的新的挑战是培训新一代的核电劳动力。仿真系统还可以应用上行操作培训来加强用户对核电站实际操作和交互行为的理解。L-3 MAPPS 将 2D 和 3D 可视技术与仿真系统整合，打造一套时事、仿真的动画物理系统，力求为培训者提供浸入式的学习环境。这种可视化可以与提供基础培训的核电站综合模拟相结合，也可以与全范围仿真相结合。如图六。



图六：3D 瞬态基本原理培训系统

## 结论

过去全范围仿真机仅限于进行操作培训。如今，改仿真机的电站模型数据的精准度和深度还起到了优化项目杠杆投资的作用。仿真系统在核电站研发早期进行验证和确认，减少了整个电站建造的成本并降低了风险。仿真软件需要配备最先进的配置控制机制以保证对仿真程序高效运行。仿真系统还为新一代核能劳动力提供浸入式的学习环境，帮助初学者掌握基本原理。

Orchid 是 L-3 Communications MAPPS 有限公司的品牌。EPR 是阿海珐公司的品牌。其它产品为其它公司的品牌。

**L-3 MAPPS**
地址：8565 Côte-de-Liesse
Montréal, Québec
Canada, H4T 1G5
电话：+1-514-787-4999
传真：+1-514-788-1442
邮箱：power.mapps@L-3com.com
网址：www.L-3com.com/MAPPS

# 加拿大 CFM 有限公司

Cameco Fuel Manufacturing (CFM) 是一家领先的压水堆机组 CANDU 加压重水堆机组燃料组件及反应堆元件供应商，在 CANDU 及相关核技术领域拥有逾 50 年专业经验。除核工业领域所用的其他特种金属外，CFM 还专业从事锆及锆合金的冷加工、制造、焊接、钎焊及切削加工服务。

Cameco 拥有在加拿大和海外自主建设核燃料生产厂的经验，并已将技术成功转让给多家核燃料生产厂，这些工厂主要来自于购买了加拿大 Candu 反应堆的国家。

目前，Cameco Fuel Manufacturing 正通过现行协议向欧洲和亚洲的诸多企业提供顾问服务。我们的工程技术团队可通过合约方式协助开展核燃料产品和生产工艺的开发工作以及反应堆元件的开发工作。

经过数十年的积累，Cameco Fuel Manufacturing 已具备了生产各种堆芯反应堆元件的独有能力。所有这些装置都符合超高的质量标准和综合技术规范。经过数十年的使用，其性能已在堆芯中得以验证。许多此类元件是专门为世界各地的 Candu 反应堆设计和生产的。另外一些元件是根据客户的技术需求为他们量身定制的。如 CFM 已经交付了总计 500,000 米的压水堆用燃料包壳。

我们的一些设备如停堆控制棒是安全级的；还有一些排管是燃料管道的关键构件。大部分堆内构件严格按照 ASME 标准和其他精确的技术规范制造。CFM 专业的工程和技术团队为客户的项目解决方案提供宝贵的技术和建议。丰富的经验，出色的制造能力，严格遵循核电行业高标准使 CFM 成为全球核电行业的合格供应商。

CFM 的堆内构件覆盖 30 多种部件标准，在过去的 30 年完成了向 1000 多个全球项目（包括中国和阿根廷在内）的核电部件供应。

CFM 有 23 年的反应堆部件制造经验，为全球客户提供包括中子通量探测器部件在内的反应堆部件。CFM 作为核电部件供应商享誉全球，并且致力于为全球客户打造量身定做的锆合金管材。而与全球客户的紧密联系使得 CFM 能够对库存材料进行精准的全面控制。

CFM 在核电设备可控气氛焊接方面遵循了一套高性能质保系统，这使得 CFM 成为反应堆探测器组件和反应控制组件方面的优选供应商。我们有多种焊接技术，如电阻焊接、激光焊接和精密钨电极惰性气体保护焊接等。大多中子通量探测器组件的接头采用的是精密钨电极惰性气体保护全透焊接技术，这种焊接技术可以将锆合金的管对接焊的直径缩小到 3.9mm，管壁缩小到 0.2mm。

CFM 遵循以下质保体系：

ISO 9001:2008

ISO 14001:2004

授权证书 – 技术标准及安全局TSSA –《抗压组件材料供应及升级》。

授权证书 – 技术标准及安全局 TSSA – 《1 级，1C 级， 2 级， 2C 级， 3 级， 3C 级 H 型焊接配件和非焊接配件制造》；《焊接支撑和非焊接支撑部件及附件制造（不包括设计）》– CSA Z299.1-85

CFM 生产的停堆控制棒和调节棒应用于多种核电项目的控制系统和核安全级系统，这些产品制造程序非常复杂，制造周期为 18 个月左右。

当反应堆操作参数超过事故保护停堆的设定值时，Candu 反应堆堆芯的控制棒可以终止裂变过程。这种控制棒由不锈钢和镉管构成，其中镉用于吸收反应堆运行过程中产生的中子。

停堆控制棒通常置于反应堆上方，由类似于齿轮的绞盘悬挂于反应堆上方。控制棒通过重力作用插入反应堆终止运行。

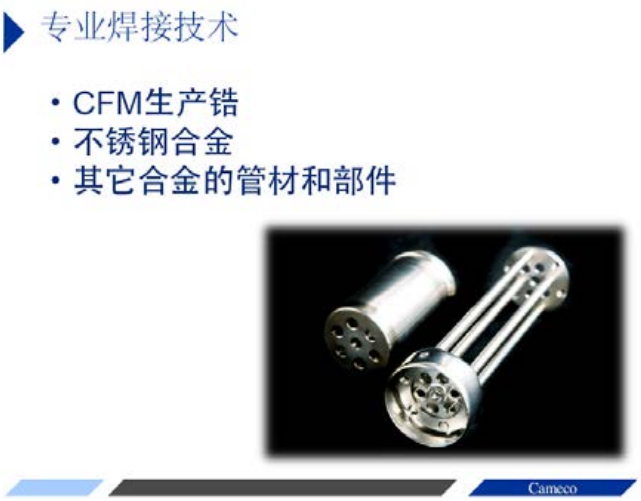
调节控制棒用于控制堆芯的中子流量。有趣的是调节控制棒常常装有钴 59，而在堆芯运行一段时间后会转变成医用或工业用钴 60。不含有钴元素的调节控制棒由大小不一的精密不锈钢管组成。在反应堆满负荷运行时，调节控制棒被插入反应堆中。与停堆控制棒一样，调节控制棒也由齿轮控制。

中子通量探测器通过检测反应堆不同位置的中子通量来计算反应堆的功率。

堆芯的中子通量探测器通过产生少量的电流可以自我供电运行，这些电流被放大后可以由核电站的控制计算机读取。

中子通量探测仪贯穿反应堆堆芯，可以精确的读取堆芯的中子流量。自 1980 年以来，CFM 已经生产了 1000 多组流量探测器组件。

下图为钴调节控制棒部件。反应堆堆芯通常有 400 到 500 个含钴 59 芯块的组件。

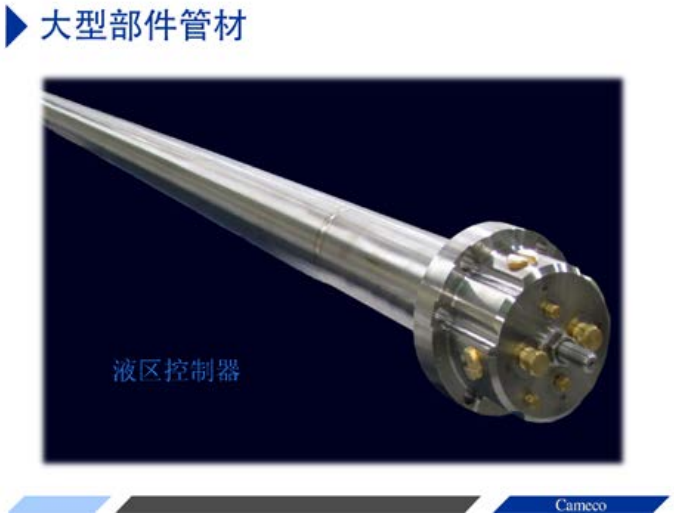




下图为中子通量探测器组件磁头。该设备长约 15 米，竖直贯穿于反应堆中。每个堆芯的不同位置都安装了探测器。

下图为堆芯内控制棒、停堆控制棒和调节控制棒的驱动装置或“齿轮”。CFM 同时还制造电机驱动装置。


下图为液区控制器，用来控制反应堆核芯的中子通量。该部件是一种密封型压力容器，位于反应堆核芯中。CFM 生产焊管和缝焊型管材，外径从 8mm 到 175mm 不等。根据管材的外径不同，管壁厚度控制在 5 微米左右。



# 新闻 NEWS

# 重点新闻

## 核电小堆项目日渐受宠

日前，江西省赣州市宁都县与中核新能源有限公司（简称“中核新能源”）就“小型多用途模块式反应堆（ACP100）”项目正式签约，项目建造周期36个月，总投资160亿元，标志着该项目建设进入实质性阶段。这是继上饶市横峰县之后，江西省与中核新能源签约的又一个小堆项目。

**地方盼小堆**

除了江西，福建、湖南、吉林等地也早已成为小堆项目的目标选择地。

在地方政府看来，小堆能够起到优化能源结构、改善电源布局、破解电力制约的作用，安全性高、建设周期短、一次投入低、适用性广、多用途等特点，也是其选择小堆的主要考虑因素。而尽早落地、早开工、早投产、早见效也成为地方的普遍期待。

目前，公开信息中所提及的与核电企业签约或者有意向建设小堆的省份中，除了福建（漳州、莆田），其他均为内陆省份。尤其是江西和湖南，更是我国首批内陆百万千瓦级核电项目所在省份。

“小堆的堆芯容量较小，对水文、地质、人口密度等要求没有大型核电站苛刻，所以选择沿海或内陆并不是主要的问题。”一位业内专家告诉记者，“资源能源禀赋的现实情况，使得一些内陆地区更有建设核电项目的需求，尤其是不同于大型商运核电站的小型堆。小堆虽然不适合远距离传输，但对稳定性要求不高的小电网电力稳定供应很有好处。”

**核电企业“爱”小堆**

在国内，包括中核集团、中国核建、中广核集团在内的核电企业近年正加快小堆的研发和推广，并适时地开始了厂址选择，与地方政府积极接触。目前，中核集团推出的ACP100走得较快，已与福建、江西、湖南有了明确的相关协议。中国核建主导推出的壳式一体化核供热堆也已确定在吉林白山建设。

虽起步时间不同，但发电、供热、海水淡化等其他工业化应用的一系列自主研发和市场推广已成为核电企业的共识。企业战略考虑的出发点正是看到了其广阔的市场前景。按照业内人士的说法，即尽早抢占市场。

据了解，今年4月19日召开的“福建莆田小堆ACP100示范工程第二次设计协调会”信息透露，莆田小堆项目计划在2014年6月开始浇注核岛第一罐混凝土，中国核电工程有限公司将组织各方在2013年12月前完成初步设计。此外，中核集团在去年第七届中博会上，与湖南省政府签署了战略合作协议，拟在湖南选择6个厂址，装机容量共约600万千瓦，争取“十二五”期间在湖南建成第一个内陆核电小堆项目，“十四五”末达到预期目标。“地方有需求，企业有动力，大家都在抢抓机遇，所以尽早进入工程应用，是在技术和时机上占得先机的关键。”上述业内专家称。

来源：http://paper.people.com.cn

## 中国制定核电标杆价格

中国宣布将对新建核电厂实施国家电价基准，替换单个电站复杂的定价规则，中国日报的一篇报道称，1月1日以后国家发改革委将反应堆基准价格设定约为每千瓦小时7美分。该报道中的一位专家称与以前的基于核电厂成本和当地火电价格的定价方案相比，该基准会给核电厂带来更多的利润。在中国，部分地区的化石燃料发电价格要比新的核电基准价格便宜，而这些地区要求反应堆以化石燃料的标准来出售。国家制定经济政策的主要机构，也表示允许示范电站的基准价格的变化。

在新核电厂建设的发展方面，中国还远没有达到世界领导者的地位，根据世界核能协会的数据，目前中国有28个反应堆正在建设中，17个反应堆正在运行，并计划于2020年使核能发电量翻两番至58万千瓦。

来源：http://nuclearstreet.com

## 核电汽轮机阀门执行机构将国产化

日前，在上海电气集团汽轮机厂与中广核工程公司召开的“核电汽轮机阀门执行机构国产化”专题会上，上汽厂百万核电汽轮机高压阀门执行机构国产化方案获得专家和用户认可，经考核，其技术性能同进口产品完全一致。

阀门执行机构是核电汽轮机的关键部件，目前主要依赖进口。国产化实

施后，将打破国外公司产品垄断，极大地降低上汽厂核电产品成本，提升工厂产品的市场竞争力及对用户的服务能力，同时也将大幅降低电厂的运营和维护成本。

来源：http://news.bjx.com.cn

## 设备商直接受益迎机遇

我国核电建设迎来快速发展期，市场人士指出，核电装配制造行业相关个股有望直接获益，并因此迎来相应投资机会。

据业内人士分析，未来 10 年我国核电装机容量的复合增长率将达到 20% 左右，如果没有重大变故，核电项目的核准与开工将迎来高峰。按照一般建设核电站的规律，核电站投资中的 50% 将用于购进设备。目前来看，国内核电投资额最大的是核电主设备市场，竞争并不激烈。但浙商证券分析师张朋认为，核电板块的机会仍在于细分子行业。由于核电建设有产业链长的特点，初步估算，仅一个核电站项目就需要 300 多种系统，涉及众多行业。

也有分析人士指出，目前核电投资应该关注技术创新。由于要严格保证核电建设安全，我国现在新建或新批准的核电站都将以第三代核电技术为主。目前一些关键性设备如蒸汽安全阀、上冲泵等，还没有实现国产化，如果有企业在这些领域取得突破，能完全替代进口产品，那么经济效益将非常突出，相关个股的投资机会也将有所体现。

来源：http://www.heneng.net.cn

## 国内核电建设将再次提速

近日，记者采访了国内核电领域专家——某核电设计院总工程师。他认为，未来几年将是国内核电建设的快速发展期，预计将有上万亿投资，其中一半用于核电设备，而核电设备的利润非常高，预计将有一批企业从中受益。

市场人士老王：未来10年，核电装机容量的复合增长率将达到20%左右。核电项目的核准与开工在未来 10 年里将出现一个高峰，每年新批新建的核电站 6-7 座。按照一般规律，核电站投资中的 50%将用于设备，平均每年用于设备投资总额接近 500 亿元。新建或新批准的核电站都将以第三代核电技术为主。目前第三代核电技术的国有化程度只有 50%，预计未来国有化程度将达到 70%，甚至更高水平。

来源：http://www.snerdi.com.cn

## 核电进入新的快速发展周期 国产化备受关注

日本福岛核事故让全球核电陷入了一轮低谷，然而随着时间的推移以及在能源消费、环保情节的需求推动下，中国的核电再次成为了国内能源发展的战略性选择。据了解，未来五至七年内，中国将有几千亿的资金落实到核电行业。

核电新项目审批有望下半年启动，并且中长期（2020 年）发展目标有望从规划中的 5800 万千瓦上调至 7000 万千瓦以上，未来中国将继续积极稳妥地发展核电。由于核电在安全性方面的高要求，核工业体系中各环节都采用严格的资质管理，一般只有少数大型国企持有牌照，核电行业总体垄断性强。设备制造是市场化相对较强的细分领域，但由于技术门槛高，在核安全等级为一级的主设备领域，市场主要由国内三大发电设备巨头（上海电气、东方电气、哈动力）和中国一重分得。

相关企业对未来核电业务市场持乐观态度，上海电气表示核电核岛设备市场占有率力争于“十二五”末达 50%，核电常规岛设备提高盈利能力，掌握自主知识产权，力争国内 40% 的市场份额。

来源：http://www.heneng.net.cn

## ACP1000 实验验证工作再获重要进展

7 月 11 日，中核集团自主研发、具有自主知识产权的三代核电技术 ACP1000 非能动余热排出系统（简称 PRS）相关实验研究通过检查，正式启动。中核集团总经理助理李晓明出席启动仪式。

本次启动仪式由中核集团核动力事业部在中国核动力院基地组织召开，来自环保部核与辐射安全中心、中核集团、中国核电工程有限公司、福建福清核电有限公司、中国核动力研究设计院等单位的专家及代表参加仪式，并听取了实验准备情况汇报，现场查看了实验装置，经过讨论后一致认为实验可以正式启动。

该实验正式启动表明，中核集团 ACP1000 的实验验证工作又将向前迈出重要一步，ACP1000 的安全性能将得到进一步验证。据悉，本次实验研究为二次侧非能动余热排出系统实验项目，研究目的是为验证 ACP1000 反应堆全厂断电、同时辅助给水气动泵失效事故工况下，PRS 系统的运行能力和特性，验证原型事故冷却水箱和原型应急余热排出冷却器的设计能力，并为设计改进提供实验数据基础。任务承担方核动力院耗时两年，设计、建造并调试完

成了高达60米的模拟实验装置。为了尽量真实模拟原型的各种热工物理现象，该实验装置采用了实时模拟设计，与原型等高、等压。通过近一个月的紧张调试工作，于7月初获得了一批正确的系统稳态工况下的调试实验数据，数据初步表明PRS系统的余热排出能力尤其是应急余热排出冷却器的换热能力较强。

来源：http://www.heneng.net.cn

## 我国铀矿勘探深度达到2818米 满足核电发展

中国核工业集团公司17日在江西抚州宣布，中国铀矿第一科学深钻以2818.88米的钻探刷新此前1200多米的纪录。这一突破填补了我国铀矿深部找矿技术的空白，对提高国内天然铀保障程度、满足核电发展需要意义深远。

这一深部找矿技术的突破是在被称为中国“铀都”的江西抚州相山铀矿大基地取得的。自2012年7月21日开钻以来，中核集团、核工业北京地质研究院等共用时283天，在大小仅为普通光盘的2倍的深钻“点”实现2818.88米钻探深度。其岩心采取率达到99%以上，最大限度地获取了地球深部成矿的条件和环境信息，这也对我国目前最大的铀矿田做了一次“地质CT扫描”。

除了找矿深度刷新纪录外，此次深部找矿在装备上，采用自主研发的钻探设备，其智能化、数字化水平填补了国内空白；在钻探工艺方面，也取得首次发现铀铅锌铜多金属矿、首次创建岩心矿化蚀变高光谱识别技术等成果。

大陆科学深钻被称为“深入地球内部望远镜”。长期以来，我国铀矿勘查的深度多在500米以浅，与法国、德国、加拿大等国外深部找矿技术差距较大。此次深部找矿技术的突破极大地拓展我国铀资源的找矿空间，也为我国进一步深挖地下3000米的资源宝藏打下基础。

来源：http://www.china-nea.cn

## 首台国产AP1000新燃料升降机第一批部件完工发运

2013年7月13日，新燃料升降机导轨、导轨托架等第一批发运部件发往海阳现场。

首台国产AP1000核电站新燃料升降机是燃料操作系统中的重要设备之一，由导轨、燃料舱、载荷称重系统，卷扬机及电控部件。主要用途是在装换

料期间，把新燃料组件从核辅助厂房大厅地面标高下降到燃料贮存水池底部，以便燃料操作机用长柄操作工具进行操作。

由于新燃料升降机为首台国产化设备，在设备的制造过程中没有现成的经验可以借鉴。在工期紧，任务重的情况下，JPMO监造人员主动放弃周末休息的时间，积极组织协调密切配合制造实现了新燃料升降机的首批部件的发运，，为HY1号机组其它后续设备的安装争取了宝贵时间。

来源：http://www.heneng.net.cn

## 近日我国核电发展或将超过规划预期

近日，中国核能行业协会副秘书长徐玉明在第九届中国核能国际大会上表示，从当前的发展势头来看，核电发展有可能超过规划预期，达到更高水平。

徐玉明所指的规划正是国务院去年10月讨论通过的《核电中长期发展规划（2011~2020年）》。该规划提出，至2020年，运行核电的载机5800万千瓦，在建3000万千瓦。分别

分析人士认为，如果按照2020年我国在运在建核电总装机容量8800万千瓦来计算，我国核电总投资规模将高达万亿元。如果按核岛、常规岛、辅助设备国产化率分别为70%、80%、90%计算，那么未来十年国内核电设备企业将分享超过3000亿元的市场。

齐鲁证券人士认为，今后国内技术领先的核电主要设备生产厂商将成为最大的受惠者。目前具备核岛成套设备制造能力的主要是中国一重、二重重装、上海电气重型厂等；而常规岛设备制造则主要集中在上海电气、东方电气和哈动力。

随着我国核电建设高峰期的到来，原有生产体系已经满足不了需求，技术研发也需要市场化竞争机制来推动，为了激发市场活力，近日国家核安全局批准四川华都、中科英华、青岛兰石、无锡华尔泰和江苏海狮五家民营企业获得核电设备设计制造资质。

可以看出，核电设备制造民营化趋势已显现，民营上市公司中的优质企业在不久的将来也将成为这个行业的新贵。

来源：http://www.heneng.net.cn

我们的专业:

# 技术咨询

五年核能领域的经验使代邦能源形成一支负责核电设备认证咨询服务的专业技术团队，包括中国的HAF 604（关于进口民用核安全相关设备的条例）和 HAF 601（民用核安全设备的设计，制造，安装，无损检测监督管理）认证。为了满足中国核电工业的所有规定要求，符合这些认证是必要的。

我们的服务:

- 制定规划--为技术认证提供一套完整的战略，翻译每份文件，并根据核安全当局的要求调整认证申请。
- 分析与说明-- 在复审的过程中与负责审查的调控人员与技术支持单位保持定期的交流。
- 现场审查--我们的工程师会现场协助您的质量控制经理回答审查人员的询问，尤其是HAF 601认证。
- 行政支持--对于特殊的进口许可证，我们会利用与买家及当局的良好关系，确保合法交易的顺利进行。

想要获得更多信息请联系我们: info@dynabondpowertech.com
http://www.dynabondpowertech.com/en/service/certificate-for-civil-nuclear-equipment

# 企业新闻

## 上上电缆集团成功研制三代核电 AP1000 壳内电缆

近日，江苏上上电缆集团三代核电 AP1000 壳内电缆成果发布会隆重召开。国家核电、国家能源局、环境保护部、中国机械工业联合会、上海电缆研究所、国家电线电缆质量监督检验中心等单位领导、专家参加了成果发布会。

三代核电 AP1000 核电站系统设计要求高，对壳内电缆性能提出了苛刻的要求：低烟无卤阻燃、60 年寿命（适应三代核电 60 年寿期要求）、耐高剂量辐射（其中耐贝塔射线剂量高达 270Mrad）、事故下耐高温环境（要求在 260℃高温冲击下能够执行安全功能）等。国际上尚无满足要求的同类电缆。

为解决这一技术问题，江苏上上电缆集团攻克了种种技术难关，历时两年完成了电缆样件的制造，顺利通过了热老化、辐照老化、LOCA 老化等鉴定试验，拥有了关键的产品核心技术，并获得了国家核安全局的壳内电缆特许制造批文。三代核电 AP1000 壳内电缆的研制，填补了世界核电工业的空白，为我国进军国际核电市场打下了基础。


来源：http://www.cmen.cc 丁山华董事长在世界首堆 AP1000 壳内电缆交付仪式上发言 来源：国家能源网

## 中国能建成功制造国内最大口径核电二次滤网

5 月 24 日，国内最大口径核电二次滤网由中国能源建设集团有限公司江苏装备公司成功制造，并顺利通过中广核监理验收，即将发往阳江核电站 3 号机组工程施工现场。

该批二次滤网产品口径达 2.8 米，是目前国内核电站同类产品中口径最大的产品。中国能建江苏装备公司按照核级产品的质量要求，在采购、生产工艺、质量、包装等环节严格把关，为同类大口径二次滤网的生产积累了宝贵经验。中广核监理及相关专家对江苏装备公司制造的该批产品给予高度评价，认为中国能建江苏装备公司在我国核电产品完全国产化进程中又迈出了坚实的一步。

据悉，二次滤网产品是凝汽器循环水系统中的主要设备之一，用于过滤冷却水，除去水流中可能堵塞管板和冷却管的杂物，保证凝汽器等换热设备及其胶球清洗装置的正常运行。

来源：http://np.chinapower.com.cn

## 中广核所属中科华两项科研成果助力红沿河核电商运

中国广核集团下属企业中科华核电技术研究院研发的我国核电领域第一个自主开发、成套的反应堆堆芯测量系统特殊工具项目和核岛重要厂用水就地控制系统成功助力红沿河核电 1 号机组投入商业运行，对推进我国核电关键技术环节的自主创新具有重要意义。

核电站 RIC 系统全称“堆芯测量系统”，能够提供堆芯出口冷却剂温度和堆芯中子注量率信息，是核电厂培训过程中的重要工具，在核电站运行前和运行期间起到至关重要的作用，是核电站工程建设主路径上的关键设备。该系统融合了核电子学、电气、仪控、自动化、计算机数字计算等诸多领域的高新技术，对核电站安全运行和事故监测的分析评价具有重要作用。该项成果首次实现了国产化，打破了外国公司长期对堆芯测量系统市场的垄断。

红沿河核电站地处辽宁地区，极端最低温度可达-28.7℃，属于严寒地区，这种严寒地区核电站的设计在国内尚属首次。针对红沿河特有的地域条件和气候特点及设备改型进行了方案优化与适应性调整，核岛重要厂用水就地控制系统的投用，解决了由于冬季海水温度低导致设备冷却水出口温度过低问题，具有深远的工程意义。

核岛重要厂用水就地控制系统将复杂可编程逻辑器件技术成功应用于核电站安全系统，产品的整体性能达到了国际同类水平。对核电安全级系统走出国门具有示范效应和样板作用。

来源：:http://www.heneng.net.cn

## 山东核电完成 1 号机组系统设备分级工作

近日，中电投山东核电海阳核电项目 1 号机组工艺、电气和仪控等系统设备分级的初版清单编制完成，搭建起一套既与国际接轨又符合 AP1000 核电厂设备分级管理需求的所有系统的分级体系。

作为核电厂的一项基础性工作，山东核电高度重视设备分级工作，成立专项小组，多部门倾力协作，开展 1 号机组所有系统设备分级的审查和研究。该设备分级清单基于美国西屋公司的设备分级原则，将设备分为关键Ⅰ级、关键Ⅱ级、非关键级和 RTF（运行至失效），在国内 AP1000 核电机组中，率

先完成了设备分级。

来源：http://www.heneng.net.cn/

## 天威保变完成中国最大核电项目 7 台变压器制造

6 月 17 日，从保定天威保变电气股份有限公司了解到，近日，由该公司自主研发，在子公司天威保变（秦皇岛）变压器有限公司制造的我国最大的核能发电项目——山东海阳核电站 1、2 号机组 7 台配套用 442WVA/500KV 主变压器顺利完成制造任务，并全部一次通过试验。目前，首批 4 台主变压器在秦皇岛顺利起航发运。

据悉海阳核电是世界首批采用 AP1000 核电技术的核电项目，也是我国三代核电自主化依托项目，目前项目一期工程一二号机组正在加紧建设，2014 年一号机组实现发电。海阳核电一期工程采用的“非能动型压水堆核电技术”，几乎不产生二氧化碳、二氧化硫等废气，因而核电成为名副其实的优质、清洁的能源。

在产品制造过程中，天威保变成立了专项领导小组，周密制定生产计划，明确管理责任，加大检查和考核力度，全面控制与质量有关的各要素；强化过程控制，加强对重点工序的自检、互检、巡检、专检和联检力度；抓好现场清洁工作，进一步落实 6S 管理，广大干部员工精心组织，认真吸收消化图纸，齐心协力，攻坚克难，按时保质完成了产品的生产制造任务，保证了 7 台产品全部一次试验合格。

多年来，天威保变一直高度重视核电用产品，针对核电项目变压器要求极为严格的特点，该公司以确保长期安全可靠运行为前提，抓住漏磁控制和局部过热控制两个核心，进行了全面详尽的计算。并采用先进的变压器验证分析软件对计算结果进行电磁场、波过程对比验证分析，确定最适合的铁芯及绕组型式、绝缘结构、油箱及电磁屏蔽结构，从而达到最佳的电场、温度场、漏磁场分布。

来源：http://www.heneng.net.cn/

## 宝钢特材完成核电用 S32101 产品首批合同

近日，宝钢特材完成首批核电用双相不锈钢 S32101 合同准发销售，产品将用于浙江三门和山东海阳核电工程。该产品的开发成功，为宝钢特材板带产线拓展了新的核电用不锈钢市场。

S32101 是一种高强度、耐蚀性优良的资源节约型双相不锈钢，被指定用于制造第三代核电 AP1000 和 CAP1400 反应堆 CA20 安全模块。核电 S32101 生产技术难度大，质量要求高。

经宝钢中央研究院不锈钢技术中心与宝钢特材制造部、炼钢厂、热轧厂通力合作，通过冶炼和热轧工艺优化，宝钢特材顺利完成了这批厚度均为 10 毫米以下中板的生产。其中厚度 6.35 毫米为国内最薄规格的 S32101 双相不锈钢中板产品，成功替代了进口，满足了国家在核电领域的需求。至此，宝钢双相不锈钢完成了 S32101、S32304、S32205 和 S32750 产品系列化，薄规格和宽规格中厚板产品在国内同行中具备了领先优势。

来源：http://www.heneng.net.cn

## 东方电气成功发运福清核电站 3 号机组 1 号蒸发器

7 月 7 日，中国东方电气集团有限公司所属企业东方电气（广州）重型机器有限公司为中核集团福建福清核电有限公司生产制造的 3 号机组 1 号蒸发器成功发运。此次发运的福清项目三号机组 1 号蒸汽发生器是东方电气为福清核电项目交付的第 7 台基于二代加技术的蒸汽发生器。

截至目前，东方电气已为福清核电站先后提供了 1、2 号机组共 6 台蒸汽发生器。

来源：http://www.heneng.net.cn

## 东汽签约广核陆丰 AP1000 项目核岛 CRDM 合同

7 月 2 日，广核陆丰 AP1000 项目 1、2 号核岛关键设备—核控制棒驱动装置（简称 CRDM）供货合同在上海国核工程公司签订。来自项目业主、国核工程公司、上海 728 院、美国西屋公司及东汽的领导和专家参加了签字仪式。

该 CRDM 项目经过东汽近三年的跟踪、技术澄清和谈判，梳理并克服了商务和技术上的障碍，最终签约成功。该项目是公司 CRDM 事业部圆满完成“二代加”CPR1000 项目 CRDM 试制，并获得业主方、环保部核安全局监管机构认可后在商务和技术上取得的最重要的突破，标志着东汽 CRDM 制造已迈入“三代”核电时代，“三代”核电 AP1000 将是未来核电发展的主流。由于该项目的制造要求高、技术难度大，且在合同执行中涉及业主、图纸设计方、技术支持方、核安全监管方等众多的相关方，管理十分严格，因此该项目对东汽 CRDM 制造技术提升及核岛产业未来发展具有重要意义。

来源：http://www.dongfang.com

## 中核建中制造的宁德 2 号机组燃料组件通过验收

近日，由中核建中核燃料元件有限公司制造的宁德核电站 2 号机组首炉燃料组件和相关组件顺利通过了出厂验收。

由宁德核电有限公司组成的验收组对中核建中制造的燃料组件和相关组件进行了检查及验收。验收人员对中核建中编制及提交的文件进行了检查，并对产品的装箱进行了现场见证。通过检查，验收人员一致认为，中核建中提供的产品符合合同规定的技术条件和相关要求，同意通过出厂验收。

来源：http://www.cnnc.com.cn

# 国际合作

## 国核电力院等电企与法国电力达成新合作协议

6月4日，国家核电技术公司所属企业国核电力规划设计研究院（以下称“国核电力院”）、山东电力工程咨询院有限公司与法国电力集团（以下称“EDF”）在北京续签合作框架协议。根据协议，中法合作双方将在大容量高参数机组发电技术、核电常规岛、可再生能源、环保、节能及调试运行等领域进行更加广泛深入的合作。

自2004年首次签署合作框架协议以来，中法合作双方在大容量高参数火电、特高压电网和节能环保和再生能源等诸多领域开展了长期友好的合作，尤其在技术人才交流、项目拓展等方面取得积极成效。此次协议的续签，将进一步巩固和扩大双方已有合作，拓展新的合作领域，有助于中法两国电力发展合作实现更多的尝试与探索。

据悉，国核电力院作为国家核电技术公司重要成员单位，拥有我国最高等级设计资质——“工程设计综合资质甲级”，主体参与国家“大型先进压水堆及高温气冷堆重大专项”的研发和大容量火电、智能电网等前沿电力技术研究，在核电、火电、电网、新能源四大板块和规划、咨询、勘察、设计、EPC、科技研发、运行技术支持七大领域有着良好业绩，为韩国、土耳其、印度、赞比亚等国家电力工程项目提供过优质的技术服务，是美国沃利帕森斯、绍尔，比利时哈蒙等国际知名企业的战略合作伙伴。而EDF作为法国国家电力公司，是一家在核电、热能、水能和可再生能源方面具有世界级工业竞争力的大型企业，可以提供包括电力投资、工程设计及电力管理与配送在内的一体化解决方案。此次协议续签，将书写双方强强联手、优势互补、合作共赢的新篇章。

来源：http://www.heneng.net.cn

## 中国制造首件产品交付国际热核聚变实验堆现场

近日，由中科院等离子体所研制的国际热核聚变实验堆计划（ITER）极向场导体采购包PF5导体成功交付法国卡达哈什ITER总部。这是中方首件交付ITER现场的产品。

中方承担了国际热核聚变实验堆计划PF导体采购包64根导体，均由中科院等离子体所负责制造。ITER计划PF导体是外方内圆的异型导体，其制造工艺复杂。等离子体所超导磁体及电力节能应用技术研究室通过自身努力，完成了异型管焊接、铠甲及焊缝无损检测、导体成型及收绕型技术的研发。2012年1月12 日，PF5导体在ITER国际组织及中国国际核聚变能源计划执行中心的见证下顺利完成。

科研人员对其进行了各种接收测试。2013年3 月在所有交付文件通过的基础上，按照PF导体技术要求，等离子体研究所将PF5导体进行了包装。4月25日，导体从等离子体所运出，首先经过500公里的陆路从合肥到达上海港，后经海、陆运，于6月3日到达ITER总部，整个行程共38天。抵达后，ITER磁体部门负责人及欧洲核聚变能源机构代表检测了导体包装箱。

美、法等国在20世纪80年代中期发起耗资46亿欧元的国际热核聚变实验堆计划，旨在建立世界上第一个受控热核聚变实验反应堆，为人类输送巨大的清洁能量。这一过程与太阳产生能量的过程类似，因此受控热核聚变实验装置也被俗称为“人造太阳”。中国是参与这个计划的七方成员之一，承担了ITER装置近10%的采购包。

来源：http://www.ipp.cas.cn

## 中国核工业二三建设有限公司与南非AVENG集团签订南非核电建设合作谅解备忘录

6月17日，南非AVENG集团核电执行总监Rob Adam一行4人来我公司参观交流。公司党委书记兼副总经理张凯热情接待了来访客人，并对双方的合作表达了良好的祝愿。双方就进一步合作的新方式展开了深入研讨。国际事业部总经理冯满军，副总经理谢凌飞、何毅及有关部门负责人参加了会议。

研讨会上，双方达成合作共识。冯满军与Rob Adam签订关于南非核电建设的合作谅解备忘录，双方的合作形成崭新的格局，为共同开发国际工程市场创造了良好的条件。会后，Rob Adam一行还参观了公司展厅、3D设计室、焊接培训车间。

AVENG集团是南非最大的基础设施建筑公司，在南非约翰内斯堡证券交易所JSE上市，并在全球30多个国家拥有超过30000名员工。AVENG集团广泛覆盖基础设施建设整个产业链，在建筑施工、工程设计、矿产、水利、交通运输、电力、能源、铁路、钢结构和制造业具有丰富的业绩。早在2011年，我公司已与AVENG集团展开合作交流。2011年8月17日，公司首次国际化核电施工管理培训在北京开班，来自南非AVENG集团的22名高级管理人员成为我公司国际培训项目的首批学员。在为期一周的核电站施工组织管理培训中，他们先后接受了包括核电站质量保证体系、工程管理、技术管理等方面的知识培训。2012年至今，AVENG集团核电施工总监Danny Quan一直保持与我公司国际业务的信件往来，并且多次就南非核电建设项目的合作进行友好交流。

来源：http://www.heneng.net.cn

## 国家核电与洛克希德马丁公司推进仪控合作

当地时间6月10日，国家核电技术公司所属国核自仪系统工程有限公司与美国洛克希德马丁公司在美国华盛顿签署《RPS工程样机合作开发和设备制造合同》（RPS即反应堆保护系统），双方将采用第一阶段合作开发的NuPAC平台，联合开发新一代核反应堆安全级数字化仪控系统。国家核电技术公司总经理顾军和洛克希德马丁公司副总裁迈克尔班尼特等共同见证了签字仪式。

NuPAC平台是国家核电技术公司与美国洛克希德·马丁公司基于FPGA(现

场可编程门列阵）技术联合开发的新一代反应堆保护系统安全平台。2013 年 5 月，美国核管会（NRC）正式发布了 NuPAC 平台评审额外信息要求函（RAI），表明了 NRC 对 NuPAC 设计理念和过程的肯定，并将进一步提升 NRC 评审的优先级。

顾军总经理和迈克尔• 班尼特先生在会谈中高度评价了双方合作团队在第一阶段的合作，表示将进一步加强沟通，提供充分的支持，及时有效地解决研发过程中遇到的各项挑战。同时，双方都期待着在更广的领域进一步深化和拓展合作。

6 月 11 日，顾军总经理一行还前往洛克希德•马丁公司位于宾夕法尼亚州斯克兰顿市的邓莫尔 NuPAC 合作研发基地，听取了国核自仪和 LMT 公司合作研发团队的工作汇报，并就技术风险、NRC 取证事项、设备鉴定等问题进行了深入探讨。

来源：http://www.heneng.net.cn

## 中核五建公司与 PCI 签订《AP1000 管道自动焊机头改造合同》

6 月 14 日，在公司总部第一会议室召开了中国核工业第五建设有限公司与美国 PCI 能源服务有限公司（以下简称 PCI）之间的交流会议。会上，PCI 与公司签订了《AP1000 管道自动焊机头改造合同》。

**签订合同**

鉴于 AP1000 LBB 管线必须采用氩弧焊，考虑到 LBB 管线部分焊口壁厚、管径较大，公司决定采用窄间隙焊来进行部分 LBB 焊口的焊接，基于现场实际工况，需要改造公司已有的窄间隙焊机机头。通过长达 4 个月的沟通，在双方基本达成意向的情况下，PCI 总裁 Chad Gigliotti，PCI 蒸汽发生器更换项目和核电产品线经理 Scott Achtor 到上海与公司就此合同进行磋商，达成共识并签订合同。

公司副总经理梁选翠主持了会议。会上对《AP1000 管道自动焊机头改造合同》进行了逐条讨论和固化。最后，合同在双方的见证下完成了修改，PCI 总裁 Chad Gigliotti 和公司三门核电施工总承包部总经理王明亮一起签订了合同。

**双方回顾前期合作成果、交流经验**

会上，公司对 PCI 在三门核电 1# 核岛主管道成功安装所作出的贡献表示了感谢。双方还就前期 PCI 对三门核电 1# 核岛主管道安装的技术支持费用及核电在世界范围内的发展状况进行了深入讨论。

公司副总经理邓晓亮、核岛主系统安装分公司经理李建，西屋电气有限公司中国区业务发展高级代表刘强，以及公司相关人员参加了会议。海阳核电工程施工总承包部通过视频参与了此次会议。

来源：http://www.heneng.net.cn

## 洛克希德•马丁公司扩展中国核合作

近日，洛克希德•马丁公司和中国国家核电自动化系统工程公司扩展合作，双方将继续在中国第三代核反应堆防护系统开发方面进行合作。

2010 年年底，洛克希德•马丁公司核电系统和方案解决部门与国家核电技术公司的子公司 SNPAS 签署协议，旨在合作开发用于 CAP1400 技术标准的安全防护系统。CAP1400 来源于美国西屋公司的 AP1000 技术标准。在 2011 年初，一个专门的研发设施在宾夕法尼亚州斯克兰顿附近成立，同时 SNPAS 派遣一个技术开发小组常驻现场。

目前，两家公司已经签署了一份协议来制造合格的原型反应堆保护系统，其中的条款尚未披露。他们将建立一个基于现场可编程门阵列（FPGA）技术的核安全仪表和控制平台，这个平台将专门处理涉及到数字核安全系统软件常见故障的安全和监管问题。这些系统将监测和检测系统的潜在故障。洛克希德•马丁公司表示，该平台可用于新工厂的建设和现有工厂升级。

中国山东省石岛湾首个 CAP1400 项目将于 2014 年 4 月开始建设。国家核电技术公司将率先持有项目公司 55%的股份。另一个股东是中国华能集团的下属公司华能核电开发公司，它是中国最大的电力公司之一。合作双方希望首个 CAP1400 项目能够在 2018 年开始投入运营。

洛克希德•马丁公司已有为海军和民用核项目提供安全重要仪器仪表和控制系统超过 50 年的历史，并有超过 30 年的数字系统供应史。目前，所有美国的核动力潜艇和航母上都安装了该公司的系统。

来源：http://www.world-nuclear-news.org

## 阿尔斯通将为中国核电项目提供汽轮发电机组

阿尔斯通 11 日与中国东方电气集团有限公司（简称“东方电气”）签署了一项合作协议，将为采用 AP1000 型反应堆的中国核电项目提供汽轮发电机组。阿尔斯通董事长兼首席执行官柏珂龙与东方电气董事长王计共同参加了在成都举行的签字仪式。

中国已宣布重启核电建设，目前正在积极向三代核电技术的方向发展，因此该合作协议对阿尔斯通和东方电气均具有非常重要的战略意义。该项协议与中国十二五期间稳妥发展核电的规划相一致。中国将按照全球最高安全标准新建核电项目，全面满足国际原子能机构（IAEA）各项标准的要求。

根据协议，东方电气未来为 AP1000 项目提供的汽轮发电机组将基于阿尔斯通的阿拉贝拉技术。阿拉贝拉汽轮机适用于包括 AP1000 在内的各种核反应堆类型，该型汽轮机具有更高的效率，同时降低安装和维护成本。AP1000 属于采用第三代压水堆技术的核反应堆，是中国未来核电发展确定选用的主要技术之一。

随着该协议的签署，阿尔斯通阿拉贝拉汽轮机使用的技术领先的 LP69 末级叶片也将首次进入中国市场。

该协议下的首个合同预计将很快签署。迄今阿尔斯通已参与中国核电建设 20 余年，与东方电气密切合作，提供了中国市场超过一半的汽轮发电机组，其中包括岭澳一、二期、台山、红沿河等核电项目。

来源：http://world-nuclear-news.org

核汽轮机转子　　来源：世界核新闻网

## GEA 重新规划核心业务 换热器脱离核心市场

GEA 集团，是位于德国杜塞尔多夫的机械工程集团，作为系统供应商，GEA 关注的焦点更加突出了其在食品工业和其它技术复杂流程工业中的领先地位。GEA 换热器（“HX”）不再被包括在其核心业务之内，因此，GEA 决定在中期从这项业务中分离出来。目前，GEA 正审视各种办法，从热交换器的市场区隔中分离出来。

这一结果来源于 GEA 集团在 2012 年实施的全面技术和战略组合审查。

GEA 进行审查的目的是确定其核心业务领域，并且要求这些领域能够具有最大的协同效应潜力。这些核心业务需要进行系统化的深入发展并且将会被作为 GEA 集团未来持续增长的基础。

GEA 集团执行董事会主席，JürgOleas 称：“人力和财力资源的高效部署是 GEA 集团保持成功发展与不断前进的核心。这意味着，随着的业务不断扩大，我们必须采取集中的办法。对于所有业务单元的深入审查已经表明，GEA 用于食品工业的技术及在其替代行业中的部署保一直保持着非常可观的增长潜力。它们的市场高度稳定并为长期的全球大趋势所驱动。因此，我们计划在中期持续增加集团在食品技术方面所占的收入比例至 70％ -75％左右”。

HX 是非常有利可图的，并且具有很强的市场地位。在 GEA 集团的投资组合中，HX 和其他业务单元之间的潜在协同效应是非常有限的，然而，他们的业务内容也不尽相同。并且 GEA 集团广泛使用的技术和能力范围也是有限的。鉴于此，GEA 坚信，HX 业务将能够在一个新的所有权结构中得到更好的发展。

来源：http://www.gea.com

# 核电站新闻

## 红沿河核电 1 号机组正式商运

2013 年 6 月 7 日，中国广核集团有限公司、辽宁红沿河核电有限公司在红沿河核电基地宣布：辽宁红沿河核电站一期 1 号机组于 6 月 6 日完成 168 小时试运行试验，经辽宁省电力公司确认合格，正式投入商业运行。至此，红沿河核电站成为我国第五个、东北首个投入商运的核电基地。

据测算，该机组日发电量达 2400 万千瓦时，可满足大连市四分之一的用电需求，减排效应相当于 1.65 万公顷森林。随着该机组商运，辽宁省清洁能源比例由 18.44%提高到 20.83%。红沿河核电站一期 4 台机组全部建成后，年发电量将超过 300 亿千瓦时，相当于 2012 年辽宁省社会用电总量的 1/6，大连市社会用电总量的 104%。

辽宁红沿河核电站位于大连市瓦房店红沿河镇，地处渤海辽东湾东海岸，北距沈阳 270 公里，南距大连 110 公里。项目于 1978 年开始厂址筛选工作。红沿河核电站由中国广核集团有限公司、中国电力投资集团公司和大连建设投资集团有限公司按股比 45%：45%：10% 共同投资。

来源： http:http://www.world-nuclear-news.org

红沿河核电站正在建设的四组 CPR1000 机组 来源：世界核新闻网

## 海南昌江核电 1 号机组压力容器水压试验成功

7 月 10 日凌晨，中核集团海南昌江核电项目 1 号机组反应堆压力容器顺利完成水压试验，各项数据均满足设计规范要求，目前已开展水压试验后续制造工作。

海南项目压力容器由中国核动力研究设计院负责设计、采购，上海电气核电设备有限公司承制。进入设备制造冲刺阶段以来，采购、供货双方采取了风险预防、工艺保障、旁站监督等各种专项措施，保证了水压试验等重大工序一次性通过；通过项目策划、风险预防等手段，最终提前了一个月完成制造工序。后续，1 号压力容器将进行安全端坡口机加工、最终尺寸检查等工作。

在项目管理过程中，海南核电采取了深度参与、提前策划、高效反应、全程推动的设备管理模式。该公司领导高度关注，通过定期协调、及时决策，有力推进了项目进展。

来源：http://np.chinapower.com.cn

## 山东海阳核电 2014 年一号机组将实现发电

海阳核电是世界首批采用 AP1000 核电技术的核电项目，也是我国三代核电自主化依托项目，目前项目一二号机组正在加紧建设，已经顺利完成 43 个工程里程碑节点，力争 2014 年一号机组实现发电。

走进海阳核电项目工地，两个矗立的“圆柱形筒体”格外引人注目，这就是一号、二号机组核岛，不久前，1 号机组的钢制安全壳在这里成功封顶，至此，海阳核电全面进入设备安装阶段。山东核电有限公司工程师姚鹏：“目前，1 号机组核岛内部土建工作已基本完成，正在进行设备安装工作，核电内部大型设备如压力容器、蒸汽发生器、稳压器都已就位，2 号核岛正在进行核岛内部土建工作。”

核电站建成后，核岛筒体显露在最外面的一层就是屏蔽墙，为现浇钢筋混凝土结构，是屏蔽厂房的重要组成部分。核岛屏蔽墙分 19 层施工，为确保项目整体的施工质量和进度，采取分段化流水作业。山东核电有限公司工程师秦超：“目前海阳一期屏蔽墙施工已形成标准化，屏蔽墙施工完成后，总体约 52 米高，1 米厚，总浇筑混凝土方 6600 多方，屏蔽墙的完成，将为我们以后的发电及商用打通关键路径。”

据了解，海阳核电总投资超过一千亿元，其中，一期工程建设 2 台百万千瓦级压水堆核电机组，预计投资 400 亿元，年发电量可达 175 亿千瓦时，将进一步优化山东电源结构，成为经济发展的重要动力。

来源：http://np.chinapower.com.cn

## 中核集团方家山核电 1 号机组堆芯焊接完成

7 月 12 日，中核集团方家山核电工程 1 号机组堆芯中子通量测量系统焊接工作顺利完成。此项工作从 4 月 20 日启动，历时 80 天。250 条焊缝经检验，质量全部合格，为后续冷试节点奠定坚实基础。

堆芯中子通量测量系统焊接具有操作空间狭窄、施焊难度大、质量要求高等特点。在施工过程中，秦山核电基地工程管理部门专人全程跟踪，并与各参建单位紧密配合，统一协调，有效保证了该项工作的顺利完成。

来源：http://news.bjx.com.cn

## 惠东黄埠将建核电站

位于惠州市惠东县黄埠镇的惠州核电项目又有新进展。昨日，记者从相关部门获悉，7月8日，中广核惠州核电有限公司成立揭牌仪式在惠州举行，惠州市政府与中广核集团公司签署深化合作补充协议，并就进一步加深与中国广核集团的战略合作、积极推动核电等清洁能源的开发交换了意见。

惠州市市长麦教猛说，惠州市与中广核将建立长期的合作关系，双方积极推进清洁能源项目筹建。各方要进一步强化责任落实，做好配套规划，全力以赴推动清洁能源项目建设。他表示，市委、市政府将全力支持配合项目建设，尽最大努力为清洁能源项目建设提供优质高效的服务。希望双方进一步深化合作，推动下游配套项目建设。

据悉，惠州核电厂址位于惠东县黄埠镇东头村附近，面向红海湾西北岸，核电厂采用AP1000技术路线，冷却水源取自红海湾。中广核集团公司承担了核电厂可行性研究阶段中的泥沙与岸滩稳定性专题研究工作，为惠州核电厂取排水口及大件码头方案布置提供技术支撑。

来源 :http://www.heneng.net.cn

## 我自主研发压水堆核电站控制棒驱动系统取得进展

控制棒驱动系统是核电站的核心关键设备之一。在国家科技支撑计划的支持下，由中广核集团研制的“百万千瓦级压水堆核电站控制棒驱动系统研发”项目经过2年多的努力，充分结合国内外核电站运行经验反馈，采用了一系列创新设计，已经完成二代加核电站控制棒驱动系统的国产化研制，包括所有的性能试验和寿命试验；三代1700MWe核电站控制棒驱动系统的自主设计与制造也已完成，目前正在开展相关试验。目前申报了13项专利，部分产品已经向国内十多个核电机组供货，逐步替代进口产品。通过国家科技支撑计划的支持，有望实现我国核电站控制棒驱动系统自主化。

来源：http://www.china-nea.cn/html/2013-07/27250.html

## 辽宁徐大堡核电一期工程钢制安全壳制造启动

2013年7月16日上午，山东核电设备制造有限公司（简称：国核设备）、中核辽宁核电有限公司、中核工程有限公司在山东海阳召开会议，正式启动辽宁徐大堡核电一期工程钢制安全壳制造。

会上，国核设备党委书记田军首先就公司概况及能力进行了简要介绍。中核辽宁核电有限公司副总经理周建虎对国核设备近年来在AP1000依托化项目设备国产化进程中取得的成绩表示赞赏，希望国核设备能将以往在设备生产、现场安装等工作中的经验和方法，应用到徐大堡项目中去。周建虎表示，将继续加强与国核设备的合作与交流。

会议由国核设备公司副总经理胡广泽主持，中核辽宁核电有限公司、中核工程有限公司及国核设备公司相关工作人员参加了会议。

来源：http://www.heneng.net.cn

## 石岛湾核电CAP 1400型压水堆项目率先获批

据国家核电技术公司内部人士透露，近日，位于山东荣成的石岛湾核电站CAP1400型压水堆项目已率先拿到“路条”——获准开展核电站前期建设工作，包括基坑负挖等。

此次获批的CAP1400型压水堆项目，不同于去年12月21日开工建设的高温气冷堆示范工程。“高温气冷堆只有20万千瓦，主要是对四代核电技术进行产业化试验。”山东省科学院能源研究所副所长许崇庆向经济导报记者解释，CAP1400型压水堆项目是石岛湾核电站扩建工程，主要用于商业运行。

据了解，与国家核电技术公司合作的CAP1400型压水堆项目，单机容量达到140万千瓦，采用的是AP1000技术（第三代核电技术）路线。石岛湾核电站远期规划容量将达到900万千瓦，建设周期长达20年。

石岛湾拿到“路条”释放出今年核电建设提速信号。国家发改委5日提请全国人大审议的《关于2012年国民经济和社会发展计划执行情况与2013年国民经济和社会发展计划草案的报告》中提道，2013年“新增核电324万千瓦”。“324万千瓦，意味着今年可能有3台机组全面投产。”许崇庆说。

据了解，目前已经进入并网调试阶段的有福建宁德1号机组与辽宁红沿河1号机组，按照计划，这两台百万千瓦级机组将于今年全面投产。

上述国家核电技术公司内部人士介绍，今年还有6台机组可能拿到“路条”，包括山东海阳3号机组、浙江三门3号机组、福建福清5号机组、广东阳江5号机组、广东陆丰1号机组以及辽宁徐大堡核电1号机组。

来源：http://np.chinapower.com.cn

## 三门核电2号核岛冷冻水模块吊装完成

7月18日，中国能源建设集团有限公司承建的三门核电工程2号机组核岛冷冻水模块顺利吊装就位，为下一步模板安装顺利进行奠定坚实的基础。

三门核电2号核岛共安装两台冷冻水模块设备，每台设备重达48吨，外形尺寸分别为长8.9米、宽4米、高 3.5米。冷冻水模块就位幅度远，外观形状不规则，吊装作业难度较大。为确保安全、高效地完成设备吊装任务，中国能建浙江火电项目部制定了专门的吊装作业计划，认真做好安全技术交底，吊装过程进行全过程监督和控制，确保了设备顺利吊装就位。

来源：http://finance.ifeng.com

INNCH INTERNATIONAL ——全球唯一针对核电信息化发展的国际高峰论坛

支持单位：

G.I.I.N. 法国核工业协会 | World Nuclear Association | 中国信息协会 能源分会

# 中国核电信息技术高峰论坛2013

NITF

2013年8月8日-9日
中国，上海

## 会议亮点

1.分析预测中国核电信息化发展趋势
2.解析中国核电信息化的特点和面临的挑战
3.分析核电行业未来可持续发展对信息化的要求
4.生动详实的中国核电信息化案例解析
5.解析中国核电软件自主化和国产化
6.最新核电信息化相关产品技术和应用展示
7.一对一的高效客户项目洽谈机会
8.借鉴国内外核电站信息化的方法和经验

## 大会主席

Taghrid ATIEH
国际核信息系统
核电能源部
国际原子能机构

肖心民
秘书长
中国核能行业协会
信息化专业委员会

吴宜灿
核能安全技术研究所
所长
中国科学院

## 指导委员会成员

邹来龙
安全信息管理部主任
中国广核集团

钱兵
信息中心主任
中国核工业集团

Sang Hyung PARK
总经理，信息化中心IT计划行政组
韩国水电与核电公司

陈义学
副主任，总工程师
国核软件技术中心

林树顺
信息中心主任
中广核集团

张琳
三维中心主任
上海核工程研究设计院

邹沫元
副总经理
中广核仿真技术有限公司

陈琪
信息中心主任
中国核工业第二三建设公司

李昌银
信息中心主任
华能山东石岛湾核电有限有限公司

## 核电新建项目介绍：以下为正在建设或者待建核电站项目，即将启动核电信息化建设。

**1.江苏田湾核电站3、4号机组**
（反应堆：VVER 业主：中核集团 FCD:2012.12）

**2.山东石岛湾核电站**
(反应堆：HTR 业主：华能集团 FCD:2012.12)

**3.山东石岛湾CAP1400机组**
（反应堆：CAP1400 业主：华能集团 FCD:2014.4）

**4.辽宁徐大堡核电站**
（反应堆：AP1000，业主：中核集团 FCD:2013.12）

**5.福清核电站5、6号机组**
（反应堆：ACP1000 业主：中核集团 FCD:2013.12）

**6.广东陆丰核电站**
（反应堆：AP1000，业主：中广核集团 FCD:2013.12）

**7.广东阳江核电站5、6号机组**
（反应堆：AP1000 业主：中广核集团， FCD:2013.12）

10+ 核电业主单位

20+ 国家

30+ 权威机构发言人

100+ 一对一客户见面会

150+ 参会代表

**现在就报名参与！**

**请联系：**
电话:+86(0)21 51920620
传真:+86(0)21 51920621
邮件:info@innchinc.com
网站:www.innchinc.com/NITF2013

Energy Intelligence www.energyintel.com

NUCLEAR INTELLIGENCE WEEKLY®

## 加拿大

美国西屋电器公司和加拿大坎杜能源有限公司最晚将于周五提交达灵顿核电站反应堆的投标申请，该核电站由安大略电力公司负责运营。但是安大略省政府并没有承诺开启该项目。西屋电器派出其 CEO--Danny Roderick 来亲自负责这个 AP1000 项目，并于 6 月 27 日在多伦多市中心举办了一场社交活动，众多本地媒体均有出席。该活动旨在宣传其在中国和美国参与的 AP1000 项目经验，西屋电器宣称将会邀请“40 余家加拿大公司”参与建设这个 2000 兆瓦反应堆项目。坎杜能源有限公司最近发布了一项新闻通告，称其加强型 Candu 6 反应堆（即 EC6）已经通过了第三步（即最后一步）获取许可证前的审查；其 AP1000 反应堆通过了第二步审查。核电站反对者新民主党呼吁自由党执政的安大略省政府将两项提议公布于众。能源部部长 Bob Chiarelli 强调政府将会认真审查长期能源计划，并承诺“我们将会秉承以人为本的战略方针制定满足安大略省长期能源需求的政策”。

## 美国

美国 NuScale 电力公司宣布近期将会重新向国家电力部提出 SMR 反应堆（小型堆）的资金支持申请，此次申请得到了美国的几个西部州及两大公用事业单位—西北能源公司和犹他州市电力系统协会的支持。NuScale 主席及董事长 John Hopkins 于 7 月 1 日宣布成立 WIN 联盟，旨在对位于爱达荷国家实验室这样的多模块 NuScale 小型堆示范项目进行研究，该反应堆预计将在 2024 年运行。该联盟认为继第一个示范项目之后，美国其它州将会陆续开展一系列小型对项目。NuScale 公司希望接下来的 5 年其小型堆能够获得能源部 4.52 亿美元中的部分拨款。其中 2.26 亿美元已经分配给了美国巴布科克 & 维尔克斯公司和贝克特尔合资公司共同开发的 mPower 反应堆，这也是目前为止唯一获得能源部资助的反应堆。接下来，这家公司将与西屋电气、美国阿莫林密苏里公司共同竞争位于密苏里卡拉威核电厂的小型堆项目。

## 美国

近期美国俄亥俄州的 Davis Besser 反应堆和田纳西州的 Watts Bar-1 反应堆进入了非计划性大修期。美国核管理委员会（NRC）发布的事故报告称由于 Davis Besse 的反应堆冷却剂泵断电，该 900 兆瓦电站于今年 6 月 29 日暂停。NRC 报告称事故第二天，电站工作人员发现负责向泵轮密封输送润滑油和冷却水的再循环管发生了泄漏。NRC 的另一份报告称 Watts Bar-1 于 6 月 28 日暂停，事故原因是电气故障导致一台主发动机和汽轮机停工。一家电力公司的发言人称 Watts Bar-1 已于 6 月 30 日恢复运行，Davis Besser 也将很快恢复运营。

## 印度

美国副总统乔拜登于本月对印度进行了为期 4 天的国事访问，旨在推动美国核电供应商和印度核电公司的商业合作，但是印度的相关法律使得建立这种合作非常渺茫。这是三十年来美国副总统首次访问印度。去年 9 月美国国务卿 John Kerry 就古吉拉特邦核电站项目走访印度，“承诺”印度核电公司和美国西屋电气将会就此项目签订“商业合同”。在孟买证券交易所针对印度工业官员的演讲中，拜登提到早在还是参议员时他就非常支持美国和印度签订核电合作协议，其中推动美国核电公司和印度核电公司签订第一个合作协议是非常重要的。在印期间，拜登还会见了印度首相曼莫汉·辛格。曼莫汉·辛格计划 9 月份在纽约举行的联合国大会结束后将会见美国总统奥巴马。

## 南非

上星期南非政府与欧洲原子能共同体签订了一份核电合作协议。该协议是在欧洲委员会主席 Jose Manuel Barroso 拜访南非期间签订的，同时欧盟承诺对南非的农村电力进行投资。欧盟和南非的这项谈判早在去年就已经成型，只是尚未签订协议。实际上，对于核电项目的建立，南非政届存在两种声音。今年 4 月份南非的国家计划委员会发布报告，称政府发布的 2010 年核电发展计划已经“过期”，实际上比预期要低的电力需求和不断上涨的反应堆建设成本将会延迟新反应堆项目投入运行，预计运行时间要到 2040 年。而支持核电发展的官员对该项报告进行了批判，并坚持认为发展核电是必要之举。如今全球新兴核电市场分布在几个非常局限的区域，反应堆供应商希望能够推动建立 9.6 兆瓦的新兴核电项目。今天 3 月俄罗斯总统普京走访德班期间大力宣传了俄罗斯原子能公司的核电服务。

## 法国

本周 29 名绿色和平活动分子由于擅自闯入法国电力公司的 Tricastin 核电站而被捕。这些抗议人士称他们试图将老化的核电站安全隐患公布于众。Tricastin 是法国最老的核电站之一，2010 年 11 月被延长了 10 年的运行期限，而在 2011 年 7 月发生了一场小型火灾事故。法国电力公司本周发布声明称“抗议者无论何时都不允许进入到核电站的敏感区域”。Tricastin 是法国五大核动力联合核电站之一，目前绿色和平组织正在向法国政府请愿关闭该核电站。其它四个核电站分别是 Blayais plant（拥有 4 个机组）、Bugey 核电站（拥有 4 个机组）、Fessenheim 核电站（拥有 2 个机组）和 Gravelines 核电站（拥有 6 个机组）。其中最年轻的核电站是 Gravelines-6，于 1985 年开始运行，其它四个的运行时间为 20 世纪 70 年代中期到 80 年代早期。

## 日本

日本前首相菅直人周二（16 日）向东京地方法院递交起诉状，控告现任首相安倍晋三诽谤。菅直人称安倍两年前在网上批评他处理福岛核危机的手法，内容不实，侵害他的名誉。安倍发表的文章指责事故发生时菅直人错误决定终止第一核电站 1 号机组的海水注入作业，导致事故不断扩大。菅直人的这一声明在周日即将举行的上议院选举之前公布于众，这次选举中核电项目仍然是热议主题，而安倍率领的自由民主党获胜的希望较高。菅直人在一场记者发布会上提到“我曾多次要求安倍删除此文并向我道歉，但是安倍却不予理睬，我行我素。在上议院选举期间，这种错误的言论仍在网上流传。他的这种诬告行为严重伤害了民主党的信誉。”菅直人目前不仅是民主党的立法人，而且对核电项目持反对意见，菅直人不仅要求安倍针对此事公开道歉，而且要求其赔偿 1100 万日元（即 110,100 美元）。

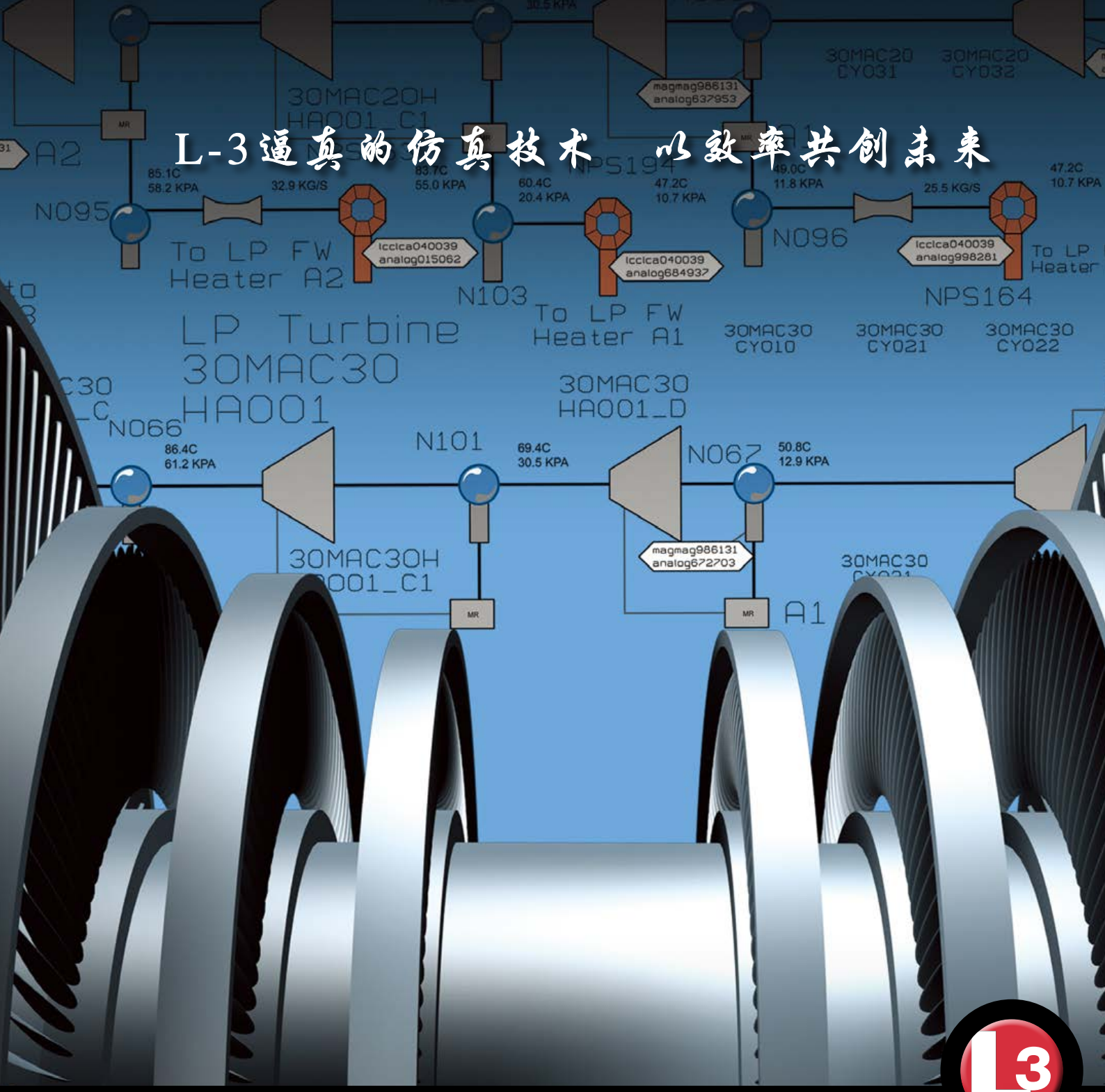
## 白俄罗斯

中国新华社发表的一篇报道称白俄罗斯能源部部长 Vladimir Potupchik 将与中国当局协商总额为 3.23 亿美元的贷款事宜，用于支持白俄罗斯未来核电站的电力设施建设，该贷款将由中国进出口银行提供，贷款期限为 15 年。白俄罗斯媒体批评浪潮迫使俄罗斯原子能公司旗下的 Atomenergomash 公司严格遵循质量和安全标准以重获公众信息。白俄罗斯总统非常支持核电发展，但是他也清楚国家财政资金短缺很难推动核电拓展。去年，白俄罗斯与俄罗斯签订了一项价值为 100 亿美元的合同，旨在建造一个 2400 兆瓦核电站，该核电站将由两个 VVER-1200 反应堆构成。

# Nuclear Glossary 核电专业词汇

| English | Chinese |
|---|---|
| backing ring | 支承板、底板 |
| backing run | 支承环（焊接） |
| backing strip | 背面焊缝 |
| backlash | 支撑条 |
| backlighted | 齿隙游移 |
| backlighted button | 带灯的 |
| backlighted pushbutton | 带灯按钮 |
| backlighted rotary switch | 带灯按钮 |
| backlighted switch | 带灯开关 |
| backlighting | 后部照明 |
| backlit | 带灯的 |
| backlit sign (e.g Exit, Fire Escape) | 带灯标志牌 |
| backpressure | 反压力、背压 |
| backpressure fitting | 被压配合 |
| backpressure regulator (incorrectly <Backpressure control valve>) | 背压调节器（不正确的“ 背压控制阀 ”） |
| backpressure turbine | 背压式汽轮机 |
| backscatter | 反向散射 |
| backscatter factor | 反散射因子 |
| backscattering | 反向散射 |
| backseat | 后座 |
| backstep method (welding) | 分段退焊法（焊接） |
| backup | 应急、备用 |
| backup manual operator | 备用手动操作器 |
| backup ring (CRDM) | 支承环（驱动棒控制机构） |
| backwall | 后墙板 |
| backward-curved vane | 向后曲线的叶片 |
| backwashing | 反洗、 拔出 |
| bad weather | 坏天气 |
| baffle | 隔板、导流板 |
| baffle assembly (reactor vessel) | 围板组件（反应堆压力壳） |
| baffle bolting | 围板栓接 |
| baffle jetting | 围板射流 |
| baffle plate (reactor vessel) | 隔板 （反应堆压力壳） |
| bail | 夹紧箍、卡钉 |
| bainitic | 贝氏体 |
| bakelite | 胶木、电木 |
| baking (electrodes or fluxes before use) | 烘、烤干 |
| balance stabilizer shaft | 平衡稳定器轴 |
| balanced check valve | 平衡的单向阀 |
| balanced seal | 平衡密封 |
| balanced-plug control valve | 平衡的旋塞控制阀 |
| balancing | 平衡 |
| balancing bellows | 平衡波纹管 |
| balancing chamber | 平衡室 |
| balancing device | 平衡装置 |
| balancing drum | 平衡盘 |
| balancing drum head | 平衡锤 |
| balancing of rotating machinery | 旋转机械的平衡 |
| balancing piston | 平衡活塞 |
| ball | 球 |

| English | Chinese |
|---|---|
| ball bearing | 球面支承 |
| ball burnishing | 钢球磨光 |
| ball control valve | 球控制阀 |
| ball flow indicator | 球水流指示器 |
| ball hardness testing | 布氏硬度测定 |
| ball isolation valve | 球隔离法 |
| ball lift check valve | 球抬升单向阀 |
| ball mill | 球碾磨机 |
| ball peen hammer | 圆头锤 |
| ball pressure relief valve | 球卸压阀 |
| ball ring | 滚珠圈 |
| ball screw | 圆头螺钉 |
| ball thrust bearing | 滚珠止推轴承 |
| ball valve | 球阀 |
| ball-float trap | 浮球活门 |
| ballast | 整流器 |
| ballrace | 滚珠座圈 |
| banana boundary zone | 香蕉形边界区 |
| banana region | 香蕉状区域 |
| band spectrum | 带状 ( 光）谱 |
| bandsaw | 带锯 |
| bank (capacitors, etc.) | 组（电容器等） |
| bank sloping | 斜坡 |
| bar | 棒、条 |
| bar chart | 总计划条线图 |
| bar manipulator | 长柄操作器 |
| bar stock | 棒材 |
| barb | 毛刺 |
| bare | 裸的 |
| bare bus | 裸母线 |
| bare cable | 裸电缆 |
| bare rod bundles | 裸棒束 |
| bare shaft | 裸轴 |
| bare solid cable | 裸实心电缆 |
| bare wire | 裸导线 |
| baring (wire) | 裸露的 |
| barrel | 圆柱体部分（安全壳） |
| barrel casing | 筒形壳体 |
| barrel casing pump | 筒形壳体泵 |
| barrel pump | 筒形泵 |
| barreling | 装桶 |
| barrier | 屏障、隔板 |
| barrier terminal block | 隔板端子板 |
| barring gear | 盘车齿轮装置 |
| barstock adj. | 棒材的 |
| barstock | 棒材商 |
| barstock body | 棒材体 |
| barytes concrete | 重晶石混凝土 |
| base | 基座、底座 |
| base insert | 基座垫片 |
| base load | 基本负荷 |
| base load operation | 基本负荷运行 |




**Orchid®**
Total Development & Simulation Environment

L-3的超级仿真培训系统采用Orchid 仿真技术，为电厂操作人员提供真实的操作环境，帮助他们获得处理任何紧急事故的经验。不管是多复杂，多危险的事故工况，都可以在仿真器上实时逼真地推演，对事故工况提供有效的监视并能对事故工况进行适当的调整。

请点击www.L-3com.com/MAPPS您可以详细地了解我们近40年所积累的核电仿真领域的相关经验，以及我们能如何改变您的现在和未来。