2006 was an important year for the IIR: the first phase in the updating of the Fridoc database, launching of the e-Bulletin, publication of a course, Refrigeration Fundamentals, the Red Book on frozen foods, a Bibliography on CO₂, two Informatory Notes, and the launching of the new Web site. Numerous IIR and IIR-co-sponsored conferences were held all over the world. Towards the end of 2006, the international conferences on ozone depletion and climate change were held: see the Focus.

2007 will be an even more important year: our information and communication systems will continue to be upgraded, new publications, including an updated version of the International Dictionary of Refrigeration in 11 languages, will be produced, and several conferences will be held (in Ohrid, Portoroz and Barcelona in April and Strasbourg in November).

The highlight of the year will of course be the 22nd IIR International Congress of Refrigeration (ICR2007) that is to take place on August 21-26, 2007. The Congress is already extremely promising: almost 1300 abstracts have been received. Register for the congress via the Web site: www.icr2007.org

Other highlights lie ahead: 2008 will be Refrigeration Year and we hope you will join in the celebrations!

Wishing all of you a Happy New Year full of promise.

Didier Coulomb, Director of the IIR

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JANUARY 2007

INTERNATIONAL INSTITUTE OF REFRIGERATION

Newsletter

January 2007

IIR Focus

2006 was a year where the International Institute of Refrigeration (IIR) continued its efforts to address the challenges of climate change and ozone depletion. The Institute launched the e-Bulletin, updated its course on refrigeration fundamentals, and published a red book on frozen foods. Additionally, the IIR focused on the development of communication systems, new publications like the International Dictionary of Refrigeration, and the launch of a new Web site. Several international conferences were held throughout 2006, covering topics related to ozone depletion and climate change.

2007 promised to be an even more important year for the IIR. The 22nd IIR International Congress of Refrigeration (ICR2007) was scheduled to take place in August, and the registration for the congress was open via the Web site: www.icr2007.org. Other highlights included Refrigeration Year 2007, with a focus on joining celebrations.

Wishing all of you a Happy New Year full of promise.

Didier Coulomb, Director of the IIR
first sign from an emerging country, which could allow more negotiations in the future, involving countries which have not ratified the Kyoto Protocol.

We need to be prepared to implement new measures concerning refrigeration and air conditioning in the near future, in developed and developing countries: faster phase-out of HCFCs, the replacement of other refrigerants with high global warming potentials, a reduction in the energy consumption of all equipment and systems.

See the statement presented by the Director on the Web site of the IIR.

**IIR events**

**Statutory meetings**

- The Publications Sub-Committee, the restricted Science and Technology Council and the Management Committee held their meetings in Paris, on December 7-8, 2006. The main issues discussed were progress in the renovation of the Fridoc database, the publication of an updated version of the IIR’s International Dictionary of Refrigeration, preparation of the Beijing Congress, the production of a video for the IIR’s 100th anniversary, and member-country policy.

**International activities**

- **ACRA2006**, an IIR-co-sponsored conference organized by SAREK, was held in Gyeongju, Korea on May 21-23, 2006. Around 300 participants from 9 countries attended and 187 papers were presented. Profs. K. Watanabe, Liansheng Li and Tae Ho Song gave keynote presentations. ACRA2008 will be held in Taipei. Order the proceedings and find out more by contacting Prof. Min Soo Kim: minsikim@snu.ac.kr - www.acra2006.org

- **Transfrigoroute** Transfrigoroute International (TI) held its annual meeting in Marrakech (Morocco) on October 26-27, 2006. Didier Coulomb attended the meeting and the IIR-TI liaison Committee meeting. Several issues were discussed, particularly energy labelling in refrigerated transport, a subject on which IIR and TI will cooperate.

- **IEA-HPP**

  A meeting of the International Energy Agency-Heat Pump Programme-IIR Liaison Committee took place in Paris on November 6, 2006 and the annual meeting of the Programme took place in Hanover on November 9-10, 2006. Henk van der Ree and Hermann Halozan attended this event. Several types of co-operation have been discussed, particularly the writing of a common policy paper on refrigeration, the organization of joint sessions during the IIR Congress in Beijing and co-sponsorship of the next Heat Pump Programme Conference in Zurich, Switzerland, in May 2008.

**Upcoming IIR events**


- **The 2nd IIR International Conference on Magnetic Refrigeration at Room Temperature** will take place on April 11-13, 2007 in Portoroz, Slovenia. Register: www.thermag2007.si Alojz Poredos alojz.poredos@fs.uni-lj.si or Peter Egolf peter.egolf@eivd.ch

- **Ammonia Refrigeration Technology for Today and Tomorrow,** the second IIR event in this series, will be held on April 19-21, 2007 in Ohrid, Macedonia. Register: www.mf.ukim.edu.mk/web_ohrid2007/main.html Risto Cikonkov ristoci@ukim.edu.mk

- **LNG 15 – Liquefied Natural Gas**, a conference co-organized by the IIR, will take place on April 24-27, 2007 in Barcelona, Spain. The IIR will be running a stand and giving out its Informatory Note on LNG: www.iirfiir.org/en/doc/1100.pdf Check out the programme and register: www.lng15.com lng15@lng15.com

**Red Book on sale!**

- The Red Book (Recommendations for the Processing and Handling of Frozen Foods) is one of the IIR’s reference publications and one of its best sellers. The 4th edition – prepared by Mr Leif Bøgh-Sørensen and several international experts – presents an overview of know-how on the processing and handling of frozen foods. It gives an update on the principles of freezing, quick-freezing, storage and thawing of food, with a focus on physical, physicochemical, nutritional and biochemical aspects, as well as microbiology, hygiene, packaging, transport, presentation and retail sale. Price: 50 €. A French version should be available in summer 2007.

  Order it via www.iirfiir.org

**Trends and Markets**

- **The Dubai District-Cooling Boom**

  The United Arab Emirates has the potential to become the world’s largest district-cooling market: demand is estimated at 10 million tonnes of refrigeration (36 360 MW) in the next 10 years.

  The construction boom in Dubai has triggered particularly high demand for cooling and the current cooling capacity is already estimated between 1 and 1.5 million tonnes of refrigeration. Tabreed is the leading district cooling service provider, but other players are also present. Carrier, for example, is claimed to be negotiating USD 250 million contracts at any given moment, despite the company not being a major player in the area.

  Several impressive projects give a clearer idea of the present developments in the sector: the Emirates District Cooling Company LLC (Emicool) is working on the Dubai Investments Park. It includes half a dozen real estate developments, one of which is the Palisades project, the Middle East’s largest privately funded mixed-use real estate development, and several other projects involving 250 000 tonnes of refrigeration. Trans Gulf Electro-Mechanical has obtained a AED (Dh) 220 million contract (almost USD 60 million) to provide district cooling to the Dubai Healthcare City, the world’s first healthcare free zone. Phase I is to include cooling capacity of 24 000 refrigeration tonnes. As part of it, nearly 680 cement trucks laid a 5000 m³ concrete foundation in 36 hours: Dubai is definitely the scene of lightning development and cooling on a grand scale!

  http://archive.gulfnews.com

- **Turkey: the AC market is expanding rapidly**

  Thanks to its efforts to achieve EU membership, Turkey has also succeeded in its eco-
nomy: at the end of 2005, it became the 22nd exporter and the 14th importer (90 billion €) worldwide. The HVAC&R industry grew four times more than overall Turkish economy: estimated total turnover of the air conditioning and part of the refrigeration sector is 680 million € production, 240 million € exports, 535 million € imports. The segment of split air conditioners (especially mono splits) showed the biggest increase on the market: production, which was 106 000 in 2001, was 964 000 in 2005 (39% exports). Since the greater part of the 70 million population lives in relatively warm parts of the country, there is still a large potential for the air-conditioning market which is far from saturation level.

**Eurovent/Cecomaf Newsletter, December 2006**

- **India: the retail boom spin-offs**
  India is positioned as the leading destination for retail investment. This followed saturation in Western retail markets and big Western retailers like Wal-mart and Tesco are entering the Indian market. The USD 412 billion investment which is projected to flow into the Indian retail sector by 2011 is predicted to generate an additional 8 million jobs. It should benefit many allied sectors, from logistics to commercial refrigeration. Carrier Air-conditioning and Refrigeration Ltd expects the commercial air-conditioning sector to grow at a higher rate than the residential sector. The total sales of Carrier India in this sector are expected to increase by more than 40% in 2006 compared with 2005.

**www.thehindibusinesstline.com**

### Climate change

- **The cost of global warming**
  The Stern Review is the most comprehensive study ever performed on the economics of climate change. According to the report commissioned by the UK Chancellor, pre-industrial level of greenhouse gases in the atmosphere was 280 ppm CO₂ equivalents (CO₂-e) and today’s level is 430 ppm CO₂-e and increasing by over 2 ppm per year. If actions are not implemented, this level will continue to rise and in the long term could induce climate change involving a 5°C rise in the global average temperature. Such a scenario would inflict damaging costs between 5-20% of GDP or more (depending on the range of risks and impacts examined) and would reshape the Earth’s geography: agricultural productivity would probably drop in most parts of the world, flooding, storms and droughts would increase and doing nothing to address climate change is predicted to be far more costly than taking measures to reduce greenhouse gas emissions. According to Stern, the latter would cost roughly 1% of GDP per year. It is estimated that by shifting the world onto a low-carbon path, benefits could add up to USD 2.5 trillion per year. Emissions reductions can be achieved by increasing energy efficiency, promotion of sustainable forestry, changes in demand and the adoption of clean power, heat and transport technologies including the use of biofuels. The power and transport sectors will need to implement major changes in strategy in order to stabilize emissions levels at or below 550 ppm by 2050.

http://www.hm-treasury.gov.uk/independent_reviews/ stern_review_economics_climate_change/ sternreview_index.cfm

**http://news.bbc.co.uk/2/hi/business/6096084.stm**

- **CERN is to investigate the climate**
  Besides the Large Hadron Collider project (see “Technology”), CERN is at the forefront of a wide range of other projects including one designed to investigate the influence of galactic cosmic rays on the Earth’s clouds and climate: for the first time, a high-energy physics accelerator will be used for atmospheric and climate science. The CERN project known as CLOUD will be conducted over a period of several years in collaboration with 18 institutes in 9 countries in Europe, the US and Russia and initial results will be available in summer 2007.


### Briefs

- **Changes at ARI**
  William G. “Woody” Sutton, President of the Air-Conditioning and Refrigeration Institute (ARI) since 2001, has resigned. Stephen Yurek has recently been appointed Chief Operating Officer and General Counsel, and Mark Menzer is now Senior Vice President. Stephen and Mark are managing day-to-day activities until Mr. Sutton’s successor is named. During Mr. Sutton’s tenure, ARI has made numerous advances in the field of industry standards, product certification, recruiting and training skilled HVAC&R technicians, and cooperation among industry organizations worldwide.

www.ari.org

- **Danfoss**
  Niels B. Christiansen has been promoted to Vice Chief Executive Officer of the Danfoss Group. Frederik Løtz has been appointed Executive Vice President and Chief Financial Officer. The President (CEO), Jørgen M. Clausen, intends to strengthen his focus on long-term strategies, the development of new business areas and external relations.

www.danfoss.com

- **DKV’s best annual meeting in years took place in Dresden in November 2006: 100 papers were presented and 720 participants took part. The proceedings CD-ROM can be ordered at info@dkv.org. The 2007 event will be held in Hanover on November 21-23, 2007. www.dkv.org**

**Alanco Technologies Inc.’s StarTrak Systems** subsidiary has a USD 10 million contract for its wireless tracking system and related monitoring services. GenTrak is a GPS-based, wireless monitoring and control system initially used to monitor the location, the operating status and fuel levels of generating units and refrigerated containers. Tim Slikfin, StarTrak President and CEO, announced that “The GenTrak contract is our initial entry into the marine cold-chain shipping market, which includes over 700 000 refrigerated containers globally.”


### Out of the ordinary

- **Cryopreservation after death** is catching on, at a price. Cryonics, defined as “the practice of freezing the body of a person who has just died in order to preserve it for possible resuscitation in the future, as when a cure for the disease that caused death has been found” is attracting persons who hope to be reanimated some time in the future. Organizations such as Alcor consider that they use “ultracold temperature to preserve human life with the intent of restoring good health when technology becomes available…” The price tag? USD 28 000 to at least 75 000 and perhaps less for customers’ brains alone, a practice that is attracting attention in Russia. Find out more:

http://www.worldhealth.net/it/fighting-for-the-right-to-be-frozen-2006-08-30.html

http://www.alcor.org www.cryonics.org


- **Chilled Medieval Book**

  A 1000-year-old Book of Psalms has been discovered by a construction worker in Ireland and is now stored in refrigeration at the National Museum of Ireland in Dublin. The book was found in a bog and the tannic acid content of the bog is thought to have acted as a natural preservative. The leather-bound...
book is probably from an Irish monastery and scholars are working on ways of turning the vellum pages without damaging them before restoring the entire book.


Cool Cows Produce More Milk

Cows placed in air-conditioned conditions have been shown to produce 10% more milk. It is also claimed that cows suffer from heat stress at temperatures as low as 22°C. This puts particular pressure on cows raised in hot places such as Israel, but also during increasingly hot European summers, enhancing the need for air-conditioning equipment. The cooling can also counter reduced birth trends in the summer as cool cows tend to produce more offspring.

RACA Journal, October 2006

Technology

Supercooling the LHC

CERN’s Large Hadron Collider (LHC) will be, upon its completion this year, the new research instrument of the world’s elementary particle physics community. This discovery-making machine will explore the structure of matter and basic forces of nature on a scale never attained before. Research will focus in particular on the Higgs boson, the hypothetical particle which plays a key role in explaining the origins of mass but has not yet been observed.

Beams of protons circulating in opposite directions along the 27-km-circumference LHC, at 99.99999% of the speed of light, are brought into collision at the heart of 4 large detectors installed in deep underground caverns, where the resulting spray of particles is analysed and recorded. The LHC is to produce up to 600 million such particle collisions per second. High-field superconducting magnets are required to guide and focus the beams. This implies high electrical currents, which can only be accommodated by superconducting windings made of niobium-titanium alloy offering no resistance to electricity, and therefore no dissipation. To maintain the magnet windings in the superconducting state under high currents and high fields, they must be cooled down to −271°C, just 1.9°C above absolute zero by sub-cooled helium. At this temperature, the helium becomes superfluid, i.e. it exhibits high thermal conductivity and minimal friction and viscosity. The magnets are thus better cooled, so that they can operate at higher field and are better stabilized against thermal disturbances.

In view of the sheer scale of the project and of its technical novelty, specific technologies were developed over the years by CERN, national laboratories and the specialized industry, thus permitting construction to start a decade ago. While most of the components and technical systems were procured satisfactorily from industry in the 20 CERN Member States, as well as in Canada, India, Japan, Russia and the USA, some difficulties plagued the procurement of the compound cryogenic line circling the ring, causing delay in the project installation. After vigorous corrective actions taken by CERN and the contractor Air Liquide, this unprecedented installation was completed in October 2006 with a better performance than initially expected.

The LHC will constitute the largest helium cryogenic system in the world, with some 100 tons of liquid helium cooling 36 000 tons of equipment at a temperature “colder than outer space” as says Philippe Lebrun, who is in charge of the main technical systems of the project and President of the IIR’s Commission A1.

Le Monde, October 19, 2006

http://press.web.cern.ch

PCMs and ice slurries

Phase-change materials: two recent applications

Phase-change materials (PCMs) can provide thermal storage which means that they can absorb thermal energy when they solidify and release it when they melt. This can be very useful to dampen temperature swings.

PCMs are usually water-based and are either non-organic as in the case of sodium chloride, calcium chloride or ammonia, or organic, and usually alcohol-based, or wax, as in BASF’s new Micronal phase-change capsules. These capsules were originally used in space exploration, for instance in astronauts’ spacesuits, but also for soldier’s garments. The innovation consists in applying this technique to interior plaster or plaster walls: Michael Guibault, a Marketing Manager for BASF’s Construction Polymers business in North America claims that “the thermal capacity of a one-half-inch thick plaster layer with 30% Micronal is roughly equivalent to that of a six-inch thick brick wall.” This can enable a reduction in air-conditioning and heating needs, and can also reduce energy costs and improve comfort.

Celmagref, an institute based in the Paris suburbs, is currently working on a PCM application for refrigerator casings that could enable better food preservation and less risks in the case of power cuts: a refrigerator and freezer incorporating such materials could store enough thermal energy to maintain the temperature down for over 14 hours without requiring compressor operation. An experimental model has been designed: a 10-mm-thick plate containing a PCM was placed between the evaporator and an insulant. The initial tests demonstrated that the system had an 18 hours self-sufficiency and its COP was improved by 20%. The system should only entail easy and minor alterations to existing refrigerators.


Cryotherapy

Whole-body cryotherapy: what does it feel like?

Whole-body cryotherapy (WBC) began in Japan in the 1980s. Applications include fibromyalgia, chronic joint and spinal pain, neurodermatitis and psoriasis. Swelling and pain due to sports injuries or surgery also respond well to WBC. Patients undergoing WBC are treated for a few minutes in a small chamber at −110°C. During treatment, the skin temperature drops to 2°C but the body temperature drops only slightly (by 0.1-0.2°C). Pain
Barney Calman has described first-hand experience of WBC in the Daily Mail. He was treated at London’s Kriotherapy Centre and donned a face mask, shorts, socks, gloves and clogs before being subjected to –90°C for a few seconds then –120°C for 2 minutes. He describes sensations ranging from initial stinging to burning then numbing while in the cold chamber. Dilatation of peripheral blood vessels on emerging from the chamber then produces a sensation of well-being. Sportsmen undergoing regular treatment claim faster recovery between training sessions. Experts differ in their opinions of the value of WBC; among physiological effects cited as beneficial are increased production of cortisol and among physiological effects cited as beneficial are increased production of cortisol and raised levels of creatinine kinase.

http://www.dailymail.co.uk/pages/livearticles/h health/healthmain.htm?in_article_id=416211&id=n_page_id=1774&ico=Homepage&icl=TabMo dule&c=GOOD%20HEALTH&c=5
http://www.back.de/en/Whole_Body_Cryother apy_WBC_Pain_relief_at_minus_110_C.html

Better air in planes - at last!

A series of technical changes is making it possible to improve the quality of cabin air in airplanes which until now has been invariably dry and poor in oxygen. The reason: the air was derived from the jet engines. This so-called “bleed air” is mixed with fuel and combusts and reaches such high temperature and pressure that it then has to be cooled and filtered through high-efficiency particulate air (HEPA) filters. However, HEPA is relatively recent and 25% of the US commercial fleet is not equipped. In existing planes, the air is compressed to the same pressure as approximately 2500 m above sea level. The fact that planes are made up of aluminium components riveted together is an obstacle to higher air pressure which would cause too much wear and tear to the fuselage. And higher humidity rates would cause corrosion, consequently the air humidity rates are at about 4% and the only humidity comes from the occupants’ breath.

In the new Boeing 787, the air will be vented directly through inlets on the lower part of the plane and will not go through the engines. An electrical system, driven by power generated from the engines, will humidify the air to 15% humidity, which is possible as the plane’s fuselage is made of non-corrosive composite material. The air can also be compressed to pressures similar to those at 1900 m above sea level. The system is also HEPA-equipped and has an additional filter to remove volatile organic gases due to hand wipes, cologne, vinyl, etc. that build up inside the plane making some passengers feel ill.

The innovative system promoting passenger comfort is considered by airlines as an important consideration when buying a plane and 400 aircraft are now on order.

www.usatoday.com

Briefs

- Reducing the TEWI by reducing channel size
  The TEWI (Total Equivalent Warming Impact) makes it possible to measure the total impact of a system on global warming. The direct effect is produced by refrigerant loss. The indirect effect is produced by the CO₂ released when producing the electricity operating the system. In order to minimize this, Cemagref is seeking to reduce the overall TEWI of refrigeration systems by reducing the size of the exchange’s channels. The studies aimed primarily at demonstrating that the use of mini-channels was compatible with thermal and energy efficiency. Fundamental research concentrated on pressure drops in small-diameter pipes and miniaturization of energy efficiency and consumption. This led to the construction of a prototype allowing for a 10-fold reduction in refrigerant for the same energy efficiency. The application concerned the cooling of 16 000 tonnes of refrigerant, which could be reduced to 2000 tonnes, not to mention potential air-conditioning applications. The direct TEWI could be reduced by 90% and the indirect TEWI by 10-20% which led to an expected overall TEWI reduction of approximately 50%. Applying this technology to the 600 000 systems in France alone could lower CO₂ equivalent annual emissions by up to 1 200 000 tonnes, i.e. approximately 2% of the French energy sector’s greenhouse gas emissions.


- MAC: what refrigerant will replace HFC-134a?
  Following the adoption of the new European Directive 2006/40 on emissions from mobile air-conditioning systems – which bans F-gases with a GWP higher than 150 (such as HFC-134a) as of 2011 for new models of cars and similar Californian legislation, the industry is being pushed to develop new alternative refrigerants, in parallel to intense R&D led on CO₂.
  After Honeywell, which gave further information on its new “H-fluid” (see Newsletter No. 28), DuPont Refrigerants recently unveiled the first demonstration of its new DP-I refrigerant. DP-I is a 2-component, non-flammable blend; the major component is a new non-flammable, fluorine-based compound; the minor component is a commercially available refrigerant. According to DuPont, DP-I offers properties and performance similar to that of R-134a while featuring 0 ODP and a GWP estimated at 40.
  INEOS Fluor – which was the first company in the world to commercially offer HFC-134a in 1990 – also announced it “has developed and is currently testing a new proprietary refrigerant designed to meet the long-term needs of automotive manufacturers in Europe”.

- Walking in space
  Interested in spacesuits? Spacesuits have to protect the human body from the extreme conditions encountered in space where temperatures can range from -135°C in direct sunlight to -82°C in areas of shadow. Cooling during spacewalking is provided thanks to a liquid cooling and ventilation garment fitted with a network of tubes through which water is pumped in order to remove excess heat. Take a close look at the cooling, life-support and other technology involved:
  http://news.bbc.co.uk/1/hi/science/5120294.stm

- Snow fleas and transplant organs
  Researchers have discovered that a potent antifreeze protein (AFP) that protects snow fleas from freezing may allow longer storage of transplant organs. The protein has been isolated and inhibits ice growth, potentially making it possible to store transplant organs at lower temperatures than those currently used, i.e. freezing point or slightly above. The snow-flea AFP breaks down in warm temperatures and will not induce antibody production in patients receiving organs. Another potential application of such AFPs is the inhibition of crystallization in frozen foods.

- Britain’s greenest supermarket?
  Tesco has opened its flagship environmental store in Wick in northern Scotland. The 4600 m² store is expected to produce 50% less carbon emissions than a conventional supermarket of comparable size. Besides using wind turbines, solar cells and natural light, the store features energy-efficient refrigeration systems and bakery ovens and cold air retrieval enabling cold air to be moved from the refrigerated areas to warm areas of the store.

Regulations-Standardization

US

- The US food industry’s preparation to R-22 phase-out was one of the issues addressed at the 27th annual Food Marketing Institute Energy Conference in Phoenix, US, in September 2006. At least 70% of US commercial refrigerating systems still use R-22 and key phaseout deadlines will start in 2010:
  - Jan. 1, 2010: ban on production and import of R-22 and R-142b, except for ongoing servicing needs in equipment manufactured before Jan. 1, 2010 and ban on remaining production and import of these refrigerants by Jan. 1, 2020;
In the 1990s, China emerged as a low-cost exporter of food products such as vegetables, meat, frozen vegetables and fruit and seafood – including canned food, some vegetable juices – must be produced using certain standards in Japan, Europe and other countries. In 2005, officials announced plans to update the 1995 Food Hygiene Law covering consumers. China’s exports slowed when shipments were rejected for failing to meet stringent standards in Japan, Europe and other countries. In 2005, officials announced plans to update the 1995 Food Hygiene Law covering consumers.

China

- Food safety improvements underway

In the 1990s, China emerged as a low-cost exporter of food products such as vegetables, apples, seafood and poultry. But in recent years, China’s exports slowed when shipments were rejected for failing to meet stringent standards in Japan, Europe and other countries. In 2005, officials announced plans to update the 1995 Food Hygiene Law covering consumers.

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**IIR Newsletter** is a quarterly publication of the IIR

**Managing Editor:** Didier Coulomb

**Editor:** Jean-Luc Dupont

**Editorial assistants:** Susan Philippou Mitchell, Gerard Vidal, Cornelia Keizer, Thomas Michineau

**Graphic Design:** Arobase Communication