# CAST Communications

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CAST (Computers and Systems Technology) is a division of the AIChE (American Institute of Chemical Engineers)


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# EDITORIAL NOTES

**About This Issue**
by Peter R. Rony and Scott E. Keeler

This issue contains two interesting pieces by Peter Rony. One is a collaboration with his sister, Ellen, in a speculative look at the future of computing, "The Toasternet Society". The other is a short communication correcting the record to inform the readership that Andy Grove of Intel (Time's Man of the Year for 1997) is in fact a graduate chemical engineer by training.

The Editorial Board of the Newsletter would like to congratule the winners and runners up of the first CAST Director's Award for best poster presentation at the Annual Meeting.

The CAST Communications editorial staff is proud to have been recognized by the AIChE for their work by being awarded the 1997 Marx Isaacs Award for Outstanding Division Newsletter. Much of the credit for this award must go to Angela Lewis for the many creative changes that she made to the Newsletter over the past several issues. The award citation includes the statement "...*CAST Communications* is a model for how a division newsletter can provide an excellent and substantial member benefit". This is the third time CAST Communication has won this award.

The extended delay in the publication of this issue of the Newsletter requires some explanation. Angela Lewis, at DowAgroSciences, has been in charge of the assembly and layout of CAST Communications for the past several issues. During that time she has made many creative improvements to the format of the Newsletter that have enhanced the quality of the publication. Recently, Angela was promoted from a position as an Office Professional in R&D to a position as a Market Research analyst (she now has her own O.P.) The Editorial Board would like to thank Angela for all her hard work and wish her continued success in her new career. Unfortunately, this move left CAST Communications without anyone to perform the layout tasks. Many thanks are due to Greg Robinson, Kathy Morris, and Karla Simpson at Dow AgroSciences for their help in the production of this issue of the Newsletter.

At their meeting in New Orleans in March, the CAST Executive Committee supported the suggestion by the Editorial Board of the Newsletter that they begin a transition towards an electronic version of CAST Communications. The intent, in agreement with staff from the AIChE, is to make an electronic version available on the AIChE Web server. The issue would be stored and maintained on this server and would be freely accessible. This issue was supposed to be the first one available in that form. With the extensive problems that the AIChE has been having with the roll-out of the new Web version of PTP submissions for the 1998 Fall Annual Meeting, the New York personnel have been unable to spend time helping with this issue of the Newsletter. Once the final deadlines are past for the 1998 Fall Meeting, work will begin to produce an electronic version of this issue of the Newsletter.

**ARTICLES**

# The ToasterNet Society: Billions of Networked Machines

*by Peter Rony and Ellen Rony*

*NOTE: This material has been adapted from the manuscript entitled, "The Domain Name Handbook: High Stakes and Strategies in Cyberspace", to be published by R&D Books, Miller Freeman, 1998.*

## Binary Computer-Network Addressing

The binary information system is used to encode specific computers on the Internet. Encoding tables, usually in the form of databases, are used. An example of an encoding table that can encode four different computers is as follows:

| Binary | Specific Computer |
|---|---|
| 00 | Computer 0 |
| 01 | Computer 1 |
| 10 | Computer 2 |
| 11 | Computer 3 |

This is called a 2-bit encoding table; four different, but related, items of information can be represented by four different binary quantities – 00, 01, 10, and 11. The greater the number of contiguous bits, the greater the number of items that can be encoded.

| Number of Contiguous Bits | Number of Encoded, Networked Computers Possible |
|---|---|
| 1 | 2 |
| 2 | 4 |
| 3 | 8 |
| 4 | 16 |
| 5 | 32 |
| 6 | 64 |
| 7 | 128 |
| 8 | 256 |
| 16 | 65,536 |
| 32 | 65536 x 65536 = 4,294,967,296 |
| 64 | 4294967296 x 4294967296 = $1.844674 \times 10^{19}$ |

## 64-Bit Computer-Network Addressing

In the early years of computer networking (1974 to 1981), less than 256 computer networks existed, and each of these networks generally consisted of only one computer. In 1981, network addressing expanded to 32 bits, corresponding to the possibility of 4,294,967,296 uniquely-addressed computers on a global computer network. R. Ullmann, in RFC 1475, proposed the specifications for "TP/IX: The Next Internet", an Internet in which there would be 64-bit network addressing with the potential to address 2 x 10^19 different computers.[i] The question, "Is 64 Bits Enough?", that he posed in his section 2.1 led to several interesting conclusions.

> **2.1 Is 64 Bits Enough? Consider: (thought experiment) 32 bits presently numbers "all" of the computers in the world, and another 32 bits could be used to number all of the bytes of on-line storage on each computer. (Most have a lot less than 4 gigabytes on-line, the ones that have more could be assigned more than one address.) So: 64 bits is enough to number every byte of online storage in existence today, in a hierarchical structured numbering plan. Another way of looking at 64 bits: it is more than 2 billion addresses for each person on the planet. Even if I have microprocessors in my shirt buttons I'm not going to have that many. 32 bits, on the other hand, was never going to be sufficient: there are more than 2^32 people.**

We look at the unfolding metapicture and address the question, 'What is the next (almost) unpredictable iteration of computer technology?' As examples from the relatively recent history of high technology, let us cite just two unanticipated

advances. First, the impact of the microprocessor chip (developed in 1971) upon the future of computing was not initially foreseen by firms such as IBM, Digital Equipment Corporation, or other mainframe and minicomputer manufacturers. Little did they appreciate, during the 1970s, that the commercial future of their proprietary computer hardware and software was jeopardized by the humble 16-bit microprocessor chip. Second, the impact of modest computer networking research by a small and obscure U.S. Department of Defense agency called ARPA was not initially predicted by communications, computer hardware, or computer software firms such as AT&T, IBM, Digital Equipment Corporation, Microsoft, Lotus, etc. During the 1980s, none of them anticipated that the explosively growing, worldwide Internet of the 1990s loomed in their futures.

So, what might be the next surprise associated with advancing computer technology? It may not have an impact the magnitude of the creation of the microprocessor or the worldwide Internet. The surprise – to most people – will be a staggering increase in computer interconnectedness (a.k.a. networking) based upon single microprocessor chips embedded in almost any type of electronic or electromechanical device. Paul Mockapetris says the interconnected world will need tools for registering 100 million objects.[ii]

For every personal computer that you now have, about 50 to 100 embedded-microprocessor machines surround you – your TV set, microwave oven, VCR, cellular phone, automobile, ordinary phone, children's toys, and, yes, even your humble bread toaster. The **Toasternet Society** is the name that we have given to a worldwide community within which millions of embedded microprocessors are connected to the Internet. By the 21st century, we may be able to paraphrase the famous New Yorker cartoon to remind us that, "On the Internet, no one knows it's a toaster!"

*Figure 1: A toaster for the computer age*

Nicholas Negroponte, Professor of Media Technology at M.I.T, in his national best-selling book, "Being Digital", stated: [iii]

> **Early in the next millenium your right and left cuff links or earrings may communicate with each other by low-orbiting satellites and have more computer power than your present PC. . . .**

**If your refrigerator notices that you are out of milk, it can 'ask' your car to remind you to pick some up on your way home. Appliances today have all too little computing.**

**A toaster should not be able to burn toast. It should be able to talk to other appliances. It would really be quite simple to brand your toast in the morning with the closing price of your favorite stock. But first, the toaster needs to be connected to the news.**

**Your home today probably has more than a hundred microprocessors in it. But they are not unified. The most integrated home system is probably the alarm system and, in some cases, the remote control of lights and small appliances. Coffee makers can be programmed to grind and brew fresh coffee before you wake up. But if you reset your alarm to ring forty-five minutes later than usual, you will wake up to terrible coffee.**

**The lack of electronic communication among appliances results in, among other things, very primitive and peculiar interfaces in each. For example, as speech becomes the dominant mode of interaction between people and machines, small accessories will also**

**need to talk and listen. However, each one of them cannot be expected to have the full means of producing and understanding spoken language. They must communicate and share such resources.**

**A centralist model for such sharing is tempting, and some people have suggested information 'furnaces' in our basement -- a central computer in the home that manages all input and output. I suspect it will not go that way, and the function will be much more distributed among a network of appliances, including one that is a champion at speech recognition and production. If both your refrigerator and your cupboard keep track of your food by reading universal product codes, only one of them needs to know how to interpret them.**

**The terms 'brown goods' and 'white goods' are used to differentiate between kitchen-top appliances like toasters and blenders and larger, usually built-in, machines like dishwashers and refrigerators. The classic division between white and brown does not include information appliances, which must change, because white goods and brown goods will increasingly be both information consuming and producing.**

**The future of any appliance is likely to be a stripped-down or puffed-up PC. One reason to move in this direction is to make appliances more friendly, usable, and self-explicating. Just think for a moment about how many machines you have (microwave oven, fax machine, cellular telephone) that have a giant vocabulary of functions (some useless) about which you have not bothered to learn, just because it is too hard. Here is where built-in computing can help a great deal, beyond just making sure the microwave oven does not soften the Brie into a puddle. Appliances should be good instructors.**

## The Domain Name System (DNS)

A **domain name** is the alphanumeric equivalent of a 32-bit hierarchical address that identifies both a specific personal computer and a specific computer network among the millions of networked computers worldwide. The Domain Name System (DNS) consists of two-letter standard alphanumeric codes for more than 150 countries around the world, plus a group of international top-level domains (iTLDs) that include EDU (higher education domain), COM (commercial domain), NET (network domain), ORG (not-for-profit and professional organization domain), GOV (U.S. government domain), MIL (U.S. military domain), and INT (international treaty domain).

If you glance at the 1998 CAST Executive Committee listing on the inside front cover, you can identify email addresses such as:

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The CAST list of email addresses includes the top-level domains, COM, EDU, and NET.

The most popular domain is the COM domain, which currently has more than one million registered domains. In 1993, Network Solutions, Inc. (NSI) was awarded a five-year contract by the National Science Foundation to administer and register the COM, ORG, and NET domains, for which they currently charge registrants a $50 per year registration fee. This NSF agreement ends on March 31, 1998, a date when the media may widely report the fact that consensus had not been achieved concerning the future of domain name registration.

Having discussed, in the *Domain Name Handbook* , the technical aspects of domain name registration, legal issues associated with domain name disputes, and alternate approaches to the InterNIC registry (as we knew it in summer 1997), the opportunity has arrived for the authors to consider an alternative future for international domain name registration processes. We do so in the context of the following quote by Eric Schmidt, the chairman of Novell, Incorporated:[iv]

> **Novell Inc's chairman and chief executive, Eric Schmidt, called the Internet the 'fastest growing phenomenon in the world' Thursday and said its potential is in its infancy. . . . We are not at the end of a phenomenon, but at the beginning of a whole new set of things', Schmidt said. . . . Schmidt said networks will evolve so that 'every person, every thing, every object' will be connected until 'the only thing that is left is outer space. And we will work on that'. The next big 'killer application' for the Internet will be the expansion of bandwidth, or the ability to send and receive huge amounts of information in a short amount of time, he said.**

## The Future of the Internet?

Our thoughts about the future of the Internet rest upon a few basic assumptions:

1. The worldwide Internet will expand to include not just individual and corporate personal computers, but also to include the embedded microprocessors (inexpensive microcontrollers) within toys, digital cameras, microwave ovens, VCRs, cellular phones, business machines, and so forth.

2. The Internet will be scaled to communicate with such embedded microprocessors.

3. The networking of household and organization microprocessors will expand substantially within the next 10-20 years. Each household and organization ultimately will have its own local, embedded-processor network. People did not predict the enormous impact of the Internet. Many will also underestimate the emergence of household processor networks.

4. In the future, the Domain Name System (DNS) will have to contend with millions, if not hundreds of millions, of household processor networks, each network handling up to 126 embedded processors. Add to this number the millions of small businesses throughout the world.

5. Domain Name System issues may well shift from business and trademark considerations to household considerations. There may be less need for, or interest in, generic-word domain names. The Domain Name System (DNS) in the future may need to focus on households, families, and individuals rather than on business products, business names, and international business trademarks.

6. Network addressing will expand beyond 32 bits to either 64 bits or 128 bits .

7. In the future, the Domain Name System will need to solve the problem of addressing individuals and families, a problem that both the worldwide postal systems and telephone systems already have solved.

In other words, we believe that the key issue for the future does not involve how domain disputes are settled or national and international trademark laws -- as was the case in 1997. Rather, we believe that the key issue for the future is the scaling of the Domain Name System to accommodate the contemplated total

number of computers that will be networked worldwide. We performed the following calculations:

How many individual computers can be addressed using a 32-bit addressing scheme? Approximately 2 to the 32nd power, or 65,536 x 65,536, or (in four-decimal-octet notation), 256 x 256 x 256 x 256, all of which equal 4.294967296 billion computers, approximately one computer for every human being on this planet. Or approximately 171.7986918 million families each of which has three personal computers as well as embedded microprocessor chips with Microsoft's "microWindows" operating system in at least one toaster, one microwave oven, one electric range, one refrigerator, one electric can opener, one home security system, one GPS dish, one adult entertainment center, one "parent-rated" teenage entertainment center, two automobiles, one cellular phone, and nine children's toys. Even 32-bit addressing will be insufficient. A future DNS – call it DNS II – will likely contend with 64-bit addressing, which will identify not only hosts, servers, clients, and personal computers, but also embedded microprocessors in electronic and electromechanical machines.

We are aware of Microsoft chairman Bill Gates' vision of an operating system (presumably from Microsoft) contained in every item of home equipment that uses an embedded microprocessor chip, which is an inexpensive computer. Our question is, 'What trends will occur when up to 64 or 126 of these embedded microprocessor chips become part of household intranetworks, which are then linked to an international network such as the Internet?' For purposes of argument, humor, and speculation in this chapter, we shall call the household intranetwork by the name, **ToasterNet**.

Could the Internet backbone accommodate ToasterNet communications? In our opinion, yes. If a high-bandwidth Internet backbone can rise to the occasion of transmitting large digital video and digital audio files, it will also be able to handle communications in a ToasterNet society.

## Toasternet Examples and Definitions

The toasternet concept is not a new idea; it was alive and well, in a variety of forms, on the World Wide Web in 1997. In this article, we use toasternet in the context of the following definition:

**toasternet** – A household computer network that is based upon the networking of small, embedded microprocessors (or microcontrollers) within electronic and electromechanical machines such as microwave ovens, digital cameras, stoves, television sets, stereos, VCRs, children's toys, and so forth.

Better definitions exist. The term, toasternet, has been applied to community networks. One definition for such a network that is available on the web is,[v]

**toasternet** <networking> 1. A low cost, low tech, publicly accessible local community network. This is probably an extension of the term "toaster" used to mean a small, cheap, slow computer. community networks. 2. The title of some informal notes on Internet addressing, ("Toasternet Part I and II"), circulated on the IETF mailing list during November 1991 and March 1992. Subsequent work was published in June 1993 in RFC 1475 and RFC 1476 and the "CATNIP" Internet-Draft by Robert L. Ullmann (01 May 1995)

An alternative definition is given at a web site that answers the question, "What are community networks?"[vi]

**toasternets** -- A Toasternet is a cooperative network built to provide members with cheaper Internet access; it takes advantage of less expensive hardware and software to keep prices low. The key word is "cheap," which is where "toaster" fits into the name. Read a better definition of "Toasternet."

This refers a viewer to an article, "Toasternets: An introduction on building your own," by Tim Pozar, who provides the following definition:[vii]

**toasternet** -- The generic term for Internet-connected computer networks built very cheaply so as to have a cost that a small business, school or individual can afford. In fact, it has been jokingly said that these networks are so cheap, you can connect everything in sight, including your toaster. Generally speaking, most Toasternets exist to meet a group's or individual's communications needs, rather than profit as a motive.

In his article, Pozar summarizes the hardware and software elements – e.g., POP, the links (T1 and 56 Kb/s leased lines, or Pots – plain old telephone service), LADD circuits, and routers -- necessary to create a small community network.

Jonathan Steuer provided an essay on toasternets that focused more on electronic machines rather than community networks:[viii]

> **You've fingered Coke machines, coffeemakers and Christmas trees. But never in your net travels have you encountered that most venerable and ubiquitous of home appliances: the toaster. You wonder: "Why would anyone build an entire network of bread-browning devices?" A fine question. But toasternets are not actually comprised of toasters and network cable. Rather, the term "toasternet" refers generically to small computer networks built out of cheap and readily available parts. . . . The least expensive gateway to the Net is a '386 running one of the free versions of UNIX (such as Linux or NetBSD), though other UNIX boxes will also work just fine. . . . Happy toasting!**

We refer you to the original Wired Ventures, Ltd. web page for the complete essay. John Romkey provided an amusing essay on his involvement with "the Internet Toaster",[ix]

> **While I was at Epilogue, we created an Internet Toaster for Interop in 1990. I wanted to get people thinking of SNMP not just as getting variables, but for control applications, a wider vision. So we had an SNMP controlled toaster. If you put bread in the toaster, and set a variable in SNMP, the toaster would start toasting. There was a whole MIB written up for it, including how done you wanted the toast, and whether it was a bagel or Wonderbread. In order to figure out a matrix of how long to toast a bagel or Wonderbread to get it done to a specific doneness, I ended up with lots and lots of bread in my garage. The other exhibit we had that year was a weather station. I created a MIB that modeled Weather information, so that you could gather information from weather stations around the net, and query the weather state. But we never got that deployed. The Internet Toaster got a lot of attention because of the novelty of it, but I don't think that managing your kitchen through SNMP is very practical today. I would never say that anyone should connect their appliances and try to manage it using today's protocols. However, to have a Toaster connected to an Ethernet shows a lot about the state of the technology and where it can go. So you should think in terms of using a network technology two or three generations beyond Ethernet to link appliances two or three generations from now.**

Though "Managing your kitchen through SNMP [may not be considered as] very practical today", the inexorable evolution of computer interconnection may make the household network practical within 10 to 14 years.

Speaking of Internet-capable toasters and weather stations, a "Devices and Gadgets on the Net" web site[x] provides a comprehensive listing that includes indoor cameras, outdoor cameras, weather cameras, coffee machines, fractal generators, aquariums, artificial life, and animals. Links are even available to "Leonard's CAM World", "EarthCam", "Tommy's Live Cam Worldwide", "The Digital Camera Network", and "Yahoo's list of outdoor spy cameras". Clearly, digital cameras will lead the movement to the toasternet society. A digital camera is a higher-bandwidth machine than a humble toaster, but it is substantially more practical on the Internet. A second "Devices & Gadgets on internet" web site[xi] provides a smattering of links to cameras, a coke machine, a coffee pot, and CD players.

During the mid-1970s, hobbyist microcomputers thrived and set the stage for the entrepreneurial efforts of Stephen Wozniak and Steve Jobs and others leading to the creation of the personal computer industry. We believe that history is repeating itself: hobbyist Internet-linked devices-&-gadgets will likely set the stage for the entrepreneurial efforts of individuals leading to the creation of the household network industry. This is a commercial opportunity whose time has come.

At the **Boardwatch** web site, **http://www.boardwatch.com/mag/97/june/bwm52.htm**, Jack Rickard's article, "Small Office Connections to the Internet", describes two interesting products – the Whistle Interjet and APEXX Team Internet -- directed at facilitating the creation of a small business LAN and its connection to the Internet.[xii] Rickard describes the nature of the business opportunity for such products:

> **Meanwhile, in the reality zone, the majority of "businesses" are much smaller, and thus far, they're not quite online. There are a little over seven million "businesses" with fewer than 100 employees operating within the United States. We found it interesting to learn that just under 14 percent of those business had a local area network—a little over a million, and that about half of those were connected to the Internet. Additionally, it is interesting to note that about 1.1 million businesses that don't have a LAN, are on the Internet—using cheap $20 dial-up accounts. That would seem to indicate that there are over a half million small businesses with LANs and no connectivity, and over a million additional businesses with computers and dial-up connections, with no LANs. Any way you cut it, there is a large number of small businesses who use computers but aren't connected to the Internet in any meaningful way beyond an e-mail box on a dial-up network somewhere—if that.**

*Figure 2:The Whistle Interjet*

And what is the Whistle Interjet? Rickard calls it "the Toaster" (see Figure 2).

> **The box itself is something of a marvel. It is actually a 75 MHz 80486 Intel microprocessor with 8 MB of RAM and a 1.2 GB hard drive. It uses a version of the FreeBSD UNIX operating system with some Whistle software. But it's packaged in a box the size and shape of a toaster. It has no real keyboard or monitor. It does have a four-port Ethernet hub built into the back of it.**

No keyboard, no monitor! Therefore, an inexpensive networking box. This is probably the forerunner of the household networking box, which likely will differ from the Interjet because it may be wireless. For further details, contact Whistle Communications through their web site.[xiii] What is interesting about the Whistle Interjet is how it finesses IP addressing through the gimmick of an ***isolated private network***,

> **Like many similar devices, the InterJet does not really set up a Class C Internet address. Rather, it uses the 192.168.1.xxx convention. This is a kind of pseudo Class C with the full 255 addresses, but 192.168.1.xxx by convention doesn't actually exist on the Internet. It is used for isolated private networks. The InterJet then "translates" these IP addresses when communicating with anyone on the public Internet to appear to be a single IP**

> **number—which can be dynamically assigned. The 192.168.1.xxx addresses only exist internally. Most of these proxy agent gateways use this convention.**
>
> **This has a couple of advantages. First, it simplifies network setup and administration. The software can assume the network addresses to some degree. But further, it actually offers a bit of security. No one on the rest of the Internet can actually access a machine on the local network because they don't actually have a true IP address. This creates a bit of a crude firewall all by itself.**
>
> **It does have some limitations. For example, we found the Microsoft PING command worked fine over this network, but TRACERT didn't actually work. Whistle provides their own TRACEROUTE function in the diagnostics menu, but it is possible that some applications just won't work through the IP number translation.**

Inexpensive business and household network boxes certainly appear to be products that are in our future. They may appear when the future Domain Name System is scaled to accommodate them. Paul Mockapetris, the acclaimed father of the DNS, addressed a group of Internet Service Providers in the summer of 1997 on the subject of the future of the DNS. He asked, rhetorically, 'Where do we need to go?' The three objectives that he named were: security, automatic management tools and tools for registering 100 million objects.[xiv] That is 100,000,000. What kind of objects does he expect to see in the future of the DNS? That's right, toasters!

## Toasternet Humor

Nowhere is it written that one cannot add a bit of levity to the DNS discussion. As proof of the phenomenon of simultaneous scientific discovery, we thought it appropriate to end this article with the following message, which is one of the humorous tidbits anonymously circulating the Internet during 1997.[xv] The opinions expressed do not necessarily reflect our own on matters of toaster development, registration, administration and marketing. We do not know the identity of the author.

**If IBM made toasters...**
They would want one big toaster where people bring bread to be submitted for overnight toasting. IBM would claim a worldwide market for five, maybe six toasters.

**If Xerox made toasters...**
You could toast one-sided or double-sided. Successive slices would get lighter and lighter. The toaster would jam your bread for you.

**If Radio Shack made toasters...**
You could buy all the parts to build your own toaster.

**If University of Waterloo made toasters...**
They would immediately spin off a company called WatToast.

**If ParcPlace made toasters...**
Their OO building block system would be called EGGO.

**If Oracle made toasters...**
They'd claim their toaster was compatible with all brands and styles of bread, but when you got it home you'd discover the Bagel Engine was still in development, the Croissant Extension was three years away, and that indeed the whole appliance was just blowing smoke.

**If Sun made toasters...**
You could get a really good cuppa Java to go with them.

**Does DEC still make toasters?...**
They made good toasters in the '80s, didn't they?

**If Hewlett-Packard made toasters...**
They would market the Reverse Polish Toaster, which takes in toast and gives you regular bread.

**If Tandem made toasters...**

You could make toast 24 hours a day, and if a piece got burned the toaster would automatically toast you a new one.

**If Thinking Machines made toasters...**
You would be able to toast 64,000 pieces of bread at the same time.

**If Cray made toasters...**
They would cost $16 million but would be faster than any other single-slice toaster in the world.

**If The Rand Corporation made toasters...**
It would be a large, perfectly smooth and seamless black cube. Every morning there would be a piece of toast on top of it. Their service department would have an unlisted phone number, and the blueprints for the box would be highly classified government documents. The X-Files would have an episode about it.

**If Sony made toasters...**
The ToastMan, which would be barely larger than the single piece of bread it is meant to toast, can be conveniently attached to your belt.

**If Timex made toasters...**
They would be cheap and small quartz-crystal wrist toasters that take a licking and keep on toasting.

**If Fisher Price made toasters...**
"Baby's First Toaster" would have a hand-crank that you turn to toast the bread that pops up like a Jack-in-the-box.

**If the Franklin Mint made toasters...**
Every month, you would receive another lovely hand-crafted piece of your authentic hand-crafted Civil War pewter toaster.

**If Costco made toasters...**
They'd be really cheap, as long as you bought a six-pack of 'em.

And, of course:
**If Microsoft made toasters...**
Every time you bought a loaf of bread, you would have to buy a toaster. You wouldn't have to take the toaster, but you'd still have to pay for it anyway. Toaster '95 would weigh 15,000 pounds (hence requiring a reinforced steel countertop), draw enough electricity to power a small city, take up 95% of the space in your kitchen, would claim to be the first toaster that lets you control how light or dark you want your toast to be, and would secretly interrogate your other appliances to find out who made them. Everyone would hate Microsoft toasters, but nonetheless would buy them since most of the good bread only works with their toasters.

**If Apple made toasters...**
It would do everything the Microsoft toaster does, but five years earlier.

---

[i] R. Ulmann, "TP/IX: The Next Internet", RFC 1475, at **http://sunsite.auc.dk /RFC/rfc/rfc1474.html** .

[ii] Dr. Paul Mockapetris, "Getting the Most from DNS Now and into the Future," ISPCON (San Francisco) August 21, 1997.

[iii] Nicholas Negroponte, "Being Digital", Vintage Books, 1995.

[iv] "Net convention produces heady predictions, rampant enthusiasm", Roanoke Times, page A7 (July 25, 1997).

[v] toasternet, at **http://wagner.princeton.edu/foldoc/cgi-script/toasternet** .

[vi] "What are community networks?", at **http://www.nortropic.com/lis341/cgold/commnet.html** .

[vii] Tim Pozar, "Toasternets: An introduction on building your own," at **http://www.draft.com/~torin/nexus/Info/toasternet.faq** .

[viii] Jonathan Steuer, "Toasternets", at **http://www.daft.com/~torin/nexus/Info/toasternets.what** . Copyright 1993,4 Wired Ventures, Ltd. All Rights Reserved. This article may be redistributed provided that the article and this notice remain intact. This article may not under any circumstances be resold or redistributed for compensation of any kind without prior written permission from Wired Ventures, Ltd. WIRED and WIRED Online are trademarks of Wired Ventures, Ltd. If you have any questions about these terms, or would like information about licensing materials from WIRED Online, please contact us via telephone (+1 (415) 904 0660) or email (info@wired.com).

[ix] John Romkey, "How PC-IP Came to Be", at **http://www.zilker.net/users/internaut/pc-ip.html** .
[x] "Devices and Gadgets on the Net, Part One", at **http://www.refdesk.com/Chapter15/gadgets.html** . See also "My Virtual Reference Desk – Table of Contents", at **http://www.refdesk.com/toc.html** .
[xi] "Devices & Gadgets on Internet", at **http://userwww.service.emory.edu/~zyu/devices.html** .
[xii] Jack Rickard, "Small Office Connections to the Internet", Boardwatch Magazine, Volume XI: Issue 6 - ISSN:1054-2760 - June 1997, at **http://www.boardwatch.com/mag/97/june/bwm52.html** . Copyright 1997 Jack Rickard - ALL RIGHTS RESERVED.
[xiii] Whistle Communications 110 Marsh Drive Foster City, CA 94404 Phone 415-577-7000 Fax 415-577-7005. At **www.whistle.com** .
[xiv] Dr. Paul Mockapetris, "Getting the Most from DNS Now and into the Future," Internet Service Provider Convention (ISPCON), San Francisco (August 22, 1997).
[xv] We wish to thank E.T. ("Perky") Perkins of Palo Alto, California for forwarding the toaster humor and many other comical notes during the course of writing the book. They helped lift our spirits as we slogged through the substantial mass of online material which we eventually condensed into this book.

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# COMMUNICATIONS

## Intel's Andrew Grove is Time's Man of the Year

by Peter Rony


One of the best kept secrets within the chemical engineering community is Dr. Andrew S. Grove [B.S. ChE 1960 City College of New York and Ph.D. ChE 1964, University of California at Berkeley], chairman and CEO of Intel Corporation, who was featured in Time's December 29, 1997 issue as Time's Man of the Year. The cover and story captions read, "His microchips have changed the world – and its economy," "The microchip is the dynamo of a new economy . . . driven by the passion of Intel's Andrew Grove," and "A survivor's tale."

Andras Grof, a name he would later Americanize to Andrew Grove, was born on September 2, 1936 in Budapest, Hungary. As a boy, he survived scarlet fever during the 1940 epidemic in Budapest; he survived World War II; and he escaped from Budapest into Austria in December 1956, barely ahead of the Red Army. He spent his first years in New York City living with an aunt and uncle who had immigrated from Hungry in the 1930s. He pursued a B.S. degree in chemical engineering at City College of New York, where he had nearly straight-A grades. He married his wife, Eva, in 1958, two years before he entered graduate school at the department of chemical engineering, University of California at Berkeley. The Editor, who also entered Berkeley with him in September 1960, remembers Andy as a graduate student.

At Berkeley, Grove studied fluid dynamics under chemical engineering Professor Andreas Acrivos.

Choosing a career course that was different from many of his Berkeley 1960 graduate student colleagues, Dr. Grove went directly to industry, to Fairchild Corporation. At the time, Fairchild was an industry leader in Metal-Oxide-Semiconductor (MOS) :hnology. [1]

Two Fairchild colleagues, Gordon Moore (who ran Fairchild's research department) and Robert Noyce (co-inventor of the integrated circuit), left Fairchild with Grove in 1968 in order to found Intel (from Integrated Electronics). The first Intel product was dynamic RAM. Intel's breakthrough product, announced in 1971, was the 4-bit 4004 microprocessor chip. In 1979, Grove replaced Moore as president of Intel, and in 1987, replaced Moore as CEO. Readers are encouraged to read the two "Man of the Year" articles in the December 29, 1997 issue of Time magazine for further details about the history and background of our world-famous chemical engineering colleague.

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*Above photo from December 29, 1997 Time magazine cover. Copyright © Time, Inc. 1997. All rights reserved.*

## 1997 Winners of the CAST Director's Award

by Michael F. Malone

The "CAST Director's Award," established in 1997, is given for the best poster presentations at the AIChE Annual Meeting. The First Place award consists of a plaque with citation and an honorarium of $500. There may also be up to three posters receiving Honorable Mention. The winners are selected by majority vote of CAST Directors, or substitutes selected by the Directors, who attend the poster session. The results will be announced as soon as possible after the meeting and a formal presentation of the plaque and honorarium for the First Place winner will be made at the CAST Award Dinner to author(s) attending the next AIChE Annual Meeting.

On behalf of CAST, I am delighted to announce the winners of the first annual CAST Director's Award at the 1997 AIChE Annual Meeting in Los Angeles. The title, authors and a short summary of the posters, along with a reference to more detailed information appears below. Please join us in congratulating the winners!

First Place Winner:

**Evaluation of the Contribution of Refinery Process Data to Performance Measures**

by Cyrille Alheritiere and Nina F. Thornhill, University College London, London U.K.
Stuart Fraser and Michael J. Knight, BP Oil, Sunbury U.K.

The objective of this paper is to create a framework for quantifying the contribution of process data to performance measures. Data are ranked according to the cost effectiveness of their contribution to improving refinery performance. Paper 215h
http://www1.che.ufl.edu/meeting/1997/annual/session/215/h/index.html

Honorable Mentions (In order of paper number):

**Model Predictive Control Design Using Partitioned Block Condition Numbers**

by Rahul Shridhar and Douglas J. Cooper, University of Connecticut, Storrs, CT

A new strategy for designing MPC has been developed that is based on condition numbers of specific partitioned blocks in the multivariable system matrix. This design strategy works particularly well for multivariable processes. Paper 214f
http://www1.che.ufl.edu/meeting/1997/annual/session/214/f/index.html

**Combined Model-based Iterative Learning and Feedback Control for Batch Processes or Processes with Repetitive Operations**

by Kwang S. Lee, Sogang University, Seoul Korea and Jay H. Lee, Auburn University, Auburn, AL

A novel framework for combined model-based iterative learning and feedback control is developed for batch or other repetitive processes, and a predictive control-type algorithm is derived under this framework. Paper 214u
http://www1.che.ufl.edu/meeting/1997/annual/session/214/u/index.html

**A New Method for Robust Autotuning**

by Mats Friman and Kurt V. Waller, Åbo Akademi University, Turku, FIN-20500, Finland

A new non-iterative method for autotuning of PI controllers with guaranteed closed-loop stability for low-pass systems is suggested. PI controller tuning is done with minimum specifications on both amplitude margin and phase margin. Paper 214v
http://www1.che.ufl.edu/meeting/1997/annual/session/214/v/index.html

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# PRIORITIZING FEDERAL R&D: A CHEMICAL ENGINEERING ANALYSIS OF DOE R&D PROGRAMS

*(An AIChE Position Paper)*

*Prepared by*
*The R&D Task Force*
*AIChE Government Relations Committee*
*May 1997*

***Serving Chemical Engineers Who Serve the World***

The American Institute of Chemical Engineers (AIChE), founded in 1908, is a non-profit, professional association that provides leadership in advancing the chemical engineering profession. Our membership of more than 55,000 is made up of individuals who work in industry, government, academia, and consulting, as well as students and retirees. The Institute's efforts in the public policy arena are geared towards using the expertise of our members to provide sound technical information to government officials and others involved in public policy issues that impact the practice of chemical engineering and the industries and organizations where chemical engineering is utilized.

Our members are creative problem solvers who use chemistry, physics, and mathematics to develop processes and design and operate facilities that alter the physical or chemical states of materials to make useful products at a reasonable cost and in the safest manner possible. They play key roles in critical industries such as chemicals, petrochemicals, petroleum, agricultural chemicals, biotechnology, ceramics, electronics, fibers, food, glass, paper, pharmaceuticals, plastics, primary metals, and specialty chemicals. Chemical engineers are also at the forefront of research on environmental protection, process safety, and hazardous waste management to assure the safe and environmentally sound manufacture, use, and disposal of chemical products.

**This commentary was prepared by the R&D Task Force of AIChE's Government Relations Committee.**

## PRIORITIZING FEDERAL R&D: A CHEMICAL ENGINEERING ANALYSIS OF DOE R&D PROGRAMS

### INTRODUCTION

The U.S. has a critical and long-standing interest in advancing science and engineering research and development. Science and engineering R&D fuels the nation's productivity and economic growth, raises our living standards, provides for national security, and sustains our quality of life. Economists estimate that half of U.S. economic productivity since World War II can be attributed to technological innovation, driven by science and engineering R&D investment.[1]

Considering that energy is the cornerstone of economic development and that its production and use causes more environmental impact than any other economic activity, it follows that the federal government should sustain its investment in energy R&D to further economic competitiveness, job growth, environmental protection, and quality of life. Americans rely on life-enhancing energy technology advances every day, and R&D sets the future direction for development and use of the nation's valuable energy resources.

Chemical engineers will continue to be key contributors to the interdisciplinary teams that will develop the world's future energy systems. The American Institute of Chemical Engineers (AIChE), a nonprofit professional association of more than 55,000 chemical engineers, believes that the federal government must maintain an adequate and effective investment in energy R&D that meets vital national needs.

***To optimize federal R&D investment in times of budget constraint, AIChE believes all R&D programs must be evaluated and prioritized based on collective input from government, industry, university, and other stakeholders. To advance this important goal, AIChE provides the following principles to help guide federal R&D funding, which can be applied to all R&D agencies.***

### PRINCIPLES FOR FEDERAL R&D INVESTMENT

- The federal budget must be balanced and no spending program should be insulated from potential reductions. Increasing federal borrowing eats away at capital that could be used for private investment, such as R&D.

- Across the board cuts in R&D should be avoided. R&D priorities should be set based on program quality and results, cost-effectiveness, consistency with agency missions and national goals, and the likelihood that such R&D would be conducted in the absence of federal support. Long-term economic growth, quality jobs, environmental protection, energy security, and export potential should be primary considerations for DOE R&D.

[1] *Science and Technology Shaping the Twenty-First Century*, Office of Science and Technology Policy, April 1997.

- Strong federal support must continue for basic science and engineering research at universities and federal laboratories. Such research provides the knowledge base for future technological advances and would not be conducted without federal investment. Rigorous merit review using expert peers should be emphasized to ensure technical quality and performance.

- R&D programs that encourage and involve collaborative research among industry, academia, and federal laboratories should be made high priority. Cooperative Research and Development Agreements (CRADAs) and other collaborative research combine technical knowledge across sectors and disciplines, leverage limited resources, and normally result in broader dissemination of technical advances, particularly when an entire industry is involved. These partnerships should be driven by mutual interest and mutual need.

- Targeting broad categories of R&D for cuts based on artificial boundaries can be counterproductive. While certain categories of research have drawn scrutiny as "corporate welfare," federal support is warranted for long-term, high-risk, and precompetitive applied research and technology development that meets national needs and is unlikely to receive private support in a competitive time-frame without federal investment.

- Federal support for short-term, lower-risk technology development and demonstration projects should be minimized because the responsibility has fallen increasingly to industry. Commercialization should be left to the private sector.

- Efforts to gain budget savings from DOE and other federal R&D programs should focus on improved coordination and reduced administrative, overhead, and compliance costs in order to minimize adverse impact on science and engineering research and world-class researchers.

- To maximize public investment, sufficient private cost-sharing on applied research and technology development and demonstration projects should be ensured to reduce the potential for federal spending on R&D that would otherwise draw full private investment. While DOE and other agencies must have flexibility to set the cost-sharing percentage by program area, generally it should increase as R&D efforts move closer to commercialization.

- Congress and R&D agencies should explore expanded use of industry royalty payments, or "recoupment," on technologies that are eventually commercialized by industry based on federal R&D support. While such recoupment comes with administrative difficulties, it is currently used by DOE and other agencies in select program areas.

- Congressional earmarks should be minimized, as they can interfere with proper program planning and competitive selection of research for funding. Support should be based on program quality and consistency with agency and national goals, not political clout.

- Federal policies to create an environment more conducive to private R&D investment should be encouraged, including a permanent and expanded Research and Experimentation (R&E) tax credit and meaningful product liability reform.

## APPLYING PRINCIPLES TO DOE R&D

AIChE believes there is a clear and necessary federal role in achieving affordable, secure, and cleaner energy supply and utilization through advances in technology. As the federal agency with primary responsibility for achieving these goals, DOE sponsors and conducts a diverse portfolio of R&D on cleaner, more efficient, and economically competitive energy technologies and on reducing adverse environmental effects of energy production and use. This work is carried out in a network of universities, companies, and national laboratories. While often invisible to the final user, DOE-supported R&D has advanced many critical technology areas. But because they are technical and difficult to understand, they go largely unnoticed.

***To help prioritize federal R&D, AIChE is committed to providing guidance to policymakers on R&D agencies that most affect chemical engineering. We believe DOE's complete portfolio of R&D should be measured against the principles for federal R&D investment stated above and recommendations from other relevant stakeholders in order to strengthen its public benefits. Accordingly, AIChE has selected key non-defense DOE energy R&D programs of particular importance—Fossil Energy, Conservation, Basic Energy Sciences, and Computational and Technology Research—and provides the following policy guidance and budget recommendations on those programs, consistent with the above principles. Energy R&D programs not included (solar and renewables, biological and environmental, etc.) may be addressed in future analysis.***

(The DOE energy R&D program areas addressed below are based on categories used by congressional Appropriations Committees.)

## FOSSIL ENERGY R&D

We believe that Congress should maintain strong funding for DOE fossil energy R&D given the widespread benefits that technological advances in fossil fuels contribute to the economy and environment. R&D investment in fossil fuel innovations is a cost-effective way to improve energy security and reduce air emissions and the associated costs of increasingly stringent regulations.

Today fossil fuels dominate the nation's energy consumption and will do so for the foreseeable future. As the dominant resources for power generation, transportation, and for providing raw materials for the chemicals, textiles, pharmaceuticals, and other industries, fossil fuels are in many ways the lifeblood of our economy. Eighty-five percent of our domestic energy consumption is supplied by coal, oil, and natural gas, and their combined contribution is expected to grow to 88 percent by 2010. The challenge before DOE and the nation is to ensure that the growing role of low-priced fossil fuels—which foster quality jobs, economic growth, and exports—do not carry unacceptable environmental or energy security risks. Chemical engineers will be instrumental in tackling this enormous challenge. DOE's fossil energy R&D program concentrates on developing domestic natural gas and petroleum supplies, providing cleaner, more efficient methods to utilize coal and natural gas to generate electricity, and converting coal and natural gas to produce clean liquid fuels and chemicals that can substitute for petroleum-based liquids.

### Coal R&D

AIChE believes coal R&D should receive priority within the fossil R&D program and that Congress should provide no less than the $100 million budget request for coal R&D. Budget constraints have forced a reduction in DOE coal R&D funding of nearly 40 percent in current dollars since 1994.

Twenty-five percent of the world's coal reserves are located in the U.S. Coal is clearly the nation's most abundant fossil energy resource, and DOE coal research advances offer long-term potential for secure, low-cost, and improved energy supply and reduced environmental impact.

Recognizing that coal will likely continue to generate over 50 percent of the nation's electric power for some time, major funding in coal R&D goes to advance cleaner and more efficient technologies for *coal-fired power plants*. DOE-supported cleaner combustion technologies, such as advanced low-NOx burners and low emission boilers, have reduced emissions of carbon dioxide, sulfur dioxide, particulates, and nitrogen oxides as well as the cost of regulatory compliance. Collaborating with industry, DOE has successfully demonstrated technologies that have increased coal-to-electricity efficiencies to 42-43 percent (compared with about 34 percent today) and is aiming for efficiencies of 50 percent, while decreasing electricity generating costs and reducing pollution. Engineering R&D on advanced combustion has been key to improvements in reducing pollution and the cost of coal-based power generation. R&D on advanced coal processing combined cycle technology seems likely to yield important breakthroughs.

DOE's longer-term, high-risk research into advanced catalysts has the potential to further new technologies for a secure supply of *clean liquid fuels* produced from coal, which eventually could reduce the import growth of conventional petroleum. DOE's coal-based clean fuels R&D demonstrates advanced concepts and furthers the potential for significantly reducing the cost of converting coal to a variety of cleaner burning liquid fuels and chemicals that could be used as substitutes for petroleum products. The nation must continue to explore ways to effectively convert coal to chemicals essential to economic growth. DOE advances in direct coal liquefaction technologies have likely shortened their time to market, but its goal of producing premium-grade liquid fuels at a competitive cost remains a formidable technical challenge. Chemical engineering contributions are critical in this area. This technology offers significant promise but its potential payoff is too distant to attract sufficient private sector R&D and should continue to be supported.

Although the coal industry is mature, these technologies require heavy capital investment in R&D and precommercial demonstration. Thus, while breakthroughs could have widespread benefits, longer-term, high-risk coal R&D is generally receiving less support from the coal and electric power industries in favor of projects with more immediate payoff and often less environmental benefits. While federal support for coal has been scrutinized given its carbon intensity, DOE-supported technology has made coal significantly cleaner, and continued advances on reducing its environmental impact are needed. Policymakers should not overlook coal's wide current use, domestic abundance, steady projected production costs compared to oil and gas, and its significant export potential in a market where key foreign competitors receive strong government support.

### Natural Gas and Petroleum R&D

The fossil program's natural gas budget places emphasis on reduced emissions through R&D on an advanced gas turbine and on next generation fuel cells for highly-efficient power plants using natural gas to produce electricity. The *advanced gas turbine* program would lower nitrogen oxide emissions, help regions meet stringent air quality standards, and increase exports. Currently in the demonstration phase

and involving high technical risks, the program deserves continued support. However, increasing private cost-sharing and reducing the time line for devolving this R&D to private developers should be encouraged.

DOE's support for *fuel cells*, while not yet economically practical in many applications, has the potential to make a major long-term impact by changing the kinds of fuels that will be used for future power generation and transportation. Fuel cells offer potentially the highest efficiencies and environmental benefits of any fossil fuel technologies. Fuel cells produce energy without combustion by combining hydrogen and oxygen electrochemically to produce electricity. Research on fuel cells that leads to a basic understanding of unique new materials should be supported.

To boost *domestic production of natural gas and petroleum*, DOE's fossil R&D program also aims to bring down the costs of locating, drilling and producing oil and natural gas in the U.S. through advanced technologies that help industry probe for hydrocarbons faster, deeper, and with improved accuracy. While we support strong technology transfer from DOE laboratories to help private companies lower their exploration and production costs, we believe more scrutiny should be applied to DOE's special petroleum R&D efforts in order to maximize the program's cost-effectiveness and connection to national goals. While the petroleum industry has cut back on R&D, this program benefits mainly independent producers, as larger oil companies have migrated overseas to cut costs. Despite some DOE-supported advances in processing research and downstream operations, domestic oil production is largely uneconomical and relatively minor compared to coal and natural gas. DOE's track record of helping smaller independents and complaints from service companies of competition from DOE in certain areas should also be explored.

## ENERGY CONSERVATION R&D

We support strong funding for DOE's energy conservation R&D program in FY '98. The Department's mission in the conservation area is to develop and deploy sustainable energy technologies in three sectors—buildings, industry, and transportation—to reduce their energy requirements, improve productivity, reduce air emissions and waste, and moderate growth in fossil fuel use. (A fourth sector, utilities, is addressed in a separate "solar and renewable energy" account.) DOE's conservation R&D program serves to reduce the nation's growing dependency on oil imports—and thus the trade deficit—and increase jobs and exports in a growing market.

Energy efficiency is increased when an energy conversion or energy end-use device undergoes a technical change that allows it to provide a constant level of output while using less energy, or more output using the same amount of fuel. Energy is *conserved* when efficiency is improved or when waste is avoided. Without federal support, businesses are not likely to invest in much long-term, high-risk conservation R&D despite its substantial economic and environmental potential, especially when energy prices are low and global competition is tough. Considering the growing domestic and world demand for energy, the increasing attention to the environmental impact of energy production and use, and the potential to increase productivity in major industry sectors, the need for DOE supported energy efficiency and conservation R&D is evident.

### Industrial Sector

Industrial-sector R&D should receive priority within DOE's conservation R&D program, and we support the budget request of $140 million for R&D directed by DOE's *Office of Industrial Technologies (OIT).* Industry consumes almost 40 percent of all energy used in the U.S. OIT aligns federal funds with industry needs to increase energy and resource efficiency and reduce the generation of industrial wastes and pollutants, which improves productivity, economic competitiveness, and environmental performance.

OIT's *Industries of the Future* program has been getting high marks for advancing innovative technologies through cooperative R&D with the nation's seven most energy-intensive industries, which account for over 80 percent of U.S. energy use and over 80 percent of wastes and air emissions produced by the manufacturing sector. These industries—chemicals, petroleum refining, aluminum, forest and paper products, steel, metal casting, and glass—provide the basic materials essential to the entire U.S. manufacturing sector and are becoming more productive, energy and resource efficient, and environmentally sound through process improvements in basic manufacturing. Chemical engineering is fundamental to most of these capital-intensive industries, which must remain competitive to sustain the nation's economic growth.

As the primary federal interface for the nation's process industries, OIT acts as a catalyst for high-risk, cost-shared, and industry-driven cooperative R&D. Each of the seven industries has developed a long-range vision of their future competitiveness, which is to be followed by a "technology roadmap" outlining R&D priorities necessary to implement those visions. Driven by industry needs, the *Industries of the Future* program integrates its R&D planning with the industry visions, which increases the relevance of the R&D and its potential economic and environmental benefits. OIT staff have a strong knowledge of the industries' needs and concerns, which helps focus and facilitate this collaborative research.

As a co-author of the *Technology Vision 2020* document for the chemical industry, AIChE worked with other leading chemical associations and professional societies to produce a vision that identified R&D needs such as computational fluid dynamics, chemical sciences, biochemical processes, catalysts, process science and engineering, and new measurement techniques that can yield significant energy and environmental improvements. OIT investments in catalysis, separations techniques, advanced industrial materials, computational tools for process design, and cogeneration can lead to substantial energy efficiency increases and improved environmental performance. OIT helps industry reduce carbon dioxide, particulates, sulfur dioxide, volatile organic compounds, and nitrogen oxides, and lowers the rising costs of pollution control compliance.

Such collaborative research with entire industries enables wider technology transfer and quicker deployment of breakthrough energy efficient technologies. We believe that OIT should use the national laboratories more strategically to accomplish key technical goals and better integrate with DOE's Fossil Program and Office of Energy Research through strategic co-planning of R&D.

**Transportation Sector**

Conservation R&D in the transportation sector is important given its potential to reduce U.S. dependence on imported oil and enhance air quality. The transportation sector is 97 percent petroleum dependent, and fossil fuels in the transportation sector produce about 32 percent of overall carbon dioxide emissions. DOE's transportation R&D concentrates on innovative technologies for improving the efficiency of engines, developing domestic alternative transportation fuels, and advanced materials technology such as high-temperature and wear-resistant ceramics and heat engine components.

**Buildings Sector**

We note that some DOE energy efficient building technologies are flourishing as a result of DOE laboratory research. Advanced in areas such as energy efficient window coatings and other materials for insulation, as well as lighting, heating, and cooling systems for buildings and residences have led to significant savings. However, the scope, degree of funding, and broad goals of this program suggests that a renewed evaluation against vital national needs and long-term R&D objectives may be appropriate. An emphasis on fundamental engineering research in this area is recommended.

**BASIC ENERGY SCIENCES**

Congress should support the administration's FY '98 budget request of $661 million for DOE Basic Energy Sciences (BES). We would support an additional increase to appropriate basic research in critical areas. Funding will support high-quality basic science and engineering research activities at national laboratories and educational collaborations at hundreds of colleges and universities. In addition to supporting basic research underlying energy technologies and other DOE missions, BES materials, chemistry, engineering, and other research provides an essential foundation for technological developments important to all national concerns, from health to communications. This broad focus should be maintained.

Basic energy research lays the critical foundation for discovery and innovation of improved energy productivity and efficiency. As industry cuts back on basic research, more and more companies are relying on universities and federal laboratories for important breakthroughs. A large portion of BES research is performed at DOE national laboratories, where large interdisciplinary teams tackle complex technical problems with a long time horizon. BES research should continue to emphasize interdisciplinary research involving scientists and engineers working together on complex national challenges to maximize this synergistic relationship.

AIChE recommends strong funding for the *Materials Sciences and Chemical Sciences* programs, which fund quality, peer-reviewed research. BES supported chemical sciences and engineering research increases fundamental knowledge of chemistry, chemical engineering, and related disciplines to advance energy efficient and environmentally beneficial industrial processes. Such research contributes to producing fuels and chemicals from coal and biomass and electrochemical energy production, for example. Basic research is conducted on combustion, catalysis, environmental processes and waste management, and energy intensive processes. BES materials research focuses on the behavior, structure, properties, and control of a wide range of materials key to improving the efficiency, cost, and environmental impact of energy technologies. Areas of research include ceramic materials, polymers, corrosion-resistant coatings, advanced sensors, superconductors, and photovoltaics.

We also strongly support engineering research within the *Engineering and Geosciences* program. This research aims to improve and advance the knowledge and processes underlying current engineering practice and expand fundamental concepts for solving anticipated and unforeseen engineering problems in energy technologies. Such research advances engineering fundamentals important to increasing efficiency and identifying potential new sustainable energy production and utilization processes.

BES also funds the operation and maintenance of large and sophisticated scientific *user facilities* at the national laboratories. These unique, state of the art facilities are too expensive for a single institution or group of institutions to build, and help the nation maintain its lead in chemical sciences, materials sciences, environmental sciences, biological sciences, and medical sciences. User facilities include large accelerators, massively parallel computers, x-ray and ultraviolet light sources, and a combustion research facility. Over 19,000 users from universities, industry, and government laboratories conduct cutting-edge experiments at these DOE facilities each year.

The Advanced Photon Source at Argonne National Laboratory, for example, involves significant university and industry participants, including major chemical, biotechnology and petroleum companies. The Advanced Light Source is the world's brightest source of soft x-rays, which allow scientists and engineers to see detailed atomic makeup of materials, which are critical to technologies from catalysts to superconductors. Companies in the electronics, semiconductor, chemical, and pharmaceutical industries in particular rely on DOE user facilities given their dependence on advanced technology to maintain market leadership.

## COMPUTATIONAL AND TECHNOLOGY RESEARCH

The Computational and Technology Research program includes the applied mathematical sciences, high performance computing, and advanced energy projects formerly housed in BES. It has similar goals and applicability to the BES programs as it explores advanced energy concepts at an earlier stage of development than other DOE energy R&D programs. Applied engineering research and technology development is also supported in select mission areas, and emphasis is given to multidisciplinary research with universities and industry.

AIChE particularly supports funding in this program for laboratory Cooperative Research and Development Agreements (CRADAs) with industry. We believe CRADAs, which require industry matching funds, are essential for linking advances in basic research to the technology needs of private companies through collaboration in areas of mutual need. The sharing of national laboratory expertise, research results, and facilities with industry and consortia through CRADAs is of significant value to a full range of science and engineering research in advanced materials and intelligent manufacturing and should be encouraged and expanded. We recommend that CRADA success be measured more on technical quality, results, and consistency with DOE R&D missions, rather than the number of CRADAs negotiated. Other collaborations such as personnel exchanges and technical consultations with business should also be supported.

The Computational and Technology Research program includes fundamental mathematical and computational research, which is applicable to all DOE R&D programs, as well as the operation of leading edge information infrastructure. Receiving particular emphasis is an initiative that will allow scientists and engineers at different DOE or other facilities to conduct joint research and cooperate on solving problems even though they are separated geographically. Research involves an integrated set of algorithms, software, and infrastructure that will enable computer simulation to be used in place of experiments that are too expensive or dangerous. Other areas that receive support include compressible fluid dynamics/combustion, environmental chemistry, and materials sciences.

## IMPROVING DOE R&D PERFORMANCE AND RESULTS

The Galvin Commission, the General Accounting Office, and many others have pointed to the strong need for better focused missions, streamlined management practices, administrative cost-cutting, and improved program coordination and dissemination within DOE and at its national laboratories. DOE has made notable advances in some of these areas, and more is needed. DOE's national laboratories, for example, possess unmatched expertise and first rate capabilities in technologies spanning a number of critical areas, but the laboratories and their industry and university partners would benefit from improved coordination among the laboratories and between DOE's R&D-related program offices and from more identifiable and better focused laboratory missions. While some overlap is healthy, we see the need for combining in-house research in specific technical areas to improve efficiency and performance. Part of the challenge is that DOE manages the laboratories program by program, rather than as a diverse research system.

Given DOE's broad R&D portfolio, ambitious goals, and its involvement in some programs in more mature stages of development, DOE should conduct a thorough assessment of industry's R&D activities in all relevant areas to better guide its R&D and to verify justification of projects. DOE should better define its R&D priorities in all R&D areas and phase down research projects where there is no longer a strong justification for federal involvement. Collaborative research with more stakeholders should be pursued. Industry should be brought in early to assist in planning of DOE's R&D portfolio, and national laboratories and universities must also participate in planning. We recommend, for example, better coordination between DOE's fossil and conservation programs, such as in the petroleum refining area, to reduce overlap and competition.

The *Government Performance and Results Act* (P.L. 103-62) requires agencies, beginning in September 1997, to define long-term goals, set specific annual performance targets, and report annually on performance achieved. The idea is to link strategic planning and performance measures more directly to the budgeting process in order to improve management, optimize performance, and control spending. We believe that DOE should look upon GPRA as an opportunity to focus its R&D and other programs to better align them with national needs.

AIChE recommends that a *bipartisan independent commission* be established to evaluate the full range of DOE energy R&D programs, recommend improvements in coordination within and between program areas, and set energy R&D priorities consistent with national needs. We believe the DOE Task Force on Strategic Energy R&D has laid the groundwork for prioritization. Such a commission should be part of, and coordinated with, a larger review of all federal R&D programs and an effort to arrive at a consensus on national R&D needs.

**How to Contact the AIChE**

Taken from the University of Florida AIChE web site, below are given several of the many ways to contact the American Institute of Chemical Engineers for information.

**"One-stop shopping" for admissions, publication sales, meeting registration, dues bills, and other AIChE products and services may be obtained from the:**

AIChExpress Service Center
345 East 47 Street
New York, NY 10017-2395
Telephone: 1-800-AIChemE
Fax: (212) 705-8400
E-mail: xpress@aiche.org

**For the AIChE Headquarters:**

American Institute of Chemical Engineers (AIChE)
345 East 47 Street
New York, NY 10017-2395
General Inquiries: (212) 705-7338
Reprint Sales: (212) 705-7342
Fax: (212) 752-3294
E-Mail: isg@aiche.org.

**For answers to special questions, try one of the following staff:**

John Bloomer
Staff Director, Educational Services
Telephone: (212) 705-7526
E-Mail: johnb@aiche.org.

Christine Burke
Staff Director, AIChE Foundation
Telephone: (212) 705-7488
E-Mail: chrib@aiche.org.

Bob Perry
Staff Director, Center for Chemical Process Safety
Telephone: (212) 705-7319
E-Mail: bobp@aiche.org.

Joe Cramer
Group Director, Programming
Telephone: (212) 705-7950
E-Mail: terrg@aiche.org.

Rich Larson
Staff Director, Finance
Telephone: (212) 705-7659
E-Mail: richl@aiche.org.

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Steve Smith
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Marie Stewart
Staff Director, Meetings & Expositions
Telephone: (212) 705-7324
E-Mail: maris@aiche.org.

Jack Weaver
Staff Director, Center for Waste Reduction Technologies
Telephone: (212) 705-7407
E-Mail: jackw@aiche.org.

Gail Nalven
So You Want to Write a Book?
Telephone: (212) 705-7336
Email: gailn@ix.netcom.com

**Not sure who to call?** Try (212) 705-7338. The receptionist will refer you to the appropriate person.

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# MEETINGS, CONFERENCES, CONGRESSES, SHORT COURSES AND WORKSHOPS

To submit a paper for consideration at any event listed below, please contact the symposium coordinator or session chair directly. For further information or details about each of the four CAST Division programming areas, contact the appropriate Area Programming Coordinator as noted in the masthead. For general information concerning CAST Division sessions and scheduling, or to correct errors in this listing, please contact Jeffrey J. Siirola (CAST Division Programming Chair), Eastman Chemical Company, PO Box 1972, Kingsport, TN 37662-5150, 423-229-3069, 423-229-4558 (FAX), siirola@eastman.com. Many of these postings are archived on the World Wide Web at http://www.che.wisc.edu/cast10/.

## Modeling and Simulation
## Pittsburgh, Pennsylvania
## May 13-16, 1998

The International Association of Science and Technology for Development, in association with the International Society for Mini and Microcomputers, will sponsor a conference on modeling and simulation. The scope is expected to include modeling, animation, simulation, visualization, hardware, multimedia, languages, bond graphs, numerical methods, petri nets, analysis and design, stochastic processes, neural networks, parallel and distributed processing, software engineering and CASE. For further information, contact the IASTED Secretariat - MS'98, 1811 West Katella Avenue, Suite 101, Anaheim, CA 92804, 800-995-2161, 714-778-3230, 714-778-5463 (FAX), iasted@cadvision.com, or browse http://www.iasted.com.

## European Symposium on Computer Aided Process Engineering (ESCAPE 8)
## Brugge, Belgium
## May 24-27, 1998

The 1998 ESCAPE event will be held in the restored Oud Sint Jan (Saint Jans Hospital) in Brugge, Belgium. The symposium will focus on recent developments requiring substantial computer power and on new challenges in the more traditional topics of the ESCAPE meetings. Focus topics include molecular dynamics and modeling in process design, use of computational fluid dynamics in process modeling, integration of processes on an industrial site, on line management of process operations, and industrial applications and case studies. For more information, contact the conference secretariat Rita Peys, Technologisch Instituut Ingenieurshuis, Desguinlei 214, B-2018 Antwerp 1, BELGIUM, 32-3-216-0996, 32-3-216-0689 (FAX), escape8@ti.kviv.be or browse http://www.kviv.be/ti/escape8/.

## Seventh International Conference on Computer Applications in Biotechnology (CAB7)
## May 31-June 4, 1998

We will hold the IFAC symposium entitled Computer Applications in Biotechnology from May 31 through June 4, 1998 in Osaka, Japan. This conference is the continuation of a successful series of conferences at which all major areas in biotechnology where computers are used to aid process supervision, diagnosis, operation, optimization and control will be addressed. Essential bioprocess systems engineering aspects ranging from metabolic engineering to control of bioproduction plants will be covered. It is intended to focus in particular on aspects of bioprocess systems engineering in the 21st century. For further information browse http://www.icb.osaka-u.ac.jp/~cab7/.

## Third IFAC Workshop on On-Line-Fault Detection and Supervision in the Chemical Process Industries
## Solaize (Lyon), France
## June 4-5, 1998

Incentives for on-line fault detection and supervision of process operations include human safety, environmental safeguards, equipment protection, and economic considerations such as improvements in product quality, increased production, etc. These incentives, together with development and evaluation of methodologies for on-line fault detection, localization and supervision form the focus of this workshop. The workshop will address theory, application, validation, performance and cost evaluation of methodologies. These methodologies include model-based systems for fault detection and knowledge-based approaches for fault diagnosis. Examples include parameter estimation, observers, parity equations, signal analysis methods, classification, rule-based systems with probabilistic approaches, fuzzy logic and neural networks. New approaches that integrate methodologies from process control and process fault diagnosis are encouraged. The workshop will also address the identification and representation of process information required for the implementation and validation of these methodologies. Such information may be derived from design specifications, first principles, simulation and on-line sensors. Temporal requirements as expressed by the representations of process trends, or in data sampling rates and information processing rates are also issues of concern in this workshop.

The workshop will be organized by the Institut Français du Pétrole, an integrated research and industrial development, training and information center at the service of the oil, natural gas and automotive industries and will be held in the CEDI Reni Navarre industrial R&D center, which designs, builds and operates pilot-plants and test facilities. For more information, contact Sylvie Cauvin, Institut Français du Pétrole, 1-4 avenue de Bois Priau, 92852 Rueil Malmaison cedex, FRANCE, 33-1-47-52-7017, 33-1-47-52-7022 (FAX), sylvie.cauvin@ifp.fr.

**5th IFAC Symposium on Dynamics and Control of Process Systems (DYCOPS 5)**
**Corfu, Greece**
**June 8-11, 1998**

This IFAC conference was formerly known as DYCORD+, Dynamics and Control of Reactors, Distillation Columns, and Batch Processes. DYCOPS-5 will focus on the examination of new methodologies and challenging applications in reacting process systems, separation process systems, batch process systems, complex and industrial systems, and the integration of design and control. A substantial industrial involvement will contribute to a dialog about what is technically possible and what is technologically desirable. Main topics will include plant-wide dynamics, monitoring, and control, verification and calibration of dynamic models, modeling and understanding of complex dynamics, open- and closed-loop identification, novel and model-based controller design, testing and verification of control strategies, controller performance monitoring, real-time optimization methods and applications, modeling, monitoring, and control of complex multivariable systems, industrial-scale problems and solutions, design and control of modular plants, novel hard or soft sensors, economical benefits of control and real-time optimization, and novel technologies for control rooms and distributed hardware. Deadline for submission of draft six-page papers to dycops5@lehigh.edu is September 15, 1997. For more details, contact Christos Georgakis, Chemical Process Modeling and Control Research Center, Lehigh University, Bethlehem, PA 18015-4781, 610-758-5432, 610-758-5297 (FAX), cg00@ns.cc.legigh.edu or the DYCOPS-5 Secretariat, Department of Chemical Engineering, Aristotle University of Thessaloniki, PO Box 472, 54006 Thessaloniki, GREECE, 30-31-996-211, 30-31-996-198 (FAX), dycops98@alexandros.cperi.forth.gr, or browse http://lpre1.cperi.forth.gr/~dycops5/.

**1998 American Control Conference**
**Philadelphia, Pennsylvania**
**June 24-26, 1998**

The American Automatic Control Council will hold the seventeenth ACC at the Adam's Mark Hotel, Philadelphia, June 24-26, 1998. Held in cooperation with the International Federation of Automatic Control, this conference will bring together people working in the fields of control, automation, and related areas. The conference will include both invited and contributed presentations as well as tutorial workshops. Chemical engineering sessions developed by the CAST Division include:

1. Nonlinear Model Predictive Control. Frank Allgower, Institut für Systemdynamik und Regelungstechnik (chair) and Jay H. Lee, Purdue University (Co-Chair).
2. Monitoring and Control of Polymerization Processes. Masoud Soroush, Drexel University (Chair), John R. Richards (Co-Chair), and John P. Congalidis (Co-Chair).

3. Model Reduction and Control of Distributed Parameter Systems. Raymond A. Adomaitis (Chair) and Prodromos Daoutidis, University of Minnesota (Co-Chair).

4. Nonlinear Process Control. Panagiotis D. Christofides, University of California, Los Angeles (Chair).

5. Integrated Identification and Robust Control for the Process Industries. Daniel E. Rivera, Arizona State University (Chair) and Sachindra Dash (Co-Chair).

6. Implementation of Advanced Process Control Techniques. Kenneth R. Muske, Villanova University (Chair) and Babatunde A. Ogunnaike, E. I. du Pont de Nemours & Company (Co-Chair).

For further information, contact the AIChE Society Review Chair, B. Wayne Bequette, Department of Chemical Engineering, Rensselear Polytechnic Institute, Troy, NY 12180-3590, 518-276-6683, 518-276-4030 (FAX), beueb@rpi.edu or browse http://www.ece.nwu.edu/~ahaddad/aacc.

**Third International Conference on Foundations of Computer-Aided Process Operations (FOCAPO-98)**
**Snowbird, Utah**
**July 5-10, 1998**

The Foundations of Computer-Aided Process Operations Conference, cosponsored by the CAST Division, CACHE Corporation, and the American Production Inventory Control Society, will be the third in a series of conferences dealing with the use of computers in support of process operations. Since the first two FOCAPO conferences in 1987 and 1993, there has been an enormous increase in interest in improving the efficiency and effectiveness of process operations. Given the likely continuation of this trend, FOCAPO-98 will bring together operations personnel, management, and researchers for a comprehensive look at the state of the art in computer-aided process operations, a discussion of strategies important to

thriving in an environment of continuous change and rapidly advancing technology, and the important challenges to be overcome. The conference will provide a forum for operations personnel to share their experiences emphasizing presentations describing technology that is being reduced to practice or is likely to be in the next five years, provide an opportunity for industrial practitioners, academics, and vendors to interact, and hopefully motivate future research by describing problems that are intractable or expensive to solve with existing approaches. Principal conference topics and issues will include plant-wide optimization, pilot and market development plant operations, emerging and high growth processes, planning and scheduling, environmental issues, product integrity and quality, and next generation enabling technology and deployment. For more information, contact the conference chairs Gary E. Blau, Dow AgroSciences, 9330 Zionsville Rd, Indianapolis, IN 46268-1053, 317-337-3137, 317-337-3215 (FAX), gblau@dowelanco.com or Joseph F. Pekny, School of Chemical Engineering, Purdue University, West Lafayette, IN 47907-1283, 765-494-7901, 765-494-0805 (FAX), pekny@ecn.purdue.edu. Space is limited. To apply for registration materials, contact immediately Janet Sandy, CACHE Corporation, PO Box 7939, Austin, TX 78713-7939, 512-471-4933, 512-295-4498 (FAX), cache@utxvm.cc.utexas.edu. Updated conference information is also available on http://che.www.ecn.purdue.edu/FOCAPO98/.

## Automatic Control of Food and Biological Processes (ACoFoP IV)
## Göteborg, Sweden
## September 21-23, 1998

Following the success of ACoFoP I, II, and III held in Paris, the Food Working Party of the European Federation of Chemical Engineering is organizing another international symposium on Automatic Control of Food and Biological Processes to take place in Göteborg on September 21-23 1998. Proceedings will be published and distributed at the symposium. The conference language will be English. The objectives of the symposium will be to present results of recent research and industrial developments in process control of food and biological processes, and to promote discussions between process engineers and scientists from the food and biotechnology industry and process control engineers. The themes of the conference will include sensors including biosensors, image processing and machine vision, on-line measuring systems, software for sensors and estimators, sensor fusion, on-line quality control, in-line sensor applications in industry, simulation in connection to process control, simulation for training in production, computer-aided design of process control, use of artificial intelligence, decision support, robotics, optimal and adaptive control, simulation of continuous and batch processes including environmental aspects, process modeling, dynamic modeling, predictive modeling, scheduling, and computer-aided engineering/computer-integrated manufacturing. Authors wishing to present papers are invited to send their proposal as an extended abstract of one page before October 31, 1997 to Christina Skjöldebrand, SIK, PO Box 5401, S-402 29 Göteborg, SWEDEN, 46-31-335-5600, 46-31-83-3782 (FAX). For additional information, browse http://www.sik.se/acofop/.

## 26th Australian Chemical Engineering Conference (CHEMECA '98)
## Port Douglas, North Queensland
## September 28-30, 1998

The theme for the conference, "Creating Competitive Resources", we believe reflects the exciting developments taking place in North Queensland. We invite papers that cover our theme and for a guide we are looking at running three streams possibly covering the following subjects: the chemical process industries of the Asia Pacific region; management, process management, best practice programs, project management, and consulting practice; energy - coal, gas, electricity, oil, refining, efficiency, renewables and greenpower; minerals, metals and light metals; sugar and food technology and production, and fertilizers; environmental/reef ecology/technical aspects of ecotourism; space technology; fundamentals - thermodynamics, heat and mass transfer, membrane processes, reaction kinetics, catalysis, adsorption, reactor design, evaporation, fluid flow and rheology; education; cleaner production; biotechnology, biomedical engineering; safety and risk engineering; fine particle technology; and process modeling and control. The conference will feature a number of workshops including mixing in the process industries; process modeling and control; hazards, hazardous materials and risk assessment; fine particle technology; and environmental engineering. If you wish to present a paper please return the Expression of Interest Form together with a one page abstract by 13 February 1998 to chemeca@minnie.cheque.uq.edu.au or submitted via the web at http://daisy.cheque.uq.edu.au/chemeca98/callform. For additional information, contact Chemeca '98 Conference Secretariat, Department of Chemical Engineering, The University of Queensland, Queensland 4072 AUSTRALIA, 61-7-3365-4199 (FAX), bobn@cheque.uq.edu.au.

## 1998 AIChE Fall Annual Meeting
## Miami Beach, Florida
## November 15-20, 1998

Meeting Program Chair: Stanley I. Sandler, Department of Chemical Engineering, University of Delaware, Newark, DE 19716, 302-831-2945, 302-831-4466 (FAX), miami98@che.udel.edu. Speakers are reminded that the deadline for submission of their hardcopy presentation

record manuscript (with a Permission to Reproduce Manuscript form) to the AIChE Manuscript Center in New York is October 1, 1998.

The CAST Division is planning the following sessions at the Miami Beach Fall Annual Meeting which have been approved by the Meeting Program Chair. A final call for papers for this meeting appears later in this issue. Deadline for submission of presentation proposals (via the world-wide web only) is April 15 or May 15, 1998 (depending on the Area review procedures). The entire CAST program in Miami Beach is being cosponsored by the Society for Computer Simulation.

CAST Division Plenary Session

1. Recent Developments in Computing and Systems Technology. Scott E. Keeler, Dow AgroSciences (Chair) and Kyriacos Zygourakis, Rice University (Co-Chair).

Area 10a: Systems and Process Design

1. Process Synthesis. Viswanathan Visweswaran, Mobil Technology Company (Chair) and Matthew J. Realff, Georgia Institute of Technology (Co-Chair).

2. Design and Analysis. Dennis D. Sourlas, University of Missouri, Rolla (Chair) and Michael L. Luyben, E. I. du Pont de Nemours & Company (Co-Chair).

3. Process and Product Design. Yinlun Huang, Wayne State University (Chair) and Luke Achenie, University of Connecticut (Co-Chair).

4. Design for Polymer Production and Processing. Steve Wilkinson, E. I. du Pont de Nemours & Company (Chair) Costas D. Maranas, Pennsylvania State University (Co-Chair).

Joint Area 10a and Area 10c Sessions

1. Batch Processing. Christine B. Seymour, Searle Company (Chair) and Marianthi G. Ierapetritou, Princeton University (Co-Chair).

2. Design for Flexibility and Operability. Stratos Pistikopoulos, Imperial College (Chair) and Jorge A. Mandler, Air Products and Chemicals, Inc. (Co-Chair).

Joint Area 10a and Area 2g Session

1. Design of Reactive Separations. Michael F. Malone, University of Massachusetts (Chair) and Jeff DeGarmo, Koch Engineering Company, Inc. (Co-Chair).

Area 10b: Systems and Process Control

1. Process Control Applications. James B. Riggs, Texas Technical University (Chair) and Jorge A. Mandler, Air Products and Chemicals, Inc. (Co-Chair).

2. Process and Controller Performance Monitoring. Bhavik R. Bakshi, Ohio State University (Chair) and George N. Charos, Amoco Corporation (Co-Chair).

3. Batch Process Control. Masoud Soroush, Drexel University (Chair) and Sheyla L. Rivera, Frito-Lay, Inc. (Co-Chair).

4. Nonlinear Control. Thomas A. Badgwell, Rice University (Chair) and Alex Z. Q. Zheng, University of Massachusetts (Co-Chair).

5. Plant-wide Control. Richard D. Braatz, University of Illinois (Chair) and B. Erik Ydstie, Carnegie Mellon University (Co-Chair).

6. State and Parameter Estimation. Kenneth R. Muske, Villanova University (Chair) and David H. Gay, E. I. du Pont de Nemours & Company (Co-Chair).

7. Data-driven Approaches to Process Control. Jay H. Lee, Purdue University (Chair) and Lloyd Johnson, University of New South Wales (Co-Chair).

Joint Area 10b and Area 3d Session

1. Modeling and Control of Particulate Systems. Anthony A. Adetayo, E. I. du Pont de Nemours & Company (Chair) and Martin Pottmann, E. I. du Pont de Nemours & Company (Co-Chair).

Joint Area 10b and Area 8e Session

1. Design and Control of Microelectronics Manufacturing Processes. Panagiotis D. Christofides, University of California, Los Angeles (Chair) and Dennis D. Sourlas, University of Missouri, Rolla (Co-Chair).

Joint Area 10b and Area 15c Session

1. Advances in Bioprocessing: Sensors, Control, and Optimization. Christos Hatzis, A. E. Staley, Inc. (Chair) and Michael A. Henson, Louisiana State University (Co-Chair).

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Area 10c: Computers in Operations and Information Processing

1. Computer Integrated Manufacturing in the Chemical Process Industries (Cosponsored by the International Cooperation Committee of the Society of Chemical Engineers, Japan). Bhavik R. Bakshi, Ohio State University (Chair) and Shinji Hasebe, Kyoto University (Co-Chair).

2. Advances in Optimization. Iauw-Bhieng Tjoa, Mitsubishi Chemical America, Inc. (Chair) and Nikolaos V. Sahinidis, University of Illinois (Co-Chair).

3. Uncertainty and Risk in Process Operations and Monitoring. Lloyd Johnson, University of New South Wales (Chair) and Viswanathan Visweswaran, Mobil Technology Company (Co-Chair).

4. High Performance Computing. Mark A. Stadtherr, University of Notre Dame (Chair) and Matthew H. Bassett, Dow AgroSciences (Co-Chair).

Joint Area 10c and Group 6a Sessions

1. Computational Fluid Mixing. Steven R. Strand, Dow Chemical Company (Chair) and Richard D. LaRoche, Silicon Graphics/Cray Research (Co-Chair).

2. Computational Mixing in Process Operations. Alan B. Coon, UOP, Inc. (Chair) and Ralph W. Pike, Louisiana State University (Co-Chair).

Joint Area 10c and Area 15a Session

1. Computational Methods in the Food Processing Industry. Federico Carvallo, Kraft Foods, Inc. (Chair) and Matthew J. Realff, Georgia Institute of Technology (Co-Chair).

Area 10d: Applied Mathematics and Numerical Analysis

1. Population Balances and Applications. Doraiswami Ramkrishna, Purdue University (Chair) and Ka M. Ng, University of Massachusetts (Co-Chair).

2. Nonlinear Dynamics. Vemuri Balakotaiah, University of Houston (Chair) and Hsueh-Chia Chang, University of Notre Dame (Co-Chair).

3. Computational, Integral and Spectral Methods in Engineering Applications. Pedro Arce, FAMU/FSU College of Engineering (Chair) and Lakshmi N. Sridhar, University of Puerto Rico (Co-Chair).

4. Parallel Computing Applications. Antony N. Beris, University of Delaware (Chair) and Joseph F. Pekny, Purdue University (Co-Chair).

Joint Area 10d and Area 8e Session

1. Applied Mathematics in Materials Processing. Ioannis G. Kevrekidis, Princeton University (Chair) and T. J. Mountziaris, State University of New York at Buffalo (Co-Chair).

Joint Area 10d and Area 15d/e Session

1. Mathematical Modeling in Cellular Engineering. Sriram Neelamegham, State University of New York at Buffalo (Chair), and Richard Dickinson, University of Florida (Co-Chair).

CAST DIVISION POSTER SESSION

Section A. Recent Developments in Systems and Process Design. Amy R. Ciric, University of Cincinnati (Chair) and Mahmoud El-Halwagi, Auburn University (Co-Chair).

Section B. Recent Advances in Process Control. Dennis D. Sourlas, University of Missouri, Rolla (Chair) and Prodromos Daoutidis, University of Minnesota (Co-Chair).

Section C. Intelligent Systems in Process Operations. James F. Davis, Ohio State University (Chair) and James R. Whiteley, Oklahoma State University (Co-Chair).

Section D. Advances in Applied Mathematics. Kyriacos Zygourakis, Rice University (Chair) and Pedro Arce, FAMU/FSU College of Engineering (Co-Chair).

Section E. Demonstrations of Software for Process Control Education. Douglas J. Cooper, University of Connecticut (Chair).

EDUCATIONAL COMPUTER SOFTWARE DEMONSTRATIONS (Joint Effort with Group 4)

Douglas J. Cooper, University of Connecticut (Coordinator) and John T. Bell, University of Michigan (Coordinator).

## 1999 AIChE Spring National Meeting
## Houston, Texas
## March 14-18, 1999

Meeting Program Chair: Peter Wanser, Fluor Daniel, PO Box 5014, Sugarland, TX 77487, 281-263-4386, 281-263-8450 (FAX), wansrp@fluordaniel.com.

The CAST Division is planning the following sessions at the Houston Spring National Meeting. AIChE and the Meeting Program Chair will finalize the sessions at the 1998 Programming Retreat in January, and any corrections

will appear in the next issue of CAST Communications. A first call for papers for this meeting appears later in this issue. Deadline for submission of presentation proposals (via the world-wide web only) is August 1, 1998. The entire CAST program in Houston is being cosponsored by the Society for Computer Simulation.

Area 10a: Systems and Process Design

1. Process Integration in Industrial Practice. Luke E. K. Achenie, University of Connecticut (Chair) and Kirtan K. Trivedi, Parsons Energy and Chemicals Group Inc. (Co-Chair).

2. Practical Process Synthesis. Andreas A. Linninger, University of Illinois at Chicago (Chair) and Metin Türkay, Mitsubishi Chemical Corporation (Co-Chair).

3. Advances in Commercial Design Software. Michael F. Malone, University of Massachusetts (Chair), Raymond Rooks, Simulation Sciences, Inc., (Co-Chair), Francisco J. L. Castillo, Hyprotech (Co-Chair), and Vivek Julka, Aspen Technology, Inc. (Co-Chair).

Joint Area 10a and Area 10c Session

1. Internet Applications in Chemical Engineering. Matthew J. Realff, Georgia Institute of Technology (Chair) and Kirtan K. Trivedi, Parsons Energy and Chemicals Group Inc. (Co-Chair).

Joint Area 10a and Area 10d Session

1. Design for Particulate Systems and Solids Processing. Peter J. T. Verheijen, Technical University Delft (Chair) and Jonathan M. Vinson, G. D. Searle (Co-Chair).

Area 10b: Systems and Process Control

1-2. Theory and Advanced Applications of Advanced Process Control I and II. Michael Nikolaou, University of Houston (Chair) and Louis P. Russo, Exxon Chemical Company (Co-Chair).

Area 10c: Computers in Operations and Information Processing

1. Potential Benefits of Global Optimization in Industrial Practice. Luke Achenie, University of Connecticut (Chair) and Iauw-Bhieng Tjoa, Mitsubishi Chemical America, Inc. (Co-Chair).

2. Practical Challenges of Data Reconciliation. Miguel J. Bagajewicz, University of Oklahoma (Chair) and Lionel O'Young, Mitsubishi Chemical America, Inc. (Co-Chair).

## European Symposium on Computer Aided Process Engineering (ESCAPE 9)
## Budapest, Hungary
## May 31-June 2, 1999

The aim of the ESCAPE-9 symposium will be to review the latest developments in process systems engineering and computer aided process engineering, with emphasis on the use of computers and information technology (methods and tools) in the design and operation of process industry. Main themes of the program will include process synthesis, design, and optimization; process dynamics, control, and operation; modeling and simulation; intelligent systems and information; industrial applications and case studies; education and training in computer aided applications; and new ideas. For more information, browse http://www.dcs.vein.hu/ESCAPE-9/.

## 1999 American Control Conference
## San Diego, California
## June 2-4, 1999

The American Automatic Control Council will hold the eighteenth ACC at the Hyatt Regency Hotel, San Diego, June 2-4, 1999. Held in cooperation with the International Federation of Automatic Control, this conference will bring together people working in the fields of control, automation, and related areas. As in the past, the CAST Division will develop a number of both invited and contributed sessions. The deadline for contributed papers will be approximately August 15, 1998. For more information, browse http://www.ece.nwu.edu/~ahaddad/aacc.

## Fifth International Conference on Foundations of Computer-Aided Process Design (FOCAPD-99)
## Breckenridge, Colorado
## July 11-16, 1999

Foundations of Computer-Aided Process Design, cosponsored by the CAST Division and CACHE Corporation, will be the fifth in the series of conferences dealing with the use of computers in support of chemical process design will be held July 11-16, 1999 in Breckenridge, Colorado. Conference topics and issues are expected to include state-of-the-art and grand challenge problems in process design (green chemistries, waste minimization and recycling for pollution prevention; design for operability, control, and inherently safer processes; and capacity utilization, costs, and productivity), fundamental design theories and methods (process design and synthesis methods; operability and control issues in process design; computational fluid dynamics and transport modeling; and basic data and properties for process design), environments and new tools for effective process design (distributed computing and distributed tools for process design;

integrated and open software environments for process design; dynamic models and modeling for the design of process systems; and managing the process of process design), and applications and emerging areas (batch process design for specialty chemicals and pharmaceuticals; integration of molecular and mechanistic chemistry with design; integrated process and product design; and education and training for effective design). To participate in the development of the technical program for this conference or for more information, contact the conference chairs Michael F. Malone, Department of Chemical Engineering, University of Massachusetts, Amherst, MA 01003-3110, 413-545-0838, 413-545-1133 (FAX), mmalone@ecs.umass.edu or James A. Trainham, E. I. du Pont de Nemours & Company, PO Box 80101, Wilmington, DE 19880-0101, DE, 302-992-3898, 302-992-2035 (FAX), trainham@a1.esvax.umc.dupont.com.

## 1999 AIChE Fall Annual Meeting
## Dallas, Texas
## October 31-November 5, 1999

Meeting Program Chair: Rob Davis, University of Colorado, Department of Chemical Engineering, Boulder, CO 80309-0242, 303-492-7314, 303-492-4341 (FAX), davisr@spot.colorado.edu

The CAST Division is considering the following programming topics for the Dallas Fall Annual Meeting. AIChE and the Meeting Program Chair will finalize the sessions at the 1998 Programming Retreat in January, and the approved program will appear in the next issue of CAST Communications. Deadline for submission of presentation proposals (electronically only) is expected to be March 15 or April 15, 1998 (depending on the Area review procedures). The entire CAST program in Dallas is being cosponsored by the Society for Computer Simulation.

Recent Developments in Computing and Systems Technology.
Process Synthesis.
Design and Analysis.
Advanced Process Integration.
Technology Transfer in Process Design.
Reviews in Systems and Process Design.
Separations System Synthesis.
Geometric Methods for Design.
Interaction of Design and Control.
Design and Operation of Batch Processes.
Design for the Environment.
Advances in Process Control.
Nonlinear Control.
Applications of Process Control.
Controller and Process Monitoring.
Process Modeling, Identification, and Estimation.
Advances in Model Predictive Control.
Perspectives in Chemical Process Control.
Advances and Applications in SQC/SPC.
Challenges in Control of Solids Processing Systems.
Control of Microelectronic Manufacturing.
Control of Pulp and Paper Processes.
Computer Integrated Manufacturing in the Chemical Process Industries - Advances and Industrial Applications.
Advances in Optimization.
Planning, Scheduling, and Supply Chain Management.
Computers in Operations and Information Processing.
Computational Methods in the Food Processing Industry.
Molecular Modeling for Refinery Optimization.
Pattern Formation and Instabilities in Physicochemical Systems.
Applications of Parallel Computing Strategies in Engineering Systems.
Stochastic Processes.
Fundamental Advances in Applied Mathematics.
D. Ramkrishna Symposium: Cybernetics, Operator-Theoretic, and Self-Similar Approaches in Chemical Engineering.
Applied Mathematics in Materials Processing.
Applied Mathematics in Biochemical Engineering.
Recent Developments in Systems and Process Design.
Topics in Systems and Process Control.
High Performance Computing.
Process Operability.
Issues in Computers in Operations and Information Processing.
Advances in Applied Mathematics.
Educational Computer Software Demonstrations.

Past postings on the CAST10 Email List are archived on the World Wide Web at **http://www.che.wisc.edu/cast10**

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*Presented by*:

Edward M. Rosen
**EMR Technology Group**
Phone: 314-434-5498
e-mail: EMRose@compuserve.com

## CALLS FOR PAPERS FOR CAST SESSIONS

**Final Call for CAST Sessions**
**1998 AIChE Annual Meeting**
**Miami Beach, Florida**
**November 15-20, 1998**

The names, addresses, and telephone numbers of the session chairs are given on the next several pages, as are brief statements of the topics to receive special emphasis in selecting manuscripts for these sessions. Prospective session participants are encouraged to observe the deadlines which have been established, but may be changed, by the Meeting Program Chair, Stan Sandler. A complete call for papers for all sessions at this meeting may be accessed at http://www.aiche.org/meeting/1998/annual/cfp/.

AIChE is currently soliciting electronic submission of proposals-to-present via the World Wide Web. To submit via the web, access http://www.aiche.org.

When submitting electronically, make note of the unique AIChE session number which will be provided for each session title listed below. Do not send proposals-to-present to the session chair email addresses.

SPECIAL NOTE TO AUTHORS SUBMITTING ABSTRACTS FOR ANNUAL MEETING SESSIONS SPONSORED BY CAST AREAS 10A, 10B, and 10C:

Because of the large number of anticipated presentation proposals for annual meetings and the limited symposia space available, and in order to maximize the number of good proposals that can be accepted and generally improve programming quality, all proposals for Fall 1998 programming in CAST Areas 10a, 10b, and 10c must be submitted to AIChE ONE MONTH EARLIER than the generally published deadline in order to accommodate the Division Review process. Please note that CAST Area 10d and CAST sessions cosponsored with other AIChE programming groups DO NOT participate in the Division

Review process, and therefore remain governed by the standard deadline.

CAST Division Review Procedure for Areas 10a, 10b, and 10c:

1. Abstracts will receive anonymous reviews by three or four session chairs and/or co-chairs and/or the Area Programming Coordinators for technical content, novelty and style. Submissions may be shifted between sessions or other CAST areas as appropriate.

2. Each area will sponsor at least one section of the Division Poster Session. Some areas may develop a topical theme for their section while others may have a more general scope to accommodate late news. Unless directed otherwise by the author, all proposals will be considered for both symposium and poster sessions.

## Miami Beach Meeting Deadlines:

April 15, 1998 (10a, 10b, and 10c): Submit a proposal-to-present electronically to AIChE via web access at http://www.aiche.org. AIChE will forward the proposals to CAST for the Division Review.

May 15, 1998 (10d, and sessions cosponsored with other programming groups): Submit a proposal-to-present electronically to AIChE via web access at http://www.aiche.org. AIChE will forward proposals to the corresponding session chairs.

May 15, 1998: Session content finalized and authors informed of selection. Authors of accepted proposals may update abstracts electronically.

October 16, 1998: Authors submit final manuscript (presentation record) to AIChE Headquarters.

November 15, 1998: Speakers bring 60 hard copies of visual aids to be distributed to the audience at the presentation. (This is a CAST Division policy, intended to improve the quality of the presentations and the benefit to the audience.)

Please note that there is an AIChE limitation that no person may author or co-author more than four contributions at any one meeting nor more than one contribution in any one session.

Authors submitting by the above deadlines will be notified of decisions on acceptance as close to May 15 as the schedules of the reviewers, session chairs, the Meeting Program Chair, and AIChE permit. Abstracts of accepted proposals will be available on the web for public browsing approximately one month before the meeting.

Presenters at AIChE meetings are reminded to send a written record of their presentation to AIChE Headquarters by the manuscript submission deadline. The purpose of this requirement is to improve the quality of presentations generally as well as to enable AIChE to more broadly disseminate ideas and results by filling requests for copies of presentation records during and after each meeting. Formal full-length manuscripts are encouraged. However, the minimal presentation record content acceptable to AIChE is an extended abstract including an introduction, results, discussion, and references which may be augmented with figures and tables, presentation visual aids, or poster panels. The Executive Board of the National Program Committee has adopted the policy that the advanced submission of a written presentation record be a condition for presenting at AIChE-sponsored meetings.

## CAST Division Plenary Session

1. Recent Developments in Computing and Systems Technology.

Plenary papers describing recent advances, and new challenges in each of the CAST areas (Systems and Process Design, Systems and Process Control, Computers in Operations and Information Processing, and Applied Mathematics and Numerical Analysis) will be invited by the CAST programming board. The papers are intended to be accessible to a wide audience with interests in any and all of the CAST areas. It is anticipated that this session will be scheduled on Monday morning and that no other CAST sessions will be scheduled in parallel in order to facilitate the broadest possible communication.

***Session Chair***
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***Co-Chair***
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Area 10a: Systems and Process Design

1. Process Synthesis.

We invite papers that deal with methods for synthesis of chemical process systems. Topics of interest include (but are not limited to) flowsheet synthesis, reaction path and reactor network synthesis, synthesis of novel separation schemes, and integration of synthesis, design and control. The methodologies presented may involve conceptual approaches, mathematical programming and heuristic strategies, among others. Areas that have not received adequate attention in traditional process synthesis literature (such as environmental applications) are particularly encouraged.

***Session Chair***
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***Co-Chair***
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2. Design and Analysis.

This session focuses on the general topic of design and analysis for chemical processes, including both continuous and batch types. This involves conceptual design, economic evaluation, modeling, flowsheet optimization, and analysis of unit operations. Papers are sought which address these issues in design and analysis.

***Session Chair***
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***Co-Chair***
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3. Process and Product Design.

This session invites paper submissions reflecting recent advances in process and product design. Research areas include, but are not limited to, process design (e.g., pinch analysis applied to heat and mass exchanger networks, reactive distillation system design, attainable region concepts applied to reactor design, design for pollution prevention, and life cycle analysis) and product design (e.g., polymers, solvents, refrigerants, catalysts, and pharmaceuticals). To date, process and product design tools have included mixed integer nonlinear programming, global optimization, interval arithmetic, knowledge-based approach, simulated annealing, genetic algorithms. This session encourages the introduction of other tools outside the usual set. It has been the norm to discuss process and product design in the absence of uncertainties. We would like to encourage submitters to discuss the impact on, and the incorporation of model uncertainties in the suggested approaches. All areas are encouraged. Whenever possible the impact of the new research on industrial practice should be emphasized.

***Session Chair***
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***Co-Chair***
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**CAST Programming Tips**
**1.** Submit Proposals-to-Present early via the world wide web. Submissions to the Fall Annual Meeting sessions participating in Centralized Review automatically will be considered for all appropriate sessions.

4. Design for Polymer Production and Processing.

Papers are invited that address the wide range of design and operational issues associated with polymer production and processing. These include the optimal design of polymers, equipment or processes, taking account of the complexities inherent in polymer systems (rheological, kinetic etc.). Also of interest are methodologies for the efficient design/scheduling of the flexible plants often employed in polymer production. Presentations of industrial success stories are particularly welcome.

***Session Chair***
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Joint Area 10a and Area 10c Sessions

1. Batch Processing.

Papers are sought in areas of concern for batch processing. Focuses may include batch process synthesis, design, modeling, optimization, retrofit, as well as sequencing and scheduling. Papers that include industrial case studies or applications are encouraged to be submitted.

***Session Chair***
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**CAST Programming Tips**
**2.** Submission of Proposals-to-Present to multiple sessions is permitted by AIChE and the web software, but may decrease chances of acceptance by the CAST Division.

2. Design for Flexibility and Operability.

The focus of this session will be on the formal incorporation of operability objectives, such as flexibility, reliability, controllability, maintainability, safety and environmental risk, the synthesis and design of processing systems. Both industrial and academic papers are sought describing general procedures, theoretical developments, methodologies, tools and case studies. Emphasis is placed on studies which will highlight the interactions of the various operability factors and demonstrate possible synergistic benefits of their inclusion in process design under conditions of uncertainty.

***Session Chair***
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Joint Area 10a and Area 2g Session

1. Design of Reactive Separations.

Papers are requested describing original research results on the design of reactive separation devices and systems. It is anticipated that the major focus will be on reactive or catalytic distillation, but studies of other technologies such

as reactive extraction or absorption with reaction are also appropriate. Authors should emphasize design approaches, tools and results but original studies in support of design such as experimental testing of new models, the treatment of transport effects, operability and controllability of designs, etc. are also welcome. General approaches or specific studies of real systems, especially those of industrial importance, will be given priority.

***Session Chair***
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Area 10b: Systems and Process Control

1. Process Control Applications.

All interested persons are invited to submit papers that address the application of advanced control to the chemical processing industry. We are soliciting papers that demonstrate how industry has benefited or how industry could benefit from advanced control.

***Session Chair***
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2. Process and Controller Performance Monitoring.

The focus of this session is on the theoretical and application studies related to control system performance monitoring and process performance monitoring and diagnosis. It covers the methods to ensure process safety, high product quality, process operability, optimum process performance, economic viability, and process profitability. Industrial implementations are particularly welcome. Topics include but are not limited to multivariate statistical methods, neural networks, process chemometrics, fuzzy logic, artificial intelligence for monitoring and diagnosis, and statistical process control.

***Session Chair***
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3. Batch Process Control.

Contributions are sought in the general area of batch process control. Papers presenting new theoretical and/or application results are solicited. Higher priority will be given to real-time control studies and to contributions from the process industry. Areas of interest include, but are not limited to, nonlinear model-based control of batch processes, simultaneous optimization and control of batch processes, industrial challenges in control of batch processes, and control-relevant model identification in batch processes.

***Session Chair***
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***Co-Chair***
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4. Nonlinear Control.

Contributions are sought in the general area of nonlinear control including model predictive control, differential geometric control, modeling of nonlinear systems, and nonlinear dynamic analysis of control systems.

***Session Chair***
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5. Plant-wide Control.

This session will focus on recent advances in plant-wide control. Papers highlighting industrial experience or comparisons between theoretical predictions and industrial applications are welcome. Some areas of interest include, but are not limited to, alternative formulations of the plant-wide control problem, comparisons between various approaches to plant-wide control, selection of manipulated, measured, and controlled variables, computational challenges associated with plant-wide control, and real-time optimization.

***Session Chair***
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***Co-Chair***
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6. State and Parameter Estimation.

Contributions concerning the development, application, and implementation of state and parameter estimation techniques for process control are sought. Areas of interest include, but are not limited to, model-based control, process monitoring, fault detection, data reconciliation, and sensor fusion. Presentations describing novel approaches in process control are encouraged, with papers concerning industrial or experimental implementations of state and parameter estimation techniques particularly welcome.

***Session Chair***
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7. Data-driven Approaches to Process Control.

This session focuses on process control techniques that make novel use of plant data (either historical or test data). Modeling is a key step in implementing an advanced process control system, and the fundamental knowledge needed to build first principles models is often lacking. However, there often is an abundance of plant data that contain a wealth of useful information for process control. In addition, one can also conduct experiments to generate additional data that contain specific information about the process. We are interested in both the use of data, and the generation of data. Both theoretical papers that discuss general methodologies, and application papers that offer insights into the interplay between theories and practice, will be acceptable.

***Session Chair***
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Joint Area 10b and Area 3d Session

1. Modeling and Control of Particulate Systems.

Contributions are sought describing work in the areas of measurement, and online monitoring and control of particle transportation, formation, breakage, and growth processes. Processes of interest include, but are not limited to, pneumatic and hydraulic conveying, crystallization, precipitation, grinding, agglomeration, compaction and extrusion. Presentations of industrial experiences with the monitoring and control of relevant product properties and critical discussions of limitations/advantages of current approaches are also welcomed. Abstracts should summarize the scope of the work, the methodology employed, and significant accomplishments.

***Session Chair***
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Joint Area 10b and Area 8e Session

1. Design and Control of Microelectronics Manufacturing Processes.

Papers are sought which describe process systems engineering applications to microelectronic manufacturing processes including model development, reaction and transport simulations, model reduction, optimization, monitoring and model-based control.

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Joint Area 10b and Area 15c Session

1. Advances in Bioprocessing: Sensors, Control, and Optimization.

The continuing industry-wide drive to reduce development time for bioprocesses while maintaining high product quality and yields has created an ever increasing need for sophisticated but practical approaches for the optimization and control of bioprocesses. Contributions are solicited describing the development and application of novel off-line optimization techniques as well as on-line sensors and control strategies. Fundamental or applied papers in the areas of biomedical, pharmaceutical, food and commodity biochemicals are invited. Suggested topics include, but are not limited to, bioreactor and process design for robustness and controllability, the application of empirical, model-based, and metabolic optimization techniques for process and organism design, and the use of statistical design or artificial intelligence applications to process optimization. Additional topics of interest include recent developments in on-line sensors and measurement techniques for property and rate measurements as applied to biochemical process identification and control. Contributions focusing on advanced modeling and control strategies for biochemical processes are also welcome.

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Area 10c: Computers in Operations and Information Processing

1. Computer Integrated Manufacturing in the Chemical Process Industries (Cosponsored by the International Cooperation Committee of the Society of Chemical Engineers, Japan).

Contributions are sought describing methodological developments, implementations, and experiences with all aspects of CIM in the process industries. Subjects of particular interest include integration of application areas such as plant information systems, monitoring, diagnosis, control, scheduling, planning, optimization, and design, as well as developments within application areas themselves that focus on integration issues. Presentations of industrial experiences with CIM technology and critical discussions of limitations/advantages of current approaches are also welcomed.

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2. Advances in Optimization.

Papers are solicited which describe recent advances in optimization theory and novel applications to the chemical process industries. Papers that address the following issues are especially encouraged: 1) new development of algorithms for nonlinear, mixed-integer, global and stochastic optimization, and 2) novel applications of optimization techniques for solving problems related to chemical process operations, scheduling and planning.

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3. Uncertainty and Risk in Process Operations and Monitoring.

This session focuses on methodologies for the planning, scheduling, operation and monitoring of processes that explicitly account for uncertainty and risk. In chemical processes, uncertainty is often present in many areas including the feedstock quality, process data, and behavior of the process. There are also inherent risks involved in operating processes, which can be magnified by the presence of uncertainty. These uncertainties and risks not only make the processes difficult to plan and operate, but also make it difficult to monitor the process. We invite papers addressing heuristic, deterministic and stochastic approaches to handling uncertainty and risk. Areas of interest might include (but are not limited to) planning and forecasting models, data rectification, fault diagnosis and statistical process monitoring for batch and continuous processes. Application papers that offer insights into the

interplay between theory and practice, as well as presentations of industrial success stories, are particularly encouraged.

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4. High Performance Computing.

Impressive gains in computing technology, especially the widespread availability of parallel computing hardware, as well as recent advances in the enabling software technology, are making possible today the solution of large-scale, realistically modeled chemical process engineering problems, even in a real-time environment. Papers are sought that describe: (i) novel numerical algorithms and codes that promote the use of high performance computing in process engineering, and (ii) applications of high performance computing technology and techniques to solve large-scale process engineering problems. Applications of interest include process simulation, online and off-line optimization, and control. Also of interest are applications in fundamental process modeling, including transport phenomena, molelcular dynamics, etc. Industrial applications are particularly welcome.

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Joint Area 10c and Group 6a Sessions

1. Computational Fluid Mixing.

This session highlights the applications of computational fluid dynamics analysis to the study of mixing phenomena and the solution of industrial mixing problems.

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2. Computational Mixing in Process Operations.

This session highlights the application of computational fluid dynamics analysis of mixing phenomena for industrial process operations. Papers illustrating both conventional and novel applications of mixing simulations are solicited for this session.

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Joint Area 10c and Area 15a Session

1. Computational Methods in the Food Processing Industry.

The food and beverage industry is an important segment of the overall US process market. The industry has many features that have lead to difficulty in applying traditional process analysis and design techniques, and there is significant opportunity to combine new understanding of material properties with advances in computational modeling techniques to support product and process innovation. Although not limited tot he following areas, we seek papers that describe the development and application of computational modeling techniques in the broad areas of:

- Product design—e.g. use of molecular modeling techniques to predict and design food and beverage product properties.
- Process design—e.g. methods for and case studies in
    - supporting process design for the food industry,
    - characterizing process variability,
    - representing complex recipes,
    - modeling food and beverage unit operations
- Process planning, scheduling and operation—e.g. methods for proactive and reactive scheduling and batch recipe control,
- Process optimization—e.g. methods, and/or examples of successful optimization of food processes using computation tools.

Submissions are welcomed from both industry and academia in all categories.

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Area 10d: Applied Mathematics and Numerical Analysis

1. Population Balances and Applications.

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2. Nonlinear Dynamics.

Papers are sought on nonlinear spatio-temporal patterns in chemical systems. Of specific interests are reaction-diffusion systems, wave dynamics, mixing kinematics and fluid dynamics and dynamics of systems under control. Experimental, computational and theoretical papers are all welcomed.

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**CAST Programming Tips**
**3.** It is AIChE policy that a person may not author or co-author more than four presentations at any one meeting. The CAST Division supports this policy.

3. Computational, Integral and Spectral Methods in Engineering Applications.

The current advances in computer hardware in conjunction with the advances in various experimental techniques capable of probing systems at the nanoscale level make a very exciting environment for the development of new and powerful algorithms and numerical strategies. There are a variety of problems ranging from the molecular and microscopic level to the meso and macroscopic scale that need the focus of intense research in the design and implementation of such algorithms. Some of these problems are in connection with the design and characterization of new materials that may include, for example, composite and polymeric fluids, porous and structured media with a wide range of applications to new bioengineering and environmental processes. The accurate description of the fluid mechanics, transport and reaction processes require the use of sophisticated numerical schemes. This session will offer a forum where researchers from a variety of fields can share their experiences in the development of new and efficient computational strategies. Contributions in the general area of integral and spectral methods are particularly encouraged. As has been the case in past sessions, a leading lecture is planned and contributors are encouraged to make use of an integrated approach among analytical techniques, experiments and computational approaches if that is needed in the solution of a given problem.

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4. Parallel Computing Applications.

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Joint Area 10d and Area 8e Session

1. Applied Mathematics in Materials Processing.

Topics of interest include modeling of reaction kinetics and/or transport phenomena in materials processing, and nonlinear phenomena in materials processing. Of particular interest are: (a) large scale scientific computing; (b) model reduction for control purposes, and (c) hierarchical modeling: from molecular to mesoscopic (properties) or from mesoscopic to macroscopic (processes). Materials of interest include, but are not limited to, semiconductors, ceramics, polymers, composites, nanoparticles and biomaterials.

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Joint Area 10d and Area 15d/e Session

1. Mathematical Modeling in Cellular Engineering.

This symposium will focus on the application of mathematics to bioengineering, with an emphasis on experimental results and computational simulations. Topics include (but are not limited to) models describing cell biophysics, drug delivery, microbial transport, environmental interactions, genetic engineering and pharmacokinetic applications, cybernetic model development and reflex circuitry modeling.

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## CAST DIVISION POSTER SESSION

Section A. Recent News in Systems and Process Design.

This poster session will present new and interesting results in systems and process design. Poster topics include, but are not limited to, process synthesis and optimization, design under uncertainty, synthesis of reaction, separation, heat exchanger networks, and hybrid systems, environmentally oriented design, and design for controllability and flexibility.

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Section B. Recent Advances in Process Control.

Poster presentations are sought that describe new theoretical developments and/or application studies in the area of process control.

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Section C. Intelligent Systems in Process Operations

Intelligent Systems technologies continue to offer an ever growing set of powerful concepts and techniques that are indispensable in addressing challenges faced in process operations. In particular, intelligent systems are playing an increasingly important role in applying the concepts of computer integrated manufacturing to the chemical process industries. The present day view recognizes that intelligent system techniques while useful, must be considered as components of hybrid systems. Techniques such as knowledge-based systems, neural networks, genetic algorithms, etc. have to be integrated with techniques based on mathematical and empirical modeling, statistical tools

and so on for a successful approach. Intelligent systems technologies have not only added to the array of techniques for encoding various forms of qualitative models thereby extending modeling capacity beyond mathematical description, but have also provided the basis for integrating a wide range of heterogeneous techniques into a coherent hybrid system.

The purpose of this session is to offer a current and future view of intelligent systems in process operations. The session seeks papers that describe applications and developing approaches that cover the range of intelligent systems modeling and integration techniques. A particular emphasis will be placed on descriptions of hybrid systems and methods of integration.

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Section D. Advances in Applied Mathematics.

Posters describing recent original results of interest in the areas of applied mathematics and numerical analysis are solicited.

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Section E. Demonstrations of Software for Process Control Education.

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EDUCATIONAL COMPUTER SOFTWARE DEMONSTRATIONS
(Joint Effort with Group 4)

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**CAST Programming Tips**

**4.** Every presenter is expected to send a hardcopy record of their presentation (with a Permission to Reproduce Manuscript Form) to the AIChE Manuscript Center no later than one month before the meeting. Full-length manuscripts are encouraged by AIChE. The CAST Division has elected not to mandate any specific length or format requirements for presentation records for its sessions. However, the minimally acceptable content does consist of an introduction, results, discussion, and references which may be augmented with figures and tables, presentation visual aids, or poster panels.

**First Call for CAST Sessions**
**1999 AIChE Spring National Meeting**
**Houston, Texas**
**March 14-18, 1999**

The names, addresses, and telephone numbers of the session chairs are given on the next several pages, as are brief statements of the topics to receive special emphasis in selecting manuscripts for these sessions. Prospective session participants are encouraged to observe the deadlines which have been established, but may be changed, by the Meeting Program Chair, Peter Wanser. A complete call for papers for all sessions at this meeting may be accessed at http://www.aiche.org/meeting/1999/spring/cfp/.

AIChE is currently soliciting electronic submission of proposals-to-present via the world wide web only. To submit via the web, access http://www.aiche.org. Do not send proposals-to-present to the session chair email addresses.

Houston Meeting deadlines:

August 1, 1998: Submit a proposal-to-present electronically to AIChE via web access at http://www.aiche.org. AIChE will forward proposals to the corresponding session chairs.

September 1, 1998: Session content finalized, authors informed of selection. Authors of accepted proposals may update abstracts electronically.

February 1,1999: Authors submit hardcopy manuscript (presentation record) with a Permission to Reproduce Manuscript form to AIChE Manuscript Center.

March 14, 1999: Speakers bring 60 hardcopies of visual aids for distribution to the audience at the presentation. (This is a CAST Division policy intended to improve the quality of presentations and the benefit to the audience.)

Please note that there is an AIChE limitation that no person may author or co-author more than four contributions at any one meeting.

Authors submitting by the above deadlines will be notified of decisions on acceptance as close to September 1 as the schedules of the session chairs, the Meeting Program Chair, and AIChE permit. Abstracts of accepted proposals will be available on the web for public browsing approximately one month before the meeting.

Presenters at AIChE meetings are reminded to send a hardcopy record of their presentation to the AIChE Manuscript Center no later than one month before the meeting. The purpose of this requirement is to improve the quality of presentations generally as well as to enable AIChE to more broadly disseminate ideas and results by filling requests for copies of presentation records during and after each meeting. Formal full-length manuscripts are encouraged by AIChE and many of the programming groups. The CAST Division has elected not to mandate any specific length or format requirements for presentation records for its sessions. However, the minimally acceptable content does consist of an introduction, results, discussion, and references which may be augmented with figures and tables, presentation visual aids, or poster panels. The Executive Board of the National Program Committee has adopted the policy that the advanced submission of a hardcopy presentation record be a condition for presenting at AIChE-sponsored meetings.

Area 10a: Systems and Process Design

1. Process Integration in Industrial Practice.

Papers are being sought for recent applications and developments in process integration. Whereas the emphasis is on proven success stories in industrial practice, new concepts that have a high potential for successful implementation in industry are also welcome. Contributions should demonstrate efficient methods in the context of process design, simulation and optimization of industrially-relevant chemical processes. Non-traditional but promising methods such as neuro-fuzzy logic concepts, petri-nets, etc. are also encouraged. The contributions can address grassroots or retrofit problems. The area of application is open. Examples include overall plant efficiency, yield enhancement, energy conservation, pollution prevention, and overall plant profitability.

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2. Practical Process Synthesis.

This session invites contributions form industry and academia in the general area of process synthesis. Special attention will be given to presentations, which document successful applications of methodological approaches in process design. In particular, we want to encourage industrial contributors to share their recent experience in using systematic methodologies, combinatorial or programming techniques in chemical process development. New theoretical strategies like network synthesis, graphical methods, rigorous or heuristic optimization techniques for flowsheet generation are equally welcome.

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3. Advances in Commercial Design Software.

Papers are requested describing original research and development on the application of commercial software to design or retrofit industrial processing plants. Papers are desired which focus on novel or non-conventional applications to design or improve processes as opposed to the simulation or rating of processes. Although the emphasis will be placed on existing commercial software, original work that highlights needed methods not available in commercial software are also welcome. The selection criteria are new results substantiated by specific examples of industrial importance. Marketing presentations are prohibited.

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Joint Area 10a and Area 10c Session

1. Internet Applications in Chemical Engineering.

Inter- and Intranet technology is having a profound impact on the availability, dissemination and use of information that can be represented in electronic media. The objective of this session is to highlight existing applications of Inter- and Intranet technology to chemical engineering practice and to provide a forum for debate on what applications we may see in the near future. We encourage participation from all sectors of chemical engineering, and are

particularly interested in presentations and papers from industrial users that highlight existing or planned uses of the net, from software vendors that are building frameworks and specific application tools that take advantage of the network structure, from content providers that are developing network resources of information for chemical engineers, and from academicians who are developing research platforms and tools for industrial or academic use. We would like to see papers that are not just compilations of web pages or which will result in "point and click" presentations. We want contributions which delve more deeply into the issues of delivering information and applications in this environment. We would like each contribution to highlight the important reasons, decisions, pitfalls and economic motivations for moving from the current means of delivering the application to a net-based one, and where applicable explain why the project was inconceivable without the net.

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Joint Area 10a and Area 10d Session

1. Population Balances and Applications.

Papers are solicited about the modeling, optimization and design of systems involving population balances. We consider among others solids processes, and handling; crystallization, fluidized bed systems; colloid systems and biological systems. Papers on design, modeling, and control are all welcome.

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Area 10b: Systems and Process Control

1-2. Theory and Applications of Advanced Process Control I and II.

Papers are solicited in the area of theory and applications of advanced process control. Particular emphasis is placed on the relationship between recent theoretical developments and industrial applications. Papers on industrial needs, novel applications to experimental processes, industrial application studies, as well as critical and tutorial reviews of recent theoretical advances in advanced process control are especially encouraged. Specific advanced process control topics of interest include, but are not limited to process modeling, identification, monitoring, estimation, on-line optimization, and fault detection.

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Area 10c: Computers in Operations and Information Processing

1. Potential Benefits of Global Optimization in Industrial Practice.

In the last several years the academic community has published many new results on global optimization. However, very few successful industrial applications of global optimization have been reported. This is due partly to the traditional gap between academic research and industrial application. In this session, we are striving to reduce this gap. We will invite two top researchers in global optimization, and up to four industrial practitioners who have had experience with optimization in the CPI to discuss the potential benefits of global optimization to the CPI, and to identify areas where global optimization will find a niche. The discussants will also try to identify what further developments in academia and industry will lead to the broad acceptance of global optimization as an enabling technology. Readers are encouraged to nominate industrial practitioners who will serve as suitable discussants for this session. The session will be tentatively organized as a tutorial on global optimization, presentations by industrial practitioners, and open discussion addressing the issues identified above.

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2. Practical Challenges of Data Reconciliation.

Data is one of the main assets of any company, especially for chemical companies, since huge amounts of data are available at processing plants and R&D laboratories. Unfortunately not all the data are "good". There are many errors and noises while collecting the data. Consequently in order to extract meaningful information, data reconciliation technology is required. In the last decade, several computer-aided methods have been introduced to perform plant monitoring, control, accounting, etc. To gain benefit from using these methodologies, it is necessary to feed in the "correct" data with the "correct" model. Thus, data reconciliation became a key ingredient for applying the advanced technologies. Since the appearance of the first commercial data reconciliation packages several issues remained the object of active research: the detection of biased instrument and leaks, instrument variance estimation, among others. Other issues are still confined to academia, like dynamic data reconciliation and optimal sensor location. This session is aimed at discussing the current challenges that the area of data reconciliation is facing in practice and the directions of research taking place in academia. We invite practitioners, software vendors and developers from academia to participate in this forum and contribute to a lively discussion of these issues.

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**CAST Programming Tips**
**5.** In addition, it is a CAST Division requirement that every speaker bring a sufficient number of hardcopies of their visual aids for distribution to the audience at the presentation.

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Please mail this application to:

**American Institute of Chemical Engineers**
**Computing and Systems Technology Division**
**345 East 47th Street**
**New York, NY 10017**

# American Institute of Chemical Engineers

# 1998 Award Nomination Form*

## A. Background Data

1. Name of the Award _____ Today's Date_____
2. Name of Nominee _____ Date of Birth _____
3. Present Position (exact title)

_____

4. Education

| Institution | Degree Received | Year Received | Field |
|---|---|---|---|
| | | | |

5. Positions Held

| Company or Institution | Position or Title | Dates |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

6. Academic and Professional Honors (include awards, memberships in honorary societies and fraternities, prizes) and date the honor was received. Use separate page.
7. Technical and Professional Society Memberships and Offices. Use separate page.
8. Sponsor's Name and Address

_____

_____

_____

Sponsor's Signature

_____

*A person may be nominated for only one award in a given year.

***THE DEADLINE FOR AWARD NOMINATIONS IS APRIL 15, 1998***

# B. Citation

1. A brief statement, not to exceed 250 words, of why the candidate should receive this award. (Use separate sheet of paper, please.)
2. Proposed citation (not more than 25 carefully edited words that reflect specific accomplishments).

# C. Qualifications

Each award has a different set of qualifications. These are described in the awards brochure. After reading them, please fill in the following information about the nominee where appropriate. Use a separate sheet for each item if necessary.

1. Selected Bibliography (include books, patents, and major papers published).
2. Specific identification and evaluation of the accomplishments on which the nomination is based.
3. If the nominee has previously received any award from AIChE or one of its Division, an explicit statement of new accomplishments or work over and above those cited for the earlier award(s).
4. Other pertinent information.

# D. Supporting Letters and Documents

List of no more than five individuals whose letters are attached.

| | **Name** | **Affiliation** |
|---|---|---|
| 1. | | |
| 2. | | |
| 3. | | |
| 4. | | |
| 5. | | |

**Please send the completed form and supplement sheets to the CAST Division 2nd Vice Chair, Herb Britt,**

**Aspen Technology, Inc., 10 Canal Park, Cambridge, MA 02141-2201, E-mail: britt@aspentec.com,**

**Phone: 617-577-0100, Fax: 617-577-0303**

***THE DEADLINE FOR AWARD NOMINATIONS IS APRIL 15, 1998***

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