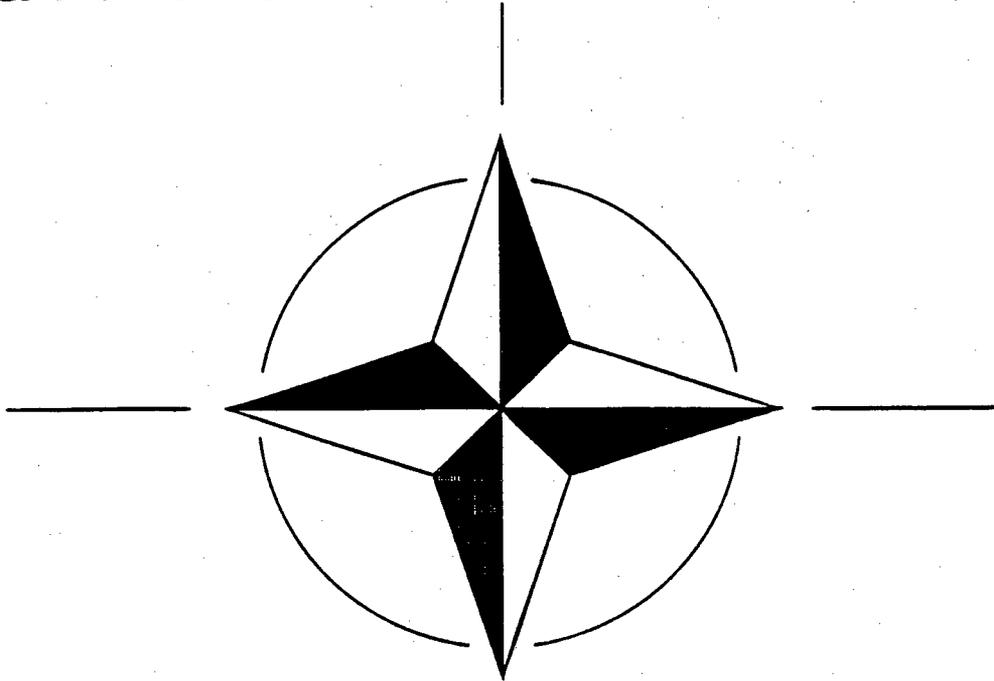


north atlantic treaty organization
scientific affairs division

advanced studies institute



**Defense Conversion
Strategies**

July 2-14, 1995
The Atholl Palace Hotel
Pitlochry, Perthshire
Scotland

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The Atholl Palace Hotel

**NATO
Advanced Study
Institute
on
Defense Conversion Strategies**

**The Atholl Palace Hotel
Pitlochry (Perthshire), Scotland**

July 2-14, 1995

Sponsored by:

North Atlantic Treaty Organization Scientific Affairs Division

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Department of Trade and Industry, United Kingdom
Argonne National Laboratories
Space Dynamics Laboratory, Utah State University
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Center for Continuing Education, University of Notre Dame**

AGENDA

NATO ASI
Defense Conversion Strategies
AGENDA

The ASI agenda below is preliminary with respect to titles of individual talks and, in some rare instances, with respect to speakers and times. Please note that there will be numerous opportunities for informal discussions, meetings and seminars during the afternoon and evening hours. Such meetings are strongly encouraged. Poster sessions will be held each week of the Institute, and contributors to these sessions will be encouraged to be available for the entire ASI to talk about their work.

Sunday, July 2

1400 - 2200 Registration
 Atholl Palace Hotel Lobby

Monday, July 3

<u>Time</u>	<u>Topic</u>	<u>Speaker</u>
0900 - 1000	Introduction and Purpose of the ASI	The Directors
1000 - 1100	Fundamentals of International Technology Transfer	Gerity, P.
1100 - 1130	Tea	
1130 - 1200	Technology Transfer (cont.)	
1200 - 1300	Strategic Role of Research and Development Conversion in Defense Conversion	Corsi, C.
1300 - 1430	Lunch	
1430 - 1600	Developments in Defense Conversion Context	Gummet, P.
1600 - 1700	Unscheduled Time (informal discussions, workshops, etc.)	
1800 - 1930	Social	

Thursday, July 4

0830 - 1030	Panel: Policy and Issue Drivers - Facts and Figures	Healey, P. (chair)
1030 - 1100	Tea	
1100 - 1200	An Historical Perspective: The	Stear, E.

Boeing Company

1200 - 1300	Analytic Models - Micro and Macro	Southwood, P.
1300 - 1430	Lunch	
1430 - 1730	Unscheduled Time	
2030 - 2300	Poster Session I	

Wednesday, July 5

0830 - 0930		
0930 - 1030	Conversion in the Perm Region of Russia: Empirical Studies	Cronberg, T.
1030 - 1100	Tea	
1100 - 1200	Military Technology and Its Linkage to the Civilian Economy	Lock, P.
1200 - 1300	Implications of Conversion for the Technology Base	Pungor, E.
1300 - 1430	Lunch	
1430 - 1530	The Political Realities of Defense Conversion	Molas-Gallart, J.
1530 - 1630	Defense Conversion and Demilitarization	Grazin, I.

Thursday, July 6

0830 - 0930	The Global Economy and International Stability	Copley, G.
0930 - 1030	Impact of Defense Conversion on the Global Economy	Robertson, K.
1030 - 1100	Tea	
1100 - 1200	Case Study: Rheinmettal	Brauner, H. U.
1200 - 1300	The European Arms Industry	de Vestel, P.
1300 - 1430	Lunch	
1430 - 1700	Unscheduled Time	

Friday, July 7

0800 - 0900	Banking and Defense Conversion	Willington, P.
0900 - 1000	Dual-Use Technology	Davies, D.
1000 - 1030	Tea	
1030 - 1200	The Role of Venture Capital in Conversion and Examples	Syrrist, D.
1200 - 1300	Intellectual Property Issues in Defense Conversion	Dundervill, R.
1300 - 1430	Lunch	

Monday, July 10

0830 - 1000	Panel: Barriers to Success in Defense Conversion	Stein, J. (chair)
1000 - 1030	Tea	
1030 - 1200	Panel: Assessing Success in Defense Conversion	Carpenter, J.
1200 - 1300	TQM and Conversion	King, R.
1300 - 1430	Lunch	
1430 - 1530	Isn't all Defense Technology Dual-Use? A Comparative Study	Duston, D.
1530 - 1630	Overview of Defense Conversion in the CP Nations	Bystritskii, V.
1630 - 1730	Conversion Activities in the Urals	Romanova, O.

Tuesday, July 11

0830 - 0930	Defense Conversion in the Aerospace Technologies	Zagainov, G.
0930 - 1030	The Economics of Conversion	Hartley, K.
1030 - 1100	Tea	
1100 - 1200	The Electronics Industry and Conversion	Larcher, A.
1200 - 1300	Dual-Use Technology in Action	Mears, A., and Tittler, P.

*Carl Defense Strategies in the UK
Dual-Use Work*

*Adrian Mears
Technical & Quality Director
DERA*

1300 - 1430 Lunch
1430 - 1700 Unscheduled Time
2030 - 2300 Poster Session II

Wednesday, July 12

0830 - 0930 KONVER Melville, J.
0930 - 1030 Case Study: GEC Ferranti Defense Systems Leach, C.
1030 - 1100 Tea
1100 - 1200 Conversion Experiences and Policies in Italy Perani, G.
1200 - 1300 Crisis and Conversion in France de Penanros, R.
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1430 - 1700 Unscheduled Time
1800 - Banquet

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0930 - 1030 Case Study: ICI Conversion of Defense Facilities Saunders, C.
1030 - 1100 Tea
1100 - 1200 Case Study: The Westinghouse Corporate Philosophy Yang, J.
1200 - 1300 Case Study: The DoD Diversification Program Davis, L.
1300 - 1430 Lunch
1430 - 1700 Unscheduled Time

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0900 - 1100 Panel: Common Elements of the Strategies Angelo, J.
1100 - 1130 ASI Wrap-up The Directors
1230 - 1430 Lunch

NATO Advanced Studies Institute Agenda Overview

	Sun Jul 2	Mon Jul 3	Tues Jul 4	Wed Jul 5	Thur Jul 6	Fri Jul 7	Sat Jul 8	Sun Jul 9	Mon Jul 10	Tues Jul 11	Wed Jul 12	Thur Jul 13	Fri Jul 14
0800 -0830													
0830 -0900			5	8	14	18			21	27	31	35	
0900 -0930		1											39
0930 -1000				9	15	19				28	32	36	
1000 -1030		2							tea				
1030 -1100			tea	tea	tea	tea			22	tea	tea	tea	
1100 -1130		tea	6	10	16	19				29	33	37	ASI
1130 -1200		2				20							concludes
1200 -1230		3	7	11	17				23	30	34	38	
1230 -1300													lunch
1300 -1330		lunch	lunch	lunch	lunch	lunch			lunch	lunch	lunch	lunch	
1330 -1400					lunch to St Andrews								
1400 -1430													
1430 -1500		4		12					24				
1500 -1530													
1530 -1600				13					25				
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Brkfst starts at 7:00

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Lecturers

Lecturer	Date-Time	Lecturer	Date-Time	Lecturer	Date-Time	Lecturer	Date-Time
1	3-0900 Hyder	11	5-1200 Grazin	21	10-0830 Stein	31	12-0830 Melville
2	3-1000 Gerity	12	5-1430 Molas-Gallart	22	10-1030 Carpenter	32	12-0930 Leach
3	3-1200 Corsi	13	5-1530 Copley	23	10-1200 King	33	12-1100 Perani
4	3-1430 Gummet	14	6-0830 Robertson	24	10-1430 Duston	34	12-1200 de Penanros
5	4-0830 Healey	15	6-0930 Brauner	25	10-1530 Bystritskii	35	13-0830 Buchanan
6	4-1100 Stear	16	6-1100 de Vestel	26	10-1630 Romanova	36	13-0930 Saunders
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8	5-0830 Cronberg	18	7-0830 Davies	28	11-0930 Hartley	38	13-1200 Davis
9	5-0930 Lock	19	7-0930 Syrist	29	11-1100 Larcher	39	14-0900 Angelo
10	5-1100 Pungor	20	7-1130 Dundervill	30	11-1200 Mears/Titter		

GENERAL INFORMATION

NATO ADVANCED STUDY INSTITUTE (ASI)

General Information

The NATO Advanced Study Institute Program of the NATO Science Committee is a unique and valuable forum. Under its auspices almost one thousand international tutorial meetings have been held since the inception of the Program in 1959.

An ASI is defined as "primarily a high-level teaching activity at which a carefully defined subject is presented in a systematic and coherently structured program." The subject is treated in considerable depth by lecturers eminent in their field and of international standing. The subject is presented to other scientists who will already have specialized in the field or possess an advanced general background.

An ASI is aimed at an audience of approximately post-doctoral level. This does not necessarily exclude graduate students and may well include senior scientists of high qualifications and notable achievement in the subject of the ASI or in related fields.

Attendance is limited to 100 participants, including lecturers, and is normally two weeks in duration.

ASI Proceedings

It has always been felt by the Science Committee that, in view of the considerable investment made by the sponsor (s) and the effort of the faculty chosen to present the scientific program, the set of lectures given during the two weeks of the ASI deserve dissemination beyond the group of participants who are selected to attend. For this reason, most of the ASI's result in authoritative publications in the field.

Before 1973, publications of the NATO ASI's were scattered over the scientific literature, and a considerable number of potentially excellent scientific publications did not materialize because of their high specialization and consequently narrow market.

As a result of a publication policy of the NATO Science Committee implemented in 1973, most NATO ASI proceedings are now published in a uniform book series, the now well-known NATO ASI Series.

The Proceedings of this ASI will be published by Kluwer Academic Publishers.

ASI Objective

The objectives of this ASI are to explore international strategies which stimulate:

- the conversion of defense technologies to industrial capabilities;
- global economic growth and stability;
- the preservation and enhancement of defense technology options; and
- the ability to capitalize on the unique economic, political, and social opportunities afforded by defense technology conversion.

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ABSTRACTS

THE TECHNOLOGY REINVESTMENT PROJECT

H. Lee Buchanan

The end of the Cold War has profoundly changed the defense structure of the U.S. Three factors especially are acting in ways that are at the same time coherent and contradictory. First, political pressure to shrink defense budgets rapidly and reap a peace dividend caused a drastic reduction of standing military forces as well as new weapons system procurements. The character of the threat to U.S. national security has changed from a single, monolithic, industrial threat to multiple, diffuse, sporadic threats that are not well countered by a contracted Cold War military. Finally, although the overarching defense strategy of the U.S. is still to build on technological superiority, many critical defense technologies are now available first and sometimes only in the commercial sector.

As a result, the U.S. Department of Defense has embraced the policy of "dual-use" in which commercial and military industries are urged to become integrated and to act as partners with the government rather than as simple suppliers. There are several elements which are critical. Certainly, federal regulations which have evolved over many years must be reformed and rewritten to allow other than the adversarial behaviors of the past. As well, policies and processes must be implemented to encourage full and widespread use of new authorities. But most difficult is the task of gaining acceptance to change on both government and industry sides.

The Technology Reinvestment Project (TRP) has been a primary tool for the implementation of this new policy. Over the three years of its implementation this program has invested nearly \$1 billion dollars in technology development, deployment and education activities. Projects are selected competitively from proposals submitted by teams and partnerships of defense and non-defense organizations and are cost shared with non-federal funding. The TRP has had both practical and political difficulties. This presentation will describe successes and failures and discuss lessons learned.

CONVERTING DEFENSE R&D IN RUSSIA: PROBLEMS AND PROMISE

Vitaly Bystriiskii

The economic, political, and social changes underway in the former Soviet Union are of unprecedented scale and importance. Figures published in 1993 cited more than 800 defense enterprises, employing a total of four million workers, undergoing conversion, while 600 conversion programs were planned to guide the process. To date nearly one million people involved in the defense domain have left the employ of the military-industrial complex. These changes will affect all spheres of post-Soviet society for decades to come.

The complete restructuring of the Russian economy and social life mandates in turn significant changes in the scientific establishment and its place in post Soviet society. The published figures indicate that defense oriented R&D has experienced enormous difficulties and can expect to suffer more. As a by-product, basic and pure scientific research, also supported by the defense science budget, have been and will continue to be affected greatly.

This report is dedicated to an analysis of the problems and promise of defense R&D conversion in Russia, which must simultaneously follow two major strategies:

- * provide sufficient defense-technology capability while sustaining the general health of advanced research and education;
- * reorient itself to the civil economy, using its pool of high technologies

Various issues will be addressed in the report such as:

- * current and future problems of defense related R&D in Russia and their consequences;
- * preservation of intellectual potential and construction of a new scientific base for Russian security interests in the transition period;
- * the role of Russian state institutions and the private sector in supporting R&D and its conversion;
- * the role of the West in support of Russian basic and applied science, and West-Russia collaboration for defense R&D conversion;
- * tentative policy recommendations for post-Soviet R&D strategy for the future, based on the given analysis.

TOO SOON FOR PLOWSHARES: NEW FACTORS IN THE DEFENSE CONVERSION DEBATE

Gregory R. Copley

The basic theme of this paper is that the sound which we now hear is not that of swords being beaten into plowshares, but rather the sound of new weapons, new alliances and new *blocs* being formed around the globe. The paper will explore the vacuum left by the collapse of superpower competition and discuss the factors which now underpin the current strategic environment.

The paper will look at the number of actual armed conflicts currently underway around the world today, and seek to determine whether we are entering a period of greatly increased hostilities and insecurity, and whether the resources exist to cope with the growing anomie. It will examine whether the United Nations can have a future in brokering and maintaining peace, or whether it can even withstand the fact that it is being pulled in opposite directions on almost every issue.

The paper will look at the fact that, while the Western world is preoccupied with perpetuating confrontation in the Balkans, with Iraq and with Libya, for example, it is not preparing to cope with the less orthodox new challenges emerging from the radical states. The paper will look at the question of why the West cannot bring itself to give due attention to the "gunpowder states" such as Iran and the DPRK, or even to the emerging economic powers such as India. The paper will ask whether, by ignoring and failing to respect these emerging threats or realities, the West is courting the same disaster which it brought upon itself by ignoring the capabilities of Japan in the 1930s.

And finally, it will deal with the question of whether today's defense conversion strategies should be considered not just in the light of converting existing defense facilities and capabilities into ecologically sound peaceful entities, but also whether some of them should be re-oriented to ensure security and balance in the world into the second millennium of the current era.

THE STRATEGIC ROLE OF "R&D CONVERSION" IN DEFENSE CONVERSION

Carlo Corsi

The key to the success of industrial policy and consequently of national economics is nowadays strongly linked with the capacity of developing, managing and transferring Innovation Technology.

One of the most relevant aspects of technology management is "managing technological change", that is of the capacity of transferring the scientific and technological results into a real socio-economical context by managing the high speed of technological change; this progress is so fast, wide and complex (the innovative wave is practically investing all the forms of modern living) that is almost impossible for a single, isolated structure and organization to react promptly and adequately to this change for surviving and staying competitive in the international market.

These considerations are particularly true for military industrial organizations, which, accustomed to the highest level of "quality and quantity" of R&D investments, are nowadays paying high costs to their market crisis. So, the evident and heavy crisis in the production market has actually hidden the higher risks (although apparently minor in money value) deriving from the R&D crisis in defense companies. In fact, although in a few countries the forms of support to military R&D have been saved by "converting" to civil objectives, in most European countries the R&D cutting has been almost drastic and total especially when, in the absence of specific government organizations responsible for managing R&D, the research activities were strongly connected to the investments for developing new equipment.

Moreover, this crisis can involve future impotence in producing advanced hi-tech products, and surely it will cause losing the competition against better organized R&D structures (like e.g. Japan), where advanced R&D national programs are even forecasting possible future developments of advanced military equipment deriving from civil technologies.

A study of an actual scenario, an identification of already existing and future problems and a suggestion for possible solutions will be illustrated and discussed.

DUAL USE TECHNOLOGIES

Sir David Davies

Changes in the world order, coupled with rapid developments in technology, have encouraged many governments to examine the relationship between defense research and civil applications. Traditionally, advanced technology often arises from defense research and may subsequently spin off for civil use.

Today, however, the civil technology base dominates the market and future developments in many generic technologies. The UK and many other countries are now encouraging increased collaboration between the civil and defense research. Increased alignment and collaboration between the civil and defense sectors leads to improved economic benefits, with defense having at least as much to gain from civil spin-off and access to commercial technology.

U.S. DoD TECHNOLOGY TRANSFER POLICY AND MECHANISMS

Lance A. Davis

The Cold War has ended and the U.S. Department of Defense has responded with massive reductions in manpower and expenditures for procurement. These reductions notwithstanding, however, the world remains a highly uncertain place, with potential threats to U.S. interests from regional or ethnic conflicts, proliferation of weapons of mass destruction and possible failure of political reform in newly democratic states. DoD strategy is evolving to counter these threats, and one element of that strategy is an \$8B Science and Technology (S&T) program aimed at ensuring technological superiority for future war fighting needs. In light of reduced procurement budgets, it is clear that the DoD can no longer afford to maintain a separate defense industrial base and, hence, a major thrust of the DoD S&T program is to develop dual-use technology and promote DoD/industrial interactions for technology transfer.

In its earliest manifestation, DoD technology transfer was viewed as unlocking the huge investment in defense technology for the advancement of U.S. global competitiveness. It is apparent now, however, that DoD must pursue dual use technology development/tech transfer in its own self interest, in order to gain access to commercial technology to assure the future affordability of DoD systems. The DoD needs to promote the development of defense and commercial technology along parallel paths, so that technology upgrades driven by dynamic commercial markets will be compatible with defense systems. This paper will discuss the policy issues and mechanisms which presently drive this vision of DoD technology transfer and dual use technology development.

CRISIS AND CONVERSION OF DEFENSE INDUSTRIES IN FRANCE

Roland de Penanros

This presentation will be divided into two parts. The first will detail the nature of the crisis facing French military industries, focussing on the problems conversion has pressed on this sector. The second will concentrate on a regional example, the case of Brest.

THE EUROPEAN DEFENSE INDUSTRY: FACTS, FIGURES AND PROSPECTS

Pierre De Vestel

The last five years have seen major transformations in the various components of the defense economy in Europe. The end of the Cold War and the reduction in defense expenditure that followed it have destabilized defense companies. In addition to the reduction in activity, the defense economy is undergoing a process of transformation that affects many of its constituent parts. The justification for the size of defense budgets, and the economic and industrial policies associated with them, are challenged, beginning with their cost and place in the economy; the examples of defense production and technology are questioned principally in comparison with the state of the civil economy; the place of internationalization of the defense sector is increasing and the traditional relationship between buyer and producer is changing. In parallel with this, defense policies must also be modified in a strategic context that is unclear.

A first evaluation of the situation can be made after these five years of change, especially as political events that are of importance for the organization of security and defense in Europe are on the horizon. A particular emphasis will be put on the presentation of the evolutions of the different aggregates related to the defense industry activity in Western Europe and in the United States (equipment expenditures, R/D investments, turnover, exports and employment). The process of internationalization of the defense industry and especially the Europeanization process, which are going to grow dramatically in the coming years, will be analyzed. The consequences of these processes are particularly interesting in terms of industrial structure and technological acquisition process. Finally, these trends will be inscribed into the most likely institutional and political scenario of the European integration process of defense industry and markets.

INTELLECTUAL PROPERTY ISSUES IN DEFENSE CONVERSION

Robert F. Dundervill, Jr.

Intellectual property rights are an important and valuable asset in today's international market. Companies are licensing, selling, and trading intellectual property and creating joint ventures involving intellectual property around the world. Intellectual property issues are fundamental to the market application of new or modified goods or services whether those goods or services are developed by public or private organizations. This paper discusses the major components of intellectual property law: patents, trademarks, copyrights, semiconductor chip protection, and trade secrets. Rights of the various intellectual property components are defined in accordance with the governing international, national, or common law foundations. Additionally, technology transfer mechanisms, such as licensing and joint ventures, are reviewed.

ISN'T ALL DEFENSE TECHNOLOGY DUAL-USE? A COMPARATIVE STUDY

Dwight Duston

Much discussion and emphasis lately has centered on the role of governments to fund research and development which is termed "dual-use". The word "dual" refers to an application driven by an agency's primary mission as well as another application, usually commercial. A recent debate raging in the U.S. is centered on whether the federal government, particularly the Defense Department, should be investing taxpayers' funds into dual-use R&D programs. What neither side of the argument seems to realize is that during the basic research/exploratory development phase, all R&D is dual-use. The real issue is the need to focus our efforts on exploiting both applications in parallel from the start of the project. This requires some commercial understanding on the part of the program manager, as well as business acumen from the entrepreneur. This presentation will attempt to illustrate these points with several case studies and examples taken from the successful Ballistic Missile Defense Organization Technical Applications Program.

THE WORLD MARKET AND DEFENSE TECHNOLOGIES

Miles Faulkner

This presentation will set the scene for the panel discussion to follow by arriving at some idea of the size of the world market for defense equipment and the related R & D expenditures.

FUNDAMENTALS OF INTERNATIONAL TECHNOLOGY TRANSFER

Peter F. Gerity, Ph.D.

A historical perspective beginning with the post World War II era advancing to current international strategies provides the platform for the initial case presented for the fundamentals of technology transfer principles and practices. Highlights of methodologies employed predominantly in the conduct of technology transfer utilized in North America, Western Europe, India, Eastern Europe and Asia form the base from which examples are drawn illustrative of several case studies in which the author personally participated. Factors critical to successful technology transfer outcomes are outlined including such factors as (1) product and market maturity, (2) ability to access start-up venture and mezzanine capitalization, (3) the role of key management personnel critical to successful market introduction and commercialization, (4) formation of strategic partnerships, (5) protection of intellectual property including proprietary technologies, know-how and process technology, (6) producing a stable platform for continued technology transfer opportunities and corporate growth.

The second session will be devoted to the utilization of teaching examples drawn from successful and unsuccessful technology transfer models created during the past and currently being applied to technology transfer areas outlined above. Some of these case study models will include (1) examples drawn from historical technology transfer to include (a) the automotive manufacturing sector, (b) electronics and consumer product market, (c) materials development, manufacturing and application, (d) military and civilian aircraft manufacturing, (e) pharmaceutical and agricultural product manufacturing and (d) the production of agricultural and construction equipment, (2) the current role of electronic network development and the introduction of computerization to (a) rapid design and manufacture, (b) rapid prototyping, (c) data compression and information sharing of manufacturing processes, (d) product development, (e) product design and build, (f) product distribution and (g) global service and support for technology transfer and information sharing. The role of this technology in facilitating global manufacturing and the need to eliminate many of the barriers to effective international technology transfer will be discussed as well as the concerns and possible risks associated with the realization of global manufacture.

THE POLITICAL ASPECTS OF THE "CIVILIZATION" OF THE MILITARY INDUSTRIAL COMPLEX (MIC) IN THE POST-COLD WAR WORLD

Igor Grazin

There are problems with our current understanding of the nature of the MIC and the process of "conversion". MIC is not determined by the nature of the products (it is easy to demonstrate that MIC produces non-military products as well and that "civilian" companies work for military purposes). It is rather the different economic-political status that makes the MIC - different technological philosophy, the nature of subsidization, tariff protection, price determination, state control and support etc. So "conversion" is not a technological but a political, ideological and economically doctrinal problem. Thus the "civilization", or making civilian, is a more appropriate word and means the dropping of the special-status benefits granted to the MIC.

That process of "civilization" goes through different stages determined by changes in political doctrines. They include ideas as to the nature of the natural state of the economy, on the economic potential, foreign political goals, the basic features of the "potential" warfare and on the potential developments of the actual military hardware. Actually these changes have included the shift from the offensive to the defensive doctrines, the exclusion of the nuclear component in the potential military solutions, and expectations towards "blitzkriegization" of the future military solutions.

The process of "civilization" of the MIC goes through the various degrees of its accomplishment: the reduction of the amount of most-deadly weaponry, "humanization" of it through international treaties, gradual increase of the civilian applicability of the initially military R&D.

Political determinant is also the question on how far the "civilization" is supposed to go - whether it is just the demilitarization of the MIC or its readjustment to the new post-Cold War world. Although this question does not rise in the established first-world countries' economies nor in the depressed economies (like in Russia) it is already a problem in the countries with economies "overheated" due to the successful transition (like Estonia or Czech Republic)

Economically "positive" for the economies with successful transition is the fact that several politically optimistic predictions on the potential convertability of the MIC have turned out to be wrong like the myth of technological superiority of the MIC, its high quality (in output and equipment), potential marketability, economic stability, etc. It opens up the perspective that special efforts may not always be needed for that procedure of conversion: without socialist style of subsidization of MIC in the superpower-countries (like the former USSR or in USA) the MIC or its parts are going to fall apart by themselves. The political decision is going to be made, though, on how much of the social costs the society and economy are going to pay for such an automatism of the "invisible hand" of democratic market economy and who is going to pay the bill.

The presentation is based on the empirical study of the whole MIC in the Republic of Estonia carried out August 1994 - January 1995.

USING SYSTEMATIC INNOVATION TOOLS TO ANTICIPATE CUSTOMER NEEDS

Bob King

In defense conversion, there is a danger in selecting products that customers want today because by the time it is designed customers may have moved on to the next generation. This talk gives a summary of approaches to systematic innovation with a focus on TRIZ and lines of product evolution as a basis for planning development for future needs.

CONVERSION OF DEFENSE ELECTRONICS INDUSTRY

Andrée Larcher

Electronics covers a wide range of technologies. Most of them have been known as dual use. The performance of electronics is proved to be necessary to armament superiority and new requirements for security and peace systems now enhance its strategic importance. As a consequence the share of electronics has been continually expanding in defense budgets but it now suffers budget constraints.

On the civil side, expanding markets for new products and services appear valuable for the diversification of defense electronics companies even if they are fueled by competition on a global economy basis. As a result progress of civilian technologies creates new opportunities for reducing the cost of development of various military products. Application of industrial methods in production processes also opens ways to reduce the price of military products or services, but defense technologies remain a huge potential for spin-off applications if still well financed by public authorities.

Four forces shape the new industrial base:

- 1) Public policies are changing fast the way they support conversion of their defense industries. Electronics is often the hinge of diversification on promising markets like those associated with multimedia and transportation applications. Nevertheless barriers remain between the logic of civil and defense administrations. Difficulties can be observed in the European Union because of national interests.
- 2) Defense contractors develop their electronics capabilities. It is fundamental to preserve their leadership on arms systems definition, to enhance their integrator role, to fit the new military demand particularly in simulation or space systems, to reduce internal costs, etc., and to compete with large defense electronics companies more and more involved as "primes". Defense contractors dominate now a third of the defense electronics industry.
- 3) Defense electronics companies face new challenges. Strategies adopted depend mostly on how they previously split their military and commercial activities. Financing diversification is of first importance.
- 4) Small high technology electronics companies which bring flexibility and innovation to the industrial base.

MILITARY TECHNOLOGY AND THE LINKAGE TO THE CIVILIAN ECONOMY

Peter Lock

The economic expansion after World War II was led by the United States whose economy managed a smooth return to a predominantly civilian economy. However, the emerging Cold War provided for a continuation of military R & D at levels unprecedentedly high in peace times. As a result military R & D contributed to opening new directions of innovation which were ultimately spun successfully into the civilian economy (nuclear energy and numerically controlled machine tools), though not necessarily in the United States by the companies doing military R & D. These cases continue to serve as a reference and suggest that investment in military R & D helps to enhance the competitiveness of national economies.

Extensive studies exploring the factors of national competitiveness in the context of a rapidly globalizing economy provide, however, cumulative evidence that the rate of innovation in the civilian sectors of the economy has accelerated so much that today the flow of innovation increasingly originates in the civilian sector.

This reversal of the "technological paradigm" will be analyzed on the basis of several case studies. In a special section the far-reaching implications of this trend for the Russian military high-tech production will be discussed. The virtual absence of advanced civilian industries and their separation from global corporate alliances put the Russian military-industrial complex into a particularly embarrassing situation with respect to its capacity to generate and integrate innovation.

The lead civilian technologies have taken will eventually also impose itself on the design philosophy of military systems. Examples will be discussed. The important question will be addressed whether certain sectors will remain exempt from this general logic of "civilianization" of military technology.

In conclusion the paper draws attention to the fundamental changes of the present defense industrial setting which are likely to emerge as a result.

CONVERSION AND CONTROL OF TECHNOLOGICAL CAPABILITIES IN THE MISSILE FIELD: THE "DUAL-USE" PARADOX

Jordi Molas-Gallart

With the help of examples extracted from the missile field, we will discuss the ways in which the dual-use applications of certain products and technologies may affect conversion initiatives. We will address some of the problems emerging in the process of missile dismantlement, and how "dual-use" can affect the future of missile-related industries.

It is often assumed that an economic unit specialized in developing and/or manufacturing military products with dual-use applications will be better placed to shift its activities toward civilian applications. Dual-use is seen as a technological bridge allowing companies to cross from military to civilian production. Yet, there is a less palatable side to "dual-use." This appears when areas of proliferation concern are densely populated by dual-use technologies. In such cases it may be felt that technological efforts carried out under civilian programs may result in military applications. Paradoxically, the international community may then regard with suspicion such conversion attempts.

There are two main reasons why the study of missiles is interesting in this respect. First, missile proliferation is raising serious proliferation concerns. Even old, first generation ballistic missile systems may, especially when armed with non-conventional warheads, pose a massive threat against population centers located hundreds of miles away from the launch sites. No effective defense has yet been developed against such a threat.

Second, ballistic missiles shared their technological foundations with space launch vehicles, a product area which is defined as of key economic importance by many developed and developing countries. Medium and long-range ballistic missiles can with small modifications be used as "space launch vehicles." The effect of such "dual-use" capability may be paradoxical. In some cases the dismantlement of ballistic missiles has extended to the closure of associated research and production facilities, mainly because it is relatively easy to shift between military and civilian activities. The objective of the lecture will be to discuss the implications of this "dual-use paradox" for the future of missile industries undergoing conversion processes.

CONVERSION EXPERIENCES AND POLICIES IN ITALY

Giulio Perani

In Italy, as in most industrial countries, the last years of decline in military procurement spending has led to an increasing interest in the definition of a large process of conversion of military industrial assets towards civilian activities, as a needed measure to reduce job losses and avoid major dislocations. Nevertheless, no consistent policies emerged in order to define a national strategy for promoting conversion activities. Consequently, the main Italian arms producers have been considering, as a priority in their strategies, the strengthening of their ability to produce and to sell civilian goods. In this respect, a number of feasibility studies and market analyses have been carried out, but no consistent industrial strategies of conversion/diversification have been defined.

Nonetheless, some conversion experiences have been developed in the Italian military industry and some measures have been implemented both by the government and the Parliament. Conversion initiatives in Italy have been developed, until now, more by the Parliament than by the government. Since 1987, at least thirteen bill drafts have been presented to define several policy tools such as a conversion fund, a monitoring unit, or financial support to regional activities in this field. However, a comprehensive law has not been approved yet.

During 1993, a Law (no.237/1993) was approved establishing the first Italian conversion fund. As to this fund, the Law no.237/1993 offered to the government two main paths for promoting both "rationalization...[and] ...restructuring" and " ...conversion of the war industry". Unfortunately, this law is currently providing funds only for supporting restructuring activities, leaving to the European funding within the Konver program a major role in supporting conversion.

It is worth considering that the Law no.237/1993, together with other less specific governmental statements, is suggesting that the Italian Regions may play a relevant role in facing economic and social consequences of the military build-down. Such a guideline is consistent with European policies aimed at strengthening the ability of the European Regions to recover from major military spending reductions.

In this perspective we may suggest that if in the '80s conversion efforts in Italy had been characterized by experiences of conversion at the plant level with large involvements of workers, Trade Unions and social groups, in the '90s the Italian way to conversion will be mainly characterized by a regional approach.

TRANSFORMATION OF THE ECONOMY IN HUNGARY

Erno Pungor

The Hungarian economy has been transformed since the beginning of 1990 from a centrally governed system to a market oriented one. The transformation was forced first of all by the change of government from a one-party system to a multi-party system. In the same time the eastern marker (COMECON States) was dropped, and this had influenced the heavy industry of the country very much. This fact influenced the Hungarian military industry also. The loss of Hungarian industry production was about 30% and unemployment increased from a very low level to a very high one (about 11%). At the start of the new government, an aim was offered to let develop a new structure of industry. Introducing privatization of state-owned industry also spurred innovation in small and medium industry. At the present time about 50% of state owned industry has been privatized and the percentage of the small and medium industries has reached 70% of the total of industrial places. The production in small and medium industries was helped also by government funding, giving support to technological development during the past 3 years of about 120 million dollars. In connection with this radical change and the new orientation of the industry in the last year, industrial production increased more than 10% in the motor industry, car industry, software production, etc.

IMPACT OF DEFENSE CONVERSION ON GLOBAL ECONOMY

Kathleen J. Robertson

The significance of the economic impact of the Cold War has not yet been fully realized. National priorities and investments, attributable to this conflict, distorted communities and industries. Although many countries, East and West, who were participants have already significantly downsized their militaries and reduced the budgets to support them, the industrial base does not have a similar process or measurement. In discussing the broad term of defense conversion, it is also important that a definition of conversion is agreed upon. Conversion is not dual use, particularly in terms of industrial strategy. Nations, economies and industries developed and grew during this unique era in world history and proceeded along a normal and established process. However, conversion on this order of magnitude, within national economies and industrially, has no precedent.

SOCIAL-ECONOMIC ASPECTS OF CONVERSION IN THE URALS

Olga A. Romanova

The military-industrial complex of the Urals is formed by over than 100 enterprises, half of them being plants of a machine-building, engineering profile. The volume of production of these enterprises, divided by total industrial output of the region, is several percentage greater points than the similar ratio in Russia as a whole. Export of military equipment and weapons being dramatically reduced and conversion processes being actively developed, most facilities of military-industrial enterprises were reoriented to produce civil goods. The share of civil products in the output of these enterprises rose from 48.3% in 1990 to 78% in 1994. There exist, however, a number of factors that counteract the processes of conversion and have led to a drop in living standards of people employed in such enterprises. The intellectual and scientific potential appeared to suffer most of all, which fact threatens the whole set of high technologies and qualified staff, and raises social tension.

Local conversion programs in the Urals are aimed at preventing such losses, developing conversion strategy and working out an effective mechanism for the conversion process. Conversion programs are an integral part of regional industrial policy, meaning to convert the resources and potential of military-industrial companies to civil needs. These programs envisage the maximal possible implementation of available R&D results and innovation, alongside the actions of social policy.

These measures cannot, however, be undertaken without financial support provided by military enterprises themselves. To raise funds, companies broaden the range of demand for civil goods in their production schemes and study possibilities to cooperate with foreign businesses. As Russia has recently lost some of its world military markets, military enterprises lack currency income that could be the major source of financial support of conversion process.

The Urals region seems to have enough financial, economic, research and technological basis to be the site for federal military-industrial centers. The redirection of military products' flows from internal toward external markets as well as the use of currency earned to reconstruct the facilities of military enterprises for civil goods demanded on the internal markets, could be a real financial base for conversion.

NEW TECHNIQUES FOR CONVERTING DEFENSE FACILITIES AND ASSETS

Charles Sid Saunders

The changing conditions of defense departments around the world are creating the need for rapid change and conversion of defense assets to commercial use. A variety of methods of conversion will be discussed with case study examples being reviewed and highlighted. Specific details of ICI America's conversion effort at the Indiana Army Ammunition Plant will be discussed. Methods of utilizing defense facilities will be explained along with financial benefits to both the Defense Department, industry, and the community. The Indiana model can be adapted to a variety of facilities and assets throughout the world. Ways to utilize the Indiana model will be highlighted and discussed. The conversion methods to be reviewed offer the most rapid creation of value from defense facilities.

MODELS OF CONVERSION: WHAT HAVE WE LEARNT?

Peter Martin Southwood

Over the last 10 years the prospects for implementing conversion strategies have been transformed. Yet defense industry adjustment has still proved an often difficult and painful process. How conversion is undertaken is important to both successfully overcoming the obstacles and also contributing to international peace. So this lecture will have three main objectives. First, to clarify the various theoretical approaches to conversion up to 1989. Secondly, to examine how they have been applied, especially in the West since the end of the Cold War. Finally, to draw out any lessons for the future.

In thinking about conversion the focus at the micro-level will be on individual plants, companies, communities and regions. The conversion potential of each will be assessed against historical experience and the policy framework that was, or was not, put in place to support particular initiatives. The focus at the macro-level will be on the link between conversion and security policies, on the one hand, and conversion and economic and industrial policies, on the other hand. The extent to which defense conversion has, or could have, contributed to international peace will be distinguished.

The value of this talk to the practitioner should lie in understanding the broader context of individual initiatives and the contribution government policy can make to assisting the conversion process. Likewise both policy makers and researchers may find this historical assessment of theory and practice useful for any future development of conversion strategies. While the theory and practice is principally related to the main Western industrialized countries some of the findings may also be relevant to Eastern Europe and the former Soviet Union as they develop market economies and new security frameworks.

AN HISTORICAL PERSPECTIVE: THE BOEING COMPANY

Edwin Byron Stear

During its seventy-eight year history, The Boeing Company has experienced many reversals of its fortunes when its business base was predominantly military and likewise when its business base was predominantly commercial. Over these several decades, Boeing has undertaken many different kinds of initiatives in order to sustain its viability as a significant and profitable American business enterprise. Some of these initiatives have been quite successful while others have been less successful and some have been failures in that they did not become profitable components of Boeing's ongoing business enterprise. This presentation will provide a brief historical sketch of the environment which engendered these initiatives, the main elements of the initiatives undertaken, and the final results. It is hoped that this overview of one company's historical experience will provide some context for the current discussions and debate surrounding the issue of defense conversion and its many challenges.

CONVERSION AT A RUSSIAN SHIPYARD IN ESTONIA: A MIXED RECORD OF SUCCESS

Josephine Anne Stein

Conventional microeconomic approaches to evaluating defense conversion almost invariably conclude that conversion is a failure. The case of Shipyard No. 7, a Russian military shipyard in Tallinn, Estonia, is no exception. The situation confronting the shipyard in the early 1990's was not, however, only a matter of conversion: there was a transfer of ownership as the Russian military withdrew from Estonia, during a period of economic transition within Estonia as a nation. The fate of the shipyard must be understood in the context of oversupply in the shipbuilding and ship repairing industry in the Baltic region and throughout the world.

However, a conversion project at Shipyard No. 7 achieved some tangible results, including the attraction of a number of Estonian, Russian and Western business representatives to a conference in June 1993, followed by the placement of some orders from Western companies. The project was part of a successful exchange between Swedish and Estonian students and their academic supervisors. This approach was used as a model for a study of the conversion of an electronics factory in Pskov, Russia.

More importantly, the conversion project achieved some remarkable, if more intangible results. The project was based on cooperation among Estonians, Swedes, ethnic Russians living in Estonia and Russian nationals, mostly from St. Petersburg, with the support of people from a number of other countries in Europe. At a time when there were considerable tensions in Central and Eastern Europe associated with the Russian presence, the spirit of cooperation was a real achievement. Even if the conversion itself could not be considered an economic success, the conversion project certainly did achieve positive results.

BANKING AND DEFENSE CONVERSION

Peter Willington

The discussion seeks to identify the risks involved from the banking aspect of defense conversion or, more specifically for the purpose of definition, the risks inherent in the change of ownership of defense companies from public to private sector and the change of products of former defense companies. The talk will consider risk limitation schemes and the trend toward stand-alone project financing techniques.

It is hoped that the role of venture capital in these techniques can be seen to complement other talks during this session. We will describe the experience in the UK of both privatization and project financing by an examination of noteworthy examples.

THE WESTINGHOUSE CORPORATE PHILOSOPHY

Joseph H. Yang

Conversion is seldom spontaneous, rarely voluntary, and most likely reactive or induced. Therefore it must be a planned activity which projected profit and challenges.

The first challenge in converting a military industry into a nonmilitary one is to develop a keen ability for search and identification of those unfulfilled requirements of the communities that have means to pay for their acquisition, in cash or in credit. The second challenge is to develop the ability to manage high-speed conversion of facilities and human resources for production and delivery of a new product or service in the new market environment. The third challenge in conversion is the ability to attract investors for resources which will be needed for new facilities and a new skills pool to do the new business in a cost effective way.

There is no unique way to convert any one military industry into a commercial product industry. Each company has its unique approach because of its unique historical background and geographic conditions. The Westinghouse Electronic Systems Group has developed three guiding principles in its assessment of conversion projects. The first principle is that the Westinghouse core competency must be the key contributor to the conversion effort. The second principle is that the market for the newly developed product must be large enough to permit new entries. The third principle is that there must be customer community participation as development partners.

Two conversion examples will be presented in accordance with these principles. They are electric power train systems for automobiles and all weather radars for commercial aircraft.

DEFENSE CONVERSION IN AEROSPACE TECHNOLOGIES

German Zagainov

In this lecture the evaluation of a defense budget reduction process is presented as well as past stages of Russian defense industry conversion. The lecture contains a brief description of the world's largest aerospace research center - the Central Aerohydrodynamic Institute named after Nikolay Ye. Zhatovsky (TsAGI)-and its role in the Russian aerospace industry. While working out the concepts of conversion of a large research center it is necessary to take into consideration the organizational peculiarities of the defense complex in the former USSR, as well as specific features of the economy functioning in those years and today.

In accordance with Russian and world community strategic purposes the concepts of a large research center conversion were developed. The concepts include:

- changes in the mechanisms of the Institute economic activity;
- adjusting new forms of relationship within the staff and regulation of intellectual property problems;
- regulating relations with Government authorities in connection with fundamental research activities and with State selective support for one of the home scientific leaders;
- reorganization of the Institute into a holding techno-park with subsidiaries to adapt high aerospace technologies to civil economy demands;
- development of cooperation with civil branches of the economy on the State support basis (gas and oil industry, agriculture, transport, medicine, lumber industry, fuel energetics) and with scientific and industrial enterprises of these branches and joint market penetration;
- participation in Federal programs;
- regional scientific and industrial corporate organizations to provide more integrated support to civil economy branches;
- reorganization of the personnel training programs according to new operating conditions;
- regional integration policy and participation in the regional programs;
- broad international cooperation in aerospace activity and conversion.

The work under the civil aviation development programs takes an outstanding place in TsAGI's activity. Under the State Committee on Defense Industries TsAGI takes part in creating new aircraft and helicopters and advanced transport space systems.

BIOGRAPHIES

Joseph A. Angelo, Jr.
SAIC

Angelo has wide military, corporate and public service experience. His twenty-year career in the USAF, where he served as a lieutenant colonel, included experience in space systems, antiterrorist and counterintelligence activities, nuclear weapons and power technologies, and advanced surveillance systems. In private industry he was director of advanced technologies for EG & G, Inc., and for the Science Applications International Corporation, for whom he still consults. Currently a consulting futurist with his own firm, he served as commissioner on the State of Florida's Commission on Space and is a member of the Space Power Committee of the International Astronautics Federation. He holds a Ph.D in nuclear engineering from the University of Arizona and publishes widely.

Herbert Lee Buchanan III
ARPA

Buchanan is the Director of the Technology Reinvestment Project, a multi-agency organization (ARPA, NSF, NIST, DoE, DoT, and NASA) responsible for the execution of nearly \$1.5 billion of funding in technology development, deployment, and manufacturing education. This project is the first of its kind, a fully collaborative execution from program design through proposal solicitation, selection, and execution. It is a centerpiece in the Clinton Administration's push to "reinvent government." Dr. Buchanan is also the Director of the Defense Sciences Office of the Advanced Research Projects Agency. This office is most involved in technology based R&D in the physical sciences and is responsible for the investment of about \$300 million toward the development of high performance electronics, materials, and manufacturing processes for use in future defense and intelligence systems as well as in medical technology and innovative new energy sources for military use. Before coming to ARPA, Dr. Buchanan was a Division Manager (Applied Science) for the TITAN Corporation, a senior theoretical physicist at the Lawrence Livermore National Laboratory, and a U.S. Navy aviator. He has B.S. and M.S. degrees in Electrical Engineering from Vanderbilt University and a Ph.D. from University of California, Berkeley/Davis. He is a Captain in the U.S. Navy Reserve and the father of three.

Vitaly Bystritskii
Institute of Electrophysics

Bystritskii is the leading scientist of the Institute of Electrophysics, Ural Department of Russian Academy of Sciences, and at the present time is on leave at University of California at Irvine.

After graduating from the State University of Voronezh as a nuclear physicist in 1964, he studied tritium production in nuclear reactions. For more than 20 years he has worked in the domain of pulse power, plasma physics and electrophysics. He received his Candidate of Science degree in experimental physics in 1977 from the Joint Institute of Nuclear Research at Dubna (Moscow) for collective ion acceleration studies, and a second degree (Doctor in Electrophysics) in 1986 from the Institute for High Current Electronics at Tomsk for high power ion beams studies. During the last few years he has been involved in the conversion of pulsed power to civil applications, including material science and clean up. In 1992-93 he was awarded a Carnegie Foundation Fellowship at Stanford University for the study of defense pulsed power conversion.

Gregory R. Copley
International Media Corporation

Copley has been Editor-in-Chief of the *Defense & Foreign Affairs* group of publications since April 1972, and has for the past 20 years also acted as an adviser to a number of governments at Head-of-Government or Cabinet level on national planning issues. He is the author of many articles, open and classified papers, and numerous books on strategic, defense, aviation, and other subjects, including two books of poetry. Mr. Copley's books include the annual encyclopedia, the 1,400 page *Defence & Foreign Affairs Handbook*, which, since 1967, has gone to senior government officials of more than 120 countries, and the 1995 *Defence & Foreign Affairs Handbook on Egypt*, just published.

Gregory Copley is President, and co-founder with Dr. Stefan T. Possony, of the International Strategic Studies Association (ISSA) which has, since 1982, organized a series of conferences around the world for professionals involved in national security management and national security studies.

Carlo Corsi
Corsorzio Roma Ricerche

Corsi is a specialist in electrooptical receivers and smart sensors, techno-biomedical devices/micro-systems and ITT through transversal technologies, as well as defense conversion. He is general manager of Corsorzio Roma Ricerche and corporate assistant for Innovation Technology Strategies in Alenia S.p.A. He holds an advanced degree in electronic engineering from Rome University "la Sapienza" where he has taught for more than 20 years.

Professor Sir David Davies CBE, FRS, FEng
Ministry of Defense

Davies has been Chief Scientific Advisor to the Ministry of Defense since 1 October 1993. He was born in 1935 in Cardiff and educated at the University of Birmingham, from which he graduated in Electrical Engineering and subsequently undertook research for a Ph.D degree. He joined the staff at Birmingham University and during part of that period held a part-time Senior Principal Scientific Officer post at the Royal Radar Establishment, Malvern via a staff interchange scheme. In 1967 he became Assistant Director of Research at British Railways Board, Derby and in 1971 he was appointed Professor of Electrical Engineering at University College London, where he also served as a Vice-Provost of the College for two years. In 1988 he became the Vice-Chancellor at Loughborough University of Technology until he moved to the Ministry of Defence. He was elected to the Royal Academy of Engineering in 1979, to the Royal Society in 1984, and was awarded a CBE in 1986, and appointed Knight Bachelor in 1994.

Professor Davies is President of the Institution of Electrical Engineers and a past President of the Institution of Electronic and Radio Engineers. He has been a Council member of various bodies including the Royal Society, the Council for National Academic Awards and the Open University. He has also served on various government and private sector advisory boards and committees, including the Science Inquiry Committee of the Royal Society, the BBC Engineering Advisory Committee and currently the British Rail Research and Technology Committee. He was also Chairman of the Defence Scientific Advisory Council prior to taking up his present post.

Professor Davies has researched and published in the fields of antenna arrays, radar systems, signal processing and optical fibre sensors. He received the Rank Prize for Optoelectronics in 1984 and the Faraday Medal of the Institution of Electrical Engineers in 1987.

Professor Davies married his second wife, a chartered surveyor, in November 1992, and has two sons and a daughter.

Lance A. Davis
Department of Defense

Davis holds a Ph.D. in engineering and applied science from Yale University, and is the author of numerous technical papers, widely-known speaker at international conferences and holder of 6 US patents related to Metglas alloys. He has long experience in private industry, with Allied Signal, Inc., where he was vice president for research and development for a decade before joining DoD as deputy director of defense research and engineering in the Office of Technology Assessment. There, as a presidential appointee, he is charged with facilitating the defense reinvestment and conversion activities of the Department of Defense.

Roland de Penanros
Université de Bretagne Occidentale

De Penanros has been teaching general economics for more than 20 years at the University of Brest. In recent years he has specialized in Defense Economics. In the late spring of 1994 he organized an international conference around the theme of the crisis in the armament industry and regional development, with contributions from S. Bondariev (Russia), Lloyd J. Dumas (USA), R. Eisner (USA), J. Fontanel (France), K. Hartley (UK), P. Locke (Germany), E. Malinvaud (France), S. Willet (UK), among others.

Currently he is chair of Defense Economics at his University, in charge of a research team on defense and development, and has several publications forthcoming.

Pierre De Vestel
GRIP

Political scientist, Senior Researcher at GRIP since 1991, de Vestel has specialized in the political economy of European defense and the statistics related to this dimension. He developed during the past four years a comprehensive database on the major aggregates related to European defense activity including statistics from 1980 to 1993 on defense budget, equipment purchases, R/D, exports and employment. During this period, he realized several studies for Belgian public authorities (Regional and Federal), the European Parliament and Commission and the Western European Union on topics related to the diversification process in Belgium and in Europe, research and development aspects and the European integration process of defense economy. He is published widely.

Robert F. Dundervill, Jr.
NTTC

Dundervill is Director of Washington Operations for the National Technology Transfer Center, providing technology transfer and commercialization services to federal and private organizations. His experience includes intellectual property law, business formation, licensing, commercialization strategy, venture financing, cooperative R&D agreements, and technology transfer program management. He has a BS in Engineering from the United States Naval Academy, MS in Aerospace Engineering from the Air Force Institute of Technology, and a Juris Doctor in law from the American University, Washington College of Law. He is a member of the Virginia State Bar and admitted to practice before the Patent and Trademark Office.

Dwight P. Duston
BMDO

Duston is the director, Science and Technology, Ballistic Missile Defense Organization, Department of Defense, Washington, D.C. In this position, he is responsible for innovative concepts and basic research sponsorship, including the Small Business Innovation Research program and the Technology Applications program. He graduated from the University of Michigan with a bachelor of science in physics in 1969 and a master of science in physics in 1973. In 1977, he was awarded his doctorate in physics from the University of Michigan. Duston's doctoral thesis work centered on plasma physics, inertial confinement fusion research and x-ray lasers.

Duston was a research scientist in the Physics Division of the U.S. Naval Research Laboratory prior to joining the Ballistic Missile Defense Organization in 1984. He has authored over 25 technical publications, edited three books and journal issues, and has served on numerous governing and advisory boards of various laboratories, research centers, and companies. In addition to his BMDO position, he is adjunct Associate Professor of Technology Management at the University of Maryland and an Associate Editor of the journal, Technology Management. He is a member of the American Physical Society and a Senior Member of the Institute of Electronics and Electrical Engineers.

Miles Faulkner
Ministry of Defence

Faulkner is the International Finance Adviser to the Defence Export Services Organization (DESO) of the United Kingdom Ministry of Defence. He is a graduate of the London School of Economics and Political Science, and an Associate of the Chartered Institute of Bankers. He started his banking career in 1960 and over a period of 20 years acquired broad financial experience in commercial, merchant and investment banking. He worked for two leading merchant banks, Kleinwort Benson and Schroder Wagg and for the stockbrokers James Capel. He then spent 10 years with the leading UK group, Trafalgar House Plc, setting up their Project Finance Department. He was closely involved in obtaining British Government support for a number of major construction projects both in the UK and overseas. He served as an adviser to the construction industry on committees of the Export Group for the Constructional Industries and contributed several Euromoney articles on export finance. He left Trafalgar House in 1990 to set up his own consultancy practice before becoming a temporary civil servant within the Ministry of Defence in April, 1992.

Peter F. Gerity, Ph.D.
Utah State University

Gerity, Vice President for Research at Utah State University in Logan, Utah, was born in Summit, New Jersey. His degrees include: B.S., Delaware Valley College; M.S. and Ph.D. from Virginia Polytechnic Institute. He became V.P. for Research at USU in 1994 with responsibility for their \$100 million research program. USU was designated a Carnegie Research-I Institution in 1994 placing it in the top 2.4% of institutions in the U.S. He served as Associate Dean at the University of Utah's College of Engineering from 1986-1994, where he had responsibility for \$35 million in research and development funds annually and helped develop numerous spin-off products and companies. In 1978, Gerity became President of AMS, Inc., an international marketing and technology transfer company whose operations reached 63 countries. He has participated in international licensing of manufacturing processes and technology; engineered products and supervised construction of turn-key manufacturing facilities abroad. Gerity has served on the Pentagon's advisory board for technology transfer since 1988. Since 1990, he has served as Chair and PI for the Southwest Center for Environmental Research and Policy (SCERP), an \$8.0 million international consortium, which includes five U.S. universities and four from Mexico, focusing on border environmental and technology transfer issues. He held research fellowships from NIH and NSF while at VPI and assignment as Science Crew Chief to VPI and Duke University's Oceanographic Institute Research Vessel RV-Eastward. He was Assistant Professor of Biology at Purdue University and in the School of Medicine at Indiana University as Medical Education Director for one of the nation's first Physician's Assistants programs. He continued such work at the University of Utah's College of Medicine in the Department of Family and Community Medicine.

Igor Grazin
University of Notre Dame

He was graduated cum laude from University of Tartu in 1975, and received his Candidate of Sciences in 1979; his Doctor of Sciences in 1986, his Docent in 1983, and has been Professor since 1987. He was Associate Dean, Head of the Chair and Chairman of the Editorial Board of the Tartu University Law School. During 1989-1991, he served as a Member of the Supreme Soviet of the USSR and the Peoples' Deputy of the USSR. He was co-founder of the Popular Front of Estonia and was Special Council to the President of Estonia as well as Chairman of the Board of the Estonian Institute for Open Society Studies.

Currently he is Faculty Fellow of the Kellogg Institute for International Studies, University of Notre Dame, USA, and Professional Specialist in its College of Business Administration. Grazin was a Founding Member and Member of the National Council of the Estonian Reform Party/Liberals.

Anthony K. Hyder
University of Notre Dame

Hyder, co-director of this ASI, received the B.S. in Physics from the University of Notre Dame in 1962, and the M.S. (Space Physics, 1964) and Ph.D. (Nuclear Physics, 1971) from the Air Force Institute of Technology. He is currently Associate Vice President for Graduate Studies and Research, and Professor of Physics and Professor of Aerospace Engineering at the University of Notre Dame. The University is located just north of the city of South Bend, Indiana, USA. Prior to joining the University in 1991, Hyder was a member of the faculty and the administration of Auburn University in Alabama. Prior to joining Auburn University, Hyder served in a number of positions in Washington, DC, including the Air Force Program Manager for Pulsed Power and Directed Energy Systems, and as the Scientific Advisor to the Director for Research, Office of the Secretary of Defense (Research and Advanced Technology). He has served on the organizing committees of four NATO Advanced Studies Institutes and as co-director of two previous Institutes: High Brightness Accelerators (1986), and the Behavior of Systems in the Space Environment (1991). He is a Senior Member of the AIAA and the IEEE. He has served as a member of the US Air Force Scientific Advisory Board and is currently a member of the DIA Scientific Advisory Board and the NATO AGARD.

Bob King
GOAL/QPC

King is the Executive Director of GOAL/QPC. He has directed the research of U.S. quality gurus and TQM worldwide and has led research on the integration of TQM principles with American innovation. He established several research/application committees to investigate how advanced TQM applies to health care, education, government, financial services and other non-manufacturing industries and has worked with many executives of leading U.S. organizations in charting their development of TQM.

King is author of two books, *Better Designs in Half the Time* and *Hoshin Planning: The Developmental Approach*. He served as an examiner for the Malcolm Baldrige National Quality Award for 1989 and 1990, and is currently the lead instructor in training others to become qualified examiners for the Massachusetts Quality Award. He is currently organizing a worldwide research journal for Total Quality Management.

Andrée Larcher
CREST École Polytechnique

Larcher is a graduated engineer of the French National Institute for Applied Sciences and she obtained a master in business administration and economic affairs at the University of Lyon. She worked for during three years in the Philips Group as a technical engineer and afterward joined after the Bureau d'Informations et de Prévisions Economiques where she was in charge of the defense, aerospace and electronics sectors. She acted as an economist for forecast studies on various technical subjects in these fields and realized some private consulting work for European companies.

Larcher was auditor during the 25th session at the Centre des Hautes Études de l'Armement (CHEAr), and she continues to operate with working groups of this French military high school. In 1989, she was associated with CREST (Center for Studies on Relations between Strategies and Technologies), a laboratory of the French École Polytechnique, where she conducts work on dual-use technologies and on conversion of the electronics industry for defence and civil public customers.

Larcher has been a member of the CREDIT Network for two years.

Peter Lock
Free University of Berlin

Lock is senior researcher at the Institute for Political Science at the Free University of Berlin, executive secretary of the European Association for Research on Transformation (EART e.v.), and editor-in-chief of Militärpolitik Documentation. He has had a distinguished career in research and voluntary service. He contributes as an expert to the World Council of Churches, UNESCO, the UN-Security Council Committee on Apartheid and other German and international governmental and non-governmental organizations. He holds a Ph.D. in political science and international relations. He is a member of the fighter aircraft work group of IDDS in Cambridge, MA, and the CREDIT network.

Jordi Molas-Gollart
University of Sussex

Molas-Gallart is a Research Fellow at the Science Policy Research Unit of the University of Sussex. He holds a doctorate from the same center. Previously, he graduated in Economics at the Universitat Autònoma de Barcelona (Spain) and obtained an M.A. in International Relations at The John Hopkins University. His doctoral dissertation, *Military Production and Innovation: The Spanish Case* has been published by Harwood Academic Publishers. He is also author of several articles and book chapters on the Spanish defense industry, defense industrial policies, the relationship between military and defense technologies, and science and technology policy.

Giulio Perani
Archivio Disarmo

Perani is currently Senior Researcher at Archivio Disarmo in Rome. He has worked for Archivio Disarmo, an independent research center and NGO, since 1987 and now he is collaborating with the Italian National Research Council in Rome as well. His research activity focusses mainly on arms production and arms trade, military spending and military conversion. He has carried out research activity for public and private bodies, including the European Commission, the Italian Office of the President of the Council of Ministers, the Italian National Research Council, ENEA - Italian Institute for Alternative Energies and the Regional Government of Latium.

Since 1992, Perani has been a member of the European research network CREDIT (Capacity for Research on European Defense and Industrial Technology), an international study group established by the British *Science Policy Support Group*. During the few last years he collaborated with the *Institute for Defense and Disarmament Studies* of Cambridge, Mass. USA, the *Stockholm International Peace Research Institute, GRIP* (European Institute for Research and Information on Peace and Security) of Brussels and the Bonn International Centre for Conversion.

Erno Pungor
Bay Zoltan Foundation for Applied Research

Pungor obtained his higher education in chemistry and physics simultaneously. His studies were suspended in 1944 for military service. He returned home in the fall of 1945 from England as a P.O.W. He received his Ph.D. degree in 1949. Based on his scientific work he was conferred the title of Candidate of Chemical Science in 1952 and degree of Doctor of Chemical Science in 1956 when he defended his thesis.

He was invited by the Technical University of Budapest in 1970 to the Department of General and Analytical Chemistry as a professor and head of department, where he stayed. He was head until 1990 when at the age of 67 he resigned but maintained his position as a leader of the academic research group.

In 1990 he was offered the government post of President of the National Committee for Technological Development and then in December of 1990 with the same scope of duties he was appointed as a Minister without portfolio. Since 1990 Hungary has made a progress in the development of science and technology international relations.

Kathleen J. Robertson
ARPA

Robertson is currently assigned to the Advanced Research Projects Agency. She is part of the Technology Reinvestment Project team and is responsible for activities related to industry, state governments and organizations, DoD and the Hill.

Prior to joining ARPA, she was a senior analyst at the Center for Naval Analyses. Dr. Robertson joined CNA in February of 1993. The projects she has supported include issues concerning the industrial base, defense conversion and international competition. She recently completed the analysis of the Advanced Automation System for the FAA. Additionally she was the project director of a shipbuilding industry business strategy game, completed December 1993, in which critical issues were combined with strategic planning requirements.

Prior to joining CNA, she was the Director of Research for a Presidential Commission, during which she organized and directed all studies and analyses, edited the final report, and managed a staff of twenty analysts.

Robertson's business and management experience includes working for a large regional bank as manager of industrial development, three years working as a international corporate tax attorney-specializing in international tax strategies -- at Coopers and Lybrand. She then joined the corporate staff of McDonnell Douglas as corporate manager of international strategic planning. She was involved with a number of major corporate initiatives, providing strategic planning analysis and decisions. Robertson initiated an international competitive assessment analysis and was responsible for briefing senior executives, including the President and the international project involving twelve major aerospace corporations -- US and European -- at the CEO and President level. This project included a comparable level of government representatives. She also served on a five-member team, reporting to the President, to develop a new corporate policy and process for internal program review and risk assessment.

She holds a Ph.D in international political economics from the University of Alabama.

Olga Romanova
Russian Academy of Sciences

Romanova is the department chief, Institute of Economy, in the Russian Academy of Sciences, Urals Branch, and holds the degree of doctor of science in economics. In 1994 she was awarded the title of Honorary Scientist of Russia. Her professional interests include conversion of military enterprises, regional economy, social and economic aspects of regional industrial policy and restructuring policies in the old-industrial area. Her latest research project is a study of conversion processes in the Central Urals. She is a member of the board of the Russian association "Forecasts and Cycles" part of the Academy of National Economy under the government of Russia.

Charles Sid Saunders
ICI Explosives Environmental

Charles "Sid" Saunders, Vice President, ICI Explosives Environmental, is responsible for the Government operations of ICI Explosives. In this position he is responsible for the management of Army Ammunition Plants in Charlestown, Indiana and Chattanooga, Tennessee. Saunders was formerly Vice President of Business Development for ICI's Advanced Materials Division responsible for product development and government systems.

Prior to joining ICI, Mr Saunders was Director of Commercial Development for GAF Corporation in Wayne, New Jersey, and was responsible for new business development, economic evaluation, and the advanced technology and materials group.

Mr. Saunders holds a B.S. Degree in Chemistry from Texas A&M University, and a M.S. Degree in Chemistry from the University of Utah. He has served as an officer in the U.S. Air Force and is retired from the U.S. Air Force Reserve. He is married, has two sons, and lives in Chattanooga, TN.

Peter Martin Southwood
Researcher & Consultant

Southwood graduated from the Department of Peace Studies, University of Bradford, England, with first class honours in 1981. He then obtained a Master of Business Administration degree from the School of Industrial and Business Studies, University of Warwick. His doctoral research on "Arms Conversion and the United Kingdom Defence Industry" was also undertaken at the Department of Peace Studies, beginning in 1984, and he obtained his degree in 1988. A book based on the thesis, entitled Disarming Military Industries: Turning an Outbreak of Peace into an Enduring Legacy, was published by Macmillan in 1991. Several reports and articles on the UK defense industry and conversion have also been produced and the author has spoken on these topics at various management and professional conferences. He was a member of the Steering Committee of the UK Parliamentary Office of Science and Technology study on defense conversion in 1992. Currently he is a member of an international scientific group, the Pugwash Conferences working party on the conversion of military research and development, whose book is due out later this year. He is Co-Founder of the Project on Demilitarisation, based from 1993 to 1995 in Leeds University's School of Business and Economic Studies, and has edited a series of briefings on concepts of security. For the last four years he has lived in Oxford and worked as a self-employed researcher and consultant.

Edwin Byron Stear
The Boeing Company

Stear was named vice president - technology assessment for The Boeing Company in July 1990. He oversees critical and key technology efforts and directs the interdivisional technology coordination groups within the company. From 1983 until joining Boeing, Stear was the founding executive director of The Washington Technology Center at the University of Washington. In that position, he was responsible for the design, building and management of the state of Washington's joint industry-university research and technology development center, and a major new research laboratory facility. The center developed programs in a variety of advanced technologies, including advanced materials, compound semiconductors, microsensors and biotechnology.

Born in Peoria, IL in 1932, Dr. Stear received his bachelor's degree in mechanical engineering from Bradley University. He went on to earn a master of science degree from the University of Southern California, and received his doctorate in electrical engineering from the University of California, Los Angeles, in 1961. He has had wide experience in business, academia, government and the military.

He serves as a member of the NATO Advisory Group for Aerospace Research and Development, the Air Force Scientific Advisory Board, the NASA Aeronautical Advisory Committee and the Industrial Research Institute.

Josephine Anne Stein
University of Manchester

Stein is a Senior Research Fellow at the Programme of Policy Research in Engineering, Science and Technology, a research institute of The University of Manchester, England. Her research interests include the impacts of European Community R&D in the UK, international S&T policy, international education and employment of scientists and engineers, technology assessment, and military research and technology policy.

Before coming to the UK, Stein worked at the United States Congress Office of Technology Assessment, analyzing the effects of military R&D on civilian technology development in the USA, including trends in government spending, technology transfer, industrial practice and human resources. She also served as a science and technology advisor to United States Congressman George E. Brown, Jr., doing research and technical analysis of public policy issues, including R&D policy, international scientific cooperation, the Strategic Defense Initiative, nuclear arms control and verification, Earth remote sensing, nuclear energy and the Superconducting Super Collider.

Stein was educated at the Massachusetts Institute of Technology, where she earned a Bachelor of Science degree in Mechanical Engineering in 1978 and the degree of Doctor of Philosophy, also in Mechanical Engineering, in 1985. She holds a Master of Science degree in Engineering from the University of California, Berkeley, and held a post-doctoral fellowship at Princeton University at the Program on Nuclear Policy Alternatives. She has worked as an engineer for General Atomic Company in San Diego and at the Jet Propulsion Laboratory in Pasadena, California, where she designed and tested cryogenic sensor cooling systems for spacecraft.

Dag M. Syrrist
Technology Funding

Syrrist, 33, is Vice President and the principal industry liaison for the Environmental Finance Group at Technology Funding. His responsibilities involve the establishment and development of industry and governmental relationships necessary to implement Technology Funding's environmental investment strategies, including technology transfer, corporate alliances, and licensing. Mr. Syrrist also acts as Technology Funding's primary coordinator with the U.S. Environmental Protection Agency, the Department of Energy, the Department of Defense, the National Laboratory system and Cal/EPA. Syrrist currently serves on several federal, state, regional and industry advisory boards and committees focussing on technology development, diffusion and financing. He is also chairman of the annual Technology Funding Environmental Conference, the largest venture capital investing conference focussed on environmental technologies in the U.S. Syrrist began his career at Technology Funding in 1988 as an investment analyst ultimately concentrating in the environmental sector. Before joining Technology Funding, Mr. Syrrist was responsible for a privately held European agricultural group.

Syrrist holds a B.A. in Business Administration from Lincoln University and an M.A. in International Economics from San Francisco State University.

Peter Willington
Lloyds Bank

Willington is a Director of the Trade & Project Finance Group of Lloyds Bank Plc, one of the leading UK commercial banks. He is a Fellow of the Chartered Institute of Bankers. From 1990-92, he was seconded to the British Government to act as Financial Advisor on export policy and overseas privatization in the Department of Trade & Industry. Willington was the Secretary of the City: Kuwait Group, which formed part of the joint public and private sector initiative in 1991/92 for the restoration of Kuwait after the Gulf War, and is a recent member of the British Invisibles Advisory Panel for the CIS. He is a member of the Confederation of British Industry Export Finance Committee.

In 1994, Mr. Willington arranged one of the first officially supported financings from the UK to the Russian Federation, for a project involving the change of production of former defense plant in Russia to civilian purposes. He is also experienced in advising and arranging finance for export sales of defence equipment.

Joseph A. Yang
Westinghouse Electric Corporation

Yang is director of special projects of the Westinghouse Electric Corporation. He holds a Ph.D. from The Johns Hopkins University as well as a Diploma for Senior Managers from Harvard University. He has extensive experience in the academic, military and commercial fields. The DoD has given him both its US Army Outstanding Civilian Service and its US Navy Distinguished Public Service Awards.

German I. Zagainov
Association of State Scientific Centers of Russia

Zagainov is general director of the Association of State Scientific Centers of Russia, an organization formed by the President of Russia. Formerly he was director of TsAGI, as well as a member of the State Commission of Science and Technology Policy, and the Russian Expert Council on Space, and vice president of the League for Assistance to Defense Industries Enterprises. He held the rank of professor at the Moscow Institute of Physics and Technology where he lectured on the dynamics of flight and aircraft control systems. Author of more than 80 scientific papers, his work has earned him numerous scientific and government awards for service and ingenuity. He is a foreign member of the Swedish Royal Academy of Engineering Sciences.

SCOTLAND THE COUNTRY

SCOTLAND: THE COUNTRY

The word "glamour" was originally Scottish, and never has a country coined its own epithet with such accuracy. From the landscape of mists and mountains, heather and granite, blood and moonlight, emerged a people rich in that intangible quality, personified in so many of its most famous men and women - supremely so in Mary, Queen of Scots who, like her subjects, was a study in baffling contrasts.

Scotland itself is a country of contrasts. There are really two Scotlands: the Anglo-Saxon Lowlands of the east, and the Celtic Highlands of the north and west, in some parts of which Gaelic, one of the world's most ancient tongues, is still spoken. There is contrast in the scenery, too - from the lush pasture lands of the Lothians to the stark magnificence of the rugged mountain scenery of Wester Ross.

Scotland is a small country, approximately 30,000 square miles, comparable in size, topography, vegetation, and climate to the American state of Maine. Almost every glen exudes history - tragic, romantic, and violent. Over the centuries, Scotland has been torn by two kinds of strife - intolerance between the churches of Rome and Scotland and the perpetual menace of England's desire for territorial supremacy.

Although much of Scotland's internal administration is conducted from St. Andrew's House in Edinburgh, the capital, the seat of government is London, where Scotland is strongly represented in both Houses of Parliament. Scottish currency is the same as English, but Scotland banks produce their own rather colorful banknotes, which are legal tender throughout Britain.

Most hotels in Scotland are medium to small, often family-owned. Food is usually wholesome, but remember that Scotland is traditionally the "Land o' Cakes" - buns, pancakes, scones, and biscuits. More imaginative fare is served in places which carry the "Taste of Scotland" plaque and offer dishes with outlandish names like Cullen Skink (fish soup), Partan Bree (crab with rice and cream), Edinburgh Fog (syllabub). Try Loch Fyne herring, Arbroath "smokies" (smoked haddock), Aberdeen-Angus steak, and the spicy haggis (chopped offal and oatmeal cooked in a sheep's stomach), usually served with "neeps and tatties" (mashed turnips and potato).

Whiskey goes with everything. Try the "single malts" - the pale, unblended spirits. Add water, ice, or even lemonade. Beer comes "light" or "heavy", and there is Scots-brewed lager as well as many imported lagers.

Following the Local Government (Scotland) Act of 1973, which became effective on 16 May 1975, the old familiar counties of Scotland were submerged into nine large administrative entities called Regions. They are:

Borders Region: the Border countries north of Hadrian's Wall.

Dumfries and Galloway Region: the southwest of Scotland.

Lothian Region: Edinburgh and district.

Central Region: the area around Stirling.

Strathclyde Region: stretching from the Island of Mull in the northwest to Loch Ryan in the southwest, and embracing Glasgow.

Fife Region: the old "Kingdom" of Fife.

Tayside Region: all the land whose little streams and lochs drain into the River Tay, and including Deeside and the Moray Coast.

Highland and Islands Region: all the land north and west of the Cairngorm mountains, including the isles of Skye, Outer Hebrids, 'Orkney, and Shetland.

Scotland is, however, a country which likes to be visited. "Ceud mile failte," the time-honored Gaelic greeting, is still offered sincerely to Scotland's guests - a hundred thousand welcomes.

The District of Perthshire

Perthshire is an inland district, stretching 60 miles from Beinn a' Chreachain (3540 ft) on the edge of Rannoch Moor in the west, to Meigle in green Stratmore to the east, and some 45 miles from The Cairnwell (3059 ft) in the north, to the Cleish Hills, on the border between Fife and the old country of Kinross to the south. The area it covers, over 2000 square miles, can be thought of as a wide bowl, tipped to one side with the catchment area the River Tay.

The Tay, the longest river in Scotland, flows majestically some 120 miles from the slopes of Ben Lui, in Argyll, to the Firth of Tay at Perth, then opens onto the North Sea at Dundee. Wherever one walks in Perthshire, tributaries of the river are to be found - the Tummel, the Earn, the Garry, the Lyon, and many more, bringing their waters from the mountains of Breadalbane and Atholl to the farmland around Perth. These constitute an economic, as well as an aesthetic, resource, as many of the rivers which provide the headwaters of the Tay are dammed where they pass through the narrow Highland glens and provide a source of hydro-electric power.

Perthshire is clearly divided into two parts, however, and it is the larger northwestern section of the district which exhibits Highland characteristics. To the south and east the land is very different - flat and green, with low rolling hills. The two parts meet along a line which, through the years, has not only divided "Highland" from "Lowland" in a geographical sense, but has also been a boundary between the separate cultures of the Gaelic-speaking "Highlander" and the English-speaking "Lowlander." This is the Highland Boundary Fault, better known as the "Highland Line," which stretches from Helensburgh on the Firth of Clyde to Stonehave, just south of Aberdeen, through Crieff, Dunkeld, Blairgowrie, and Alyth in Perthshire.

The Pitlochry Area

Lying in the colorful valley of the River Tummel, Pitlochry is almost exactly in the center of Scotland and has been long famous as a holiday resort. Situated in the Perthshire District, it enjoys a temperate climate and has a very

low rainfall. It is little wonder that it attracts visitors, for nature has indeed been generous to this area, endowing it with a variety of scenery ranging from the soft, pastoral beauty of the lowlands to the rugged grandeur of the mountains.

Situated just off the main Perth-to-Inverness road (A9) and railway line, 27 miles from Perth, Pitlochry is properly "Pit-Cloich-Aire" (The Town by the Sentinel Stones). Pitlochry was originally a sentinel station in connection with Moulin Castle, later known as the Black Castle, which belonged to the Celtic Earls of Atholl. On the present golf course are the remains of an ancient Pictish fort, where some 2000 years ago a Pictish watch kept guard over the important Pictish village of Moulin, which lay along the shores of a small lake drained some two hundred years ago. When warning was given that danger was high, the inhabitants paddled their canoes and took refuge on an artificial island in the center of the lake, where now stands the remains of the old Black Castle of Moulin.

Pitlochry owes much to Queen Victoria, who, on a journey through the Highlands in 1844, remarked on the beautiful scenery, and her personal physician declared that Pitlochry had "the finest bracing mountain air in Scotland." Almost at once, Pitlochry became renowned as a "health center." Hydropathics were built and the 19th century saw the rise of the large, gracious Victorian mansion house built of local stone. These were let in summer for a few months at a time during the "season," and with the building of the Highland Railway in 1865, more summer visitors began flocking to the Pitlochry area.

Today, the diversity of tongues heard in the shops and on the streets indicates that Pitlochry has, in a relatively short period, changed from sleepy Highland village to become an "international center," and can justly claim to be "The Center of Scotland."

Golfing, walking, or touring - you'll find Pitlochry to be a lovely town to visit and explore, and an excellent base for touring the Scottish Highlands. Due to the countryside varying from dry heather moorlands to lochs and marshes, from oak and birchwoods to pine and spruce forests, and from mountain tops rising to over 3000 feet to agricultural land only 200 feet above sea level, there is an exceptional variety of birds, mammals, trees, plants, and wild flowers throughout the area.

Pitlochry is known for its manufacture of tweed, distilling of whiskey, and, most recently, production of leather goods. The downtown shops abound with native Scottish goods, including crystal, wools, and tartans, and are within walking distance of the hotel.

Of particular interest to the first-time visitor, and within walking distance of the hotel, are the following:

Pitlochry Festival Theater

Founded in 1951 by the late John Stewart, Pitlochry Festival Theater began life in a giant marquee which was rehoused in 1953 in a more permanent form. After thirty years in the center of Pitlochry, in 1981 the Theater moved to a new location on the banks of the River Tummel close to the famous Hydro-Electric Dam and Fish Ladder.

Now entering its 45th year, and winner of the British Tourist Authority's coveted "Come to Britain" Trophy in 1981, Scotland's only International Festival Theater is open from May to October. An exciting program of popular plays in repertoire, Sunday evening concerts, and open rehearsals is complemented by a series of events in the foyer, ranging from recitals and demonstrations by local crafts people, to Plays in Progress and late-night entertainments.

Since 1981, thousands of visitors from home and abroad have been delighted by the range of entertainment and facilities offered by the new, purpose-built theater. Truly a Theater in the Hills, the theater is within walking distance of the hotel via a suspension bridge or by way of the Dam and Fish Ladder.

This summer's repertoire includes Wuthering Heights, Charley's Aunt and A Chorus of Disapproval. Other events include a backstage tour, and a craft show. Ticket prices for plays are £9.50, £14.00 and £12.00.

Although no formal plans have been made for the ASI attendees as a group to attend a performance, the hotel's dinner schedule, beginning at 1830, should leave ample time for anyone to make curtain call at 2000.

Please consult the Pitlochry Festival Theater brochure contained in your Pitlochry Area Tourist Association packet for the repertoire schedule and booking information.

Pitlochry Dam and Fish Ladder

Spawned several years earlier in the streams above the Dam, the same salmon returning from the Atlantic may be seen "jumping" the River Tummell before finding their way through the specially constructed 900-foot ladder to complete their journey. It is a fascinating sight, as is the Hydro-Electric Dam regulating the flow of water from beautiful Loch Fascailly, created in 1947 to form a reservoir. Inside the Center and Power Station is an exhibition illustrating the history and work of the North of Scotland Hydro-Electric Board, which, since 1943, has been the body responsible for the development of Highland water power resources for the public supply of electricity.

The Pitlochry Dam, a ten-minute walk from the center of town, is 54 feet high, 475 feet long, and has two spillways and automatic drum gates. The crest of the Dam is a walkway which the public is permitted to use, and which links with other footpaths which the Board, in conjunction with the Forestry Commission, makes available for the public's enjoyment.

Blair Castle, Blair Atholl

Located seven miles north of Pitlochry, and the site of the ASI's Banquet on Wednesday, 12 July, this impressive building dates back in parts to 1255, and is the seat of the Duke of Atholl. The Duke is the only person in the British Isles who is allowed to maintain his own private army, and exercises his option - the Atholl Highlanders can be seen on ceremonial occasions around the Vale of Atholl.

Thirty-two rooms of infinite variety displaying beautiful furniture, fine collections of paintings, arms, china, lace, and other unique treasures present a

stirring picture of Scottish life from the 16th to the 20th Century, all set in magnificent grounds surrounded by the rolling hills of Perthshire.

The Castle is open daily to the public.

THE ATHOLL PALACE HOTEL

Set in 48 acres of wooded parkland and surrounded by a natural amphitheater of forest-clad hills, the baronial Atholl Palace Hotel has, since Victorian times, offered its guests all that is best in Highland hospitality.

Quite possibly originally built as a hydropathic health center in the 19th century, the hotel also briefly served as a school during the Second World War, offering a safe location from the German bombings of the London area. The Atholl Palace offers spacious private accommodations, idyllic views of the countryside, splendid dining and lounge facilities, and superb meeting facilities.

The Atholl Suite, the main meeting room for the ASI, is a self-contained facility attached to the Hotel via an enclosed walkway, and will seat up to 400 people comfortably. Numerous small syndicate rooms are also available for small topical meetings and discussion groups.

The Verandah and Salon Restaurants will be used for all meals, and the Stags Head Bar will be open for all to enjoy. The meal times, unless otherwise indicated, will be:

Breakfast:	0700-0900
Lunch:	1200-1400
Dinner:	1830-2100

Although the Hotel has been booked entirely for the ASI, meals may be attended during any of the above times - a seating "en masse" by participants and guests, which has characterized many past ASI's, is not necessary, and is even discouraged. This should allow ample opportunity for everyone to set his or her own daily schedule, within the limits of the Institute's Agenda and Lectures.