SESSION VI

April 26, 1989

Chairman: **D.H. Freas, The Ferroalloys Association - USA.**

Introductory Address:

"Challenge of the 90s", G.N. Booth,
General Manager, Casting Division, Ford Motor Company - USA.

1. **Panel Discussion: "The World Ferroalloy Producers' Problems and Opportunities in the 1990's"**
   - M.M. Mesquita - Brazil
   - B. Angles D'Auriac - Europe
   - S. Hanamura - Japan
   - J.E. Gomersall - South Africa
   - J.P. Trunzo - United States

2. **Comments:** A.M. Edwards, President International Committee on Ferro-Alloys

3. **Closing Address:** J.G. Oxaal, Chairman, INFACON'89

G.N. Booth of Ford Motor Company introduces Session VI with "Partners for Survival in the 90's.

M.M. Mesquita, Chairman of ABRAFI in Brazil leads off the Session VI panel discussion on "The World Ferroalloy Producers' Problems and Opportunities in the 1990's.

Session VI Panel Members D.H. Freas, B.A. D'Auriac, S. Hanamura, J.E. Gomersall and J.P. Trunzo.

Challenge of the 90's

by
George N. Booth
Ford Motor Company

I am delighted to have the opportunity to present the Foundry Products Perspective to this distinguished audience from around the world.

I want to take you on a journey this afternoon into the future. A future filled with dramatic changes and opportunities for those willing to discard "old ways" and move progressively into the next decade. The changes taking place today and in the next decade are second only to the industrial revolution. Those who can adapt to that change will survive - others, as we have already seen, will not. Which will you be?

Iron casting production tonnages will continue to decrease and other materials continue to capture a "larger share" of the casting business. For example, in the automotive business all future passenger car cylinder heads, and some truck heads, will be aluminum; and aluminum blocks are starting to make inroads. Weight reduction in our business is still an important driving force and the lighter we can make our iron castings the less likely they will be replaced by aluminum or some other lighter material. The message is clear, the demand for near net shape iron castings will increase. These actions will be the primary driving force behind a diminishing ferroalloy business.

We can view this as "a glass that is half full or one that is half empty" - opportunity or death knell. The choice is ours! The foundry customer's needs are changing dramatically and this in turn changes our needs relevant to the ferroalloy industry. Those who respond adequately and timely to those needs will survive, those who do not will fall by the wayside. A close working relationship between the casting customer, foundry and ferroalloy supplier will be essential for the survival of all parties in the next decade.

Ford Motor Company and specifically the Casting Division have met this challenge head on and this commitment is most evident in the following corporate statement:

Our mission is to improve continually our products and services to meet our customers' needs, allowing us to prosper as a business and to provide a reasonable return for our stockholders, the owners of our business.

This statement holds true for all of us as corporations and can be applied at all levels within a corporation. We all, whether Corporations, Divisions, Plants, Departments or individuals, have a customer - that customer's needs must be met!

We cannot accomplish this mission alone.

Consistent with our Corporate Mission, Values, and Guiding Principles statement that "suppliers are our partners", we recognize that the commitment needs to be "two-way" and be mutually beneficial to Casting Division and the supplier. We must work as a team in conjunction with the casting user to the mutual benefit of all parties. We are committed to

more effective involvement of suppliers to encourage their planning and input and ensure that mutually advantageous technologies are developed on a timely basis.

This afternoon I would like to start by taking a close look at casting customer "wants" in the next decade. Next we will look at how casting technology changes will respond to meet these customer wants. Third, and most important of all for each of us here today, I would like to put forth some challenges as to how the ferroalloy industry can meet their customer needs - the needs of the foundry industry in the 90's.

Casting Customer Wants

During the next decade far greater demands will be placed on foundries by their customer than ever before as designers strive for optimum value while providing the best possible performance and reliability in components. In addition these demands must be met while reducing the time required to take a product from concept to production.

The cost of a casting will be evaluated in terms of its contribution to the total cost of a component. Factors such as machining, shipping costs, ease of repair and service life, to name a few, will all be taken into consideration in determining the value of a casting.

Since virtually every step in a manufacturing process can affect total production economics and timing, and these steps are all highly influenced by the basic design, a much closer working relationship must be established between design and manufacturing functions at the customer and the foundry. This link will be established in the very early design stages and will be made possible by the interaction and implementation of new information systems such as Computer Aided Design and Computer Aided Manufacturing stations at the customer and foundry. The complexity of castings will increase as designers strive to eliminate costly assembly operations by integrating functions while taking weight out of the assembly.

Cast in features and casting designs never before possible will emerge as design engineers realize and capitalize on the full potential of new processes such as Evaporative Casting. The close working relationship between customer and foundry, already mentioned, will assure that an optimum design is obtained which provides good castability, highest reliability and lowest total manufactured cost - the highest value to the customer. As casting section sizes are reduced, improved tensile properties will be required to maintain sufficient strength to weight ratios. It will be highly desirable from a cost standpoint to produce these properties in the "as cast" condition.

More specialized types of iron will be required, not only to satisfy the need for improved tensile properties, but to meet increased demands in other areas such as impact strength, fatigue strength, corrosion resistance, modulus of elasticity and wear resistance, to name but a few.

Ultra high speed drilling, milling, tapping and boring will be extensively used by the mid-1990's. Machining rates will increase on the average by 200% over today's technology, with some operations

having the potential to increase from 500% to 1000%. With a cutting tool moving at these rates, hard spots cannot be tolerated.

In a continuation of a trend already started, foundries will be asked to provide a machined casting ready for assembly which will provide added incentive for the foundry to produce a near net shape casting. Casting customers will give preference to those foundries that are capable of providing value added features and a machined casting or component assembly, which can also be attractive from the foundry's perspective in terms of pricing and quality control.

Casting Technology Changes

As we enter the next decade the very nature of how foundries conduct their business will change dramatically. Being a full service supplier with design, testing, machining and development capability will be a must. Changes will touch all areas of a business from the organizational structure to manufacturing facilities and beyond.

Quality excellence will be expected in all areas of a business from design of the casting to follow up at the customer's plant. Implementation of advanced technologies in foundries will accelerate to an extent never before seen in the industry.

Leading this technological explosion will be a rapid evolution of the computer in design, engineering, manufacturing and office operations. Communication between all operations will be rapid, direct and occur on a real time basis whether internal or external to the foundry.

Computer Aided Design systems in the foundry will make it possible to interact directly with the customer in the design of castings and components. The use of techniques such as finite element analysis will be routine in the development and optimization of a casting design.

Computer Aided Manufacturing will be used to generate required tooling without the time consuming process of making models. This tooling will be very accurate because it is produced directly from the data base developed jointly by Product Engineering and foundry tool and manufacturing engineers. Multiple tooling sets will be produced rapidly and with extreme accuracy.

Simulation technology, solidification modeling and Computer Aided Engineering will enable the foundry to determine the castability of a design and make modifications without the time consuming stages used today in the production of prototype casting. All aspects of foundry processes used to produce castings from the melt shop to the cleaning room will be analyzed and optimized in terms of productivity and quality using Computer Aided Engineering.

Computer Aided Manufacturing will be widespread in the foundries of the next decade. Artifical Intelligence or Expert Systems on the foundry floor will provide a degree of process control never before seen.

Material usage such as ferroalloys will be controlled by AI systems having a direct interface with chemical and metallurgical analytical equipment in the lab and weights and measures equipment on the foundry floor. Dispensing of these materials will be fully

automated and tightly controlled by an AI system.

Late adjustments to chemistry will be minimized by very precise control over charge makeup materials using AI. This system will go far beyond chemistry control, it will utilize a very sophisticated data base to select and order all charge materials on a least cost charge makeup and just in time delivery basis. This data base will be just a small part of an extensive computer business system that will continuously monitor and make decisions that control cost and timing.

Computer aided design, engineering, manufacturing and business systems will be brought together through one integrated system, CIM, Computer Integrated Manufacturing. This system will be the "ultimate manager" in monitoring and making decisions on a plant's operation - one can readily see how this scenario could be expanded to a division - a corporation - and yes a country.

The message by now should be quite clear, we have only seen the very beginning as far as computers are concerned. By the end of the next decade we will view today's use of computers as archaic to say the least!

Foundries will maintain and operate highly instrumented experimental and pilot facilities with the capability to provide customers with a fully machined casting for evaluation. These facilities will utilize CAD/CAM/CAE as I mentioned previously to provide castings in a fraction of the time it takes today. Fully equipped chemical, metallurgical, mechanical, physical and environmental laboratories for the analysis of foundry materials and processes will provide a high level of technical support.

Let's turn our attention now to the area of molding and core processes. Efforts here will be concentrated on improved dimensional control and the production of a near net shape casting. To accomplish this on existing green sand mold lines, more casting surfaces will be formed by cores and less by green sand. The use of cast in place inserts of a wide variety of materials will become more common to meet design and performance criteria.

On line monitoring of tooling, cores and molds for dimensional accuracy will be common.

Self diagnostic software and hardware on core and molding equipment will monitor key wear areas that affect dimensional accuracy so that corrective actions can be taken before out of tolerance cores or castings are produced.

The Evaporative Casting Process, which already is well established in aluminum, will be producing near net shape iron castings on mold lines that will be a substantial step toward the totally automatic foundry of the future we have only talked about in the past.

The Evaporative Casting Process will be used extensively in producing thin wall, light weight ductile iron castings with outstanding strength and ductility. The in-mold process for producing ductile iron will be applied to ECP and will also be used to eliminate "trapped carbon" from the breakdown of polystyrene often encountered in producing castings with thin sections with this process.

Austempered ductile iron castings will be well established in the castings marketplace by the mid-90's and by the end of the next decade austempered ductile iron castings will be produced "directly" by controlled solidification and cooling of a casting.

Compacted graphite irons will find increased application in replacing forgings and producing near net shape castings that have strength properties that are between grey and ductile iron.

During the 90's many changes will occur in metal melting, holding, treating and pouring practices used in the foundry. A good many of these changes will be in the category of refinements to existing processes; however, by the end of the decade innovative new technology will take its place in the melt shop as well.

We are already seeing the refinement of furnace designs to improve melt and holding furnace efficiencies. Metal level indicators, rotary nozzle systems, electronic weighing and batching and automatic alloy additions are relatively recent innovations adapted from the basic steel industry. The optimization of charge make up through the application of computer technology has already been implemented in some foundries and will reach a state of perfection in the next decade.

Plasma fired cupolas will be in operation as foundries strive to reduce melt losses and charge material costs while reducing environmental problems. The ability to charge a wide variety of scrap and the drastic reduction in oxidation loss of silicon will reduce substantially the consumption of ferrosilicon and other ferroalloys while allowing the foundry to produce a wider range of chemistries.

Computers in the next decade will literally run the melt shop. Programmed start up cycles after relining an induction furnace will be controlled so that the furnace will ramp in temperature, hold for the correct time and then go into a melt down mode. In a like manner, during operation the computer will monitor lining condition, metal temperature, metal level and mold line demand so that optimum power parameters are maintained. Adjustments to chemistry will be rapid, precise and made by automation receiving its input directly from laboratory analytical equipment.

Metal holding and treatment will advance to the point where it will be possible to hold ductile iron for prolonged periods without drastic losses in nucleating ability and temperature. This will be accomplished through the development of improved facilities and new treatment alloys that greatly reduce or eliminate the "fade" we currently experience. Inoculation to control microstructure will progress in much the same way as chemistry control. Chill depth, graphite type and shape and matrix micro-structure data will be entered manually or automatically into a computer which will interface with appropriate ferroalloy feeders to dispense the needed alloy amount based on weight of metal.

Automatic pouring in the next decade will become the "norm" for virtually all foundries large and small, driven by the need for improved yield and better control over pouring temperature. The use of "contact pouring" methods will

further enhance the integrity of castings by providing a uniform high pressure head of slag free hot metal to the mold cavity.

Foundry processes and machining operations in-house or at satellite manufacturing locations will be monitored and controlled on a real time basis. A central data base will compare production process performance with historical data and pilot parameters. Machine vision systems will verify the surface and dimensional characteristics of the casting and machined part. Laser systems will code all parts for later problem analysis if required. The castings produced must be of consistent quality for use in flexible machining systems and dimensional integrity, hardness and soundness must be assured for the unmanned manufacturing process of the future.

In the next decade productivity will be driven by continuous improvements in quality and quality excellence will continue to be at the forefront of everything we do.

Ferroalloy Industry Changes

Driven by our customers' needs, the next decade in the foundry industry promises to be one of the most exciting and challenging since that first casting was made - and that goes back a long way! What then must the ferroalloy industry do, as a major supplier to the foundry industry, to participate profitably in the next decade?

The ferroalloy industry must move beyond the traditional "customer, supplier relationship" to form a partnership with the foundry industry. Being a full service supplier is a requirement. it is essential that the ferroalloy industry work closely with the foundry in the manufacturing, packaging, shipment and use of their products.

In this relationship "simultaneous engineering" must prevail wherein the supplier and foundry work together as a team in developing and applying new technology that will benefit both parties while meeting the customer's requirements.

Total quality excellence must be at the forefront of everything we do in the next decade - whether we are producing automobiles, castings - or ferroalloys. Let me elaborate further on what I mean by total quality excellence.

Outstanding quality of product is of course a fundamental part of total quality excellence and an area with which I am sure you are all familiar since it has been a topic of discussion for several years. However, total quality also includes engineering, delivery and commercial aspects. Engineering is taken in the broadest sense and includes all technical areas involved in producing a product. Delivery involves quality of performance in meeting all agreed upon objectives to assure that all purchased materials are at the foundry when they are needed and not before. The commercial aspects deal with areas such as cost competitiveness, business capability and responsiveness to business issues.

Since this is a technical conference, let's take a closer look at the engineering area and what it means to the ferroalloy industry.

Quality excellence begins with the design of an alloy and

continues through development and testing. You must maintain excellent design liaison with the foundry industry and their customers in determining how your alloy can help solve not only foundry problems but also problems of the casting user. Since computer aided design, finite element analysis and process modeling techniques will be used by the foundry and casting users, the ferroalloy industry must also have this capability.

An adequate research and development activity must be maintained to develop new products in support of design needs. This facility must be capable of maintaining a current awareness in the ferroalloy, casting and casting user industries and should be capable of producing small quantities of new materials for pilot evaluations. An integral part of this Research and Development activity is the laboratory capability for testing new and existing products.

When a new or improved alloy is ready to be placed into production, quality excellence must continue in manufacturing and process engineering up to, through and following release of the material to the foundry industry.

Failure mode effect analysis, manufacturing feasibility, use of statistical process controls and actual foundry evaluations are important parts of these engineering phases. Open communications and involvement with the foundry and casting user is of paramount importance at this point to assure that profitability exists for all parties.

Last, but by no means least, quality excellence must be present in all those activities that support the manufacturing of ferroalloys. Maintenance of equipment, inspection gages and equipment, computer systems and an adequate machine shop capability are typical supporting activities. Total quality excellence in the next decade must be the foundation of your business.

Supplier involvement in advanced technology is a necessity at Ford Motor Company. A well defined worldwide technology management process has been developed consisting of three phases; an indentification phase, a development phase and an implementation phase. Along with appropriate engineering, purchasing and manufacturing personnel, supplier input and active participation in all phases of this process is important.

In meeting the requirements for total quality excellence it will be imperative that the ferroalloy industry capitalize fully on emerging computer technology in the next decade.

Solidification modeling and mold flow analysis of simple castings has been accomplished. In the next decade these modeling techniques will be expanded to much more complex castings. Computer aided design, engineering and manufacturing will be essential in reaching and maintaining profitability in the ferroalloy business in the 90's.

More aggressive research and development will be required in the ferroalloy industry and the foundry if we are to remain competitive in the 90's.

Control over chemistry and microstructure will become much more critical in producing the high quality value added castings needed to meet customer demands. For

example, the elimination of trapped carbon from the breakdown of polystyrene patterns in the Evaporative Casting of thin wall ductile iron parts would be a significant breakthrough in the application of this process. This could possibly be achieved by incorporating an oxidizing agent into an inmold inocculant.

Inoculation practice can influence dimensional accuracy through effects on graphite precipitation and morphology occurring during solidification of an iron in green sand. Since many of the actions taken to improve dimensional accuracy will adversely affect mechanical properties, development work is needed in this area.

More specialized types of iron will become common as the castings of the next decade compete with other materials and manufacturing methods in the marketplace. These irons must have increased strength, higher modulus of elasticity and improved castability. Foundries of the next decade must have the flexibility and capability of producing near net shape castings with these irons.

A greater variety of high quality specialized ferroalloys will be required to produce the chemistries and control the microstructures of these irons while maintaining adequate fluidity to feed much more complex castings with substantially reduced section size.

In producing these irons as well as our standard irons in the foundry industry, we need to get back to basics; the charging of high quality basic elements to the primary melter instead of additions to the molten metal. To achieve this foundries will need a good supply of premium quality master alloys at a competitive price suitable for charging in cupolas and induction furnaces. Late chemistry adjustments must be minimized.

Uniformity of sizing and improved consistency in ferroalloys will be more important than it has ever been so that the foundry can maintain closer control over hardness and microstructure. Metallurgical communication between the ferroalloy industry and foundry production personnel must be improved and should include coke, limestone and scrap suppliers as well. For instance, the foundry should be made aware of the presence of any tramp elements and what effect they might have on casting quality. This open communication is particularly important at a time when the technical workforce is decreasing and experienced people are disappearing from all of the industries mentioned.

Ultra high speed machining methods will make increased control over hardness and microstructure essential. Specifications requiring less than a 20 point spread in hardness will be commonplace in the next decade. Ferroalloys must be developed that will not only promote the desired hardness and microstructure but will also assure the uniformity of that hardness and structure throughout all areas of the casting, while eliminating all free carbide from any machined surface. An intense ongoing development effort will be required to meet the chemical, metallurgical and casting objectives I have mentioned.

However, there is another area of equal importance - the controlled usage of the materials supplied to the foundry industry. The ferroalloy industry should expand from the position of a raw material supplier to a full service supplier of systems to precisely control the use of their materials. These systems could utilize sealed containers for shipment to the foundry on a "just in time" basis. The container could be an integral part of an automatic system sold or leased to the foundry for dispensing a controlled amount of the alloy at the appropriate point in the process. A computer could monitor usage and provide information directly to the alloy supplier on a real time basis. This service could not only be beneficial to the foundry, but could be financially attractive to the ferroalloy industry.

We have covered a lot of ground here this afternoon in a very short time. We have seen how dramatic changes in foundry customer's needs will be the driving force for revolutionary changes in the foundry industry. Changes that will touch all areas of our business, technical and non-technical alike. These changes will have a profound effect on the ferroalloy industry in the 90's.

Total Quality Excellence, a strong research and development activity and an expansion to a full service supplier of "ferroalloy systems" will be the foundation of a profitable ferroalloy business in the next decade.

The challenges of the next decade are immense, but so are the opportunities for those who are willing to break away from tradition and be progressive. The ferroalloy industry in partnership with the foundry industry will meet these challenges head on, we will arrive at innovative profitable solutions - together we will survive!

I want to wish you the very best of success in the next decade. Thank you.

PANEL DISCUSSION: "The World Ferroalloy Producers Problems and Opportunities in the 1990's"

Chairman: First on the program is Mr. Manoel M. Mesquita from Brazil. Mr. Mesquita is the President of ABRAFE in Brazil and he is a graduate of Civil Engineering from the Polytechnic School of Sao Paulo University. He is also the Managing Director of Cimento de Portland in Brazil.

Our second panelist is from France. Mr. Bruno Angles D'Auriac is President and CEO of Pechiney Electrometalurgy. He is also Vice Chairman of IPFEO, the Institute of Ferroalloy Producers of Western Europe. He has had many important positions in Pechiney, and is well known in the industry

Mr. D'Auriac will be followed by the speaker from Japan. Mr. Shinpei Hanamura is Chairman of Nippon Denko Company and Vice Chairman of the Japanese Ferroalloys Association. He is a graduate of Tokyo University and has a degree in law. Mr. Hanamura will be assisted in translation by Mr. Setsuo Suzuki.

The next speaker is from South Africa. Mr. John E. Gomersall is known to many of us. He is a Managing Director responsible for both ferrochrome production, the ferrochrome business and the stainless steel business of Middelburg Steel and Alloys. He is a graduate of Natal University and he is a Chartered Accountant. He has nineteen years with various large industrial companies in South Africa.

Our last panelist is Mr. John P. Trunzo who is President of Elkem Metals Company and Chairman of the Board of Elkem Metal, Canada. He is also the past chairman of The Ferroalloys Association of the US. He is a graduate of the University of Buffalo and holds a Bachelor's of Science degree in Mechanical Engineering.

THE WORLD FERROALLOYS PRODUCERS

PROBLEMS AND OPPORTUNITIES IN THE 1990's

M. M. Mesquita

ABRAFE

Ladies and Gentlemen

Dear Congressmen

First of all I want to congratulate with our friends, the north-american ferro-alloy producers, by their perfect organization of this Congress, as well the high technical level of the papers presented, the kindness we found here and the hospitality with which we were received. The choice of New Orleans, beautifull and sophisticated, for our Congress, couldn't be better!

After my participation on the two last Infacon's, I felt that the pessimistic feeling. that prevailed there, fortunately did not repeat here.

The steel production , didn't grew on Western World in the earliest of this decade, but, after 83 till 88, it developed 19.6 %, with higher increase in developing countries , that reached 51.4 %. Brazil was one of these countries, with its production jumping from 14.6 millions tons in 83 to 24.6 millions tons in 88, which represents 67.8 % of increasing between those years, and the brazilian ferro-alloys sector followed the steel sector. In the same period it passed from 596.000 t in 83 to 973.000 t in 88, representing an increase of 63.2 %.

But to those figures it has to be added some of international market. The steel brazilian industry exported about 11 millions of tons in 1988, which represents an increase of 114 % of the exported in 1983.

In the same direction, our ferro-alloys sector exported 457.6 thousand tons in 1988 , an increase of 33.7 %. When compared with the performance of 1987, it represents an increase of 17.8 %. In the last 10 years, the brazilian ferro-alloys exports expanded in a rate of 11.5 % a year.

Brazil is, today, the third world producer and exporter; only Norway and South Africa export more than us. I must mention that I am comparing only with the countries of western world and Japan.

Nowadays the western world, mainly the richest countries, are living a period of prosperity with intense commercial activity and low inflation rates. In my opinion, the risk of stagnation or reduction in business is withdrawn, at least in the short term. I think that the next years have almost all conditions for being a period of stable economy.

Naturally, there are some risks along the way, for example, the north-american deficit. But it's nor apropriate to discuss things of that magnitude here.

In such an international profile, I'll take the risk to make the followings comments:

- the trend of the most industrialized countries is to develop more and more sophisticated technologies.
- these countries, each time more, will produce products of high value contents in crescent quantities and at descendant costs.
- on the other hand, they will have to transfer to developing countries, and others, the production of commodities and products of singlest technologies , widely spreaded. These countries, to be able to produce such products, shall have abundant ore deposits and both potential and availability of energy . They shall have, too, low costs labor, nevertheless with the social and economic evolution, this advantage will soon disapear.

Those comments about the transference of the less sophisticated steel production for developing countries can be proved by the following fact: between 1983 and 1988 for a total production of 334 millions tons by

United States, Japan and European Community, it occured an increase of only 34 millions tons; on the other hand, the developing countries produced 96.6 millions tons in 1988, representing an increase of 33 millions tons over 1983 , almost the same quantity of those industrialized countries.

Only Latin America increased its steel production in 48 %, in the last 5 years, and Brazil was responsible for the biggest part of that expansion.

As I previously mentioned, the brazilian ferro-alloys sector increased substancially its production in the last 5 years, but its exports didn't grow at the same proportion, due to internal market increase.

The II Brazilian Steel Plan forecasts 50 millions tons of steel production at the end of this century. And the ferro-alloys sector plans to produce more than 2 millions of tons by the year 2.000, and it's expected to export over 1 billion dollars per year.

Our country has all conditions for realizing such plan:

- a huge material reserve: iron ore spreaded all over the country, manganese ore, in the center and in the north, quartz for excellent quality and abundant, new discoveries of chrome ore deposits in the north, nickel in center and north, the biggest niobium reserves of the world, etc.
- electric energy of hidraulic source; abundant in production and potential.
- avaiability of coal and charcoal , the latter being produced under a rational policy of afforestation on which the ferro-alloys sector is deeply engaged.
- our technology is up-to-date, both in process and equipments.

Even the environment control is being absorved and adopted by ferro-alloys sector. The universal conscience of environmental preservation that is fully present in brazilian society today, is being adopted and observed by industrial sector in Brazil, and particularly by ferro-alloy industries.

My dear Congressmen

As I mentioned in the beginning of this speech, in 1983 I felt the pessimistic climate that dominated the ferro-alloys main producers all over the world. On that Congress , my country had frightened some ferro-alloy producers with its always crescent production and exportation. Today brazilian's position in international market is consolidated. The quality of our products is internationally recognized and constantly bettered. The reability on our deliveries is an important factor of confidence for our customers. Proving what I say is the crescent demand for our ferro-alloys by foreign customers, directly or by trading companies.

With the continuous progress and stability of industrialized countries, brazilian ferro-alloys sector always practised the free market rules, never utilized subsidies or dumping practises. If one's has any suspicion of that, we are ready to receive him and fully demonstrate this assertion.

On the other hand, we want to remember to our partners who utilize retaliations and dumping complaints that economical determinism that prevails today on commercial transactions among the richest countries and the less favoureds is unavoidable: those depend on these for products to their industrial center, each time more sophisticated; they will have to forsake the production of singlest products for the less developed nations, as steel products, celulose, aluminium, and ferro-alloys, too , etc. And proceeding in such a way they will propitiating better conditions for these countries who want to develop faster. And this will bring an enlargement of international markets and a more just richness distribution.

Thank you very much!

THE WORL FERROALLOYS PRODUCERS:

PROBLEMS AND OPPORTUNITIES IN THE 1990s

B. Anglès d'Auriac

I.P.F.E.O.

Institut des Producteurs de Ferro-Alliages d'Europe Occidentale

I - the European ferroalloys industry (EEC, Scandinavian countries) has undergone considerable changes in the eighties allowing this industry to face the 1990s' chalenges with confidence.

a) Companies concentrations (acquisitions, mergers) occured in Scandinavia (Norway) as well as in the EEC (Spain, France).

b) These concentrations gave way to the acceleration of a strong move to rationalise and modernize plants :

- closure of the less competitive factories. A dozen of plants were shut down through the decade, especially in Portugal, France, Spain and Norway.

- modernization of the operating plants with the installation of bigger furnaces and introduction of automation and process computerizing.

- workforce reduction of at least 3500 people and high productivity increase.

c) Power supply conditions were greatly improved for most of the producers :

- construction of hydro electric dams by the producers in Spain.

- development of the French electro nuclear program : + 45.000 MW from 1980 to 1988.

- improvement of the interconnexions in the EEC (link between France and neighbour-countries) and in the Scandinavian countries.

- greater perception from power suppliers of the big consumers' requirements. Less discrimination towards the industrial sector.

d) At the end of 1989, the European ferroalloys industry does not look anymore as it did in the eighties. If the production capacity slightly decreased, the production costs tremendously declined (restructuration, modernization, lower power rates). Additionaly, this substantial cost improvement was combined to a rapid evolution towards more efficient (specialty alloys) and more reliable products (SPC).

e) The EEC has realized the efforts made by the ferroalloys industry (investments, labor reductions, research and development, etc...) and has come to check that this industry was important and competitive. This has strenghtened the European Community in its determination not to allow unfair trade practices in a market very attractive by its dimension and accessibility (low tariffs). Therefore anti-dumping measures have been taken by the EEC since 1983.

II- The nineties : Problems and opportunities

a) Problems

1) Social and human challenges

- The ferroalloys industry will be subject to stricter pollution standards. Consequently European producers, 95% **of whom** already capture furnace fumes, are emphasizing efforts to valorize dust and slags.

  The producers will also have to pay more and more attention to sulphur and NOx in the gasses.

- The social-cultural evolution dictates similarly a rapid evolution of the working environment : safety, working conditions (noise for example).

2) Economic problems

In this field, the main risk lies certainly in the currency fluctuations causing big distorsions on the international competition scene and making any longterm programmation difficult.

b) Opportunities

1) A European market including powerful and very modern industries (iron and steelmaking, aluminium, silicones), which have felt and measured, specially during the last months of very high demand, the interest to have a competitive and profitable european ferroalloys industry.

2) Process and technology improvements will allow, through important investment costs (R&D, personnel training, new facilities) to propose to customers better adapted products and services at lower prices.

3) The total integration of the EEC beginning in 1993 will no doubt permit a progressive harmonization of the economic conditions within the Community (taxes, wages and related costs, power rates, etc...) and allow therefore to go even further in the rationalization of the ferroalloys industry.

4) Expansion of Free Trade over the world.

   Let us hope that the GATT negociations (Montevideo round) will progressively result in the elimination of dumping practices, in the harmonization of duties and in the opening to European producers of some large markets which are today out of reach for them.

Ferro Alloy Situation in Japan

by
Shinpei Hanamura
Vice-Chairman
Japan Ferro Alloy
Association

Mr. Chairman, secretary of INFACON'89 and distinguished members!

I feel quite honored to have this opportunity of delivering an address before this INFACON assembly.

I believe that, for prosperous co-existence by the people involved in the ferro alloy industry, it is necessary to deepen our mutual understanding. In this connection, I would like to explain about our ferro alloy situation in Japan for a better understanding.

Annual ferro alloy consumption in Japan has been more or less 2 million tons over the past 10 years time. To look into respective major alloys: For manganese alloy concerned, the introduction of the steel making technology called hot metal pretreatment by direct charge of manganese ore has replaced the demand for FMnH partially; chromium alloy consumption has increased following a remarkable jump in stainless steel production; and silicon and other alloys have stayed almost at the same level.

As regards to the supply position, domestic production has decreased due to high rates of electric power and yen's appreciation to a large extent, while import has been accelerated to cope with demand. In terms of quantity, our domestic production is maintaining more than 1 million tons, and the balance with consumption is being covered by imports from abroad.

In reviewing the past ferro alloy production in Japan on a 5 year period, our annual average production has been;

about 2.3 million tons for the period from 1974 to 78
about 1.9 million tons for the period from 1979 to 83
about 1.3 million tons for the period from 1984 to 88

As was just mentioned, our domestic production has been curtailed drastically against the 2.3 million tons, the peak for Japanese production.

Now, I would like to move to the subject of recent supply and demand positions of ferro alloy in Japan. In overall ferro alloy, consumption for steel making usage is approximately 2 million tons per year with about 1.1 million tons available locally and about 1 million tons imported from abroad. Major supply countries for such imports into Japan are South Africa, China, Brazil, and Norway, recently China has made a remarkable increase in market share in Japan.

Next, I would like to refer to the supply and demand situation for each commodity.

For FMnH and FMnM/L, almost all of the annual consumption of 400,000 tons is produced locally. This is because major consumption is supported by blast furnace mills who hold close relations to local ferro alloy manufacturers by holding equity positions in each other, and furthermore, requirements by blast furnace mills are very severe on specification and size.

As regards to SiMn, 300,000 tons of annual consumption is supplied by 150,000 tons each from local sources and imports. Major supply countries for imports are China, South Africa and the U.S.S.R., and such imported materials are delivered mainly to mini mills who are not so strict in specifications.

For the case of FSi, annual consumption is 500,000 tons, and the major part of this figure is being covered by imports. We have only about 70,000 tons locally produced. Major countries from which we import are China, Brazil and Norway, reaching 24 countries in total. China has made a tremendous increase in share in Japanese market. More time will be required for China to become a stable supply source.

About FCrH, 700,000 tons are being consumed annually and supply is made of 300,000 tons local and 400,000 tons from abroad. Imports are from South Africa, India, Zimbabwe, Philippines and a few other countries. Active consumption in Japan last year was filled by an increase of both local production and imports.

Next, I would like to talk about the future forecast of our ferro alloy industry in Japan. Firstly, consumption is anticipated to remain at the level of 2 million tons in line with the situation of the Japanese Steel Industry. To cope with such consumption; we intend to maintain local production at over 1 million tons. There are some grounds to support our production plans. Locally produced alloys have strict specification acceptable to blast furnace and specialty steel mills, and also stable and flexible supply has been maintained. Local producers have made efforts to maximize rationalization to overcome severe circumstances caused by high energy cost and high value of Yen. Furthermore, the movements for lowering of power rates and our self compliance by factories in pursuing the lowest power rate, thus our cost competitiveness has improved a lot. To make a long story short, our anticipation to continue local production at a minimum rate of 1 million tons is based on a judgment which will satisfy both supply and demand in Japan.

Last but not least, I feel we are in a booming market after many years of slump since 1982. Under changes in the world economy, an internationally well balanced market is desirable for the ferro alloy producers and maintenance of such an orderly market is necessary. For us as producers, it is important to keep up a reasonable supply to comply with actual demand for every alloy.

I sincerely hope that my speech today will be helpful for your understanding on ferro alloy in Japan.

Thank you very much.

World Ferro Alloy Producers Problems and Opportunities in the 1990's

J.E. Gomersall

Its hard to imagine if one looks at the stainless steel and the ferrochrome markets today and forward into the 90's that there might possibly be any problems. Certainly, I'm sure a lot of people see that the 90's are littered with opportunities. However, I think its a time for some sober reflection and particularly to have a look at the performance of stainless steel in the last few years. We should reflect on the demand growth in stainless steel and hence ferrochrome and the huge shortages that have developed in both ferrochrome and nickel, and perhaps have a look at what the future outlook might be. I think its a fact that this staggering performance probably which has outperformed most other alloys, steels and metals in the last few years has attracted many people to look at the possibilities of both stainless steel manufacture and ferrochrome manufacture. There are huge expansion plants under construction right now in the area of ferrochrome at which we'll have a look at in some detail. I think what is a little bit disconcerting is that many of the forecasters and perhaps potential entrants and near entrants to particularly the area of ferrochrome, but also stainless steel are looking at the recent performance and are anticipating a similar kind of performance of stainless growth and hence ferrochrome demand growth in the 1990's. Well in our opinion it won't, and I'll set out some thought provoking thoughts and figures to illustrate that.

Apart from the projects that are now in construction, and we'll look in some detail at almost 900,000 tons for the period 89-93, there are probably, another 850,000 tons of discussed ferrochrome projects that are currently under consideration. Now, like any producer of any alloy, I want to make a profit. I must admit in the recent past we've had a very fortuitous situation that has resulted, out of the world shortage that developed - particularly in 1988 and now through into 1989, but we have to remember the difficult situations back in the early 80's. We all know that alloys are very cyclical businesses. Our company is very competitive, and as I say we wish to make a reasonable return, a reasonable profit of our market cycles. We're not afraid to compete internationally, so therefore what I am going to discuss is I believe an honest attempt to outline the situation.

Its not for me to discourage future entrants. I'm quite sure that they do their own homework. We are not afraid of losing market share nor are we afraid of not being competitive. So I am really outlining a potential problem that is looming for all of us ferrochrome producers and we are all going to suffer. In addition I have some thoughts on the opportunities that exist for doing something to make the pain a little bit less severe. The growth of stainless steel goes from 1950 at round about a million tons to almost 11 million tons in 1989. There is a projection beyond that which I shall talk about later. Violent market cycles have taken place in stainless steel. Low carbon ferrochrome which in the early 1970s was one of the major sources of chrome units in stainless manufacture, obviously with the advent of the AOD vessel, was supplanted by high carbon ferrochrome and charge chrome and thereafter, particularly from the mid 70's that the majority of

ferrochrome supplied for stainless steel production comes from these sources and that their market cycle tracks very closely with stainless demand.

Firstly, just to reflect where the chrome reserves of the world reside, more than seventy percent reside in South Africa, almost twenty percent in Zimbabwe, and then the next largest , know reserves in the Soviet Union followed by Turkey, India, Albania, Brazil, Finland, Phillipines and Yugoslavia. The point that I want to make is that with all the capacity that is in the process of coming on-stream right, now around the world it begs the burning question - where will the chromite come from? From which reserves and at what sort of price? And if one looks further in addition to the 900,000 tons that is currently in the process of being installed or has just been installed the other mooted projects totalling 850,000 tons, where will that chromite come from? If we look at the development of chromite prices one can see its been a pretty flat trend for many years now. You can see that, for example, the Russian ore and the Turkish ore after a rise in 1985 remain flat until 1987 in the case of Turkish ore and took somewhat of a downturn in early 1988 before soaring now together with Albanian and Russian prices to the region of $200.00 a ton. Now obviously these are higher grades of ore than the the South African or Transvaal ores which you can see have soared to just over $70.00. But one can see the differential if one looks at the chrome units. So, the question is, what is going to be the development of chromite prices particularly non-South African chromite prices with the kind of demand that is being mooted? We will look at where that ferrochrome may be supplied shortly. Looking at the last twelve years of charge chrome demand and supply we see here how, in the main supply has exceeded demand and in actual fact - installed capacity at that stage was about 1.9 million tons. So you can see the degree to which the world industry was operating below capacity. We'll look at the effect of this on prices in a minute. You look further in early 1982 until production geared up again supply lagged a little behind demand but then right through until 1987 supply exceeded demand and in the latter part of 1987, 1988 and 1989 the demand ran ahead of the supply and hence the very rapid development of prices around the world. So there have been significant periods where that supply and installed capacity were significantly below market demand. If we look at the development in the last few years looking at the supply side, in 1987 the Western world's supply was approximately 2.3 million tons. This rose to 2.5 million tons in 1988 and in 1989 to 2.75 million tons. The demand was slightly in excess of supply in 1987 and the small shortage prevailed. But in 1988 that shortage increased significantly to almost five percent, or 157,000 tons and hence the development of prices. However, in 1989 the situation, seems to be continuing a lot more strongly than was anticipated by many quarters around the world earlier in the year in spite of the high price of nickel and the high stainless prices. So we are looking at a potential balance situation for 1989 and going into 1990. The price tracked between 1979 and 1983 pretty much constantly. There was a minute decline in 1983 which came back up again. The price was down to about 32 US cents per pound of chrome delivered, came up to about 40 cents went up to about 45 then gradually declined down again before the sudden rapid rise in 1988

and 1989 due to the shortage. You can therefore see of this period of twelve years that there were not many years in the market cycle where the ferrochrome producers of the world made what you might call a reasonable living. There are some interesting influences, if one looks at the impact of that in yen terms for example, from a base of 100 the price increased and in fact by 1987 the price in yen terms in Japan for charge chrome was less than it had been in 1978 and in 1989 is only about forty percent higher. To a certain extent with the German mark the impact similarly has been less than in dollar terms and unfortunately because of the weakness of the French franc they have suffered more than the rest of us. So, an interesting development of prices showing how flat ferrochrome prices remained for long periods of time and that the last couple of years really isn't an unbelievable aberation as a result of a huge shortage that I haven't seen in the seventeen years that I have been in the ferrochrome industry.

If we have a look at the nickel scenario, in the last twenty-five months the nickel price, has moved from an index of 100 to well over 440 which is an increase of 340 percent. The charge chrome price has virtually doubled, 100 percent increase. And obviously stainless steel scrap sits in between due to the average influence of both nickel and charge chrome. The nickel shortage, of course, is a very very significant factor and there I'm afraid the outlook is much bleaker than it is for ferrochrome as there is very little supply mooted to come on-stream. If we look at the growth of world stainless steel from 1950 to 1987, however, what is important to remember is that in the 1950's stainless grew at a rate of about ten percent; in the 1960's it grew at a rate of about seven percent, but from the period 1970 to 1988, including this fantastic growth from 1982 right through to 1988, the average growth is in effect only 3.8 percent compounded. Now, these figures are freely available from sources around the world so they are not a figment of Middelburg Steel's imagination. I think the important thing is perhaps to stop and dwell on why in this 1982 to 1988 period has there been such a fantastic growth in stainless steel. Obviously, there has been significant growth in many metals, many steels, and alloys over that period. But stainless perhaps has really performed outstandingly. One of the reasons goes back to the nickel price. I'm sure you will recall that until December 1987, for a period of about five years prior to that the nickel price languished in the doldrums below two dollars. It was as low as one dollar fifty and it averaged about one dollar eighty for two or three years until it moved to two dollars. The result of that was that during this 1982 to 1988 period, and I speak now as a stainless steel producer, there was a certain degree of illegitimate growth of stainless steel. A penetration into markets that were perhaps based illegitimately on an anomalous or unrealistically low nickel price. Illegitimate in the sense that it was not the price at which the nickel producers of the world could expect to make a reasonable return. Now there is a lot of debate about where that price should be, but it certainly isn't as low as two dollars and it certainly isn't as high as the seven or eight dollar period where we are today. But if you consider that until the early of 1988 that nickel price was below two dollars, during which all that growth took place, its stands to reason and I think the stainless steel producers of the world are starting to see it already, the start of

quite significant resistance to particularly austenitic stainless steel because of the high nickel price. So in looking forward to the likely development of stainless steel growth over the next few years, I forecast a slight downturn in 1989 but our latest feeling is that 1989 in fact will be the same as 1988. Like other observers this afternoon we don't see a major recession in world economies because they are pretty soundly based. However, we do see price resistance to stainless steel resulting in stainless dropping back below the long-term trend line again before its starts to continue growing in the trend line range at about 3.8 percent per anum. People who are projecting 3.8 percent growth per annum from the current point, that is blatantly well above the long-term trend line are making a mistake. A 3.8 percent growth is the likely development of stainless steel but not from the current situation. Now based on that scenario of stainless growth and perhaps another economic cycle we reflect through the year 1998 and have come up with this projection - 1989 at 10.6 million tons compared to 10.8 worldwide. Declining slightly because of that resistance to the high nickel price to about 9.7 million tons and thereafter starting to grow again on that 3.8 percent trend line but really only coming back to 11-1/2 or 12 million tons by 1993. If we now look at the impact of that on ferrochrome we looked at only the three years 1987, 1988 and 1989 rising to 2.7 million tons. The outlook is for a 910,000 ton increase from the 1988 figure of 2.5 million tons to the year 1993, a significant growth in Southern Africa and many other parts of the world as well. The demand on the other hand based on the likely development of stainless steel reflects a decline in 1990 to 2.4 millon tons, roughly the same in 1991, recognizing what happens with the downturn and the impact of stainless scrap in the market cycle rising to 2.7 and 2.9 million tons. The theoretical surplus, if all that capacity that is included here continues to produce, which of course is totally hypothetical, but there is a potential oversupply of 500,000 to 800,000 tons. Of course that won't happen because we can't eat the chrome and we will all have to cut back because it will be impossible to continue to produce it. If we take a more optimistic scenario for the growth of stainless and say maybe there isn't going to be a significant resistance to the nickel price then the duration of potential oversupply is 1993 as opposed to 1994. However, that sort of growth will demand extra nickel and extra nickel will demand investment and what is the price of nickel going to be for that investment and what is the likely outlook for the nickel price.

In conclusion then, ferrochrome demand growths will be constrained by stainless growth due to nickel availability and the nickel price. The potentially massive ferrochrome oversupply situation which will arise in 1990 to 1993 will require responsible marketing, and bold action. By responsible marketing I mean that if we all attempt to continue to produce its going to be "blood in the balance sheets". Unfortunately, it has the propensity for a significant downturn in prices and quite an aggressive situation. And I think that demands a responsible approach from all the producers of the world and some bold action. And one thought we have expressed in several stainless forums that the bold action needed is perhaps to actively develop the world market for stainless steels. If we look at Hans Schade and the Nickel Development Institute activities and

the successes they have had perhaps the chrome producers of the world need to form their version of Nickel Development Institute and really put some serious money into the development of feritic steels particularly, but stainless and chrome bearing steels in general to attempt to get ourselves out of this predicament. The ferrochrome producers should invest a significant amount in a bold market program through perhaps the auspices of the Chrome Association in Paris and the Chromium Centre. The object being to grow the demand to absorb the oversupply. Obviously, that is a long-term project and will not bring about immediate results.

World Ferroalloy Producers Problems and Opportunities in the 1990's

J.P. Trunzo

Ladies and Gentlemen I'd like to update you on the ferroalloys situation that exists in the United States. The past decade has seen radical changes in the United States ferroalloy industry. At the start of the decade the domestic industry supplied the major part of the United States ferroalloys market. As we neared the end of the decade the imports supplied two thirds of the market as it exists today. Why did this dramatic a change occur? In part this change reflects the maturity of the world's ferroalloy industry. Large, efficient furnaces have been installed throughout the world utilizing the latest advances in ferroalloy technology. Many of these furnaces have access to nearby ore bodies and low cost power making them world competitive. Many have also been in parts of the world where they do not face stiff environmental regulations that we face in the United States. Obviously, this is an important economic advantage. But, there are also some economic conditions in the United States that encourage this shift to form ferroalloys. The biggest factor was the U.S. strong dollar. In fact, the dollar reached its peak in 1984 and since 1984 has dropped between 30 and 40 percent.

In the mid 1980's the U.S. dollar was so strong that every industry in the United States had trouble competing with overseas producers. In addition, the United States had and has completely opened borders that allowed any producer in the world to seek access to the U.S. market. The result was a rapid growth in imports from 40% in the U.S. market in 1975, to 66% in 1988. And of that manganese is 89%, chrome is 86%, ferrosilicon is 32%, and silicon metal is 28% of the market. This was coupled with a declining market for ferroalloys because of the reduced production of steel in the United States and the improved utilization of ferroalloys by our end-use customers. This caused a radical change in the U.S. ferroalloy industry. Many ferroalloy furnaces were shut down including approximately ten plants. Many familiar names in the ferroalloy business such as Union Carbide, Airco, Foote, sold their businesses to other companies or to employees. Companys cut their overhead and focused on improving efficiency in order to survive. In fact, after Elkem bought Union Carbide facilities in 1981, between 1981 and 1986, we reduced the hourly and salary workforce by 50% and continued to output the same productive capacity.

What has emerged from all of this is a much smaller but more efficient ferroalloy industry. All this history is familiar to you and had these changes not happened we would be having a much smaller Infacon audience today composed of non-Americans. In actuality we have a relatively healthy U.S. ferroalloy industry today; some of this is due to external factors. The extremely strong U.S. dollar that has plagued the industry for so long has weakened so that overseas pricing had more difficulty being sharply discounted against the U.S. producer prices. But the strongest factor of all is the healthy business climate. Our U.S. customers who have faced the same dollar problems as we have are more world competitive today and are facing a strong demand for their product. Together with the strong economics in Europe and Japan and many third world countries, the world ferroalloy industry in 1988

was hard pressed to supply its customers. This has resulted in higher prices worldwide and a greatly improved profitability, as all of us can remember from Infacon 1986.

So much for history, What about the future of the U.S. ferroalloy industry, its problems and opportunities? I believe that it is important to recognize that the U.S. ferroalloy industry will never again dominate the U.S. market like it did in the past. There are too many world class furnaces throughout the world. Many conveniently located near ore bodies, such as manganese and chromium, that are not found in the United States. But the U.S. ferroalloy industry has many strengths that will enable it to maintain an important niche in the U.S. market. First, the U.S. has an abundant supply of quartz and gravel that are within economic shipping distances of our U.S. plants. This allows us to keep an important presence in the ferrosilicon and silicon metal business. Admittedly, other countries have this benefit too but, then they have to absorb the cost of shipping finished products to the United States.

Second, the United States has competitive power. This is important since power is the largest cost that we face particularly in the silicon metal business. Several of our plants have access to low cost hydroelectric power and I believe the major challenge facing the U.S. industry is to convince the U.S. power industry to keep its power prices competitive. And if we go back to 1986 as we recall in Brazil the power prices in somewhere between 18 and 22 mils. Today in Brazil its much higher I'm told its between 27 and 29 mils. Today the U.S. coal-fired generated power is selling somewhere between 26 to 29 mils. And it looks, in my opinion, if you went back to 1986 or 1985 the same power was selling anywhere from 31 to 38 mils. So there has been a tremendous improvement in recognition by the U.S. power industry that in order for the industry to survive they had to be competitive. There are some people like Elkem that have their own hydroelectric power and SKW in Niagara Falls who has a blend of hydropower and fossil fuel.

Third, we have modern fully abated furnaces, although some marginal furnaces are operating today because of the heavy demand for products. The core industry is composed of world-class furnaces and we are not resting on our laurels. We must continue to invest in R & D and advances in computer control technology. To this end one of our chrome producers has a government supported R & D project on the use of plasma arc process in the manufacture of ferrochrome. Further, these furnaces have pollution control equipment and in fact, they cannot run a furnace in the United States today that is not fully abated; both air and water. This will give the U.S. industry an advantage as pressures on pollution control spread to countries where furnaces are not abated today. The U.S. industry has made this expensive investment and includes the cost of operating it in its production costs. As other countries absorb these costs the differences in operating costs, if any, will be narrowed.

Fourth, the U.S. industry has become very quality conscious, as have our customers. As you are aware the automotive industry in 1984 was recognized to be a very poor quality producer as compared to Japan. There has been tremendous emphasis on quality in

the U.S. automotive foundries and the U.S. automotive production in total, and that flows back into the ferroalloy industry requiring very very strict control of quality. We have adopted Statistical Process Control on most of our operations. And are now working with our suppliers to meet total quality objectives. One of our producers was recently awarded the Malcolm Baldridge Award, the highest quality award that the government can give in the U.S. The close cooperation between the U.S. ferroalloy industry and its customers will help both meet the high quality demands of the consumers worldwide. And I can't say enough about the change of quality in the United States. In everyone of our products whether its dealing in the foundry industry, or whether its dealing in silicon metal with the silicones industry they demand piece-to-piece statistical control where there is the minimum variation. And I have to admit I think its going to take a lot of effort for this to be matched by foreign producers who ship large quantities in bulk into the United States even if it is shipped into a warehouse and ground in the United States because the chemistry and the quality control is so stringent.

Our fifth point is related to this in that the U.S. industry has worked very closely with its customers on specialty products that meet special needs. The U.S. industry has been a leader in developing innoculants, nodulizers, and deoxidizers for particular applications and operating conditions. We must continue the research and development needed to meet our customers needs and changing conditions. All of this does not mean that the U.S. industry is guaranteed future health. It is most likely that prices will be weakening as demand starts to slacken. This will again force our marginal facilities to close and weaken the profitability of healthy companies. But the important thing to remember is that there will continue to be a strong U.S. presence in the world ferroalloy industry. The industry has weathered the rough seas of change and so can survive down the road, but it must relentlessly pursue the strengths that have allowed it to survive, and those are quality, service and technology while being world competitive. When the U.S. industry goes, differing from the European community, to its government for support it finds it unsympathetic. Its basic fundamental thrust is free enterprise and it wants the U.S. industry to be able to compete against the world and be competitive at all times. I believe the Bush administration might be a little softer on this point. In the area of unfair trade the Democratic Congress might attack or penalize countries that are willing to close their borders and not trade on a fair basis.

In closing I would like to give my views on what I think we need to do as a total industry. I think, as I believe I stated in Brazil in 1986, that the industry has to use the Infacon and other technical meetings to provide a media for the Ferroalloy Industry to find ways to coexist in a global business while being a healthy industry serving our customers with total quality products.

Discussion of the Panel Discussion:

Q. J.F. Papp, Bureau of Mines, USA. I would like to address my question to Mr. Gomersall of Middelburg. I think you rightly point out at this time what we are concerned about is too much excess capacity in ferrochromium. What I am thinking though, is we have just come out of a tough time period when stainless steel has grown and there has been inadequate capacity. You pointed out what happened in the case of nickel where we have inadequate capacity and the price is going up, and ferrochromium inadequate capacity, the price is going up. So while, indeed, now is the time to be concerned about not growing too much in capacity in the industry, I think it is fair to ask how much excess capacity ought there be in order not to get into the kind of situation we were in during the past two years again?

A. J. Gomersall. That is a very difficult question. I think that requires a crystal ball. If I could perhaps point out that much of the existing ferrochrome industry a few years ago was on the point of decline, there were several expansion programs mooted, including our own, and discussions with stainless steel producers' customers around the world saw a bleak outlook and in fact discouraged any move of prices until, as I mentioned, the later part of 1987, and it takes two to three years to get a large ferrochrome capacity on stream. Some of the smaller submerged arc furnaces do it quicker. But as to the degree of over capacity, it is a very difficult question. I would say it should be no more than 10%, but we are looking at something approaching 30% or 40%.

Q. F. Fulgenzi, UCAR Carbon - USA (Comment). The panel certainly presents a marvelous opportunity to ask my question, in that in general in the silicon metal world, it represents the four major producing areas and a very major user. I was intrigued by the comment that Mr. Hanamura made concerning possible shaky reliability of the Chinese silicon supply. However, they still remain probably the largest single producing country for silicon metal, and indeed, if we believe the Metal Bulletin, last year Japan imported 65,000 metric tons out of the 90,000 China made. Do you foresee, Mr. Hanamura, a decrease in the importation of Chinese silicon metal into Japan, and if so, might we then assume that the rest of the world will have a chance to make up that shortfall? What is your opinion on the Chinese supply, since Mr. He is not here with his paper, however it is in the proceedings?

A. Hanamura. When we talk about silicon metal from China, silicon metal has a longer history of stable supply than ferrosilicon where we recently had difficulties with deliveries from China. We view that there is a similar factor in both, but I think that silicon metal is more reliable.

Q. J.D.G.Groom, Zimbabwe Alloys - Zimbabwe. We have been challenged this afternoon by the panel, and also perhaps especially by Mr. Booth from Ford, for the ferroalloy producers to respond in some cases with increasing sophistication, increasing R&D, new techniques and new ideas to the future needs of our consuming industries. However, as many have observed, the ferroalloy market, or the ferroalloy production capacity world-wide, is shifting increasingly perhaps to the developing world which is, I suggest, rather less capable in terms of skills, resources, financial and infrastructure to respond directly. I

wonder if any of the panel would like to comment on cooperation, partnership or joint development of techniques or ideas to meet the challenge?

A. J. Gomersall. Come to South Africa!

A. B. D'Auriac. Maybe your question means that we have reached a sort of balance in this move of the ferroalloy industry from northern hemisphere to southern hemisphere. With more and more exacting demand from the northern industry, maybe we are in the process of reaching a sort of balance in the geography of the ferroalloy industry in the world. Maybe it is stabilizing and maybe this move is gradually going to stop.

J.D.G. Groom(Comment) - I think my comment was prompted really by a real enthusiasm to respond, but an equally real appreciation of the problems that we perhaps have only in Zimbabwe. I don't intend that my comments cover the whole of the southern continent. But we would have real problems in meeting the challenge as enthusiastically as I would personally like to. Computer facilities are not readily available. Computer expertise is not available. Sophisticated analytical equipment is not readily available. And I am sure these problems are not unique to Zimbabwe. I am really just suggesting that the theme that Mr. Booth mentioned, and which came across to me at least, as being perhaps slightly one-sided as a partnership in demanding higher standards from the suppliers, could in fact be looked at from the other side as well.

Q. H.Z. Bornstein, Haborn Consultants - USA. I should like to raise the question of the Eastern Block. Now it is quite true that until recently it was very difficult to obtain realistic assessments of what is going on in production and consumption. However, it seems most obvious to me that recent political developments will have realistic economic consequences, and I would therefore like to ask the panel whether there is any plan among you to create perhaps a committee to obtain new and realistic information, because it will have great influence on our economy. I give you the example of chrome, of course, and also recent exports of ferrosilicon to the Western world.

A. Chairman, D.Freas. I might start the discussion by saying that in this Infacon we made attempts to involve individuals from the Eastern Block as we have in other Infacons, but we got very little response. And we decided that for the next Infacon we would be more aggressive in pursuing this, trying to involve people from the Eastern Block in Infacon, because we feel that we are missing one of the largest producers of ferroalloys in the world, which is the Eastern Block. Their presence can be a great plus to everyone in this room as well as a great benefit to them. So we should be a lot more aggressive, and I would ask each of you, where you have contacts with the Eastern Block, to encourage them and give them information to try to get them to participate in Infacon in either a formal way or an informal way.

Q. J.P. Schade, Nickel Development Institute - Canada. This was one of the sharpest questions this afternoon so far, because it raises a totally different horizon. The metals and alloys production in the COMECON world, not only in Russia, China and Cuba and so on, is such an order of magnitude in the meantime that it can make and break our markets in the West. I am talking in particular about chrome and nickel, but it has certainly similar significance in other sectors. The fact is that we know from recent contacts that the Eastern side is as interested in talks as we are to talk to them. And we have had direct contact with Russia and Cuba recently. We have indirect contact with China. The system does not move easily, so the contacts have to be established through government channels of the individual countries. We have recently had, in Canada, a delegation of the Russian Nickel Industry and when they come they come with a very powerful delegation. We had the minister in Moscow who is in charge of the entire Russian Nickel Industry as well as the President of the three biggest Nickel Mining and Smelting facilities in Russia. I must say that we are very open with information. They were very interested in how we saw things. I must say that they do not necessarily see things our way, because for them increase of productivity doesn't mean anything. For them to produce enough in order to meet the demand is the big objective. It is similar to what we faced in the 50's or 60's in the Western world. They think that market development is something that is totally useless because it only accelerates the exploitation of natural resources so that the children or our children don't have any more chrome or nickel or manganese, so they should take it very slowly. They have totally different ideas about the environmental protection that we in the industry are so concerned about, and the public is so concerned about in our part of the world, but, nevertheless, it is extremely important to talk to the people. They are much more open than they used to be. As I said at the beginning, they have enormous potential in terms of capacities installed and expansion plans on top of that. It is also true at the same time that they have their own pretty good boom going on in the Eastern world. For example, talking about stainless steel, they gave us figures on stainless steel which were absolutely breathtaking; about twice as high as we had assumed they would produce in the Soviet Union, and that you see in the past three years so little material coming out of Russia, for example, is certainly that they consume everything they produce themselves in house. How this will develop if we have a downturn on the cycle in the Western world is something entirely different. So I would encourage the dialogue with the COMECON world as they are such an important part of the overall world-wide situation.

Q. R. Vicintin, RIMA Eletrometalurgi - Brazil. My question is to Mr. D'Auriac. I would like to clarify. You finalized your statement saying that some markets prefer high protection. Please, what do you consider markets with very high protection?

A. B. D'Auriac. In my mind I was thinking of Brazil which is a big steel market, as you know, more than twenty million tons of production which is not accessible to non-Brazilian ferroalloy producers today.

Q. R. Vicintin. Not accessible in what sense?

A. B. D'Auriac. I think it is not possible to go through the customs' duties and regulations, and it is not possible for European or North American producers to have access to the Brazilian market.

Q. R. Vicintin. I guess it shocks me a little bit as you were Chairman of European Producers, and also Pechiney is a very large producer that you are aware of the Brazilian position for more than, let's say, four to five years. The imports are absolutely free and you may come as when you want. Yes, we do not have access on competitiveness. That is a different opinion. That is my opinion. I would like also to question you. In my opinion the more protected market today is the European market. And I do not think that I am the only one alone on it, and we face very strict regulations in the EEC that you decide to put an anti dumping case that for so many times against Brazil, and if the authorities in Brussels decide that there is dumping we do not have any courts or superior court to go and try to defend ourselves. And I would like to know how do you expect, or if you expect, a fixed rate policy in ferroalloy after 1992?

A. B. D'Auriac. The position of the ferroalloy industry towards the GATT negotiation is clear: free-trade position. We are not looking for any sort of protectionism, but we are looking for fair-trade practices. And we are quite ready to accept cuts or tariffs if those cuts are generalized all over the world.

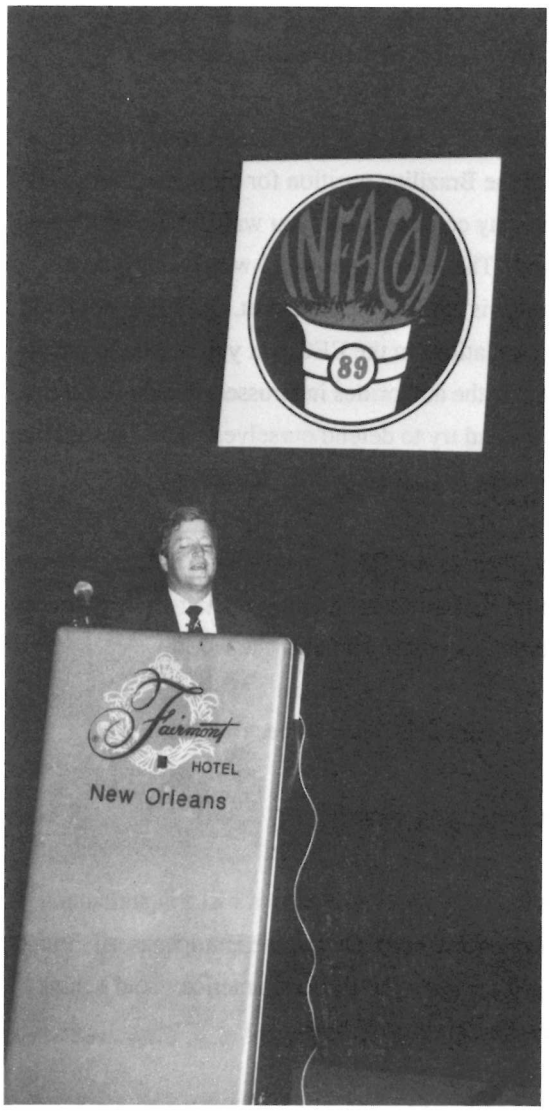
Q. R. Vicintin. If you say you may accept, what type of guarantees may we receive from you?

A. B. D'Auriac. Guarantee of what? I don't understand what you mean?

Q. R. Vicintin. If you said that you are able to accept free-trade policy, that is a historic statement, you know. You are changing very much. I mean you, nothing personal, I mean the Europeans, of course. They appear to be nice guys, but in my opinion they are just the opposite on trade practice. And I think that if you say you are able to accept it, what type of guarantees do you offer us?

A. B. D'Auriac. I don't understand your question. I would just like to maybe finalize this short discussion. Today more than 50% of the European market is covered by imported products and today I don't know if 1% of the Brazilian is covered by imports. So I don't see the discussion is to know how we can go further into a fair-trade practice which is proved in Europe. My question is, is it possible to envisage in a not too long future certain opening of the Brazilian market which is to date totally protected?

R. Vicintin (Comment). No, that is not true. You are making not a realistic statement by far. You do not sell more than 1% in Brazil. Why you can't. We do not have prices and quality as we have to do it in Brazil. But I appreciate your answers that clarify again the European position, that is to put a cork in alloys in the market. Thank you very much.



COMMENTS BY A.M. EDWARDS

Thank you, Mr. Chairman. As Chairman of the International Committee it is our responsibility to assure the healthy continuity of Infacon. And I recall back to our last meeting in Rio de Janeiro when Dr. John Trunzo mentioned that New Orleans would be the location for the next Infacon. Little did any of us realize that this would be such a wonderfully successful Conference. In Rio we boasted about a new record attendance and indeed this has even been far exceeded at this particular Conference. And we see a growth here of something like 30 to 40% per annum. So once again if we project lines and look at 30 to 40% per annum there is probably no other city in the world that can accommodate Infacon, in say, a few years time.

So hence, we have had a Conference "par excellance" and I think the organizers of the next Infacon, will, with some trepidation, have to try and meet the success of this one. Planning I believe started over two years ago when this hotel was reserved and the U.S. Ferroalloys Association under the very eminent leadership of John Oxaal and his Committee met monthly throughout the States to assure the success of this Conference. So I am sure many of you do not realize how much has gone into insuring the success of this operation.

At our meeting yesterday as tradition will, we had a look at ourselves and asked ourselves - are we following the right track? And certainly there has been no change. We still agree to meet every three years, we still insist that technical input is the real issue not other aspects such as marketing, and pricing and so forth. And possibly the only new issue that Donald Freas mentioned was conspicuous by it's absence is the lack of members from Eastern Europe. We will certainly to the best of our endeavors, try to insure that we do have such members if at all possible at our next Infacon.

As you might see from our panel, and I think they represent what has happened so far, and being somewhat scientifically oriented, we like to regard this as the theory of continental drift. And

if you consider these last five Infacons, they have drifted from Africa, to Europe, then we went to Tokyo in Asia, and Rio de Janeiro in South America and we have ended up at New Orleans in North America. So it seems as though we have ended the first cycle and are about to commence the next one.

Now I have tried to ponder this point, and in fact we have even seen some healthy argument today, that in the field of science and engineering we may have slightly less argument than we do have in field of supply of commodities and pricing as one might have just noticed. It has left me thinking that when Mr. Booth gave his excellent presentation he started with something in the realm of astronomy. Seeing that we are all conference weary at this stage, I thought I would like to mention something which to me personally is one of the most exciting developments in technology that I have experienced. Certainly, not in the ferroalloys field on this occasion but I would like to mention something that is a real tribute to our American friends as I see it as an observer. That as far ago as twelve years in the United States, Voyager II was launched. In fact, so long ago I suppose that many people have forgotten about Voyager II. But during the course of its years its drifting up towards outer realms of the solar system we have seen the phenomenally good pictures of the planets Jupiter, followed by the interesting discoveries at Saturn and Uranus. Shortly, and I don't doubt that its going to happen, we will see the most magnificent pictures of the planet Neptune maybe later on this year. When we consider the instruction to this little satellite takes so long that at least ten hours are required for the instruction to reach the little satellite and to activate it's camera and try and get it to veer it's course by a few micro seconds. Even the energy is supplied, solar energy, from such a distant source being at least ten light hours away from the sun. To me this is a most phenomenal thing and also bearing in mind that its technology that is now, at least, twelve years old. To me this is a most wonderful achievement and I thought I'd like to mention that in contrast why we insist that we do not have a marketing and sale conference. If we were to have one it should obviously take place in Las Vegas and not in New Orleans.

But the one good thing, of course, is that we do have the attraction of opposites. So that whereas we who are technologically trained people would regard that the economist is usually right 50% of the time. When you look at John Gomersall's excellent indication, a very slight difference between supply and demand of commodities creates an enormous differential in the price of such a commodity. It makes one wonder, that in our science we are so accurate and yet economics we are so off the mark. Instead I was thinking that if one could play such a game, we should have a lottery such that at the next Infacon we have to guess the prices of the commodities discussed at this one and see who is closest to the target. And I am sure it would be a most surprising one.

The one good that comes out of highly fluctuating metal prices is that times such as we are experiencing now, very high prices, you do find that industry is reasonably fat. This allows R & D to take place because normally these do not take place when time are bad, for obvious reasons. We also see the

emergence of new ventures and expansion of existing ventures.

Now we all know that this could lead to imbalance and we also know that the price of commodities will fluctuate and they will fall again. That we know, these are facts. But when that time comes, and the other good side of course is that when prices are low we are forced to be very efficient. We also find out that certain countries or companies are not as economic as some of the others. So we do have a development of new industry, possibly new technologies and new locations of such industries as is also well discussed at this stage.

Well, gentlemen it certainly wasn't my purpose to make a speech here but purely to report back the findings of our Committee. And getting back to this theory of continental drift we have decided unanimously that the next Infacon will be back in Africa. Having completed our cycle, and seeing that our Conferences are so much more successful in non-industrial environments, such as Rio, and New Orleans, away from industry, we are strongly thinking of Capetown as the next venue for 1992 perhaps the first venue of the 1990's. This will be followed, at this stage there are a number of suggestions but it will certainly be in terms of our continental drift theory, in Europe. This will be arranged by the European Ferroalloys Institute, and followed this in the later 1990's we will be located once again in Asia.

With that Mr. Chairman on behalf of our Committee we would like to thank you very much and we sincerely hope that we have been able to keep, in a rather difficult position, the standards of Infacon. You have certainly set a very high one and we have to endeavor to keep it this way. Thank you very much!