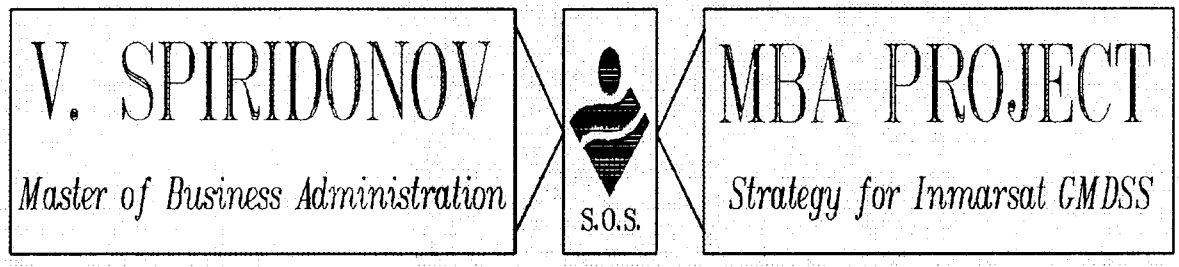
# PRESENTATION




for Inmarsat Directors:

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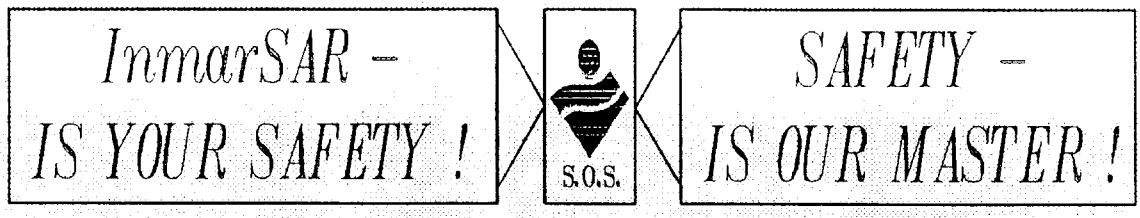
# SUMMARY

**STRATEGY**
**FOR**
***INMARSAT***
**SAFETY & RESCUE**
**COMMUNICATIONS SERVICES**

**25 NOVEMBER 1991**



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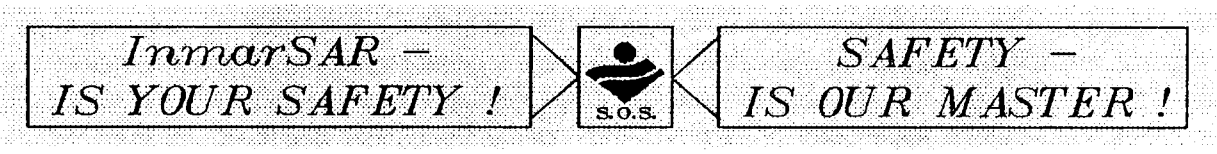
# 1. PROJECT DESCRIPTION

The intention of this project was to identify areas of strategic and operational concern to the Inmarsat organization and to propose feasible solutions in the most sensitive domain of maritime mobile communications market.

The project proposes that in cooperation with voluntary search and rescue agencies Inmarsat might consolidate its global advantage and improve its competitive edge! The strategy should include development, implementation and management of the International Maritime Safety and Rescue Network InmarSAR to promote higher than GMDSS performance standards, provide an adequate return of the initial investments and boost its mission:




One of the primary needs for management in the 1990s is to deal with an increasingly uncertain environment exposing competitive pressure which matures as new technologies and global competition are leading to shorter product life cycles, tough trade-offs, and the need for more focus. In this project I wanted, *inter alia*, to provide material with which managers can build up a solid foundation to cope with the challenges of the 1990s.

***Chapter two*** of the project, on the basis of carefully selected data, explores the Inmarsat business environment. The chapter identifies the responsiveness of the present position of the Inmarsat and its competitors to the environment and forecasts emerging of companies with a position extended into three-dimensional environment (more than one type of systems, stronger ability to invest, greater spectrum and orbit capacity). To retain competitive global advantage Inmarsat should improve the complexity of the system and ***ability to provide services direct to the system end users***. Strategic move in a way of improving direct liaison with the end user might be to establish and operate Inmarsat safety and rescue network (InmarSAR) proposed by the project.

***Chapter three*** examines historic data of the user base development and presents world-wide overview of the availability and status of telecommunications services and supporting electronics industry. The ideas of the MBA courses 'Corporate Strategy', 'Marketing' and 'International Business' and others have been employed. The concepts of the global competitive advantage of Porter, M. (1990) have been applied to the structural analysis of the business, its positioning, have been effectively employed to identify sources and scope of the competitive advantage and eventually to formulate a proposed competitive strategy.

The chapter addresses the need for realism in presenting the likely scenario of the Inmarsat business environment after 1991. The environment seems to change to a less friendly user base, more challenging new entrants, more nationalistic electronics suppliers and services

providers, with a stronger threat of substitution, all leading to a split of the maritime user base by national and regional markets, provided Inmarsat continues present strategy for GMDSS. ***The natural role of the GMDSS is to consolidate the user base, services providers and manufacturers on an international base. The Inmarsat is already given a natural role of a global operator.*** Our strategic move should merge these both qualities and enjoy unbeatable competitive edge.

***Chapter four*** of the project introduces results of the research and analytical work done to the produced and selected forecasts of GMDSS market sector and the developed GMDSS evaluation model. The chapter suggests that, although the global GMDSS market sector seems to be mainly in its embryonic status at the moment, it contains strong explosive user base, which can be triggered and driven by strong international regulations. The commercially-driven user behaviour will be strongly affected by the GMDSS explosion. ***Through the GMDSS regulated market there will be a thread to the commercially-driven users.*** The work of the chapter justifies that the development of the GMDSS market sector by Inmarsat will consolidate efforts of different players on the market and direct them to the mutual benefit of the Inmarsat global advantage. The computations made by the model suggest that the GMDSS market, taken through the InmarSAR, will return initial investments.

***Chapter five*** addresses practical aspects of implementing the strategy on the developed principles and discusses the operational plan for the Inmarsat safety and rescue communications network InmarSAR.

***Four annexes*** contain valuable details of the proposed and implemented tools to justify the statements and conclusions of the project.

## 1.1 BACKGROUND

Introduction in 1992 and effective operations of the global maritime distress and safety system (GMDSS), highly sophisticated integrated telecommunications services for safety of life at sea, is at risk of unsolved problems of funding, management and operations.

The proposed national and international strategy, based on developed technical and operational, political and commercial, managerial and administrative principles, is aimed at solving these problems. Concerted actions of Inmarsat signatories, parties, directorate, services providers and manufacturing industry are required to realize the concept which should result in the improvement of the Inmarsat's competitive edge.

## 1.2 ISSUE

Inmarsat capital investments include generic elements of specific requirements of reliable distress and safety communications which cannot easily be separated and assessed

individually. It is hardly expected that these investments and associated operating and maintenance costs can be directly recovered by earnings from a relatively small distress, rescue and safety related traffic at the tariffs of commercial services.

A specific element of the Global Maritime Distress and Safety System is that the international maritime community pursue the fundamental humanitarian principles of using communications means free of charge to the ship in distress. Hence, the whole set of outstanding questions: Who should pay for the traffic and how, what should be the payment mechanism, and what messages and volume of traffic should be under the category of distress and safety. It is proposed in this project to qualify the traffic, for the purposes of safety of life at sea, in two categories: Preventive information and Rescue information.

The International Convention for the Safety of Life at Sea makes obligatory for ships to carry standard GMDSS equipment and use communication services, whereby inducing growing demand in the maritime market for both the population of the satellite shipborne equipment and satellite communications services. In my hypothesis, proposed in this project, the slice of the global market, induced by the GMDSS regulations, will lead to a stronger competitive advantage to Inmarsat, if the organization takes certain risk to invest in developing this regulated market further as an intrinsic element of the Inmarsat system.

## 1.3 RESEARCH OBJECTIVE AND METHODOLOGY

The research objective was to examine a strategic option whereby the simple global strategy should be aimed at a specific global market, where the participant's behaviour is regulated by the international law. In my perception, this strategy will allow the organization to take the global GMDSS market well in advance of perspective regional and emerging global competitors and build up further on this regulated market, exploiting it as a bulldozer to pave the way for leadership in the global market.

The examination and assessments were given to new opportunities and threats in positioning a proposed safety and rescue communications network InmarSAR in specific sector of the maritime mobile communications services market.

In establishing assumptions for an initial model of traffic and cost assessments for all GMDSS communications functions, certain operational data of the Inmarsat satellite networks were analyzed. Special programmes were applied to processing and sorting out relevant information, forecasts of improper operations traffic was developed by using rather powerful Forecast Master Plus programme.

International statistics on casualties at sea were obtained from the International Maritime Organization and Lloyd's Register upon request. The samples were used to extrapolate the number of situations generating a specific traffic and establish certain relationship between different market variables. One 24-hours sample was taken from live tests, involving real

time operations.

Traffic development of the maritime market and forecast trend were obtained from the Inmarsat open publications like 'Ocean Voice' and internal sources not disclosing sensitive strategic values.

All the above data helped in developing assumptions which in no way purported to represent the real world, but it seems to be useful in that it allows conclusions to be reached that do have real world validity. The initial model was tested to ascertain the methodology of assessments and acceptability of the model for decision making process. Adjusted model was finally developed.

Financial data related to operations, maintenance and investments involved in distress and safety communications services of individual owners of Inmarsat stations were requested through questionnaire and interviews. The model was adjusted accordingly in order to finalize the methodology in assessing the concept.

## 2. INMARSAT BUSINESS ENVIRONMENT

As a unique global mobile system, Inmarsat provides its users with economic benefits from reliable and cost-effective communications. The market place will require an expanding range of services and competitive equipment prices. Demand for satcoms is growing, as its advantages are becoming better known.

This chapter integrates data which were carefully selected from different sources to represent a brief and concise feasibility study of the Inmarsat business environment. The purpose of this research is to identify responsiveness of the present position of the Inmarsat and its competitors to the environment and assess possible strategic moves. The conclusions of this chapter form the environmental basis for review and research work of the strategic option proposed by the project in the subsequent discussions.

***Current market position*** There is no single mobile market but a multiplicity of market segments, each with its own requirements and each in different stages of maturity in the penetration of satellite communications. Some market segments are close to saturation in terms of ship earth station fittings, although considerable potential still exists for increasing their utilization of Inmarsat system.

***End user base expansion.*** Inmarsat's overall market penetration is still remarkably low after many years of global operation. As regards demand, there are currently over 15,000 users of the Inmarsat system. They utilise a great variety of services offered by a good number of land earth stations based on basic Inmarsat-A services. With the advent of the Inmarsat-C system, access to Inmarsat satellite communications is available to a much bigger potential marketplace.

***Competition.*** The commercial satellite industry looks toward years of intense competition both domestically and internationally. It is fair to say that there will be more competition in mobile communications, which should benefit the end user, particular as that competition drives down the cost of equipment and tariff charges for communications. In most cases competition will also create faster growing markets.

***Getting Finance.*** A key hurdle to pursue new opportunities is the reality of getting finance. The challenge will be the spectre of massive high-risk investments in the face of uncertain economic climates and the possibility of future changes in both satellite and terrestrial technologies. Raising capital to enter new businesses at the same time the economy is heading into a recession will continue to be a problem for satellite entrepreneurs in 1991 and beyond.

***Broadcasting services.*** It is agreed opinion that a marketplace for satellite sound broadcasting exists to be cultivated and harvested however it is unclear at this time whether a sufficient market exists to justify the associated costs. There are at least three reasons why satellite sound broadcasting will be a hit: the ability to provide continuous programming to the mobile audience; the ability to provide CD-quality for discerning home listeners; and the ability to provide something better than shortwave for the international audiences receiving Voice of America, BBC World Service, etc., throughout the world.

***Low earth orbiting (LEO) technology.*** In the arena of small satellites and low-earth orbits, the LEO satellite technology appears to be a promising, although as yet unproven, alternative for commercial applications such as mobile. The low-orbit technologies will expand the marketplace and the number of applications available to the user. This increased competition between MSS providers and technologies will be beneficial to the market.

***System complexity/cost.*** The cost barriers to entry into the mobile satellite business are very high. Some countries with strong domestic requirements have chosen the route of implementing mobile satcom capability as hybrids with their domestic telecommunications and/or broadcasting satellites.

However, there were recent revelations of ambitious plans of Motorola (USA) to implement 77 low-earth orbital (LEO) satellite system 'Iridium' for mobile market and project 'Marathon' of the USSR to embrace both LEO and GEO satellites. Those are clear signs that the cost barrier may not be taken as an obstacle to get global advantage. Inmarsat should find the ways of retaining user oriented global strategic advantage.

Long-run potential impact of LEO systems is expected to be enormous. They raise the potential for satellite systems to compete on both a performance and an economic basis with terrestrial systems by an order of magnitude.

Fibre optic technology continues to infiltrate markets once reserved for satellite applications, and this development paradoxically has helped space-based communications providers.

***Transmission media.*** The demand for new technology and new applications has exceeded the amount of available spectrum. Spectrum issues, and therefore the World Administrative Radio Conference in 1992, will dominate the mobile communications and satellite industries throughout 1991 to grapple with sharing spectrum, using heretofore unusable spectrum, and reallocating inefficiently used spectrum.

In this area, at least for the time being, competition would seem to make little sense. The member countries which signed the Inmarsat Convention agreed that there should be only one system, in part for reasons of frequency economy.

***Deregulation.*** Regulatory philosophies and practices have swung widely over the past several years to the point where we now have a patchwork quilt of differing laws and varying speeds of regulatory evolution in countries around the world. Protectionist actions could well trigger a new round of regulatory structures that will seriously hamper the development of truly global mobile communications.

Inmarsat services are provided to both mobile and fixed users through national telecommunications authorities, usually, but not exclusively, the signatory organizations. Any country, whether an Inmarsat member or not, can access and use the Inmarsat system. Different national approaches can coexist side by side in Inmarsat while the Organization safeguards the ultimate aims of achieving economy of scale for the benefit of the users through international cooperation, international standards and interconnectivity as well as frequency economy. This supports Inmarsat's unique global dimension which can ensure a broad and growing base of users well into the 21st century.

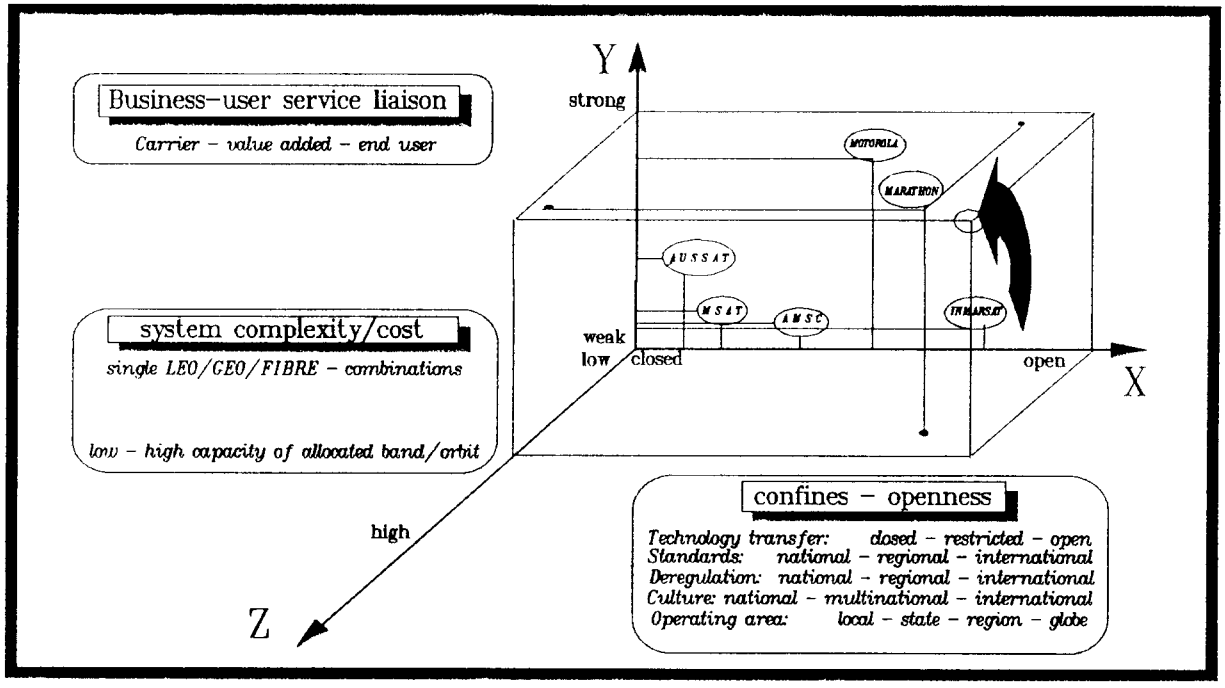
***Standards.*** Developing technical requirements for the equipment design, procedures and the scope of test to ensure approval of compliance of the design with the requirements, and commissioning of the world-wide manufactured equipment for operation within the global Inmarsat system requires universally accepted methodology and standards. This is always a problem for national regulations. The idea of global standards makes good economic sense. Universal standards for user equipment could also result in substantial economies of scale for manufacturers, resulting in lower equipment costs and an expanded user base.

The policy of global mobile communications standards protracts availability of the standards to anyone without charge, even if this information is used in connection with other space segment systems. In the long term, if users have equipment which is capable of operating via Inmarsat space segment, there may be a question to their regulators why they are forced to use the domestic mobile satellite system.

***Evaluation*** of the Inmarsat business environment is completed by producing a three dimensions chart (Fig.2), using the most challenging environmental parameters. The purpose of the analysis is to identify relative positions of openness of Inmarsat and perspective mobile satellite operators to the global environment in order to assess a strategic direction for Inmarsat to retain and improve position of a global operator. Responsiveness of the company

to the environment suggests certain ability of the company to penetrate and keep leading the global mobile telecommunications market.

FIGURE 2: *Inmarsat responsiveness to the global business environment*




For the first dimension 'confines - openness' the following highly correlated parameters of environment are selected: technology transfer and system standards, regulatory aspects and operating areas, and the culture. Each of these characteristics extends from a very close, confined to a small area of selfprotection, to the full openness to the outside world, unprotected position.

For the second dimension, only two parameters are selected: system complexity associated with corresponding cost and availability of scared natural resources of spectra and orbits. Both characteristics appeared to be slightly correlated. The scale lies between the low and high values of the parameters.

For the third dimension the strength of liaison between a system operator and the end user is selected. This helps to identify ability of the company to response quickly and taylor the service to the needs of a particular end user. The assumption is that the quicker the response, the stronger the end user base is.

*Conclusions.* The ideal company, capable of outperforming all the others, should place itself on the top of openness to the global business environmental challenges.

At present, all existing companies can be positioned on two-dimensional plane X-Y (user

liaison vs openness). There is no known operator capable of using any combination of transmission media. Inmarsat is outperforming all of them and can enjoy relative global advantage.

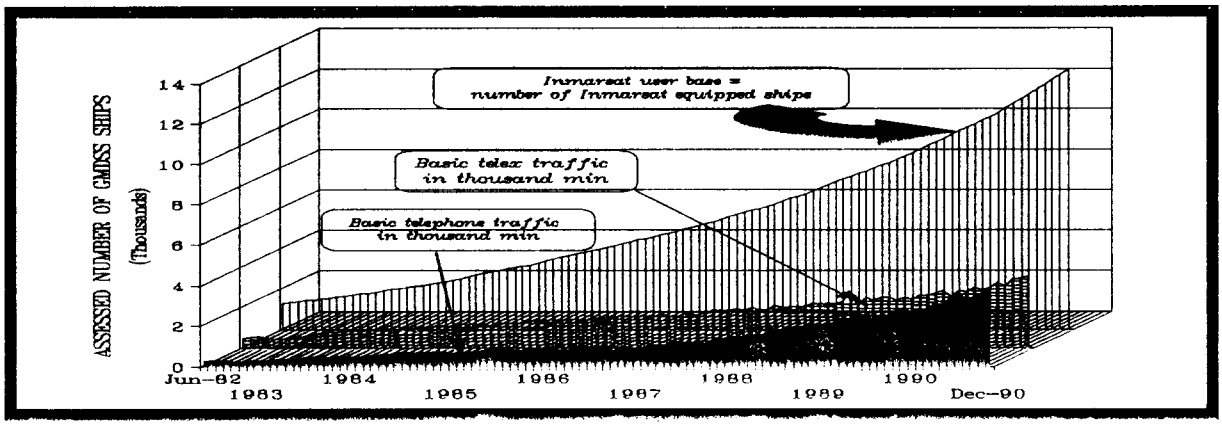
In near future, however, there are clear signs of emerging of companies with a position extended into three-dimensional environment (more than one type of systems, stronger ability to invest, greater spectrum and orbit capacity). To retain competitive global advantage Inmarsat should improve the complexity of the system and ability to provide services direct to the system end users. One of the way to improve liaison with the end user is establishing and operating Inmarsat safety and rescue network (InmarSAR) proposed by the project.

## 3. MARITIME MOBILE COMMUNICATIONS MARKET

The purpose of this chapter is to select and process historic data of the user base development, to analyze the obtained statistics and work out sound conclusions as to the availability and status of telecommunications services and supporting electronics industry.

***The historic trend*** of Inmarsat user base and corresponding traffic in basic satellite services is given below. Figure 2 shows at least two important events: (a) it suggests that the expansion of user base produces correspondingly growing total traffic; and (b) it also suggests that the basic telephone service is growing at a higher rate than telex. The explanation of this is in that the greater variety of economically-viable telecommunications services available to end user can be and, in fact, are arranged on a cost effective basis using telephony. Facsimile, data, electronic mail and video are the representatives of a good variety of available and potential value-added services which stimulate greater utilization of Inmarsat space segment.

**FIGURE 2:** ***Traffic generated by the Inmarsat user base.***




***End user base development.*** The number of potential GMDSS ships is assessed on the ground of tonnage, category of fleet and trading area. Other vessels, like platforms at sea,

purpose-built crafts, off-shore constructions are not taken into account as it is difficult to predict to what extent GMDSS regulations will be applied by government on a regular basis. Therefore this sort of outsiders are excluded from GMDSS driven users. On this assumption the potential GMDSS ships roughly account for 57 per cent and non-GMDSS vessels account for about 43% of the total world maritime vessel population above 100 tonnes. The number of small vessels below 100 tonnes can be assessed as high as 400,000 units.

Both Fig. 2 and Fig. 3 suggest that, in all GMDSS fleets, the Inmarsat user base is far below the saturation point. Although the trends demonstrate the higher rate of Inmarsat installations over the growth rate of potential GMDSS-ships population, the actual portion is still around 20 per cent.

Different fleets demonstrated different attitude to a chance to join the Inmarsat user base. **General cargo market, Figure 4.** The fleet in this market represents a third of the potential GMDSS ships population. It has been declining as a result of the relatively high scrapping levels, which in turn reflected the advanced age of the fleet. This partly explains rather low increase in the Inmarsat user base of this sector, staying at 10.8 per cent of the saturation level and representing about 15.5 per cent of the total Inmarsat base.

**Bulk vessel market, Figure 5.** The fleet is in a period of some consolidation, representing nearly eight per cent of the potential GMDSS ships population of which 32 per cent enjoy using Inmarsat terminals. This represents 11.3 per cent of the total Inmarsat user base.

**Oil market, Figure 6.** Although the fleet is only 9.6 per cent of the potential GMDSS ships population, the Inmarsat user base reached 38.4 per cent of the saturation level and amounts to 15.6 per cent of the total Inmarsat user base. The explanation of these very high figures can be found in better appreciation of good quality communications needs for effective fleet management and relatively low associated cost.

**Passenger market, Figure 7.** The Inmarsat user base of the fleet seems to grow surprisingly slow, approaching 8.8 per cent of the saturation level and representing 2.5 per cent of the total user base. Possible explanation is in that the most demanding for satellite communications luxury cruise liners and ferries, and large ocean-going passenger vessels are forming a tiny proportion of the fleet.

**Containers market, Figure 8.** The fleet is relatively young and the upturn in the market has removed the pressure to scrap vessels. Order books are healthy at present, reflecting expectations among shipowners of growth in demand. This fact is also reflected in rapidly growing use of satellite communications. Inmarsat user base approached 22% of the saturation level while fleet and user base are equally represented in appropriate totals. The Inmarsat user base development has been mainly driven by intuition of fleet managers that reliable communications, though costly, saves time and money in decision making.

FIGURE 3: *GMDSS ships - user base.*

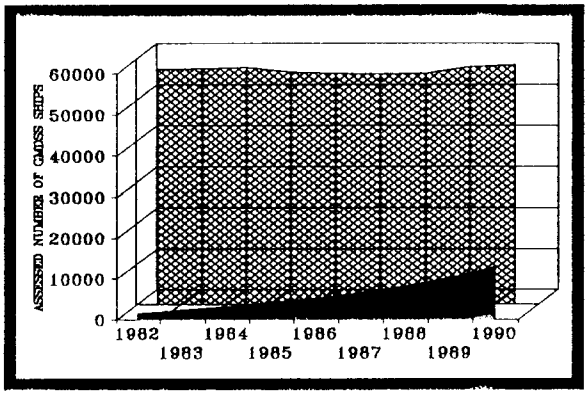



FIGURE 4: *General cargo ships - user base.*

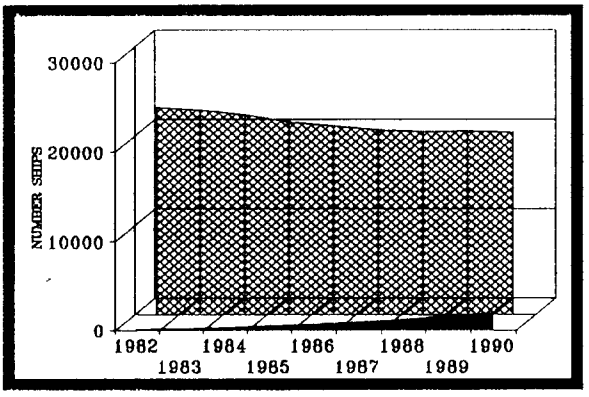



FIGURE 5: *Bulk ships - user base.*

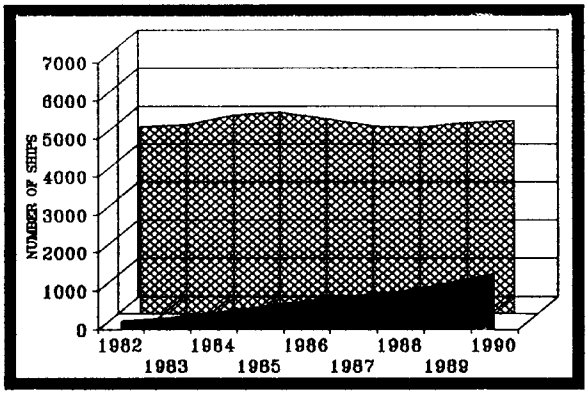



FIGURE 6: *Oil tankers - user base.*

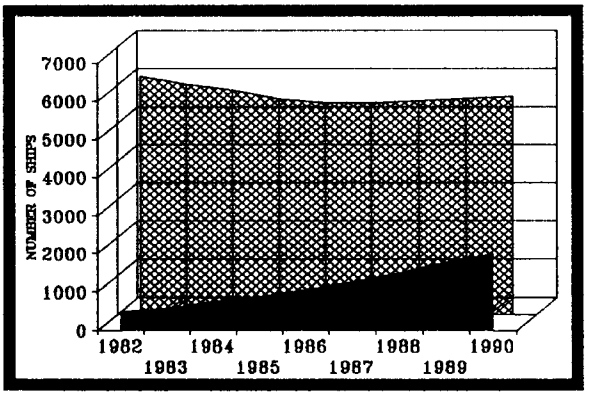



FIGURE 7: *Passenger ships - user base.*

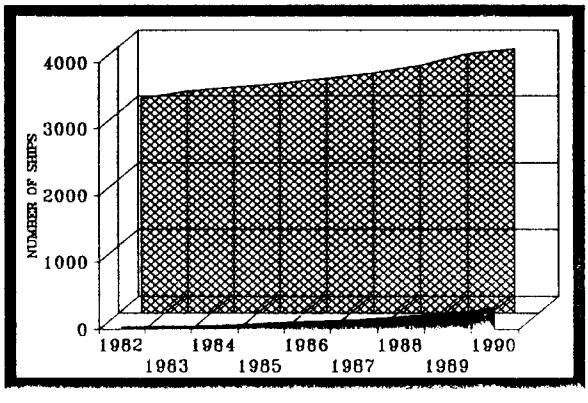
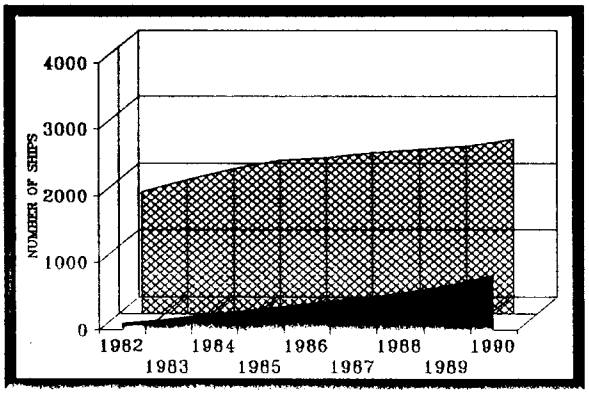



FIGURE 8: *Container ships - user base.*



*Services providers competition.* In the Inmarsat system, provision of services to end users is the responsibility of Inmarsat Signatories. The earth station operators in each ocean region compete with each other. A ship has a choice of communicating via any one of available earth stations. The final choice could be based on such factors as the price, availability and quality of a particular service, the nationality of the coast earth station and its proximity to the final destination of the communications.

The information technology services and products developed for general use are available to anyone with a telephone line and the necessary equipment. The number of services devised especially for use by the maritime community is increasing. There are essentially three sources for these services.

*The first source* is represented by Inmarsat coast earth stations themselves offering more than 500 telecommunications services to the end users. *The second source* consists of independent firms wishing to offer services to the maritime community through the Inmarsat systems. Most of these services take the form of databases that furnish information on particular matters. *The third source* is Inmarsat subscribers themselves, who have developed their own information technology applications.

***Electronics market*** The Inmarsat equipment market, although it is a small portion of the mobile electronics market, may very well represent the general trends in manufacturing Inmarsat ship earth stations (Figure 9, as at 1st June 1990) and its distribution to the Inmarsat user base (Figure 10, as at 1st September 1990).

FIGURE 9: ***Manufacture by countries.***

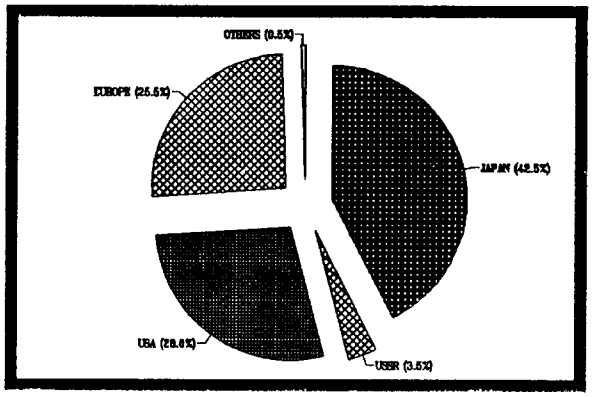
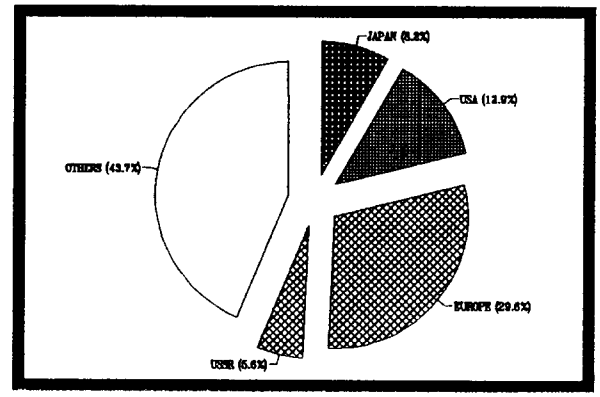


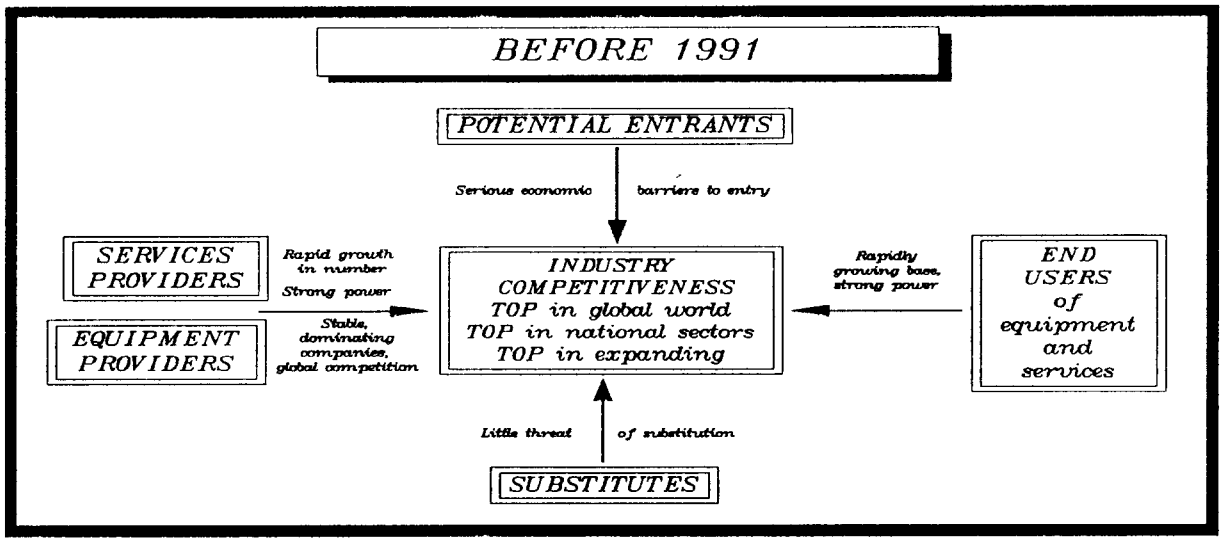

FIGURE 10: ***Distribution by countries.***




This market has been supplied by a fairly steady group of up to a dozen manufacturers with a keen sense of competition. Its steadiness has given the market a confidence in the supply and support of equipment and a familiarity with most of the manufacturers involved. And the competition remains and it is, of course, this competition which has driven prices down and led to a substantial improvement in the quality of products offered.

*Evaluation* of the Inmarsat business environment and specifics of the maritime mobile communications market is completed by producing a more precise structure of the competitive environment shown in Figure 11.

FIGURE 11: *Inmarsat competitive maritime environment by 1991.*

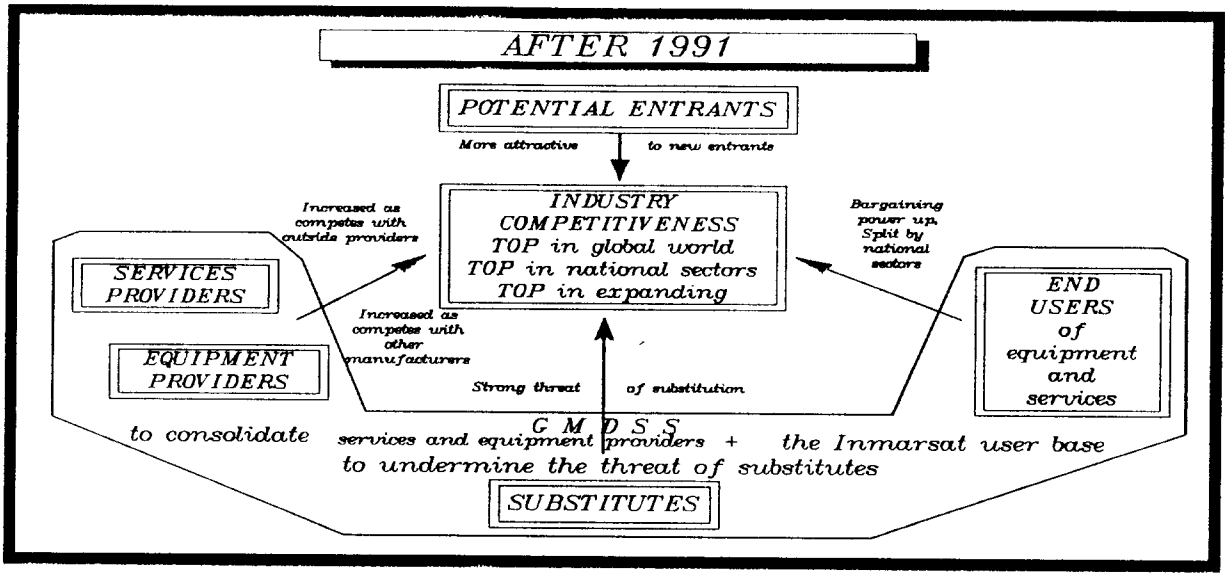



The clear message of the analysis is that there is a threat to the competitive position of Inmarsat through the protectionism of national and regional telecommunications market interests. This will make the Inmarsat competitiveness relatively weaker, reducing protection from new entrants and leaving little threat for substitution.

Figure 12 shows the likely scenario of the Inmarsat business environment after 1991. The environment seems to change to a less friendly user base, more challenging new entrants, more nationalistic electronics suppliers and services providers, with a stronger threat of substitution, all leading to a split of the maritime user base by national and regional markets.

The figure also shows the role of the GMDSS, if it is strategically sponsored by Inmarsat, in consolidating the Inmarsat user base, services providers and manufacturers and reducing the threat of substitution.

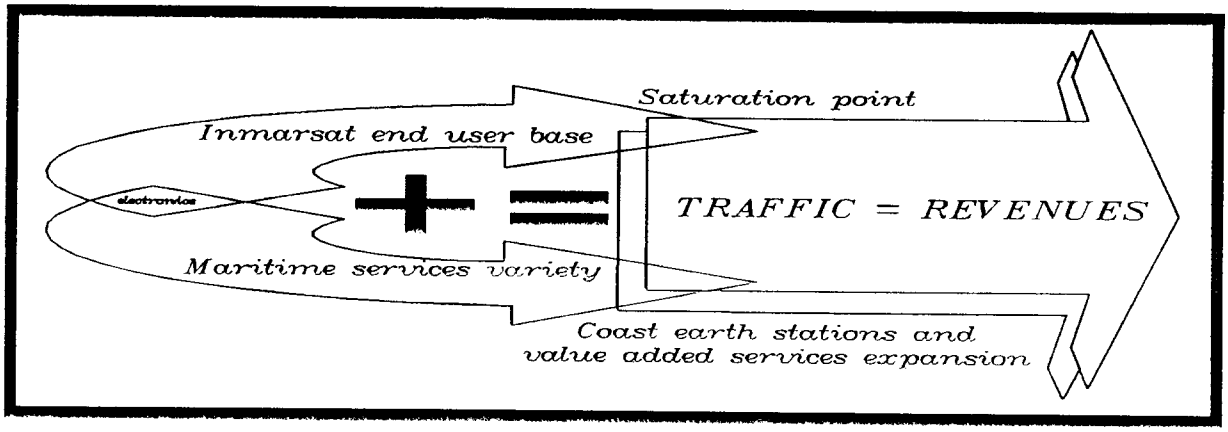
FIGURE 12: *Inmarsat competitive maritime environment after 1991.*




*Conclusions.* Physical benefit of getting competitive global advantage is measured by the volume of traffic converted into the revenues of the organisation. From the discussions we may conclude that the growth of traffic is dependent on two variables (a) expansion of the Inmarsat end user base and (b) growing variety of Inmarsat maritime services, both supported by advancing electronics equipment market, Figure 13.

Deviation of any or both components from the strategic intent causes the risk of diminishing or loosing the global strategic advantage. One of the way to reduce effects of deviations in achieving the strategic intent is to establish and sponsor operations of an Inmarsat safety and rescue network (InmarSAR) proposed by the project.

FIGURE 13: *Strategic intent.*



## 4. GMDSS COMMUNICATIONS SECTOR

*Status and forecast* The portion of the Inmarsat user base was slowly increasing in the potential GMDSS-ships population over 1982 - 1990. The Inmarsat user base forecast (Fig. 16) suggests that by the year 2000 the portion of commercially driven Inmarsat user base might reach 58 percent of the saturation level, the rest of the potential GMDSS fleets being left to conventional radio. The forecast is based on the historic analysis of eight years of Inmarsat operations and the assumption that the growth of the Inmarsat user base was primarily driven by the expectations of shipowners to improve competitiveness of their fleet operations. The Inmarsat user bases by categories of ships Fig. 4 to Fig. 8 reflect the shipowner actions to make their fleet more competitive by means of executing high cost operational decisions in a shorter time.

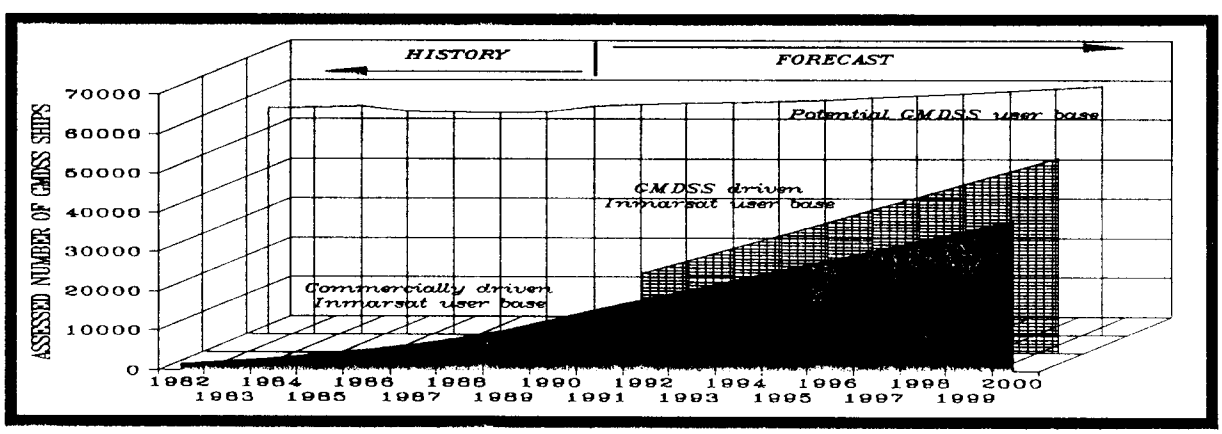
**GMDSS-driven Inmarsat user base.** By establishing the factor of GMDSS influence, the forecast of the GMDSS-driven Inmarsat user base may take into account the associated growth of user base induced by GMDSS requirements. For this purpose consider two extremes: (a) assume that container fleet demonstrated purely commercial growth of Inmarsat user base, the evidence being an equal representation of the container fleet in the potential GMDSS-ships population (6.3 per cent) and Inmarsat equipped container ships in the total Inmarsat user base (6.2 per cent); (b) assume that the yachts above 100 m demonstrated growing Inmarsat user base as a result of prevailing intention of private and chartered owners to maintain safety communications.

The higher rate of the Inmarsat user base growth in the yachts sector than in the container trade market suggests that the difference might very well represent a likely inducement factor to respect safety and rescue needs of the Inmarsat user base.

$$D = Y - C = 52\% - 22\% = 30\%.$$

Applying this factor to the commercially-driven Inmarsat user base find out that Inmarsat user base can reach 77 per cent of the saturation level by the year 2000.

**FIGURE 16:** ***History and forecast. User bases.***



***International regulations*** form the GMDSS-driven user base in a way of a strictly regulated International, global market. This puts the existing and potential commercially driven Inmarsat user base and potential Inmarsat GMDSS-driven user base under the pressure of different standards and market specifics:

| USER BASE⇒ | ⇒USER BEHAVIOUR⇒ | ⇒MARKET SPECIFICS |
|---|---|---|
| INMARSAT USER BASE | ⇒GMDSS-DRIVEN⇒ | ⇒DICTATORSHIP |
| | ⇒COMMERCIALLY-DRIVEN⇒ | ⇒COMPETITION |

If a manufacturer decides to claim that his particular model is type-approved for GMDSS by Inmarsat, this will make the market position of this model quite different. The position will improve by embracing a GMDSS-driven user base, which is a new not yet touched niche.

***The evaluation model*** has been developed on a computer basis in order to assess a wide range of cost elements for assumed scenarios. When agreed on assumptions for each scenario the cumulative results can be developed to build up charging principles. The model suggests that every GMDSS communications function from one to nine should be thoroughly examined and agreed on the method of calculations; volume, structure, contents and routing of traffic, and some assumptions on capital investments, maintenance and operations.

The structure of the model also suggests that the GMDSS related costs should be seen in two dimensions: (a) tariff-traffic induced costs and (b) capital, maintenance and operating (CMO) costs. These costs have been grouped into two categories: (a) distress and rescue traffic related costs, and (b) maritime safety information circulation related costs.

The following table consolidates results of computations made on the assumptions of the initial model for certain traffic and capital cost scenarios. The third adjusted model suggests that the required investments into the InmarSAR network can be apportioned as follows:
**Coast earth stations.** Total number of coast earth stations involved should be eight. Capital, maintenance and operating cost apportioned to the InmarSAR network should be within three per cent of the CMO cost of an individual CES. This makes up $1.2 million for ten years, which can be placed on the contract with a CES participating in the InmarSAR.
**Rescue Coordination Station.** Total number of the required terminals should be eight. CMO per unit is around $50,000, then the total CMO shall be $400,000. Approximately $100,000 should be allocated to the R&D programme associated with InmarSAR terminal design and development.
**Ship earth station.** The R&D cost associated with development of the Distress and Safety Unit can be as high as $100,000.
**Central database and data network**. Setting up a central database for registration and operating control, data communications including hardware and software feasibility study may require $1.5 million. The total cost will amount to $3.3 million in ten years.

TABLE. *Initial Evaluation Model.*

## CUMULATIVE ASSESSMENTS

### ALL GMDSS COMMUNICATIONS FUNCTIONS

#### RESCUE RELATED TRAFFIC

GMDSS COMMUNICATIONS FUNCTIONS 1, 2, 3, 4, 5, 6, 9

| **Scenario: tests required** | TRAFFIC VOLUME (unit) | TRAFFIC COST ($) |
|---|---|---|
| Inmarsat systems | 219,400 | 638,200 |
| Non-Inmarsat systems | 513,600 | 284,300 |
| free | 346,100 | not applicable |
| Total | 1,079,100 | 922,500 |

| **Scenario: tests prohibited** | TRAFFIC VOLUME (unit) | TRAFFIC COST ($) |
|---|---|---|
| Inmarsat systems | 5,594 | 87,600 |
| Non-Inmarsat systems | 13,054 | 32.250 |
| Total | 18,648 | 119,850 |

#### SAFETY RELATED TRAFFIC

GMDSS COMMUNICATIONS FUNCTIONS 7

| | TRAFFIC VOLUME (unit) | TRAFFIC COST ($) |
|---|---|---|
| Inmarsat systems | 18,729,780 | 56,189,340 |
| Non-Inmarsat systems | 42,768,420 | 21,384,210 |
| Total | 61,498,200 | 77,573,550 |

#### CAPITAL, OPERATING AND MAINTENANCE COSTS

| **Scenarios:** | **Planned basis** | **Assumed minimum basis** |
|---|---|---|
| Inmarsat systems | $11,088,000 | $ 4,361,400 |
| Non-Inmarsat systems | $ 1,532,575 | $15,992,000 |
| Total | $12,620,574 | $20,353,400 |

***Completion of the forecast and gmdss model evaluation.*** Certain analytical work has been undertaken to select the best fitted model and evaluate the obtained results. The methodology of econometrics was mainly applied to build up a profile of a prospective GMDSS user base. The fundamental approaches have been taken from the publications Makridakis, S. (1989), Goodrich, R.L. (1990), material of elective course "Business and Economic Forecasting", Hadjimatheou, G. and Hankinson, G., (1989).

Short-term Forecasting Package 'Forecast Master Plus' was used as a main tool in research work in depth of a particular sector in developing suitable models to forecast likely development of the GMDSS-driven user base and Inmarsat commercially-driven user base. Time series of variables have been constructed and used to forecast the Inmarsat user base by applying methodology explained in the text books.

At present, more than 12,000 installed Inmarsat SESs are type approved and commissioned by Inmarsat for maritime applications. However there is no one user representing the GMDSS-driven user base, because (a) there is no Inmarsat-GMDSS terminal in reality, (b) there is no recognized authority to issue a GMDSS certificate to an Inmarsat ship earth station, (c) there is no GMDSS in operation.

The GMDSS sector seems to be waiting for everyone to come and to take it. Today, the future leadership may cost Inmarsat less than in near future when other satellite operators may realize the situation and take appropriate actions. In fact, the GMDSS-regulated market sector will play the role of an international caterpillar, paving the way to the whole maritime user base in a rather short time. On the Inmarsat side there are certain elements already developed to ease entering this market: (a) nearly completed paper-made Inmarsat-A GMDSS configuration, which reflects a complete set of existing GMDSS regulations and Inmarsat guidelines; (b) internationally recognized GMDSS services centre; (c) global coverage.

***Conclusion*** The obtained results of the research and analytical work suggest that the global GMDSS market sector is mainly in its embryonic status but contains strong explosive user base, which can be triggered and driven by strong international regulations. The commercially-driven user behaviour will be strongly affected by the GMDSS explosion. Through this GMDSS regulated market there will be a way to the commercially-driven users.

Development of the GMDSS market sector by Inmarsat would reduce additional investment in consolidating efforts of different players on the market to direct them to the benefit of Inmarsat to maintain its global advantage.

## 5. STRATEGY FOR GMDSS

Currently Inmarsat follows technical and operational standards recognized by the international maritime community as their minimum requirements of the Global Maritime Distress and Safety System (GMDSS). If continue in line with this direction this will lead to further split

of the global maritime market into national segments and will negatively contribute to the Inmarsat global advantage.

Present use of the system produces a lot of criticism about service quality which weakens the image of the organisation as a backbone of the GMDSS. Having obtained authority to provide improved general public telecommunications services via the Inmarsat system, to ignore this authority in respect of the satellite GMDSS communications functions weakens the advantage of the Inmarsat competitive edge.

The strategy should be wider and embrace such areas as financial, regulatory, marketing and operations on the proposed principle of continuous evolution towards universal integrated system under the Inmarsat umbrella. GMDSS minimum level of requirements should be left to governments and national administrations.

Concerted actions of Inmarsat Signatories, CES operators, SES manufacturers, Inmarsat Directorate, governments and rescue authorities in development of the advanced system will lead to consolidation of an international (global) market around Inmarsat as a lynch-pin of the Inmarsat GMDSS and will bring potential GMDSS user base to Inmarsat.

Concentration of certain GMDSS communications functions under the Inmarsat global umbrella shall be taken as a strategic advantage to the organisation over segmented national and regional efforts and finance. With this in mind, centrally controlled system to provide advanced GMDSS communications services is proposed to be established on a feasible cost recovery mechanism, initially sponsored by Inmarsat.

***The proposed InmarSAR network*** will require a fraction of the absorbed CMO costs amounted to $3.3 million during ten years. More than that, the proposed InmarSAR net might have sound sources to recover the invested capital, operating and maintenance costs and absorbed GMDSS traffic cost. The following likely sources of cost recovery mechanism have been identified: registration fees (1%), additional tests (5%), additional maritime safety information services on request (5%), advertising programmes on the network (15%), world news media service on the network (10%), Inmarsat sponsorship (62%), voluntary donations (1%), 'Thank you' button (1%). These sources are to be valuable components of both the return on investments and the fund for further InmarSAR development. The most significant source should be the Inmarsat sponsorship on the assumption that the forecast growth of user base, driven by GMDSS, will be around 30%, generating additional commercial traffic and revenues, one or two per cent of which can be sufficient to maintain the level of sponsorship.

As the evaluation model suggests, the overall costs of the InmarSAR network is significantly lower than the costs of any other system. Concentrated minimum required equipment and a possibility of establishing a global recovery mechanism due to central control over GMDSS functions, lead to a lower cost leadership adding significantly to the Inmarsat competitive advantage.

The following principles of InmarSAR are proposed:

In cooperation with voluntary search and rescue agencies Inmarsat initiates coordination of development, implementation and management of the International maritime safety and rescue network in a way which provides a return of the initial investments.

In cooperation with voluntary SAR agencies the Inmarsat takes responsibility for controlling network operations and maintaining electronic databases of the quality control system.

The end users of the network, information technology services providers and equipment manufacturers are all voluntary registered participants of the network. In cooperation with registered participants, the Inmarsat sets higher technical, operational and management standards than the minimum GMDSS performance standards, thus providing balanced improvement of application of new satellite communications and information technology to the safety of life at sea.

Safety and Rescue communications are an integral part of Inmarsat maritime activities which allow Inmarsat to build up its global competitive advantage and as such the investments in these activities are commercially and economically viable and strategically justified.

The mission should be clearly projected:

**INMARSAR - IS YOUR SAFETY! SAFETY - IS OUR MASTER!**

These principles do not interfere with the principles of present distress and safety communication systems and GMDSS services. The InmarSAR will be evolving from the established ship-to-shore distress alerting networks and will peacefully coexist and compliment national contributions to the GMDSS. Evolution will have to take some operational stages. At the top stage of development the network operation will alow to establish its own Code of Communications, funds for operations, maintenance and development.

Along the proposed strategy the InmarSAR should also take responsibility and cost for issuing Inmarsat GMDSS Type Approval for Inmarsat ship terminal and coast earth stations. This will include the cost for attesting and commissioning of SESs and CESs and issuing a Type Approval Certificate to certify GMDSS functions provided by the CESs. In the end, Inmarsat GMDSS type approval and commissioning will lead to a lower cost leadership adding significantly to the Inmarsat competitive advantage.

***Advantages to Inmarsat:*** (a) Strength of the international recognition to be a GMDSS guarantor in satellite communications; (b) Significant acceleration of SES population growth; (c) Enlarged user base at the cost of GMDSS-driven users, hopefully close to the saturation point; (d) Enhanced ability to control Inmarsat GMDSS SES prototype development,

production and system operations.

***Advantages to SES manufacturers:*** (a) Savings on national type approval process; (b) Reductions in production and development costs.

***Advantage to ship owners:*** universal standards produce lower retail prices and whole prices, universal standards on installation and operations also reduces installation, maintenance and operations costs.

***Advantages to GMDSS contracting governments:*** In addition to all above listed advantages they will enjoy better global control over GMDSS functions, operations, management, practice and use of the GMDSS regulations. This will greatly assist in their examination and review of the international regulations.

***Evolution plan.*** In developing the evolution plan the following complimentary directives should be accepted:
(a) to continue using the Inmarsat Priority system on the present national basis to meet at least minimum GMDSS requirements by CES and GMDSS contracting governments;
(b) to establish and sponsor inmarsat Safety and Rescue communications network InmarSAR, whereby a priority system and other GMDSS system features are used by a group of selected services providers on a standard international basis.

The following evolution plan of GMDSS services and operations represents an example of the proposed development in one dimension, which cannot be taken in isolation of others, such as, evolution in design and configuration of the system, organisational change, etc., which are not presented but taken into account.

**1st stage.** Ship-to-RCC Distress Alerting Networks (DISALNET).
*GMDSS function 1*: ten seconds set-up, ensured 99.5% availability of instantaneous message delivery.
*Ship terminals*: Inmarsat-A, Inmarsat-B, Inmarsat-C, Inmarsat-E.

**2nd stage.** Inmarsat/RCC DISALNET = 1st stage + RCC-to-Ship(s) distress alerting broadcast. *GMDSS functions 1, 2.*

**3d stage**. InmarSAR Network = 2nd stage + RCC-to-RCC coordinations.
*RCC terminals*: Integrated Inmarsat-A,-C ship earth station for RCC.
*GMDSS functions 1, 2, 3, 4.*

**4th stage.** InmarSAR = 3d stage + continuous MSI circulation.
*GMDSS functions 1, 2, 3, 4, 7:* Twenty seconds of 99.95% instantaneous message delivery.
*Ship terminal:* Inmarsat-A,-B,-C ship earth station + Distress and safety unit with all GMDSS communications functions of the network. The stand alone unit will be compatible with any commercial mobile Inmarsat terminal and conventional radio.

Near the final stage, centrally controlled and operated system will admit registered users with dedicated GMDSS receiving capability. The registered participants will enjoy all GMDSS communications functions free of charge. This will include two-way distress communications; one-way distress alerting; automatic positions polling for safety purposes; one-way (to ships) instant broadcasts of navigational and meteorological warnings and scheduled regular broadcasts warnings and forecasts, and electronic charts correction data; one-way (from ships) transmissions of navigational and meteorological danger reports, requests for medical advice, medical assistance and maritime assistance requests and responses; one-way (from ships) transmissions of weather, pollution, locust and position reports.

The nerves and the hart of the system will be a computer-based database of registered users, distress-priority quality control system, billing and fund management system, 24-hours safety, advertising and music broadcasting systems, operational information distribution system and data links with a central communications centre and regional RCC databases.

The shipborne InmarSAR terminal will be a stand alone 'black box' connected to the Inmarsat terminals, conventional radio and navigational aids available on board. This unit will be capable of transmitting a distress alert in telex, voice, data and facsimile modes, to record and store accurately all data of distress communications in the 'black box' for possible investigations. The unit will be automatically programmed for distress message routing, communications and continuous reception of the broadcasts of preventive (safety) and InmarSAR information, news, music and advertisements in a selected language. Aural and visual alarm system and remote distress activation will be available.

Rescue terminal will be a transportable version of the InmarSAR unit, supporting all GMDSS functions of the network. In addition it will have data links to the communications and distribution centre, local computer-based database and regional InmarSAR communications centres.

The InmarSAR will provide GMDSS services directly to the end users, strengthening a very important element of the strategy - business-user liaison.

The position of the Inmarsat in the global industry will change as follows:
SES production - global, regional and national; services - global, international and national; end user access to services - global, international, deregulated, the threat of potential entrants and substitutes is reduced.