

INSURANCE IMPLICATIONS ABOUT COMMERCIAL AND INDUSTRIAL ACTIVITIES IN OUTER SPACE

by
dr. Gabriella Catalano Sgrosso*
University of Rome, Italy

Abstract

The present report wishes to emphasise the problems specific to insurance commitment in the space sector.

After analysing the evolution of the insurance market through the various crisis we reach the present Nineties, a period of maturity in the space sector where the insurance companies seem to be satisfied of the reached economic results.

We then proceed to examine the main questions that the insurers have had to face from the beginning of their intervention in outer space and which have determined the specific characteristics of space insurance coverage. In particular the accent is placed on three main themes: the determination of insurance premiums, the relationship of co-operation to be established between space industries and insurance companies, the importance of the insurance guarantee as an essential requirement for companies to obtain indispensable financial resources to formulate and realise projects relevant to mostly commercial space activities.

We feel bound to make a more technical kind of report on the subjects involved in "great space risks" and on the instruments by which the insurers cover them. We examine the clauses introduced in the insurance contracts including those limiting liability and the cross waiver clauses taken into consideration by American legislation.

We then observe the various kinds of policies offered by the insurance market in the three phases: pre-launch, launch and life in orbit. Our attention is then drawn to the problem of liability, with a more accurate analysis of the insurance against liability for damages to third parties and a comparison of the European and American solution.

After a brief study of some special policies, of the payment procedure and of the system for solving the controversies, we have tried to find an exact place for risks connected to activities in outer space in the framework of the European Community law.

In particular we examine the insurance system reserved by the directives of 1988 and 1992 to great risks, and how they have remarkably contributed to the realisation of an internal market for space insurance.

Evolution of the insurance market to its present phase of maturity

The first commercial satellite, TELSTAR I owned by American Telegraph and Telephone, marked the beginning of those activities carried out in outer space for not purely scientific but commercial reasons. Commercialisation also involves competition among the persons committed to the production and the placing in orbit of the space objects for the maximum possible profit. Obviously, this cannot leave out of consideration those principles which having become fundamental in the framework of a healthy company management, required the space industries to protect themselves from the risk of possible accidents. The opportunity arose for insurance companies to take part in this particular branch of industrial activity¹.

The insurance markets try to guarantee their clients from the happening of those casual events which can create losses and from the consequent obligation of reparation for the persons acknowledged as liable. The study of such events is generally approached through the calculation of probabilities, but this was not possible in the branch of space activities, especially in the early years when such new enterprises were taken up. Such a situation was worsened by the fact that damaging events which were beginning to occur in the area of space activities were not only closely connected among themselves but were particularly capable of conditioning the insurance company's cash flow, due to the enormous entity of the losses. This may explain why in the beginning the companies present on the market and interested in the new emerging branch of activities, companies who were already involved in the coverage of risks in the air industry, were reluctant for fear of not being able to honour their commitments.

The insurance companies were not sufficiently prepared to approach the problems that space activities involved; they lacked an adequate technical knowledge of the production processes used by the space industries and of the functional features of their products. This prevented the insurance companies from properly estimating the risks of possible accidents deriving from production faults or mistakes during launching

Copyright © 1993 by G. Catalano Sgrosso. Published by the American Institute of Aeronautics and Astronautics, Inc. with permission. Released to AIAA to publish in all forms.

*Researcher of International Law Faculty of Economics, University of Rome, Italy; Member IISL.

procedures. Therefore it was impossible to determine adequate insurance fees which could guarantee the companies the necessary financial equilibrium². In the beginning the insurance rates settled around 15% of the insured values and different franchises were set up for the insured parties. When the number of space projects to be carried out grew and with it the request for insurance cover, so much that the insurance premiums dropped to a level of 5%, the insurance market was overwhelmed by a series of accidents without precedents. Between the late Seventies and the early Eighties the amount of settled or soon to be settled damages was over 850 million \$ compared to 535 million \$ as a total of the premiums collected, which, reduced by the premiums returned to the clients in the event of a successful space operation, dropped to 445 million \$³. This dangerous financial difference was followed by an equally unbalanced reaction on the part of the insurance companies who raised the premiums to values equal to 20% or even 30%.

The high level of the premiums drove the companies to alternative solutions to the instruments offered by the insurance market, either through auto-insurance or through the creation of company pools. These pools by merging considerable resources, would allow them to face the consequences of a *damaging* event with the following reduction of the request for insurance services. It then became clear that to raise the rates was not enough; rather, it was necessary to push space operators to limit the number of accidents by increasing controls and it was also necessary to acquire technical competence for a correct calculation of the rates. Other requirements to be answered to re balance the market were the certainty of law and the transparency in the relationships existing among all the parties operating in the space field.

After a rather unsettled phase it seemed that a certain equilibrium had been reached both from the point of view of the economic results and from the one regarding technological efficiency, nevertheless the market suffered a new serious shock. On January 28 1986, the American space shuttle Challenger exploded in flight only 73 seconds after take-off and the seven crew members died. The cause of the accident was the subsidence of the gasket of a joint placed between two segments of the solid propellant reactor⁴.

The already serious situation which brought to a halt in the long series of shuttles launches was further worsened by the disaster which occurred shortly after to the European launcher ARIANE. Man's activity in outer space experienced a bar's rest and the insurance capacity was reduced considerably by a new and unexpected premium increase.

The insurance companies attributed the responsibility of the serious market crisis to a scarce technological

efficiency and to a control system not suitable for the necessity of minimising faults, disorders and damages.

Nevertheless, strong criticism was also addressed by the insurance world to the structure of the policies it was forced to formulate to induce its clients. In particular, the coverage offered was considered to be of excessive reach and therefore that it would exclude all implication of the person liable for the *damaging* event⁵. The solution envisaged was to allow the insurance company to make good of its losses at the expense of the manufacturer who had undertaken his commitment in a *negligent* way or of the launching company who had not supplied an adequate service. The use of clauses preventing the insurer from the right of subrogation was to be limited in the contracts stipulated by the two above mentioned parties and the owner of the satellite. This would have offered the insurance market the possibility of suing the persons liable for the accident without having to undertake all the consequences personally and so to allow a reduction of the rates at the expense of the *insured parties*.

The first symptom of a positive change, together with the resumption of space activities was the reaching of stable insurance premiums around 20% with a consequent total volume of collected premiums not much below the amount of the paid losses. Insurance companies became aware of the fact that competition along wrong lines was not productive and they realised that close co-operation on a world level would allow them to satisfy the needs of the space industries, seeing the enormous values at stake. It was therefore necessary to create insurance syndicates capable of offering their clients better services. An example of this new co-operative spirit was the creation of the Australian Space Insurance Group.

It was also deemed necessary to form closer relationships between insurance companies and companies operating in the space field to increase the technical competence of the insurance world and to obtain insurance covers in accordance with the real needs of the industries through a limitation in costs. The insurance capacity trend resumed its growth and the companies acquired a full awareness of their unreplaceable role: the worry over a future competition with forms of mutual insurance, once prospected by space industries, faded away and demonstrated the need to eliminate those clauses in the insurance contracts which foresaw a "bonus" to the advantage of the insured party.

We can finally assert that in the Nineties the space field reached its full development. The insurance companies have reached some economical results, that is to say a satisfying ratio of premiums/damages. This allows us to expect the future possibility of avoiding to have to turn to the profits of other insurance branches to compensate the losses in the space field, what insurance

companies call "self-financing"⁶. The global volume of the collected premiums in 1992 was over 400 million \$, whereas the amount of paid losses was under 300 million \$. Statistics show that the most dangerous phase in a space operation still remains the launch phase, and, within the latter, the principal causes of an accident are connected to technical problems in the vector, in the launched satellite or in the upper stage engines.

The insurance capacity trend settled around 350-380 million \$, 65% of which coming from the European market, 30% from the American one and the remaining 5% divided among other countries where insurance companies are engaged in the space branch. It is important for the insurance companies to follow the development of the industrial and commercial activity to establish their future investments.

The present general economic crisis induces many governments to reduce funds for research and space development and drives private companies to cuts on investments, with a consequent decrease in the offer of innovative products. The reduction of economic resources could affect the realisation of important scientific experiments, often already begun, especially in the case of failures due to accidental causes. To avoid the damaging effects of this trend it is necessary to rationalise expenses and, at the same time, the space insurance industry, besides covering commercial activities, must make the effort of widening its coverage and offering solid guarantees of security to scientific programs.

Another strategic factor in the satellite market is the cost of launches. A wider availability on the market of systems and launch vehicles can have positive effects on the development of this sector. Russia is more than ever willing to provide western space companies with its vectors PROTON and ZENIT, China offers a cheaper alternative compared to American and European launching agencies with its "Long March" rockets. Finally a possibility is being studied to use Russian and American ballistic missiles for commercial launches.

The dimensions of the launch vehicles designed and created up to now allowed the transportation of big satellites such as the present INTELSAT, however, the direction in which the space industry should evolve is that of smaller sized satellites (approximately 500 KGs) for which minor sized launch vehicles are used. The most important programs are IRIDIUM which establishes the placing of a high number of small satellites in early orbit and PEGASUS which is based on a launch vehicle not taking off from earth but breaking loose from an aircraft carrying it to a high altitude. Finally a class of small launchers has developed, which can only carry out sub orbital launches, such as SKYLARK, TEXUS and MASER⁷. The realisation of smaller sized satellites and launch vehicles will allow those countries and their private organisations having limited finances at their

disposal to undertake space activities, such as Italy and the San Marco project, devised in the Sixties, which is in the forefront in the field of small launch vehicles. All these enterprises will hold a strong influence over the insurance markets, both for the consequent development of space activities and for the presence of new operators and the opportunities they will offer⁸.

The insurance companies have created their own organisation, the "Space Risk Study Group", whose members meet twice a year to examine innovative aspects in the market. The Assicurazioni Generali⁹ organised since 1981 an international biennial convention with the participation of all the major representatives in the space field. Only a deep technical knowledge allows original solutions, adaptable to each situation, in a field where standardisation of insurance instruments is not permitted.

Characteristics of space insurance covers

The insurance branch dealing with space risks presents a strong lack of balance, in fact it holds a limited number of accidents whose consequences are, however, remarkable due to the amount of the insured values. The results must be measured over a long time range to avoid enthusiasms or disappointments dictated by periodical events. The rates are higher compared to insurance covers: an element which makes the market appetising for the insurance companies who must, in any case, offer particular guarantees to the operators to face space risks.

The insurance companies cannot do much about limiting the percentage of accidents, this is a task for the manufacturers of space apparatus and for launching agencies. It is extremely important that the insurance companies work professionally due to the field's extreme technicality and to the difficulties connected to the evaluation of risks, to the determination of losses and to the calculation of premiums¹⁰. Nowadays a restricted but extremely specialised number of insurance companies follows space events and the evolution of risks while technology reaches new results¹¹.

The insurance premium constitutes a cost problem of primary importance for space operators, due to the fact that an insured program involves greater expenses. In the past the major world operators had searched for an alternative to the insurance market by creating mutual insurances. In these, each member was obliged to pay a share lower than the insurance rate it would otherwise have had to pay, and, in the event of an accident, could collect the whole sum put by¹². When, due to the occurring of new accidents, it became necessary to collect other resources to cover the losses with an enormous financial exposure, it also became clear that an extremely specialised intervention to face space risks could only be offered by a solid experience in the space field.

A better solution had been found by ARIANESPACE, who tried to offer its clients a guarantee represented by a reimbursement in the case of a failure of the launch or by the execution of a completely free second attempt, but lately the company decided to avail itself of insurance covers to better face the consequences of accidents.

One of the major worries of the buyers of space insurance services is that of counting on stable rates which make the insurance cover desirable and which allow the cost of a policy to be calculated beforehand for the purpose of filing a final budget for the project. To determine the level of the premiums the companies must examine a series of factors with particular technical characteristics¹³.

The trend in the demand is strictly connected to the amount of the rates. When, for example, an insurance rate is over the level of 25-30%, it is not convenient to insure a satellite, because to keep a second one in reserve is less expensive. If the level of the rates is between 10 and 25% the evaluation of the convenience varies from client to client. Finally if the rate is lower than 10% the insurance cover will present undoubtable advantages even for the parties less willing to face this expense¹⁴. It is therefore necessary for insurance companies to develop company strategies to limit the increase of the rates without penalising the financial balance.

A correct determination of the rates requires an adequate technical preparation on the part of the insurance companies. The latter are more and more willing to co-operate with the companies to gain useful information and to update their personnel on the technological evolution of the space industry. The insurance company may moreover counsel the insured party from the moment the latter draws up the acquisition contract for the apparatus, and will then ask for the policy for a correct evaluation of the risks and of the relevant insurance rates.

It should be expected that following the directions of the laws of the market, the more technically trustworthy projects may benefit of a lower priced insurance cover. While a certain attention is drawn to the quality of the satellites, no difference in the premiums is laid down for the quality of the launch vehicles. In this sense a request arrives from ARIANESPACE who has launched in the last ten years 60% of the insured satellites with an extremely positive balance between premiums paid and suffered losses¹⁵. The insurance companies, though, tend towards a certain levelling of prices to avoid unpleasant fluctuations which would effect the insurance capacity trend.

Space activities are characterised by risks whose consequences it is difficult to forecast not only on a technical level, but also on an economic one due to the extreme variability in the factors coming into the determination of an eventual accident and due to the

multiplicity of effects on all the parties involved in the realisation of a space project. Space operators, including insurance companies, must therefore create **flexible contractual plans** to be kept constantly updated regarding the fast evolution of risks¹⁶. The first flexible contractual element to be established is the date of execution of the contractual commitments. For security and reliability reasons the launching company may be obliged to postpone without the client being able to ask for the payment of any damages¹⁷. The client may also request to postpone and the penalty to be paid will be increased the more the request for delay is closer to the established date.

The second flexible contractual element is the price. While in launching contracts the price is established at a flat rate, in the contracts between the manufacturer and the buyer of a satellite and between the manufacturer and his subcontractors this is not possible due to the heavy financial exposure and consequent risk that manufacturers cannot in any way suffer. It is therefore up to the client to undertake such burdens, through contractual clauses foreseeing future price increase as the amount of the received services grows¹⁸.

A last instrument of flexibility in the launching contracts is the clause giving the client the right to cancel the contract unilaterally¹⁹. To avoid that the practice of such a right may carry excessive economical weight for the client, if the launching agency manages to substitute it for a new client, it will not be obliged to pay any penalty²⁰.

In the past the satellite market was dominated by military needs. When technological development opened the way to commercial applications, it was the industries of countries already using outer space for war purposes who controlled the market and influenced international competition. The considerable political changes in the last years and the détente in the relationship between western countries and countries belonging to the ex-Soviet block, have determined an inevitable reduction in the military expenses and a consequent re-balancing of competition in favour of those industries not formerly engaged in national defence programs.

The range of **commercial space activities**, that is to say those aiming at the use of outer space and not at its exploration, is the one that is mostly expanding²¹. Insurance companies, who are especially interested by such activities, must face the need to study innovative and evermore adequate instruments for the expectations of the space industry.

Other than the traditional field of telecommunication, where at present high-definition television and cordless telephone systems hold a major industrial and economic role, there are many new sectors in which the insurance industry may carry out a stimulating or supportive role such as meteorology, remote sensing and observation of the Earth from outer space for the monitoring of the

environmental conditions of our planet and the relevant evolution.

In the enormous structures launched and assembled in outer space it is possible to conduct very important experiments in conditions of micro gravity. All this involves new possibilities of intervention for insurance companies, both to guarantee the success of the experiments and to protect the life and safety of all those who will be working in outer space for long periods²². To face this new commitment the interested parties, therefore the insurance companies too, gave life in 1986 to INTOSPACE to widen the knowledge on micro gravitational programs and to spread them to those countries who can participate in their realisation.

Another new sector which may need insurance cover is that of **video events**, that is to say big political, mundane or sports events transmitted via satellite and picked up by radio-television stations who may be insured against the risk of an unsuccessful reception. This eventuality is included in the so-called **contingency contracts**, that is to say insurance agreements not covering physical persons or properties but economic losses deriving from future possible events²³.

A new kind of intervention on the part of the insurance companies emerges in the field of the so-called **political risks**. In fact, space activities are frequently based on operative programs which are to be approved by the government authorities of each country. For many reasons the political power may cancel or noticeably reduce whole programs already close to their realisation phase. Even in this case the insurance market could intervene by offering policies that may also take this kind of risk into consideration.

These present and future activities call for both public funds and private investments. The latter need an insurance for the protection of the properties and services that they will allow to be produced (damage insurance) and to protect the property of the suppliers (civil liability insurance)²⁴.

Space risk and involved parties

The insurance companies considered the problem of the management of risks connected with space activities when the combination of economic and technological development caused not only a worsening of the known risks but also the generation of new ones²⁵.

Space industry is unable to realise serial productions and so to exploit possible scale economy. This, added to the high value of the apparatus to be realised, exposes it to a heavy risk of losses, in the event of failures, or delays in the realisation of the programs²⁶. Moreover the companies engaged in the construction of satellites often commission systems to specialised industries and this reduces their control over the final product they commercialise.

An important aspect characterising risk in space activities is that of being, in most cases, a total and not a partial risk. For these reasons space risks are to be classified as **great risks**, and their evaluation requires various parameters to be considered such as the probability of an accident, the amount of the damages and compensation, the frequency of the accidents in time.

Insurance companies usually divide "great risks" into three groups: a) risks of a catastrophic origin, such as those connected to natural events; b) risks of political nature, those connected to wars, revolutions etc.; c) risks of economic nature linked to technological development. Space risks are included in the category of great risks of economic and industrial nature. These, compared to the other two risk categories, have a remarkable advantage in the matter of insurance cover: they may be circumscribed and evaluated from a technical point of view, and are therefore insurable.

The great risk reaches remarkable dimensions mostly in financial terms, whence the necessity of transferring the risk to an insurance company who may offer omnicomprehensive protection for the insured party. Obviously this kind of cover is extremely expensive for those who benefit from it and for those who supply it. This is the reason why insurance companies must resort to necessary instruments for the transferring of the risks, such as **co-insurance** or **reinsurance**. These allow the risk to be divided among the involved parties, limiting the serious economical consequences deriving from accidents. In the first case, the insured party stipulates more insurances with various companies against the same risk, for the same interest and the same amount of time, predetermining the share of coverage guaranteed by each insurance company. Co-insurance is the typical instrument the insurance market turns to when new or too heavy risks emerge for which a distribution among various operators is preferable²⁷. The policy may be one or there may be more, but the insurance company is obliged to pay the damages only in proportion with the share it has subscribed.

In reinsurance, the mechanism of risk distribution is different and the insured party is not aware of it. The reinsured party, after the payment of a premium, may insure the risk with another company (reinsurer), or part of the risk (reinsurance for percentage shares) assumed against the insured. This way, in the event of an accident, the insured party will pay its client the agreed damages, but will be entitled to a refund from the insurer within the limits of the reinsured sum²⁸.

Reinsurance has many advantages for the involved parties: a) the reinsured may equally divide the assumed risks, strengthen its activities, offering a wider number of covers, and limit the economic risk by transferring it this way to the reinsurer; b) the reinsurer, by taking over risks coming from different insurance companies may reach an ideal breakdown of the risks and provide a

remarkable economic and technical support to the insurance market; c) the insured, by not taking part in the reinsurance relationship, may profit from the stronger reliability reached by its insurance company to avoid in future having to turn to more insurance companies.

There are numerous **parties involved** in space activities and a first gross division may be carried out with reference to the product to be realised and later with reference to the insurance relationship.

Often the **owner** of the satellite and the **manager** of the latter are the same even if this is not the general rule. Up to recently the owners were mostly state organisations, then, with deregulation in telecommunication, many private companies became engaged in this activity for purely commercial reasons. The manager must be able to intervene upon the satellite through its own control centre. He commercialises the satellite's services through branches spread all over the world.

The owner orders the construction of the satellite from the **manufacturer** who is never alone. There are always a head-purchaser and subcontracting parties, represented by many companies, generally of different nationality. The category of the satellite **users** is most varied and it depends on the purpose to be realised (from television, to communication, to remote sensing etc.). There are then a series of services attached among which the most important is the **launching agency**.

In an insurance relationship we find the **client**, private, state or international party, represented by all the manufacturers, the owner, the manager and users possible, and the **insurance company**, which, by co-operating with highly specialised advisors wishes to reach the same purpose as the client: the proper functioning of the satellite or the realisation of the service²⁹. In the relationship between the two it is necessary to turn to **specialised mediators (brokers)** who can find sufficient insurance capacity on the world market to absorb and distribute the risks connected to space projects³⁰. The broker, by examining the client's space program, the obligations the latter has undertaken with the stipulation of the contracts on the acquisition and launching of the satellite and the financial feasibility of the operation, proposes an insurance scheme and contacts the insurance companies by organising meetings to illustrate the cover program he has arranged.

We have already noticed that co-operation between the insurance company and its client allows to limit losses, but it may also minimise them³¹. It has been thought, for example, to program a higher number of multiple launches. The client, by asking the launching company to place more satellites into orbit at the same time allows the company he is insured by to break down the risk into more similar events and to receive an amount of premiums not diluted anymore within a wider

number of single policies. At times, rather than acquiring a policy for the launch of a satellite it is preferable, right from the early stages of the realisation of the space project, to arrange a second satellite as a substitute of the first in case of an accident. This way the excessive recourse to insurance commitments is limited and above all the market works better in the framework of the existing insurance capacities³². Finally, in the event of space accidents, the client may provide help and technological assistance to the insurance company to allow the latter to face the accident without excessive expenditures. Think, in fact, of the precious technical co-operation that the insured may supply the insurer with whenever the possibility of recovering damaged apparatus from outer space arises.

The launch phase is with no doubt the most dangerous of all space activities and the major cause of accidents happening in this occasion is to be attributed to faults found in the launch vehicles or in the relevant operations. It is therefore extremely important to hold detailed information on the technical characteristics of the launch vehicle and of its previous flight experience³³. The better the control guarantees the client offers, the better insurance conditions he will be able to obtain, conditions in accordance with his needs but also advantageous as regarding the quality and economy of the acquired service. On the other hand, despite the highly praised progress in technological reliability, the percentage of accidents that have occurred to commercial satellites after the separation from the launch vehicles, in the so-called **AKM** and **Early Orbit** phases has increased in time³⁴. The values changed from 6,5% in 1980 to 7,5% in the early Nineties. Moreover, because insured and insurers are, among the parties we have mentioned, the ones who are mostly penalised by the accidents often connected to a **human error**³⁵, it is necessary that they co-operate through a joint effort, to carry out stricter quality controls and to create conditions that will allow the insurance market to operate more efficiently³⁶.

To realise and launch commercial satellites, banks and financial institutions capable of offering their own capital or credit are often turned to³⁷. These financial operators, before approving intervention plans in favour of space activities, request the managers of the latter to stipulate an adequate insurance policy to guarantee the recovery of their capital and an adequate remuneration for the kind of investment³⁸.

The remarkable number and possibility of accidents weighing on space activities involves the need to limit the enormous amount of claims that could be filed in the event of a failure by the participants in the launches. To this purpose, it is usual to establish a scheme of **mutual waiver of claims**. This practice emerges from the first agreements stipulated by NASA regarding the supply of

launch services with the Space Shuttle³⁹. The principle of **risk division** was introduced, according to which each participant must bear the consequences of potential losses including the damages to property or personnel; clauses of this kind were also introduced by NASA in the launch contracts they signed with their own clients. This clearly demonstrates the necessity for each party involved in space activities to be insured. Today the scheme of contract waiver has evolved and is nowadays generally present both in the launch contracts drawn up by the U.S.A. and in the ones stipulated by ARIANESPACE and by the Chinese launch industry "The Great Wall"⁴⁰.

The **Commercial Space Launch Act**, adopted by the United States Congress in 1984 is a law that takes into consideration the waiver of claims and the consequent limit of the liability, with the purpose of favouring national interest. This law, as modified in 1986⁴¹, establishes that the essential requirement to issue a situation of mutual waiver of claims consists in the fact that each company, having obtained the concession for the supply of the launch services, its clients, the government and the relevant contractors and subcontractors must accept to assume liability for the risks of each loss, material or physical damage or death consequent to the realisation of a space program.

As the "Senate Commission for Commerce, Science and Transport" has said in its report presented to the Congress in 1988, the Minister of Transport may not waive the claims belonging to government employees⁴². The latter may benefit from third-party liability insurance, imposed by art. 16 of the Commercial Space Launch Act Amendments. Moreover, the Government is not obliged to waive the claims if the failure of the launch has generated damage to its properties⁴³.

The question of the contract clauses for the allocation of space risks has been taken into consideration more than once by American jurisprudence⁴⁴.

The division of the risks among various parties is carried out through **contractual mechanisms** or **cross waiver or limiting clauses**, present in the contracts⁴⁵. Because the major consequences of a failure weigh heavily on the buyer, the need has arisen to elaborate a series of instruments, present in the contractual schemes of the satellite, for his protection⁴⁶. The buyer may carry out **controls** and **request information** to verify the project; he may also carry out **controls on payments** through which the client makes the payments as the purposes are reached. Another instrument protecting the buyer of space systems is the **interest scheme**, according to which a part of the established price will be paid to the manufacturer only if the launched apparatus works properly. The last instrument is the possibility of waiver of the contract, usually for a sound reason, but also without a specific or serious one⁴⁷.

The satellite sales contract differs from the sales contract as defined in the "Vienna Conference on International Goods Sale" of 1980. In fact, the satellite manufacturer does not guarantee his client from the absence of hidden faults nor the proper functioning of the satellite. If the client requests this kind of guarantee, he must pay an additional price. This "service-price" rapport is the basis of the contractual mechanism of **incentive payments** and establishes a number of incentives or penalties for the manufacturer to lead him to a correct execution of the contractual commitments. Incentive payments, by preventing the manufacturer from paying performance premiums in the event of failure or technical problems, avoid any other kind of reparation. Therefore they limit the manufacturer's liability in the case of malfunctions and prohibit the waiver of the sales contract. Incentive payments establish the eventual reparation on the part of the manufacturer and for this reason they may not be classified as limiting clauses of liability but as penalty clauses.

Law has laid down the difference between these two contractual mechanisms. While the **penalty clause** establishes the total liability of the defaulting party quite apart from the damage caused, the **liability limiting clause** defines the maximum limit for reparation not to be surpassed even in the eventuality of the damage having greater consequences⁴⁸.

The liability limiting clauses, such as the "negligence clause" were present in maritime transportation, but the 1929 Warsaw Convention, on air transportation prohibits the clauses excluding the carrier's liability. Because a specific rule is lacking in space transportation one may consider as valid those clauses which, in this kind of transportation, refer to material damage, but are not applicable in the event of a major fault of the carrier.

These clauses are, on the contrary, widely used in satellite launching contracts⁴⁹. They establish that each party, the satellite owner or the launching agency, must waive to declare the failure of the opponent as a valid reason for issuing an action of contractual liability. The contractors, in fact, by renouncing every possible appeal, undertake to sustain the damages caused to their properties and all the relevant consequences and are especially committed to guarantee the opponent against any claim requested by its co-operators or by third-parties. Excluding appeals, the parties feel the need to safeguard themselves by drawing up insurance policies.

All the United States legislations establish that the liability limiting clause be applied not only in the case of economic losses or of damages to property, but also when the fault of the manufacturer or of the launching agency is called upon, only if this possibility is foreseen in the contract. It is important that the cross waiver clause expressly mentions the word "negligence" otherwise the court will have to deny its application. But, as the procedures for applying the clauses differ in the various

jurisdictions of the United States, the applicable law must be specified in the contract. The Court of the State of Maryland and the Court of the State of California came to two different solutions for the two similar cases of satellite INTELSAT VI and satellite PALAPA B-2⁵⁰. All jurisdictions deny the applicability of clauses to reduce or eliminate liability of the guilty party in the event of a **wilful misconduct**, that is to say the non observance of the most elementary caution rules and of those techniques relevant to a specified profession⁵¹.

There is a quite recent appearance on the space market of a new kind of contract for the supply of satellite: the contract of **delivery in orbit**⁵². The client settles a contract with a satellite manufacturer, the latter, at the head of a syndicate, is able to offer a range of services from the planning of the apparatus to its placing in outer space.

The contract foresees not an only satellite, but a group of three satellites: the first must be placed in orbit by a certain date from the laying down of the contract, the second is to be launched after a certain interval from the first and the third is to be used as a substitute in case of a malfunctioning of one of the first two. It is also up to the manufacturer and not to the client to take care of the launch of the satellites undertaking the relevant risks⁵³. Finally the manufacturer must supply its client with the equipment and control systems to allow, after the launching, the orientation of the satellite, to keep it in the orbit indicated by the client or to correct it in the event of any inconvenience.

Through this kind of contract a global service is supplied covering all the phases of realisation of a space program relevant to the acquisition of a satellite system. The market segment to whom this "ready to use" contract is addressed is made up of clients who, although they operate in the space field, lack a wide scientific or technical preparation. This is the case of developing countries who wish to have independent satellite telecommunication systems⁵⁴ or of small companies who use the services supplied by satellite networks.

As for the management of risks, the contract allows to transfer the risk from the client to the manufacturer. The latter must also face the risks of the client's delayed payment and insolvency and the risk of possible modifications in the program. In the light of these considerations, it appears necessary for the manufacturer to turn to an appropriate insurance cover even in the launch phase. In the event of the satellite showing irreparable anomalies, it is declared totally lost and becomes property of the insurance company covering the relevant losses.

This kind of contract will favour the development of commercial and industrial activities in outer space, because on one hand it will allow a reduction of risks and costs for those realising the project and on the other hand

it will allow the companies to gain a wide amount of the purchases against the competition⁵⁵. The companies undertaking the cover of risks must be capable of developing a good absorption capacity.

Main types of policy

There are three forms of insurance mostly negotiated in the space field: insurance of the pre-launch phase, insurance of the launch phase, insurance of the satellite's life in orbit

An insurance policy relevant to the **pre-launch phase** provides the coverage of all the risks which could happen from the beginning of the realisation of the space program right to the carrying out of the launch. It particularly refers to possible accidents which may happen during the production of the satellite and of its systems and sub-systems, during the phase of storage- which is rather long-lasting because of the problems which can affect the predisposition of the launch-, during the phase of transportation of the satellite from the place of production to the launch site and finally during the placing of the satellite on the launching vehicle⁵⁶.

The transportation may occur in different ways: transportation of the already assembled satellite or of its separately packed components; air, sea or road transportation. Because only the launch confers the space object its specific quality, the pre-launch phase risks are often covered by the transportation insurance market rather than by the space one, also because the premiums are lower. This is often to the disadvantage of the client and the insurance companies in the space branch would rather cover the whole risk, in fact, it is not always possible to define the moment in which the transport phase ends and the space one begins. Generally the first phase ends and the next one begins with the opening of the clamps that hold the launching vehicle to the launch ramp and with the ignition of the first stage of the vehicle.

In a satellite's pre-launch phase the buyer may also be insured against the risk of a delay in the delivery on the part of the manufacturer, but these are normal risks that insurance companies are used to covering even in other fields.

The **launch phase** is without doubt the most delicate in the whole space program; the gravity of the risks determines a higher premium level compared to the two other mentioned coverage forms: the phase lasts from three to six months. The relevant policy considers a variety of different risks: faults in the launching vehicle, trouble during the separation of the satellite from the various stages of the vehicle, the risk of the satellite not reaching its established orbit and finally the problems which may occur during the preparation for the operative life and the control of the satellite's efficiency⁵⁷. The launch policy may be divided into two completely

separate parts: one concerning the risks prior to the separation of the satellite from the launching vehicle, the second one concerning the risks subsequent to the separation.

During the launch and the post-launch phase different kinds of accidents may be identified, and considering that unfortunately in this phase major accidents have happened (in 1984, 1985 and 1988), the global balance from the beginning shows a deficit of more than one hundred million \$.⁵⁸

The phase of **life in orbit** requires a specific coverage which represents a real insurance on the satellite's life. It begins at the end of the phase for verifying the satellite's operative capacities and the length of its lasting may vary. In particular, as the life of a modern telecommunication satellite may last well over ten years, the policies are usually re negotiated yearly to adapt the terms to subsequent events which may occur while the satellite carries out its function. The first year is generally considered the riskiest, because during this period accidents may occur which could be relevant for the whole life of the satellite.

The insurance for the period of life in orbit doesn't only guarantee the life of the satellite, it also guarantees that the latter is able to satisfy the performance standards established by the sales contract⁵⁹. If this does not happen there is the possibility to request the insurance company for compensation for a "partial loss", the amount of which will depend on the remaining operative capacities of the satellite; if the faults are over a certain level, though, there will be a total loss of the satellite. Naturally if the launches become less hazardous, because the checks previous to the operation phase have been thorough, accidents in the orbit phase will diminish.

After the first year the probability of faults is reduced but there still remains the possibility of the satellite being damaged by environmental factors such as meteorites, solar radiation, eclipses, cosmic dust, etc. In particular, a risk that the growing pollution of the space environment and the increasing crowding of the orbits involve is that of a collision with fragments floating in space, the so-called **space debris**. From a NASA research it appears that only 6% of the objects present in the terrestrial orbit, of a diameter of at least 10 cm, is made up of operative satellites, the remaining 94% is made up of "space debris". The latter, especially if located in high orbits, pick up a very high speed and in spite of their small dimensions could cause great damage if they hit a satellite. The probability of this happening is not really very high, but it is still present. In the geostationary orbit fragments and abandoned space objects not only risk collision with the numerous telecommunication satellites, but also risk creating interference with the reception and transmission of signals from our planet⁶⁰

The 1972 Convention on the liability for damages caused by objects launched in outer space does not

consider the damages brought to the space environment. Although there exists a general principle of international law according to which a State should avoid that the activities carried out under its control cause any damage to environment, there is no international rule defining the objective liability for environment pollution⁶¹. In any case, there remains the civil liability in the municipal law and even if it is difficult, in these cases, to identify the connection between the damage and the cause that brought it about, it seems necessary that the insurance covers relevant to the period of the satellite's functioning in orbit also take into consideration this kind of risk.

Insurance on **civil liability** which may arise for different subjects, such as the launching agency, the entity using the satellite for commercial purposes and finally third parties⁶². The civil liability of the launching agency against the owner or the user of the satellite or of these against the former, may occur respectively when the launching vehicle damages one or more satellites during the execution of a multiple launch, or when the space apparatus has caused damage to the launcher or to another client. Civil liability against the subject who intends to commercialise the services offered by the satellites arises when the space apparatus can no more offer adequate services because of a fault in the functioning of the satellite, or because of a mistake in the launching procedure or in the subsequent control phase. It is obviously necessary in these cases to have an insurance coverage to guarantee the different parties involved from unpleasant consequences.

Particular attention is to be paid to the insurance for **third-party liability**. In particular, the insurance in the launch phase involves two kinds of liability which may derive from accidents occurred in such occasions. The first refers to damages to personnel or property belonging to the Government or to the launching agency, the second to the accidents occurred to third parties, that is to say to natural or artificial persons alien to the launch operations⁶³. In fact, during the phase preceding the ignition of the engines, not only explosions but also fires may occur. The insurance relevant to the phase of life in orbit also guarantees against damages deriving from collisions with other equipment placed in outer space and against the damages caused to third parties on the Earth in the event of a fall of the satellite or of its fragments.

The authorities of those countries mostly involved in launching operations require suitable guarantees of financial coverage for this kind of damage. Unfortunately, the existing insurance capacity for civil liability connected to the operations of launching and life in orbit of the satellites is still inferior to the request which is generally around 1000 million \$. This is because the insurance companies do not consider as appetising the premiums that the space operators are willing to pay

in view of the risks which, although of enormous consequences, may difficultly happen.

In **Europe**, the problem of third-party liability has been faced by the company **ARIANESPACE**, through the joint intervention of the insurance market and of European governments. In fact, the space operators who intend to have their satellites launched by the vehicle **ARIANE** have an insurance coverage of about 420 million French francs at their disposal, guaranteed by **ARIANESPACE** and by the involvement of different insurance companies. European governments have agreed, on their hand, to financially sustain the requests for damages higher than the mentioned insurance⁶⁴.

These insurance guarantees are requested because of the growing number of public and private subjects operating in the space sector for whose activities the States are internationally liable, according to the 1967 Treaty on Outer Space. With the 1972 Convention on Liability a regime of liability was created (liability being objective for the damages to third parties on the earth's surface), which falls back on the international subjects, the States and the international organisations.

In Europe the correspondence to the principles of international space law is guaranteed by the institutional tie that the launching agency **ARIANESPACE** keeps with the French government and the European Space Agency⁶⁵. In fact, **ARIANESPACE** could not carry out any activity without the consent of the other two subjects. In the **United States**, instead, private companies supplying launching services have no institutional ties with the federal Government, and it has therefore been necessary to introduce a legislative regulation expressly establishing the conditions according to which commercial enterprises may operate in that branch⁶⁶.

At present, the situation in the United States is different compared to the one in Europe. The federal Government prescribes conditions for the private companies who wish to supply launching services for commercial reasons. From those wishing to use the Space Shuttle NASA requires the purchase of a policy against third-party liability with a maximum amount of 500 million \$ and undertakes the commitment to reimburse eventual requests for the part exceeding such coverage⁶⁷. This kind of intervention is conditioned by the fact that the damage happens in a precise interval of time, called "risk period" beginning when the load to be sent into space is placed on the Shuttle and ending when the Shuttle, after having deposited it in orbit, returns on Earth⁶⁸. Furthermore, NASA requires an insurance also for the period of life in orbit, but does not supply any compensation if the damage to third parties occurs after the risk period. The eventual damage to property belonging to the American Government are covered by the NASA, while those occurred to the properties of private clients are at the expense of the latter unless there

are any particular contractual agreements made between the parties or any optional insurance policies.

While the Shuttle, during the same mission for transportation of commercial satellites, always carries out tasks for the Government, this is not always possible when non-reusable launch vehicles are employed (ELV). On the other hand, the private companies engaged in the supply of launching services have felt the increasing pressure of foreign competition stimulated by an increase in the request for non-reusable vehicles, also because of the Challenger tragedy which had interrupted the positive series of launches carried out by the shuttle.

Foreign launching agencies may in fact count on Government sustain for third-party liability; this induced the American Government in 1988 to pass an amendment on the "Commercial Launch Space Act".

The 1984 "Commercial Space Act" established an expensive situation for those companies operating in the field of commercial launches; they were to protect the equipment and the personnel that the Government supplied and also, to fully sustain the cost of the insurance for third-party liability and of the other policies relevant to the coverage of their properties. On the other hand the laws and the administrative rules established for private companies a liability exceeding any kind of insurance coverage; that is to say that these companies were exposed to an unlimited liability⁶⁹. To allow national companies to compete against foreign operators an amendment was passed in 1988 to the "Commercial Space Act".

In particular Art. 16 establishes that the subject requesting a government licence must prove he has arranged a system of insurance protection against third-party liability, but it also lays down that the amount of the insurance must be determined by the Minister for Transport, with the opinion of NASA and of the Air Force, but it may not exceed 500 million \$. The second comma of Art. 16 deals with insurance against material damage to property. It demands the company requesting a government licence to have an insurance coverage sufficient to compensate the maximum possible loss of property or equipment belonging to the United States and damaged during the operations carried out in accordance with the above mentioned authorisation. The insurance policy must indicate the Government of the United States as the added insured party, and its amount must be established by the Minister for Transport within a maximum limit of 100 million \$. It is necessary that the Government of the United States share the risks and liabilities consequent to national space activities. This is regulated by the amendment⁷⁰. In the first place the Government compensation only holds good for legally recognised damage requests, filed by third parties and only in the case of activities carried out by virtue of a federal licence. In the second place the Government covers the damages only for the difference between the

request for compensation and the amount insured by the private companies and within a maximum limit of 1,5 million \$. Therefore above this amount it is always up to the private launching company to satisfy the requests for damages. Finally, the Government is not expected to intervene for the coverage of damages when the latter are caused by intentional misconduct on the part of the subject supplying the launching services.

New contractual mechanisms are often laid down not so much as to prevent the manifestation of a risk but more so to limit the consequences and to allow the continuation of the program. Such mechanisms often involve the stipulation of **special policies**.

One of these is the **replacement in case of a failure of the launch**; according to the sales contract, the satellite manufacturer is obliged to supply the client with substitute satellites if the launched satellite presents any technical problems making it unsuitable for the use formerly defined with the buyer. The sales contracts establish a different replacement from the one laid down in Art. 46 of the 1980 "Vienna Convention on International Goods Sale"⁷¹. In fact, in our case, the replacement of the faulty satellites is not entirely free because the relevant onus integrated the sales prices established in the contract. The economic risk of the operation weighs on the client, while the launching agency only sustains the technical risks. In fact the new launch, which must in any case be paid for, will only be privileged in its temporal execution compared to the launches previously booked by other subjects. For these reasons the client must necessarily turn to an insurance coverage allowing a correct placement of the risks⁷².

Today it is possible to try and carry out a **repair operation** of the compromised equipment in outer space and to obviate the total loss of the latter. This kind of operation involves considerable risks and a high cost; it is therefore evidently necessary to turn to an adequate insurance coverage without which, in the event of a failure of the attempt at restoration, there is the risk of adding to the first loss a further considerable prejudice.

To guarantee the maximum safety for **space personnel** during missions, it is still necessary to carry out thorough technical studies and to lay down regulations, in the different internal orders of the States, following the principles of international law applicable to the subject⁷³. Such a question could not leave the insurance market indifferent: The United States National Space Institute was the first to buy an insurance for the crew of the Space Shuttle: It is established that Government organisations insure public or military personnel, while the employees of private companies can be protected thanks to the intervention of their employers who stipulate collective policies. With the advent of space stations and orbital laboratories the insurance on space personnel will register a remarkable increase. Even

though the risk is not much different from the risk of an aircraft pilot, it is not easy to immediately identify the real effects of a flight in space on the person of the astronaut.

We must not forget that the policies establish a series of **general waiver clauses** according to which the happening of a series of events is not guaranteed by insurance coverage. This is the case, for example, of damage caused by war and hostile acts in times of peace or during an armed conflict; by anti-satellite devices using nuclear fission or fusion or laser beams; by insurrection, riots, risings, rebellions, revolutions, civil wars and acts of usurpation, by confiscation by order of the Government authorities, other organisations or public officials; by nuclear reactions or radiation, radioactive contamination of any kind, except radiation naturally present in the space environment; by radio or electromagnetic interference causing economic damage and finally by intentional actions carried out by the insured party or by subjects who have stipulated contracts with the latter regarding the use of the satellite.

The operators are being convinced that the application of the **No Claim Bonus** clauses is possible in mass risks, while in space risks it involves many problems; even if a revision of the premiums in the event of a reduction of the risks would be useful. It is also being discussed if it is advantageous to introduce the so-called **Sunset Clause** in the space field, that is to say the contract formulation limiting the insured party's possibility of notifying the damage within a limited period.

Payment is usually issued shortly after the statement of the accident. This, accompanied by proper information, including the results of the committee of inquiry on the causes of the accident, must be notified as soon as possible to the insurance company and in any case not more than thirty days from the moment the insured company is informed about the accident. Among the various probative elements of the detrimental event the partial, total or presumed loss must be proven as well as the real loss whenever the insurance contract includes coverage for the loss of profits. The insured party must prove it has acted with the due care to avoid or limit the above mentioned loss⁷⁴. The amount of the sum to be reimbursed is generally predetermined but could be reduced in the event of partial damages. On the other hand every space insurance operation is peculiar, therefore no pre-established contract exists.

If the parties do not reach an agreement about the request for damages in the thirty days following the presentation of the evidence, each party may turn to an arbitral organ for the solution of the controversies. After approximately seven days the insurance companies are to

deposit the sum equivalent to the amount of the calculated damage in a bank.

The insurance contract may expressly establish the procedure for the recourse to the above mentioned arbitral organ⁷⁵. For example, it is possible to refer to what has been established in this respect by the 1972 Convention on Liability. This was, a committee made up of three members will be formed, two members named by the parties and the third one named by the first two. If one of the parties doesn't name its own member, the other may request that the appointment may be done by the court of the State or of the province in which the insured party resides. As for the role of such an organ it must be said that it should follow the rules of arbitral procedure of the International Chamber of Commerce and its decisions, inspired by the principles of justice and equity should be binding.

Compared to traditional jurisdictional organs the arbitral procedure presents remarkable advantages. In fact operators and space insurers confront each other on different if not unique questions, therefore questions it is difficult to solve on the basis of existing precedents in jurisprudence. Furthermore, the disputes are often solved by the courts by appealing to traditional legal principles and not on the basis of the regulations of space law. Moreover, judges often have no experience in the space field or no specific preparation to understand the employed technology and they are often lacking the necessary instruments to judge the subjects involved in the disputes. It is therefore best that the parties first agree on the necessity of turning to arbitral organs; the arbiters will be appropriately competent regarding insurance coverage, space technology and most of all in legislation to be applied for the solution of the specific case. Lately the procedure has developed in this direction.

The insurance contract establishes the right to **subrogation** on the part of the insurer with the consequent possibility for the latter to make good of eventual damages at the expense of the liable legal or physical persons. The insured party will co-operate to **guarantee** the practice of such a right. This rule is often hard to apply due to the difficulty of the trial and because of all the appeal waiver clauses included in the various contracts, which we have previously mentioned. Naturally, an adequate equilibrium could be found in the interpretation given by the chosen jurisdictions of the different appeal waiver clauses⁷⁶. Finally the insurance contract must expressly indicate the law applicable in the case of controversies connected to its interpretation and realisation⁷⁷.

Space insurance in the Community Law

Freedom of service, one of the basic principles of Community law, carries competition in the European

framework to a higher level and necessitates an appropriate harmonising legislation even in the framework of space insurance.

The concept of **great risk** has been widely dealt of in the second directive of the E.E.C. Council regarding the co-ordination of damage insurance, **Directive n.357 of June 22nd 1988**⁷⁸. The main purpose is to create a market within the European Community for the so-called great risks based on the principle of the home State, that is to say of the State in which the insurance company covering the risk is situated. Such a criterion establishes that whenever a company wishes to offer another member State an insurance coverage for great risks, the relevant authorisation is to be issued by the authorities of the State of origin and not by the host country, unless the activity is carried out from a branch or by an agency fixed by the State in question⁷⁹. A "single licence" is proposed because, in this case, as for the Community trend for the practice of other basic kinds of freedom, between the two kinds of approach, harmonisation or reciprocal recognition, the second one is preferable.

Among the problems faced by Directive n.357 what we are most interested in regards the creation of two different insurance systems, one for the coverage of great risks and the other for mass risks, that is to say risks of no great gravity. Art.5 letter D of the Directive divides the category of the great risks into three sub-groups according to classifying criteria not based on the gravity of the risk but on its nature and on the importance of the insured party.

The first group includes risks relevant to transportation (such as ships, aircraft's and rolling-stock), goods in transit and any kind of legal liability weighing on the carrier. The second group includes the so-called "credit" and "guarantee" risks (that is to say insurance for the insolvency of the debtor, exportation credit, mortgages, etc.), provided the insured party carries out, in a professional capacity an industrial, commercial or independent profession and the risk weighs on such activity. Finally, the third group refers to fires, other damages to property, legal liability in general (Different from the first group) and the various financial losses. The risks belonging to this last group are to be considered great risks only if the insured company exceeds at least two of the relevant parameters, that is to say a patrimonial status of 12,4 million ECU, a net amount of the global business of 24 million ECU, and 500 employees. Such parameters have been halved since January 1st 1993⁸⁰.

The risks relevant to space activities are part of the concept of great risk both for the importance of the insured party and for the nature of the risk. As for the first aspect, it is obvious that the subjects involved in space activities present remarkable dimensions, they being State or inter- State organisations, big private companies or company holdings. As for the second

aspect, it is undeniable that the nature of space risks is not unique, but extremely various. The risks connected to the transportation of the space object are with no doubt part of the first group of great risks. By analogy, the ones connected to the launch phase and to the placing in orbit can be enclosed in the group of great risks relevant to transportation due to the characteristics of the objects, such as launch vehicles, space shuttles, etc. Furthermore, considering that space objects such as satellites and space probes are equipped with independent propulsion systems, the too are considered as vehicles. Therefore, even the risks relevant to a fall back onto Earth or to a collision with other space objects or aircrafts in flight can be undoubtedly included in the group of risks regarding transportation. Instead, the risks relevant to an unsuccessful functioning in orbit of the space apparatus, to the consequent losses for the managing subjects and to the financial risks connected to delays in the execution of the launches seem to be part of the third group of great risks, that is to say the one regarding financial losses.

It is necessary to consider the two different insurance systems that Directive n.357 lays down for great risks and mass risks⁸¹. While for great risks there is the possibility of **accumulation**, that is to say the possibility for an insurer having its headquarters in a member State of insuring a risk in this State not only directly from its headquarters, but also from an area in another member State, for mass risks it must follow the authorisation system for the policies and relevant premiums of the host Country.

The two different risk types also establish different regime for the **technical reserves** of the insurance companies. Even if it would be preferable that they be harmonised for all kinds of policies, at present it is foreseen that for great risks the technical reserves be subject to the regulations of the member State in which the company has its headquarters, whereas in mass risks the reserves are regulated by the rules of the host Country.

It is important to specify that Directive n.357 does not foresee an immediate actuation of the system relevant to great risks. This will be applied progressively, but with a different timing for the various insurance branches and member States. January 1st 1999 is the date starting from which all the States will be able to apply a uniform system, after the phase of adaptation and of progressive application. Today the system for the actuation regime is faster in Belgium, Denmark, Germany, Italy, Luxembourg, the Netherlands and the United Kingdom. Spain was slower to apply the directive, quickening the pace in a later phase. Finally Greece, Ireland and Portugal are the Countries in which the actuation will follow a slower rhythm.

Undoubtedly the greater liberalisation introduced in the field of the great risks by Directive n.357 will allow insurance companies to reach a global presence on the

market offering products more adequate to the needs of the clientele with policies on a European scale⁸².

On June 18th 1992 the E.E.C. issued a new Directive on insurance. Directive 92/49⁸³ co-ordinates legislative, regulation and administrative provisions regarding direct insurance different from life insurance, and also modifies the first two Community directives on damages insurance, that is to say 73/239 and 88/357. This third prescriptive intervention of the European Community Council considers that the previous Directive n.357 contributed remarkably to the realisation of an internal market for damage insurance, but it recognises the need for the integration of the insurance markets to be completed. The purpose of Directive n.49 is therefore to allow those subjects interested in buying an insurance coverage to do so from any insurer with headquarters in one of the member States of the Community and carrying out his activity in virtue of the system of free establishment or free service. The system will allow insurance companies to look onto the other European markets in search of better operative conditions, and at the same time to enrich the new contexts in which they will be working with their past experience. The markets will become more dynamic and competition more vital; this new reality will be of advantage to the clientele, offering the possibility of comparing different operators in the insurance market and a great variety of offers and technical solutions to choose from.

Unfortunately Italian insurance companies still denounce the lack of a national law of the **equilibrium reserves**, which would allow them to adequately face the competition of the other European insurance companies; an already strong competition on other fronts which has brought to the revision of administrative and financial management to improve economic results, cost incidence and most of all the quality of the services offered.

The equilibrium reserves represent an instrument which allows to compensate in a few years the income and expenditure of the great risks insurance branch, even in such an unbalanced sector (for the ratio of loss and gain) as the space one. The institution of this instrument has been suggested not to obtain simple fiscal benefits, but to avoid that, seeing the length of space insurance contracts, the premiums cashed in wide advance be considered common profits to be attributed to the year of stipulation of the contracts and therefore not available for the coverage of eventual later losses. That is to say that the mentioned reserves must allow to set aside a part of the income not distributed to the shareholders of the insurance companies, income which would not be taxed for a certain number of years.

The Italian government showed its appreciation of this idea with the formulation of a relevant bill; nevertheless, this was not welcomed by the insurance companies because it limits the equilibrium reserves to a three year period whereas the expected period was of at

leas ten years and also because it foresees an automatic return to fiscalisation at the end of the mentioned period, instead of reconsidering everything again.

Conclusions

The present general report on space risks wishes to demonstrate the specific quality of the subject from a technological, economic, commercial and also political point of view. We have seen how the insurance industry has been trying hard to sustain, by all the instruments at its disposal and also by creating new ones, a sector which for its peculiar characteristics does not allow those operating in it to plan future engagements with a high probability of obtaining positive results and to yield from its investments. The risk to be faced is much greater than the one normally characterised by company activities.

The insurer appears as a privileged operator for international commerce and technology; he not only is the financial guarantor for a positive outcome of the space mission, but, as he is to necessarily intervene with competence from the first supply contracts, he becomes a particular partner, and, directly or indirectly, a promoter.

A last observation must be made. Precisely when the space sector seemed to have reached a certain equilibrium between the total volume of premiums and the one of damages paid to insured parties, a great new problem has occurred to insurance companies and to the operators of all the other productive and commercial branches: the crisis which has recently hit the whole of the world's economy.

The Governments of those countries mostly involved in the realisation of commercial or scientific programs connected to the use of outer space have been forced to cut expenses in the research and in the application sector and consequently the national and international agencies have had to cancel those projects still in the study phase or to limit the capacity of those ready to be realised. The economical problems could lead to a contraction in private investments with a remarkable reduction of innovative products available on the market in the near future. All this could cause a slowing-down of technological evolution with a probable decadence of the quality of the space products and a worsening of the security standards reached up to now.

To avoid such consequences and to avoid the inevitable negative repercussion on insurance conditions, it is essential to carry out a policy of rationalisation of expenses allowing to direct the investments in such a way as to avoid those projects not offering sufficient guarantees or being unsuitable for the satisfaction of the market's needs. It is therefore extremely important that the insurers support the companies during the preparation of the programs and that they give their support not only to commercial enterprises but also to scientific projects. Furthermore, it is necessary that the

insurance companies exploit the advantages that international co-operation now offers in the space field, the overture towards the western world on the part of those countries where the communist regimes have fallen will permit the comparison of experiences that the different space operators have undertaken. This will represent a further instrument for finding new solutions to the problems in this sector.

NOTES

¹ The first satellite insurance contract, written for Intelsat's "Early Bird" in 1965, provided pre launch coverage.

² GOBBO, An insurer's view of space business, Space policy, 1991, pp. 47-48; MAGNO SCIFONI, Space activities and insurance, Proc. 20th Colloquium on the Law of Outer Space, 1978, p.327.

³ Reimbursement up to one fourth of the premiums paid as foreseen by the "no claim bonus" or "profit commission" clauses.

⁴ For the case see DEMBLING WALTERS, The 1986 Challenger disaster: legal ramifications, J. Space Law, 1991, p.1.

⁵ COPPOLA di SCANZANO, general report, V International Congress, Le attività commerciali ed industriali nello spazio, Assicurazioni Generali, Roma march 2-3 1989.

⁶ PAGNANELLI, Sviluppo delle assicurazioni spaziali, general report, VII International Conference, Le attività commerciali ed industriali nello spazio, Assicurazioni Generali, Roma march 11-12, 1993

⁷ GOBBO, Reinsurance in new technology: space program, paper VIII Inter European Congress of Reinsurance, Madrid October 1-3, 1990

⁸ PAGNANELLI, Supra note 6

⁹ The Italian Insurance Company holding 90% of the space risks in Italy, first company in world capable of subscribing risks up to 55 million \$.

¹⁰ CASSIDY, Current Status and Prospects for Space Insurance, J. Space Law, 1991, p 168; PLOCHINGER, insurance of Space Risks, in ESA Bulletin, 1989, p. 87

¹¹ In Europe there are "Assicurazioni Generali" the Italian Insurance Company, engaged in the space sector from the beginning of space activity, the French "Renion Aérienne", that use an Agency, the Reunion Spatial, that operates in reinsurance, the "Alliance" of Monaco, made from an insurance pool of air companies and the "Lloyd's of London. In The United States there are many insurance companies, the most important are: the ASAU (United States Aviation Underwriters), the AAU (Associated Aviation Underwriters) and the INTEC

¹² GOBBO, Space a risky business: insurance in the space flights, paper to the Conference, Delft University of Technology, may 24-27, 1992

¹³ MIYAZAKI, Space Insurance, VI International Conference, Le Attività commerciali ed industriali nello spazio, Assicurazioni Generali, Roma September 16-17 1991.

¹⁴ *Ibidem* BRAUN, A Commercial Operator's Perspective on Satellite Insurance.

¹⁵ VIENNE-SCHMITT, ARIANESPACE, the commercial launch services and the competitive situation, paper VII International Congress, Assicurazioni Generali, le attività commerciali ed industriali nello spazio, Roma, march 2-3, 1989.

¹⁶ FINCH MOORE, Astrobusiness: A Guide to the Commerce and Law of Outer Space, New York, 1985, p. 58; STEWART Jr, US. Private Enterprises Enter the Space Arena: The Beginning, Proc. 28th Colloquium on the Law of the Outer Space, 1985, p. 149.

¹⁷ MARCUS, Spaceport Florida Ready to Buy Rockets, Space New, 1990, p. 32; HANNIGAN, The Economic Impacts on Space Operations of Future Launch Vehicles, Proc. 32th Colloquium on the Law of Outer Space, 1989.

¹⁸ MARSHALL Jr., Outer Space Commercialisation in the United States: Effects on Space Law and Domestic Law, Proc. 27th Colloquium on the Law of Outer Space, 1984, p. 90.

¹⁹ ATIYAN, La garantie conventionnelle des vices cachés dans les conditions générales de vente en matière mobilière, R.T.D. com, 1979, p.52; VISCHER, The antagonism between legal security and the search for justice in the field of contracts, Académie de droit international, 1974, p.1.

²⁰ MORIN, Le devoir de coopération dans le contracts internationaux, DPC I, 1980, p.33; FEDUCI, L'obligation de minimiser les dommages en cas d'inexécution des contracts internationaux, LGDJ, 1986, p.49

²¹ MARTIN, Droit des activités spatiales, Paris 1992, p. 123.

²² CATALANO SGROSSO, La responsabilità degli Stati per le attività svolte nello spazio extra-atmosferico, Padova 1990, pp.95-105.

²³ For this type of insurance bought by SPACEHAB society, that attends to the planning and the production of the orbital modules launched through the shuttle and supplied by about 150 insurance companies, see TUCKER, Disputes Arising out of Space Related Contracts, the Search for Intent, VI International Conference, Le attività commerciali ed industriali nello spazio, Assicurazioni Generali, Roma September 16-17, 1991.

²⁴ DAOUPHARS, L'assurance des risques spatiaux, in KAHN (direction), L'exploitation commerciale de l'espace, Bourgogne 1992, p. 279.

²⁵ *Ibidem* LOQUIN-VEIL, La gestion contractuelle des risques de l'exploitation commerciale de l'espace, p. 165

²⁶ WEBB, Estimating the life cycle cost of the Space Exploration Initiative, Space Policy, 1992, pp.49-64; KOELLE, The transcost model for launch vehicle development, production and operations cost estimation, paper IAA Symposium, 1990; SCARBOROUGH, Free trade and the commercial launch industry, Space policy, 1992, p. 109.

²⁷ JANNUZZI, L'assicurazione nel mercato unico europeo. Milano 1989, p. 119.

²⁸ POOL, Le assicurazioni 1992 ed oltre, Bruxelles 1991, p. 15; GOBBO, Reinsurance in new technology: space program, paper, VIII Inter European Congress of reinsurance, Madrid, October 1-3, 1990.

²⁹ DAOUPHARS, *Supra*, note 24, p. 259.

³⁰ BALDI, Il contratto di agenzia, Milano 1987, p.307; MARGO, Aviation Insurance, London 1980, p.195; PAUL-CROLY, EC Insurance Law, London 1991, p.119.

³¹ GREENBERG-GAELIK, Space Insurance: Comments from an observer, Space Policy, 1986, p.314.

³² REED, What the Organisational Changes Within the Hughes Aircraft Company Mean to the Insurance Industry,, VI International Conference, Le attività commerciali ed industriali nello spazio. Assicurazioni Generali, Roma, September 16-17, 1991

³³ PEREK, Impact of the development of space technology on the law of outer space, Proc. 32th Colloquium on the law of Outer Space,, 1990, p.462.

³⁴ The AKM phase being when the satellite's apogee engine turns on to reach the established orbit; the Early orbit phase being when the satellite, separating from the vector reaches the first orbit which is not the final one, but only a temporary allocation.

³⁵ The hook of a crane hit satellite INSAT D during the integration phase; a piece of abandoned material obstructed a pipe destroying the launch vehicle ARIANE V36, with the consequent loss of Japanese satellites B and BS 2X; an unidentified liquid object caused the accident of satellite BS 3H etc.

³⁶ For the statistics of losses, expenses, recoveries from 1977 to 26th may 1993, see the table at the end of the paper.

³⁷ GIARDINA-VILLANI, Garanzie bancarie, commercio internazionale e diritto internazionale privato, Padova 1984, p.22.

³⁸ FANELLI, Le assicurazioni, introduzione, analisi e giustificazione del rapporto assicurativo, in CICU-MESSINEO, Trattato di diritto civile e commerciale, Milano 1973, p. 277; DONATI-PUTZOLO, Manuale di diritto delle assicurazioni private, Varese, 1987, p.24; LA

TORRE, *La disciplina giuridica del diritto delle assicurazioni*, I, 1987, p.175.

³⁹ DIEDERIKS VERSCHOOR, *Legal aspects of the space shuttle*, in *Space shuttle and the law*, L.Q.C. Lamar Society Monograph, series n. 3, University of Mississippi Law Centre, 1980, p.11; SLOUP, *A Guide for space Lawyers to Understanding the NASA Space Shuttle and the ESA Spacelab*, 1977, p. 197.

⁴⁰ GOROVE, *La commercialisation des activités spatiales: aspects juridiques*, University of Toulouse.

⁴¹ STRAUBEL, *The Commercial Space Act; The Regulation of Private Space Transportation*, *J. of air Law and Commerce*, 1987, p.322; MILLER, *Licensing and regulating U.S: Commercial Space Launches*, *J. of law and technology*, 1988, p.45.

⁴² Report of the Senate Committee on Commerce, Science and Transportation on HR. 4399, 100th Cong., 2d sess., report 100-593, Washington 1988. MEREDITH, *A comparative analysis of United States Domestic Licensing Regimes for Private Commercial Space Activities*, Proc. 32th Colloquium on the law of Outer Space, 1989, p.373.

⁴³ GOROVE, *The Growth of Domestic Space Law: A US. Example*, *J. Space law*, 1990, p.99; DULA, *United States government Authorisation and Supervision of non-Governmental Space Activities: Present Law and Future Possibilities*, Proc. 27th Colloquium on the Law of Outer Space, 1984, p.35.

⁴⁴ See APPALACHIAN Insurance co v. Mc Donnell Douglas Corporation for the satellite WESTAR VI, *J. Space Law*, 1991, p. 173; CRAFT, *Aviation Liability Law Developments in 1990*, *J. Air Law and Commerce*, 1990, p. 183; LEXINGTON, *Insurance co. v Mc Donnell Douglas*, *J. Space Law*, 1990, p. 41; PINO, *Civil Liability in commercial Space Ventures under United States Law*, VI International Conference, *Le attività industriali e commerciali nello spazio*, Assicurazioni Generali, Roma Sept. 16-17, 1991, p. 175.

⁴⁵ KAISER, *An achievement of domestic space law: Us regulation of private commercial launch services*, *Annals of Air and Space Law*, 1991, p.341; NESGOS, *Recent Developments in Risk Allocation of Concern to the US Commercial Launch Industry and the Insurance Community*, V International Conference, *Le attività commerciali ed industriali nello spazio*, Assicurazioni Generali, Roma, march 2-3, 1989, p. 393; LAVIECH, *Protection et promotion des investissements: étude de Droit International Economique*, Paris 1985, p.246.

⁴⁶ BOCKSTIEGEL, *Legal implication of Commercial Space Activities*, Proc. 24th Colloquium on the Law of Outer Space, 1981, p. 1; GOROVE, *Implication of International space Law for Private Enterprise*, *Annals of Air and Space Law*, 1982, p.319.

⁴⁷ TURK, *L'evolution des obligations contractuelles du constructeur vis-à-vis de son client*, in KAHN,

L'exploitation commerciale de l'espace. Droit positif, droit prospectif, Université de Bourgogne 1992, p.203; RITHOLZ, *International and Domestic Regulation of Private Launching Ventures*, 1984, p.20.

⁴⁸ LOQUIN, *Clauses dissuasives des litiges*, *Juriclass contract distribution*, 135, n.16.

⁴⁹ DULA, *Regulation of Private Commercial Space Activities*, Proc. 24th Colloquium on the Law of Outer Space. 1981. p.25; STEPTOE, *Regulation of Private commercial Space Transportation by the United States Department of transportation*, Proc. 28th Colloquium on the Law of Outer Space, 1985, p. 240.

⁵⁰ In the first case *Intelsat v. Martin Marietta corp.*, the liability limiting clause could be applied to the advantage of *Martin Marietta* because the liability could not foresee the event of economic losses, while in the second case, *Lexington Insurance Co. v. McDonnell Douglas*, the appeal for fault was to be issued only in the event of economic losses. See DIEDERIKS VERSCHOOR. *An Introduction to Space Law*, Deventer 1993, p. 104.

⁵¹ After the promulgation of the "Commercial Space Launch Act Amendment" in 1988, by the Congress, American law has been in favour of applying the cross waiver clause even in the event of a serious fault, at least in favour of the launch agencies

⁵² Elaborated by the biggest American industry of satellite manufacture, the Hughes Aircraft, and effected before with the US. Navy, after with private stranger societies, like the British Satellite Broadcasting and the Australian Aussat, see JACQUES, in *Air et Cosmos*, 1987, n. 1155, p.36; GILSON, *Partage des risques pour la deuxième génération de satellites d'AUSSAT*, *Air et Cosmos*, 1987, p.31; in Europe the Aerospatiale concluded a contract of delivery in orbit of telecommunication satellites with the Turkey, see *Air et Cosmos*, 1990, nn. 1298, 1306, 1309.

⁵³ PARKINSON, *Commercial and Operational Impacts on the Design for the Hotol Advanced Launch Vehicle*, Proc. 33th Colloquium on the Law of Outer Space, 1990, p. 35; see the contract concluded by the AUSAT, with the China for a launch with the rocket "Long March", in *Air et Cosmos* 1987, p. 31; POITIER, *Swords into ploughshares: missiles as commercial launchers*, *Space policy*, 1991, p. 146; SIFTZEN, *World Guide to Commercial Launch vehicles*, Pasha Publication, 1991, p.101.

⁵⁴ SPECTER, *An ISY policy for developing and newly industrialised countries*, *Space Policy*, 1990, p.117.

⁵⁵ LOGDSON-LAUB, *The globalisation of technology: Implication for Future Space Programs*, 1992, p.129; BENNET, *Creating competitive space trade: a common market for space enterprise*, 1990, p. 22.

⁵⁶ MARTIN, *Supra*, note 21, p.117; DAOUHARS, *supra*, note 24, p. 262; THOMA-SHIMROCK, *Insurance of satellites*, *ESA bulletin*, 1978, p.65.

⁵⁷ HESSE, Practice and Problems of covering space Flight Risks, Policy Holder Insurance Journal, 1981

⁵⁸ The launcher Ariane V.36, in February 1990, was destroyed with its two satellites during the launch phase, because a canalisation was obstructed by a piece of material; in march 1990, during the separation phase, the last stage of titan rocket, carrying the satellite Intelsat VI, remained stowed, so the satellite could not be launched into orbit; in march 1987, during the placing in orbit of the satellite TV SALT I, one of the solar panels got stuck, the aerial could not be unfurled, the satellite became useless and was placed in another orbit so as not to damage other satellites. For the cases of accidents in the three phases see PAGNANELLI, Sviluppo delle assicurazioni spaziali, VII International Conference, Le attività commerciali e industriali nello spazio, Assicurazioni Generali, Roma, march 11-12, 1993; GOBBO, *Supra*, note 12

⁵⁹ MAGDELENAT, Spacecraft Insurance, Annals of Air and Space Law, 1982, p. 363.

⁶⁰ CATALANO SGROSSO, Protection of Outer Space Environment: The Present International Law Rules and Suggestion for New Legal Measures and Instruments, Proc. 32th Colloquium on the Law of Outer Space, 1989, p. 146.

⁶¹ CATALANO SGROSSO, *Supra*, note 22, p. 45 and p.56.

⁶² BOURELY, L'assurance des activités spatiales, Annuaire de droit maritime et aérien, 1983, p.360.

⁶³ GREENBERG, Third party liability insurance and space launches, Space Policy, 1988, p.211; STEVENSON, GE-MARIETTA satellite deal, New York Times, January 27, 1988.

⁶⁴ PLOCHINGER, Insurance of Space Risks, in ESA Bulletin, 1988, p.88; MADDERS, Space insurance - A European Perspective, Proc. 34th Colloquium on the Law of Outer Space, 1991, p. 393.

⁶⁵ CASTELLO, La grande aventure d'Ariane, Paris 1987, p. 27; CHAPPEZ, Ariane: première société de transport spatial, 1983, p. 68.

⁶⁶ RACLIN, Going to Work in Space: A Survey of Present Available Launch Systems, American Enterprise, the Law and the Commercial Use of Space, 1986, p. 31; CASSIDY, Insurance space Launch and related risks, Proc. 34th Colloquium on the Law of Outer Space, 1991, p. 389.

⁶⁷ DULA, United States Government Authorization and supervision of non-Governmental Space Activities; Present Law and Future Possibilities, Proc. 27th Colloquium on the Law of outer space, 1984, p. 201. MASSINGHOFF-SLOUP, Legal Issues Inherent in Space Shuttle Operations, J. Space Law, 1978, p.47.

⁶⁸ CASSIDY, *Supra*, note 10, p. 166.

⁶⁹ STRAUBEL, The commercial space Launch act: The Regulation of private Space Transportation, J. Air Law

and Commerce, 1987, p.942; TRAA ENGEMAN, Problems of State Responsibility in International space law, Proc. 26th Colloquium on the Law of Outer space, 1983, p.141; NESGOS, Recent Developments in Risk Allocation of Concern to the US Commercial Launch Industry and the Insurance Community, V International Conference, Le attività commerciali ed industriali nello spazio, Assicurazioni Generali, march 2-3, 1989; MILLER, Licensing and regulating US Commercial Space Launches, J. Law and Technology, 1989, p.45.

⁷⁰ OKOLIE, Patent Law and space activities of States in industrial property technology co-operation, Proc. 27th Colloquium on the Law of Outer Space, 1984, p.178.

⁷¹ HUET, Responsabilité du vendeur et garantie contre les vices cachés, Litec, 1987, p.37; ANCEL, La garantie conventionnelle des vices cachés dans les conditions générales de vente en matière mobilière, R.T.D. com. 1979, p.203; LESSARD- NORDLUND, Les bases de lancement: évolution et aspects juridiques, Annals Air and space Law, 1990, p.359.

⁷² NESGOS, Private commercial Launch Services, Annals Air and Space Law, 1991, p. 25. Examples of such insurance coverage are given by the satellite SIRIO, an Italian project, assured by the Assicurazioni Generali, and the satellite SPOT.

⁷³ VASSILEVKAJA, Legal aspects of ensuring the security of space personnel flight, Proc. 25th Colloquium on the Law of Outer space, 1982, p.261.

⁷⁴ PISILLO MAZZESCHI, Due Diligence e responsabilità internazionale degli Stati, Milano, 1989, p. 34.

⁷⁵ BOCKSTIEGEL, Arbitration and Adjudication Regarding activities in Outer space, J. Space Law, 1978, p.3; IDEM, Settlement of Disputes Regarding Activities in Outer Space, Proc. 20th Colloquium on the Law of Outer Space, 1979, p.176.

⁷⁶ MARTIN, *Supra*, note 21, p. 128.

⁷⁷ NORTH, Contract conflicts, the EEC Convention on the Law applicable to contractual obligation: a comparative study, Amsterdam, New York, 1982, p. 143.

⁷⁸ Dir. 357, June 22, 1988, O.J.E.C., L 172, July 4, 1988, p.1, emen.in O.J.E.C., L 330, November 29, 1990, p. 44, emen. in O.J.E.C., L 228, august 1992, p.1.

⁷⁹ POOL, *Supra*, note 28, p. 133; BEER, Droit Européen des assurances: la directive du juin 1988 sur la libre prestation des services, Rev. trim. droit eur. 1989, p. 655 GREPPI, Mercato interno e circolazione dei servizi: problemi concettuali e regolamentazione giuridica, Mercato comune e neoprotezionismo, Padova, 1987, p. 200.

⁸⁰ FRIGESSI di ROTTALMA, Il contratto internazionale di assicurazione, Padova 1990, p.93; GREAVES, EC competition law (Banking and Insurance Service), London, 1992, p.48.

⁸¹ PAUL e CROLY, EC Insurance Law, London 1991, p. 44.

⁸² JANNUZI, L'assicurazione nei mercato unico europeo, Milano 1989, p. 18.

⁸³ Dir. 92/49/EC, June 18, 1992, in O. J. E. C., L 2228/1, August 11, 1992.

26th May 1993

DETAIL OF LOSSES, EXPENSES, RECOVERIES (statistics)

SATELLITE	INSURED	DATE	PHASE	PAID LOSSES (Million US\$)	NOTES
OTS I	ESA	13.09.1977	LAUNCH	29.13	
ANIK B INC.	RCA ASTRO	31.01.1979	LAUNCH INC.	0.38	
JAPAN ECS	NASDA	06.02.1979	LAUNCH	13.90	
SATCOM III	RCA CORP	07.12.1979	LAUNCH (akm)	70.00	
SATCOM III INC.	RCA ASTRO	07.12.1979	LAUNCH INC. (akm)	6.93	
INTELSAT V F1, F2 INC.	FORD AEROSP.	23.05.1981	LAUNCH INC. (sat)	0.42	
INSAT 1A	GOV. OF INDIA	10.04.1982	EARLY ORBIT (sat)	64.90	
INSAT 1A INC.	FORD AEROSP.	10.04.1982	E. ORB INC. (sat)	5.35	
MARECS B	ESA	10.09.1982	LAUNCH	20.00	
MARECS B INC.	BAe	10.09.1982	LAUNCH INC.	1.07	
INTELSAT V F5, F6 INC.	FORD AEROSP.	28.09.1982	LAUNCH INC. (sat)	2.60	
SATCOM II	RCA CORP.	01.04.1983	IN ORBIT (sat)	9.00	
OSCAR 10	AMSAT	16.06.1983	LAUNCH	0.25	
WESTAR VI	WESTERN UNION	03.02.1984	LNC (pam D) (ups)	85.00	(Orig. 105 Mio less 20 Mio recov. from sale)
PALAPA B2	PERUMTEL	03.02.1984	LNC (pam D) (ups)	55.16	(Orig. Loss 75.39 Mio less recovery from sale 1 Mio Dep. + 8.5 Mio 1st Inst. on 31/12/86 + 8.5 Mio 2nd Inst + 2.23 Mio Ins on 30/06/87)
INTELSAT V F6, F7 MCS	INTELSAT	.05.1984	EARLY ORBIT (sat)	2.94	
INTELSAT V F7, F8 INC.	FORD AEROSPACE	.05.1984	E. ORB INC. (sat)	4.52	(plus about US.\$ 300,000 for claim expenses on F5 , F6, F7, F8)
INTELSAT V F09	INTELSAT	09.06.1984	LAUNCH	102.00	
PAL. B2 / WEST. VI		08.11.1984	RETRIEVAL	10.50	(Retrieval expenses)
ANIK D2	TELESAT CAN.	08.03.1985	EARLY ORBIT (sat)	4.21	
ANIK D2 INC.	SPAR AEROSP.	08.03.1985	E. ORB INC. (sat)	0.20	
LEASAT 3 (SYNCOM IV 3)	HUGHES	12.04.1985	LAUNCH (ups)	19.50	(Original Loss 85.0 Mio, 32 Mio recovered on 30.12.85 + 8.375 Mio on 30/12/87 + 8.375 Mio on 30.12.88 + 8.375 Mio on 30.12.89 + 8.375 Mio on 30.12.90)
ARABSAT 1A	ASCO	17.05.1985	EARLY ORBIT (sat)	6.67	(plus about US.\$ 500,000 for claim adjustment expenses on the two ARABSAT)
ARABSAT 1A INC.	AEROSPATIALE		E. ORB INC. (sat)	4.00	
ARABSAT 1B	ASCO	19.06.1985	LNC (pam D) (ups)	3.83	
LEASAT 4 (SYNCOM IV 4)	HUGHES	27.08.1985	LNC (sat)	85.00	
Ariane V15 decl	ARIANESPACE	12.09.1985	LAUNCH	9.28	
ECS 3	ESA	12.09.1985	LAUNCH	84.50	(65 Mio + 19.5 Mio contingency)
ECS 3 INC.	MATRA'-BAe	12.09.1985	LAUNCH INC.	1.25	
SPACENET 3	GTE	12.09.1985	LAUNCH	85.00	
SPACENET 3 C.L.	RCA Astro	12.09.1985	LAUNCH	17.00	
GSTAR 2	GEOSTAR	14.03.1986	EARLY ORBIT (sat)	2.25	
Ariane V18 decl	ARIANESPACE	30.05.1986	LAUNCH	10.44	
INTELSAT V F14	INTELSAT	30.05.1986	LAUNCH	82.00	
TV SAT 1	DBP	20.11.1987	EARLY ORBIT (sat)	57.10	
TELECOM 1B INC.	MATRA	15.01.1988	IN-ORB INC. (sat)	0.60	
INSAT 1C	GOV. OF INDIA	29.07.1988	EARLY ORBIT (sat)	68.32	
INSAT 1C INC.	FORD AEROSP.	29.07.1988	E. ORB INC. (sat)	3.45	
GSTAR 3	GTE Corp	11.09.1988	LAUNCH (akm)	60.00	
GSTAR 3 Geostar	GEOSTAR	11.09.1988	LAUNCH (akm)	5.00	
GSTAR 3 INC.	RCA Astro	11.09.1988	LAUNCH INC. (akm)	7.37	
HIPPARCOS INC.	MATRA'	06.08.1989	LAUNCH INC. (akm)	6.64	
UOSAT D	UNIV. OF SURREY	22.01.1990	EARLY ORBIT (sat)	0.38	
SUPERBIRD B	SCC	22.02.1990	LAUNCH	94.50	
BS-2X	GE Astro	22.02.1990	LAUNCH	94.90	
INSAT 1D	D.O.S.	06.07.1990	EARLY ORBIT (sat)	1.03	
INSAT 1D INC.	GOV. OF INDIA	06.07.1990	E. ORB INC. (sat)	0.44	
TDF 1	TELED. DE FRANCE	06.08.1990	IN ORBIT (sat)	25.05	
BS 3A	NASDA	31.08.1990	EARLY ORBIT (sat)	11.60	
SATCOM 3R tpt	RAJNBOW	01.09.1990	IN-ORBIT (sat)	1.00	
SUPERBIRD A	SCC	20.12.1990	IN-ORBIT (sat)	170.00	
ANIK E2	SPAR AEROSPACE	12.04.1991	E. ORB INC. (sat)	0.63	
BS 3H	G.E. ASTRO	18.04.1991	LAUNCH	96.40	
MAXUS 1	MBB/ERNO-SCC	08.05.1991	LAUNCH	8.23	
OLYMPUS inc.	BAE, SPAR	29.05.1991	IN ORB INC. (sat)	4.30	
AURORA II (SAT C5) INC.	G.E. ASTRO	11.06.1991	E. ORB INC. (sat)	3.30	(fuel loss)
AURORA II (SAT C5)	G.E. AMERICOM	11.06.1991	EARLY ORBIT (sat)	2.91	(fuel loss)
AURORA II (SAT C5)	PACIFIC TELECOM	11.06.1991	EARLY ORBIT (sat)	6.39	(fuel loss)
PEGASUS F2	OSC	17.07.1991	LAUNCH	0.82	
SATCOM 4	INTEG RES	12.10.1991	IN ORBIT (sat)	2.94	
COSIMA IV	INTOSPACE	27.11.1991	LAUNCH (sat)	0.06	

DETAIL OF LOSSES, EXPENSES, RECOVERIES (statistics)

SATELLITE	INSURED	DATE	PHASE	PAID LOSSES (Million US\$)	NOTES
UOSAT E	UNIV. OF SURREY	14.12.1991	EARLY ORBIT (sat)	0.03	
ASTRA 1B	G.E. ASTRO	31.12.1991	E. ORB INC. (sat)	1.29	
JOUST 1	ORBCOMM	31.12.1991	LAUNCH	2.50	
ORBCOMM X	CIT	31.12.1991	LAUNCH	0.80	
GALAXY 1R	HUGHES	22.08.1992	LAUNCH	159.50	
CONSORT 5	EER	01.10.1992	LAUNCH	2.07	
OPTUS B2	HUGHES	21.12.1992	LAUNCH	42.00	
OPTUS B2	AEROSPATIALE	21.12.1992	LAUNCH	59.60	
SKYNET A,C	BAE	31.12.1992	E. ORB INC. (sat)	5.45	(have just been informed that these claims have been settled at PND 1,341,700 and PND 2,316,400)
TOTAL				1,905.78	MILLION US\$

OUTSTANDING LOSSES/RECOVERIES

SATELLITE	INSURED	DATE	PHASE	OUT. LOSSES (MILLION US\$)	NOTES
ANIK E2	SPAR AEROSPACE	12.04.1991	E. ORB INC. (sat)	0.79	
ASC 2	A.S.C.	29.04.1991	EARLY ORBIT (sat)	16.10	
AURORA II (SAT C5)	PACIFIC TELECOM	11.06.1991	EARLY ORBIT (sat)	0.00	(heater anomaly)
ANIK E1	SPAR AEROSPACE	26.09.1991	E. ORB INC. (sat)	0.63	
HISPASAT 1A	MATRA MARCONI	08.09.1992	E. ORB INC. (sat)	2.24	
HISPASAT 1A	HISPASAT	08.09.1992	EARLY ORBIT (sat)	36.68	
SPOT 2	SAT IMAGE	26.11.1992	IN ORBIT (sat)	2.91	
UHF 1	HUGHES	25.03.1993	LAUNCH	142.00	
TOTAL				201.35	MILLION US\$