

25th EUROPEAN ROTORCRAFT FORUM

PAPER No. D-2

EC 120 DESIGN

by Jean-Claude BOUVIER

Head of Eurocopter Design

September 14 - 16, 1999

Rome, Italy

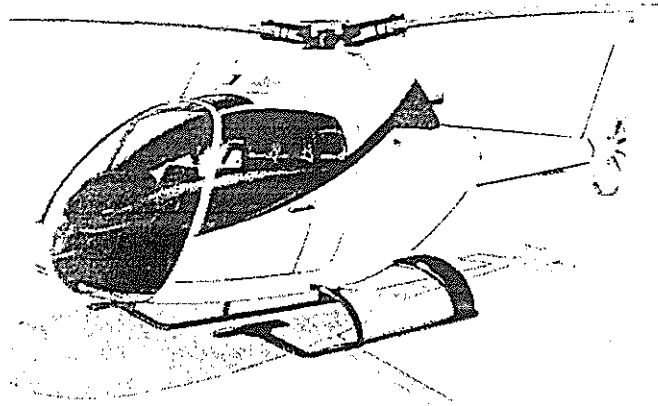
Cleared for public release

**ASSOCIAZIONE INDUSTRIE PER L'AEROSPAZIO, I SISTEMI E LA DIFESA
ASSOCIAZIONE ITALIANA DI AERONAUTIC ED ASTRONAUTICA**

EC 120 DESIGN

Our new helicopter, the EC 120, is the first EUROCOPTER helicopter to have incorporated an industrial design process from the time the general specifications were drawn up.

As a discipline, industrial design helps improve man/machine interfaces and is dedicated to users' satisfaction.



At the end of the eighties, Eurocopter, then Aérospatiale Helicopter Division, initiated the P120 study i.e. a four-blade helicopter with high engine power. The Pre Project unit of the Engineering Department consulted two agencies in Paris, Volanis design and Picard IDEI, to assist Aérospatiale with the shape and outfitting studies.

This first contact between company and industrial design helped sensitize the Engineering Dept. to this field associated with human factors.

The projects were presented as 1/5th scale models and perspective drawings of the helicopter fuselage and cockpit internal outfitting; they proved really helpful and were highly appreciated by the Engineering Dept.

This design gave personality to the helicopter as it was being thought out. A designer's drawing is both a synthesis of the engineering work and a projection for new proposals. Marketing analyses are also facilitated by the designer's suggested changes.

Since he is not necessarily an aerospace specialist, the designer will naturally come up with innovating ideas showing the helicopter in a different and unusual light. Innovation is playing a significant role from the conceptual and commercial standpoint when manufacturers may come up with the same type of product over a short period of time. Originality is today increasingly based on the services helicopters do offer and it is those novelties that underline the competition's obsolescence.

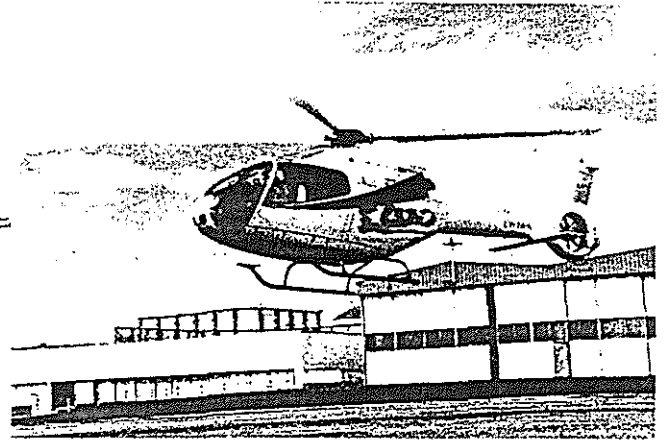
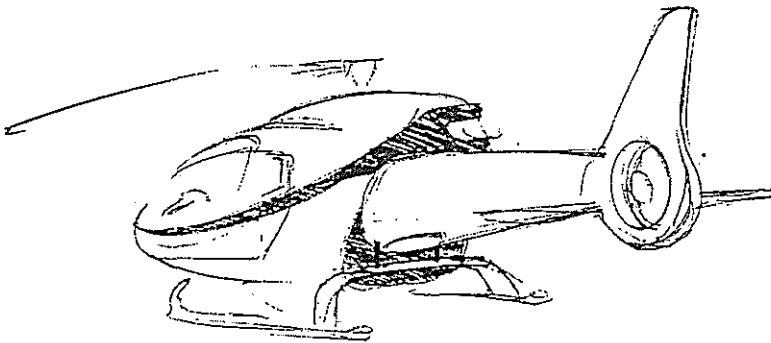
Twenty years after the Ecureuil, Eurocopter elected to integrate industrial design in the Engineering Dept. and the work that was done on the P120 demonstrated that a specialist in this field could become a full time member of the engineering team.

P120 is now, for strategic and commercial reasons, a simpler, lighter and cheaper EC120, and EUROCOPTER DESIGN has been integrated as a company unit.

The EC 120 program was started in 1992 and our first job was to put this new helicopter into shape.

Interior design is obviously the field in which the industrial designer must focus the most attention and numerous elements connected to passenger comfort were studied. All layout proposals must however match with the general shape of the aircraft and correspond to the prevailing character of the helicopter. One consideration took precedence with regard to the outline of the EC120: this aircraft had to be esthetically pleasing for the next 30 years. The direct consequence of this requirement was to refuse any concessions to fashion; nothing changes more quickly than fashion.

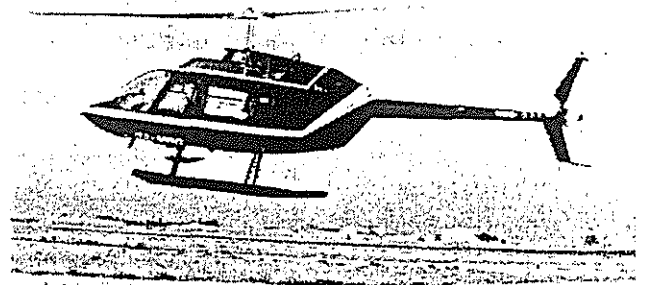
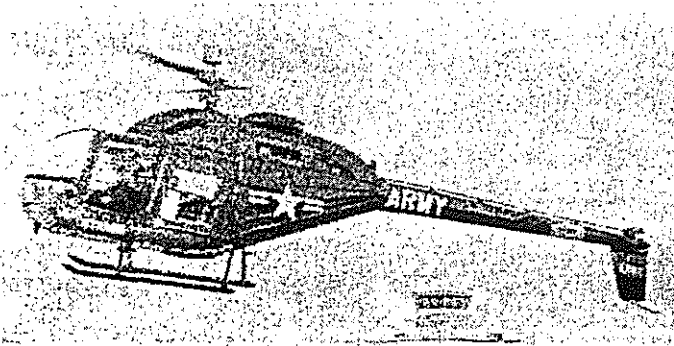
The shape of the EC120 seems to have been sculptured as it moves through the air and at the same time, it conveys the traditional brand image of EUROCOPTER products. The drawing below is the first rough sketch of the EC120.



Well before the interior drawings were started, the design work consisted in visiting several small helicopter operators in the area.

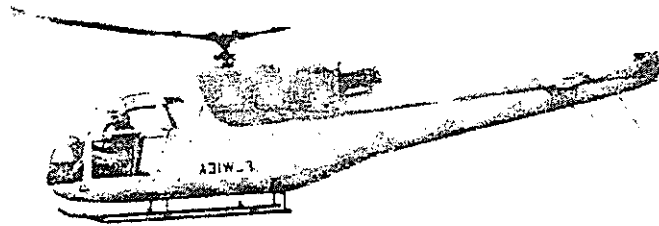
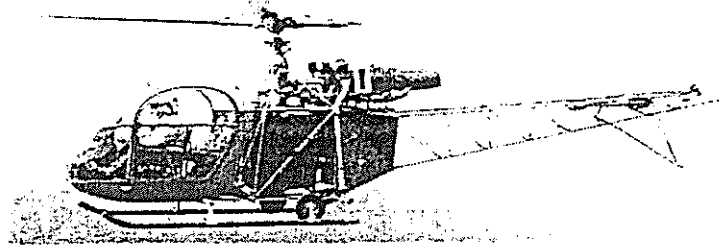
About twenty operators, pilots, mechanics and passengers were met and we have had very open discussions. Dozens of photos were taken. The photos and the operators' comments were analyzed and this analysis became the database that the designer used to make his suggestions for the EC 120.

Before analyzing the EC 120 in more detail, let's take a quick look at what had happened in the past.



When the BELL engineers decided to put in a proposal to the MOD invitation for bids, they presented the OH4, which was not particularly adapted for a commercial market. Convinced that they had a good helicopter, BELL called in an industrial design consultancy to improve the helicopter in all the areas where it wasn't up to standard, without modifying the very satisfactory technological aspects. The Jet Ranger took form from this design study and went on to become the best selling turbine helicopter world-wide.

The first known experience in this field in France was the study conducted by Raymond Loewy on the Alouette II. Unfortunately this "Governor" Alouette was not a true industrial design study in that Raymond Loewy proposed a simple styling, decorating study, which had for first consequence to make the helicopter a lot heavier.



Now to come back to our EC 120, EUROCOPTER wanted the design to be part of the work covered by the Preliminary Design Department, which was tasked with drawing up the general specifications and the initial dimensioning studies, before it was handed over to the Design Office. This study should also be useful for other programs in any case.

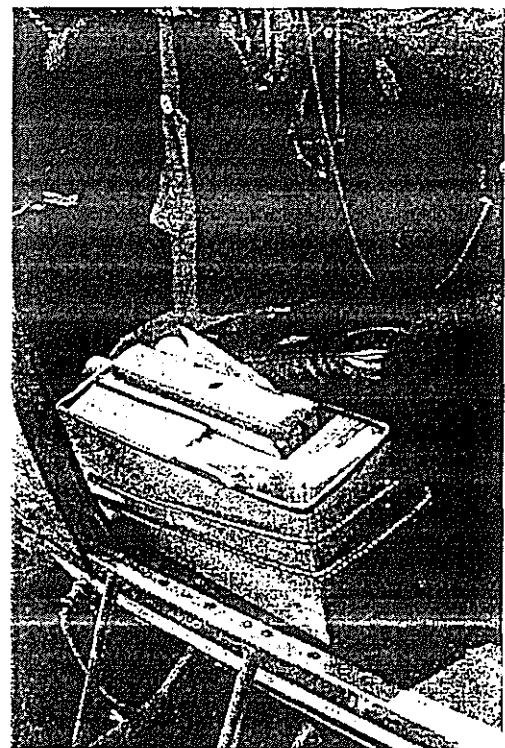
Using the reports of findings on existing helicopters, the designer first concentrated on the weak points which operators put up with, either consciously or unconsciously.

This is how the scope of the industrial design stage went much further than simply drawing the general silhouette of the helicopter.

Creativity is offering users what they need, before they know they need it!...this means that there is no chance that it will come out of clinical tests.

An enthusiastic acceptance comes from a good surprise, and a surprise will never come out of a Gallup Poll, because the average of any opinions will always give an average opinion. It is up to the designer to analyze human behavior and to draw from it the lessons that will generate innovating proposals.

When a designer realizes that nothing has been provided to carry the mandatory documents that are just as indispensable for each flight as the main rotor, i.e.: the Flight Manual, the Aircraft Log Book, the insurance certificates, the weight sheet, the maps and, for public passenger transport, the Operating Manual and the safety directives, and, consequently, that the owners of new helicopters end up by making cases themselves out of plywood with a hammer and nails, then he does not think of styling nor is his aim to catch the eye; he does his job as a designer and proposes rational solutions, using all the typical aeronautical parameters. His answer must be a certifiable product that takes into account the ergonomic aspects as well as the weight, cost and industrialization requirements. Hence the first thing we did was to identify the largest possible number of anomalies.



Observing, on the spot, the way in which human beings behave is far more effective than anonymous answers to a questionnaire.

The designer applies behavioral ergonomics, semiology ; in other words, he tries to identify problems by noting attitudes that he considers to be abnormal. When he discovers that three out of ten passengers fall when embarking or disembarking, he tries to find out why this happens. His findings will have immediate effects as regards to the size and the position of the footsteps, as well as the number and locations of the hand grips.

Let us analyze this slide together:



This gentleman is a business man, who is not used to traveling in a helicopter. As he approaches the helicopter, he is either a little anxious or enthusiastic, in any case he is inevitably already stressed when he arrives with his attaché case. Now he must pass under the rotor, which is spinning. A flight line technician has placed some steps in front of the door and he is ready to help our friend to board.

Nevertheless, if we take a closer look, his left foot misses the step and he desperately gropes for a non-existent handgrip with his left hand. He hits his shin harshly, then as he straightens up he hits his head on the top of the door opening. What a welcome on board!

The designer's aim is to produce the stimulus that makes people want to become owners.

TECHNICAL ASPECTS

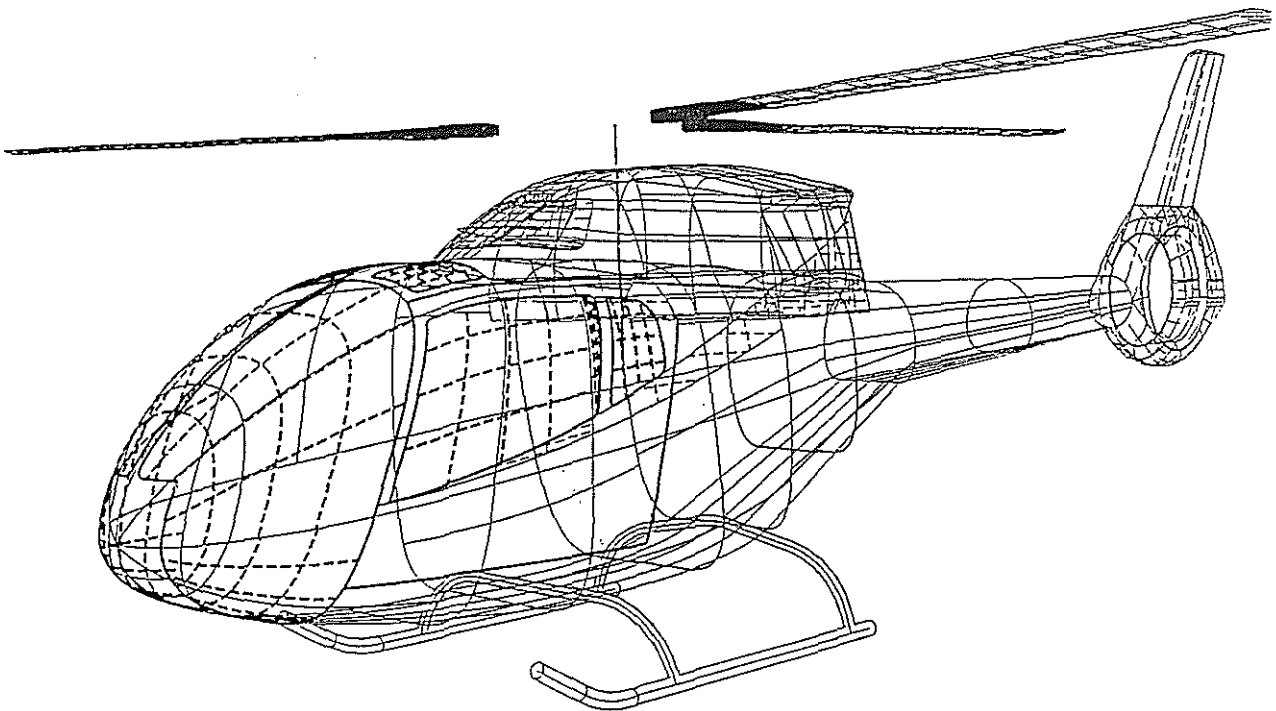
GENERAL CONCEPT:

Because the general outline of the helicopter had to remain ageless over decades, the design department chose the following principles: natural balance of volumes, harmonious interaction of shapes and extreme simplicity of lines. These considerations had an immediate consequence: good aerodynamic integration. The first reduced scale model tested in the wind tunnel gave excellent results and nothing has had to be modified subsequently.

EC120 structure is a novelty for EUROCOPTER. Human factors imposed as much space as possible for passenger's luggage and that lead to the split fuel tank concept. The fuel tanks were divided into two units offering a large cargo space with a rear access thus improving the helicopter's comfort and efficiency for the users.

The wide canopy surrounding the crew is an industrial design decision, which is apparently running against recent developments favoring composite nose cones. However, this choice was based on the need to enhance pilots and passengers visibility, this requirement is particularly well adapted to the missions conducted by such a light helicopter.

It is also with daily usage in mind that industrial design recommended two different cabin openings, with a flap door on the right hand side and a sliding door on the left one to meet every expectation.



SEATS

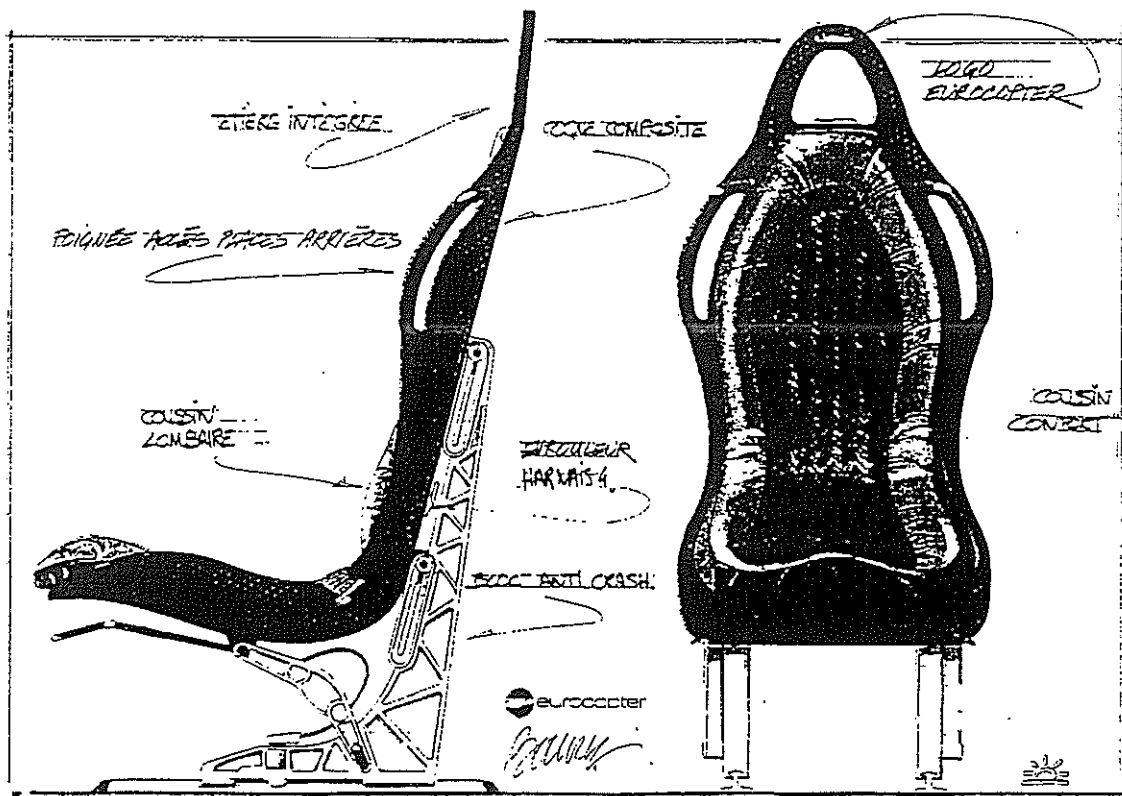
The seat is the interface through which the cockpit is adapted to the anthropometric and physiological characteristics of the pilot.

Nowadays pilots count their flying time in thousands of hours and they are more sensitive to the discomfort of their seat, which can cause backache, lumbago, stiff necks and other traumatism.

The EC120 seat was also drawn to harmonise with the helicopter's soft shapes and everything was done to integrate this seat secondary fonctions. The side bar, for example, is an integral part of the back and its role is to facilitate passengers access to the rear seats. The headrests are also part of the back and they contribute to the aesthetics of the whole. The legs made of mass machined aluminum include attachment points for the future optional items. Even highly technical concepts such as energy absorption with leg deformation were integrated by the designer and these legs, a very novel concept in themselves, were deliberately left as visible structural parts.

The seat bucket is designed to follow the body shapes as closely as possible, in order to optimises crew comfort and preserves the aft passengers' visibility.

These minimal principles naturally helped reduce the seat's cost and weights.



The EC 120 seat must be considered from three essential aspects: immediate environment (including accessibility), comfort of the cockpit and man-machine interface.

A helicopter must be a uniform whole. Skipping over areas that are not considered to be particularly "noble" such as stowage space or handles could be detrimental to a helicopter and cancel out considerable efforts that may have been made elsewhere.

All our actions and aspirations are directed towards finding the happy medium, harmony, and equilibrium. The helicopter is no exception.

The EC 120, and particularly its seat and its accessories must reflect the rigorous thought whose aim is to satisfy all those whose lives are organized in, around, for or are dependent on this helicopter.

POSSIBLE FUTURE EVOLUTIONS:

The design work done on the EC120 is obviously a first step in this field, and the proposals we made can be useful on any other machine.

When we met light-weight helicopter operators, we noted that they were really concerned about the quality of the cabin appearance and that it was absolutely necessary to have a multipurpose cabin.

Both these considerations lead us to the same answer: functional modules fitted into the pilots' seats.

We owe it to our customers to offer them the guarantee that when they buy an helicopter, they will have a pleasant, attractive and functional cabin, whatever types of missions the helicopter will be carrying out.

The differences between the helicopters will only be created by the different FUNCTIONS, hence MODULES that correspond to specific missions.

The interchangeability of functional modules will no doubt be one way of making the tool even more suitable for the requirements.

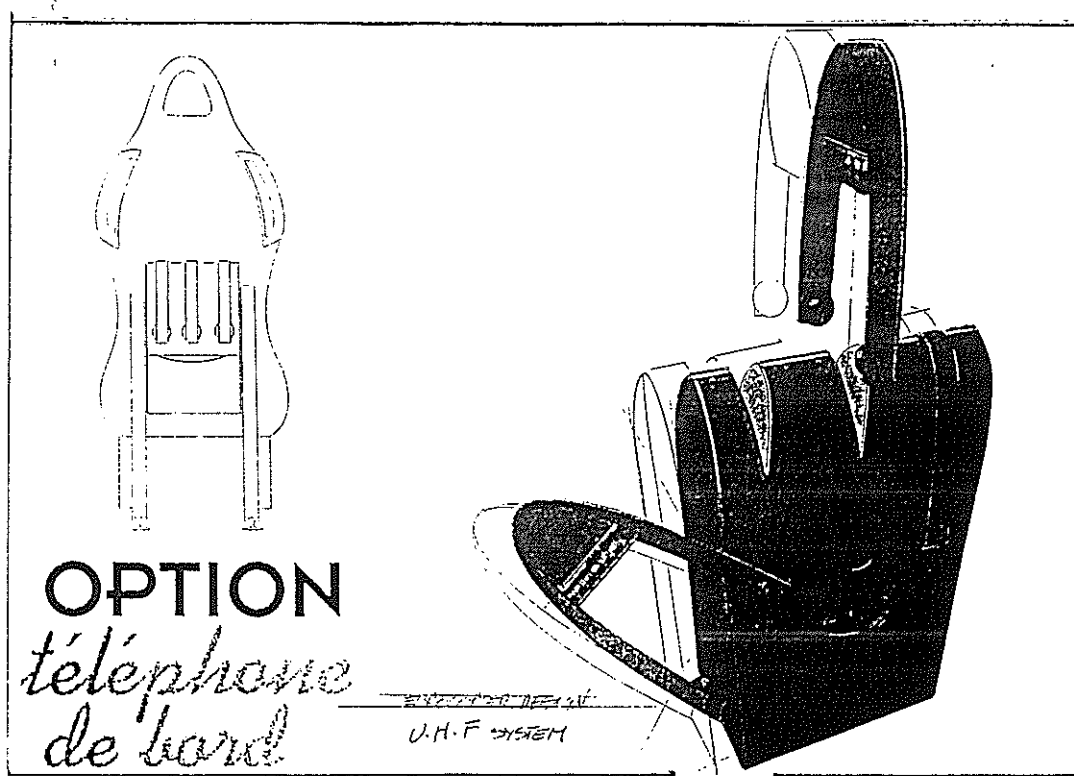
Let us take as an example the optional intercom system.

At the present time, if a customer wants to fit an intercom system on his helicopter, he must first refer to a specialist in this type of installation, take the helicopter to his facilities and have it grounded for several days. When he collects his helicopter, he will, of course, have paid for the intercom system, plus the installation, plus the transfer, plus the grounding. He will have a costly installation permanently installed but he will only use it for certain specific missions.

Now let's imagine that EUROCOPTER offers an "Intercom System Module", which is in fact a compact component that can be installed in just a few seconds on the back of the pilot's or copilot's seat and powered by plugging it in to the center console.

The customer would have the equipment he wanted without having the inconvenience of transferring his helicopter for the installation and the grounding period and he would be able to purchase this equipment directly from EUROCOPTER.

He would be able to install his module only when it was needed, so he would add extra weight to the helicopter only when the FUNCTION was required. Moreover, an operator with several helicopters would only need to buy one intercom system, which he could install on any one of his helicopters at any time.

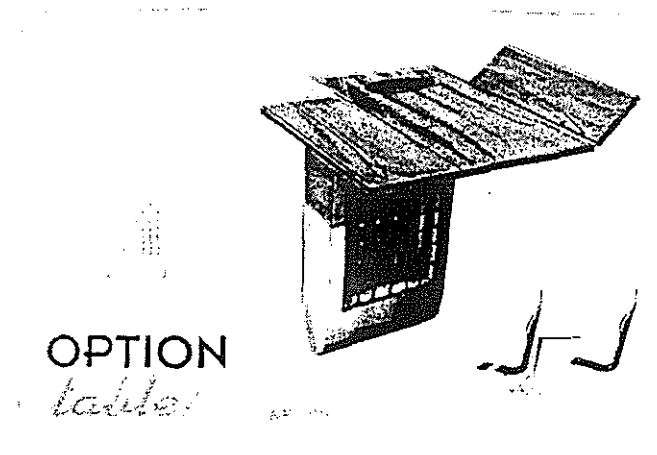
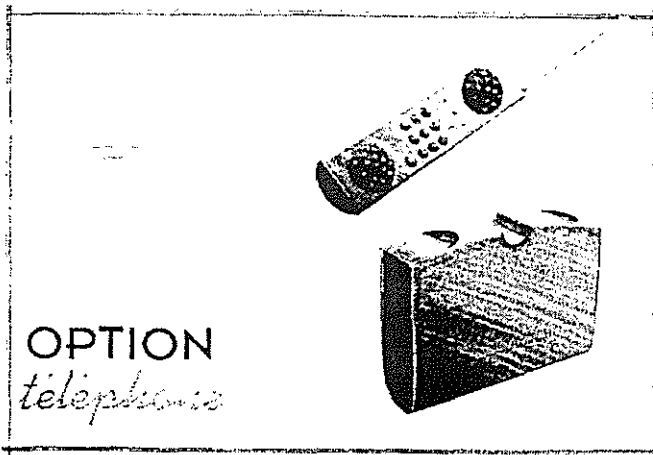
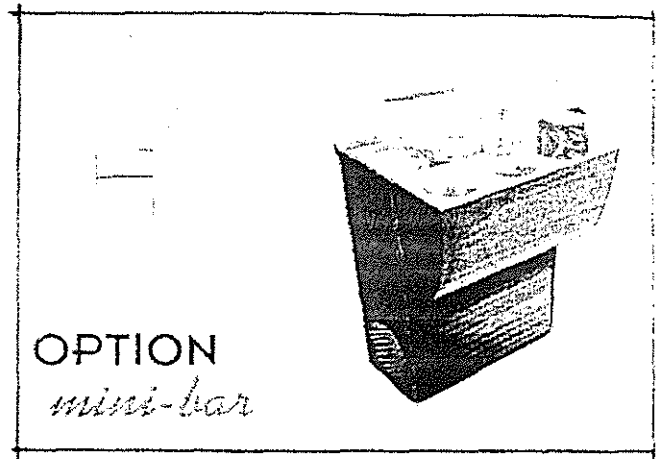
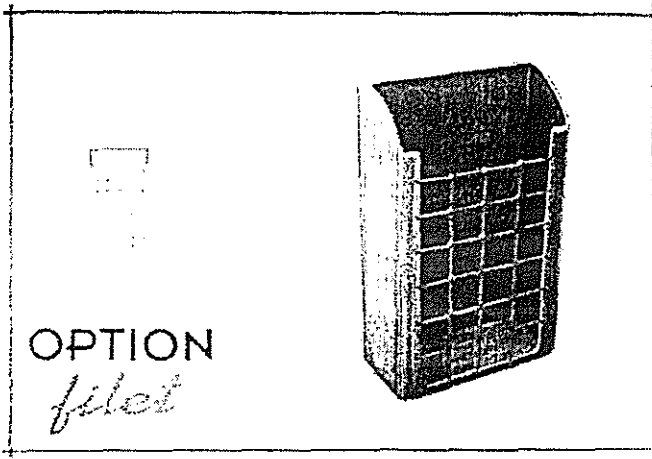


The same could be true for a large number of equipment items such as the Public Transport kit, the radio-telephone or the mini bar, a whole host of optional equipment that the operator could instantly install and remove, thus adapting his helo to the requirements of the moment.

Nowadays we deliver a significant part of light helicopters "green", that is to say with very little or no equipment. This is a problem that concerns the design department directly. It would be very interesting to follow up some of these helicopters that are sold unequipped to find out what happens to them afterwards and why we couldn't provide these aircrafts with a complete equipment.

The interchangeable module could be the answer.

Example of proposals:





IN CONCLUSION

Technology for technology's sake is not only tremendously expensive, it is also a self-perpetuating quest that puts off what should be done today in the pursuit of what may be possible tomorrow ... or the day after. We now have an opportunity to adapt our ways of working to the changes in our civilization, which, day after day, are redefined around a production process that combines techniques, culture, usage value analysis and sociology of life styles.

Designing a product implies making a multitude of choices and "micro decisions" which give rise to an optimized industrial and commercial reality. The challenge consists in designing helicopters with such choices of compromise that the resulting aircraft prove to be the best solutions for the largest number of **customers**... therefore operators and manufacturers.

The designer refuses all dogma and constantly fights against generally accepted ideas.

The EC120, because of its size and the market it is aiming at, has been a great opportunity to develop new industrial design concepts. This EUROCOPTER light single carries some specific thoughts that may open a new era for helicopters at the beginning of the millennium to come.

If we are not careful, very rapidly we could find ourselves with two types of helicopters: on one hand, the best machines, those that fly fastest and highest; on the other, those that sell because they are more functional, easier to live with and better suited to the passengers' everyday interests.

