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EVOLUTION OF THE LAND FORCES AIRMOBILITY CONCEPT

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A B S T R A C T

PREMISE

This paper can be considered the continuation of that one presented last year at the 12° Forum on "European helicopters for NATO theater", where a glint was given to the approach of the convertiplane as a new aerial vehicle able to meeting new operational requirements.
Deeper considerations are here exposed about the military employments of the convertiplane, mainly within the Land Forces airmobility concept.

THE AIRMOBILITY

WHAT ?

The airmobility is the capability of a modern Army to employ its own aircraft for performing by air essential duties not otherwise performable using other air or ground vehicles, or with new parameters in terms of speed, range, flexibility.
The essential functions: transport,information support, protection, fire support.

WHY ?

Airmobility as force multiplier factor.

Very often, the only possible solution of the logistic problem.

The only suitable countermeasure to the enemy airmobility.

HOW ?

The Army Aviation is the appropriate organization for translating into the reality the airmobility concept.

The Army Aviation is the complex of personnel, means and logistic structure necessary for performing the assigned duties.

MEANS FOR AIRMOBILITY

Aeroplanes and helicopters: the use of light fixed wing aircraft was the first approach to the airmobility concept, mainly in terms of artillery service and liaison. But the helicopter soon demonstrated to be the only possible answer to the requirements when the concept expanded to other possible roles and functions.
Joint evolution of helicopter capabilities and users' requirements.
Helicopter limitations.
Present situation and tendencies in NATO and WP environment.

ANOTHER EVOLUTION OF THE OPERATIONAL REQUIREMENTS

New strategic situation.
New threats.
Different operational scenarios.
Land Forces need improved operational capability in terms of flexibility, quick reaction and long range intervention.

MEETING THE NEW REQUIREMENTS IN AIRMOBILE TERMS

The aircraft should maintain the basic capability of vertically taking-off and landing and of operating in hovering flight but together with more speed, more range, more manoeuverability.
Possible solutions: jet lift, combination of fixed-wing and rotary-wing performance.
The tilt-rotor convertiplane.
Different fields of application.

MILITARY EMPLOYMENT OF THE CONVERTIPLANE

All Services will receive substantial benefits from the use of convertiplanes.
Naval missions.
Air Force missions.
Army missions.

HELICOPTERS AND CONVERTIPLANES IN THE NINETIES

The role of the helicopters and the convertiplanes in the Land Forces environment.
The current programs and the European perspectives.
Coordination between civil and military exigencies.

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PREMISE

- At last Rotorcraft Forum in Garmish, I presented a paper on "European Helicopters for NATO Theater" where I touched the subject of the convertiplane as another possible field for cooperation in the rotorcraft sector.

- Today I wish to enlarge this argument, again from an European point of view and mainly in the optics of the military employment of this aircraft within the land forces environment.
  However my examination will also include some aspects of the use of the tilt-rotor by other Services and by civil operators.

- I realize that my paper does not contain new things technically and operationally speaking; never the less I hope that stressing new solutions and possibilities for improving the operational effectiveness of the European NATO forces into the aeronautical field, there could arise new options both from military and industrial side.
  Another purpose of this paper is the attempt to put in a real and balanced perspective the alternate aerial means for the land forces airmobility in order to avoid two possible negative consequences from the appearance at the horizon of a new and advanced rotorcraft:

  - or the underestimation of the new possibilities offered by the new machines;

  - or the understimation of the present generation rotorcraft, posponing reinforcement and improvement programs that are necessary and possible since today.

- It is a matter of fact that the time is rapidly approaching that new configuration rotorcraft will be available for both civil and military uses.
  After many years of studies, experiences and tests on how to improve on the phisical and inherent limitations of the conventional helicopter whilst retaining its typical and unrenounceable performance for vetical take-off

and landing and hovering, we have under our eyes the reality of the already tested formula of a tilt-rotor convertiplane.
In fact, following the experimental XV-15 BELL aircraft, the on-going program launched by the U.S. Defense for the V-22 convertiplane, demonstrates confidence that such an aircraft will allow a substantial improvement in the operational effectiveness of the Armed Forces,whilst the Aeronautical Industries envisage also a practical and convenient employment for civil uses.

- Moving from this concrete fact, my exposition will proceed along the following points:

  . the airmobility: its operational meaning, its necessity, how it can be implemented;

  . means for airmobility: the present situation and the new perspectives;

  . evolution of the military requirements;

  . how new requirements can be met;

  . the military employment of the convertiplane;

  . how helicopters and convertiplanes will be coexisting in the nineties and beyond.

THE LAND FORCES AIRMOBILITY

WHAT ?

- The airmobility is the capability of a Modern Army to employ its own aircraft for performing by Air essential duties not otherwise performable using conventional surface and aerial vehicles.

- Today the Airmobility is no more, as in the past, a complementary capability of Ground Forces, but has the same level of importance of the other capabilities provided by traditional vehicles and armament systems.
  A modern Army without the direct control - in terms of organization, management and employment - of the aircraft, would suffer serious limitations in performing its roles.

- I want only list the range of the tactical employment of the land forces aircraft:

  - command, control and liaison;
  - aerial reconnaisance and security;
  - aerial resupply;

- aeromedical evacuation;
- movement of troops and equipment;
- fire support against point and area, hard and soft targets.

- Furthermore, the Airmobility allows the Ground Forces to give an increased contribution on peace time to national problems as natural disasters, integrating the State planning and organization.
  In this frame, the inevitable high cost for implementing the Airmobile concept, becomes an useful investment that would be easily accepted by the public opinion which is generally against the continuous growth of the military budgets.

- Tactically the availability of a modern Army Aviation allows Ground Commanders to extend the operational capability implementing the classic war principles:
  " maneuver, mass, surprise".
  In fact, thanks to the capability to rapidly deploy troops and supplies, it is possible to move ground units according to the situation (maneuver), to regroupe them, at the right place and on the right time, for obtaining the requested strength level (mass) and to attack the enemy from unespected directions (surprise).

WHY ?

- Airmobility is a luxury or a high priority exigency?

- I think and hope that it is no more necessary to demonstrate that a modern Army is incoceivable without adequate airmobile potential not because it is an attracting aspect of the Armed Forces modernization, but for a series of good reasons.

  . First of all, taking into account that the worring superiority of the enemy forces shows now a tremendous airmobile potential in terms of helitransport and helicombat in different forms, anuling the only present superiority of the conventional forces from NATO side.

  . But there are other not negligible aspects of the importance of the Airmobility such as:

    .. Airmobility as force multiplier factor
    .. Airmobility as the only possible solution of the logistic problems.

  . The continuos growth of the cost for maintaing the Armed Forces and the General reluctance against the military expenditures, make very difficult, if not impossible, to combine the operational effectiveness of the Ground Forces - in quality terms - with the quantity

level necessary for facing the potential threats.
The Airmobility can provide a solution. In fact some highly specialized units particularly equipped and trained, provided with aerial vehicles, could represent very precious reserves to be employed for performing assault operations or for reestablishing the situation, should the enemy pressure cause breakthroughs in the defensive lines.
Furthermore, an airmobile fire support, mainly with antitank capabilities, would integrate or replace the surface armament systems when they are not sufficient or not available in critical situations.

. Many negative factors could hamper or disturb the more accurate logistic planning.
Enemy interventions against supply lines, refugies crowding the roads, units dispersion, increased distances due to fast advance of the units in case of successful results of their actions: all these aspects require an extremely responsive, flexible and adequate logistic support that can be provided only by air transport capability.

- If all these reasons were valid in the operational scenario that was the background for the configuration of the conventional forces - that is the potential nuclear option - the perspective of "zero-zero option" will require a different and certainly higher consideration of the importance of the conventional forces.

- In this frame there should be obvious that an increased airmobility level of the ground forces would be one of the most important factors for improving the operational effectiveness of the ground forces.

HOW ?

- If the land forces airmobility is the capability and the possibility of a modern Army to employ its own aircraft, according to Mr de La Palice, that means that the Army must have aircraft in adequate number and variety and in an adequate organization.

- Although in some Countries there still are controversies about the management of the aircraft that operate in favour of the ground forces airmobility, the Army Aviation is widely considered the appropriate organization for translating into reality the airmobility concept.

- Within the Army, the Army Aviation must be inherent part of the structure with men, aircraft, logistic support and direct command and control.

MEANS FOR AIRMOBILITY

- The story of the modern Army Aviation started during the Second World War using light fixed-wing aircraft.

- Although those romantic fabric-coated airplanes accomplished very useful missions, mainly for artillery service, observation and liaison, only the helicopter allowed a real jump of operational effectiveness and now is considered the only eligible means for the employment by the Ground Forces in the frame of the "Airmobility Concept". The main characteristic of this aircraft is its capability of hovering and to fly at very low speed at the point that it can be pratically considered a "Ground Vehicle" able of moving without touching the terrain, but taking advantanges from the terrain features, in tactical situations, for achieving protection and surprise.

- The inherent flexibility of the helicopter allows different and apparently contrasting uses of the aircraft, as an example, from the medical evacuation to the fire support.
  However different categories of rotary wing aircraft comply with the users requirements, whilst dedicated versions are necessary for particular missions that require the best harmonization of operational equipment, performances and protection features in order to achieve the highest effectiveness level.

- The helicopter has gained its essential role either in support of ground combat activities performed by different elements of the various committed military units or in certain specialized units such as Air Cavalry, which operate with full and responsible operational autonomy.
  This role is being implemented within the framework of military operations where rotary wing support is not only beneficial, but essential from gathering intelligence to fire support, to all forms of warfare and logistic mobility: liaison, transport, medical evacuation etc.

- In Italy we have a very old proverb: "the appetite grows eating". In other words, the more you eat, the more you are hungry.

- That occurred when the capabilities of the rotary-wing aircraft initiated to be understood and appreciated.

- Requirements became wider and more stringent beyond the actual performance of the helicopters, pushing the technology for obtaining more capabilities.
  In fact, from a simple and limited transport platform, the helicopter became a sophisticated weapon system able to directly partecipate to the combat.

- But the user's requirements were not yet satisfyed: looking with a certain degree of envy at the fixed-wings performance, they require more speed, more range, more agility and manoeuverability, much beyond the phisical limits of the helicopter.

- Presently the airmobility panoply shows a great range of solutions and situations in quality and quantity terms. I want not to repeat what I presented last year at the Garmisch Forum. For those which did not attend the Forum or did not read the paper, I can summarize the situation as follows:

  . from WP side, there is by force a sort of standardization, with huge capability to performe tactical and logistic heliborne operations, expanding the threat from the front to the rear areas of the NATO forces deployment.
  Helicopters are increasing in number and improving in quality. New attack and anti-helicopter helicopters are entering service - Havoc and Hokum;

  . from NATO side, two quite different situations:

    .. the US Army with an actual and effective airmobile potential in terms of transport and combat capability (remember: almost 14 helicopters for each 1000 men; hundreds of tactical transport, medium transport and heavy attack helicopters are available at Corps level);

    .. the European Armies, with a scarce airmobility potential (from almost 4 to 1.7 helicopters for each 1000 men), without a common helicopter policy, with only a valid light anti-tank helicopter close to enter service, but with a clear attitude to vaste financial and human resources for inventing the wheel or the hot water.
    Last year MARK LAMBERT on INTERAVIA wrote: " How hard it is to be Eurpean! " The statement does not deserve demonstration in the helicopter field.

- I'm sure that this high professional audience is well informed about the present helicopter situation in technical terms.

- Besides aging machines, new aircraft are in service or close to enter service, while new programs are announced for the nineties.

- But they always are helicopters, with better performance than those of the previous generations, never the less confined within the inherent limitations of their formula.

- How go beyond the speed and range limits still retaining the unrenounceable performance to vertically take-off and landing and work in hovering?

- We'll give a look later to the possible solutions, in the mean time let us consider how the user's requirements are changing.

EVOLUTION OF THE MILITARY REQUIREMENTS IN THE AIRMOBILITY FIELD

- The evolution is a consequence of two strategic and one tactic aspects.

- The General ROGERS, former NATO Forces Commander, gave his name to a doctrine that, in the various aspects of the future air-land battle, stresses the importance to operate against the enemy second echelon forces as the only possibility to balance his numerical superiority that otherwise would allow him to aliment without interruption the frontal attacks.
  In this perspective, the land forces airmobility could play a preminent role but, as I said before, the present rotary-wing aircraft show limitations that cannot be overcome just for the more necessary performance: speed and range.

- Another new strategic aspect influencing the evolution of the military requirements is the possibility that imprompt conflicts arise in different areas than the typical NATO European theater.
  Consequently the Continental Countries should be ready to intervene both inside and outside their territories with quick reaction forces whose effectiveness will greatly depend on the sense to be given to the adjectif "quick": that is in terms of hours or days.
  When the action is beyond of the operational range of the helicopters and if the deplacement of the unit should rely on conventional aircraft,the summation of the partial times (from gathering the troups on the airfield to the disembarkment on another airfield,more or less distant from the engagement zone), will show that the surprise and the timely intervention would certainly not characterize the action.
  Furthermore, when engaged, they could not relay on the necessary airmobile support in terms of information, mobility, fire and logistical support.

- The third aspect characterizing the evolution of the land forces requirements in the airmobility field,arises from tactical situations where countermeasures against enemy airmobility shall be found.

- The air-to-air combat between helicopter is becoming a fashion subject for press articles but also for more concrete experimental activities.
  It seems that the best helicopter countermeasure is another helicopter adequately armed.
  Really I don't Know if air-duels as in the first world war have to be envisaged in the future. If so, the aircraft should have agility, manoeuvrability, speed and acceleration capabilities much more than the present helicopters can do.

- Another aspect and probably the most realistic one of the tendency to change the operational requirements in terms of airmobility, could be envisaged for what the close air support to the ground combat is concerned.
  I'm not discussing here if this support must be under the direct responsibility of the Army or shall be always provided by Air Force.
  It's a matter of fact that many doubts exist that this activity can be performed in the future by conventional aircraft considering four negative factors:

  - enemy air superiority;
  - the possible interdition of the air bases;
  - the weather limitations;
  - the never completely solved problems for the coordination of the air interventions with the surface action.

- From this point of view I don't understand why vectored-thrust aircraft like the Harrier are not more largely adopted.
  However the possibility exists that also the close air support will be definitely assigned to VTOL aircraft better performing this role than the present VTOL/jet fighters for which the capability to vertically take-off and landing is pratically limited to the initial and final phases of the mission.

- It appears evident from this new strategical and tactical scenario that the military operators are waiting for a new answer to their changing requirements.

MEETING THE NEW REQUIREMENTS

- In few words the new requirements can be condensed in this concept " we want both the fixed-wing and rotary-wing performance. We want speed, range, acceleration, agility, manoeuvrability of the airplanes, but we want also to take-off and land vertically, to stay in hovering without limitations for many purposes such as lifting external loads, recovering people in search and rescue missions, firing weapons from stand-off positions, flying nap-of-the hearth among terrain obstacles".

- Different possibilities have been studied and experimented, with the definition of two pratical solutions:

  - maintaining the use of the rotor but overcoming its inherent limitations;

  - combining the effectiveness both of the rotary-wing and the fixed-wing.

  The first solution or, to say it better, a group of solutions consists in :

  - counter rotating rigid rotors with additional thrust given by an ad hoc engine. This the ABC concept experimented by Sikorsky;

  - a very sophisticated control of the aerodynamic flow around the blades that can operate both in rotary-wing and in fixed-wing mode. This is the X-WING concept under development by Sikorsky.

  The second solution, that is the rotor/wing combination, can be obtained in two ways:

  - the rotor is active during the vertical take-off phase and progressively reduce its effectiveness up to full autorotation, while the wing reachs sufficient lift with the speed given by conventional propellers. The contrary happens during the deceleration, hovering and vertical landing phases. This formula, although successfully tested, was abandoned because of the difficulties given by the aerodynamic resistance and flutter phenomena of the autorotating rotor;

  - rotors giving both the vertical and orizontal thrust having the possibility of rotating,indipendently or together with the engines, at the tips of the wing.

  In a general trade-off of the advantages and disadvantages, the last solution - denominated TILT-ROTOR - is presently considered the most convenient under the technical and operational point-of-view.
  The tilt-rotor convertiplane allows speed exceeding 500 Km/h and operational ranges up to 1500 Km. The real jump in performance is evident in respect of conventional helicopters, still retaining the capability not only to vertically take-off and land, but also to operate in hovering according to the particular requirements of the operators.
  Continuing this presentation, speaking of convertiplane rotor-craft, I will only refer to the tilt-rotor configuration, although I'm sure that in future this will not be the only pratical solution for meeting the previously described requirements.

- I'm speaking here about the military application of the tilt-rotor concept but marketing studies indicate that also civil applications can be envisaged provided that a series of timely activities be performed for facilitate the introduction of this new aircraft into the civil aviation field.

- The requirements of easier, faster, more comfortable and more available communications on short/medium distances is continuosly increasing.
  The long distance connection is not a problem. The modern airplanes, although operating at subsonic speed, offer good possibilities in connecting distant countries in an acceptable number of hours, covering thousand of miles. The traveler accepts this situation but he does not accept and considers absurd wasting time, getting involved in difficulties and feeling uncomfortable for a few kilometers trip, having thus to add to the flight time, hours for reaching the airport, for departure procedures and for reaching the focal point of the destination.
  As an example, we can fully accept the twenty hours flight from Rome to Shanghai, but one becomes very nervous to spend in total more than three hours for a fifty minutes flight between Rome and Milan, which are distant only 500 Kilometers!.
  But there is another potential sector of the air traveler market offered by the towns of growing economical importance that do not have suitable airports for air connections. Space and /or financial constraints may prevent the solution of this problem. Without suitable aeronautical infrastructures for the employment of conventional aeroplanes, these towns are destined to remain isolated.
  I only mention the oil platforms and the executive flight sectors as other possible applications.

- But technical and economic favourable perspectives are not sufficient to ensure optimism on the expansion of tilt-rotor employment in the civil market, unless a series of measures are not quickly taken outside of the Industries' competence and responsabilities.
  The tilt-rotor is a new aircraft and although it is a relative of both the fixed-wing and the rotary-wing aircraft, the Authorities responsible for the civil certification will not issue any licence without serious and complete tests. On the other hand the same Authorities shall previously determine the standards which the aircraft shall comply with. If that is not defined in due time, it could happen that a flightable aircraft would not be utilized for a long time.
  But this is not the only problem, and probably not the most important. Presently the activity of the helicopters inside towns is marginal. Authorities are reluctant

to authorize the establishment of heliport facilities both for safety fears and for the consequences of an increasing helicopter activity mainly in terms of noise level.

- These and other problems should be solved at least during the development phase of the new aircraft although they are presently conceived for military cases.

MILITARY EMPLOYMENT OF THE CONVERTIPLANE

- Because of my previous military experience I would prefer to remain in the Army airmobility field. Nevertheless the growing importance to jointly consider the problems of the different Services in order to find concrete solutions with evident benefits in economical and gestional terms, allows me to examine all the military potential of the convertiplane.

- Of course I will discuss this aspect of the future employment of the tilt-rotor convertiplane as a natural evolution of the enormous possibilities offered by the helicopter to the military operations.
  I don't think necessary to demonstrate again that the helicopter has given the full demonstration of its potential in the ground forces operational environment although the formidable support given to the naval operations must not to be understimated: in fact, mainly for the antisubmarine warfare, the helicopter is now an unreplaceable weapon for the ships.
  For the Air Force the helicopter plais a complementary role, considering that the istitutional missions of the Service are normally performed by quite different aircraft.
  But for the Army the helicopter was more a revolution of the operational concepts than an evolution. In fact, the possibility to directly exploit the third dimension for performing missions not otherwise possible using other conventional air or ground vehicles is really a new aspect of the Army.
  The importance of the Airmobility concept is under our eys if we consider how much the modern Armies rely on their airmobile forces, thanks to the technical progress of the helicopter, for their operational effectiveness.
  Nevertheless the entire potential of the airmobility concept cannot be completely utilized because of the inherent phisical limitations of the conventional rotary-wing aircraft mainly in terms of speed and range.
  In fact, if we try to image some possible aspects of a hypothetical future conflict, we can figure that the land operations could be developed with new dimensional parameters that are outside the present helicopter performance. In other words, the airmobility should be

available at two different levels:

. at short range, in the normal area of deployment of the ground units,let's say within a range of about 300 Kilometers;

. at long range for the extension of the defensive capability in terms of quick reaction, intervention against second echelon forces, rapid deployment of troops for balancing critical situations.
In this slide , there are schematically indicated the possible utilizations of the convertiplanes in support of ground operations.
In the past and also presently this type of long range operations requiring the utilization of air vehicles, was and is by force limited to the conventional air transport by conventional aeroplanes,while for assault force the only possibility was the employment of paratroops limited in number and with critical perspectives to succeeding in their action if at least the tactical surprise was not achieved.
As an example, if we consider the need of a rapid concentration of forces at a distance of about 1000 Kilometers from where they are located, today an operation of this type, after the necessary agreements between the ground forces and the air forces, would require not less than 4-5 hours considering the time necessary for moving the troops to the airport and, after the landing, for reaching the engagement zone.
By convertiplanes the time would be reduced to about two hours because the troops would be directly embarked where they are stationing and directly disembarked very close to the engagement zone.
With the perspectives given by the employment of tilt-rotor convertiplanes we can say that the improvements in terms of operational effectiveness given by the air mobility will become a permanent and inherent capability also for long range and fast operations.

- Having in mind this envisageable operational scenario, we can anticipate that the future needs for such a type of aircraft would be related to the following requirements:

. troop transport at platoon level or corresponding material weight, as a priority;

. eventually troop transport at lower levels with also multirole capabilities for other support missions, fire support included.

The slide shows the possible evolution of the fleets of the European armies in the next decade and beyond.

- At this moment I cannot figure if also dedicated combat tilt-rotor convertiplanes, will be developed or if different configuration advanced rotorcraft will be considered more suitable for pure attack purposes, mainly in air-to-air engagements.
  But I guess that the development of a medium and probably a utility type convertiplane can be envisaged.
  In the slide is schematically indicated the possible evolution of the European Armies helicopters and convertiplanes fleets in the nineties and beyond.

- If I have stressed the importance of the tilt-rotor convertiplane in favour of the airmobility of the ground forces, that does not mean an understimation of the role performable by this aircraft within the other Services.
  Navy, particularly, will receive a tremendous support using tilt-rotors for missions presently performed, with limitations, by helicopters or by aeroplanes. Only listing some possible missions we can realize how wide is the field of utilization of the tilt-rotor in support of naval warfare operations:

  . airborne Early Warning, that is long and slow loitering at high altitude, with the possibility to take-off, landing and refueling on any suitable vessel and not necessarily on a carrier;

  . in "air-tanker" configuration for refueling jet fighters or helicopters;

  . the delivery of supplies to the ships both landing on the deck or from the hovering, at long ranges from the bases or from other ships;

  . for the antisubmarine warfare combining the performances of the present fixed wing and rotary-wing aircraft for surveillance, search and attack;

  . for the Marine Corps operations in similar way than for ground troops, for landing assaults, fire support, Electronic Warfare and Command and Control.

- Finally Airforce. Apart the internal exigencies, the Service could find in the covertiplane the excellent machine for performing the institutional role of Search and Rescue and for integrating the transport fleet.

- In this slide there are summarized the missions performed by helicopters in the three Services.

- What about the sizes of the future convertiplanes?
  I'm personally convinced that the Armies will stress the importance o a significant transport capability in terms of number of soldiers or materials: consequently a

"platoon-sized" (about 30 men) convertiplane should be preferred.
However, for the necessary tactical support performed by rotor-craft with the same performance, a certain number of "utility" or "multirole" smaller machines ("squad-sized": 10-15 men) should be acquired at a given ratio with the "medium transport" convertiplane.

- Viceversa, Navy could pratically solve all the operational problems using only the smaller version, with the capability to replace both the present embarked helicopters and the long range patroling fixed-wing aircraft.
Of course the convertiplane would not have the range and endurance of present aeroplanes.
Such as, for example, the Atlantic.
But the surveillance and search missions could be performed by the convertiplanes starting from the ships instead from the land bases, with the possibility to be refueled by the same ships.
However a certain number of medium convertiplanes could be acquired for logistic exigencies and for the Marine corps requirements in view of amphihions operations.

- It's now premature to anticipate the envisageable operational characteristics of the future European military convertiplanes.
However at least three aspects must be immediatly underlined:

  1. the necessity to realize the folding of rotors and wings for making the machines compatible with embarking (Navy) and masking (ARMY) problems.
  On the other hand, although that could appear a secondary problems, we must not forget the peace-time infrastructural aspects knowing that the present hangars of the armies were built for helicopters.
  I think this aspect has to be considered also for civil utilization on heliports;

  2. the already mentioned necessity to take into account since the design phase of the program both the civil and military requirements in order to find solutions accetable by the users without heavy penalizations;

  3. the definition of the mission profiles, mainly by the armies, should consider the possibility to accept for long-range transport missions, the running take-off technique for the maximum exploitement of the transport capability.

HELICOPTERS AND CONVERTIPLANES IN THE NINETIES

- At this point a question could arise about the possibili

ty that the convertiplane could determine the end of the helicopter.
We are convinced that - as long as rotary wing remains the most convenient method for obtaining the vertical lift for take-off, landing and hovering - both helicopters and convertiplanes will be utilized for playing different , although in some cases complementary, roles.
The helicopter has not yet reached the final stage of its technological development. With also moderate improvements of the present performance, it will remain a valid work-horse especially if the overall management costs will be significantly reduced as a consequence of higher availability and less maintenance.
Both for civil and military uses, the transition from helicopter to convertiplane will be justified only if the range and speed performance of the later really will pay in terms of economical or operational (in military sense) redditivity.
Under a military point of view it is envisageable that the Armies will maintain the helicopters for the basic airmobility requirements at all operational levels, acquiring the number of tilt-rotor convertiplanes necessary for operations outside the limits of the deployed units. That will depend on the strategic and tactical concept of each Nation. However the proportion between helicopters and convertiplanes should remain in favour of the former.

In fact, not with standing the imminent availability of this advanced rotorcraft (and in the U.S.A. a program has been already launched), advanced generation helicopters will enter into service by the end of this decade and in the beginning of the nineties, for meeting both military and civil exigencies.
We are referring to the A.129 and EH-101 families. The first one will pratically cover all the basic airmobility requirements, from anti-tank, reconnaisance and armed protection roles, to general battle-field support.
The second one, developed in the frame of an integrated program, will be utilized for naval operations, military tactical and logistic medium transport, and civil uses.

- In front of these perspectives, it can be interesting to give a look at the current development activities in the convertiplane field.
From the "hard-ware" point of view, there is only the already mentioned V-22 OSPREY program launched by the U.S. Defense for meeting the requirements of Army, Navy, Air Force and Marine Corps.
BELL-TEXTRON and BOEING-VERTOL are developing the prototypes: the first flight is expected in 1988 and the beginning of production in 1991.

- But things are moving alsó in the old Continent.
  While the Government are studying the perspectives offered by this new aircraft in both the civil and military fields, many European Industries from the fixed-wing and rotary-wing sector - AGUSTA, AERITALIA, AEROSPATIALE, BRITISH AEROSPACE, CASA, MBB, WESTLAND - have agreed to unite in an ambitious program called EUROFAR, from EUROPEAN FUTURE ADVANCED ROTORCRAFT, in the frame of the technological innovation program called EUREKA.
  Presently the program is aimed towards the civil use of a tilt-rotor convertiplane. But certainly the European Military Staffs will soon consider their requirements against the new operational capabilities offered by the future aircraft.
  Hopefully the interface between the military and civil perspectives should be timely verified for avoiding to start in a direction going too far from the other potential users' exigencies.
  Avoiding mistakes very often made in the past, in this circumstance it is possible to previously verify in parallel the possible civilian and military utilizations of the convertiplanes. In fact the possibility of combining military and civilian requirements should be carefully examined before the actual development of a new aircraft to avoid the realization of a machine in accordance with the characteristics required by only one of the two potential users, that could be reiected or accepted with reluctancy by the other one because his particular requirements have not been met, or indeed exceeded.
  On the other hand, whilst dedicated aircraft, such as jet-fighters or attack helicopters, must take into account without compromises their basic mission, when application can be made of the "utility concept" - and that is the case for air transport in general - it is often possible to harmonize civilian and military requirements with mutual benefits in terms of development and production costs.

- However, apart the envisaged pratical results, the EUROFAR project will certainly produce concrete benefits in the area of new technologies as far as:

  - materials,
  - aerodynamics and flight qualities,
  - dynamics,
  - acustics,

  are concerned.

CONCLUSIONS

The convertiplane appears as a convenient answer to new

requirements expressed from both civil and military sides, thanks to the innovative capability to combine the flight characteristics of the helicopter and the aeroplane.
Presently, apart from the solution offered by the vectored thrust for high speed jet-fighters, the tilt-rotor configuration seems to be the most convenient for obtaining a significant increase of performance in respect of conventional rotary-wing aircraft, in terms of range, speed, and also manoeuvrability and agility.
However the helicopter will entirely maintain its importance also after the advent of the convertiplane, both in the military and civil fields. The two aircraft will play diferent but sometimes complementary roles.
For the Europe a common convertiplane program does represent a chance and a challenge that can not be lost.
It is another opportunity for an european collaboration.
Let'us hope that this time will be a little less difficult to be Europeans!.