

aerospace industry is characterized by a large share of so-called "high-tech" products. In this domain, keeping up to date with technological change is a necessity. In the aerospace industry, the main objectives for technological development focus on

- lowering the operating costs for aircraft;
- protecting the environment;
- improving the performance and manoeuvrability of military aircraft and measures for low radar signature (or stealth); and
- routine mastering of launch technology for space equipment and lowering of related costs.

New Materials

The following summarizes future trends in the penetration of new materials for different product areas in the aerospace industry.

- In airframes (structures and structural material), there will be increased use of organic composite and advanced metal technology products such as the aluminium/lithium alloy.
- In helicopter engines, metal composite parts will be manufactured using silicon carbide reinforced aluminium crankcases, such as for the military helicopters HAP/HAC and NH-90.³²
- In aircraft engines, (i) fibreglass, Kevlar or carbone reinforced (epoxides) will be used for the manufacturing of cold parts (up to 150 degrees celsius) acoustics panels, mazes and so on; (ii) Cerasep (silicon carbide reinforced fibres) will be used in the manufacture of certain hot parts such as turbine engine vanes, made by the Société Européenne de Propulsion (SEP) for the new military M88 engine to be used for the Rafale; and (iii) warm parts (about 300 degrees celsius) will be produced using thermoplastic resins. These developments

are expected to increase the share (weight) of composites in aircraft engines from 2 per cent to 15 per cent in a few years.

By the year 2010, it is expected that in military engines the proportional weight of composite materials will represent 60 per cent, with the compressors made of metal composites and turbines made of ceramics composites (silicon carbide and silicon nitrate), allowing for increased operating temperatures and efficiency.

Avionics

One group of products that should show a marked worldwide increase is that of avionics, which is the generic term encompassing all the electronic systems used in aircraft, engines, missiles, space shuttles and follow-up systems. The demand for sophisticated avionics systems has risen because these systems allow for the reduction of costs at several levels of production and operation. One reason for the increasing emphasis on improved avionics is that they can save aircraft manufacturers huge sums of money during the process of mid-life upgrading of aircraft by avoiding development outlays of entire new airframes. Furthermore, improved avionics allow for more efficient operation of the aircraft since these systems help improve navigation, optimize fuel consumption and reduce workload for the operating crew. In addition to reducing costs directly, avionics permit increased use of test and diagnostic procedures at all stages of management and of equipment and material production. Furthermore, with computerized design and testing, improved avionics allow for reduced delays in the development of new models of airframes. Thus, as the cost of developing new products across the entire aerospace spectrum rises and the development of major new types of civil and military aircraft therefore declines, the demand for sophisticated avionics systems is also rising.

The future trends in the field of avionics can be summarized as follows:

- widespread use of electronic controls in new military and civilian programs;