The bird strike problem from a technical point of view by A Roed,
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Gentlemen, it is a pleasure to have the opportunity to come to the tenth BSCE meeting and talk about bird strikes from a technical point of view.

I shall not bother you with technical details but rather look at the problem in a broad way.

Man's desire to fly like the birds can, as you well know, be traced back to mythology. When he finally succeeded, it did, however, take him a long time to realize that he might meet one of his "bird buddies" in the air - head on.

In the bird strike case, as in many other cases of flight safety, it appears that we must have someone dead before we wake up to realize that something can and should be done before accidents happen. This is true both for aircraft and airport design.

Why does it take such a long time between the discovery of a danger and the technical solution of the problem? The answer is difficult to give, but it is not that the aircraft or airport engineer does not care. Part of the explanation may be found in basic engineering education and in the traditional way of developing airplanes.

First of all, in aviation as in all types of engineering, you need a set of standards to work to. Therefore, for design purposes we use a standard atmosphere with standard pressures and temperatures and standard variations with altitude. In this atmosphere there is no wind, no rain, no snow, no fog, no night, no birds - no operational problems?! It is surprising how little is being taught about practical operational problems in schools and how long time it takes a person in post-school practical work to realize that there is more to aeronautical engineering than basic aerodynamics, basic structures, basic engine design (with uniform air intake flow), etc. Better training in practical problems is required.

Secondly, there is a tendency in aircraft manufacture for the various departments to isolate themselves to some degree. Therefore, you may find designs that are good from some points of view but poor in other respects. A side-by-side design with a large unobstructed canopy may have many advantages as far as flight training is concerned, but it is not a good "bird strike design". There is a real need for people who can handle the total problem area and optimize from more than one or two points of view.

Thirdly, it is not easy to develop a new aeroplane. From the day the configuration is chosen and the manufacturing schedule has been selected until some years past the first flight date you have your time filled with work and problems to solve. Sometimes weeks appear to consist of Mondays and Fridays only. Monday is the day you say: "This new week I will do the job" - and on Friday you think: "Oh, well, we will catch up next week, but what to hell happened to Tuesday, Wednesday and Thursday".

In this environment you must have a very strong argument if you want to do something new or to introduce new basic design requirements. And, you must come early with your suggestions, because after a short time the tools are made and then it becomes extremely difficult to make changes, due to the high costs involved. (To me the time it takes to make tools has often appeared to be unbelievably short - sometimes I think tools are selected before the configuration.)

The question then comes up: "Do you have good arguments for design changes from a bird strike point of view?" Someone may say that you do not. Accident statistics may, for instance, show that the real safety problems today concern human factors and landings (in civil aviation) and that the money for improvement should be invested here. This is not a very good argument. It is better to consider separately the various problems and the cost for their solution. One may then find that the bird strike problem falls in the rather simple design deficiency class, where solutions are not necessarily difficult to find and where the cost of the solutions may be much smaller than the cost of doing nothing. In such a case you have a good argument for design changes disregarding the magnitude of the specific problem in relation to the total safety picture. Contrasting this type of safety problems you may have larger problems that are more psychological in nature, where it may be more difficult to show convincing cost effectiveness in the solution. It is not necessarily the size of the problem that decides when it should be attacked.

Fortunately, the continuous work of dedicated people wears through the resistance to design modifications, and in the bird strike case new and better design requirements are appearing and resulting in improved structures and engines.

However, we both should and can go much further than we have today, both in airport and aircraft design, before we can feel satisfied. There is, for instance, no reason to believe that ongoing canopy research, such as the American bird strike tests at sea level supersonic speeds, will not result in canopy glass that can take any sensible bird strike. Before we reach this goal, we have to solve many optical, glass scratching and glass shatter problems and we have to solve the problem of how to get out of an aircraft (military) with a jammed canopy having an "infinitely" strong glass.

New materials, composites for instance, will emerge that will make it possible to design wing leading edges meeting the combined requirements of high lift, excellent antiicing and good bird strike resistance. The need to do so will increase as the efficiency of leading edge devices goes up and the requirement for all-weather flight with excellent leading edge deicing becomes a necessity. This is a typical aerodynamics-design-manufacture-maintenance-operation problem that must be solved.

However, even if we make the improved designs, we cannot relax the work required to maintain low bird strike hazards in operation, because, even if modern engines can take a very high "bird beating" without disintegrating, we still as a rule have to discontinue the flight and remove the engine for inspection and repair when a bird strike is indicated. This is very expensive, especially in case of a large airplane. There is no immediate hope for damage-free bird ingestion in engines.

Even if we should be able to solve the damage problem, we still have to consider the flame-out problem, especially for smaller engines. The increased use of executive jets and turboprop aircraft at all types of airfields indicates that this problem may increase.

Thus, from a technical point of view the good work must continue. International cooperation will reduce the costs of doing so by making sharing of material development, design methods and test results possible. Also, considerable cost reductions for improved airframe design may be obtained in the future by means of new computerized stress calculations that eliminate the need for bird strike tests. There is still some way to go before high speed flight at low levels is technically safe with regard to bird strikes.