Commentary on SOLAS Ch II, Reg 18, helicopter facilities

To understand these specific SOLAS regulations, one has perhaps to go into the history of how this particular sub-section perhaps came about. We can only assume that this is a leftover from the Falklands War and the erroneous reporting of how '*aluminium was seen to be burning'*. This sensational reporting was subsequently proven to be just that, sensational and without basis. What was burning on the HMS Sheffield was ammunition which had been hit by Exocet missiles and was exacerbated by the liquid rocket fuel missile propellant. Ministry of Defence white papers issued in 1987 cleared aluminium of these allegations but the reporting had had an effect. Even today, we hear this same baseless allegation repeated. Think about it: if aluminium burns, could you pour molten aluminium into castings? Could you wrap chicken in aluminium foil and pop it in an oven? And could racing cars run with aluminum engines and pistons? Aluminium melts at about 650C but it does not burn. It is a classified as non combustible by BS 476 part 2.

The current SOLAS requirements seem to mirror these misunderstandings and the Code says that the lower melting point of aluminium could cause problems if an aluminium helideck is used directly above a ship's deckhouse or similar structure. Meaning perhaps that the helideck could melt in the fire and deposit large quantities of burning fuel into the deckhouse. The Code stipulates that any aluminium helideck be 'made equivalent to steel' if it is to be used in such circumstances.

This is where the confusion starts. There is no prescription as to what constitutes 'equivalent to steel' for a helideck construction. Ostensibly, an aluminium helideck has to resist fire as well as a steel helideck? A little too simplistic actually! We are dealing with a huge, connected structure here and not a small angle bar of aluminium. The thermal conductivity, specific heat and reflectivity of even weathered aluminium is several times that of steel and in any fire scenario, we will find that heat has been channelled quickly into non-exposed parts of the structure and the overall performance of an aluminium structure is as good or perhaps better than steel. There are no hot spots as with steel so that rescue crew can access the helideck fire without having their feet browned off and in all tests that we have carried out over more than twenty years, the aluminium structure remains pristine and unaffected by a surface fire.

In one fire test which was observed by DNV inspectors, we flooded the surface of a flat aluminium helideck with enough jet fuel to cover the deck completely to a depth of about an inch. The fire was allowed to burn for 10 minutes (assumed time for sleeping fire crew to make it to the deck?) and we kept pouring fresh quantities of jet fuel to maintain the fire on the deck . A 5000kg (11000lbs) steel weight with four support leg cross sections of only 100mm(4") square was placed on deck. At no time during the test did fuel burn through the decking and no fire was seen below deck. The aluminium helideck remained in perfect condition and subsequent tensile testing of the worst affected decking showed NO reduction in strength after the fire. Data is available on request.

Interestingly, in a previous test, we had sprayed water to extinguish the fire at the end of the stipulated burn time and found that the tensile strength of the aluminium alloy had actually increased by 5-9% (documented in a Lloyds Register observed test). Therefore, AA6082T6 alloy worked itself up to a T7 or T8 temper because of the heating and subsequent water quenching. Another point to remember and which we discovered in fire testing is that a connected, welded steel plate will heat up uniformly and very quickly. But aluminium helideck surfaces are made up of interlocking double-hollow extrusions of between 250-500mm wide, which are interlocked through a very small tongue and groove arrangement with special insulated sealing tape and which therefore considerably reduces the surface area for heat transfer to adjacent deckings. Heat will tend to travel in straight lines but along the affected deckings and not across the deckings. So, you can stand on an aluminium helideck immediately after the fire because the surface cools very quickly.

The other interesting result of extensive fire testing over the years was a realization that the greatest risk in helicopter crash and burn situations on a deck is not the prospect of burn through but the threat of the fire over-running the deck. In some tests, the wind whipped up fuel enough to cross 100mm high coamings and flowed, freely burning, over the side. And the wind speeds on those test days were in the region of 20kmph! No gutter is going to deal with this problem in high winds except maybe a meter wide one with half meter walls which is quite impractical. The only practical way of dealing with this situation is to use an XE Enhanced Safety helideck which will eliminate the fuel by draining it off instantly.

DNV scenario testing in progress. You can see the 5mt weight on deck and the feeder tubes for fresh fuel injection. There is no fire under the helideck even though everything appears to be on fire. The fire seen here has been whipped over the deck sides (4" high) by a fresh wind of less than 10knots. This is the greatest danger in a crash scenario and not whether the deck is made of aluminium or steel or concrete.

With an XE Enhanced Safety helideck, dealing with jet fuel fires is child's play

Burning fuel is quickly drained away thru the perforations on the XE Enhanced Safety helideck. This photo is taken moments after a major fire on a safety helideck and you can see from the 'civilian' footwear that the heat from the fire has not heated up the surface appreciably.

Need more confusion? Here it comes. Flag authorities will approach Classification Societies to ensure that the Code is followed for 'steel equivalency' and Classification Societies are in a bind because there is no uniform test for this. DNV have devised a fire test to test if a structure can be considered equal to steel in a helideck situation but none of the other Classification Societies seem to have such a test.

The SOLAS rules, and rules from related Rule Organizations such as the USCG are currently the only regulations which have any specific policy on aluminium helidecks. The UKCAA CAP437 standard "Offshore Helicopter Landing Areas", largely seen as the bible of the offshore aviation community is a 138 page detailed document on the use and design of helicopter landing decks, is rendered somewhat feeble by that single debilitating paragraph in SOLAS above.

To summarize: SOLAS reg. 18-2 says that it has no problem with accepting the use of an aluminium helideck in a cantilevered situation. However, it is concerned if the helideck is directly above an accommodation unit or similar structure and needs the aluminium helideck to be 'equal to steel'. If this 'equal to steel' rating cannot be met, then there are additional exacting conditions which must be satisfied. These include that the deckhouse top shall have no openings and that windows underneath shall be provided with steel shutters. These additional conditions are onerous enough to make aluminium helidecks unattractive to intending users.

SOLAS Reg. 18-2, para 3.1 also stipulates that "if the helideck forms the deckhead of a deckhouse or superstructure, it shall be insulated to "A-60" class standard". This deals with cases where the living quarter roofs are simply stiffened to create a helicopter landing deck. Unfortunately, or fortunately depending on which side you happen to be on, this low-cost practice not only died out many years ago but is frowned upon by Civil Aviation Standards such as the Norwegian and UK CAP437 which specifically call for an air-gap between any slab sided structure and the helideck above it, to reduce unwanted turbulence from eddying heli-rotor downdrafts. The current practice is to allow at least a 2m clear airspace between the two and therefore this paragraph has little relevance today.

Additional information about fire and aluminium and helidecks:

a) Aluminium helidecks are generally made of marine grade, high strength aluminium alloys with tensile strengths exceeding or equalling steel. There is no fire rating required for a helideck, as the reader is probably aware. If a fire rating is required, the usual route is for the customer to carry out a hazard analysis and if the helideck is viewed as needing fire-protection, Chartek or similar intumescent coating is sprayed onto the underside of the deck. This holds good irrespective of whether the helideck is aluminium or steel. The only difference between the two is the thickness of the Chartekwhich depends on the base material.

b) Steel melts at about 1500C and aluminium at about 650C but these absolute figures are misleading. Aluminium has a thermal conductivity of about 4 times steel and a specific heat capacity of about double steel. It has a reflectivity index of upto 19 times steel and that is even the case for weathered aluminium. This allows fire containment by reflectivity. Taken together, an aluminium structure has a thermal efficiency factor which is much better than steel; meaning that its ability to handle heat and fire is better than steel and in any given fire situation, it is too simplistic to assume that the aluminium structure would melt first. The helidecks we build are not of plated construction but complex hollow sections and I-beams of considerable thickness. The heat input required to make a structure of this size unusable would mean that a similar helideck in steel would be rendered similarly unusable.

c) Taking this thermal efficiency into account, it is useful to note that these grades of aluminium lose about 50% of their tensile strength at 1 hour, pre-soak temperature of 230-250C. For steel, the corresponding figures are about 450C. Since aluminium has a lower modulus of elasticity than steel (about one third), deflection governs the design in aluminium construction. Since the tensile strength of the alloys we use is about the same as mild steel, this gives a safety factor, in terms of allowable stress, for aluminium, of about twice that of steel. This safety factor is of course meaningful in fire situations since it means that the integrity of the structure is less easily compromised.

d) A helideck is not viewed as an escape facility in the case of a major fire engulfing it. To land on a helideck which is threatened by fire would endanger the life of the crew. In addition, at the temperatures at which the aluminium alloy loses half its tensile strength (230-250C), no human being could survive on its surface, irrespective of whether it is steel or aluminium.

To summarize the fire issue in simple terms: either you have a fire on top of the deck or below the deck. The XE Enhanced Safety helideck deals with a surface fire better than any steel or other type of helideck does, as explained above. If you have a fire below deck, then the thermal response of steel or aluminium cannot be assumed merely by the extrapolation of generic data relating to small shapes in furnaces. If the fire is of a minor nature, it will not affect either type of deck. If it is a major fire, then it is impossible to predict which type of helideck will suffer most. At the temperatures at which aluminium loses half its strength (230°C/480°F):

1. The surface and ambient temperatures would be too hot for human access, whether steel or aluminium, so evacuation thru the helideck is not feasible

2. There would still have be sufficient reserve in the structure to handle dead loads.

3. Good recovery of strength occurs when the source of heat is removed

There are well over 1000 aluminium helidecks in use in marine and offshore vessels (we have built over 400 of them), platforms, FPSOs and jackups and the number grows by over 100 helidecks each year. Aluminium helidecks provide a low maintenance, low weight and cost effective solution and will continue to be attractive to owners for these reasons. They are also environmentally sound as aluminium is fully recyclable (recycling only uses about 5% of the energy of the original creation) and the reduction in weight leads to reduction in engine emissions on MODUs and other vessels. Both our XE Enhanced Safety and XD Standard aluminium helidecks have been tested to be equal to steel in accordance with DNV test procedures. It is time for some amendments to this Code to remove this ancient paragraph from the SOLAS regulations.