History of the Tempest Chapter 2
By Keith Manion

“A new modern concept two man racing keelboat with spinnaker”

The IYRU was not content to allow world yachting, and particularly Olympic yachting to stagnate in the 1960’s. Of particular concern was the perceived obsolescence of the Star and most of the other International keelboat classes. Most were old fashioned designs, built of old fashioned materials. Most were displacement designs. In particular, these yachts featured timber hull construction and typically, timber spars. A particular problem not limited to the Star was that wide building tolerances were usually permitted, which allowed for substantially different hull shapes to remain legal. What was needed was a modern fiberglass **true one design** yacht that did not carry the accumulated baggage of the established classes. What was wanted was something closer to the high performance dinghies like the Flying Dutchman and 505 which, in those days, excited the sailing world in the way the B18 and 49er did in the 1990’s. Accordingly, in 1961 the IYRU set up a Committee to look at the problem.

At only 910 lbs., the International 110 could be craned out and trailed behind –yes, even a TR3A! Given the propensity of most early TRs to overheat, it was advisable never to stray too far from water.

The Committee’s first task was to determine whether any of the existing classes would be suitable. Around the world there were a number of two man keelboat designs, a few of which had international status. Two boats in particular- the International 110 and the Flying Fifteen were both capable of satisfying an international demand for a fast 2 man keel boat. However the 110 was a 1939 Ray Hunt design which, although fast, was of simple box like sectional shape, being a slab sided, hard chined, flat bottomed double ender. It did not impress the 1960’s imagination as being “modern”.

International 110s

Many boats, but particularly the Flying Fifteen, had building tolerances which had led to rapid obsolescence of hulls after they were beaten by a better shaped hull. The economic situation after World War II, particularly in England and Europe, was that many small boat designs had to be capable of being built by the home builder as many had insufficient money to purchase a new yacht- or even a new hull and deck. Generous

building tolerances were therefore allowed. Moreover, with the construction of any timber yacht errors could creep into the construction, so tolerances were essential.

Typical minimum tolerances in many classes could be up to + or – ¼"- giving an effective tolerance of ½", but sometimes far greater tolerances existed- or could be created by careful reading of the rules. These tolerances were essential to allow honest home builders to register their boats where building errors had crept in. The skillful and the professionals were soon able to exploit these tolerances to increase waterline length, reduce rocker or otherwise manipulate hull shape in the quest to develop faster boats.

This problem still plagues Flying Fifteens despite considerable tightening of the rules within the past 15 years, and Stars were particularly renowned for it. Not all see it as a "problem", as wide tolerances allow for continued development and improvement. It is only a "problem" from the perspective of one who wishes to ensure equal and level racing without a need to update the hull periodically.

Flying Fifteen's swept back keel. Uffa Fox theorized that most of the work was done by the leading edge of the keel, so he simply deleted what he considered to be unnecessary. Unfortunately Flying Fifteens do not point particularly well compared with more recent designs.

As an example, in the 1980s an Australian builder of Stars cut the hull mould in half about amidships, straightened the bottom out and re-faired the mould to produce hulls of substantially reduced rocker and increased waterline length. The hulls still measured as legal, as the builder was able quite legally and properly to exploit the class measurement

regulations to produce what his customers wanted- a faster hull. The disadvantage to owners of earlier hulls was inevitable.

The Swallow at 26 feet was simply too big. The Flying Fifteen was too small and not powerful enough. The sail area was so modest that if a trapeze were fitted, lightweight crews would benefit disproportionately. Neither design was really modern, the Ff having its roots in pre-war dinghy design. Nothing else was found to be suitable. It was always considered a basic tenet of the exercise that the suitable class would be strictly one design, with the idea that a crew in, for example USA could simply fly to Europe with only their sails , take over an identical hull and be competitive. Strict one design of hull form was the basis of this approach.

In November 1961 the IYRU's "Class Policy and Organization Committee" announced that there was "***an immediate need for a new modern concept 2 man racing keelboat with spinnaker***'. The Committee spelt out no specific or general design parameters at this stage, other than the motherhood statement that it must be a "modern concept" boat- whatever that might encompass.

The Committee also announced that it intended to select the new class by the end of 1964 and that it was intended to propose the boat for selection in the 1968 Olympics. Nothing could have been more certain to raise the ire of the ISCYRA.

Jack Knights, writing in **Yachts and Yachting** in September 1962 referred back to this announcement and wrote:

> "This is important...and not only important, it's urgent .Now is none too soon to be designing the prototype".

He clearly agreed that a modern 2 man keelboat was urgently needed. But what was meant by a "modern concept" boat? Jack raised the general question of what type of boat was wanted, without proffering any answers himself. "Do we want to sit in 'em or on 'em?" he headed his article. He finished it by cautioning that the new design must be "a boat for the World. From St. Tropez to Leningrad, and Sandringham and Sydney…".

The issue was plain enough: was the new boat to be an overgrown performance dinghy, or was it to be more oriented towards the true keelboat end of the spectrum – a boat you sat in, not on.

The last time the IYRU had called for designs for a new international class was in 1952 when the Flying Dutchman was selected, in 1954, after over 18 months of trials and prevarications. The FD narrowly beat the 505 and the Osprey for selection, although on the water the 505 won the final trials in 1954. The mechanics of the selection were such that , initially, a design competition was held whereby paper designs were submitted. Following this, boats were built and raced in a series of races, which the selection panel deemed inconclusive. Thereafter, two further series of selection races were held, the

entire process taking around 18 months. One of the features of this process was that it allowed designers an opportunity to modify their designs to incorporate improvements. An example of this was that several designers adopted the trapeze from the Osprey- Ian Proctor's design. Proctor invented the modern trapeze, although he modestly and self-deprecatingly referred to it as a "development" of an earlier concept. That concept was known as the "bell rope", tried out in the 1930's by a man who was to become famous in Tempest circles: Beecher Moore. He tried it on a Thames Rater and found that it helped keep the boat flat for short periods, but as the crew was supported simply by holding onto a knotted rope attached near the hounds, crew endurance was a severely limiting factor. The Osprey also featured an overlapping genoa as well as a jib. Several designs adopted the trapeze, and the Flying Dutchman adopted the genoa for the final selection series- and went a lot faster as a result.

It was with chagrin that Proctor found his design features had been pinched by his competitors, and that his Osprey was beaten by one of them in the Selection trials. This had a profound effect on Ian Proctor's tactics in 1964 and 1965.

Ian reacted to the 1961 IYRU announcement by designing what he thought would be the type of small 2 man keelboat best suited to meeting the world's needs. He thought in terms of a significantly smaller boat than the one the IYRU eventually called for in 1963.. He thought in terms of a boat which was a clear development of the Osprey. This boat was the Peregrine, the true predecessor of the Tempest.

The Osprey

The Osprey design was originally drawn in the early 1950's. It was designed for the 1952 Olympic Selection Trials along with several others; including the Hornet, the Flying Dutchman and the Coronet (the 505 of today). The Flying Dutchman was chosen and gained its genoa from the Osprey in the search for extra speed after being beaten in the first round by the Osprey. It also copied the Osprey and added a trapeze.

Osprey's principal dimensions were:.

LOA:	17ft 7ins
Beam	5ft 9ins
Hull weight -	134kg minimum (295lbs)
Mainsail -	100sq ft
Genoa -	50sq ft
Spinnaker -	185 sq ft

The boat has a single trapeze and it can carry a crew of either 2 or 3, with excellent weight carrying capacity. The Osprey remains today a fast and exciting boat to sail. The Osprey's lines were influenced design parameters common in the fast dinghy classes like the National Twelve and International Fourteens in the mid 50's.

Upwind performance was good, whereas off-wind speed was quite exciting in its day, generated by a 185 sq ft spinnaker, launched in more recent times from a spinnaker chute.

The Peregrine

Ian Proctor designed the Peregrine in 1961 because, in his own words, he was

> "intrigued with the problem [of producing a two man planing keelboat] and impatient to see what kind of boat could be produced. I designed and built an 18'6" light keel boat with a fin keel and bulb. The fin was housed in a casing which formed part of a central spine and permitted the keel to be raised when beaching the boat and when trailing.
>
> We had a lot of fun with this boat and she taught us many lessons, particularly as regards rig and confirmation that the keel idea was highly satisfactory-it was adopted ultimately by nearly every boat entered for the IYRU trials" –per Ian Proctor, published in Seacraft November 1965 p 29.

Proctor elsewhere described the Peregrine as a development of the Osprey.

> "At first sight the Peregrine looks similar to a slightly bigger and keeled version of the Osprey, but this is really an oversimplification…..Unusual in a keelboat, the hull has no appreciable overhangs. They add weight, cost and difficulty when trailing and they generally have little place in a light displacement hull of this type

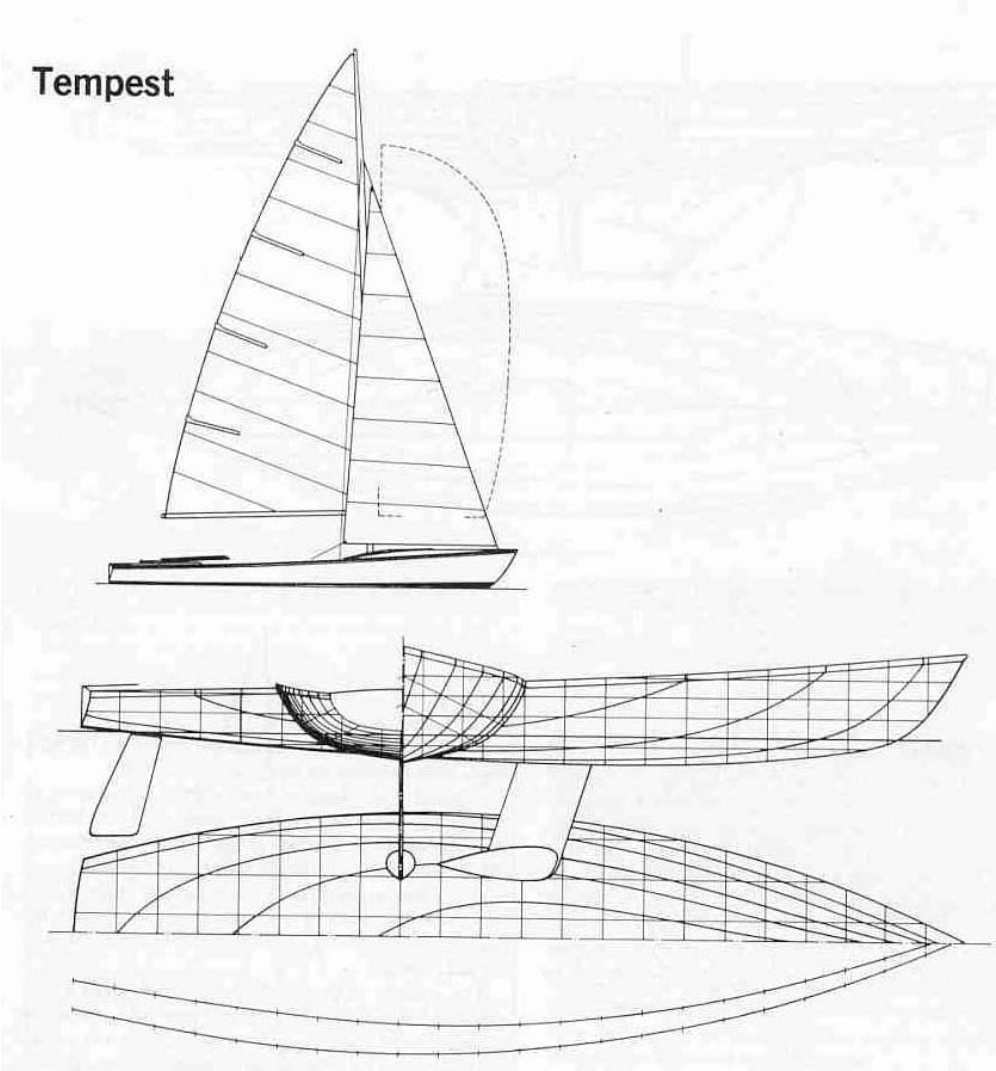
which should be sailed upright dinghy fashion. The Osprey hull, in any case, is generally accepted to be of pleasant appearance." (per Ian Proctor reported in **Yachts & Yachting** 8 Feb 1963 page 197).

The Peregrine was a masthead rig with a 280 sq foot spinnaker, 80sq ft jib and 105 sq foot main. Jack Knights thought this was the first British designed small boat to boast a mast head rig (which became all the rage in the next decade). The keel was, like the Tempests, a raked parallelogram of steel plate which was galvanised and which had a lead bulb. It was fitted to the boat via a ½" wide daggerboard case, and bolted to aluminium or galvanized steel angle at the top of the case, just as the Tempest keel is. Unlike the Tempest the cockpit was not fully decked, and the daggerboard case was similar in construction to most other dinghy centerboard cases, except for the aluminium angle pieces at the top to which the keel bolted.. It protruded above the cockpit floor and was supported at the aft end by a thwart which could house a mainsheet traveler if desired..

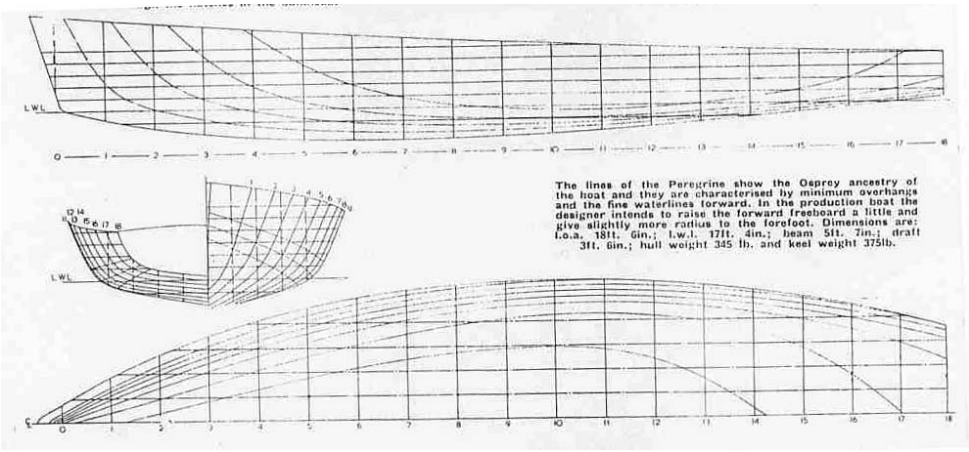
Peregrine specifications:

LOA	18'6"
LWL	17'4"
Beam.	5'7"
Draft	3'6"
Hull weight	345 lb
Keel weight	375lb
Hiking devices	toe straps, trapeze

Jack Knights, who test sailed the boat for **Yachts and Yachting** in a force 2-3 breeze, 'doubted that in International 14 could have held her', although his impression was that she may not point as high. He wrote" We footed through the water at a speed out of all relation to the wind strength". Conditions were too light to allow the use of the trapeze, but Knights reported that in a breeze: "David Dwyer informs me she planes away from a Merlin, and I can well believe it.". This remarkable little boat even had twin plywood berths built under the foredeck, although Knights thought an extra inch or two of freeboard would not go amiss both to give a bit more room for the occupants of the berths and to keep the boat a bit drier, as it tended to take a bit of slop over the bows (not surprising considering the abbreviated forward overhang and concomitant reduction of buoyancy). Overall, he was of the view that Peregrine would certainly be faster than a Flying Fifteen.



Peregrine



Comparison of the Peregrine's lines to those of the Tempest reveal remarkable resemblance: particularly in the sectional views. Both boats have similarly slack bilges, similar forefoot and a long flat planing run aft. The squared off bow of the Peregrine is

the most striking difference, but this is mainly cosmetic and the lines reveal very similar underwater hull forms. Interestingly Proctor always maintained the Tempest was designed to sail well at 15 degrees of heel, but in the comment quoted above he said hulls such as the Peregrine were designed to be sailed flat. Experience has shown that 15 degrees of heel in a Tempest is slow, and that 10 degrees is about as much as one can manage and be competitive.

IYRU's Challenge

In 1963 IYRU finally released its design parameters. In 1963 Proctor had acted as a technical advisor to an RYA committee on the subject of the design parameters for the new international 2 man keelboat, which made submissions to the IYRU. He thus had substantial input into those parameters, as he attended the IYRU Technical Committee meeting in Belgium which laid down the basic parameters set out below..

LOA	22 ft
Hull depth	44 inches
Max weight	1433 lbs
Working sail area (main & jib)	247sq ft
Spinnaker	240 sq ft
The ends must appear "balanced".	
Hiking devices:	toe straps, single trapeze

By the time the first Peregrine was built, the IYRU had already announced the parameters it required for the new 2 man international keelboat. This called for a significantly bigger boat, with a much heavier keel and greater sail area, and with an unusual requirement that the ends must "appear balanced". Importantly, it also called for a trapeze and spinnaker.

Thus, the Peregrine would not fit the requirements of the IYRU, but valuable lessons were learned by Proctor and the Tempest lines only have to be compared to those of Peregrine to see the pedigree. Apart from the Peregrine's near plumb bow, the family resemblance is striking.

Ian Proctor counted himself fortunate that he had enjoyed a lot of experience in the design of development classes (also called restricted classes) in England: the Merlin Rocket (14 feet) the National Twelve and the International 14. Much of his design experience was gained in these classes, just as more recently the Bethwaite family's experience was gained in NS14s in Sydney (another 14 foot development class but with only 100 sq ft of sail), whose experiences revolutionized (or more correctly, radically evolutionised) modern hull, rig and foil developments. Proctor was able to produce many designs of cheap to build boats, each of which was expected to have an effective racing life of only a season or two before it would be foreseeably rendered obsolete by fresh designs. In this environment he was able to experiment. He was able to learn empirically:

> "One of the most valuable things [I] learned from the long experience of designing for the restricted classes is the effect of each characteristic in the shape of the hull or the design of the sail plan and its relation to the lateral plane. In fact

there exists the benefit of almost constant tank testing of the most reliable kind, as new hulls and sail plans are evolved and then sailed competitively. The design of a racing sailboat is inevitably a compromise seeking to achieve a wide range of performance characteristics. Sometimes that compromise is more successful than at others, but at least an experienced designer will know what sort of dish he will produce from the ingredients thrown into the cooking pot. Designers lacking the competitive performance data on fairly closely related designs such as are found in the restricted classes are almost inevitably at a disadvantage when it comes to producing a completely new type of boat aiming to achieve a very positive type of performance. The Tempest was designed against this background."- per Ian Proctor "**Launching the International Tempest**" published in International Tempest Association 25 year Anniversary publication, at page 18.

Frank Bethwaite in **High Performance Sailing** usefully described this design process in detail. He too used the NS14 class for life size tank testing of various hull models in a range of real sea conditions, and sometimes found to his initial surprise that results in real life conditions were different to tank test predictions. He described how, partly as a matter of empirical trial and error, and of observing not only his own designs but also all the designs of all the competitors, the evolution of the modern "2nd mode" dinghy hull came about: the boat that goes significantly faster than the wind not only in moderate and heavy airs, but which, by moving the weight forward and heeling the boat to leeward, presents an entirely different but still almost symmetrical underwater "canoe" shape of grossly reduced wetted area for very fast light airs performance.

Proctor, using the same types of experiences, succeeded in developing another hull which was astonishingly fast in both light and heavy airs- and in most conditions in between. It's performance approximated the world's top high performance dinghy- the Flying Dutchman-and like the modern "2nd mode" hull, maintained a good and fairly symmetrical underwater shape when heeled in light airs to reduce wetted area. Its downfalls were more in the line of the keel section (disastrous flat plate) and spinnaker size (an IYRU requirement and not Proctor's fault) and- **by today's construction standards,** a very heavy hull (and keel) weight.. An updated Tempest could be a very exciting boat. But by the standards of its day it was a stand-out design, for which Proctor won the prestigious British Design Award and was appointed a Royal Designer for Industry (along with people such as Sir Alec Issigonis , the designer of the Austin/ Morris Mini, and the legendary Uffa Fox).

As it had for the selection of the International 2 man centreboarder, the IYRU again held a design competition in Holland. British journalists complained that it looked like the selection would again be handed over to the Dutch. There remained considerable sentiment that the 505 would have been a more worthy winner than the Flying Dutchman, and the selection trials over 18 months were widely regarded as either a debacle or a fiasco, depending on your perspective and how generous you were feeling. The FD won the initial set of trials which were held in heavy weather and big seas (for which the Osprey was less well suited, as Proctor has stated: …"it was primarily a light airs boat" (Seacraft Feb 1967 p 50)), and were judged to be inconclusive, no doubt partly because

of insufficient variation in conditions. The second set of trials was held in England, where the Osprey came out well on top of the FD. The British designer John Westall's 505 won the third set of trials in France, but both the Osprey and 505 were passed over in favour of the FD because, according to the "official line", the FD had an established class organization. In fact the choice was merely political.

"When the FD was chosen", Ian Proctor said, "I thought the Osprey had had it". Happily he was proved wrong, the strengths of the design being sufficient to ensure its continued success.

But this time, Proctor held on to his cards.

He did not prepare a set of drawings for entry in the design competition. He did not want to risk a repeat of what he later euphemistically described as the "pooling of ideas" that occurred. In an interview with Geoff Simpson published in 1967 he was more forthright:

> "One thing I learned from those trials was to keep quiet. In those days, as soon as I had what I thought was a good idea, I would immediately tell all. The result was that my ideas were pinched": "**He Raised a Tempest**" Seacraft, February 1967 p 50.

As proof of the adage that a camel is a horse designed by a committee, the boat which won the 1964 design competition, **Champion** turned out to be one of the worst performers at the Medemblik trials. Its rudder was attached to the aft edge of the fin keel like an overgrown trim tab, and was controlled by a yoke that looked a bit like a set of motor bike handle bars mounted on a pylon amidships. The boat was slow upwind and down, could not plane, and was unresponsive. It was designed by H.E.Glacer for high displacement speed, rather than for planing performance, and the design died with the trials. Indeed, none of the 9 other original designs continued with any life of their own after their rejection at the trials, unlike both the Osprey and 505 at the 1954 Centreboarder trials, and unlike the Etchells after the 1966 3 man international keelboat IYRU trials (at which the Soling was selected) The Etchells and 505s went on to develop strong international followings and in many countries enjoy strong fleet racing This did not happen for Cobra, the runner up, despite the fact that it could be cheaply home built and was nearly as fast as Tempest despite far less investment and development.. Did the world really want a high performance keelboat at the dinghy end of the spectrum? Certainly, it had no use for two in those days.

It is now part of Tempest lore that Proctor sat down to design Tempest in December 1964 and that his major design work was concluded in February 1965. Richardsons had begun building the hull in March 1965 before he had even finished final design of the boat's fittings. The boat was ready by April, undergoing testing and competitive trials in a Flying Dutchman fleet. It was in the water at Medemblik by the 15th May 1965.

The influences that operated on Proctor as he sat down to begin drawing Tempest's lines in December 1964 are instructive. Obviously, the IYRU design parameters were

paramount. But beyond that, the Tempest was an extension of other design themes which Proctor had been developing for years.

Ian Proctor was predominantly a dinghy designer. Looking only at the development classes, he had designed approximately 16 different Merlin Rockets, 12 National 12's and 8 National 14's. To be so prolific indicates that he was also highly successful.

Between 1952 and 1968, Proctor designed Merlin Rockets won 15 out of 17 National Championships. His most successful designs showed trends developing towards finer and finer bows, wider beam and less rocker. His designs up to 1965 are all narrow by today's Merlin Rocket standards, which have developed along lines which involve a narrow entry and a significantly wider run aft .But when compared to other 21st Century developments in classes such as NS14s, Australian 16 foot skiffs and Australian 14 foot skiffs (very similar but not identical to International 14s), waterline beam has again been reduced to l.o.a. /waterline beam ratios close to the Tempest's.

The most successful of his designs was the Mk IX of 1956, which featured a long narrow entry and only a moderate beam. Subsequently the beam was widened in the Mk IXb and in 1966, it was widened again in the Mk IXc . The Mk IX design won the Merlin Rocket championships in 1957, 1958, 1960,1961, 1963 1965 and 1966. However, he also had success before 1965 with various other designs incorporating:

- Mk XI (1958): more rounded stern sections but which was not as fast as the Mk IX in open water or in strong breezes. Mk XI won the 1959 Championships.
- Mk XII specifically designed for light air and flat water such as inland waterways. It won the 1964 Championship
- Mk XV: an unsuccessful experiment to improve heavy airs speed where the long fine entry was replaced by a broader flatter bow. This boat performed worse to windward particularly in chop. The importance of this design to the Tempest's development cannot be underestimated. It may or may not be that Proctor understood why it was significantly slower than the finer entry boats that came before and after. In the light of modern understanding, this is explained because the wave impact drag caused by chop is proportional to the **square** of the "bluntness" of the bow wedge angle. This is why Proctor found the finer bow wedge angles were faster. And this is one of the central keys to the success of the Tempest's design, which has an extremely fine bow wedge angle, approximating that used in very modern designs now.
- The Mk XVI of 1964 was a design comprising elements of the Mk XII and the Mk XV in an attempt to combine speed through choppy water in light winds with good stability and speed I heavy airs.
- After 1965 the progression was towards progressively wider flatter hulls, a progression which was continued by others long after Proctor retired from Merlin design (his last being in 1974). This was a widespread trend in boat design throughout the 70's and 80's, and has now been reversed in leading edge development classes in relation to waterline beam at least.

The Tempest was designed at a time when Proctor's Merlin designs were pre-eminent but continually evolving. Relating these design experiences to his design of the Tempest specifically, Ian Proctor said:

> "If you have an idea that you think will pay off in hull design, you can produce that design and when you see people actually sailing it , you can tell if you are right or wrong. The great value of this method of working is that you quickly learn that certain features in hull design produce a specific result. When you have gained sufficient experience, you can design a boat for flat-out windward work, for instance, or for speed off the wind, or perhaps for heavy weather ability in rough water, or maybe for e light weather speed. The skill lies in the mixing of the features to produce the type of boat that is wanted. The main difficulty is to set in your mind what the exact requirements are, or the conditions in which the boat is to be used.
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> "When you have settled that, you should then know how many of these different features you should build into the finished design. Unfortunately, nearly every feature you build in detracts from some other aspect of the boat's performance. The most obvious example of this is a boat designed for light airs which suffers in heavy weather because it is not powerful enough.
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> "At the time, the IYRU were after a two man keel boat which would eventually replace the Star. Of course, they didn't say so at the time, but it is fairly common knowledge now." [Seacraft Feb 1967 p. 51]

It was known that the Dutch again wanted control of the Trials. It was known the trials would be held in Medemblik. Proctor was determined to avoid repeating previous mistakes, and indeed had learned much from the Osprey experience. One thing he regarded as a serious mistake was his design of the centerboard in Osprey, which he had designed intentionally shallow to suit Holland's shallow waters, whereas he discovered that there was ample depth of water for a deep board. Tempest was undoubtedly designed with Medemblik in mind. He now also regarded it as a mistake to send a boat designed for predominantly one set of conditions if those conditions could not be guaranteed.. Osprey- the light airs boat- suffered as a result of the heavy airs at the Dutch 1952 trials. Tempest therefore had to be fast in all conditions, a design task which required a balancing act which had hitherto defeated yacht designers: how do you make a boat fast in heavy airs and still fast in light conditions? We have seen that The Bethwaites found the answer in the 1980's and 1990's with the so called "2nd mode" hull configuration, as a result of years of accumulated testing and experience .

Proctor's answer was twofold: First, a very light displacement hull developed indirectly out of his dinghy influences, but more directly developed from Peregrine's lines. The utilization of slack bilges would allow the boat to sail efficiently with a reasonable amount of heel, so the ballasted keel would have some righting moment. Secondly, the use of modern aluminium alloy to build a very flexible mast to allow rapid depowering of the mainsail and opening of the jib slot by way of both fore and aft and lateral mast bend.

For reasons which will be discussed in a later installment, the Tempest came close to the modern "2nd mode" hull configuration that Bethwaite referred to, and in that lies the strength of the design.

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