



**Three USN Catalina wrecks  
(Catalinas Four, Five and Six)  
Darwin Harbour  
Heritage Assessment Report**

**Compiled by Heritage Branch  
February 2014**

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## **APPENDICES**

**A) McCarthy's criteria for Catalina research potential**

**B) Heritage Branch draft criteria of aircraft wreck intactness**

## **1.0 Introduction**

The purpose of this report is to provide the Heritage Council with an assessment of the significance of the three United States Navy Catalina wrecks located in Darwin Harbour, known colloquially as Catalinas Four, Five and Six, and to enable the Council to consider whether it should recommend to the Minister that they be declared three heritage places under the *Heritage Act*.

The nominator had purposely nominated these three sites together, whilst also nominating the other three Catalina wrecks in Darwin harbour individually. The nominator explains that this was done because these three were lost on the same day through the same event. The Heritage Branch believes this is a sound approach. There are some differences between these wrecks in terms of operational histories and physical integrity, which are identified where appropriate. A single Statement of Heritage Value has been generated which acknowledges the shared values of these places whilst also detailing differences.

## **2.0 Administrative Details**

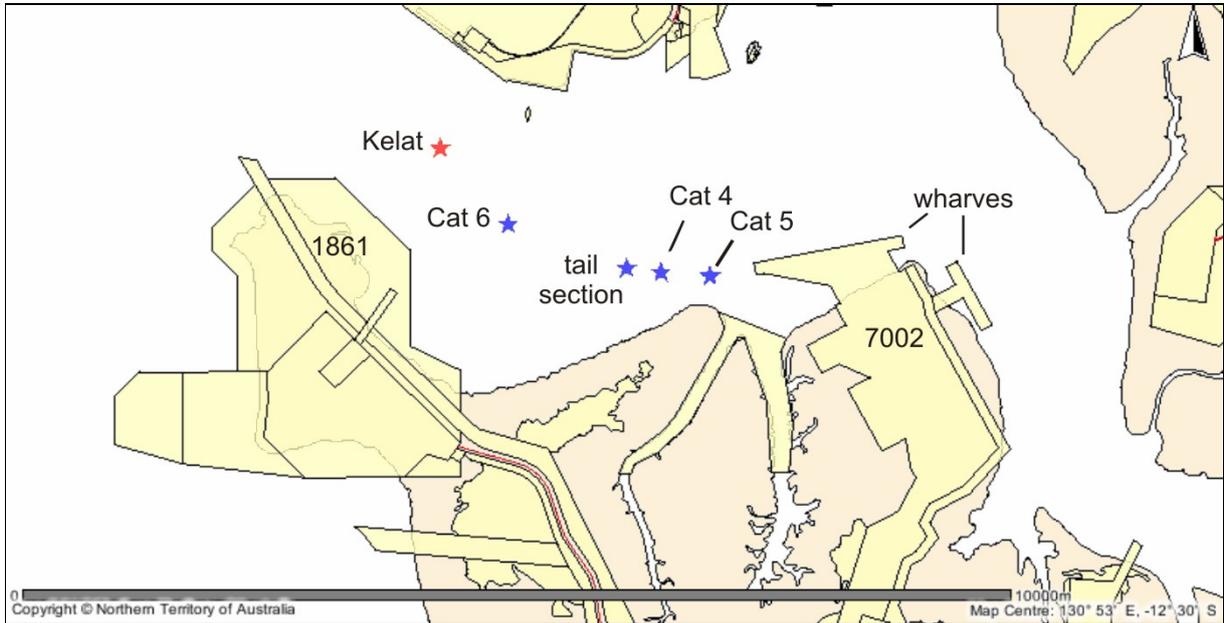
### **2.1 Nomination**

The three USN Catalinas, known colloquially as Catalinas Four, Five and Six were nominated to the NT Heritage Register by Dr Silvano Jung on 6 November 2013. The Heritage Council accepted the nomination on 6 December 2013.

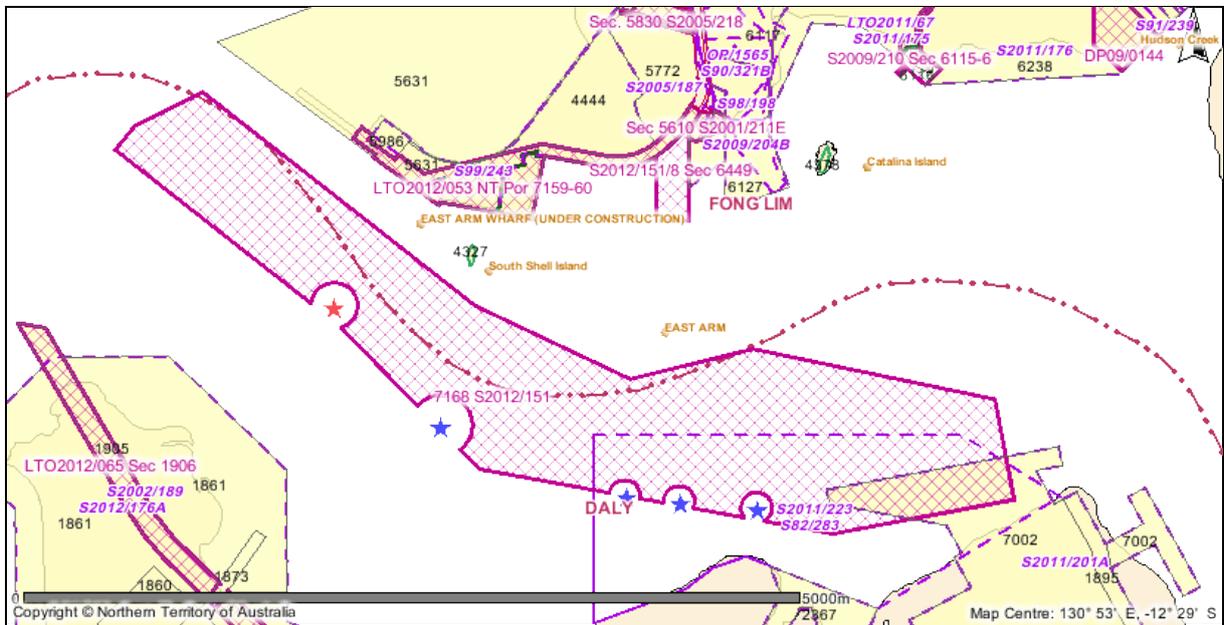
### **2.2 Tenure & Current Use**

The waters in which the wrecks are located is Crown Land. In close vicinity is NT Portion 7002. This portion is a crown lease held by Ichthys LNG Pty Ltd (Inpex). This a large portion (over three kilometres in area) and includes both land and water. The area will facilitate the onshore gas facility and the wharf that will service the large

LNG ships. Through the EIS process Inpex has assured the government that the three USN Catalinas will not be impacted by either the construction or ongoing operation of the facility.



The location of the three USN Catalinas in relation to Lot 7002 (Inpex). The yellow areas outline the lots. The light brown area outlines the intertidal area. Lot 1861 is the Wickham Point Gas facility



The wreck locations in context to the administrative area allotted for possible dredging. The actual dredging was not this extensive.

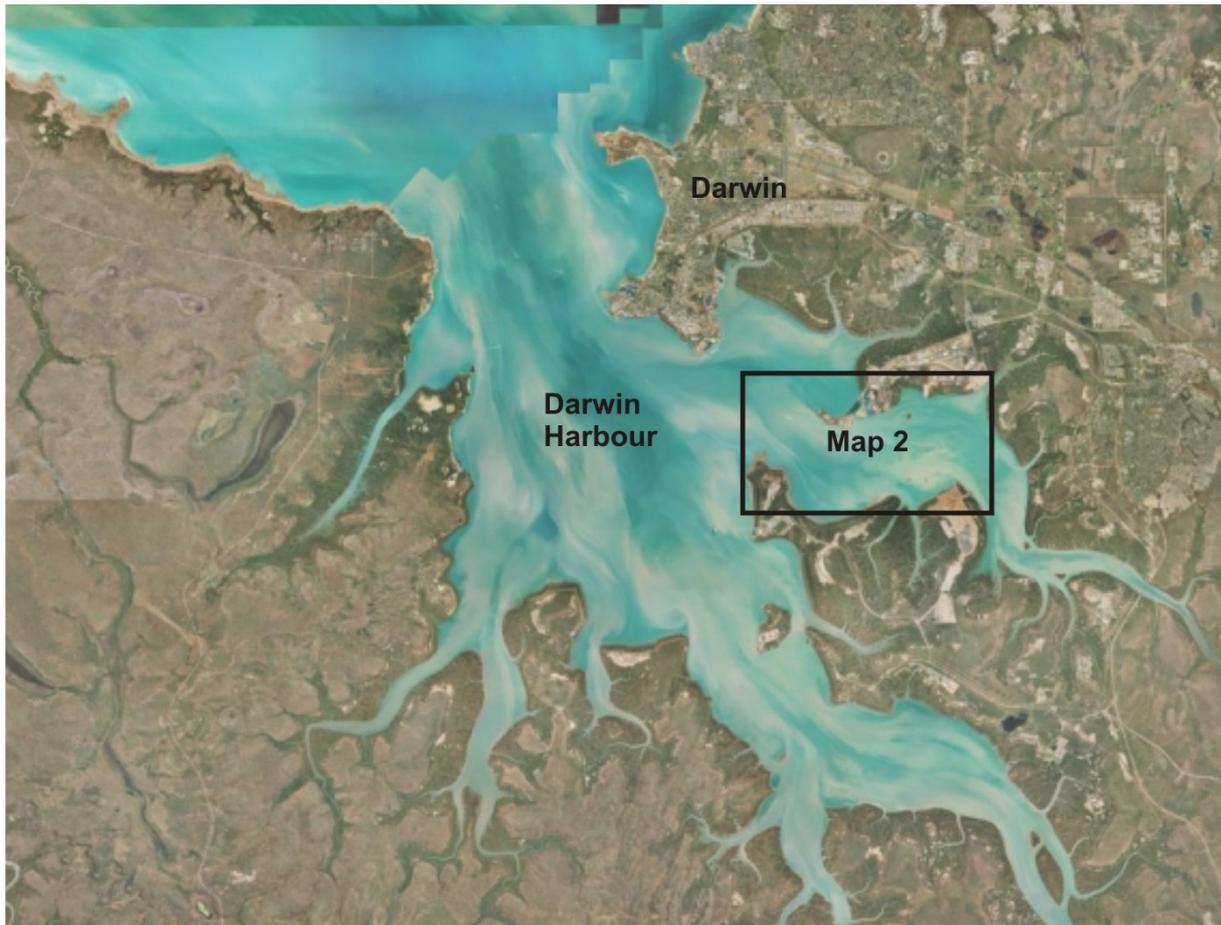
### 2.3 Heritage Listings

Catalina Six is provided with provisional protection under the NT *Heritage Act*. The provisional declaration has effect until either by the Minister declares Catalina Six a Heritage Place, or the Minister revokes the provisional declaration.

Catalina Four and Five are currently not provided provisional protection. However if the Heritage Council determine that they are worthy of heritage listing and proceed with the process by seeking comment, the Minister must extend provisional declaration until a determination is made.

The Heritage Branch has had correspondence with the United States Navy regarding these three wrecks in particular, and the US Navy has confirmed that it considers these Catalina wrecks protected under their *Sunken Military Craft Act*. The US Navy acknowledges that this not law in Australia, and that effective protection will be through Australian or Northern Territory legislation. Inpex, through the EIS process recognises the US Navy as a key stakeholder in the conservation of these sites. Inpex has submitted permits under the *Sunken Military Craft Act* covering actions that may have involved or impacted on one or more of these wrecks.

## 2.4 Location



### 3.0 History

#### Introduction

Catalinas Four, Five and Six were flying boats owned and operated by the United States Navy (USN) that were sunk at their moorings in Darwin Harbour by Japanese attack planes on 19 February 1942. The designations 4, 5 and 6 are widely accepted when referring to these specific wrecks, but are arbitrary designations and have no relationship with their manufacture or operational history.

Accurately identifying the individual Catalina wrecks was the subject of Jung's thesis (Jung 2001). Jung's work has been the primary source of information on the history and archaeology of these sites, and so should be appropriately acknowledged.

In relation to their manufacture Catalinas Four, Five and Six were PBX-4 and PBX-5 (28-5MNE variant) type flying boats. PB stood for Patrol Bomber and X was the manufacturer designation for Consolidated Aircraft. Four and Five stands for the generation of Catalina. 'Catalina' is taken from the popular holiday destination close to San Diego, the location of one of Consolidated Aircraft's factories. People tend to use the terms 'Catalina' or 'Cat' when referring to the PBX flying boats.

In terms of their operational history these three flying boats were owned and operated by the USN, and were all eventually assigned to Patrol Wing (Pat-Wing) 10. Records showed that Pat-Wing 10 planes #41, #4 and #8 were the ones which were sunk, and records further showed that #41 was a PBX-5 and #4 and #8 were PBX-4s. Identifying key design attributes on the wrecks, Jung was able to identify Catalina Four as the PBX-5 (#41) leaving Catalina Five and Six as the PBX-4s (#4 and #8). Which of the two wrecks is #4 and which is #8 is unknown.

Catalina Four	PBX-5 variant (28-5MNE)	Pat-Wing 10, #41
Catalina Five	PBX -4	Pat-Wing 10, #4 or #8
Catalina Six	PBX-4	Pat Wing 10, #4 Or #8

Identifying these two separate craft should be addressed in future research, however it would require some degree of site disturbance (e.g. dredging and excavation). This was not deemed necessary for the purpose of this assessment. The history of Catalina's #4 and #8 are similar enough to provide Council with the necessary knowledge to assess their historic significance.

These three wrecks are located in relatively close proximity to each other, and reflect a line of mooring positions used by the USN at the flying boat base in East Arm, Darwin Harbour. There are three other Catalina flying boat wrecks in East Arm. These other three were owned and operated by the Royal Australian Air Force (RAAF) and were not casualties of the Japanese attack. They are the subjects of different assessments. There is also an as yet unlocated seventh Catalina wreck in Northern Territory waters, which is also not the subject of this assessment.

### **The Asiatic Fleet and Patrol Wing 10**

Pat-Wing 10, assembled in 1940, was the aeroplane contingent of the US Asiatic Fleet. The US Asiatic Fleet was born in the 19<sup>th</sup> century and served the United States' commercial interests and colonial aspirations in East Asia. US engagement in the area included conflict with the Chinese and Spanish and then the Filipino independence forces. The US colonial interest in the Philippines, having been offered the territory by Spain in a peace deal, explains why Manila was a major base for the Americans at the beginning of WWII. At this time the Philippines was a protectorate of the United States with some level of self-government.

Pat-Wing 10 was made up of two Catalina squadrons named 101 and 102 (VP101, VP102). Together these squadrons had a total of 28 Catalinas. Support tenders (mother ships used for repairs and maintenance) included the *William B Preston*, which would later be fiercely defended by its crew during the bombing of Darwin.

The role of Pat-Wing 10 was crucial in early military planning and action against the Japanese. The Catalinas were used in reconnaissance flights looking for enemy movements, as long-range level bombers and in sea rescues. They had a particularly long flight capability and so could travel and return to distant targets. Their ability to land at sea meant they could pick up floating survivors, and refuel without the need of

airstrips. Jung explains that they were particularly vulnerable from fighter attacks during bombing, in part because of their size and slowness (Jung 2001:63).

The Japanese took control of Manila on the 2 January 1942. Pat-Wing 10 retreated to Dutch bases in the Indonesian archipelago particularly Surabaya. It was at this point that Pat-Wing 10s dwindling numbers were augmented with replacements, which included #41 (Catalina Four).

When based mostly at Surabaya, but perhaps also Ambon for a time, planes #4 and #8 were involved in patrols, bombing missions and sea rescues. Jung recounts stories of #4 rescuing seven army bomber crew and being attacked numerous times, in one incident being able to shoot down an attacking zero (Jung 2001:72-73).

### **Darwin attacked**

With the continuing advance of the Japanese forces Pat-Wing 10 began a further retreat with some planes arriving in Darwin by January 1942. By 11 February 1942 there were only 12 operational aircraft in all of Pat-Wing 10 (Jung 2001:75). Six of these were based in Darwin and serviced by the tender *William B Preston*.

On 19 February Lieutenant Thomas Moorer in Catalina #18 of Pat-Wing 10, based in Darwin, was charged with locating enemy shipping near Ambon. He spotted the *Florence D* and was then attacked by what was the first attack wave in the Japanese air assault on Darwin. The plane was gunned down but all crew survived, being picked up by the *Florence D*. The *Florence D* would itself be sunk that day by the attack force and Moorer would lose a crew member in this second incident. Moorer's Catalina is yet to be found.

Three of Pat-Wing 10s aircraft were moored in a row, these being #4, #8 and #41. Aircrafts #4 and #8 had critically high engine hours and were grounded until major services and repairs were conducted (Jung 2001:80). There were no crew aboard #4 or #8 during the attack; however three were aboard #41. They managed to swim to safety as the three vessels were strafed and sunk. Jung references eyewitness accounts suggesting that #4 and #8 went down after being machine gunned, and #41 stayed afloat after gunfire and so was then bombed by the enemy (Jung 2001:84).

## 4. Technical description

### The flying boat

On a conceptual level it is useful to think of the Catalina as a boat that flew rather than a plane that could operate on water. This is evident by its design, function and how crew were trained and designated.

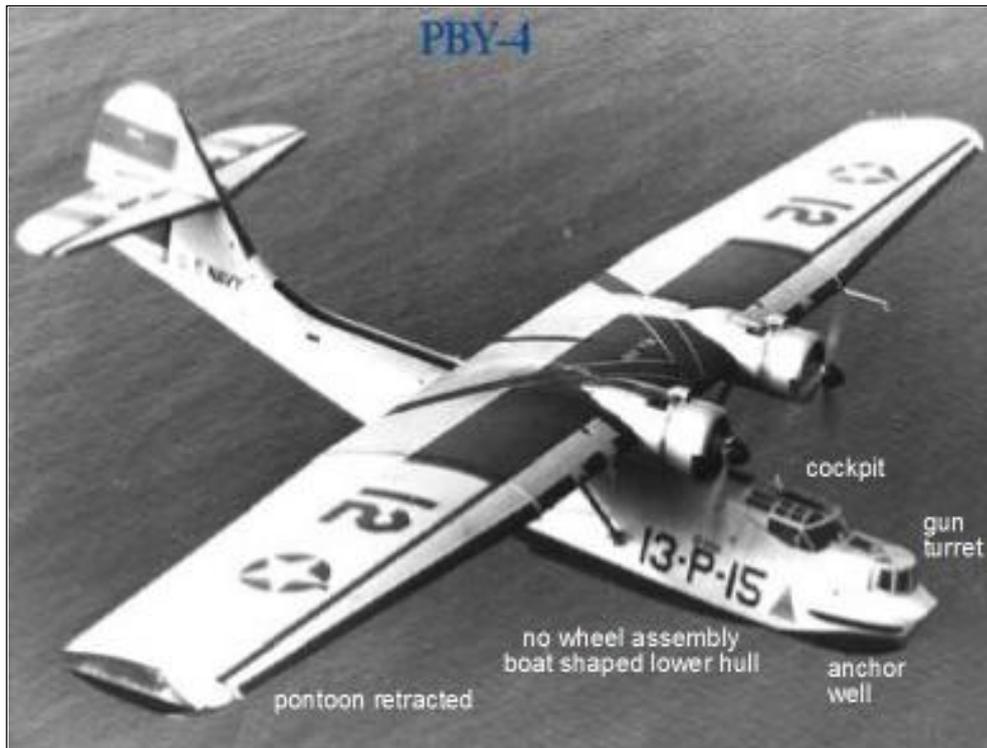
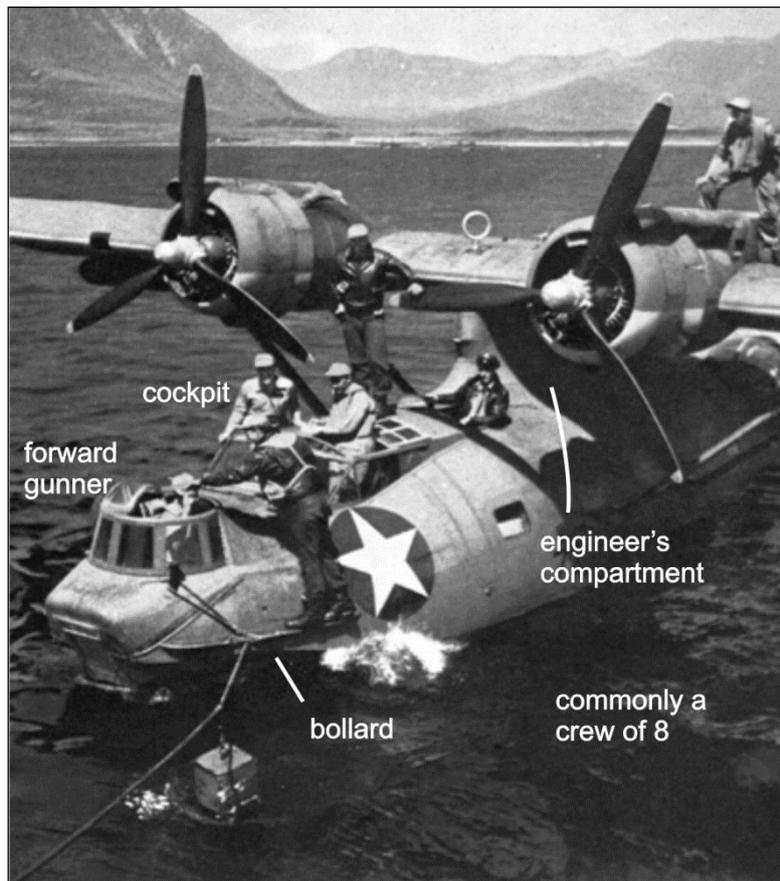


Image adapted from Catalina Group of New Zealand  
<http://www.catalina.org.nz>

The Catalina's hull was primarily a boat hull rather than shaped like a plane's fuselage. These craft were moored in the water with anchors, as opposed to being hauled onto land after a flight. It was in fact an arduous task to pull a Catalina onto land for major repairs and required the use of beaching gear. Later manufactured Catalinas had landing gear attached, but not the PBV4s. Furthermore in many cases this later adaptation was removed to reduce deadweight.



PBY Catalina with crew  
(US Navy public domain)

When on missions Catalinas could be refuelled on the water by either fuel tender boats or **by reaching hidden fuel caches at coastal points and islands.** This did away with the need to maintain airstrips for the Catalina. The crew were assigned naval rankings and were trained as seamen as much as aviators; learning skills such as celestial navigation, sea lore, small boat handling and knotting.

### **The crew and internal workings**

An assessment of a Catalina wreck should appreciate the internal architecture and workings of such a plane and the specific role of the people that were aboard. The description below provides an excellent introduction to both issues, accepting that this serves as a general description and it likely varied across specific generations of planes and different crews.

The PBY Catalina was split into seven distinct sections. The Bombardier's compartment was in the nose, with the forward gun turret at the top and the bomb aiming window in the lower front. This window was providing with a sliding cover to protect it when landing or taking off on the water.

The Pilots compartment was next, in the upper half of the fuselage. Below them was the anchor, and on the later amphibians part of the nose wheel mechanism. The two pilots sat side by side, with the door into the bombardier's compartment between them.

Behind the pilots was the Navigator's, Radio operator's and Radar operator's compartment, normally pictured with the radio operator on the right and the navigator on the left.

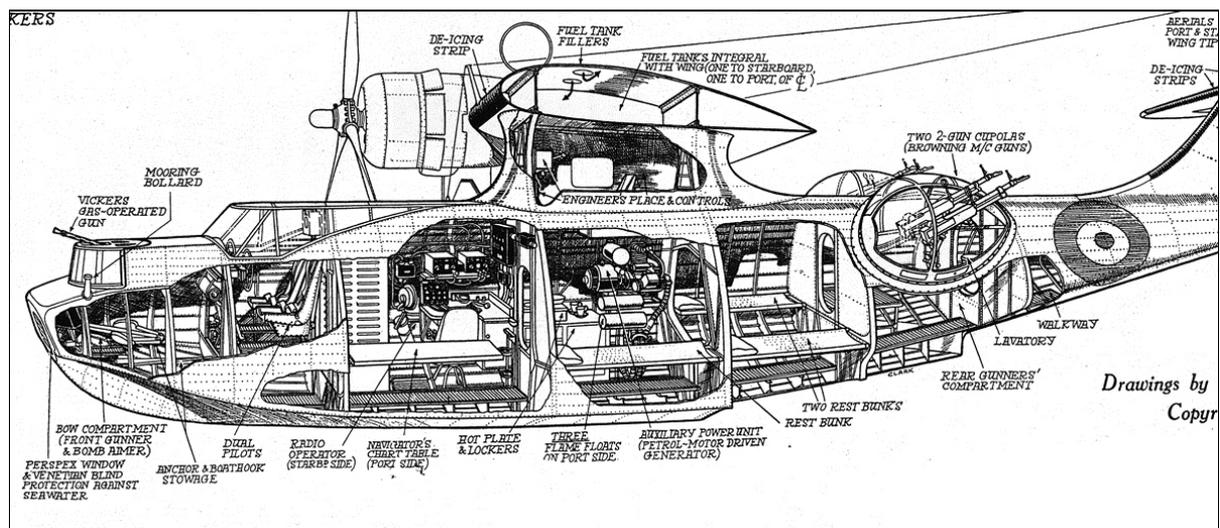
Next was the tall mechanic's compartment, which stretched up into the pylon supporting the wing. The mechanic's seat was in the roof of this compartment, accessed up three steps. Small windows in the side of the pylon allowed the engineer to see the engines from inside the aircraft. The base of his seat was cushioned to protect crew members walking underneath! The bottom half of the compartment carried some of the engineering equipment, but also contained a two ring electric cooker, with water tanks.

Behind the engineer were the living quarters, complete with bunk beds, an essential feature in an aircraft that might be required to operate in very remote areas, at quite a distance from the nearest base.

Behind the living quarters was the waist gunner's compartment. In the PBY-1 to PBY-4 the guns were mounted behind sliding windows, which opened out and forward. On the PBY-5 these sliding windows were replaced with the famous gun blisters. This compartment also contained a chemical toilet and the life raft.

Finally, at the rear of the fuselage, came the tunnel gunner's position. A single rear firing machine gun was mounted in the floor of this compartment, protected by a hatch when not in use. The gunner fired his gun while in a kneeling position. Late in the production of the PBY-5 ball mountings were added in the side of this compartment, and the single gun could easily be moved between the three firing positions.

Rickard, J (28 February 2007) [http://www.historyofwar.org/Pictures/pictures\\_catalina\\_tunnel\\_gun.html](http://www.historyofwar.org/Pictures/pictures_catalina_tunnel_gun.html)  
Taken from Coastal Command, 1939-1942, HMSO, published 1943, p.87



PBY 5 Catalina schematic  
(Its value is showing the locations of personnel)  
Copyright resides with The Aeroplane  
sourced from [www.aero-links.net](http://www.aero-links.net)

## 5.0 Physical evidence

Our understanding of the physical nature of these wreck sites comes from three sources. The primary source for understanding Catalina's Four and Five is Jung's 2001 Archaeology thesis. At that time five of the six Catalina wrecks in Darwin Harbour had been located and Jung provides detailed descriptions of these. Catalina Six was not discovered until 2008 and so was not a subject of this work.

Wrecks in dynamic environments and subject to impact from human activities can change significantly. Therefore providing an up to date condition report on these wrecks, accounting for change since Jung's 2001 wreck inspections, is vital. In 2008/9 the Heritage Branch carried out brief site inspections of Catalinas Four, Five and Six and some changes were identified. The third source of information is the Catalina monitoring program which has been implemented by Inpex, as part of its commitment under the Environmental Impact Statement (EIS). This program included a comprehensive baseline survey of the wrecks in 2012, and periodic monitoring surveys after that. Its purpose is to measure physical impacts caused by the project's development.

Catalina Six, not a subject of Jung's thesis, was inspected and recorded by the Heritage Branch following its discovery in 2008. It is included in the Inpex Catalina monitoring program.

### 5.1 Significance of design

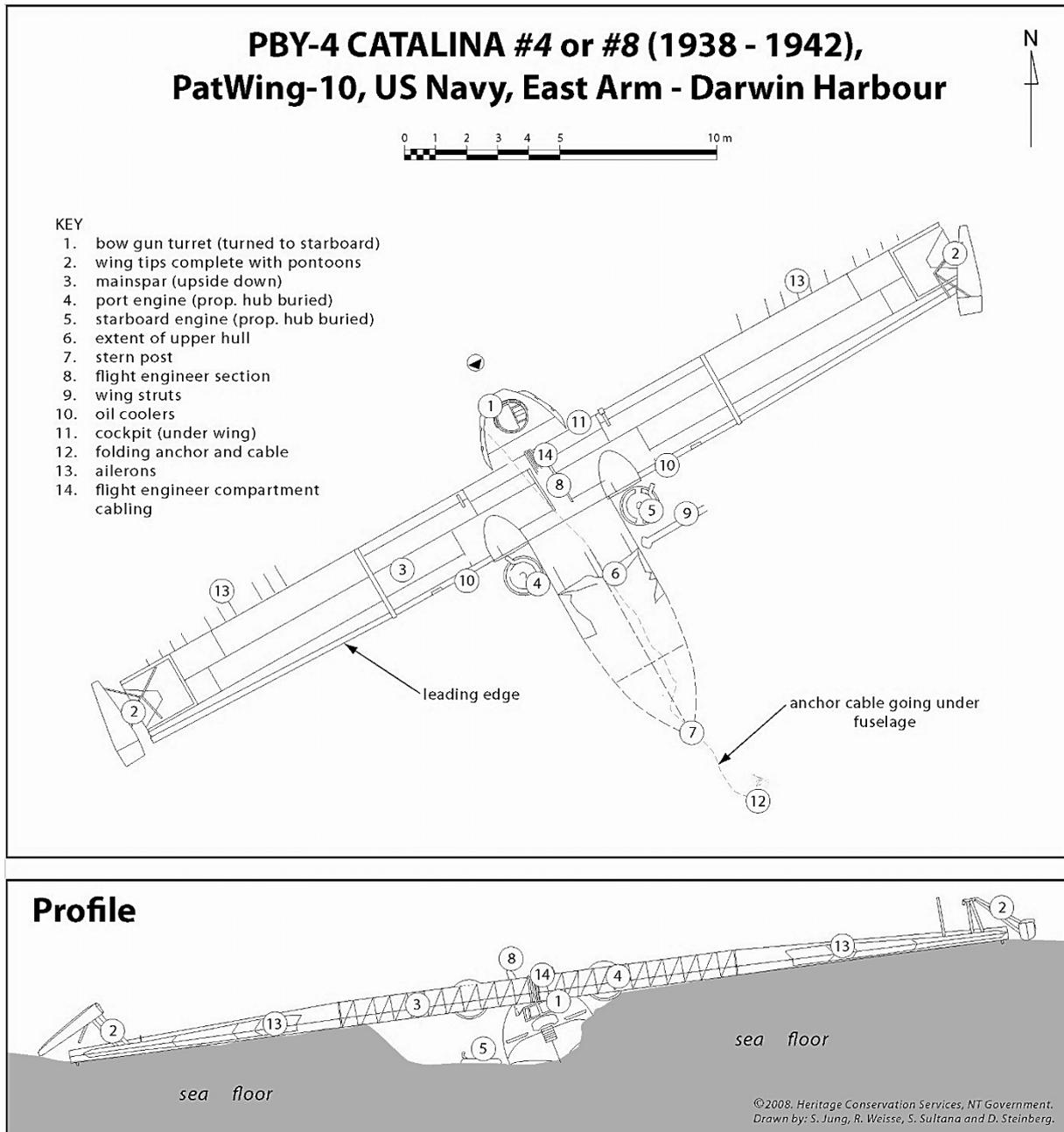
An important aspect of the significance of these wrecks rests in their design and engineering and their place in the history of aviation engineering. The Catalina was an outdated aircraft when WWII began. As Jung states 'The war meant the Catalina was saved from the scrap heap...The design concept advances in the Catalina were accelerated during WWII and as a result, Darwin Harbour has a representative sample of Catalina types dating from 1938 to 1943' (Jung 2001:30). Catalinas Four and Six are PB4Y-1 models and Catalina Five was a PB4Y-2.

Consolidated were leaders in the development of long range flying boats and the PB4Y-1 had some key innovations that were considerable landmarks in flying boat

evolution; particularly the internal fuel tanks, the mono hull design and the loss of extensive struts; all which reduced drag (Jung 2001:33-41). The following generations of Catalina were all alterations to what was basically the same revolutionary design. The PBY-4s may have been the last generation of the Catalina, as designers were experimenting in different directions. The onset of the War developed a need by the Allies for a long-range flying boat. Rather than mass producing a newly designed but untested plane, the allies went with a plane that, though obsolete in ways, was tested, reliable and could be quickly mass produced (Jung 2001). One source suggests that Consolidated Aircraft only produced 32 PBY-4s ([http://en.wikipedia.org/wiki/PBY\\_Catalina](http://en.wikipedia.org/wiki/PBY_Catalina)). Jung puts the number at 33 (Jung 2001:38). In contrast 684 PBY-5s and 802 PBY-5As were produced. This means that Catalina's Four and Six were one of only 32 planes built and represent an early version of Catalina prior to the mass production phase.

Catalinas Four, Five and Six are part of a group of six Catalina wrecks in East Arm. Jung argues that these wrecks represent various different stages in Catalina evolution, and so as a group of sites they have an educational value (Jung 2001). The test of this argument is whether or not these wrecks are intact enough to be able to demonstrate both generic Catalina design principles, and the individual features that distinguish them as representing subsets.

## 5.2 Physical Description: Catalina Six



Site plan dates to 2008; changes have occurred since

Catalina six is located in approximately 18 metres of water, a depth sufficient to protect the site from most destructive action on the water's surface such as chop or wind, and shallow enough to provide natural light for divers. It sits in a bed of fine grey mud, which has built up on the seafloor in this part of the harbour through a process of rains washing dirt and organic matter from the surrounding Darwin catchment into the harbour. This process is extensive and the turret of Catalina Five for example is filled with sediment and mangrove wood. The silt bed has likely made

a cushioning base for the Catalina and contributed to its preservation. A diver can easily stir up the silt making visibility in their location drop to zero instantly.

Catalina Six is still arguably the most intact located Catalina wreck in the Northern Territory, although since it has been discovered it has undergone some considerable changes. In terms of its overall structure it is the least collapsed and broken up. The forward section of the plane's fuselage is sealed and intact, this part housing the forward gunner and cockpit. It therefore has a measurable degree of intactness. This in turn means this particular site has a medium-high degree of archaeological integrity.

The profile view of the site plan shows that the engineering compartment has collapsed and the wing rests on the fuselage. The wing has broken away from the fuselage, flipped backwards and resettled back on top. By chance it rests in about its original position both in terms of its axis (like hands on a clock) and in terms of the middle of the wing being on top of the fuselage. An engineering cable (feature 14) tells us how the wing flipped back and over rather than forward and over. With the wing intact, the wreck shows off the full span of the wing, which was over 30 metres. This is the only Catalina of the six wrecks in the harbour with its wing span intact, and this contributes significantly to this wrecks ability to represent one of the distinguishing features of the Catalina design.

In his nomination Jung notes the particular significance of the intact wing in the study of Aviation Archaeology. He states

'This is the only known flying boat wreck in Australian waters, sunk by Japanese air raids, with an intact wing. It challenges the site formation theory of 'wing inversion' and it is still not understood how Catalina 6 sank. The site formation processes must have been different to the other Catalina wrecks in Darwin and Broome.

The engines (features 4 and 5) have fallen away from the wing and have landed in the mud in close proximity. Both are upside down with the propellers buried in the mud. These propellers are stainless steel and prized by collectors. The back workings of the engines are visible for study.

Features 13 is the skeleton of the ailerons or flaps. What they demonstrate is that the wing was originally much wider, but the canvas component is gone leaving behind the remaining two-thirds which is aluminium.

Feature 6 on the site plan shows the extent of the roof of the fuselage. Looking under the roof one notes there is a bulkhead blocking access to the forward section. This likely provides structural strength to this enclosed cavity. These would certainly contain material of significant cultural value including controls and personal items. Aft of this section the roof of the fuselage is gone but the lower part of the fuselage is buried in the sediment. Significant material may be buried with the confines of this buried lower part of the fuselage. The stern post is visible, delineating the length or end of the fuselage. The tail section is not connected to the main body of wreckage and was not located.

Leading away from the wreck in a SSE direction is the mooring chain which leads to the buried mooring anchor. Catalinas carried a smaller mooring anchor in flight, which was stored in a forward locker. The mooring chain however leads to a larger anchor. These larger anchors were deployed by the boat tender crew that serviced the Catalinas. Both the small and larger anchors are stainless steel.

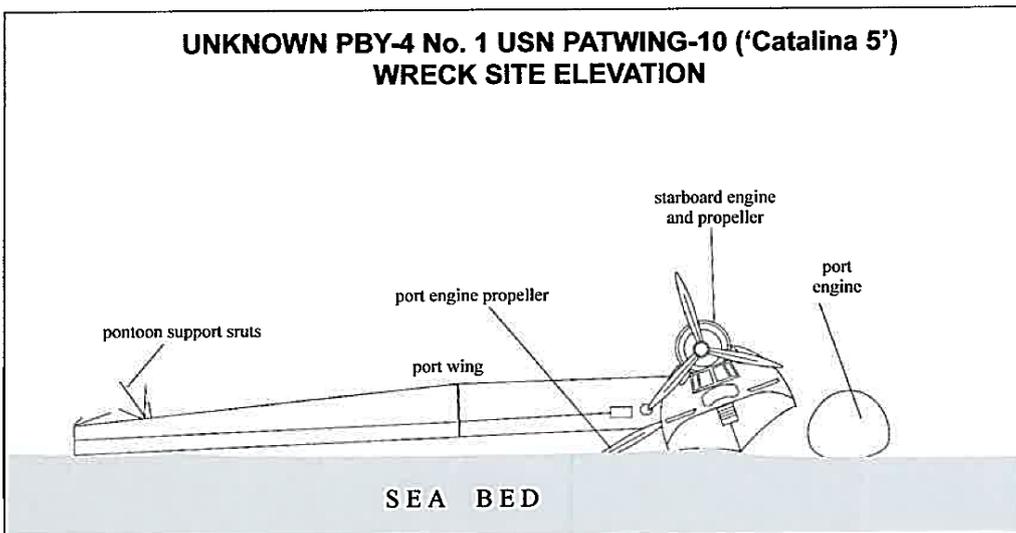
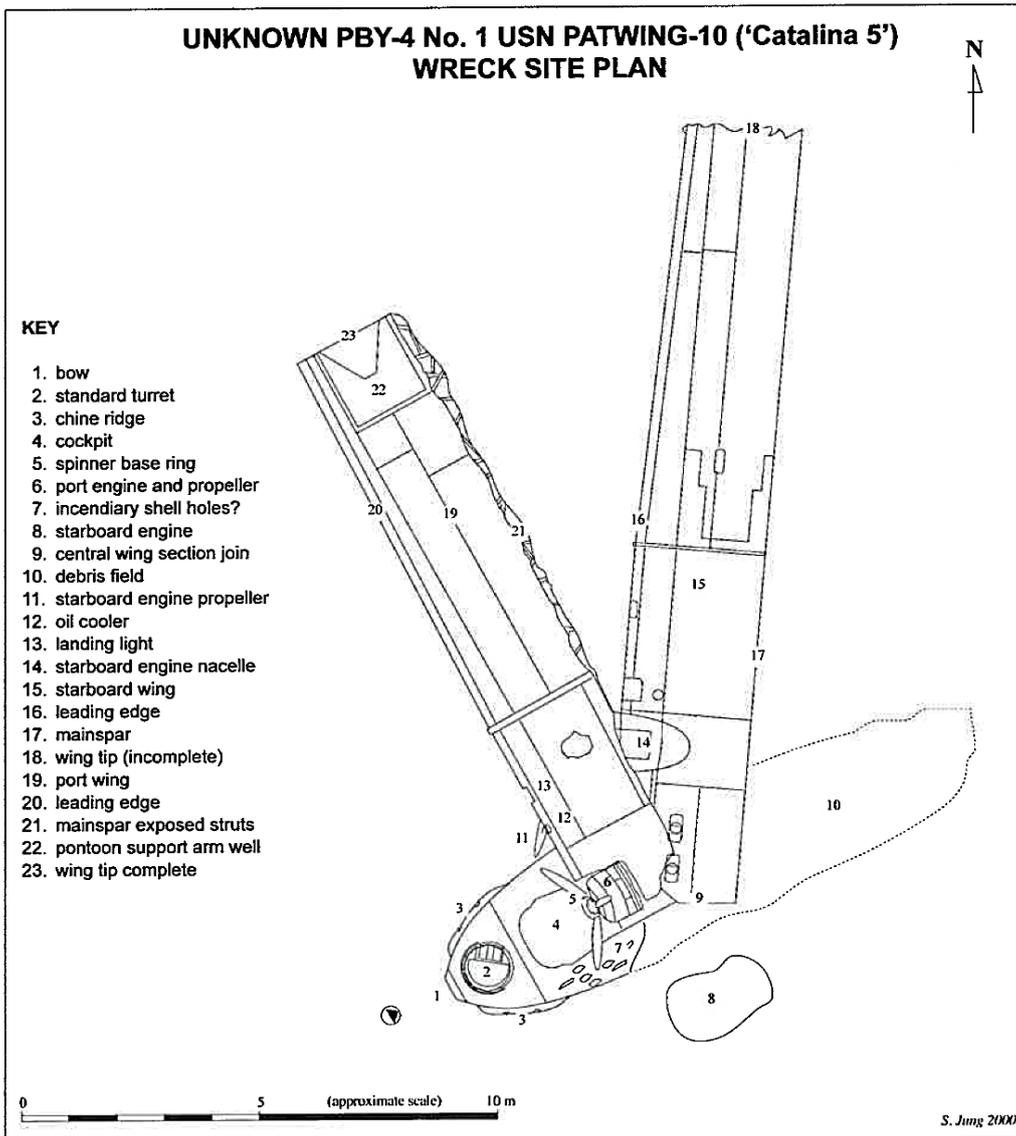


Example of a larger mooring anchor,  
taken from another Catalina wreck site in Darwin Harbour

Catalina Six was discovered in 2008 and was soon inspected and surveyed by the Heritage Branch. An inspection some months later noted that the site had been visited by others and the small folding anchor stored in its forward locker had been taken. This discovery instigated the Interim Conservation Order over the site, which continues in the form of provisional declaration. A 2011 site inspection noted that the starboard wing pontoon, identified in the 2008 survey was missing. Furthermore a 2013 site inspection noted that the distinctive forward gun turret, mounted forward of the cockpit, has separated from the fuselage and was now located in the mud behind the starboard wing. This has been secured with rope to the structure. The turret and its mounting on the fuselage has not independently been inspected by the Heritage Branch because of the Wet Season conditions.

The loss of the anchor was disheartening signalling the site has been partly salvaged by divers. The structural loss of the turret and pontoon also impact on the site's integrity. The turret and pontoon losses were likely not caused by divers; however it is as yet undetermined whether they were caused by natural forces, or other kinds of human disturbance, such as boat anchors or the propeller wash of large passing ships.

5.3 Physical Description: Catalina Five



Site Plan dates to 2001; changes have occurred since. Also corrections have been made since (Jung 2001)

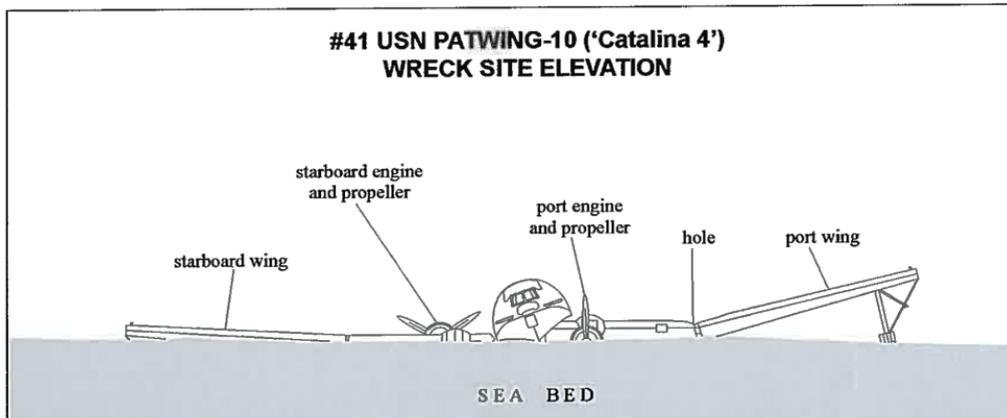
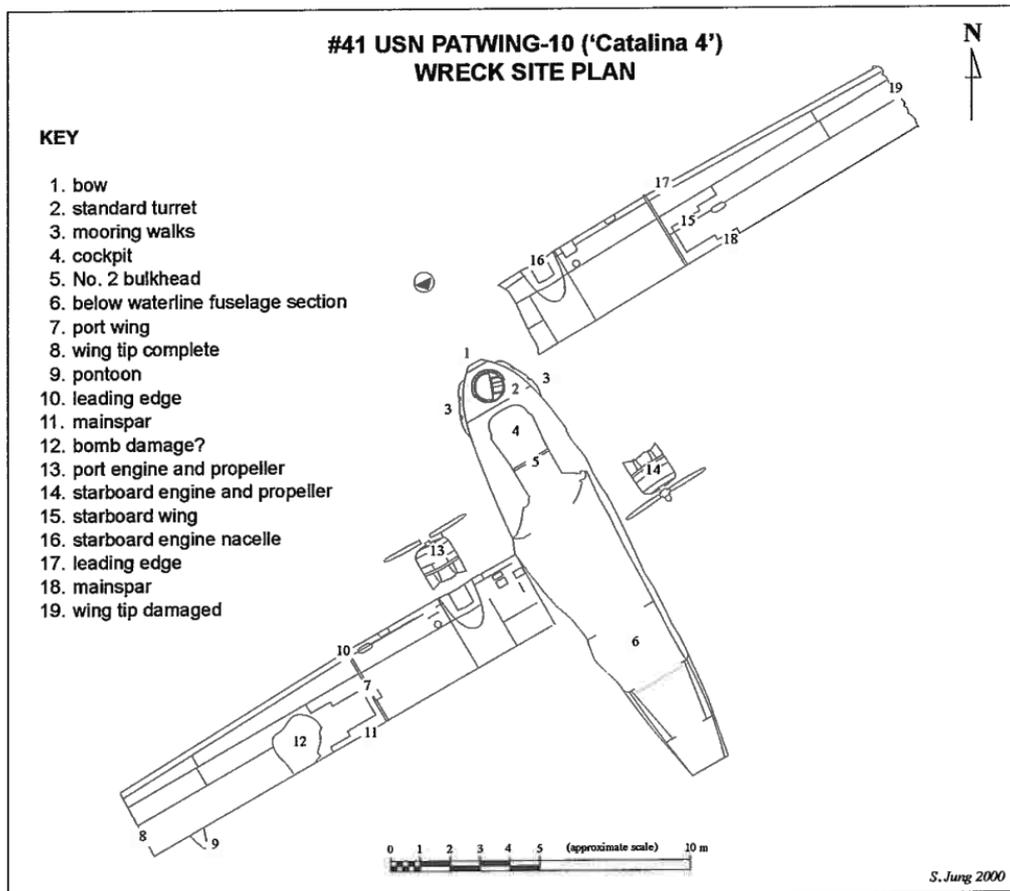
Catalina Five sits in approximately 14 metres of water. The site plan shows that the most obvious difference between it and Catalina Six is the wing. The wing is broken in two with the starboard wing in a four o'clock position to the fuselage and the port wing flipped over and back onto the fuselage and starboard wing. Like the wings seen elsewhere on the other Catalinas wreck sites in the harbour, the trailing edges have not survived and only masses of ribs and stringers can be seen along the rear of the mainspar. No pontoons have been located on the wreck site. One engine has fallen into the cockpit. Jung suggest the second engine is to the side of the fuselage (feature 8). However the 2012 survey confirmed that this feature is not related to the Catalina, suggesting the starboard engine may be attached to the wing and covered over out of view. Similar to the other Catalina wrecks the engineering compartment has collapsed. The fuselage lists to starboard in the direction of the wings.

Similar to Catalina Six, the walls of the fuselage forward of the wing remains intact (feature 1). However whereas the cockpit roof remains intact in Catalina Six, the roof over the cockpit is gone in Catalina Five. This compartment is filled with sediment. It is unclear whether this compartment has been salvaged by divers.

The seabed around the outside of the hull is scoured exposing as far down as the keel (feature 4). This affords a good view of the exterior of the forward hull section, revealing the classic lines of the flying boat. The fuselage's aluminium skin is also holed in many places.

There is no upper hull structure aft of the wings however close to the sea floor the lower edges are visible. The stern post is visible, delineating the end of the fuselage. The tail section is not connected to the main body of wreckage and was not located. The 2012 survey noted that the port wing is greatly deteriorated, with damage likely caused by anchors, and that the sheeting is coming off the turret and fuselage. Also in 2012 Inpex identified Catalina debris, thought to be associated with Catalina Five because of proximity, within its dredging footprint, This was an aluminium box filled with wire components and a pontoon. These were relocated to the Catalina Five wreck site.

## 5.4 Physical Description: Catalina Four (#41)



*#41 ('Catalina 4') wreck site plan and elevation.*

This site plan dates to 2001; and changes have occurred since. For example the port wing has been considerably damaged.  
Jung 2001

The 2001 site plan of Catalina Four shows that the engineering compartment has collapsed and the wing is broken in two sections. The port side of the wing appears in a correct alignment with the fuselage. The starboard wing lies forward and to the side of the fuselage with its engine detached and lying further down the fuselage. The 2012 survey confirmed this to be an error. The starboard wing is flipped upside

down and the engine is still attached to the wing. The 2012 site inspection also noted considerable changes to the port wing. The pontoon structure has collapsed. The wing has been torn in two, at the weak point where a hole was identified in 2001 (feature 12). The far end has been torn away and flipped upside down. A 2013 inspection located the pontoon 30 metres S.W. of the wreck. The 2012 report notes many fishing boat anchors on this wreck.

In terms of the fuselage's integrity aft of the turret the roof of the fuselage is gone, with the walls of the fuselage breaking down to the seafloor aft of the cockpit. However although the walls are gone, the outline of the fuselage floor is recognizable by the bottom aluminum panels, which taper off towards the tail (feature 6). Examination of the cockpit in 2001 revealed that the flight instrument panel had been removed or had disintegrated. The tail section is not connected to the main body of wreckage.

### **5.5 Physical Description: Tail Plane**

Three hundred metres west of Catalina Four is the remains of a tail plane from a Catalina; the tail plane being the horizontal wing that sits across the tail of a plane. It is unconfirmed whether this is the broken tail plane from a USN or RAAF Catalina, although its close proximity to Catalina Four does suggest it may be from that wreck. None of the Catalina wreck sites contain visible evidence of their tail sections, either attached to the fuselage of the wreck or as a broken but visible local debris field. This suggests that the loss of the tail is common in either the wrecking/sinking event of Catalinas or occurs over time following deposition, and likely points to the fact that tails were a weak point in the plane's structural strength. The location of the tail plane is marked in the maps of this report, although it is not the subject of this assessment.

## 6.0 Suggested approaches in assessing archaeological significance

Criterion (c) of the heritage assessment primarily deals with the concept of archaeological significance. The speciality of Aviation Archaeology and even underwater Aviation Archaeology is developing a comprehensive theoretical framework, and sites are evaluated against sophisticated research designs. Two sources in particular will assist in assessing the archaeological significance of these three wrecks.

The first of these is McCarthy's classification for the archaeological significance of submerged aircraft wrecks (appendix). McCarthy divides plane wrecks into three categories, based on the circumstances surrounding their deposition. Those lost in active circumstances, such as in battle belong to Group A. Group B are those deliberately abandoned but done so in flying condition; and Group C are those stripped, as would a ship hulk, before deposition. Against these criteria Catalina Four, Five and Six fall within Category A, which is the category suggesting the greater archaeological research potential.

Although these wrecks belong in Category A it should be conceded that there is a caveat attached. These three Catalina wrecks were not sunk in battle, like Moorer's Catalina, mentioned earlier. Also Catalinas Four and Five were scheduled for service, therefore were not primed and outfitted for a mission on the day they sank. Therefore although they belong in Category A, they may not have been armed with all of the 'accoutrements of action' and may or may not have had the personal belongings of their crew when sunk. The status does however provide an opportunity for new research questions, for example studying field operational standards. How for example were these planes prepared, when they were not scheduled for flights, but may have been urgently needed for rescue duties?

The second suggestive source is the draft criteria for aircraft wreck intactness and integrity produced by the Heritage Branch and Mr Bob Alford, endorsed by the Council, and applied to other wrecks in the Northern Territory including the C-47 in Fannie Bay and the B-25 Mitchell wreck in Nightcliff (Appendix). Under this criteria these wrecks are defined as being in 'good condition'.

Greater intactness generally provides an opportunity to address what may be higher-level archaeological questions about a site. The fact that for example the forward fuselage of Catalina Six remains enclosed and has not been salvaged, greatly increases the opportunity for addressing research questions. However intactness alone does not determine archaeological significance. For example although the aft section of all three wrecks have broken down, indicating hull integrity is lost, it may be the case that there is significant material scattered in a debris field and buried in the sediment.



## 7.0 Assessment of Significance

### 7.1 Existing listings

Catalina Six has provisional protection under the NT *Heritage Act*. All three Catalinas are considered protected by the United States Government under the US *Sunken Military Craft Act*.

### 7.2 Heritage Act Assessment Criteria

The nomination provided by Dr Jung includes an assessment of the three sites against the heritage criteria. The assessment provided here is the Heritage Branch's own application of the criteria. Dr Jung's knowledge of Catalina wrecks is of international standing. However the criteria must be applied in a manner consistent with the Heritage Council's own interpretation of its meaning, and its opinion whether the threshold for criteria has been met. Dr Jung's assessment has been considered, and where applicable his arguments incorporated.

**(a) whether it is important to the course, or pattern, of the Territory's cultural or natural history;**

These three Catalina flying boat wrecks are associated with the Northern Territory's wartime history. These planes conducted numerous wartime missions, constituting frontline battles opposed to just supply or behind the scenes support. As part of a USN squadron their presence in Darwin waters shows the shared effort of the allies to defend Asia and northern Australia. As a part of Pat-Wing 10 their presence in Darwin symbolise the retreat of allied forces and how Darwin became a part of the new frontline in the War. As these sites are directly associated with the bombing of Darwin, they are associated with one of the formative events in 20<sup>th</sup> century Australian history.

**Therefore criterion (a) is met.**

**(b) whether it possesses uncommon, rare or endangered aspects of the Territory's cultural or natural history;**

These three USN Catalina wrecks are rare in the Territory's cultural history. Catalina missions from Territory bases were a particular aspect of our wartime history, with different purposes and meanings compared to other air or sea missions. Therefore the conservation of other plane wrecks on land and of airstrips are not acknowledgements of their story. Catalina operations involved surveillance, bombing raids and rescues. Their long range, ability to land on water and bombing capacity made their strategic value and their mission histories unique. There are only six located Catalina wrecks in the Territory, and these three USN wrecks were operational during the height of conflict in 1942. The role of these wrecks to symbolise Catalina operations in the Territory is crucial considering the continuing struggle to conserve the remaining remnants of the flying boat bases.

The three USN Catalinas are the only located planes that were casualties of the first Japanese Air Raid on Darwin on the 19 February 1942. There are seven shipwrecks in Darwin Harbor sunk in the same attack that are heritage listed. The fact that these three flying boat wrecks are not also heritage listed has created an unrepresentative sample of heritage listed sites. The three USN Catalinas are singular in their ability to broaden the representative sample of protected sites to include aspects of our air forces.

Two of these Catalina wrecks are also 'rare' as representative of their design. Catalina Five and Six are PBY-4 Catalinas, of which only 32 were manufactured, production ending in approximately 1939. It was an early version prior to the mass production of later types. These wrecks have sufficient integrity to demonstrate many aspects of this design and therefore represent this class of flying boat of which there were not many, and of which production stopped almost 70 years ago. There are no operational versions in Australia.

**Therefore criterion (b) is met.**

**(c) whether it has potential to yield information that will contribute to an understanding of the Territory's cultural or natural history;**

The question of the ability of these sites to 'yield information' deals with the concept of archaeological significance. The question can be restated for clarity as 'What further significant knowledge can be gleaned from the wreck sites that is not already provided by historical documents, oral history records or other means?' Section Five of this report provides some guidance to approaching this criterion.

First and foremost is the question of correctly identifying Catalinas Five and Six; meaning which is plane #4 and which is plane #8. This remains a fundamental question in the archaeology of these sites. We are still unable to assign an operational history, including all of the missions and personal histories associated, to either of these two individual flying boat wrecks. This issue could easily have a Public Archaeology aspect, if for example we have a request from family to lay a wreath on the wreck their loved one served aboard, and we can't confirm which one it was.

As discussed earlier in this report, McCarthy provides a framework for assessing significance which sees the wreck in terms of what its operational status was when it sunk. If it sunk in battle for example the personal belongings (as well as the human remains) of crew may be aboard. If it was scuttled after being stripped it would have neither the accoutrements of action nor personal belongings aboard. To a sufficient degree these Catalina wrecks could provide insight into Catalinas at a certain stage of readiness (see section five). Although this benchmark has been met, it should be acknowledged that research may be hampered by the possibility that Catalina Four and Five have been partly salvaged by divers in the past.

Another aspect of archaeological research in this context is the Heritage Branch framework for measuring intactness (see section five). These wrecks are of 'good condition' with Catalina Six the most intact; appreciating that its cabin is enclosed and undisturbed. This level of intactness has permitted Jung to identify subclasses of PBV flying boats based on design features. It has yielded information about the state that these planes when moored in (e.g. turrets turned to a particular direction) and provided knowledge about how these wrecks sunk and broke down.

**Therefore criterion (c) is met.**

**(d) whether it is important in demonstrating the principal characteristics of a class of cultural or natural places or environments;**

These three wrecks certainly represent many of the principle characteristics of their class; which is the PBY-4 and PBY-5 (variant) of flying boats. It is the case that these wrecks are somewhat incomplete; with for example the tail sections missing and the engineer's compartments collapsed. However a sufficient level of integrity exists for them to be considered representative of their class. They have an ability to demonstrate both gross characteristics such as the wing span and turret architecture and more detailed characteristics such as engine design.

These sites also meet this criterion by being representative of a class of flying boat lost at a certain stage of operational readiness. There are Catalina wrecks that crashed. There are Catalina wrecks that were stripped of valuable items and sunk as a form of disposal. These represent Catalinas moored at a specific stage of readiness.

**Therefore criterion (d) is met.**

**(e) whether it is important in exhibiting particular aesthetic characteristics;**

These wrecks do display distinctive characteristics unique to Catalina Flying Boats such as turrets, the shape of the hull and long wing spans. But these attributes do not meet the benchmark of exhibiting a particular aesthetic characteristic.

**Therefore criterion (e) is not met.**

**(f) whether it is important in demonstrating a high degree of creative or technical achievement during a particular period;**

The Catalina has always been greatly appreciated for its technical innovation and design excellence. The concept of a flying boat is a creative blend of the aviation and maritime worlds. The Catalina was an early version of a flying boat and became by far the most popular and best remembered version of this type of craft. The attempts by many to maintain flying versions of this historic craft are testament to their significance in the history of aviation. The key question is whether these three

Catalina wrecks have an ability to demonstrate this value through their physical remains. Considering the degree of intactness and site integrity the answer is yes.

**Therefore criterion (f) is met.**

**(g) whether it has a strong or special association with a particular community or cultural group for social, cultural or spiritual reasons, including the significance of a place to Aboriginal people as part of their continuing and developing cultural traditions;**

The USN Catalina wrecks have social value to different stakeholder groups. There are veteran groups with particular interest in the conservation of the Northern Territory's Catalina wreck sites, and they have written on a number of occasions expressing this sentiment. The USN consider these wrecks their cultural property and heritage. The USN has corresponded supporting their conservation and protection through local legislation. As the Bombing of Darwin remains one of the definitive episodes in Top End history, and these wrecks are victims of that attack, they share a collective social value with other wrecks in this group, all which have been afforded heritage listing.

**Therefore criterion (g) is met.**

**(h) whether it has a special association with the life or works of a person, or group of persons, of importance in the Territory's history.**

These wrecks are not associated with any persons or group of persons are considered of importance in the Territory's history. 

**Therefore criterion (h) is not met.**

## 7.4 Summary and Draft Statement of Heritage Value

Catalinas Four, Five and Six were assessed and found to meet heritage criteria (a), (b), (c), (d), (f) and (g). The following draft Statement of Heritage Value is provided:

*These three Catalina Flying Boats, attached to the United States Navy (USN) Patrol Wing 10, were sunk at their moorings by the Japanese during the air attack on Darwin on 19 February 1942. This was the first enemy attack on Australia's mainland and remains a formative event in Australia's 20<sup>th</sup> Century history.*

*Catalina missions from Territory bases were a particular aspect of our wartime story, with different objectives compared to other air or sea missions. Their long range, ability to land on water and bombing capacity made them strategically valuable and their mission histories unique. They reflect the combined effort of the allies to defend Asia and northern Australia. As a part of Patrol Wing 10 their presence in Darwin symbolise the retreat of allied forces, and how Darwin became a part of the new frontline in the War.*

*These flying boats were numbers 4, 8 and 41 of Patrol Wing 10, and are examples of two PBV-4 type Catalinas and one PBV-5 variant (28-5MNE). Though in each case the tail sections are gone and the engineering compartments have collapsed, the overall level of intactness of these wrecks mean they have an ability to demonstrate some of the principle characteristics of their innovative design. There was only a limited number of PBV-4s built and so two of these three a rare examples of their type.*

*These wrecks have the ability to address significant research questions about crew belongings that may be aboard, operational practices and archaeological site formation. The heritage listing of these wrecks would bring them into line with those shipwrecks protected as casualties of the same bombing raid.*

## 8.0 Management Issues

The Heritage Branch has been in protracted negotiations with key stakeholders regarding the conservation and heritage listing of the three USN Catalinas. The wrecks are located in waters that have seen significant activity in recent years; particularly wide scale dredging and the movement of large ships associated with this work. Inpex had released a heritage management plan which has worked towards minimising impact. Their initiatives include creating 'control areas' around the wrecks to manage their own shipping, and instigating a Catalina monitoring program to measure any impacts. The project is now moving from the dredging to the construction phase. Large shipping activity will continue both during and following construction, the latter involving the LPG tankers. Inpex has demonstrated a commitment to mitigating impact to the Catalina wrecks through the EIS process. However, in previous correspondence it has been unwilling to support heritage listing.

The monitoring program and periodic site visits by the Heritage Branch has identified changes in the Catalina wrecks. Most of these changes have been caused by forms of human disturbance. Anchor damage from recreational fishing may be the cause of much of these changes, for e.g. the port wing of Catalina Four and the turret and pontoon on Catalina Six. However impacts from the Inpex project cannot be ruled out at this time, for e.g. propeller wash impact from large ships.

The proximity of the Inpex wharf and the new shipping lane suggests that in the near future these waters will be busy, dangerous and likely restricted to outsiders by some form of regulation. The restriction of fishing boats would help conserve the wrecks by eliminating anchor damage. However it will also restrict future research and site visits.



## 9.0 Bibliography

- Jung, S 2001 *Wings beneath the sea: The aviation Archaeology of Catalina flying boats in Darwin Harbour, Northern Territory*, unpublished MA thesis, NTU
- McCarthy M 1997 *The Black Cats: report into the feasibility of locating, raising and conserving one of the four lend-lease PBY Catalina Flying boats scuttled off Rottenest island in the years 1945-1946* unpublished WA Maritime Museum report n0. 125

## Appendix A

(v) **The archaeological significance of submerged aircraft wrecks**

It appears evident from the very small sample listed above that the wrecks of flying boats generally can constitute sites of importance to archaeologists, historians, aircraft restorers and enthusiasts.

Indications from this sample are that those which come to rest in shallow water will sink upright, while those in water deep enough to allow it, will sometimes invert due to the weight of the engines up on the wings. Fifty years of corrosion in a salt water environment in either case will most likely lead to severe corrosion and possibly the collapse of the engine mounts. Being a combination of ferrous metals and aluminium, those parts of the aircraft designed to carry weight will prove most susceptible due to the advanced processes of bimetallic corrosion (White, pers com).

It is also evident that within the framework of underwater archaeology, submerged aircraft wrecks potentially form a class of archaeological site in themselves. Within that class of site, it is possible to attempt to identify sub groups of sites with decreasing archaeological/museological/technological significance. The compiler has proposed an embryo 'classification of use' to researchers and potential excavators/salvors based on his experience with maritime archaeology generally (McCarthy, 1996). Clearly it is an area that can be developed, with Jung's research entitled 'Archaeological investigations of the Catalina wreck sites in East Arm, Darwin Harbour (in press), a useful beginning.

As a beginning the following archaeological classifications (which reflect similar categories for shipwrecks) are suggested:

**Group A aircraft wrecks**

One grouping of sites would be remains of aircraft that have sunk in a fully operational and active circumstance. In itself this group would contain a number of categories.

**Category 1**

The first class of site would be remains of aircraft that have sunk in a fully operational and active circumstance and which now lie completely intact. These aircraft generally have landed on water or mud in a reasonably controlled fashion and have sunk to the bottom sediments without disintegrating. They are potentially a source of significant structures, materials, artefacts and information. This data is little altered by any but the incident that caused them to be forced down, by the impact with the surface itself, or though natural transformation processes. These processes are water movement, corrosion and biodegradation.

Normally these Category 1 wrecks will appear as sites lying in (comparatively) deep water or inaccessible mud away from the effects of wave action and human interference. Within this group there would be subsets. Those wrecks lying in fresh or nearly fresh water, given that they have been proved capable of recovery, restoration and exhibition, would contrast with concreted structures, lying in a saline and/or coralline, warm water environment. The latter have yet to prove a viable proposition with respect to raising and restoration (White pers com).

**Category 2**

A stark contrast with Category 1 would be former fully operational aircraft susceptible to heavy corrosion and/ wind and wave action. Even if these are inaccessible to human interference, those parts of the airframe that are not buried in the seabed rapidly disintegrate. The remainder will lie buried in the sediments, though the effect of sulphate reducing bacteria may ensure that the corrosion processes are continuing.

Despite these ongoing processes, and the loss of a great deal of material and data through natural processes, significant artefactual material remains on site.

### **Category 3**

These aircraft sites would possibly be those once forming Categories 1&2, but which have been subject to human interference by professional or recreational salvage. This element of itself, can be categorised according to the extent of the interference and the degree of salvage.

### **Group B aircraft wrecks**

Group B sites could be those abandoned with all their fittings and/or fixtures, but not containing any of the accoutrements of action as in the group above. They have been deliberately abandoned in flying condition and the material remains on-board is expected to reflect that fact.

Within Group B, there would appear categories similar to group A.

### **Group C aircraft wrecks**

These sites would be stripped aircraft, similar to the commonly encountered abandoned shipwreck hulk. Material and information gleaned from these sites is most often limited to structural detail of fittings and fixtures deemed unsuitable for salvage and/or reuse before the hulk itself was abandoned. Occasionally artefactual material could be found in inaccessible locations, but its context is unknown, or the material itself is fragmentary. (In abandoned ship hulks this material appears in the bilge, which being often full of foul water, makes the recovery of such material initially undesirable.)

Again within Group C there will appear categories similar to Group A.

The Rottnest Island Catalinas would fit into Group B, given their scuttling as operational aircraft previously cleared of loose items.

Clearly, other factors such as the relative rarity of a particular aircraft, its contents and its associations with a particular person or event(s) will have a bearing on the categories above. This is one of the arguments that the Catalina Club of Western Australia have put with respect to the 'Black Cats'.

### **Recovery and conservation of the aircraft. Is it possible?**

Mr John White, the Curator of Military Technology, Australian War Memorial, made the following comments with respect to the potential raising, conservation and exhibition of one of the Rottnest Island Catalinas in an interview conducted on 9 December 1996.

- The Australian War Memorial has successfully conserved aircraft engines taken from submerged sites at Kota Baru in Malaysia. The process has taken from 6 months to a year, requiring treatment tanks, the provision of facilities and chemicals.
- Though the Catalina type, which was designed for use at sea had corrosion inhibition systems, (See Jones' transcript) the process continues in a submerged environment. It has been found that similar large-bodied types such as the *Mavis* flying boats in Rabaul waters have collapsed over the years, partly due to their own weight. i.e. the high-wing type do not necessarily sink into the sediments up to the

## Appendix B

### Aircraft Condition: establishing a criteria for measuring aircraft wreck integrity and archaeological significance

With the need to maintain consistency in decisions about the inclusion of aircraft wreck sites on the Heritage Register, the following is a draft for assessing the degree of aircraft wreck site integrity (or intactness) with some consideration of **research potential**. Integrity is fundamentally about a site's **ability to demonstrate** its significance. 

The following rating structure is a guide to assess and rate aircraft wreck integrity. It is imperfect because one or two attributes may determine a higher level is met, despite the absence of corresponding attributes. It nevertheless provides a trial framework.

1. A **very good condition** rating would mean that the plane remains a close to complete structure, in contrast to being broken up or scattered. The majority of components remaining in place and the physical evidence may identify the individual craft and show field modifications. The site may also retain an ability to demonstrate key aspects of its last mission and how and why it crashed. This category may include personal belongings of crew.
2. A **good condition** rating would mean that although the structure is partly scattered, a significant degree of the structural elements and other components still remain on the site. The type of plane can be clearly identified by obvious design features. The wreck may demonstrate aspects of the plane's use or mission or aspects of its crash. In this category a plane may still constitute a representative example.
3. A **medium condition** rating would mean that the structure of the wreck is broken up and scattered however major features remain on the site. The individual plane or type may be evident from a specialist examination of structural elements; however the plane no-longer clearly demonstrates its

type. There is less ability to address research questions regarding its mission, or why and how it crashed.

4. A **poor condition** rating would mean that the site comprises of scattered features and it would be clear that a significant portion of the original material is absent. Physical evidence investigated with specialist knowledge will provide *supportive* evidence as to the type or identification of the plane. This wreck is unable to demonstrate aspects of its mission, how it crashed or why. There may have been some post-depositional movement of materials by natural or human intervention.
  
5. A **very poor condition** rating would mean that the site consists of a few scattered remains. The site has little ability to demonstrate its type or specific identification. There may have been considerable post-depositional movement of materials by natural or human intervention.



