1.4.40 **Cyclic Input v Pitch**. Figure 1-4-6 graphically illustrates aircraft cyclic input and pitch during the HP's exercise. Exhibit 11

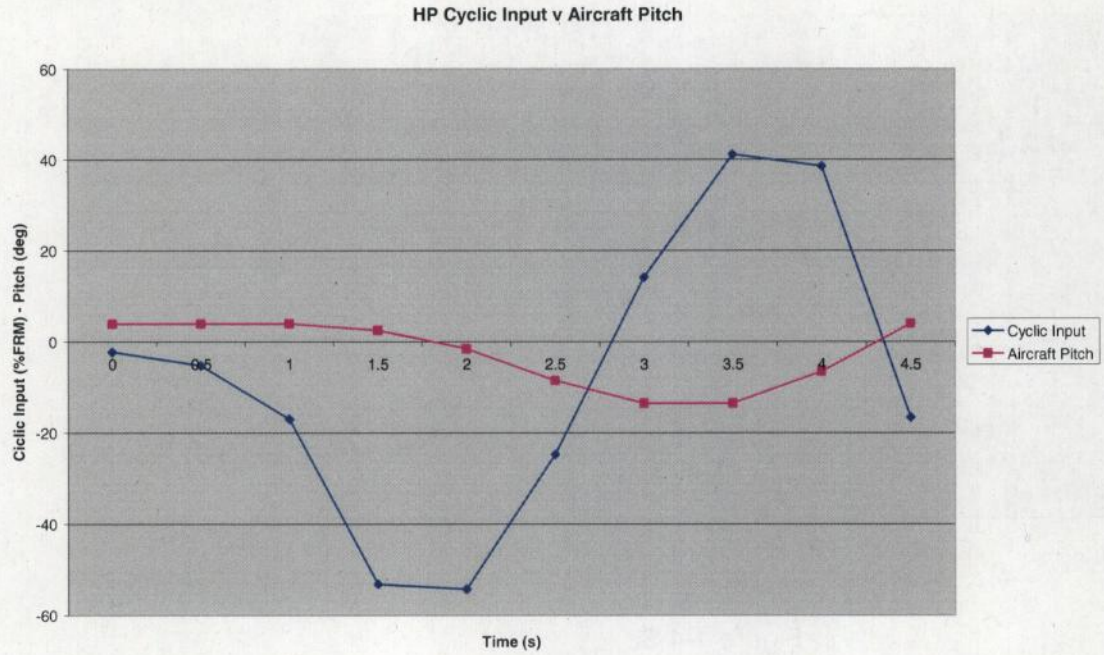

Figure 1-4-6

1.4.41 Analysis of Figure 1-4-6 suggests a lag between the HP's input and the aircraft's reaction. This lag is not considered unusual for the Sea King Mk 4. The lag seen during the QHI's demonstration is similar. The lag experienced by both pilots is **not considered a factor** in the incident.

1.4.42 **Pitch Rate**. Figure 1-4-7 graphically illustrates aircraft pitch rate (i.e. the change in aircraft pitch in degrees per second) during both the QHI's demonstration and the HP's exercise. Exhibit 11

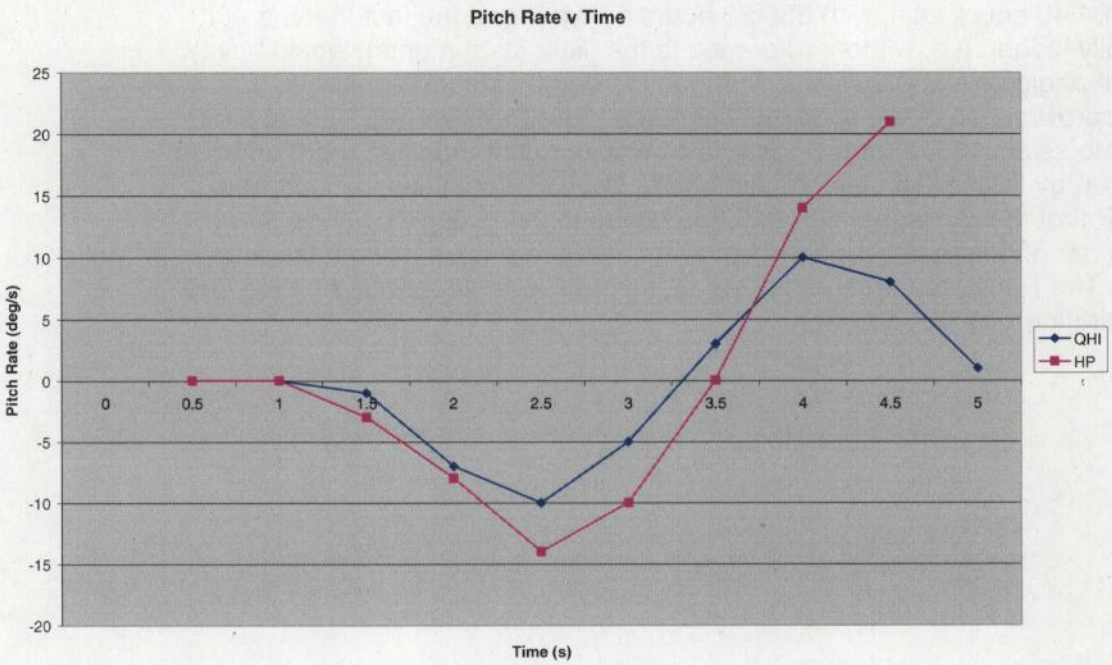

Figure 1-4-7

1.4.43 The QHI attains a maximum of approximately 10 degrees per second on both the nose down and nose up motion of the aircraft. Additionally, the aircraft had almost stopped rotating (1 degree per second) by the time of the impact. This equates to an additional rate of decent of 21 ft/min at the tail wheel which will be considered further in para 1.4.50.

1.4.44 Conversely, the rotational velocity of the aircraft during the HP's exercise attains a maximum of approximately 14 degrees per second during the nose down motion and 21 degrees per second at the point of impact of the tail wheel with the ground. These pitch rates are consistent with the control inputs already described. More important, however, is the fact that the aircraft is rotating with a considerable angular velocity as it impacts the ground. This angular velocity will have a vertical component which must be added to the aircraft's rate of descent in order to establish the rate of descent experienced by the tail wheel as it struck the ground. The vertical component of the angular velocity has been calculated as 479ft per minute for the HP compared with a figure of 21ft per minute for the QHI's demonstration. The total RoD is calculated in para 1.4.51. Exhibit 11, 37

1.4.45 The Panel concluded that the rate of pitch change or angular velocity applied to the aircraft by the HP was an **aggravating factor** in the incident, as this significant rate of decent on the tail wheel made the outcome worse.

1.4.46 **Application of Collective Pitch**. Figure 1-4-8 graphically illustrates the amount of collective lever applied by both the QHI during the demonstration and the HP during the exercise. Exhibit 11

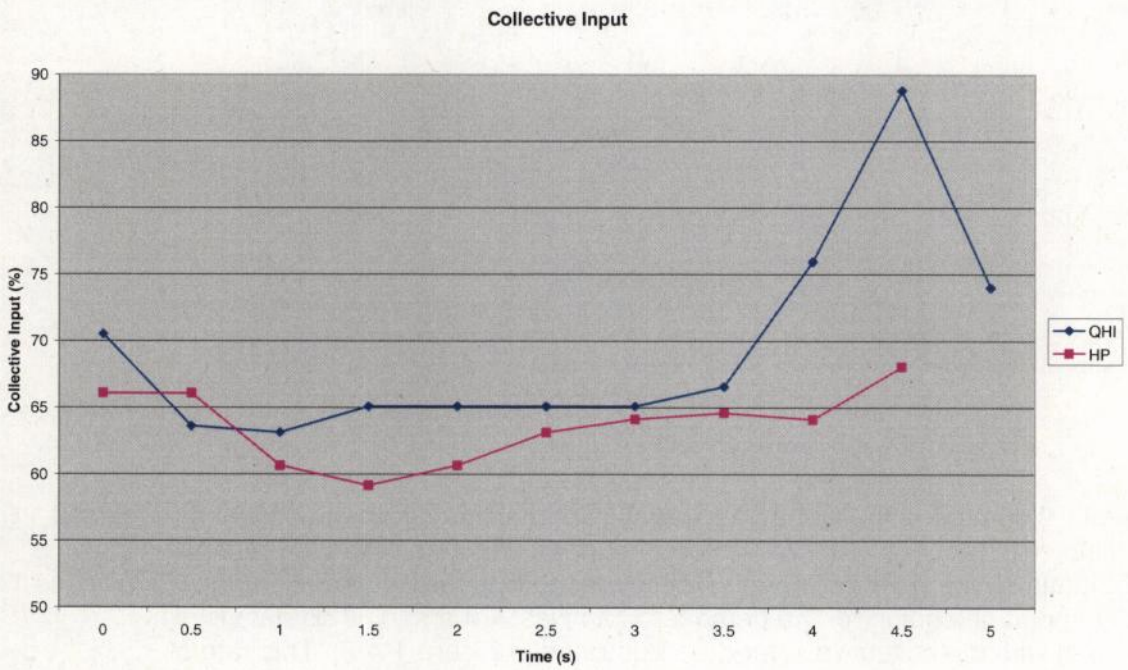

Figure 1-4-8

1.4.47 The difference in the collective lever positions at the start of the exercise can be attributed to the same factors as in para 1.4.35, although again the Panel cannot identify how much influence, if any, can be attributed to each of these factors. Exhibit 11

The QHI immediately checked down on the collective[16] (in order to conserve Nr), from 71- 63% full range of movement (FRM) and, whilst he regains some collective to 65% FRM, he maintains this level until he makes a very large movement up to 89% FRM to cushion the landing. The HP's profile, whilst broadly similar, has some notable differences. The HP is slower to react with the initial check down (by 0.5 seconds). He did not maintain the collective lever position after checking down and steadily increases the collective input during the exercise. The effect of this increased collective input is likely to have been countered by the higher engine power setting. The HP does begin to apply a higher collective input to cushion the landing, but he impacts the ground before he completes the movement.

1.4.48 The Panel concluded that the HP's application of collective pitch was insufficient and too late to markedly reduce the rate of descent and cushion the landing. The lack of cushioning and the subsequent rate of descent was assessed by the Panel to be an **aggravating factor** in the incident as discussed in para 1.4.51.

1.4.49 **Rate of Descent**. Figure 1-4-9 graphically illustrates aircraft RoD in feet per minute during both the QHI's demonstration and the HP's exercise. Exhibit 11

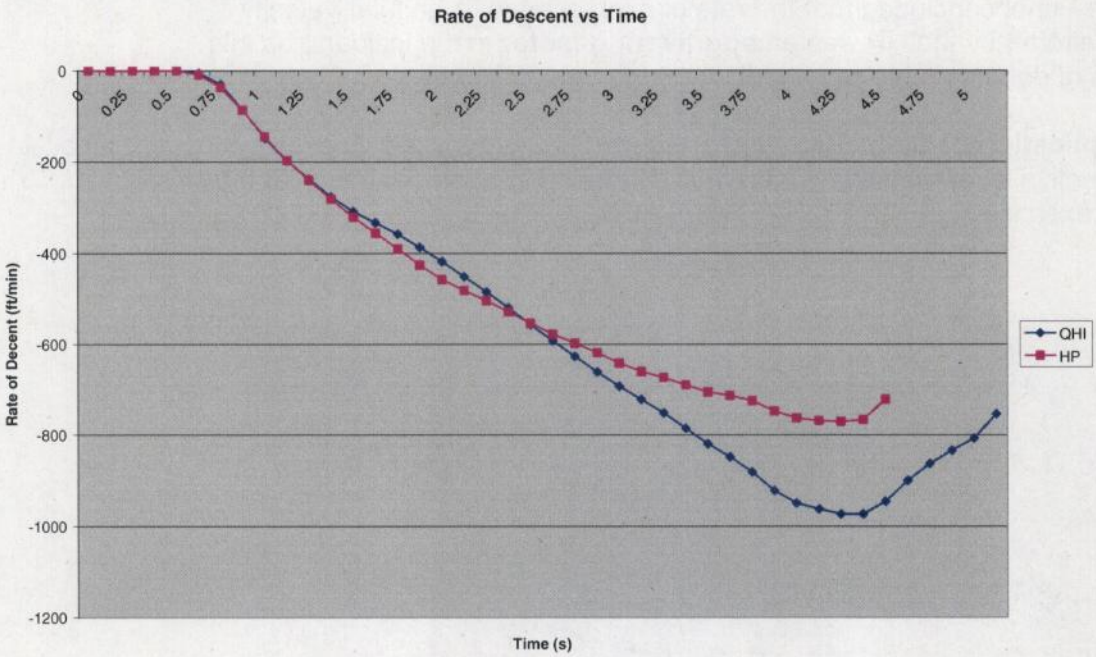

Figure 1-4-9

1.4.50 The QHI controlled the aircraft to a significant maximum rate of descent of 974 feet per minute (ft/min) in a reasonably linear manner. He then slows the rate of descent to 753ft/min by the point of impact. Therefore the true rate of decent, at the tail wheel, at the point of landing for the demonstration was 774 ft/min. This data is entirely consistent with the collective lever data illustrated in Figure 1-4-8. This rate of descent at the point of impact accounts for the perceived firmness of the landing. When compared with the design maximum Vertical Velocity (Vv) on landing of 480ft/min, the QHI's landing should in fact have been considered a 'heavy landing' as it was well outside the design envelope of the aircraft, (1.61 times the Vv). The QHI did not register the landing as excessively firm. Additionally, the Sea King does not Exhibit 11, 38 Witness 1

[16] 'Checking Down' on the collective lever refers to a small movement of the lever in order to reduce the collective pitch on the rotor blades, thereby reducing drag and power required.

have a system to indicate to the crew that a heavy landing has been experienced. The QHI proceeded with the planned sortie and did not instigate heavy landing engineering checks. This is discussed further under Wider Issues in para 1.4.82.

1.4.51 The HP initially controlled the aircraft to a very similar RoD profile, which he then reduces towards the later stages of the exercise. He attains a maximum rate of descent of 771ft/min which is reduced to 722ft/min by the point of impact. It should be noted that this RoD is the vertical component only and does not account for the pitch change in the aircraft. Para 1.4.44 above concluded that the vertical component of the rotational velocity of the rate of descent was 479ft/min which, when added to the vertical component, subjected the tail wheel to a Vv of 1201ft/min at the point of impact. This equates to 2.5 times the Vv. Exhibit 11, 37

1.4.52 The Panel concluded that the RoD and the pitch change at the time of impact combined to be the cause of the majority of the damage sustained by the aircraft during the incident. Therefore the RoD was an **aggravating factor**.

1.4.53 **Further Analysis of HP's Profile – Start Height**. Figure 1-4-10 shows the HP's exercise had it commenced at 40ft as described in the Flying Procedures. Exhibit 11

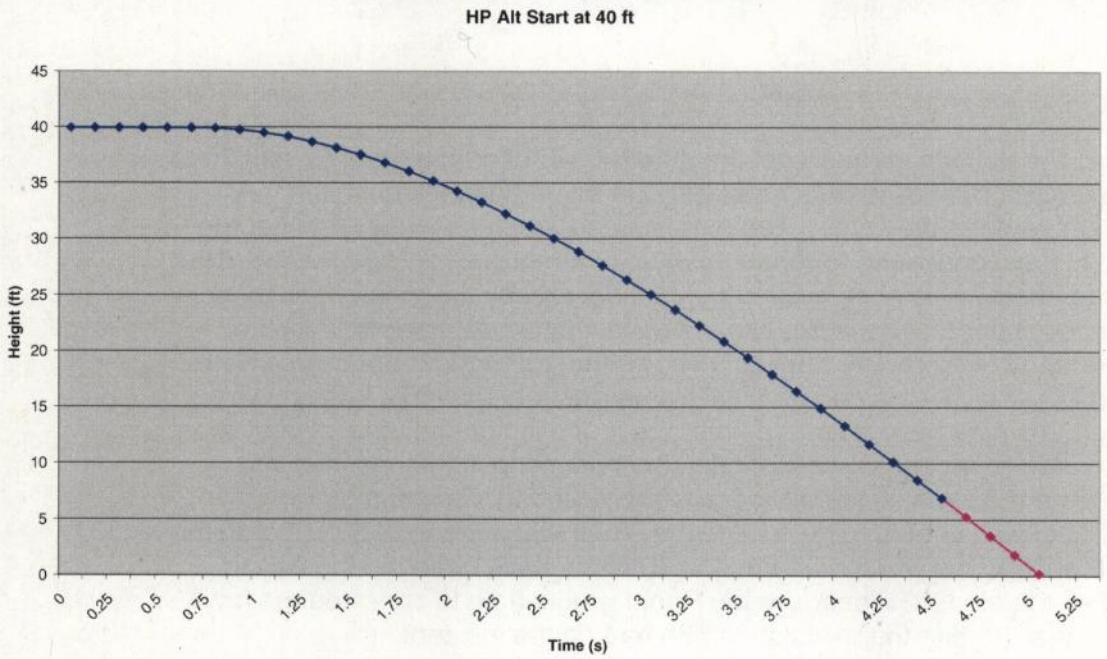

Figure 1-4-10

1.4.54 By moving the height profile start point from 33ft up to 40ft (but not changing any other variables) and then extrapolating the profile in a linear manner, as shown by the pink line, the Panel concluded that the HP had approximately 0.5s less time to complete the exercise. Having established that the HP would have had an extra 0.5s to complete the exercise the Panel then added this time to the other elements of his flight profile and extrapolated the data, ascertaining what may have happened had he started at the correct height.

1.4.55 **Further Analysis of HP's Profile – Aircraft Pitch**. Figure 1-4-11 illustrates the HP's Cyclic input in pitch and the aircraft attitude had he had an extra 0.5s in which to complete the exercise.

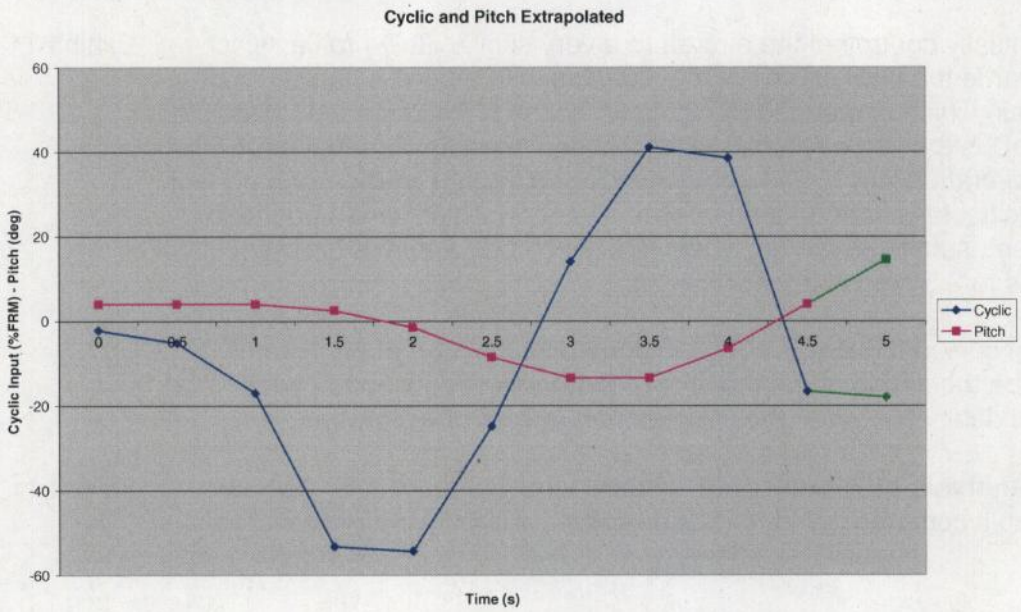

Figure 1-4-11

1.4.56 It was the opinion of the Panel that had the HP had an extra 0.5s and 7ft to complete the exercise, but flown the aircraft with the same control inputs, the outcome would have been the same. The extrapolated graph above shows that the aircraft is likely to have continued to rotate nose up in a relatively linear manner. The HP had begun to apply some nose down input to the cyclic by the moment of impact, which the Panel consider that he is likely to have maintained, in order to level the aircraft for the landing. Figure 1-4-11 clearly shows that throughout the exercise the aircraft reaction to cyclic input is delayed[17]. This implies that the HP's nose down input at approx 4.25s may have decelerated the rate of pitch change but is very unlikely to have caused a nose down motion in the remaining flight time, thereby leading to the same outcome, suggesting that starting at 33ft was not a factor. However, the Panel was unable to determine the effect that starting at 33ft had on the HP's visual perception, and whether starting at 40ft may have changed the way in which he handled the aircraft. Therefore the Panel was unable to conclude the level of influence that that starting the exercise at 33ft had on the incident.

1.4.57 **Aircraft Weight**. The aircraft was operating at approximately 19600lbs during the QHI's demonstration and approximately 19500lbs during the HP's exercise. The weight limit in the Flying Procedures for the exercise is 18000lbs. At 18000lbs the exercise requires hover torque (HTq) + 25% to be manually set on the No1 engine, whilst the No2 engine is retarded to ground idle. It is the Panel's opinion that the extra power set by the QHI (HTq + 30%) may have been sufficient to negate the effect of the excess weight on the exercise. However, this could not be proved conclusively; therefore the Panel was unable to determine the level of influence, if any, that conducting the exercise in excess of the weight limit had on the incident.

Exhibit 8, 12, 40

Witness 1, 2, 3, 5

[17] A delay in aircraft reaction to control input is a function of a number of factors and is normal in helicopters.

The HP's Understanding of the Technique

1.4.58 The HP had previously been taught to react to single engine failures from 10-15ft, covering recovery techniques from the hover and aborted or continued transitions (confusion between the 40ft ASEF and these procedures are discounted in para 1.4.59 below). It was approximately 2 years since the HP had received a Mass Brief on the 40ft ASEF. The HP had stated that he had been taught single engine failures from 40ft for confined area approaches in the simulator. Although a simulator report from 17 Jul 13 confirms this, there was no evidence of training for engine failures over a load. The confined area technique is a different profile, requiring a vertical descent as opposed to moving forwards during descent, which is the aim of the 40ft ASEF. The HP stated he had read the instructions for the exercise in the Flying Procedures but had not read the warnings. In the Panel's opinion he had received a less than comprehensive verbal brief just prior to the exercise and he had been given a practical demonstration. The QHI had shown that this was a visual exercise which involves taking cues from the earth horizon rather than relying on cockpit instruments. During the demonstration the HP was required to retard No2 engine SSL (located on the overhead console) to the ground idle position. The Panel considered whether it was conceivable that the HP could have remained 'eyes in', missing the point of the demonstration but took the view that this was unlikely given that the main focus of events was outside the aircraft. The Panel assessed that the HP had insufficient knowledge and understanding of what was required to complete the exercise safely and that this was a **contributory factor**. Exhibit 2, 6, 12 Witness 2

1.4.59 **Single Engine Failure Practice during a Continued Transition**. During instruction for single engine failures there is a requirement for the student pilot to learn the procedure to be carried out in the event of an engine failure during a transition from the hover to forward flight (the 'Transition Continued' profile). As this procedure requires the selection and maintenance of a nose down attitude, and 'Transition Continued' was mentioned during the QHI's brief in the aircraft, the Panel considered whether there might have existed confusion in the HP's mind regarding the amount of nose down pitch required during the 40ft ASEF. However, the Panel concluded that the HP's previous flying experience had taught him that a transition requires a 5 to 7 degrees nose down attitude and that there are no normal handling exercises that necessitate the amount of pitch used in his handling of the 40ft ASEF. The Panel therefore concluded that potential confusion by the HP between the 40ft ASEF and 'Transition Continued' was **not a factor**. Exhibit 2

Potential for the QHI to Intervene

1.4.60 The 40ft ASEF is a complex dynamic exercise initiated by moving the No2 SSL to the ground idle gate. This requires the non-handling pilot (the QHI during the incident) to have his hand on the engine controls on the overhead console, leaving very little time to move his right hand from the overhead console to the cyclic. The QHI's left hand normally covers the collective lever as its rate of application is typically the control in which the student requires guidance.

1.4.61 The HP's exercise lasted 4.5 seconds. At the point that maximum pitch down is achieved the aircraft is approximately 1.5s away from impact. This gave the QHI minimal time to react and take control. The standard intervention time from DEF STAN 00-970 Part 1, Section 4, Leaflet 36 is 2 seconds for an un-alerted detection. Exhibit 11, 42, 43

1.4.62 The Panel concluded that the QHI did not have sufficient time to intervene in the control of the aircraft, thereby preventing the incident from occurring. The Panel

concluded that this was a **contributory factor**.

Rear Crew

1.4.63 All crew attended the pre-flight brief at which the abseil serial was covered in detail including limitations and emergencies. It was mentioned that the 40ft ASEF would take place but it was not briefed any further. At the time of the incident the Aircrewman and the pilot waiting to take his turn for the abseil detail were in the rear of the aircraft. The pilot was seated and restrained at the MX15 console and during the demonstration the Aircrewman was standing at the cargo door wearing a dispatcher harness. Witness 1, 2, 3 5, 7

1.4.64 The 40ft ASEF was an unfamiliar exercise for the Aircrewman and during interview he stated that he had not flown it before, had not been briefed on the profile and was surprised by how firm the landing had been. As a consequence of the firmness of the demonstration the Aircrewman elected to be seated for the HP's exercise. During the serial there was some confusion as to when it was being conducted and he was not expecting the abseil exercise to finish abruptly (as review of the cockpit voice recorder (CVR) shows) and he voices his surprise when told to "*ditch the rope*" by the QHI. On completion of the heavy landing from the QHI's demonstration he responds to the front seat query regarding the Helicopter Emergency Egress Lighting System (HEELS) and continues with a debrief of the 4 HUMS fault codes. After a short debrief the crew commenced the second 40ft ASEF. At this point the crewman conned[18] the aircraft back to the position over the taxiway. Once the front seat crew were happy he moved to the aft crash-worthy seat but did not strap in and remained connected to his dispatcher harness. JHC FOB states that helicopter crew should be restrained as follows: '*...all aircrew are to be strapped into a seat harness. The only exception to this Regulation is when aircrew are required to perform duties necessary for the safe operation of the aircraft or completion of an essential authorised task.*' Exhibit 1, 2, 33 Witness 3

1.4.65 The Panel made wider inquiries regarding common practice amongst other CHF aircrewmen when conducting similar sorties, where there is a constant need for the aircrewman to be switching between the dispatchers' harness when conducting their duties in the rear cabin and correctly seated and restrained at all other times. During the investigation the Panel observed that there may be occasions whereby CHF aircrewman are not always seated and restrained in accordance with the RA and JHC FOB, when it is in their best interest to do so, even if it may require short delays to the conduct of the sortie. Urgent safety advice has been issued to the Operational Duty Holder regarding rear crew restraint. The Panel **made the recommendation** that all helicopter Rear Crew are reminded of the requirement to be secured as appropriate for their role in the aircraft. Exhibit 31, 33, 53

[18] Con – a term used to describe the directing of an aircraft by an aircrewman using voice commands to the pilot.

Post-Incident

Survival Aspects

1.4.66 There were no intrusions into the crew compartment and no post-impact fire. [redacted] Exhibit 3, 45

Personal and Aircrew Equipment Assemblies (AEA)

1.4.67 There were no issues with AEA and the Panel had no comments to make on the subject.

Other Service Personnel

1.4.68 The only other Service personnel in the vicinity were the MAOT abseilers who, after completing the first abseiling serial, were directed to remain away from the aircraft and took no further part in its operation. The Panel had no comments regarding other Service personnel.

Post Crash Management (PCM)

1.4.69 The station Post Crash Management procedures were initiated from the ATC tower on receipt of the 'PAN' call. All agencies reacted in a timely fashion with no areas for concern. The Panel noted that the local procedures appropriately follow MAA guidance. Exhibit 14, 57

Costs of Damage to Aircraft & Civilian Property

1.4.70 The aircraft was assessed Cat 3 Depth by 1710 NAS. The Sea King Project Team calculated the net book value to be £670k and estimated the cost of repair to be approximately £2.8 million so the decision was taken to retire the airframe. There was no damage or associated costs to civilian property. Exhibit 3, 46

WIDER ISSUES

Monitoring of pre CofC Aircrew

1.4.71 **CHF Training Supervisory Process**. CHF has a comprehensive training system, underpinned by Regulatory Articles and Orders. Training is conducted on the conversion unit, 848 NAS and continued on 845 NAS, currently the only Front Line Commando Sea King squadron. The flying performance of all RN squadrons is independently checked by the NFSF(RW), typically every 2 years. The Panel reviewed the orders concerning pre CofC aircrew supervision and the 3 principal means of monitoring their progression as employed by 845 NAS, namely: the Task Book, the 401A&A and quarterly Training Office meetings. These are considered in detail at para 1.4.73 – 1.4.76. The Panel also reviewed the case file of a pre CofC pilot who had recently been suspended from flying whilst on 845 NAS, which demonstrated very effectively how the CHF training system can work in such

circumstances.

1.4.72 **Orders Concerning Pre CofC Aircrew Supervision**. The RN reference for the monitoring of training for pre CofC aircrew is BRd 767 Naval Aviation Order 2102 which states: *'On award of the Flying Badge aircrew shall undergo a period of consolidation in role not normally to exceed 15 months prior to the award of Certificate of Competence.'* The monitoring of this is achieved using the Task Book, 401A&A and the quarterly Training Office meetings. Exhibit 20, 31, 33, 47

1.4.73 **Task Book**. The Task Book and its system of monitoring progress was considered by the Panel to be a reasonable way of ensuring that the Subject retains responsibility for their own training progress and served to ease the administrative burden on the training staff. The Task Book is not used as a means of supervision and was therefore **not a factor** in this incident. Exhibit 18

1.4.74 **401A&A**. The 401A&A log is a loose leaf file containing 5 divided sections comprising: Exhibit 6,19, 48

a. Record of Flying Experience and Ability.

b. JPA form 2020G – Record Sheet Course Report.

c. NAC Form 195A – Standards Report.

d. NAC Form 195D – Instructor Recommendations.

e. NAC Form 195G – Miscellaneous Test Reports.

1.4.75 The instructions for completing the 401A&A are only contained in BR767 Naval Aviation Order 2401 and not in any part of the 401A&A document. The Panel observed that, although the Order describes the 401A&A as 'providing Commanding Officers a continuous record of the experience and ability of each individual', nowhere in any of the report forms is there a signature block for the Commanding Officer (CO), the Sqn Senior Pilot or any other supervisor. Additionally, there is no signature block for the subject officer. Only the person conducting the training and writing the report has the ability to formally acknowledge the content of any reports. There is no easily identifiable path of progress for the reader, save reading every report. Records of sortie success or failure are contained in the text of each report and not reflected in any collated format. The typical routine is for the Sqn Training Officer to hold all the 401A&A folders in the Training Office whereby the subject officer can then access their own folders upon request. The Panel observed that the document resembles a Record of Achievement rather than an independent record of ability and a supervisory tool for independent assessors. The Panel considers that there are some shortcomings in this system, including: Exhibit 6, 49

a. There is no independent check of progress.

b. Document control is compromised.

c. There is no formal feedback through these reports.

d. Trends are not easily recognised.

e. Sqn COs or Senior Pilots are not formally required to audit or comment on

progress.

f. There is potential for the training staff to become both the trainer and assessor, which can create the opportunity for systemic error.

The Panel **made the recommendation** that the recording of training and achievement be reviewed to ensure that there is an auditable layer of supervision. Shortfalls in training should be easily identified so that supervising officers can identify risk to ensure it is tolerable and As Low As Reasonably Practicable (ALARP).

1.4.76 **Quarterly Training Office Meetings**. 845 NAS hold quarterly Training Office meetings to monitor the progress of pre CofC pilots and these meetings are attended by the Senior Pilot and Training Officers. Minutes are taken and known issues addressed. During these meetings the progress of the subject pilots is briefed by the training staff and senior Training Officer to the Senior Pilot. As neither the CO nor the Senior Pilot routinely see or sign as having read an individual's sortie reports in the 401A&A the opportunity exists for the Sqn Executives to miss trends in individuals' progress if they are not raised at this meeting. Exhibit 16, 50

1.4.77 **Aircrew Suspension**. Despite the shortcomings mentioned above, the Panel noted that the training system had worked effectively during the recent identification and suspension from the Front Line of a pre CofC pilot. The QHI as the TO1 had played a central role in this suspension, was comfortable with the procedure and would not be deterred from using the same process again if necessary. Exhibit 50, 56 Witness 1

1.4.78 **Training Shortfalls**. Regulatory Article 2102(1) covers the monitoring of pre CofC aircrew. This Regulatory Article (RA) is further amplified by JHC and CHF orders 2102 and 2103. The Commando Pilot Operational Performance Statement (OPS) within the 848 NAS Master Training Document permits training deficiencies to be completed as 'On Job Training (OJT)' on the Front Line. On 11 Oct 13 scrutiny of the wall board in the 845 NAS Training Office by the Panel, on which shortfalls were recorded for planning purposes, showed that there were a total of nine pre CofC pilots who had not carried out the 40ft ASEF exercise in the aircraft. Interrogation of the Squadron Training Achievement Recording System (STARS) by the Panel showed that all of these pilots had conducted load lifting sorties since leaving training. The Panel concluded that the monitoring and addressing of shortfalls was not effective, allowing shortfalls to be carried for considerable periods and exercises to be completed without having conducted some of the requisite training. Therefore the monitoring and addressing of shortfalls was assessed to be both a **contributory factor** and **an other factor**. Exhibit 33

1.4.79 Having reviewed the training monitoring system on 845 NAS the Panel concluded that it was effective, but that it held some intrinsic systemic weaknesses which could allow a trend of erratic and poor performances to go undetected. The Panel **made the recommendation** that the monitoring and recording of pre CofC aircrew is reviewed with regard to the shortcomings listed at para 1.4.75.

Simulator Training

1.4.80 The Panel observed that the Sea King Simulator was not routinely used to instruct the 40ft ASEF exercise. NFSF(RW) were tasked to examine the utility of practising the 40ft ASEF in the simulator vice a live aircraft. NFSF(RW) assessed the Sea King Simulator to be fit for the purpose of conducting the 40ft ASEF training. The HP had not conducted the 40ft ASEF in the simulator and the exercise is not Exhibit 54

mandated as part of the simulator syllabus during the conversion to type or during the annual simulator refresher visit. It is routine practise that the first time a pilot experiences the handling procedure for the 40ft ASEF is in a live aircraft. However, the Panel noted that this is the first recorded incident of this type in the Sea King after more than forty years in service. The Panel therefore **made the recommendation** that the instruction of the 40ft ASEF is reviewed to ensure the risks therein are tolerable and ALARP.

Radar Altimeter Partial Test Flight (Rad Alt PTF)

1.4.81 During the morning prior to the sortie, ZE428 was flown on a Rad Alt PTF, post replacement of the Rad Alt transceiver. The instructions for the Rad Alt PTF were contained in AP 101C-0400-5M1 and the test flight was carried out in full, with the exception of a requirement for the aircraft to be climbed to a height of 5000ft to assess the serviceability of the 'no-track' flag in the instrument. The weather was unsuitable for this part of the Rad Alt PTF to be carried out. The instructions allow for this not to be completed in the event of unsuitable weather but it is stipulated that an entry to that effect is made in the aircraft's Form 700C, the aircraft log book. The Panel made **the observation** that an entry was made in the Form 700C after the test flight stating that the Rad Alt was assessed as serviceable, with no caveat stating that the 5000ft check had not been carried out. The Panel **made the recommendation** that all aircrew are reminded of the need for accurate post flight recording. Exhibit 8, 41, 45

Heavy Landing Detection

1.4.82 **Rate of Descent**. During its investigations the Panel noted that the definition of a 'heavy landing'[19] for a Sea King was a Vv in excess of 8 feet per second or 480ft/min. The figure of 480ft/min was obtained from the OEM (AgustaWestlands) and passed to the Panel via the Sea King Project Team. This figure is not published in the Sea King aircrew manual, Release to Service or Flight Reference Cards and its absence is considered by the Panel to be a potential breach of defences for all Sea King operators. The HUMS reading for the QHI's demonstration shows that the Vv was exceeded, at 774ft/min. This equates to 1.61 times the Vv which, according to the definition, is a heavy landing and should have stopped the sortie pending an engineering examination. The evidence shows that the QHI did not believe that the rate of descent and resultant heavy landing were out of the ordinary and therefore continued with the sortie. The QHI's perception that the firmness of the landing was not unusual may represent a more widely held view amongst Sea King aircrew that the aircraft is capable of and designed to land at higher Vv than 480ft/min, especially given its maritime role. The Panel made the **observation** that this is a potentially unknown risk, or one not fully appreciated by the DH chain. Although not germane to this Inquiry, the Panel discovered other helicopters in service had lower Vv limitations than the Sea King, of which their operators may not be aware. The Panel observed that whilst Vv is not recorded in the HUMS data it can be derived from the vertical accelerometer data that is gathered. The Panel **made the recommendation** that the application of the Vv limit of 480ft/min be considered by the ODH, Release to Service Authority and Sea King Project Team with regard to Sea King operations and maintenance. The Panel also **made the recommendation** that the application of the Exhibit 2, 11, 38

Witness 1

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[19] DEF STAN 00-970 Leaflet 307/1 defines a heavy landing as: 'any landing above the design vertical velocity (Vv) ... in which control is retained. Some yielding of structure. Possible collapse of the undercarriage above 1.2Vv. No incapacitating injury to the crew. After a heavy landing the rotorcraft may be able in emergency to take-off, fly back to base, and alight, with negligible risk of further injury to the occupants, depending on the state of the undercarriage.'

Vv limit is reviewed across all Service helicopter operators.

1.4.83 **HEELS**. The Panel observed that the cabin door HEELS was activated normally during the QHI's demonstration as the aircraft landed at 774ft/min and 2.95g. This system is designed to be activated at 3g (-10%). However, the Release to Service Authority has stated that it is not designed, calibrated or declared as a heavy landing warning system. The Panel **made the observation** that although the HEELS was in no way intended to indicate a heavy landing, the fact that it is designed to activate in landings above 3g (-10%) suggests that it might have a potential purpose not previously considered. The Panel **made the recommendation** that the link between HEELS activation and heavy landings is explored further. Exhibit 1, 2, 11, 39

JHC Risk Register

1.4.84 The risk of Sea King single engine failures was captured in the JHC Risk Register and the 'treat'[20] required the actions in the event of single engine failures to be trained on 848 NAS. Once a pilot had joined the Front Line with shortfalls, as permitted by the 848 NAS Master Training Document, and those shortfalls were not addressed during a Change of Unit Check, then the risks were no longer being mitigated as per the JHC Risk Register. The Panel observed that the 9 pilots with outstanding 40ft ASEF shortfalls had all carried out load lifting and therefore each of these pilots represented an unmitigated risk. This was highlighted to the DG MAA in briefing note SI ZE428 01/13 and became urgent safety advice. The Panel **made the recommendation** that JHC review risk monitoring for the 40ft ASEF. Exhibit 10, 19, 51, 52, 53,

Technical Report

1.4.85 The Panel made the following 2 **observations** from the MilAAIB Technical report: Enclosure 2 at Part 2.8

a. A Quality Assurance audit of the preceding 50 flying hours of the MOD Form (F) 700C and GOLD esp 700c had a large number of inaccuracies in its completion. None were of a hazardous nature and they did not contribute to the incident. However, the Panel **made the recommendation** that CO CHF ensures that all aircraft documentation is completed accurately.

b. The DDH chain issued a SQEP Assessment using an internal Loose Minute format which did not follow a recognised engineering template and lacked content and detail. The Panel **made the recommendation** that the DDH engages with the MAA to develop a method of ensuring that SQEP Assessment Directives are comprehensive, detailed and provide clear direction to all action addresses.

[20] The term 'treat' is used throughout risk management for an action to mitigate the assessed risk

Summary of Findings

1.4.86 **Cause**. The cause of the accident was determined to be an achieved and sustained excessive nose down attitude in a situation where there was little room for manoeuvre (para 1.4.38).

1.4.87 **Contributory Factors**. The Panel identified 11 factors that did not directly cause the incident but made it more likely to occur:

a. Planning of the Sortie (para 1.4.15).

b. QHI's Preparation for the Sortie (para 1.4.16).

c. HP's Preparation for the Sortie (para 1.4.17).

d. Time delay between the HP receiving instruction and carrying out the exercise (para 1.4.19).

e. Pre-Sortie Brief (para 1.4.19).

f. Briefing in the Aircraft (para 1.4.21).

g. Decision to Continue Following the Demonstration (para 1.4.25).

h. Pilot Cyclic Input (para 1.4.33).

i. The HP's Understanding of the Technique (para 1.4.58).

j. The Potential for the QHI to Intervene (para 1.4.62).

k. Training Shortfalls (para 1.4.78).

1.4.88 **Aggravating Factors**. The Panel identified 3 factors that did not cause the incident but made the outcome worse:

a. Pitch Rate (para 1.4.45).

b. Lack of Collective Input (para 1.4.48).

c. Rate of Descent (para 1.4.52).

1.4.89 **Other Factors**. The Panel identified one factor that may cause or contribute to a future incident:

a. Monitoring and Addressing of Shortfalls (para 1.4.78).

1.4.90 **Observations**. The Panel made 5 observations regarding issues that were not relevant to the incident but worthy of consideration to promote better working practice:

a. Documentation, Flying Procedures (para 1.4.8).

b. Radar Altimeter Partial Test Flight (para 1.4.81).

c. Heavy Landing Detection (para 1.4.82).

d. Aircraft Documentation (para 1.4.85).

e. SQEP Assessment Directives (para 1.4.85).

1.4.91 **Breached Defence**. The Panel noted 3 Breached Defences; those rules, orders, practices and procedures designed to assure the safe operation of aircraft, which failed or were breached by those involved.

a. Training Shortfalls (para 1.4.11.c)

b. Crew Resource Management (para 1.4.24)

c. Decision to continue with 40ft ASEF (para 1.4.25)