Requirements for a Safety Case

Air and Water Operations

Victoria Harbour

Report Dated: 10th September 2010

QualaTech Aero Consulting Ltd.

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EXECUTIVE SUMMARY

This report has been prepared by QualaTech Aero Consulting Ltd. in response to a request by 'The Save The Harbour Group' (The Clients), for a review of the requirements for a Safety Case.

This assignment for the 'requirement for a safety case' reviews to the extent possible, the issues that should be considered in the development of a safety case in respect of the air and water operations in Victoria Harbour and the proposed Victoria International Marina and its consequent effects on the safety of the Victoria Harbour Water Aerodrome and marine navigation.

It is important to note that under normal circumstances a safety case is prepared by a project proponent or service provider, to demonstrate to regulatory authorities and interested parties that a specific project or service can meet all safety requirements and also to provide assurance that all risks can be managed. QualaTech has conducted an impartial third party review of the requirements for a Safety Case, to demonstrate what a formal safety case would have to achieve as a result of examining, evaluating and reporting on the risks and safety issues.

Before proceeding with any further developments of any kind in the vicinity of Victoria Inner Harbour and the Victoria Harbour Water Aerodrome the responsible authorities and other interested parties (e.g. City of Victoria and the Province of British Columbia) should consider the need for the operator (Transport Canada) of the Victoria Harbour Water Airport (Certificate No. TADB 5151-P325) to undertake a formal safety case on the complete operation of the current marine and air operations and to extend the consideration 10 years into the future (2020). In addition it is reasonable to expect the regulator (Transport Canada) to require this, since the initial 'Systems Safety Review (Risk Assessment)' of the Victoria Harbour, was undertaken by Transport Canada 10 years ago with a future time horizon of 10 years. Thus the said review is now expired and obsolete, as are the subsequent reports arising from it. Furthermore, there have been significant changes to a number of relevant national and international standards.

The activities described in this document would also need to be undertaken to establish a comprehensive safety case by the regulator and/or other authorities or proponents, in respect of the proposed new marina, prior to Transport Canada approving such a development. Prior to any further changes taking place in the infrastructure and operations of the Victoria Harbour, there should be a new Hazard and Risk Assessment followed by the preparation of a Safety Case, taking into account the very latest national and international standards and recommended practices. In particular, it should be noted what actions and recommendations in the original two reports have been implemented and what changes have taken place in the harbour infrastructure and its operations since the original reports were first prepared in 1999/2002.

Transport Canada mandates implementation of Safety Management Systems (SMS), of which safety cases are an important element, in most of the Canadian aviation industry but is not seen to be leading with regard to this simple management role at Victoria Harbour Airport (YWH). Had TC not deferred the SMS implementation date for its own water airport, then by the end of this year (2010), YWH would have had to apply the full

force of the Canadian Aviation Regulations in respect of SMS. Any developments in the vicinity of the water airport would have given rise, and will give rise in the future, to SMS actions by the operator and by extension the regulator, based on the numerous requirements of the regulations (CARs 107 and 302.500 etc).

It is not clear why implementation of SMS at a busy certified water airport such as Victoria Harbour, (let alone any other water airport – especially as the owner/operator is Transport Canada), should have been delayed for four years, when it was mandated at all other certificated airports in Canada in 2009. This situation reinforces the need to proceed with a full safety case encompassing both the aviation and the marine programs at the earliest opportunity.

Broadly, the Safety Case is the ***documented*** assurance (i.e. argument and supporting evidence) of the achievement and maintenance of safety. It is primarily the means by which those who are accountable for service provision or projects assure that those services or projects are delivering [or will deliver] and will continue to deliver, an acceptable level of safety.

Transport Canada is in the position of being both the regulator and the operator of the water airport (located within the area under consideration) and the Port and Airports Programs Directorate of Transport Canada is responsible for the operation of the water airport. In addition, Transport Canada, in its marine regulatory function is also the regulator for applicable marine activities.

Transport Canada provided exemption to the SMS implementation date for Water Airports, initially to 2010, then extended to 2012, and recently further extended to 2014. This means that all SMS regulatory provisions will apply to the Victoria Harbour Airport (as with other water airports in Canada) by 2014 including all guidance material on implementation contained in the various related Transport Canada aviation publications and circulars.

The main objective of safety regulation is to ensure that those who are accountable for safety discharge their responsibilities properly and it follows that a Safety Case which serves the above primary purpose should also provide an adequate means of obtaining regulatory approval for the service or project concerned.

Transport Canada has reasoned correctly that to achieve objective Safety Management Systems policy, there should not only be regulation, but industry must also be encouraged to voluntarily adopt safety (and security) management principles and/or systems. It would appear unreasonable for the Minister of Transport to expect this of others and not of Transport Canada itself. As The Honourable Lawrence Cannon (Minister of Transport, Infrastructure and Communications) stated: *"... an organisation's culture is demonstrated by what people do; decisions, actions and behaviour tell us something about the values of the organisation"*.

Since Transport Canada is also the owner and operator of YWH, their responsibility and accountability is arguably greater to the general public, than that of a non-government agency.

It might be asked, if Transport Canada, as the Owner / Operator of the Certified Victoria Water Airport has shown satisfactory *due diligence* in providing sufficiently current and

crucial analytical report(s) and data to truly identify, categorise and mitigate the potential hazards and associated risks of the proposed Victoria International Marina project and also the operations of the port and water airport, before authorising Approval (Ref. Transport Canada Approval Number 8200-06-8949) pursuant to subsections 5(1) and (2) of the Navigable Waters Protection Act (NWPA). (*The aforementioned approval only covers Lots 3 & 4, as the Province of BC owns Lot 1 and as such, the BC Government should also consider proper safety studies prior to issuing any approval*). Additionally, is a dedicated and formal Safety Case an expectation (duty) to the general public that the Government of Canada, served in this situation by Transport Canada, has an obligation to meet, other than in compliance to the minimum laws/regulations of the land?

For any new operation or installation it would normally be the responsibility of the operator to develop a safety case for approval by the regulator, or the authority having jurisdiction. As stated previously, approval has already been granted by Transport Canada for lots 3 & 4 (conditions to be met) for the large marina project, without providing what might be considered reasonable and sufficient due diligence. Additionally, Lot 1, owned by the Province of British Columbia, will also need Provincial approval before the project commences.

Readers are cautioned that this executive summary is of necessity a brief overview of the main issues of the full report. It is therefore important to review the contents of the full report in order to fully appreciate and understand all the issues involved.

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INTRODUCTION

Preamble

This report has been prepared by QualaTech Aero Consulting Ltd. in response to a request by 'The Save The Harbour Group' (The Clients) for a review of the requirements for a Safety Case. The review takes as a project of reference the proposed new marina – Water Lots 1, 3 & 4, located east of Lime Bay and west of Songhees Point, on the north side of Victoria Harbour at approximately 480 25' 38.0" N – 1230 22' 56.0" W, adjacent to the designated Seaplane Taxiway Area (Ref. TP 13410). However the scope of the review also considers the aviation and marine operations in Victoria Inner Harbour of which the proposed new marina project forms but one part.

QualaTech Aero Consulting Ltd. provides consultancy and training services to airports, National Authorities, aviation organizations and others industries around the world and is highly experienced in the development of Safety Management Systems, Safety Case, Hazard, Risk and Human Factors assessment, plus other assorted programs and training. QualaTech has provided many training courses, conforming to the Transport Canada and ICAO standards to aviation personnel during the past 10 years.

It is important to note that under normal circumstances a safety case is prepared by a project proponent or service provider to demonstrate to regulatory authorities and/or other interested parties that a specific project or service can meet all safety requirements, and also to provide assurance that all risks can be managed. This assignment for the 'requirement for a safety case' has been undertaken by an impartial third party to demonstrate what a formal safety case would have to achieve.

Transport Canada operates the Victoria Harbour water airport, and carries out its aviation and marine regulatory responsibilities in the harbour under the Aeronautics Act and Canada Marine Act. Victoria Harbour Regulations are administered by Transport Canada and are enforced by the Harbour Master (a Transport Canada employee) and the Harbour Patrol. Victoria is a public port within the meaning of the Canada Marine Act.

Transport Canada is in the position of being both the regulator and the operator of the water airport (located within the area under consideration), and the Ports and Airports Directorate of Transport Canada is responsible for the operation of the water airport. In addition, Transport Canada in its marine regulatory function is also the regulator for applicable marine activities. It might be considered that the situation of Transport Canada being both the regulator and operator of the water airport may at worst lead to some degree of conflict of interest, or at best, evoke a possible supposition of bias.

LIST OF ABBREVIATIONS

Abbreviation	Meaning
AIM	Aeronautical Information Manual
ALARP	As Low As Reasonable Practicable
ANC	Air Navigation Commission (ICAO)
AOM	Airport Operations Manual
ATM	Air Traffic Management
CADORS	Canadian Aviation Daily Occurrence Reporting System
CAR	Canadian Aviation Regulations
CASA	Civil Aviation Safety Authority (Australia)
CEAA	Canadian Environmental Assessment Act
CSA	Canadian Standards Association
CYWH	ICAO code for Victoria Harbour Water Aerodrome
EASA	European Aviation Safety Authority
FMEA	Failure Modes & Effects Analysis
FMECA	Failure Modes, Effects & Criticality Analysis
FSS	Flight Service Station
FTA	Fault Tree Analysis
GVHA	Greater Victoria Harbour Authority
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IMO	International Maritime Organisation
ISM	International Safety Management
ISO	International Organization for Standards
SARPs	Standards and Recommended Practices
SMS	Safety Management System
TC	Transport Canada
TP	Transport Canada Publication
TSB	Transportation Safety Board
VFR	Visual Flight Rules
CYWH	ICAO Code for Victoria Harbour Water Aerodrome
YWH	IATA code for Victoria Harbour Water Aerodrome

Service Undertaken

QualaTech Aero Consulting Ltd. has conducted a review of the requirements for a Safety Case, based on the available information, which would be applicable to the proposed new marina project, to be located at Water Lots 1, 3 & 4, east of Lime Bay and west of Songhees Point, on the north side of Victoria Harbour at approximately 48^0 25' 38.0" N – 123^0 22' 56.0" W.

The review considers, to the extent possible, the issues that should be considered in the development of a safety case in respect of the air and water operations in Victoria Harbour and the proposed Victoria International Marina, and its consequent effects on the safety of the Victoria Harbour Water Aerodrome and Marine Navigation.

Every attempt has been made to secure accurate, applicable, relevant and current information; however, QualaTech has made every effort not to use unauthenticated third party data.

The review was conducted with two primary objectives: one being 'accuracy' and the other being 'without-bias'. QualaTech has conducted an impartial review of the requirements for a Safety Case (or Cases) and has no motive other than, on behalf of the Client, to report on the risks and safety issues that would need to be examined, evaluated and reported on in a safety case.

Background to Safety Case Development

Before defining a safety case, we should first define the formal meaning of 'Safety'--more specifically, 'Aviation Safety'. There are several versions to review. For example, the ICAO Air Navigation Commission (ANC) defined 'Aviation Safety' in 2006 as: "***The state of freedom from unacceptable risk of injury to persons or damage to aircraft and property***". Additionally the ICAO Doc. 9735 (Safety Oversight Manual) defines Safety as: "**A *condition in which the risk of harm and damage is limited to an acceptable level".*** However, Transport Canada Civil Aviation has not officially defined '**Safety'** or "**Aviation Safety**" (within the Aeronautics Act or the Canadian Aviation Regulations); instead, Transport Canada Civil Aviation has provided an unofficial definition on their website – "***Safety: Is the condition to which risks are managed to acceptable levels"***, matching the same definition as provided in the TC: Aviation Safety Program Manual for the Civil Aviation Directorate.

Broadly, the Safety Case is the ***documented*** assurance (i.e. argument and supporting evidence) of the achievement and maintenance of safety. It is primarily the means by which those who are accountable for service provision or projects assure that those services or projects are delivering (or will deliver), and will continue to deliver, an acceptable level of safety.

Therefore, since the main objective of safety regulation is to ensure that those who are accountable for safety discharge their responsibilities properly, then it follows that a Safety Case which serves the above primary purpose should also provide an adequate means of obtaining regulatory approval for the service or project concerned.

The priority and ultimate objective of a Safety Case is to provide a true and accurate account of the hazard(s) and associated risk(s) of the project and the actions that would

need to be taken to manage such risks – if they were to be manageable. It has to be recognized that some risks may be unmanageable within the parameters of the approved level of safety and therefore cannot be incurred.

The success of a Safety Case is dependent upon the logic in the argument and the accuracy of the evidence. Circumventing and under-resourcing either of these two primary requirements will affect the result and may initiate consequent re-examination by the respective authority(ies) and/or other stakeholders.

THE NEED FOR A SAFETY CASE

Discussion

Before proceeding with further developments of any kind in the vicinity of Victoria Inner Harbour and the Victoria Harbour Water Aerodrome, the responsible authorities and other interested parties (e.g. City of Victoria) should consider the need for the operator (Transport Canada) of the Victoria Harbour Water Airport (Certificate No. TADB 5151-P325) to undertake a formal safety case on the complete operation of the current marine and air operations and to extend the consideration 10 years into the future (2020). In addition it is reasonable to expect the regulator (Transport Canada) to require this since the initial systems safety review was undertaken by TC 10 years ago with a future time horizon of 10 years. Thus the said review is now expired and obsolete.

As a minimum the successive activities described in this document would need to be undertaken to establish a comprehensive safety case by the regulator, and/or other authorities or proponents, in respect of the proposed new marina project prior to Transport Canada approving such a development. A schedule of measures and associated processes would also provide assurance to all concerned that all safety requirements could be met both now and in the future.

A comprehensive Safety Case has not been prepared with specific regard to the proposed Victoria International Marina or on the Victoria Inner Harbour (in broader terms) aviation /marine activities, operations, facilities, etc., by Transport Canada. Additionally, a specific "Aeronautical Study" or current "Risk Assessment" has not been undertaken recently to the required depth and standard befitting a very busy port and airport. In 1999, Transport Canada carried out an initial "Systems Safety Review (Risk Assessment)" of the Victoria Harbour, which will be referenced later in this document. Transport Canada then commissioned an independent "Management Review of Victoria Harbour Navigational Activities" in August 2002. This document ("The Malatest Report") was commissioned as a follow-up study to the 1999 Transport Canada "Report of a Systems Safety Review".

The Malatest Report (Management Review of Victoria Harbour Navigational Activities) addressed 7 key issues (there were 8 but one was deleted by TC) and included a Q-850 documentation report (CAN/CSA – Q850-97 Risk Management: Guidelines for Decision Makers). A primary consideration for commissioning the Malatest report was to continue the TC Report of a Systems Safety Review, by completing the Q850 Risk Control steps with regard to the identified mitigation measures. In addition to identifying and evaluating additional opportunities to mitigate risk, the report was a Risk Management Review. Risk Management is defined in ISO 31000:2009 (Risk Management Principles and Guidelines) as:

- coordinated activities to direct and control an organization with regard to risk.

In September 2006, Community Marine Concepts Ltd. and its joint venture partner, WAM Development Group Ltd., commissioned an Air Operations Study of seaplane activities within the Victoria Harbour. Then, in March 2008 (expanded and revised in May 2008), Community Marine Concepts Ltd. and its [current new] owners (according to the aforementioned report), Western Management (WAM) Developments Ltd. and Mr.

Robert Evans, commissioned a "Traffic and Communications Plan" to show that the proposed marina project did not pose a potential safety issue that could affect the vessel and seaplane activities in the harbour and at the proposed marina. Both reports were prepared by the same organisation (McNeal and Associates Consultants Ltd.).

Since then, little was amended or documented until Transport Canada and Fisheries and Oceans Canada jointly produced the Environmental Assessment Screening Report on the proposed new marina, pursuant to the Canadian Environmental Assessment Act (CEAA). This document will be examined in greater depth with regard to safety issues later in this report.

Risk is commonly defined as the combination of the probability of an event and its consequences and is also defined in ISO Guide 73:2009 and ISO 31000:2009 as the effect of uncertainty on (achievement of) objectives. Risk Management involves the coordinated and economical application of resources to minimize, monitor, and control the probability of an incident. It should be noted that ISO 31000 is a much more recent document than Q850.

There is often confusion over the meaning of specific safety terms, including but not limited to: Aeronautical Study, Risk Assessment and a Safety Case. All three of these processes can be defined in a number of ways depending upon which authority and which document is consulted. Unfortunately, although Transport Canada encourages the use of a Safety Case, there is no formal definition in the Canadian Aeronautics Act or the Canadian Aviation Regulations Part One – General Provisions Subpart 1 – Interpretations. However, Transport Canada has provided some guidance in various other publications, but these should perhaps be considered specific only to the document within which they appear. It is acceptable practice for Governments and regulating authorities, including Transport Canada, to utilise definitions developed by other national and international authorities, adapting them as may be required to best suit national interests, thus making for best practice and promoting global harmonisation. Therefore, it is acceptable in certain situations, when the Canadian Government has not provided a definitive meaning, to look to the next best source, e.g., ICAO, the UK CAA, EASA, etc. It should be noted that unless Canada specifically files a difference to an ICAO Standard, then, as a signatory to the Convention on International Civil Aviation, it is understood as being compliant.

In considering the concept of a safety case and when it would or should be utilised, it becomes equally important to review other aspects of Safety Management.

The Canadian Aviation Regulations – Part VIII – Air Navigation Services, Subpart 6, defines an 'Aeronautical Study' as: *a study designed to identify the risks to aviation safety attendant upon a particular course of action and how to eliminate or reduce those risks*. By its very nature however, an Aeronautical Study is **not** a safety case – it is what it says it is, namely a study to identify certain issues. The Transport Canada meaning of Risk Assessment may be found in AC 107-001 which states: "*A comprehensive Risk Assessment identifies the range of possible hazards, threats, or perils that might impact the entity, surrounding area, or critical infrastructure supporting the entity.*"

Yet another description of Risk Assessment can be found in the UK Civil Aviation Authority (CAA) publication CAP 760 – Guidance on the Conduct of Hazard

Identification, Risk Assessment and the Production of Safety Cases (sometimes referenced by Transport Canada). CAP 760 defines it as a: "*Process that for identified hazards, evaluates their risk in terms of probability and severity of consequence.*" The CAP 760 meaning of a Safety Case is: "*A documented body of evidence that provides a demonstratable and valid argument that a system is adequately safe for a given application and environment over its lifetime.*" It should be noted that a *system* is a set of elements that are interrelated or interact with one another and includes processes and procedures, people, equipment, hardware, software, etc.

Unfortunately, although Transport Canada encourages the use of a Safety Case in AC 107-001, the document does not provide sufficient detailed guidance or definition, leaving the risk manager or assessor to use the information provided by those States or organisations that do (e.g UK CAA, Eurocontrol, CASA Australia, New Zealand). TC Circular AC 107-001 states that: *A safety case is developed in much the same way as a business case. It helps the organisation to anticipate hazards that can result from operational change. At a minimum it should be used:*

(a) When a major operational change is planned
(b) When a major organisational change is made . . .

Canada likes to be considered and is proven to be a world leader in many areas of aviation; i.e., Canada was one of the first nations to embrace Safety Management Systems (SMS) within the aerospace industry. Transport Canada emphasises in its Mission Statement – A Vision for Civil Aviation, that: ***"A safe transportation system is an essential element of the Government of Canada's commitment to protect the health and well being of Canadians. To support this commitment Transport Canada's vision is: A transportation system in Canada that is recognised worldwide as a safe and secure, efficient and environmentally responsible."*** However, it could be argued that Canada is lacking in other critical areas of safety both within aviation and in other areas of transport, including marine. The international governing body for marine is the International Maritime Organisation (IMO), which produced the International Safety Management (ISM) Code (2002). The purpose of this Code is to provide an international standard for the safe management and operation of ships and for pollution prevention. Canada has not yet regulated Safety Management into the Marine industry, unlike some other nations - e.g. New Zealand.

Two relevant examples of a perceived lapse in Canadian regulation and/or policy by Transport Canada are the limited development thus far shown on Water Airports and the requirement (unlike in other jurisdictions) for Safety Cases generally. Another illustration relevant to the Victoria Harbour Water Airport (IATA designator YWH & ICAO designator CYWH) is the SMS exemption granted to some (specific) Certificate Holders for Certified Airports (Transport Canada included) on the implementation of SMS.

Other nations, including but not limited to Australia, New Zealand, Great Britain and the institutions of the European Union, have outreached Canada in terms of the requirements for Risk Assessment and the prerequisites for a Safety Case. For example, the Maritime Safety Authority of New Zealand has produced a very comprehensive guideline entitled "Port & Harbour Risk Assessment and Safety Management Systems". This document

supports their Port & Harbour Marine Safety Code while providing great depth and detail to those responsible for navigational safety within designated harbour areas. The UK CAA now requires Safety Cases for aerodromes and ATS providers, and in Australia the CASA is using a Safety Case approach to the National Airspace System while Air Services Australia uses it for new developments. In addition the European Organisation for the Safety of Air Navigation (EUROCONTROL) has several related publications of importance, including the Safety Case Development Manual. This manual specifies the primary purpose of a Safety Case: "*Broadly, the safety case is the documented assurance (i.e. argument and supporting evidence) of the achievement and maintenance of safety."* It goes on to say: *"It is primarily the means by which those who are accountable for service provision or projects assure themselves that those services or projects are delivering (or will deliver), and will continue to deliver, an acceptable level of safety."*

ICAO Doc 9774 states in Para 1.1 that "Articles 28 and 37 oblige each State to provide airports . . . in accordance with the Standards and Recommended Practices – (SARPs) developed by ICAO". Such SARPs require that aerodromes/airports have a SMS – and all that goes with it. Water Airports are not divided out or exempted in any definition. It should be noted that ICAO does not define the term '*airport*', and the international definition for the area of land or water used for the movement of aircraft is, and has always been, '*Aerodrome'*. However, Canada does provide each with its own definition. The Canadian Aeronautic Act defines an 'Aerodrome' as ". . . *any area of land, water (including the frozen surface thereof) or other supporting surface used, designed, prepared, equipped or set apart for the use either in whole or in part for the arrival, departure, movement or servicing of aircraft and includes any buildings, installations and equipment situated thereon or associated therewith . . ."* whereas an airport is defined as: *". . . an aerodrome in respect of which a Canadian Aviation Document is in force.*" There is no distinction made under the regulations that isolates a water aerodrome or water airport from any other type. In Canada, all airports are aerodromes but not all aerodromes are airports.

The proposed new marina project introduces other issues that may, in the event of an incident, involve not only aircraft but could, in all probability, involve marine craft as well. There exist many examples in the Transportation Safety Board (TSB) files (as others from around the world) that relate to this type of incident, proving that aircraft and boat collision as a result of direct contact is not as unusual as might be imagined and certainly not "remote," as has been indicated in the previous referenced reports. (See attached photo Campbell River 2003 – an incident between a DHC-2 and a moored boat).

In addition there are other examples from the TSB to consider. For instance:

> *On 1 November 2000 a DHC-6 Twin Otter had just departed the Vancouver Harbour Water Aerodrome enroute to Victoria when its number 2 engine failed at 50 to 100 ft (15 to 30 m). It impacted the water about 25 seconds later in a nose-down, right wing-low attitude. The two crew members and 15 passengers all escaped unharmed and were rescued by local watercraft present in the harbour.*
>
> *On 26 September 1999 a DHC-2 Beaver floatplane was on a scheduled flight from Victoria Harbour to Vancouver Harbour, with the pilot and six passengers on board. When the aircraft was on final approach the pilot received clearance to land from the Vancouver Harbour control tower. Just as the aircraft was about to touchdown the pilot heard a "thump" sound and felt the aircraft shudder. The pilot did not see the small pleasure boat and was not aware of its presence until the impact. As a result of the collision, the operator of the boat suffered serious injuries and the passenger received minor ones. There were no injuries to the occupants of the aircraft, which was not damaged during the collision.; and*
>
> *On 29 November 2009 a Seair de Havilland Beaver was departing Lyall Harbour, Saturna Island, at about 16:00 Pacific Standard Time, on a flight to Vancouver International Airport, British Columbia. There were eight persons on board—one pilot and seven passengers including an infant. Once airborne, the aircraft remained below the surrounding terrain and during a turn to the left, it descended and collided with the water near the north shore. The aircraft sank quickly and was completely below the water surface before first responders arrived. Responders rescued the pilot and an adult passenger from the surface of the water. Later, Canadian Coast Guard divers retrieved six bodies from the wreckage resting on the bottom of the harbour, in approximately 14 m of water.*

These are just a few of the instances of emergency situations and it is important to consider that even in cases where, as noted above, there was no collision with surface vessels, other aircraft, shore or floating installations, etc., this was pure chance. In a busy water airport environment there is every possibility that an aircraft (or even surface craft) malfunction may lead to a loss of control situation which places all traffic, people and installations in the vicinity at immediate risk. Additionally, it is estimated that up to 80% of marine incidents are attributed to human error.

There is also the issue of the proposed marina project being an additional element of the total Victoria Harbour system and having an effect on the overall operation. The safety case(s) would have to assemble the evidence to show the effects of this additional element on the entire system and the target level of safety. It is obvious that marine law and associated regulation and safety requirements are equally important, and that no single aspect of the Victoria Harbour can be reviewed without all of the operations being examined. This type of review is best accomplished by means of a full Safety Assessment and subsequent preparation of a Safety Case.

The Vancouver Sun Quoted the Transport Minister John Baird (4 June 2010) in an article called 'Survivor Urges Ottawa to act on float-plane safety' as saying: '*There's always an important federal role when it comes to safety and security*'. The Minister, in the same

article, also stated: '*We want to take all reasonable measures necessary to ensure safety'* and '. . . *expect government to take all reasonable steps to ensure people are safe'*. A full Safety Assessment followed by a Safety Case fulfills the Minister's expectations as being "***reasonable.***"

It might be asked if Transport Canada, as the Owner / Operator of the Certified Victoria Water Airport, has shown satisfactory *due diligence* in providing sufficiently current and crucial analytical report(s) and data to truly identify, categorise and mitigate the potential hazards and associated risks of the proposed Victoria International Marina project, and also the operations of the port and water airport, before authorising Approval (Ref. Transport Canada Approval Number 8200-06-8949) pursuant to subsections 5(1) and (2) of the Navigable Waters Protection Act (NWPA). (*The aforementioned approval only covers Lots 3 & 4, as the Province of BC owns Lot 1 and as such, the BC Government should also consider proper safety studies prior to issuing any approval.*) Additionally, is a dedicated and formal Safety Case an expectation (duty) to the general public that the Government of Canada, served in this situation by Transport Canada, has an obligation to meet, other than in compliance to the minimum laws/regulations of the land?

It is instructive to consider the paper presented at the 2007 Conference of The Australian Society of Air Safety Investigators (ASASI) by Dr Dmitri Zotov, a leading expert in air safety with the Civil Aviation Safety Authority of Australia. In his paper Dr. Zotov noted the following:

> *Safety Cases are not the bags of useful stuff you take onto an accident site, nor yet are they first-aid boxes. They are a way of managing the safety of operations which can have a profound effect on the way regulations are written, or safety recommendations are made.*
>
> *The term 'Safety Case' comes from the legal origin of the idea. In an inquiry into occupational safety and health, it was said that* ***compliance with Regulations was not sufficient to ensure safety: it was necessary for the operator to 'make a case' that the system was safe to operate (Robens 1972).*** *This meant to demonstrate that it was safe, by producing evidence to support arguments that safe operation would be achieved.*
>
> *The destruction of the Piper Alpha oil rig in the North Sea was not the origin of Safety Case requirements, but it produced a huge boost to the general introduction of Safety Cases in hazardous industries.*

The Commission of Inquiry commented that:
"Compliance with detailed prescriptive Regulations was not sufficient to ensure safety".

(Cullen 1990).

Dr. Zotov also noted that "*the cost of producing a Safety Case is trivial in comparison with the cost of an accident.*" He pointed out that "*SMS has been increasingly promoted as the answer to the maiden's prayer*" but went on to say that "*although an SMS is necessary, it is not sufficient. Without a Safety Case, you will have no real idea how effective your safety efforts have been, nor whether you have done everything necessary to assure safe operation*."

Regulatory Situation and Related Aspects

All Canadian certificated airports (CAR 302.500(2), are required (since 1 January 2009) by the Canadian Aviation Regulations (CARs) to implement a Safety Management System, the minimum provisions for which are laid down in the regulations.

However, Transport Canada provided exemption to the SMS implementation date for Water Airports, initially to 2010, then extended to 2012, and recently further extended to 2014. This means that all SMS regulatory provisions will apply to the Victoria Harbour Airport (as with other water airports in Canada) by 2014 including all guidance material on implementation contained in the various related Transport Canada aviation publications and circulars.

It has been cited in publications, including one written by James Ellsworth: Victoria Sea Plane Traffic – Air Turbulence, that YWH is the world's second busiest water airport following Lake Hood, Alaska. However, this is a dubious claim since Vancouver Water Airport handled 54,741 aircraft movements in 2009 and is listed as the 8th. busiest airport in BC and the busiest water aerodrome in Canada. Nav. Canada statistics recorded YWH "Total Movements" for 2009 as 38,644. Vancouver Water Airport is also the only Water Airport in Canada to have a dedicated control tower (VFR Controlled Airspace), which, incidentally, is reported as the world's highest at 142 meters.

Irrespective of what position the Victoria Water Airport fills in the world with regard to aircraft movement (not including any ship, boat or small craft), it is undeniably a very busy airport – albeit, total aircraft movements have declined since 2007 when they peaked at 44,271 total movements (this state of affairs may be due in part to transient economic factors). Statistics indicate that the overall aircraft traffic movement in the

Victoria Harbour is greater than a significant number of other Certified Canadian airports, which should raise some concern as to why such a busy airport (excluding Vancouver Water Airport and/or any others) operated by Transport Canada, is not required (irrespective of the harbour operations) to have a formal Safety Management System in place for another four years. It is difficult to envisage a land based airport operating under an SMS (or any other for that matter), that would allow an equivalent operation, i.e., a marina (maybe a heavy maintenance yard for commercial vehicles), to operate adjoining an active Taxiway, other than in compliance with the requirements of TP312 and the applicable safety analysis as performed/required under an SMS.

It is interesting to note that Transport Canada mandates implementation of SMS in most of the Canadian aviation industry but is clearly not seen to be leading with regard to this simple management role in at least one of their own airports and their own expectation for the public good. Had TC not deferred the SMS implementation date for its own water airport, then by the end of this year (2010) YWH would have had to apply the full force of the Canadian Aviation Regulations in respect of SMS. Any developments in the vicinity of the water airport would have given rise, and will give rise in the future, to SMS actions by the operator and by extension the regulator, based on the numerous requirements of the regulations (CARs 107 and 302.500 etc.). This somewhat fluid situation reinforces the need to proceed with a full safety case encompassing both the aviation and the marine programs at the earliest opportunity. It should be obvious that a Safety Management System need not be regulated for it to be implemented. There have been many organisations who have implemented SMS without being mandated by the national authority. One pertinent example close to Victoria is Comox Valley Airport, which implemented SMS between 2008 and 2009 without regulatory requirement. They voluntarily adopted SMS because they understand the importance of the program, in respect to safety, savings, liability and best practice. A similar situation prevailed at the Campbell River, Abbotsford and Victoria International airports with regard to early voluntary adoption.

Guidance on SMS Development is provided in Aviation Circular 107-001. The reference in this document at section 6.3.3(1) & (a) is noteworthy as it defines Hazard Identification:

> *"Hazard Identification is the act of identifying any condition with the potential of causing injury to personnel, damage to equipment or structures, loss of material, or reduction of ability to perform a prescribed function. In particular, this includes any conditions that could contribute to the release of an un-airworthy aircraft, to the operation of aircraft in an unsafe manner* ***or unsafe practices in an airport environment.*** (It goes on to state) *This can be achieved through:*
>
> *(a) A safety assessment of all company processes used to perform a specific operation. This involves an ongoing assessment of the functions and systems, and any changes to them,* ***and the development of a safety case*** *to proactively manage safety".*

The Honourable Lawrence Cannon – as Minister of Transport, Infrastructure and Communications, stated in TC1002279 (TP 14678) – "Moving Forward" dated 2007: *'It is recognized among regulators that* ***an entity can comply with regulations without***

effectively managing risks to acceptable levels.' This phenomenon was first published by Benner, L. Jr. in 1984, having discovered in his research that organisations can be compliant with prescriptive regulation and still be unsafe. The Minister made another pertinent statement in 'Moving Forward' that the predicted aircraft traffic growth and subsequent number of accidents could increase unless TC looks at different ways to improve safety and therefore reduce the risk of accidents from occurring. This entails changing from a '**Reactive'** process to a '**Proactive**' process, which is what a SMS is really all about. These statements echo those of Zotov and Cullen noted heretofore.

Under a formal SMS, any proposed or newly changed activities, operations, facilities, etc. are subject to SMS requirements and therefore would invoke a formal Aeronautical Study and/or a Hazard Analysis/Risk Assessment and subsequent Safety Case, depending on the situation. One example of where SMS requirements would have required an analysis was in the addition of the Nav. Canada Flight Service Station (FSS). However, even though SMS regulations are not yet in force for Water Airports, it should not be unreasonable for the general public to expect the regulator – especially as the owner/operator – to proceed as though such safety regulations are already applicable and in force, particularly since The Honourable Lawrence Cannon (Minister of Transport, Infrastructure and Communications) has categorically stated: *"Introducing safety management systems has been recommended to address the contributing and underlying factors in a number of recent, major transportation accidents."* Transport Canada has reasoned correctly that to achieve objective SMS policy, there should not only be regulation, but industry must also be encouraged to voluntarily adopt safety (and security) management principles and/or systems. It would appear unreasonable for the Minister to expect this of others and not of Transport Canada itself. As the Minister of Transport (The Honourable Lawrence Cannon), so accurately stated in TP 14678 – Moving Forward: *". . . an organisation's culture is demonstrated by what people do; decisions, actions and behaviour tell us something about the values of the organisation."* Fortunately, the Minister was not only referring to industry since, in the same document, he stated: "*All employees and all organisational levels (within industry and **TC**) must understand and apply risk management in day to day activities,"* [and] *"The long term objective is for risk management to be normal work practice in industry and TC."*

It is not clear why implementation of SMS at a busy certified water airport such as Victoria Harbour (let alone any other water airport – especially as the owner/operator is Transport Canada) should have been delayed for four years when it was mandated at all other certificated airports in Canada in 2009.

There is, in any case, the issue that regulation implies a minimum standard and that due diligence, the duty of care and good business practices encourage higher than minimum standards. The voluntary adoption of new and/or higher standards, without waiting until the last moment prior to regulation, is the best practice and one that fulfills the Minister's ideals of 'early adoption'. The Minister's words cannot only pertain to the general public but must be equally applicable to the regulator.

SMS was first introduced into other industries in Canada, besides that of aerospace, in the mid 1990s or earlier, i.e., nuclear power, rail and petrochemical. Since then, Safety Management Systems have evolved and matured within their own respective disciplines.

This trend continues as SMS continues to be introduced and applied to other industries besides the aforementioned, such as the health, pharmaceutical and medical sectors.

Since Transport Canada is also the owner and operator of YWH, their responsibility and accountability is arguably greater to the general public than that of a non-government agency. The minimum regulations as prescribed under the Canadian Aviation Regulations (CARS) may be insufficient in many areas for a Certificate Holder to assure safe operation, if indeed prescriptive regulation is considered to be the optimum way to achieve safety. As the Certificate Holder of YWH, should Transport Canada rely on the minimum requirements of 'prescriptive regulation' to conduct its own business when it openly encourages other Certificate Holders to voluntarily adopt higher standards? In a letter interview with the Vancouver Sun, the Transport Minister John Baird commented that: "*It's only natural from time to time we re-evaluate what the rules and regulations are."* One of the best ways to improve float plane safety is to be proactive in all areas of operations. Float plane safety is more than improving egress and evacuation; it is also about prevention and being proactive. Re-evaluating existing rules and regulations is one of many ways to be proactive in safety. The performance of a Safety Case is another.

Furthermore, should not the desire of TC to undertake a safety case in respect of the current situation, regardless of the various requests and opinions of the stakeholders, as a matter of public duty and care, be of the highest importance? As the owner/operator of the water airport, it would fall on the regulatory arm of Transport Canada to audit its own operating division. The operating division of Transport Canada (just like any other owner/operator) is required to undertake internal audits and other activities to ensure minimum compliance with the regulations. However, since there is not an operational SMS at YWH, and subsequently no formal Quality Program (also required for a certified airport under its own SMS), the process of audit may be at best outdated and at worst not suited to the current mode of operation and prevailing regulation, thus appearing to demonstrate a lack of proactive management. It should be noted that if a TC audit found areas of non-compliance, then Transport Canada Operations would be subject to enforcement action by Transport Canada. As such, YWH is still operating on the prescriptive style of regulation and as the Transport Minister John Baird stated: *"It is recognized among regulators that an entity can comply with regulations without effectively managing risks to acceptable levels."* Furthermore AC 107-001 11.0 (3) states: "*For SMS to be a success, however, TC, like the industry we regulate, must undertake numerous changes internally and externally. We have established an internal discipline policy that promotes and rewards the behaviours we are striving to achieve."*

At present there does not seem to have been any formal safety case conducted in respect of current marine and/or air operations and their respective interaction by Transport Canada and/or other interested parties. For any new operation or installation it would normally be the responsibility of the operator to develop a safety case for approval by the regulator, or the authority having jurisdiction. As stated previously, approval has already been granted by Transport Canada for lots 3 & 4 (conditions to be met) for the large marina project, <u>without</u> providing what might be considered <u>reasonable and sufficient due diligence</u>. Additionally, Lot 1, owned by the Province of British Columbia, will also need Provincial approval before the project commences.

Transport Canada Safety Review of the Victoria Harbour in November/December 1999

The Transport Canada Safety Review of Aviation and Marine Operation in Victoria Harbour commenced on the 29th November 1999. Over a period of four days, lasting until December 3rd, 1999, the Safety Review Team (SRT) conducted multiple interviews with various stakeholders, concerned citizens and harbour officials, etc. The final report, dated 21st March 2000, is now over ten years old (ten years being the effective time frame of the review), which also means it was conducted prior to significant changes in both regulations and procedures. For example, it preceded the most significant and possibly most important change involving safety and operations – the implementation of the Transport Canada Safety Management System program. In addition, the main ISO/CSA Standards which are relevant to the operations have all been updated since 1999.

Several documents named within the Review no longer appear to be available on the Transport Canada website, including the actual Safety Review – TP 13578E. Additionally, TP 10028E – Safety Services/Systems Safety Operations Manual, to which standard the Review was allegedly conducted, is also not available via the Transport Canada Website, although this does not mean it is not available to the general public via another means.

That aside, the Safety Review is very detailed and indicates a great deal of scrutiny, work, research, assessment and discussion. The Safety Review Team (SRT) appears to have used a qualitative approach to the Hazard and Risk Assessment, which typically identifies the levels of risk of various activities. In a harbour/water airport risk assessment, the application of risk in a structured comparative manner allows for the identification of activities which can result in higher levels of risk, but it does not determine the absolute value of a risk. For example, there was no assessment on aircraft (or shipping) hitting semi-submerged or floating debris or the effect of an aircraft colliding with wildlife, other than bird strikes. Equally important and not completely identified is the addition of new obstacles (buildings) to the harbour area and/or moving obstacles (although collision with shipping was identified) such as masts of marine vessels, cranes, derrick, wave attenuators, etc.

Eurocontrol considers runway incursions to be extremely hazardous, having resulted in a number of very serious incidents and actual collisions over the last few years. The worst aviation incident in history was a runway incursion. Eurocontrol predicts as other authorities do, including Transport Canada, that given the predicted growth of air traffic the actual numbers of incidents are likely to rise unless held in check by preventative and proactive actions.

As a point of interest, the report mentioned engine reliability; however, the probability of an aircraft suffering an engine failure as a result of reliability issues, even as low as 0.3% per 100,000 flight hours (as quoted in the review for a Pratt & Whitney Engine [PT6]) theoretically increases significantly with the greater number of engines an airframe is provisioned with i.e., Single Otter DHC-3 Turbine versus Twin Otter DHC-6. However, the consequence of an engine failure is somewhat mitigated with multiple power plants. It should also be borne in mind (and considered in any safety case) that virtually all the aircraft used on scheduled (and also charter) service to and from Victoria are at least

twenty five years old, of which a great majority have been highly modified from their original Type Certificate. (Note: *This statement is not intended to suggest that the aforementioned aircraft are any less safe in their current post modification condition than they were when in accordance with their original type design/certificate*.) Irrespective of what was and what was not mentioned in the aforesaid report, this paper is not intended to be a Hazard and Risk Assessment, and the inclusion of the above examples are merely to illustrate where further diligence might be required.

The hazard and risk terminology and processes used are in many cases no longer current or in line with TC SMS Regulations and Guidelines. However, many of the cautions stated i.e., "*Continued aviation growth is likely*" and "*There are now significant numbers of people living in very close proximity to the harbour and to the aircraft operating areas. This population is expected to grow substantially in coming years,"* have come true.

Subsequently, the Transport Canada Victoria Harbour Marine and Aviation Operations Report of a System Safety Review must be considered obsolete if for no other reason than Para 1.4.2, which states: "*The period of time considered by the SRT when assessing probability was 10 years*" (which expired March 2010).

Additional Comments and Observations:

On Pages 7 and 8 of the above noted report, there is some confusion between Hazard and Risk.

The Statement: "*Those directly involved in an event often can do little to alter the outcome*" is opinion and conjecture which has no place in a report of this nature. Human Factors research has shown that it is very often the people who are involved, (i.e., the end user) who will most often prevent an incident from occurring; they become effectively the last link buster.

The Review Team did not record that it made any physical inspections or observations, although there is an implication that it may have done so (Para 3.7).

The Risk Assessment Matrix in figure 6.1 does not conform to current ICAO and TC practices.

In Para 2.1 and elsewhere, the Team used the term "*opinion*" but did not state on what objective evidence this opinion was based. Some statements were made which were not backed up by evidence/facts – for example, Hazard 1.1 – falling debris(?).

The same statement was made repeatedly regarding mitigation: ". . . *due to the nature of such collisions, little can be done to mitigate the severity of such events.*" This should have been reviewed more diligently and robustly.

As stated previously, Transport Canada commissioned an independent 'Management Review of Victoria Harbour Navigational Activities' in August 2002 which has become commonly known as the "The Malatest Report". The document included a Q-850 documentation report (CAN/CSA – Q850-97 Risk Management: Guidelines for Decision Makers).

With regard to the current usefulness of the Malatest report (the life of which is also ten years – expiring by 2012), and considering that the primary document upon which it was based is now obsolete and lacking in many areas, it is not unreasonable to question the present validity of the Malatest Report. It is virtually outdated and consequently no longer current with regard to data, detail, and technique. Although the Q850 is a commonly quoted source document, Canada formally adopted ISO 31000:2009 on 4 Feb 2010 and the CSA statement on that day is as follows:

> *CSA Standards, a leading standards-based solutions organization, today officially announces Canada's adoption and availability of the ISO 31000 Risk Management standard. CAN/CSA ISO 31000* Risk Management – Principles and Guidelines *is a national standard that provides principles, framework, and process for managing risk in a transparent, systematic and credible manner. ISO 31000 is not specific to any country, industry or sector and can be used by any public, private or community enterprise, association, group or individual.*
>
> *These principles and guidelines in ISO 31000 Risk Management serve as an overarching guide for organizations and individuals to help incorporate internationally-recognized best practices for identifying and managing risks across financial, strategic, and operational areas," says Doug Morton, Director, Life Sciences & Business Management, CSA Standards. "The Canadian adoption of the ISO 31000 Risk Management standard will enable Canadian organizations to compare their practices with an internationally-recognized benchmark, providing them with sound principles for effective risk management.*

It appears that prior to any further changes taking place in the infrastructure and operations of the Victoria Harbour, there should be a newly commissioned Hazard and Risk Assessment followed by the preparation of a Safety Case, taking into account the applicable CARs and the latest national and international standards and recommended practices. In particular, it should be noted what actions and recommendations in the original two reports have been implemented, and what changes have taken place in the harbour infrastructure and its operations since the original reports were first prepared in 1999/2002 (e.g., construction of new Nav Canada Flight Service Station [FSS], ownership, construction, services, traffic, etc.). Another example of a change that would become part of a comprehensive Safety Case is the level of service currently provided by Nav Canada at the FSS, i.e., is the level of service appropriate to the required safety requirements of the Victoria Harbour Water Airport / Victoria Harbour?

Transport Canada & Fisheries and Oceans Canada – Environmental Assessment Screening Report Pursuant to the Canadian Environmental Assessment Act (CEAA). April 2010

The subject report records an environmental assessment and is thus not germane to discussions surrounding a safety case. However, since the report makes some references to safety it is appropriate to make some comment on that aspect.

The TC & Fisheries and Oceans Canada report appears to have used a certain amount of un-validated or un-verified data which calls into question the weight of the safety aspects of the report itself and the robustness of resulting conclusions and recommendations. Although the report was produced in 2010, it appears to place great reliance on statistics form 2005 and on other reports going back to 1999. For example, on Page 15 Para 6.2.2, the report states:

> *In 2002, Transport Canada retained the services of R.A. Malatest & Associates Ltd. and GeoInfo Solutions Ltd to complete a management review of navigation activities within Victoria Harbour titled Management Review of Victoria Harbour Navigation Activities; Q850 Documentation Report. The report included a risk management assessment as part of the system safety review and assessed the potential hazards of conflicts between marine vessels, aircraft and harbour facilities. The matrix table within the report noted that the probability of conflicts between floatplane traffic and large vessels and or shoreline facilities such as docks, wharfs, moored boats was remote though the severity of such a conflict could be very high (R.A. Malatest, 2002). During peak daylight hours, Victoria Harbour receives up to 100 seaplane flights a day (McNeal and Associates Consultants Ltd., September 2006). An on-site survey of the seaplane operations in the harbour in June of 2006 observed that both Alpha and Bravo taxiways were being used with most landings occurring on Alpha and take-offs on Bravo. The taxiway around Pelly Island/Sleeper Rock was not observed to be in use at that time.*

Additionally, 'Safety' was raised as a concern by the general public: "***Safety – The safety of small boats, kayaks, canoeists and seaplanes to navigate may be compromised by the proposed marina.***" The Federal response as recorded within the aforementioned environmental report appears not to have been followed through, i.e., ". . . *Direct effects of the project on navigation and aviation safety are being considered under Transport Canada's mandate as part of the regulatory review prior to any approvals being provided by Transport Canada for the project.*" It would have been in the general public's best interest if TC had released the above mentioned 'regulatory review' before granting the proposed marina project Approval.

Since Transport Canada was responsible for the 2010 report, it is reasonable for the public and Victoria City Council to expect that they would have applied robust due diligence and used current information acquired from its own independent and authoritative sources. This does not appear to have been done and instead, the report relies on information in the Malatest report of 8 years previously and the McNeal report of 4 years previously. Furthermore, the McNeal report is not independent, and thus TC used out-of-date information from a report from the marina developers' consultants instead of its own independent sources.

It must be asked why TC has not carried out its own safety and risk assessment, using the latest up-to-date risk assessment tools and matrix, reflecting the current CSA/ISO 31000:2009 guidelines, etc. There is no apparent justification for stating that the probability of conflict is "*remote*" based on obsolete data from another report using outdated standards. Why was the latest data from reliable sources such as Statistics Canada and Nav Canada not used, as well as the very data collected from industry by

TC? The 2009 data on aircraft movements at Victoria Harbour is freely available from Stats Canada and Nav Canada. There are reported discrepancies between traffic figures from different sources (perhaps because they use different criteria), and this should have been clarified. Reference is also made to hourly movements, etc., but there is no apparent attempt to consider the concept of the annual peak busy day and the peak busy hour.

This brings one back to the validity of the referenced reports of 1999, 2002, 2006, etc. As noted throughout this report, in the context of late 2010 they are out of date, both in depth of content and standards and practices in current use, and have not always adhered to the standards of in-depth research, diligence and impartiality that should be expected. There are areas of some reports and official documents that appear more like a case for a particular point of view than a dispassionate and impartial assessment, sometimes accompanied by language that is difficult to comprehend. For example on Page 33 of the Environmental Assessment in the Federal response column it is stated *"The project area is previously impacted."* This is incomprehensible – grammatically incorrect and conveying no discernible meaning.

The McNeal report, quoted by TC, was described by its authors in the executive summary as "an air operations study of seaplane activities". Despite this, the 12 "key study findings" actually include only three or four items that could genuinely be described as germane "findings". One "key study finding," for example, stated that 166 construction workers would be employed – hardly a key finding in respect of an air operations study of seaplane activities. Section 10 of the report states that it is a risk assessment, but this in fact is not the case, most of the section being merely a reprint of extracts from other documents and making reference to the Transport Canada assessment of 1999. The statement that "the risk of collision between a seaplane and a marine yacht is remote" is not substantiated or backed by objective evidence. (It is not clear why the report speaks of a *"marine"* yacht – is there a "non-marine" yacht?) Table 14 is described as a "risk assessment matrix" (it was copied from the TC 1999 report) but it would not nowadays be accepted as such.

Minimum Requirements for a Safety Case

There are numerous books, documents and references relating to the Safety Case. In fact, new information is released almost on a daily basis by governing authorities around the world, including but not limited to: ICAO, Eurocontrol, Civil Aviation Authorities, Transport Canada, International Maritime Organisation and EASA etc., regarding the safety case and all that it pertains to. There is virtually an unlimited supply of information explaining the why, wherefore and reasoning behind the production of a safety case. Consequently, it is logical to say that not only has the Safety Case become a recognised process in Safety Management around the world, but it is also an extremely important process in proving due diligence with regard to liability.

Lord Cullen wrote into his report after the 6th July 1988 North Sea Oil Rig (Piper Alpha) disaster where 167 people died, that: *"Primarily the Safety Case is a matter of ensuring that every company produces a formal safety assessment to assure itself that its operations are safe."* Unfortunately, the recent disaster in the Gulf of Mexico, with

concurrent loss of life and billions of dollars in costs, indicates that many people are still ignoring his words. One would not wish to see Victoria become the scene of negative media attention due to a lack of a due diligence and the exercise of a duty of care.

There is an increasing burden of proof on the regulator and others working under the laws and regulations of a country and those countries which are signatories to international organisations such as the ICAO – i.e., Canada – to demonstrate that acceptable levels of safety have been met and that they continue to be fulfilled in accordance with those laws and regulations, no matter whose they are. The regulator or authority is not exempt from compliance, nor is the regulator exempt from ensuring that the burden of proof and duty of care has been achieved with regard to safety. A safety case would also enable the concerned authority to determine if the proposed installation, facility, change, system etc., is fit for purpose and the entire harbour operation has, *inter alia*, continuing safe operations and emergency response procedures in place.

A safety case has been broadly described as the documented assurance (argument and supporting evidence) of the achievement and maintenance of safety. It is the primary means by which those accountable for a service provision or a project can assure themselves that those services and projects will continue to deliver an acceptable level of safety. Depending upon the safety case and its subject matter, a safety case should be viewed as a living document that captures a specific window in the life cycle of a service, project, operation, etc. As a living document, it will require additional revision, refining and reference, and/or if necessary, total replacement due to previously indeterminable factors, i.e., current events, time, regulation, policy, changes to an Airport Operations Manual (AOM), reduction or expansion of services, etc. This appraisal/assessment requirement is a function of a robust Safety Management System, comprising in part of the annual review and update.

A safety case is not an alternative to a safety assessment. A safety case is a proven means of documenting and formatting a summary of the results of a safety assessment or other activities (e.g., simulations, surveys etc.), so that a reader can easily follow the logic path as to why a change or an ongoing service or operation could be considered safe or not safe. A safety case will ideally harmonise with a Safety Management System (SMS), the latter being the method to record and document the safety of a service or system. Conversely, the implementation of a SMS would also provide evidence to support a safety case.

As a precursor of a safety case there are primarily two types of hazard analysis to support a risk assessment that may be undertaken – qualitative and quantitative. The quantitative approach requires considerable amounts of incident data and may require significant resources to establish a numerical evaluation of the level of risk. The qualitative approach seeks to identify the levels of risk of various activities using readily understood and commonly used descriptive terms. Nevertheless, to have worthwhile meaning these terms must be backed up by certain defined numeric values (e.g., one event per 100,000 landings or take-offs etc.). Techniques such as Fault Tree Analysis (FTA), Failure Modes & Effects Analysis (FMEA), Failure Modes, Effects & Criticality Analysis (FMECA), Event Tree Analysis, and Common Cause Failure Analysis, may be used. In a harbour/water airport risk assessment, as in any other, the application of risk assessment

in a structured comparative manner allows identification of activities which result in higher levels of risk, but does not determine the absolute value of the risk.

Typically there are also two types of Safety Case, which perform different functions and are utilised accordingly for different situations. One is used to demonstrate the safety of an ***ongoing operation, service or activity,*** while the other type is used to demonstrate the ***safety of a substantial change*** to a service or operation (and/or underlying system(s). The former may be known as a unit, operation or service safety case, while the latter may be known as project safety case or safety case for change.

A project safety case may be warranted when a particular or substantial change is proposed to an existing safety-related operation/system (including the introduction of a new service/system or operation). A project safety case will usually consider only those risks created, changed and/or modified by the change, and will rely on an assumption (or evidence from a corresponding unit or service safety case) that the pre-change situation is at least tolerably safe – in other words, it meets required or applicable safety levels.

A comprehensive Safety Case suitable for the Victoria Water Airport and the Victoria International Marina must as a minimum, review current operations, including future plans for all air and marine operators and service providers in the harbour area covered. Furthermore, it would include a review of any applicable operations, safety manuals, directives and policies/procedures as may be pertinent to the project/situation for which it was originally undertaken. This should include not only any regulatory changes pertinent to the area under consideration that may have taken place, but equally as important, a proactive review of pending regulatory changes.

A Safety Case must provide logical, reasoned arguments, demonstrating that the risks to people and the environment are: '**As Low As Reasonable Practicable**' (ALARP), and should demonstrate that regulatory safety requirements have been met. One means of accomplishing this is to undertake inspections, meetings, discussions and relevant research with any/all applicable persons, parties, organisations, stakeholders, etc., to fulfil the requirements as listed below. The following minimum actions should be undertaken in the production of a comprehensive Safety Case:

- Develop key safety principles and safety goals;
- Conduct comprehensive hazard identification and hazard analysis activities for the operation of the facilities in the context of integration with the full range of other operations in the vicinity (Victoria Harbour);
- Documentation of risk management measures for all hazards and accident scenarios that may arise from the installation and operation of the facilities;
- Justification that the design meets the identified goals and safety requirements;
- Demonstration that all relevant regulatory requirements have been adequately discharged;
- Development of formal safety case documentation to current standards;

Additionally and with respect to the Victoria Harbour:

- Production of a Safety Case Report summarising the arguments and evidence of the Safety Case and documenting how it will integrate with the Victoria Water Airport SMS, scheduled to be in place by 2014.

These activities, when carried out and supervised rigorously, can demonstrate compliance with a prescribed or required safety margin or level of safety – namely the proof of the "safety case."

[TYPICAL] CONTENTS OF A SAFETY CASE

A Safety Case when undertaken, should consist of, but not necessarily be limited to, the following elements.

The Safety Case Elements

Aim	This is where a short explanation is written explaining what the safety case is trying to demonstrate. The explanation should be directly related to the 'Safety Claim' in that the subject matter is acceptably safe.
Purpose	For whom is the Safety Case being written and for what reason(s). The Purpose should contain sufficient detail so as to leave no ambiguity or doubt in the readers mind as to what the initial intent is.
Executive Summary	1. Assurance that safety requirements have been, or will be, met by: (i) Confirming that Safety Case work has been carried out satisfactorily. (ii) Confirming that all other stakeholders have acknowledged their safety responsibilities. (iii) Confirming that safety risks associated with further actions can be satisfactorily managed. 2. A brief description of the facility or operation, noting that a full description will be contained within the main Safety Case. The summary should be sufficient to enable the boundaries and scope of the Safety Case and its interfaces with any other Safety Cases to be clearly defined and understood.
Scope	The importance in correctly defining the scope and/or boundaries of a safety case cannot be over-stated. The scope provides an initial and essential step in developing a safety case and should also concisely and accurately state: a). specifically what the safety case defines in terms of range and depth; b). applicable suppositions made while defining the scope, boundaries and safety criteria; c). applicability and compliance with laws, regulations, standards and policies; d). jurisprudence with regard to other applicable and relevant safety cases; e). levels of managerial responsibility and control, in addition with stakeholder involvement; f). that a safety case can be [temporarily] limited or

	restricted to the safety of a new concept, thus rendering it tentative to completion by the accountable organisation.
Assumptions	Assumptions that underpin the scope of the safety case, or the safety requirements, argument or evidence should be stated. For example, this may include numbers of personnel, training levels, operational profiles, operating environment etc.
Description of the System, Installation and/or Facilities and Operation	The system description describes the applicable system under review including any change(s) in the operation and/or environment that might be expected. It should provide sufficient information and detail to explain what the safety case addresses, while providing a comprehensive explanation of the operational environment upon which the safety case is based. Additionally the system description should include a description of the context that explains: a). the relationship and interplay between other systems including but not limited to: people, procedures, equipment, etc. b). operational environment – including all characteristics that may be affected and elements that are relied upon, when assessing acceptable levels of safety. c). a descriptive summary of the concept of operations that explains how the system and the service that is supported (when applicable) is intended to operate. d). the purpose of the system from a safety perspective. Operational Information**,** including outputs from the Safety Case that are relevant to the management of operational safety, including but not limited to: ✈ A description of the operational envelopes. ✈ Any limitations on use or operational capability. ✈ The main areas of risk. ✈ Relevant information that can assist the operator in balancing the operational imperative against safety risk. ✈ Demonstration that operating and maintenance procedures and publications have been, or will be developed.
Justification	Most relevant to the Project Safety Case, the Justification is where the requirement for change is explained with regard to potentially incurring some degree of risk.

Argument	The Argument or 'Safety Argument' is a statement (or a set of statements) that is used to assert that the service or system concerned is safe. The safety argument should ultimately explain how the Aim can be satisfied.
Evidence	Safety evidence is collected to support or substantiate a safety argument. It can comprise expert judgement and/or established fact(s) that the originating safety argument is well-founded. Evidence must be able to withstand certain tests and meet an acceptable level of confidence as well as validity. Additionally, evidence must withstand the following tests: a). **Necessity**: presented only to the degree and extent necessary to support the related argument. b). **Sufficiency**: confirms that the related argument is true in a clear, concise, unequivocal, accurate and objective fashion. c). **Appropriate**: evidence must be appropriate and relevant to the argument. d). **Rigour**: must be appropriate to the associated risk. e). **Relevance**: means that the evidence must relate to the correct configuration of the system or the operations under consideration. f). **Guidance**: must withstand certain gathering, assessing and presenting requirements.
Meeting the Safety Requirements	The following should be included: ✈ A statement describing the agreed Safety Requirements. ✈ A summary of the argument and evidence that demonstrates how the Safety Requirements have been, or will be, met. ✈ Summary of the hazards and likely accidents associated with the system, noting the main areas of risk. *Note: The main areas of risk will also be highlighted under the System/Operations Description heading.* ✈ Safety requirements that are unlikely to be met, either in part or in full, with remedial/follow-up actions identified. ✈ Risk management actions that are outstanding identifying both the risk and the organisation responsible for its management. ✈ The residual risk that is, or is anticipated to be, posed by the operation and/or facility.

	✈ Issues of particular sensitivity, e.g. use of hazardous materials, or with significant project or community risk. ✈ Regulatory approvals/certificates, and any associated restrictions, that are currently in place. ✈ Any counter evidence found that may invalidate the Safety Case, including a description of the activities taken to address this counter-evidence ✈ Feedback, reporting and auditing arrangements for defects and shortfalls. ✈ Particular issues related to interfaces between different systems and other stakeholders
Emergency/Contingency Arrangements	A statement may be required to confirm that appropriate Emergency/Contingency Arrangements (e.g. procedures) have been or will be put in place and identification of any areas where such arrangements do not exist or are inadequate.
Caveats	Caveats consider all **Assumptions**, outstanding safety issues and any **Limitations** or restrictions on the operation of the system.
Conclusions	A simple statement to explain that the Aim has been satisfied, subject to the stated caveats.
References	Insert details of references used in the safety case.
Appendices	Attach appendices as required.

Examples of Items to be Included in a Safety Case Relating to Victoria Harbour

The following represents some of the types of material and issues that would be relevant to the Safety Case for the proposed Victoria Harbour installations. It is not exhaustive and is intended as an illustration of the type of issues to be considered under the headings in the foregoing table.

Review the applicability or otherwise of:

1. **Natural and Man-made Harbour Navigation and Use Regulations (SOR/2005-73)** to the Victoria Harbour and which include the following statement.

> **SAFETY OF PERSONS AND SHIPS IN HARBOURS**
>
> Prohibitions:
> Unless otherwise authorized under these Regulations, no person shall, by act or omission, adversely affect the use of a harbour, interfere with navigation in a harbour or jeopardize the safety of persons or ships in a harbour by doing anything or permitting anything to be done that has or is likely to have any of the following results in the harbour:
>
> (*a*) to obstruct or threaten any part of the harbour;
> (*b*) to interfere with an authorized activity;
> (c) to divert the flow of a river or stream, cause or affect currents, cause silting or the accumulation of material or otherwise reduce the depth of the waters;
> (*d*) to cause a nuisance;
> (*e*) to cause injury to persons or damage to ships; or
> (*f*) to adversely affect sediment or water quality.

2. Review the supporting risk assessments made by Transport Canada leading to the issuance of the NWPA approval. If no supporting evidence exists, ascertain why.
3. Ascertain the level of service currently provided by Nav Canada and determine whether this is appropriate to the required safety level. (should be part of the safety case).
4. Addition of new obstacles buildings etc to the harbour area since the previous reports. Include moving obstacles such as masts of marine vessels etc.
5. Include provision for annual review and update of the safety case(s).
6. Changes to the Airport Operations Manual - required or pending.
7. Include all appropriate points/issues stated or referenced in this report.
8. Review all current operations and future plans of all air and marine operators and service providers in the area covered by the safety case. Include review of all operations and safety manuals, directives and procedures.
9. Review of all regulatory changes pertinent to the area under review that have taken place since 1999.
10. Undertake inspections, meetings, discussions and research with all relevant persons, parties and organizations to fulfill all aspects of the table above.

REFERENCE DOCUMENTS

Authority / Resource	Ref. No.	Title
Canadian Aviation Regulations	107, 302,	CARs
Dr. Dmitri Zotov, MBE, PhD, MRAeS	N/A	Safety Cases
EUROCONTROL	DAP/SSH/091	Safety Case Development Manual
EUROCONTROL	EATAP Ref. 07/03/19-13	Safety Case Guidance Material
Government of Canada	Aeronautics Act	
Greater Victoria Harbour Authority (GVHA) Website		
ICAO	ANNEX 11	Air Traffic Services
ICAO	ANNEX 14	International Standards & Recommended Practices - Aerodromes
ICAO	Doc 9426	Air Traffic Services planning Manual
ICAO	Doc 9734	Safety Oversight Manual
ICAO	Doc 9735	Safety Oversight Audit Manual
ICAO	Doc 9774	Manual on Certification of Aerodromes
International Marine Organisation		International Safety Management Code
James Ellsworth		Victoria's Sea Plane Traffic – Air Turbulence
Maritime Safety Authority of New Zealand	N/A	Port & Harbour Risk Assessment & Safety Management Systems
McNeal & Assoc. Consultants Ltd.		Victoria International Marina Port Victoria Yacht Club - 2006
McNeal & Assoc. Consultants Ltd.		Victoria International Marina Traffic and Communications Plan (Revised) - 2008
National Standards of Canada	CAN/CSA 9000/9001etc. CAN/CSA/ISO 31000:2009	ISO Quality Management Series Risk Management
Transport Canada	AC 107-001	Guidance on SMS Development
Transport Canada	AC 300-002	SMS Implementation Procedures for Airport Operators
Transport Canada	TP 13095	Risk Management & Decision-Making in Civil Aviation
Transport Canada	TP 312	Aerodrome Standards & Recommended Practices
Transport Canada	TP 13410	Port of Victoria Traffic Scheme
Transport Canada	TP 14371	Aeronautical Information Manual
Transport Canada	TP 14469	Flight 2010 – A Strategic Plan for

		Civil Aviation
Transport Canada	TP 14693	Civil Aviation Integrated Management Systems Standard
Transport Canada	TC-1002279 (TP 14678)	Moving Forward
Transport Canada	Mission Statement	A Vision for Civil Aviation
Transport Canada / Fisheries & Oceans Canada	RDIMS No. 2536483 NWPP File No. 8200-06-8949	Environmental Assessment Screening Report
Transport Canada Civil Aviation	RDIMS No. 4135989	Aviation Safety Program Manual for the Civil Aviation Directorate
Transport Canada Website		Total aircraft movements by class of operation
UK Civil Aviation Authority	CAP 700	Operational Safety Competences
UK Civil Aviation Authority	CAP 726	Guidance for Developing & Auditing a Formal SMS
UK Civil Aviation Authority	CAP 760	Guidance on the Conduct of Hazard Identification, Risk Assessment and the Production of Safety Cases