Investigation into the Elvington Airfield Incident, 20th September 2006

May 2007

Revised June 2007

CONTENTS

This report is intended to be read as a whole. Examination of parts of the report in isolation may lead to misrepresentation. To protect their privacy, individual's personal information has been removed.

1.0 EXECUTIVE SUMMARY

On the 20th September 2006, the BBC were at Elvington Airfield filming Richard Hammond driving what is described as a "jet car" for the Top Gear programme. The car was provided by Primetime Landspeed Engineering (PLE). Richard Hammond undertook three runs in the vehicle without deploying its afterburners. Following a lunch break, Richard Hammond then undertook three runs with the afterburners in use. On the fourth run after lunch, approximately 14 seconds into the session, the vehicle veered sharply to its right, rolled, before coming to a halt upside down on the grass margin of the track.

On evidence available, the immediate cause of the incident was the catastrophic disintegration of the front off-side tyre attached to the vehicle following the penetration of the side wall of the tyre by an object such as a nail which was probably picked up during the day's events.

The underlying cause appears to have been the inability to spot the damage to the tyre. The Top Gear team did not have anyone present with sufficient knowledge to assess the adequacy of the checks made by PLE on the day of the shoot. Without evidence of written record sheets or third party verification that such inspections were being done the evidence is inconclusive whether the safety checks, especially tyre checks, were being conducted to an appropriate standard which may have identified the damage to the front off side tyre prior to the final run.

Where the BBC relies on 'experts' [people with specific knowledge/skills] with prime responsibility for safety issues for high risk activities there is a need to ensure the BBC has selected competent persons and that it provides an appropriate level of assurance that these responsibilities are being discharged adequately.

This report identifies much good practice of the Top Gear team but also presents, in addition to the points above, proposals for actions needed to improve the BBC's arrangements for risk management in programme making. The priority recommendations reflect the key areas where the BBC could improve the management of risk and its use of the BBC's own support framework and expertise. These relate to improving the use of the ORM expertise at the early stages of a programme, better use of the risk assessment process as a helpful tool in the planning of a programme and in the mitigation of risk, and the need for adequate assessment, to approved standards, of third parties for high risk activities.

ACKNOWLEDGEMENTS

The Investigation Team would like to gratefully acknowledge the assistance of the following people; Andy Wilman - TG Executive Producer, s.40(2), s.40(2), Ben Collins - Consultant, Colin Fallows - Primetime Landspeed Engineering, s.40(2), Grant Wardrop- TG Assistant Producer, Jon Ling - Occupational Risk Manager, s.40(2), s.40(2), Mark Newby - Primetime Landspeed Engineering, s.40(2), s.40(2), Pat Doyle - TG Series Producer, Paul Bamford - Cameraman, Rachael Lister - TG Production Team Assistant, Richard Hammond - Presenter, Richard Porter - TG Script Producer, s.40(2), s.40(2) s.40(2), s.40(2) Edwards - Soundman, Scott Weintrob - TG Director, Seonaid Murray -TG Production Coordinator, s.40(2) and Susie Cooper -TG Production Manager.

2.0 TERMS OF REFERENCE – BBC INVESTIGATION

The Terms of Reference document for this investigation was signed off by Jana Bennett, the Director of Television, on the 5th October 2006 (see insert below). Investigation sponsors are Jana Bennett and Jim Brown, Head of Occupational Risk Management.

Terms of Reference

Investigation title:
Formal Investigation into the Elvington Airfield Incident, 20th September 2006

Stakeholder(s):
- Project sponsor: Jana Bennett
- Jim Brown, Head of Occupational Risk
- EDG/MCORC

Investigation team:
Steve Hocking, Paul Stirk, Daniel Curtin, Debbie Hughes

Background & purpose:
- Jana Bennett (Director of Television), in accordance with BBC Guidelines for the Reporting and Investigating of Accidents, has commissioned an investigation into the immediate and root causes of the accident that occurred at Elvington Airfield, N Yorks on 20/9/06.

Investigation remit:
The investigation will:

- determine the events leading up to the accident and identify the immediate cause of the accident,
- identify why the accident occurred i.e. the underlying causes and contributory factors which led to the accident, and
- recommend actions to address any relevant underlying causes of why the accident occurred and contributory factors.

Information, data and relevant documentary and physical evidence will be gathered and statements and interviews undertaken to establish the above. Notes will be made of all discussions.

All people interviewed will be given the opportunity to be accompanied by a colleague or a Trade Union/Safety representative. Regular liaison with a Union nominated safety representative will be maintained throughout the investigation as agreed at the September NJC HS&W.

Intended outputs/outcomes:
An Interim Report on the current status of the enquiry and any initial recommendations will be submitted within 28 days of the incident.

The Final Report shall be completed by 30th November 2006 subject to the availability of information from third parties. It will address the terms of reference and will be signed by the project sponsor prior to circulation to relevant parties.

SIGNED BY PROJECT SPONSOR: Jana Bi[illegible] **NAME: JANA BENNETT**

JOB TITLE: Director of Television **DATE:** Thursday 5th October 2006.

3.0 SUMMARY OF RECOMMENDED ACTIONS

The proposed recommendations in this report address areas for improvement identified as a result of the investigation. They are listed by priority under each sub-heading. They are numbered as they appear in the report.

Section 9.3 provides a full explanation and context in which these recommendations were made.

Commissioning of Programmes

1. The BBC's commissioning process should ensure that. where a potential significant risk associated with the programme concept which might have an impact on the resources for the programme is identified, the ORM department should be contacted. [Priority recommendation]

2. ORM to ensure that resources are focused on activities and areas where the BBC faces the greatest occupational risk.

Initial Ideas and Scoping of Programmes and Programme items

3. Where significant risks become evident through the scoping of programmes, senior management (Head of Production or Executive Producer of series, or their equivalent) should contact the ORM department. [Priority recommendation]

Planning

4. Executive Producer or Producer of a programme (or their equivalent) to review the degree of risk involved in programme activities as the production process progresses, seeking ORM advice where potential significant changes in risk are identified, and to escalate to senior management when appropriate. [Priority recommendation]

7. Risk Assessment needs to be started at the beginning of the production process and, where high risk activities are involved, including those undertaken by other parties, in discussion with ORM. [Priority recommendation]

8. The key findings from the risk assessment must be properly and adequately communicated to the relevant parties. [Priority recommendation]

10. Review and improve potential gaps in procurement of non vetted, high risk activities. [Priority Recommendation]

5. Where experts are used to assist with the BBC's research they should be given clear terms of reference.

6. Database to be considered along the lines of the International Film Advice database to capture sources of expertise for high risk, specialist activities

9. Written advice and recommendations given by ORM should be stated clearly and concisely to avoid ambiguities over interpretation. Doubts over interpretation should be discussed with the production team.

11. Contracts to be reviewed for specific clauses regarding cooperation in the BBC's investigation should an incident occur.

12. Where possible training should be completed prior to the filming day. Where presenters of programmes have specific training or skills this documentation should be held and updated by the production office.

13. Production training to be reviewed to ensure greater understanding of the role of the producer and their responsibilities and how to effectively discharge them. No one in production should be in any doubt as to their level of responsibility. The role of ORM as an advice and guidance service not an authoriser should be emphasised.

Implementation (day of recording)

14. On the day of the shoot, the Producer should ensure that responsibilities for health and safety are clearly communicated and understood by all parties, and ensure that the RA is kept under constant review to take account of changing circumstances. [Priority Recommendation]

16. In addition to the overall responsibility of the Producer, where unusual high risk activities are identified, programmes may wish to consider the use of independent specialists/in house expertise (eg ORM) to provide a degree of assurance that the activities are being controlled appropriately and in accordance with the risk assessments. [Priority Recommendation]

15. Where training is a core component of the activity there should be clear, documented criteria for the effectiveness of the training. A single point of responsibility should be determined for the activity to proceed based on evaluation of the training against the criteria and its effectiveness.

17. A clear statement on the rights and obligations of individuals and the powers of the police and other enforcing authorities in such incidents to be produced and communicated to production teams.

18. The area of pastoral support following serious incidents to be reviewed and the arrangements made clear to production teams who may have to call on them.

Post Programme Review

20. The identified good practice and lessons learned from this investigation should be widely communicated. [Priority Recommendation]

19. ORM to be involved in the review of high risk programmes with production teams so that lessons can be learnt and best practice spread across the organisation

4.0 INVESTIGATION CALENDAR

4.1 BBC

The internal investigation has completed its enquiries into the incident, however, there are still some outstanding questions related to Primetime Landspeed Engineering's (PLE) procedures which have yet to be answered. These have been sent from the BBC solicitors, Beachcroft LLP, to PLE's solicitors but no response had been received at the time of writing this report. See Appendix 1 for questions.

Immediately following the incident, Occupational Risk Management (ORM) Head of Programme Safety and ORM Principle Risk Manager met (21st September) with BBC solicitors, Beachcroft LLP, in Leeds for a preliminary discussion regarding the incident and way forward with the investigation. Following this meeting and further discussion with the Head of ORM, it was agreed that the investigation team should be comprised of ORM (Occupational Risk Management) colleagues not directly attached to the programme advice and a senior member of DEC (Drama, Entertainment & Childrens).

The Terms of Reference for the investigation were signed off on the 5th October. During this period of investigation planning, the investigation and interview protocol were being developed prior to commencing interviews on the 12th October. Paperwork relevant to the investigation was also being sourced from BBC and external sources. The main interview period lasted until the 31st of October. The interviews with Richard Hammond and PLE were concluded by the 19th of December.

The investigation team submitted the 1st Interim Report on the 20th October, a month after the accident.

The BBC solicitors formally appointed the tyre analysts, Burgoynes & Partners on the 30th October. Burgoynes met with the HSE and PLE on the 7th of December in order to clarify information.

The investigation team submitted the 2nd Interim Report on the 8th December.

In mid February the company conducting the investigation into the tyre failure were able to carry out their laboratory analysis and submitted their report on the 14th March, Appendix 2.

4.2 Enforcement Authority, HSE

The HSE have been pursuing two lines of enquiry – technical and procedural, with John Micklethwaite, HM Inspector of Health & Safety leading on the former and Keith King, HM Principal Inspector HSE, Leeds Office on the latter.

The areas of BBC procedures the HSE have looked into are:

- BBC RA procedures
- BBC arrangements for contracting third parties
- ORM/production relationships and the Elvington accident

The HSE have spoken to several members of BBC staff, including senior BBC managers, the Top Gear Team and the Investigation Team. They have also conducted laboratory analysis on the tyres and are expected to have completed their investigation report by May/June.

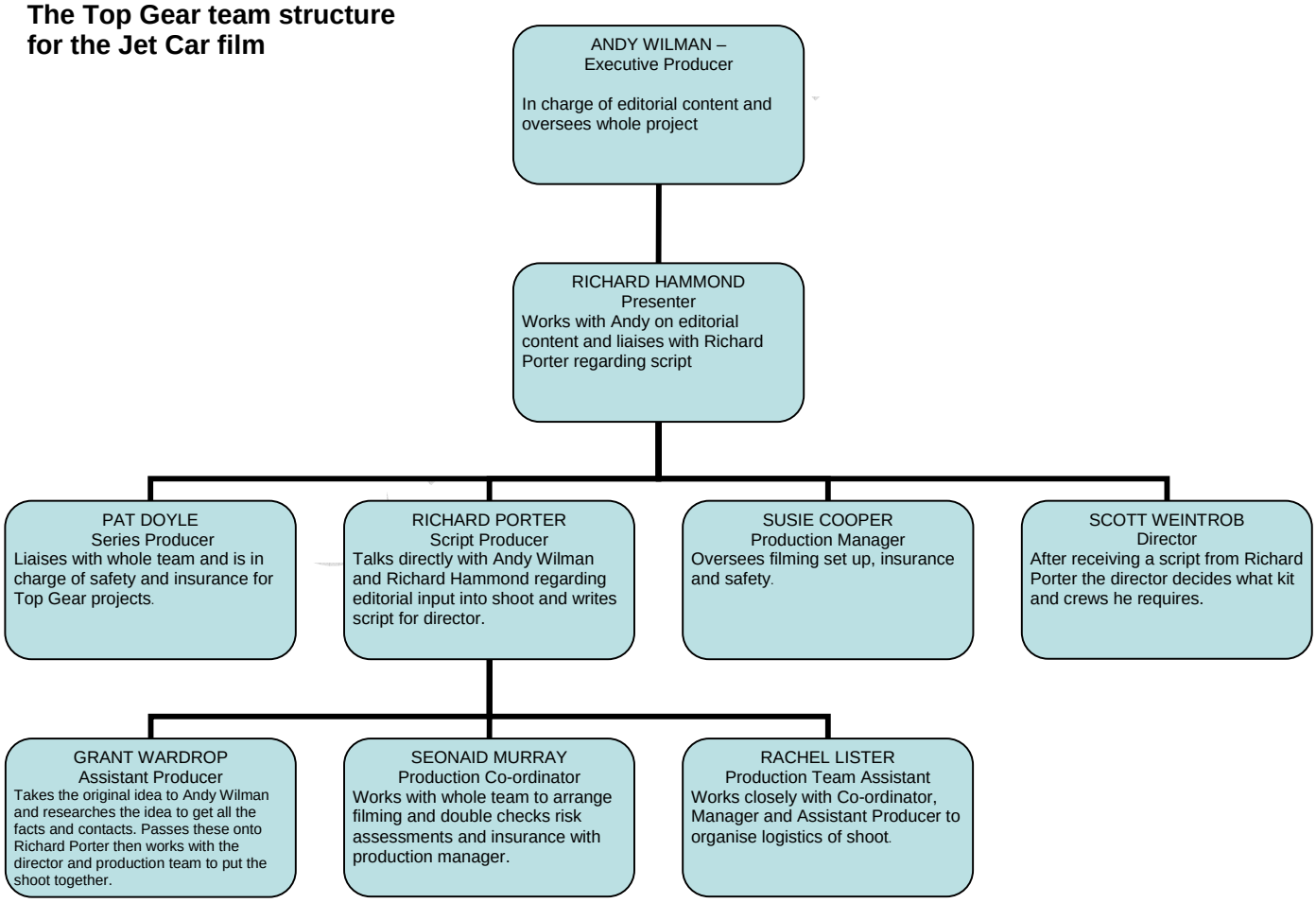
5.0 BACKGROUND

5.1 Overview of Top Gear Production Structure

The Executive Producer Andy Wilman has been involved with Top Gear (TG) since its re-launch in May 2002. Many members of the team have been involved with TG for the last two series. Each series consists of 8-10 shows and there are 2 series made a year. Each show usually consists of 4 films of which the Jet Car film was an example. The TG team, therefore, make approximately 80 short films each year.

There are 3 Assistant Producers (AP) and 2 researchers in the team. Each AP is assigned a couple of shoots/pieces, conducting much of the research, feeding back to the Executive Producer.

The Top Gear team structure for the Jet Car film



6.0 EVENTS LEADING UP TO THE INCIDENT

The following section has been compiled from evidence provided in witness statements, notes and documents. These sources of information have been corroborated where possible, however, on many points, the report has had to rely on a single source.

6.1 Prior to the Day of Filming

The Idea

In general the Top Gear (TG) team hold a couple of brainstorming sessions at the start of a series to generate ideas to fill the framework format of each show. This format includes a track test, a 3 header film and individual films to complement the programme. The ideas come from a broad variety of sources including the general public and the presenters. The ideas are discussed and either kept for further development or rejected. Criteria for this decision include the tone, balance for the individual programme and the series in general.

Grant Wardrop (Assistant Producer) received an e-mail from Primetime Landspeed Engineering (PLE) in July 2006 enquiring whether Top Gear wanted to report on an attempt at setting a new UK land speed record. As reporting on events is not part of the TG format, the offer was declined. Telephone enquiries were made however, as to whether a TG presenter could make an attempt at breaking the record. PLE had tentatively said that it was possible.

Film Concept and Development

Although the initial enquiries had tentatively explored the feasibility of a TG presenter breaking the UK land speed record, this was abandoned by Andy Wilman at a very early stage on the grounds that a target speed would put unnecessary pressure on the driver.

The concept was to drive and then describe what it felt like to drive a car at very high speed, and if sufficient progress had been made during the day, activate the afterburner which is visually impressive.

The idea had been around for between one and two months, however, the gestation period of the film was approximately three and a half weeks.

Primetime Landspeed Engineering and the 'Vampire'

According to the information on their web site, Primetime Landspeed Engineering (PLE) has been operating for over 20 years and is the current holder of the UK land speed record, 300.3 mph. PLE own 2 cars, 'Split Second' and 'Vampire'. The elder one, 'Vampire', was chosen for the TG film because of its provenance. PLE had completed approximately 3000 runs with this car.

The 'Vampire'

TG had not worked with PLE before so used background research to establish their pedigree. Pat Doyle (Producer), Scott Weintrob (Director) and Grant Wardrop (Assistant Producer) spoke to Colin Fallows at PLE by telephone as part of an informal interview process. Scott Weintrob had enquired specifically about the positioning and fixing of mini-cams on to the car and the potential for them to detach. General information about PLE was also gathered over the phone and from the PLE website by the TG production team. PLE were asked about their previous accident history and did not reveal any issues. Grant Wardrop asked Ben Collins, an auto sport consultant, to visit the company in order to confirm their technical integrity. Ben Collins visited the company on Monday, 18th September and fed back that day to Pat Doyle by phone, and by e-mail the next day Appendix 3.

Assessing the risk

Pat Doyle completed the TG BBC Programme Risk Assessment (PRA), Appendix 4, on the 14th of September. The input to the PRA was based on his own experience, Grant Wardrop's knowledge of motor racing and the arrangements organised by the production team. Additional comments from Jon Ling, Appendix 5, the Principle Risk Manager providing operational support to the Top Gear programme, were added following his discussion with the Producer on the 18th of September 2006 Appendix 6. The PRA still contained anomalies such as; incorrect date of shoot, length of shoot and the decision not to follow up with a driver's seat fitting. The PRA was distributed to the TG team on the 14th of September 2006 and to the crew along with the schedule the day before the filming and on the day of the filming.

Primetime Landspeed Engineering Risk assessment

Grant Wardrop asked Primetime Landspeed Engineering (PLE) to provide a risk assessment which they sent through the week prior to the shoot, Appendix 7. A copy of this was forwarded

to BBC Insurance on the 14th of September. This risk assessment was a generic assessment for jet cars operating at the Fairford Airbase. It addressed basic technical issues regarding the car's build and operation and stated that all risks were tolerable regardless of outcome. The Primetime Landspeed Engineering Risk Assessment does not refer to driver training but see Appendix 3 for discussion on this item.

Involvement of ORM

BBC Insurance contacted ORM on Thursday 14th September, drawing their attention to the TG jet car shoot. Stuart Page, Occupational Risk Advisor, was providing cover for Jon Ling, Principal Risk Manager, while he was on leave. Stuart Page contacted the TG team on the 14th and in return received a copy of the programme risk assessment. As Stuart Page was on leave the following week, he left a message with Jon Ling, to pick the issue up as soon as possible on his return.

Jon Ling contacted Pat Doyle early Monday afternoon, the 18th September, to discuss the activity. Jon Ling provided advice and discussed generalities of the shoot, although it is unclear what elements of speed were discussed. Jon Ling followed this conversation up with an e-mail to Pat Doyle, confirming the advice, having spoken to the Head of Programme Safety, Stephen Gregory, to sense check the advice given. This e-mailed advice appeared verbatim on the TG production risk assessment.

Ben Collins Remit and Report on Primetime Landspeed Engineering and operation of the 'Vampire'

Ben Collins' (BC), an auto sport consultant, remit was broad, focussing on getting a feel for the Primetime Landspeed Engineering (PLE) team and to identify any concerns based on his knowledge of auto sport engineering standards. This was the first time that BC had been used in this role for TG. His report is in Appendix 3.

Speed

Andy Wilman stated that he was aware that previously a novice driver had driven the car at 260mph and was happy for speeds of 260-270 mph to be achieved.

According to the TG production team, the ultimate control of the capability of the car was left up to Primetime Landspeed Engineering (PLE). Increasing the speed was part of the discussion during the turnaround period between runs. The principle of gradation of speed increase was introduced for this shoot. The level of the incremental increase would be determined by PLE's assessment of the progress and the demonstration of competence by the driver through driver feedback.

Driver Selection

Following the discussion with Colin Fallows of Primetime Landspeed Engineering (PLE) and an independent journalist, Colin Goodwin, who had driven the car, it was decided that the car could be driven by one of the TG presenters. The presenter who immediately sprang to the mind of Grant Wardrop, the Assistant Producer, was Richard Hammond (RH), however Andy Wilman (AW) was unsure of this as RH had done a large number of films already. James May was identified by AW as the presenter to drive the car. Due to the issues of the availability of James May, the track and car, this was not possible. RH was then approached by AW. In a previous discussion, RH had expressed his desire to go 'really fast', faster than 'super car fast', and so when offered this opportunity RH agreed to drive the jet car. Grant Wardrop contacted Ben Collins, an auto sport consultant, familiar with TG and he confirmed that RH would be a good choice. This choice was agreed between AW and RH approximately 10 days before the shoot.

PLE indicated that the onsite training would be adequate when considered with RH's prior driving experience. RH's ten years experience as a motor journalist, track testing and driving a

wide variety of cars at speed and his lifelong enthusiasm for cars and motor bikes had provided him with a wealth of experience. An example of this acquired experience was that RH had recently spent 2 days with Renault Formula 1 driver training.

Driver Equipment

Grant Wardrop sought advice from Colin Fallows at Primetime Landspeed Engineering (PLE) with regards to the appropriate clothing for the driver, fireproof motor racing overalls. This was supplemented by information from Ben Collins, who in particular, specified the standard of helmet they should use, a GP5 professional motor racing helmet.

Location

Grant Wardrop consulted Primetime Landspeed Engineering (PLE) regarding the options they had for the filming location. PLE provided TG with a list of four airfields including Fairford where PLE had recently broken the UK record. Elvington Airfield in Yorkshire was the only location which could offer vacant days which suited the TG plans.

Emergency Planning

The Top Gear team generally employ local service providers. Elvington Airfield were approached and asked to provide recommendations for Paramedic services and Fire and Rescue services. On the basis of these recommendations Inter-County Paramedics and Event Fire services were engaged. Both of these organisations have extensive experience in motor racing scenarios and events held at the airfield.

One or Two Day Shoot

The TG team had provisionally booked in two days to make the film. Following a review of the weather forecast for the two days, a decision was made a couple of days before the shoot to reduce the shoot to one day. Elvington Airfield had discussed with the TG team that if the winds

were too strong that they would have to abandon the shoot. TG were pre-empting this cancellation.

Primetime Landspeed Engineering (PLE) had confirmed that there was enough time over one day to achieve something. The second day had been included when planning as the TG team were unsure how long the preparation and filming would take, additionally, there may have been an opportunity to film PLE's second record breaking car, 'Split Second'.

Number of runs

Prior to the shoot, Primetime Landspeed Engineering had estimated the maximum number of runs would be approximately 8-10, based on a turnaround time of 15-30 minutes, track time and training times.

6.2 On the Day

Responsibilities

It was the TG team's understanding that Primetime Landspeed Engineering (PLE) were responsible for all aspects of safety and training relating to the car on the day. As the TG team were not the experts in the car or its operation they had relied on the expertise of PLE and looked to them for guidance. The TG team's responsibilities lay with identifying and engaging competent contractors.

Setting Up

The airfield was booked from 7am onwards on the day of the shoot. The crew started to arrive on location at between 7 – 7.30 to set up and meet the Primetime Landspeed Engineering

(PLE) team. PLE had brought along both of their jet cars, however only 'Vampire' was unpacked.

The camera men had a separate discussion with the Director in order to go through the shots and look of the piece, while the camera assistants worked on attaching the minicams to the car. The minicams were positioned; facing Richard Hammond's face; on the roll cage; facing the rear of the vehicle. The 3 recorders were positioned behind the roll cage in a void.

Richard Hammonds Instruction

While the car was being rigged, Colin Fallows (CF) began briefing Richard Hammond (RH) for approximately half an hour or so, off camera. This instruction was an introduction to the car and training on the procedures of how to operate the car's controls and the sequence in which they are operated; the critical check words relevant to the procedure that let CF know that RH had understood the instruction. This was then repeated with RH in the car for the benefit of the camera.

Following each run CF debriefed RH, and they discussed the progress and the changes to the speed. CF had knowledge of the telemetry information including, speed, G- forces, line of travel etc, on which advice could be based. As the day progressed and RH acquired experience, the debrief and discussions shortened.

Checking the Track

Checking the track for 'Foreign Object Debris' was carried out on the day of the shoot. This check was done first thing in the morning by the Primetime Landspeed Engineering team and during the day, after each run, by the crew of the PLE support van driving down the runway at slow speed. The critical area of the track was the narrow channel along which the runs were conducted.

Camera positions

The camera positions were at the start, middle and end of the run. The Director had been told by the Primetime Landspeed Engineering (PLE) Safety Advisor where the key camera positions would be, parachute deployment, fastest point etc. in order to get the right camera positions. This was based on a discussion between the Airfield Manager and the external consultant employed by PLE, Malcolm Pitwood.

Between each run, while the car was being prepared, a member of the PLE team would check on the camera positions.

Speed

The decision as to how fast Richard Hammond (RH) was to go was made before each run between himself and Colin Fallows (CF). CF would judge this by the previous performance and the debrief with RH after every run.

Immediately prior to the car setting off CF would signal with his hand to RH to increase the throttle which would increase the engine revs, which would determine the speed of the car for that run.

With the afterburner activated the final speed was governed by the distance travelled. Acceleration would only stop when the parachutes were deployed; the deployment point was indicated by two green cones on the runway.

The car does not have a speedometer, the only record of the speed the car was travelling at was recorded on the telemetry data. It was decided that RH was not to be told the speed he had achieved until after the last run where his reaction and surprise would be recorded on a

piece to camera. The second motive for this was that it would not give RH a target to surpass on each run.

The Initial Jet Car Runs

The car was in position at approximately 10am. Colin Fallows (CF) did the first run of the day with the afterburner in the ‘’Vampire”, this having been suggested to Grant Wardrop by Ben Collins.

RH was strapped in to the seat of the jet car, which was equipped with a 5 point racing harness which included arm restraints which prevented his arms from leaving the cockpit and a neck brace which kept his neck rigid. CF gave RH instructions with regards to the throttle, checked that his visor was securely in place and moved back to a safe distance along with the support vehicle. The jet car would then slowly move off the stand and accelerate down the runway.

RH’s instructions were to continue to the green cones, which had been set up by Primetime Landspeed Engineering (PLE) at a certain point along the runway, and once he had reached these, he would deploy the parachute and slow the car to a halt.

The ‘Vampire’ with the parachute deployed

The car would roll to a halt and RH would get out of the car by which time the support vehicles would have arrived at the car, along with a camera crew. The camera crew would film RH's reactions while the car support team packed up the parachute, and towed the car back to the start area.

The car would be checked over by the PLE team and refuelled while RH waited in a support car, and did some pieces to camera before being strapped back in to the car for the next run. During refuelling the TG team were positioned at a safe distance, and not until CF had indicated everything was ready were the TG team allowed to move back to the start.

The car runs in which the afterburner was not to be deployed would get steadily faster for each subsequent run provided CF and Richard Hammond (RH) were satisfied with the progress. The speed of the car in these runs would be limited to 190-200mph.

Jet Car with the Afterburners

During the lunch break RH and Colin Fallows (CF) decided that enough progress had been made to use the afterburners on the car. The plan agreed with CF was to stage two aborted runs for the camera. RH was to pull the parachute, and cut the engine, after 2.5 seconds on the first afterburner run, 5 seconds on the second run with afterburners and go the full distance on the third.

Following the two successfully staged aborted runs, RH said that he wanted to do a run at full speed. This run was carried out successfully, with RH delaying deploying the parachute until 300m beyond the green cones. As a consequence of this additional distance RH reached a speed of 314mph. RH was elated and impressed by the car's speed. The Director went to see

how RH was and then RH and CF did conversation pieces to camera. The telemetry operator informed the Director and explained that RH had reached a speed of 314mph This information was not disclosed to RH.

Timings of the Jet Car Runs

TG contracted Racelogic Ltd the day before the film to track and record the speed of the car as the car did not have a speedometer. The timings of the runs of the jet car were as follows and can be seen in full in Appendix 8:

10.34	C. Fallows (Prime Time) demonstration run (266 mph)	
12.54	R. Hammond	1st Run (206 mph)
13.44	RH	2nd run (210 mph)
14.53	RH	3rd run (220 mph)
Lunch		
15.26	RH	4th run (205 mph) (with afterburner)
16.21	RH	5th run (234 mph) (with afterburner)
16.56	RH	6th run (314mph) (with afterburner)
17.25	RH	7th run (288mph), (with afterburner) at point of tyre blow out

7.0 DESCRIPTION OF THE INCIDENT

Following a telephone conversation the Producer, Pat Doyle and the Executive Producer, Andy Wilman decided to go for a final run. This decision was based on the desire to get more shots with the afterburner lit as they had only achieved one full run with the afterburner. Richard Hammond (RH) was keen to do another run.

RH and the Director asked the Airfield Manager for an extension to 5.30pm as the initial agreement was to end filming of the car at 5 pm, the Airfield Manager agreed to this. The time limit is in place due to local noise restrictions.

The Final Run

The decision for another run was made at 5.00. Colin Fallows started the turnaround procedures which were no different from any of the previous runs.

The Cameramen and Director were positioned to achieve the best shots. The car started its run normally at 5.25 pm, however, after approximately 14 seconds and 1140 metres from the start and travelling at 288.3 mph, the front right tyre is seen on film to peel off the wheel hub and the car veers to the right. At this point there was a significant negative drop in vertical velocity, indicating the ride height had dropped by a small amount. The car turned on to its roll cage as it crossed the grass verge and came to a halt 59 metres from the centre line of the runway.

8.0 EMERGENCY RESPONSE

The paramedic ambulance from Inter County Paramedics and fire support vehicle from Event Fire Services who had been standing by all day, were on the scene of the crash within seconds. The Paramedics had been positioned on the secondary parallel runway to left hand side of main runway, while the Fire & Rescue were on the opposite side of the runway. They found the jet car overturned with the roll bar partially buried in the ground. The Paramedics and the Fire & Rescue personnel took immediate control of the situation. Most of the film crew ran over to the crash site or drove up the runway to offer their assistance.

The 'Vampire' following the removal of Richard Hammond to Hospital

The car was righted from its overturned position and the roll bars were cut off to gain access to Richard Hammond who was removed from the car. His helmet was removed as there were concerns about his breathing. An airway was inserted and he was strapped to a rigid backboard. Richard Hammond began to regain consciousness. The Director, Scott Weintrob kept talking to Richard Hammond throughout in attempt to help him maintain consciousness.

The Producer, Pat Doyle, dialled 999 as he arrived on the scene immediately after the crash and requested an air ambulance which arrived within 15minutes. He also requested the Fire and Ambulance service to attend the scene which arrived after 10 minutes. It took several minutes to load Richard Hammond in to the Helicopter. He was then taken to Leeds General Infirmary.

9.0 ANALYSIS OF THE INVESTIGATION FINDINGS AND RECOMMENDATIONS

9.1 Immediate Causes

The immediate cause of the incident, according to the tyre report, was the catastrophic disintegration of the front off-side tyre attached to the vehicle.

The following describes in detail the physical failures which led to this disintegration. Analysis of the front offside Hoosier radial ply tyre, comprising of six tread piles, 3 nylon, 2 glass and a further nylon belt, with 3 nylon side wall plys, revealed separated bead wire filaments at a position of around 4 o'clock with respect to the valve. The tyre also revealed that there was an area of 'missing' cord structure on the inner shoulder at a position of between 12 and 1 o'clock. The ends of the cords at this area appeared to be relatively brittle and there was a large failed area immediately above. The side wall immediately adjacent to this area revealed the presence of a small coned shaped penetration in the side wall, close to the shoulder/tread interface.

This hole was made by a penetrating object such as a nail.

The penetrating object had completely penetrated the side wall. The cone like appearance of the hole is an indication that the penetrating object had probably been moving whilst in the tyre.

The evidence provided from the film footage, shows the effect of the failure of these cords, allowing the inner liner of the tyre to be displaced into the structure of the tyre, causing a bulge. This bulge is evident at the end of the penultimate run and start of the final run.

Further detail may be found in the 'Report on an Accident which occurred at Elvington Airfield on 20 September 2006' prepared by Burgoynes.

9.2 Underlying Causes

The penetrating object was probably picked up during the days events. PLE outlined concern for ensuring that event sites were free from hazardous objects such as nails, and evidence from eye witness statements does indicate that visual sweeps were made from the PLE support vehicle as it travelled up and down the track prior to and following each run.
PLE verbally outlined their procedure for tyre examination between runs but this has not been confirmed. Evidence that PLE carried out 'hands on tactile examination' has yet to be demonstrated and is absent from any of the film footage, witness statements, or PLE procedures and assessments provided.

Prior to, and on the day of the shoot, PLE had not provided information in any significant detail, which emphasised what particular routine safety checks they followed to ensure that the car was in a safe state prior to each run.

It seems clear from the video recording that the bulge, clearly visible during the penultimate run, was not clearly visible on the recording at the start of the final run. It can be reasonably implied that the sooner the tyre examination was carried out following the run, the more likely it would be that the area of weakness would be found.

Clearly the type of examination carried out is important and it is understood from the meeting with HSE and Prime Time representatives, that a "hands on" examination of each tyre was carried out between each run, but, as previously mentioned, the interval between the end of the run and the examination is important.

It is the provisional opinion of the tyre expert, pending further information from PLE, that a detailed examination of each tyre immediately following each run is likely to have revealed the area of weakness on the front offside tyre. It is also a distinct possibility that examination of the

tyres between earlier runs should/could have identified the presence of the penetrating object which the tyre expert believes led to the failure of the tyre.

The Top Gear team, although, having the expertise of Ben Collins prior to the day of the shoot, did not have anyone with sufficient knowledge to assess the adequacy of the checks made by PLE on the day of the shoot. Without evidence of written record sheets or third party verification that such inspections were being done the evidence is inconclusive whether the safety checks, especially tyre checks, were being conducted to an appropriate standard which may have identified the damage to the front off side tyre prior to the final run.

In summary the indirect cause was the inability to spot the damage to the tyre, possibly due to either the lack of an adequate checking procedure or inadequate implementation of the procedure by PLE as the 'experts' with sole responsibility for the safety of the car; and to a much lesser extent TG not having an assurance system to ensure that the safety checks were being performed on the day.

Given that the tyre was properly constructed and free from structural defects, the use of such tyres is reasonable for the use they were being put to.

Although the bulge was evident during the penultimate run, it was the tyre expert's opinion that it would be unreasonable to expect Richard Hammond to visually notice it, or feel it through the steering.

9.3 Occupational risk management - Findings

This section of the report has two aims:

- an evaluation of current arrangements for safety

- the identification of actions needed to improve the BBC's processes and arrangements for risk management.

The proposed recommendations in this report address areas for improvement identified as a result of the investigation. The improvements proposed would help to prevent, future combinations of circumstances which could lead to incidents.

This part of the report also identifies good practice within the BBC and implemented by the Top Gear production team. The investigators feel these should be communicated to the wider BBC in order to illustrate effective management of risk.

The BBC recognises that production of quality programmes involves risk (for the purposes of this investigation we refer to all content production as "programme making"). It nevertheless requires programme makers to do all that they can to ensure that risks are eliminated or reduced as far as is reasonably practicable, meeting all legal requirements. This principle is supported by a framework of BBC requirements and guidance.

The authors of the report, as part of their recommendations, suggest model behaviour and practices in the management of risk in programme making. For these to be adopted, a number of actions are proposed. **These should be considered in their entirety**. The model practices proposed build on existing good practice as revealed by the investigation. The suggested actions take into account the complex and varied nature of the BBC's programme risk portfolio. The authors' intention is that programme makers enjoy the full benefit of the resources available to them to reduce risk, some of which appear underutilised at present whilst others could be improved.

The Proposed Model

The BBC has a responsibility to ensure that creative, high quality programmes are produced within a framework of good risk management. This framework should ensure that risks are examined by the appropriate level of competent persons and that timely steps are taken to mitigate risk. Recommended actions are made below for the key stages of the programme making cycle. The key stages are defined as:

- Commissioning of Programmes
- Initial Ideas and Scoping of Programmes and Programme items
- Planning
- Implementation (on the day of recording or transmission where live)
- Post Programme Review

The model practices are intended to ensure a framework for the management of risk which is aligned to, and compatible with, the programme making process. The model is applicable to all programme genres, describing the outputs for the key stages of the production process, irrespective of the programme scale and production timetable. The realities of the programmes themselves will determine exact timings.

The authors have concluded that the areas that could be improved in the making of the film at Elvington Airfield are broadly generic across the BBC. They likewise believe that across the organisation there are also many areas of good practice. The model behaviours proposed will require very little additional effort and are seen as more a realignment of the when, clarification of the who, and better utilisation of the supporting resources of the BBC. The recommended actions have been framed, where appropriate, within the context of ‘level of risk’. This should determine the degree of effort required.

Each stage of the programme making cycle has been broken into four sections:

- Strengths identified from the investigation
- Areas for improvement identified from the investigation
- Recommendations for a model to improve occupational risk management in programme making
- Recommended Actions

Commissioning of Programmes

Strengths identified from the investigation

It is clear that the senior management of Top Gear have a clear understanding of the programme brief. As a consequence they recruit people with relevant experience, both off and on camera including the recruitment of presenters – such as Richard Hammond – with a high degree of skill and experience in high speed driving. This unquestionably reduces risk.

Areas for improvement identified from the investigation

From information gathered during interviews there is no evidence of involvement of ORM at the commissioning stages of Top Gear. Due to lack of information at this stage of the process, ORM are unable to forward plan and commit resources to high risk programme areas when they are commissioned.

Recommendations for a model to improve occupational risk management in programme making

The BBC's commissioning process should take into account an informed understanding of its toleration of risk. Where the risks are potentially high, senior management must ensure the

resources available are commensurate with the ability to put in adequate arrangements to control the risks.

Where the commission identifies a potential significant risk associated with the programme concept which might have an impact on the resources for the programme, the ORM department should be contacted. Early knowledge of programme making activities and discussions about the risks they may introduce would enable ORM to align its resources on the basis of an informed understanding of the degree of risk inherent in a programme brief and therefore provide programme makers with valuable support when and where it is most needed.

Recommended Actions

1. The BBC's commissioning process should ensure that. where a potential significant risk associated with the programme concept which might have an impact on the resources for the programme is identified, the ORM department should be contacted. [Priority recommendation]

2. ORM to ensure that resources are focused on activities and areas where the BBC faces the greatest occupational risk.

Initial Ideas and Scoping of Programmes and Programme items

Strengths identified from the investigation

Top Gear has a structured approach to planning items across a series. The team has within it a lot of valuable and relevant expertise. The use of this expertise was evident throughout the investigation.

Top Gear in its current format has been around since 2002 and each year makes around 80 films of activities such as the jet car runs. It is to be noted that any filming involving the driving of motor vehicles at speed involves a degree of risk. It is to the credit of the production team and those who support and advise them, that the programme has a good safety record.

Areas for improvement identified from the investigation

Despite the relatively high levels of risk associated with many programme items the investigation found no evidence of involvement of ORM, or any third party consultants in general, when ideas are initially considered on Top Gear.

Recommendations for a model to improve occupational risk management in programme making

Senior managers in production teams should share their knowledge of specific items that have significant levels of risk with ORM. This should happen at the earliest stages of their development. This would enable occupational risk advisors to help the production team in identifying suitable sources of expertise, whether internal or external, to assist in planning, delivery and review of the programme.

Recommended Actions

3. Where significant risks become evident through the scoping of programmes, senior management (Head of Production or Executive Producer of series, or their equivalent) should contact the ORM department. [Priority recommendation]

Planning

Strengths identified from the investigation

The Top Gear team has a lot of experience in the activities they carry out. This resulted in the implementation of some key actions which the investigation team deemed to be good practice and worthy of note. In particular,

a) The decision by the Executive Producer, Andy Wilman at an early stage to drop the original idea of attempting a land speed record. It was felt that it would increase risk substantially by potentially putting too much pressure on the driver.

b) Grant Wardrop's, (the Assistant Producer) decision to use an independent expert, in this case Ben Collins, to visit the specialist contractors PLE prior to the activity taking place to give the BBC a view as to their expertise, competence and validity, supporting and supplementing other testimonials.

c) The decision to consult an independent journalist who had driven the jet car under PLE instruction to validate the feasibility of the activity

d) The medical check on Richard Hammond to determine that he was fit for the proposed activity following an injury earlier in the year.

e) The selection of top grade Personal Protective Equipment for Richard Hammond including a GP5 crash helmet – the best crash helmet available.

f) The choice of the more stable, most proven of PLE's two cars, 'Vampire' to feature in the film in preference to the newer, faster car, 'Split Second'.

g) The decision to abandon the second day of filming due to the poor weather forecast for that day

h) The choice of a location based on PLE's experience and recommendation.

i) The planned phased increase in power of the jet car over the day as a key component of familiarisation by Richard Hammond with the vehicle

j) The emergency arrangements for the day and the selection of paramedics with the necessary experience of incidents at high speed

Areas for improvement identified from the investigation

a) Research

On this occasion the research undertaken by the TG team enabled them to select a suitable contractor for the shoot. However, apart from the visit by Ben Collins as mentioned above, the research was done largely by discussion over the telephone with Colin Fallows of PLE with some background research on the internet. With so much of the research being verbal it is difficult to say exactly what was known or not known about PLE and the risks associated with the shoot at the planning stage. There appears to have been no formal criteria set for the research where it may have benefited from formalisation. The team relied on previous and personal experience to assess the information that they needed. In particular there was heavy reliance on Grant Wardrops' experience in this type of activity to prompt the questions and search for information about the suitability of PLE. The employment of a less experienced researcher in these circumstances could lead to gaps and omissions in data collection. Where TG benefited

from the good fortune of having such a knowledgeable research team, other productions may not be so fortunate.

b) Use of specialist expertise

ORM - The Top Gear Team reported a good working relationship with the ORM department and with Jon Ling (Principal Risk Manager). However the involvement of ORM in Top Gear appears haphazard, sometimes 2-3 weeks before an activity, sometimes a few days and to differing degrees. In this particular instance ORM were only made aware of the activity through a contact by the BBC Insurance department and did not see the BBC risk assessment until Thursday the 14th September and the PLE risk assessment on Monday the 18th September, two days before the shoot. This gave very little time to enable ORM to do adequate research and provide other than very generic advice. With sufficient time more comprehensive advice could have been sought and offered.

A misconception was detected that ORM "signed off" assessments and hence authorised filming. This is not the case. Although ORM will give advice and seek further clarification and assurances in certain cases, the sign off and go ahead for the activities is a management function.

A fundamental misunderstanding/miscommunication arose around the speed at which the car would be travelling. There is no written evidence that Jon Ling and Pat Doyle shared an understanding of the likely speeds that Richard Hammond would reach.

The recommendations given by Jon Ling in an e-mail to Pat Doyle lacked sufficient precision to enable the Top Gear team to be clear about the advice given. In part, this was due to the lack of time available to Jon both to do the appropriate amount of research and to give a considered response.

Other specialists - There was no evidence of clear terms of reference set for the independent reviewer, Ben Collins. Although his report was useful it did not cover all the areas it might have - notably the history of previous incidents (although this was asked by Ben Collins), details of the capability of the PLE team to train a presenter, nor any recommendations for the TG team regarding what to be aware of on the day.

c) Selection and procurement of third parties

The engagement of specialist contractors such as PLE does not currently have to meet the specific criteria and processes for the selection and approval of third parties undertaking high risk production work set out by the BBC. There were no criteria for the level of vetting required for such a contractor.

The Top Gear team relied heavily on the third party specialists (PLE) themselves to provide the specialist knowledge about the risks associated with the car. PLE are not, and were not, the only possible source of expertise. It would have been good practice for the team to have looked at other possible suppliers of jet car 'services'. This would have enabled a benchmark of the service level of PLE to be determined in an area where the expertise of the Top Gear team was limited.

The selection of the driver was determined ultimately by availability of the presenters for the days of the shoot. When looking at best practice, the determination of the driver should be based on firstly, their competence, secondly their appetite for the activity and lastly, everything else being equal, their availability. Details regarding experience and training should be recorded.

d) Risk Assessment

Thoughts about the risks involved were evident early in the planning stages but there is no evidence that these were captured as part of an on-going completion of the risk assessment document. As a consequence opportunities were missed to learn from the research that was taking place. A gradual completion of a written risk assessment and the identification of gaps in knowledge could, for example, have provided the basis for the terms of reference for Ben Collins' report.

The BBC risk assessment was completed on the 14th September - the Thursday before a shoot planned for the following Wednesday. Although risk assessments for Top Gear programmes are usually sent to ORM, the practice of completing the risk assessment form and sending to ORM a few days before the activity is to take place, is of concern.

ORM reviewed the BBC Risk Assessment and the PLE assessment and comments were sent by Jon Ling, the Principal Risk Advisor, to Pat Doyle, the Producer. This information was added to the risk assessment document by cutting and pasting from the e-mailed comments. It is not clear what specific interpretation of the comments was made by the Top Gear team and given the lack of clarity in some of the recommendations from ORM it is hard to judge exactly what actions resulted from them.

The third party assessment from PLE was thought by those who reviewed it to cover many of the significant hazards but to be a bit sparse. It is the view of the authors that the PLE risk assessment was not suitable and sufficient. It should have been noted at the time that PLE assessment was not signed or dated and contained errors - in both the location specified and in the risk assessment itself. Although it covered many of the key points the information for the mitigation of the risks was sparse and incomplete, especially for those risks which were foreseeable and crucial should the mitigations fail - notably a tyre blowing. The issue of driver competence was not mentioned at all.

e) Implementation of mitigation measures

There is a disconnection between the mitigation measures documented in the risk assessments and the means to both implement the measures and check they have been implemented appropriately. The relevant mitigation measures should have been clarified at the start of the day and assurances obtained throughout the day that they were being carried out. A clear understanding as to responsibilities of the TG team regarding the management of PLE on site would be desirable.

The Producer, Pat Doyle, was not sure whether all persons who received the assessment had or would read the information presented.

f) Responsibilities

The Top Gear team had a good appreciation of the overall responsibilities for health and safety. However, responsibilities for actively carrying out specific functions dealing with

safety, such as who was to check that the controls identified by the PLE assessment had been or were being implemented, were not defined.

Where the producer is relying on others for research, and where the knowledge gained is unrecorded, there is a danger that the risk assessment will be incomplete, with subsequent gaps in implementation. Although the Producer is ultimately responsible for ensuring that safety is managed competently, this does not preclude the practice of doing the job safely from being delegated to competent members of the team.

Because the Top Gear team relied heavily on the third party specialists (PLE) themselves to provide the specialist knowledge, they also assumed that PLE had complete responsibility for any of the risks associated with the car. Although there was, out of necessity, a heavy reliance on their competence there still remains a responsibility on the BBC to assure itself that mitigation measures are being carried out effectively.

Recommendations for a model to improve occupational risk management in programme making

a) Research

Research should examine those areas of the activities where key risks have been identified in the early planning stages and ensure appropriate records are kept. Involvement of ORM and other specialists will enable greater clarity of the criteria to base the research upon.

b) Use of specialist expertise

Programmes regularly facing areas of high risk should have a closer working relationship with ORM especially at the early planning stages. Early and continued involvement makes it possible for ORM to make an informed contribution and would also help discussions if changes occur later in the process which could have an impact on risk.

Discussion of risk with ORM at an early stage would allow the production team to explore any specific issues regarding the selection of competent persons (3rd party and employee) and decide what kind of training may be needed. It allows time to plan accordingly.

The involvement of ORM in the planning offers production teams access to sources of internal expertise and/or recommendations on independent alternative sources in addition to advice on vetting processes. ORM can undertake appropriate research and make recommendations on the need for independent monitoring on the day of the shoot for high risk issues.

c) Selection and procurement of third parties

The BBC has set out specific criteria and processes for the selection and approval of third parties undertaking high risk production work. Approved contractors are listed on the Procurement Vetted Lists. Similar standards need to be applied to the selection of contractors for high risk activities that are not on the procurement vetted lists especially if high risk, one off, and unusual.

Productions should get assistance from ORM and the Procurement Team on the level of vetting required for specialist contractors, including where necessary the use of an independent expert, and hence the lead time involved. The contractor and the details of the vetting should go on the vendor supply list for future reference.

Procurement should ensure contracts are relevant to the degree of risk and contain clear statements of obligations, for example with respect to incident investigation.

d) Risk Assessment

Risk assessment is a tool to assist a structured thought process. Completion of the risk assessment should enable programme makers to carry out activities with the risks from identified hazards eliminated or controlled to an acceptable level. The risk assessment process should enable managers to identify the things that need to be done to control the risks identified and make it easy for them to monitor that such controls are in place. The assessment should also cover the competence of the relevant parties including persons at risk (training, experience, medical assessment etc).

Risk assessment should begin as early as possible in the programme making process. It is the responsibility of the producer but it requires input from relevant people with knowledge and expertise for the activity in question. As a first pass, during the early planning stages, it should be determined whose involvement will be required – for example whether expert knowledge is required - to enable a suitable and sufficient risk assessment to be carried out. This may be done by the producer alone or it may require a number of people, each looking after different aspects but coordinated by the producer.

When the key risks are identified in the early planning stages this will help direct the research. The risk assessment should cover the need for specific emergency arrangements as part of the mitigation measures. Specialists, whether internal or external, should be used to review third party risk assessments for suitability and adequacy in cases of high risk and very specialised activities.

The completion of the risk assessment documentation should not be regarded as an end in itself but as a process by which hazards are identified and the key controls documented so that they can be communicated and assigned to specific parties and individuals. The online risk assessment process will assist in this as it can produce output reports which can be used as checklists for ensuring controls are in place and responsibilities are clearly defined and understood. Risk assessment is a continual process and should be reviewed whenever significant changes are introduced. It can also act as a point of reference in the event of changes to the planned activities to ensure risks are being managed effectively through the change (in this example, the cancellation of the planned second day of filming due to the bad weather forecast).

e) Implementation of mitigation measures

Having identified the risks and associated controls and mitigation measures during the risk assessment process it is essential that the programme team have arrangements in place to ensure they are implemented at the appropriate times, whether in preparation for the filming/recording or on the day of the filming/recording. Responsibilities should also be defined for ensuring that identified control measures are implemented.

f) Responsibilities

Responsibilities for the management of occupational risk should be clear to everyone within a production team and there should be a clearly understood route for escalating concerns which arise from risk assessment. The producer should act as the main coordinator for information relevant to the risk assessment process. They should have an overall picture and be able to spot obvious gaps or clashes.

There needs to be clear identification and communication of responsibilities with all parties. This should begin with the identification, in the early planning and research phases, of people who are to develop specific aspects of the risk assessment. In the later stages, responsibilities should also be defined for ensuring that identified control measures are implemented.

Recommended Actions

4. Executive Producer or Producer of a programme (or their equivalent) to review the degree of risk involved in programme activities as the production process progresses, seeking ORM advice where potential significant changes in risk are identified, and to escalate to senior management when appropriate. [Priority recommendation]

5. Where specialists are used to assist with the BBC's research they should be given clear terms of reference.

6. Database to be considered along the lines of the International Film Advice database to capture sources of expertise for high risk, specialist activities

7. Risk Assessment needs to be started at the beginning of the production process and, where high risk activities are involved, including those undertaken by other parties, in discussion with ORM. [Priority recommendation]

8. The key findings from the risk assessment must be properly and adequately communicated to the relevant parties. [Priority recommendation]

9. Written advice and recommendations given by ORM should be stated clearly and concisely to avoid ambiguities over interpretation. Doubts over interpretation should be discussed with the production team.

10. Review and improve potential gaps in procurement of non vetted, high risk activities. [Priority Recommendation]

11. Contracts to be reviewed for specific clauses regarding cooperation in the BBC's investigation should an incident occur.

12. Where possible training should be completed prior to the filming day. Where presenters of programmes have specific training or skills this documentation should be held and updated by the production office

13. Production training to be reviewed to ensure greater understanding of the role of the producer and their responsibilities and how to effectively discharge them. No one in production should be in any doubt as to their level of responsibility. The role of ORM as an advice and guidance service not an authoriser should be emphasised

Implementation (day of recording)

Strengths identified from the investigation

The Top Gear team met the PLE team the night before the day of the shoot. This enabled RH to have a long discussion about the car and how it worked and also built a good working relationship for the day of the shoot.

The Top Gear team complied with the requests of the PLE associate who was responsible for safety on behalf of the PLE activities. This included the safe positioning of cameras and camera crew, a role which the PLE associate was responsible for when the jet car was used at shows and events.

Richard Hammond was initially briefed off camera which enabled him to focus and concentrate on the briefing. Richard was briefed after each run by PLE before the decision to go to the next stage was made

PLE did the first checkout run of the car, with afterburner, to ensure the car, track and conditions were ready for the day.

The presence of competent emergency services (fire and paramedics) with the relevant experience for the activity being undertaken. The immediate calling of the air ambulance when the incident happened together with the assistance of the Top Gear crew, under instruction of the emergency services, were of great assistance in the rescue of Richard Hammond and his prompt treatment at hospital.

Areas for improvement identified from the investigation

a) Responsibilities

There is insufficient evidence that responsibilities for safety measures were clarified with all those involved on the day and no one from the BBC appears to have been tasked with ensuring that the relevant mitigation measures in relation to PLE were in place.

b) Training

PLE provided no clear criteria for establishing Richard Hammond's competence to progress to the next level of speed.

c) Filming schedule

The investigators saw no written evidence of a filming schedule which would have assisted the detailed planning of training on the day, the planning of a phased movement from one speed to another or an assessment of the number of times the car would be run down the track. A broad outline should have been mapped out with PLE and documented, making it clear exactly how much time was available for each activity and giving information to all parties as to what was expected of them at each point in the day. This would have facilitated discussion of the progress in implementing safety procedures and technical checks.

d) Emergency Service and Enforcing Authorities

There was confusion over whether the police, at their request, should be given the tapes of the day and this should be clarified.

e) Post Incident Assistance

Following the incident it is apparent that the pastoral support given to the production could have been improved. The production team personally helped Richard Hammond's family during the days following the incident and although they never felt they lacked the backing of the BBC's senior management, it is not clear that the BBC has sufficient measures in place to support staff who experience traumas of this nature.

Recommendations for a model to improve occupational risk management in programme making

a) Responsibilities

At the start of the day the person responsible for communicating the roles and responsibilities of different parties should brief all those involved, if possible together, ensuring a common understanding of who is doing what and when and how.

Where high risk activities are being undertaken consideration should be given to the proactive involvement of specialists to provide an independent and objective view of the implementation of the mitigation measures.

b) Training

It should be possible before and after the training to assess its value. Where a new activity is being learned clear criteria and a single point of responsibility for the decision to progress from one phase to the next should be defined and understood by all parties.

c) Film Schedule

Programmes should have a clear and documented plan of action for the day of filming/recording. Where specific training is required this should also be incorporated into the schedule, not left until the day.

d) Emergency Service and Enforcing Authorities

Production teams to be aware of the roles and powers of the various emergency services and enforcing authorities in the event of serious incidents.

e) Post Incident Assistance

In the event of a serious incident there may be the need for specialist expertise to deal with the effects of the incident on individuals involved and to deal with the families and friends of those injured.

Recommended Actions

14. On the day of the shoot, the Producer should ensure that responsibilities for health and safety are clearly communicated and understood by all parties and ensure that the RA is kept under constant review to take account of changing circumstances. [Priority Recommendation]

15. Where training is a core component of the activity there should be clear, documented criteria for the effectiveness of the training. A single point of responsibility should be

determined for the activity to proceed based on evaluation of the training against the criteria and its effectiveness.

16. In addition to the overall responsibility of the Producer, where unusual high risk activities are identified, programmes may wish to consider the use of independent specialists/in house expertise (eg ORM) to provide a degree of assurance that the activities are being controlled appropriately and in accordance with the risk assessments. [Priority Recommendation]

17. A clear statement on the rights and obligations of individuals and the powers of the police and other enforcing authorities in such incidents to be produced and communicated to production teams.

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18. The area of pastoral support following serious incidents to be reviewed and the arrangements made clear to production teams who may have to call on them.

Post Programme Review

Strengths identified from the investigation

Due to the incident no comment can be made on any post programme review which would have occurred under normal circumstances

Areas for improvement identified from the investigation

Due to the incident no comment can be made on any post programme review which would have occurred under normal circumstances

Recommendations for a model to improve occupational risk management in programme making

To achieve continuous improvement and learning from what we do, occupational risk issues should be reviewed as part of the programme review mechanism

Recommended Actions

19. ORM to be involved in the review of high risk programmes with production teams so that lessons can be learnt and best practice spread across the organisation

20. The identified good practice and lessons learned from this investigation should be widely communicated. [Priority Recommendation]

Appendix 1. List of Outstanding Questions for PLE

Our Ref: BBC001-0473104 - Iain Moore
Your Ref: AJS/EP/PRIM002.1.1
20 February 2007

Downs
Solicitors
DX 57300
DORKING

Dear Sirs

Our Client : British Broadcasting Corporation
Your Client : Primetime

We refer to previous correspondence. In order to finalise his report, our expert would appreciate it if your clients could answer the following questions

1. How often are the tyres on the car changed – are new/unused tyre put on the vehicle at the start of each new event?

2. Are the temperatures of the tyres measured at any time during an event and if so, what temperatures do the tyres reach immediately after the run?

3. Are the tyres examined in any way after each run, it in between separate runs during the days event?

4. What precautions are taken for ensuring the runway/event arena is free from debris?

5. What is the steering geometry set up on the car, and by this he would like to know the toe-in, camber angle, castor angle and degree of offset?

6. I any examination of the tyres is performed in between runs, is it performed immediately after a run or immediately before a run?

We look forward to hearing from you say within the next ten days.

Yours faithfully

Beachcroft LLP

L to OS re dd\20/02/07

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Appendix 2. Tyre Report

BURGOYNES

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REPORT ON AN ACCIDENT WHICH OCCURRED AT ELVINGTON AIRFIELD ON 20 SEPTEMBER 2006

PREPARED FOR THE COURT

BY

MR JOHN MANDERSON

CASE REF: 523228/JDM **DATE: 14 MARCH 2007**

BURGOYNES

REPORT ON AN ACCIDENT WHICH OCCURRED AT ELVINGTON AIRFIELD ON 20 SEPTEMBER 2006

CASE REF: 523228/JDM **DATE: 14 MARCH 2007**

GENERAL CIRCUMSTANCES

1. On 20 September 2006, an accident occurred at Elvington Airfield when a jet powered car, known as 'The Vampire' and driven by Mr Richard Hammond, lost control prior to overturning.

2. The accident occurred during a "Top Gear" programme for the BBC. The vehicle's loss of control was initiated by the sudden and dramatic failure of the front offside tyre, and this failure resulted in rapid movement of the vehicle to its offside, off the runway being used for the event, and onto a grassed area where the vehicle overturned.

3. During the day of 20 September Mr Hammond made several runs and all of those runs were filmed and recorded by the BBC.

BASIS OF REPORT

4. In this matter I am instructed by Beachcroft LLP, solicitors representing the BBC. I have been supplied with the following documentation:

   1. A series of discs carrying the complete recording of the day's events.
   2. Copy of a "wash up" meeting held on 8 November 2006 between Mr Keith King, Mr John Micklethwaite, Mr Keith Scholey, Mr Gary Marven and Mr Steve Hocking.
   3. Copy of an interim report dated 20 October 2006.
   4. Copy of notes concerning the day's events made by Mr Daniel Curtin.
   5. Copy of the BBC accident/incident report form.
   6. Copy of an attendance note held on 27 October 2006.

5 On 7 December 2006, I attended a meeting comprising representatives from Prime Time, the owners of the car concerned, Health & Safety Executive representatives, and Mr Dave Price, a tyre expert instructed on behalf of the Health & Safety Executive. The purpose of this meeting was for Prime Time representatives to outline the instructions given to Mr Hammond prior to driving the motor car, and to outline the safety regime adopted by Prime Time.

6. After reviewing the sequence of the recordings made by the BBC I attended premises in Oxford Street where sections of the day's recordings were copied onto separate discs. These recordings show the penultimate run and the final run and failure of the tyre. I also obtained "stills" of various points of those runs on a separate disc.

7. I am instructed primarily to comment upon the tyre failure and, if possible, the reasons for that failure and the likelihood of avoidance of loss of control.

THE DAY'S EVENTS

8. During the day of the accident Mr Hammond had completed six runs in the Vampire and was on the seventh run when the incident occurred.

9. The vehicle is capable of being operated both on jet power alone, and with after burners. Mr Hammond completed three successful runs on jet power alone, reaching speeds of up to 220 mph, after which it was judged that he had demonstrated sufficient competence to use the after burner.

10. Three successful runs were completed with after burner use achieving speeds of up to 314 mph.

11. The seventh run was also with use of the after burner, and the vehicle had reached the speed of 288 mph when the incident occurred.

12. The speed of the vehicle is governed by the power of the jet engine, and braking from high speed is achieved through the use of a parachute brake which also closes down the jet engine.

13. The vehicle is also fitted with brakes on each wheel, but these are not used until the vehicle has been slowed to low speeds by the parachute.

14. The recordings of the final run show clearly the front offside tyre failing suddenly and dramatically, imparting a large violent movement to the offside on the vehicle, together with very heavy vibration. After leaving the airfield strip and reaching a grassed area, the vehicle overturned.

EXAMINATION OF THE TYRES

15. Following the meeting in December the wheels and tyres from the vehicle were taken to Mr Price's premises near Bath and, on 7 February 2007, I examined the tyres in Mr Price's presence.

Rear Nearside Tyre

16. This tyre comprised Hoosier P275/50 ZR15 radial ply tyre. At the time of my examination the tyre was on its wheel but deflated. I noticed a small amount of mud between the outer flange of the wheel and the tyre.

17. I did not remove the tyre from its wheel. There was no obvious damage to the tyre's structure and I noted that it had been manufactured in August 200[illegible].

Rear Offside Tyre

18. Similarly the rear offside tyre comprised a Hoosier P275/50 ZR15 radial ply tyre fitted to a one piece alloy wheel, and again I noticed that there was mud trapped between the wheel flange and the tyre.

19. There was no obvious damage to the tyre and it also was manufactured in August 2001.

Front Nearside Tyre

20. This tyre comprised a Hoosier P225/50 ZR15 radial ply tyre manufactured in August 2003.

21. Again there was no obvious damage to the tyre.

22. In summary: I did not remove the three undamaged tyres from their wheels. It seemed clear to me that they had not suffered any pre incident defect/problem and all of them appeared to be in good structural condition.

Front Offside Tyre

23. This tyre had originally comprised a Hoosier P225/50 ZR15 radial ply tyre which had failed catastrophically. The extent of the damage is best seen in the video recording of the incident, where it is clear to the observer that the tyre has failed suddenly and dramatically, and that following that failure the tyre has been comprehensively destroyed.

24. Its original structure comprised six tread plies made up of three nylon, two glass and one further nylon belt, together with three nylon side wall plys. The tyre was of tubeless construction and therefore did not require an inner tube.

25. The outer side wall was relatively intact over the area extending from 11 to 4 o'clock with respect to the valve and I noted that the outer bead wire filaments were separating at a position of around 4 o'clock.

26. Close examination of the tyre revealed an area of "missing" cord structure on the inner shoulder at a position between 12 and 1 o'clock with respect to the valve.

27. I noted that the ends of the cords at this area appeared to be relatively brittle and there was a large failed area in the tread immediately above this area.

28. Examination of the sidewall area immediately adjacent to this area revealed the presence of a small cone shaped penetration in the side wall, close to the shoulder/tread interface.

29. I believe this hole was made by a penetrating object, such as a nail.

30. Viewing of the underside of the relevant section of side wall rubber revealed that the penetrating object had completely penetrated the side wall. This penetration site was immediately above the centre of the area of missing cords, which in turn was immediately beneath what I believed to be the original failure site on the tread.

31. The cone like appearance of the hole is an indication that the penetrating object had probably been moving whilst in the tyre, thus leading to the conical appearance of the penetration. Such movement is likely, in my view, to result in the inward end of the penetrating object rubbing and abrading the structural cords of the tyre.

32. Such abrasion would lead to weakening and possibly failure of those cords. This in turn would eventually allow the inner liner of the tyre to be displaced into the structure/carcase, causing an outward bulge in the tread.

33. Confirmation of this mechanism can be found by viewing the penultimate run of the day, in which one can clearly see such a bulge on the inner shoulder/tread area. This bulge is best seen as the vehicle slows down prior to coming to rest at the end of the that run.

34. I believe the bulge is also visible at the start of the final run, although it is not as clear or as obvious as at the end of the penultimate run. However, during the final run the bulge becomes quite clear prior to the tyre failure.

35. I should also say that the bulge is seen more clearly whilst the vehicle is in motion compared to the stills taken from the video.

36. One might assume that once the tyre had commenced bulging, as in the penultimate run, then the bulge would remain visible until it either failed, or the tyre was removed. In this instance this does not appear to be the case, the bulge being much less prominent at the start of the final journey.

37. The apparent "disappearance" or reduction in size of the bulge between the end of the penultimate run and the start of the final run may possibly be explained by the tyre cooling down during that period of time.

38. I am unaware of the temperatures reached during the runs and those instructing me are obtaining the relevant information from Prime Time, the owners of the Vampire.

39. A second possible explanation could be the enormous forces exerted on the tyre during the run which will "encourage" tread movement if there is a weakness in the underlying structure of the tyre. For example at a speed of 300mph the tyre will revolve at around 80 times/second, depending upon the overall diameter of the wheel tyre assembly, generating very high g forces on the tyre.

Suitability of the Tyre

40. As far as I am aware no commercially available tyre is designed and intended for such events, ie accelerating rapidly from a standstill up to 300+ mph.

41. The actual tyre used, a Hoosier ZR rated radial ply tyre is designed to be capable of withstanding being driven at sustained maximum speeds of up to 180 mph. Whilst this speed is considerably below the speeds achieved by Mr Hammond (greater than 300 mph) it should be remembered that the wheel/tyres on the Vampire were not actually driven, but were "simply"

revolving at those speeds. ie there was no direct torque on the wheels of the Vampire.

42. Under these conditions, and given that the tyre was properly constructed and free from structural defects, I believe the use of such tyres is reasonable and should not, in itself, be a cause for concern.

43. I am uncertain as to the policy of Prime Time with regard to the use of the tyres, ie whether the tyres at the end of an event are removed and scrapped, or whether they are used on more than one event. Again those instructing me are seeking information concerning the tyre change policy.

44. I note that the front tyres on the vehicle were manufactured just over three years before the event.

45. There is increasing attention/concern being centred on the use of new and unused tyres long after their production. The concern centres around the possibility of internal degradation within the tyre even though the tyre has not been used.

46. There is increasing advice from vehicle manufacturers over the use of spare tyres, and companies such as BMW and Mercedes recommend that spare tyres greater than six years old should not be used, but should be replaced, whereas Ford & GM, since 2005/6 started printing warnings in their vehicles handbooks, of the fact that tyres more than six years old could be hazardous.

47. Similarly, I understand that the Kwik Fit tyre fitting/retail centre returns new and unsold tyres which are more than three years old to the manufacturer.

48. With regard to the rear tyres on the Vampire they were manufactured more than five years before the event and, whilst they had not failed or showed any sign of defect were approaching six year threshold period mentioned above. However, I found no indication of any signs of age related problems on the tyres fitted to the Vampire.

Failure of the Offside Tyre

48. I have indicated in earlier paragraphs my views on the cause of this tyre's failure. I am of the opinion that the penetrating object was probably picked up during the day's events, and whilst Prime Time representatives outlined their concerns and procedure for ensuring event sites were free from hazardous objects such as nails etc, again those instructing me are seeking further clarification over the procedures used on the day of the incident.

50. At the meeting in December Prime Time representatives also outlined their procedure for tyre examination between runs, but again further clarification/confirmation of that procedure is being sought.

51. I understand that a "hands on" tactile examination was carried out between events and, this is what one would expect to take place. However, examination of the day's recordings does not reveal any examination of the tyres taking place, but this could well be the fact that it is a simple mundane task and not worthy of being recorded. Those instructing me are seeking clarification of the inter run tyre examination routine.

Driver Response

52. It is clear from the video recordings of the day's runs that the bulge in the tyre did not become potentially visible until the penultimate run. Whilst it is possible for me to see the bulge in the tyre on a recording one should remember that I was specifically looking for a bulge following my examination of the tyre. The possibility of Mr Hammond noticing the bulge is so remote that it can be discounted. Furthermore, I would not expect the bulge in the tyre to transmit itself through the steering to Mr Hammond.

53. As I have said, at 300 mph, the tyre would be revolving at approximately 80 times per second. There is no possibility, in my opinion, of a driver identifying a small bulge on the shoulder of the front offside tyre at such speeds/revolutions

54. Viewing the tyre on its final run it is clear that the time interval between the initial burst and the point at which the car begins to veer violently to the offside is a matter of less than 0.5 seconds.

55. I note with interest that the recording of the final run, taken from a camera outside the car, indicates that Mr Hammond had commenced braking via the footbrake before the vehicle reached the grass verge and overturned. The fact that he was able to initiate any action at all is, in my opinion, remarkable and a tribute to his reaction capability.

56. At the meeting in December representatives from Prime Time made it clear that Mr Hammond had been instructed/trained to apply the parachute brake lever in the event of a problem. It might be thought that as Mr Hammond had the time to apply the foot brake he also had the time to apply the parachute brake.

57. Mr Hammond is a well known and clearly competent motor car driver capable of driving and controlling motor cars at high speed. One can understand that it would be instinctive to apply the foot brake in the conditions taking place at the time the Vampire lost control. Whether that can be used as a criticism must ultimately be a matter for the Court.

58. I understand that Mr Hammond had been instructed to use the parachute brake lever, and only the parachute brake lever, in the event of any mishap. Whilst this advice was given by experts in the use of the Vampire, one can appreciate that Mr Hammond's response, to such a catastrophic event, taking place at close to 300mph, was to "hit" the footbrake.

59. Furthermore, the effect of applying the parachute brake at a time when the vehicle was veering rapidly to its offside out of control, with one wheel making intimate contact with the road surface, whilst the others were leaving the road surface due to the effect of the tyre blow out, is perhaps open to question and it may well have exacerbated the situation. If necessary I could try to evaluate the effect of the parachute brake on the vehicle under such conditions.

BURGOYNES

DECLARATION

I have read Appendix 12 of the Commercial Courts Guide, and Part 35 and the Practice Direction – Experts and Assessors of the Civil Procedure Rules. I therefore understand that my duty as an expert witness is to the Court and this report has been prepared in compliance with that duty.

All matters relevant to the issues on which my expert evidence is given have been included in this report.

I confirm that insofar as the facts stated in my report are within my own knowledge I have made clear which they are and I believe them to be true, and that the opinions I have expressed represent my true and complete professional opinion.

Report Author: 

Date: 14/3/07

Appendix 3 Collins Racing Report

Jet Car Info - "I feel the need; the NEED for SPEED" (Maverick, 'Top Gun')

Weather

Weather is a factor with this film because heavy rain or a cross wind will affect the cars performance and especially the braking.

VAMPIRE

Colin Burrows spent 20 years as an engineer in the Royal Air force – 12 of which involved working on the Rolls Royce powerplant that will be sending Richard Hammond down the road at up to 300mph. The engine was originally housed in a training fighter aircraft used by the Red Arrows. Colin picked one or two of these up 'cheap' when they were retired from the air force – the engines have plenty of life in them and Colin describes them as '30 years young'.

Colin's Jet Car consists of a tubular frame chassis and jet propelled engine fuelled by of all things, Heating Oil. The overall shape of the 'Car' is not too dissimilar to a Drag Car in dimensions and sits on four semi-slick Nascar racing tyres (Hoosier) cut down to size to fit the car they call "VAMPIRE". Colin admitted that "VAMPIRE" does have a tendency to attract wildlife and recently spilt the blood of an eight pound rabbit...

The cockpit is completely encased in tubular chassis and comes with a 5-point safety harness. Behind and to the front of the safety cockpit the chassis has 'break points' so that in the event of an accident the cockpit can sheer away from the rest of the missile.

The brakes on the car are standard road discs and pads... But the car is fitted with 2 parachute pods which are deployed each time the car has to slow down. Apart from the tyres and the brakes though, the CAR has more in common with a plane and the aerodynamics are all positioned and designed for stability and keeping the car from going airborn.

The suspension is fairly unique - the front suspension is held together by a 'Panard Rod' which is used in rear suspensions of Nascar cars to provide an adjustable and stable centre of gravity. In Vampire its used to secure the front uprights and suspension joints, whilst at the rear the suspension allows for independent travel to allow for the thrust of the Engine to express itself. The rear wheels are controlled by bespoke spring and dampers which aim to control the movement of the rear under the huge acceleration and deceleration forces. Stability under deceleration is especially important so that the car doesn't go into a spin.

Driving it

The car should feel quite stable once its rolling – the front wheels are set with toe-out to encourage it to drive in a straight line. That said, there is a crown in the road at Elvington which means that Richard will need to apply around 30 degrees of steering lock in order to keep it in a straight line – under deceleration; he will need to feel the change in the cars pull and modify his steering inputs as it slows down in order to control the car. An occasional feature of the cars handling which he will need to look

out for is what Colin describes as the 'Shimmy'. Because of the length of the car and the forces under deceleration – its possible for the chassis to flex under braking and then oscillate as it tries to return to a natural state. The feeling in the car will be uncomfortable as the car will feel like its wriggling. Richard can either ride this out and continue braking or if it becomes severe, simply release the brake for a moment, let the chassis settle and re-apply the brake.

To begin with, Richard will learn the controls of VAMPIRE so that he can operate the power and parachuting systems of the car. His first runs will be done on 'standard' jet power which can be controlled on the throttle with varying degrees of rpm – using standard power the car can move at any speed from 1mph to 170mph.

Richard will balance the Revs of the engine with a lever in his right hand and hold the car steady on the foot break with his right foot (starting with 3,000??? And up to 9,-000??? Rpm). Meanwhile his left foot will depress what they call the "DEAD MAN'S PEDAL" – this must be pressed all the time to maintain power – in the event on an accident it will automatically cut all power to the engine as soon as the driver's foot releases pressure on it.

Richard eases his foot off the brake and VAMPIRE will creep forward and gradually build speed at the engine continues to push it along. Increasing the throttle position will increase speed until its time to slow down.

Slowing down in VAMPIRE is not as simple as just pressing the brake pedal – in fact if he uses the brake at a high speed it will simply glaze the disc and overheat the brakes. Whenever the car does 120mph or more it needs to deploy the parachute to slow down. The lever that operates the parachute is connected to both the throttle lever (and the afterburn lever) so that power is cut to the engine automatically as the parachute is operated.

AFTERBURNER

Afterburn works by pumping unspent fuel into the engine and igniting a flame which substantially increases the rate of burn and so the thrust of the engine. Once Richard has found a comfortable balance using standard thrust he can operate the afterburner. From a standing start again the Jet is wound up to maximum thrust and held on the foot brake (just like a Passenger Airliner prior to take off) – then the Afterburn lever is pushed fully forward until the lever is flush with the throttle lever.

Next, Richard presses an innocent looking switch on the steering grips which 'ignites' the afterburner and he must simultaneously releases the brake pedal. In reality – if he keeps his foot on the brake it will have little effect on the ????? Tons of thrust the engine produces in that instant.

From the moment the afterburner is ignited Richard will accelerate at some 50 miles/second down the runway. He will have no control over the cars speed as it builds and builds unless he decides to slow down – and the only way to do that is to pull the parachute.

Pulling the parachute cuts the fuel to the engine and deploys the chute – once the canopy spreads it will generate 12G (12 x Gravity in line) on initial deceleration, punching Richard into the seat belts. As the car slows to 120mph, Richard can gradually slow the car down with the foot break and return to Earth.

Schedule

Briefing

First run on standards power up to 150ish MPH

Later runs using afterburner will be controlled by keeping the distance reduced until Richard feels happy to let the car accelerate for a longer distance – the longer the distance/the greater the speed. Starting with a quarter mile, then up to a full mile before deploying the parachute and reaching speeds of up to 300mph and beyond...

Good luck Richard – Chuck Yeager would be proud!

Appendix 4. Draft Risk Assessment

BBC PROGRAMME RISK ASSESSMENT

		Distribution			
Series/Dept/Business Unit	DOCUMENTARIES & CONTEMPORARY FACTUAL – White City	**Name**	**Designation**	**Room No.**	**Bldg.**
Strand/Series	**Top Gear Series 9**	s.40(2) s.40(2)	Safety Services	3302	WC
News or Programme Item	Jet Car	Susie Cooper	Production Manager	4356	WC
Date or period this Risk Assessment covers	20th and 21st August 2006	Pat Doyle	Series Producer	4356	WC
Producer/Editor	Pat Doyle Seonaid	Murray	Production co-ord Docs	4356	White City
Location address and Contact No.	Main Runway Elvington Airfield Yorkshire				

Tick the hazards identified then refer to the BBC Safety Rules and Guidance (latest version on Gateway)

*(If you contract a company to provide a service in a high risk activity (those Identified with a * in the first column, then companies listed on the BBC Pre-vetted List of Contractors must be used. If the programme includes high risk, activities, work abroad or the use of Pre-vetted, contractors this form must be sent to Safety Services)*

HAZARD - Pre-vetted Contractors - attach specific assessment		HAZARD		HAZARD	
Aircraft / "special" flying *	☐	Access/egress	☒	Machinery	X
Armourers *	☐	Animals	☐	Manual handling (attach specific assessment)	☐
Costume/Make-Up Vehicle	☐	Audience/Public	☐	Mines/excavations/caves/tunnels/ quarries	☐
Diving Operations *	☐	Communication Failure	☐	Noise (attach specific assessment)	☒
Explosives/Pyrotechnics/ Fire effects *	☐	Compressed gas/cryogenics	☐	Person with special needs	☐
Flying Ballet *	☐	Confined spaces	☐	Physical exertion	X
Hydraulic Hoists (Cherry Pickers) *	X	Derelict Buildings/dangerous structures	☐	Radiation ionising/non ionising	☐
Lasers *	☐	Electricity or gas	☐	Speed	☒

Location Catering		Fire/Flammable material	X	Tropical Diseases (e.g. Malaria - attach details of medical arrangements e.g. prophylactics, local hospitals and evacuation plan)	☐
Location Lighting Services *	☐	Fight sequence	☐	Vehicles/off road driving	☒
Hire of Lighting Equipment	☐	Glass	☐	Violence/ Public disorder	☐
Scaffolds *	☐	Hazardous substances/ chemicals/ drugs micro-organisms (attach specific -assessment)	☐	Water	☐
Smoke Effects *	☐	Heat/cold	☐	Weather	X
Stunts *	☐	Hostile Environment: (attach confirmation of clearances from Senior Management)	☐	Working patterns/working hours	☐
Physical Effects	☐	Inexperienced performer or children **N.B.** for children, risk assessment must be provided to parents or guardian.	☐	Working at heights	X
		Lifting appliances/ machinery	☐	Other	☐

Experts Engaged

List experts used, including pre-vetted contractors. Each pre-vetted contractor should be required to provide the significant findings of their risk assessment in writing. This information should then be included in, or appended to this form and reviewed with other activities and arrangements to check effective co-ordination.

BBC Top Gear:

Scott Weintrob	Director	……	……..
Richard Hammond	Presenter		
Toby Wilkinson	Cameraman	……..	……
Paul Bamford	Cameraman	……..	……
Grant Wardrop	AP	……..	……
Andy Wilman	Exec		
Pat Doyle	Series Producer		……..
Susie Cooper	Production Manager	……..	
Seonaid Murray	Production Co-ordinator	……..	

BBC Transport

Electra
Electra Film & Television, Wharf House, Brentwaters Business Park, The Ham, Brentford, Middx, TW8 8HQ

Jet Car

Mark Newby Prime Time Landspeed Engineering

Colin Fallows Prime Time Landspeed Engineering

http://www.primetimelandspeed.co.uk

Basing Rescue Paramedics / Fire Crew

Details of Activity

Briefly Describe what is intended. For clarity, this may include sketches/story board/diagrams/checklists.

Over the course of two days presenter Richard Hammond will receive instruction in how to drive a jet powered dragster supplied by Prime Time Landspeed Engineering. Instruction and all driving will take place on the main runway at Elvington Airfield,Yorkshire. Instruction will be provided by Prime Time drivers, Mark Newby and Colin Fallows.

The jet car has a potential top speed of approximately 320 mph.

Hazards Identified and Risks Arising *Identify and list what could reasonably cause harm. Against each identify who is at risk, i.e. who could be harmed and how. Ignore the trivial, concentrate only on those hazards that could result in serious harm or affect several people.*	**Risk Assessment and Proposed Precautions** *For each of the above, evaluate the risks and decide whether existing precautions are adequate or more needs to be done. Take into account information from contractors, premises management, resource providers, and others about the risks and controls. List the proposed controls for each significant hazard and identify any contingency plans in place for emergencies or failures of safety critical arrangements, e.g. miss fire of explosive effect or stunt; car going off road; member of public being doorstepped, turning violent.* ***Include fire and first aid and welfare arrangements.***
• Track Access	• Top Gear will have exclusive use of the runway at Elvington for the duration of the shoot. Access to the runway and the observation positions will be strictly controlled by Elvington staff and BBC crew. At no time will Top Gear crew members position themselves on the track so as to put themselves or others at risk
• Noise	• It is anticipated that the Jet Car car will potentially generate a maximum volume of around 150Db. All talent and crew members will be required to wear ear plugs and ear defenders capable of withstanding this volume whilst working with the three race cars. Richard Hammond will be fitted with active noise reducing head phones. These will be equipped with a closed radio loop to allow communication with the race teams in the pits.
• Speed and Car Safety	• The Jet Car is designed for high stress, high speed use, and will be maintained by engineers from Prime Time Land Speed Engineering. The car will be checked after each run. If any of the mechanics believe the car to be unsafe the filming will be aborted until the fault is corrected. • For safety it is essential that the seats in the Jet Car cars fits Richard Hammond exactly. To this end Richard Hammond will attended a seat fitting prior to the shoot. • Whilst driving the Jet Car and Clio Richard Hammond will wear bespoke FIA approved race overalls and FIA approved flame retardant under wear. • Whist driving the Jet Car Richard Hammond will wear a bespoke FIA crash helmet. He will also be wearing a Hans device that prevents the head and shoulders from being wrenched around violently in the event of an accident.

	• Richard Hammond will perform PTCs whist driving the Jet Car. Whist doing so he should endeavour to keep his eyes on the road and look at the camera for no longer than it would normally take to inspect the car instruments. He should also endeavour to keep both hands on the wheel when recording PTCs. • Richard Hammond suffered a whiplash injury on 30th of June after performing a van rolling stunt during the making of a Top Gear film. After careful consideration and following discussions with his physician and the Top Gear producers he has decided to go ahead with this shoot. • A paramedic / fire team will be in attendance for the duration of the shoot • The maximum speed of the Jet Car will be governed by Prime Time engineers prior to each run. Only when they are happy that Richard has mastered control of the car at a particular top speed will they 'turn up the wick' on the jet car, allowing him to move up to the next level of top speed • The Prime Time engineers are confident that given two days training Richard Hammond should be able to reach a speed in excess of 300 mph. This speed is achieved by turning on the Jet Car's afterburners. Only when they are happy that Richard is capable of driving at such speeds will they activate the afterburners • The runway Elvington is surrounded by a large, grass covered run off area. There are no buildings or other obstructions within close proximity to the runway. Therefore the risk of the Jet Car colliding with any solid object is low. • The key Prime Time engineers have 25 years experience of working with Jet Cars. They regularly use the Elvington runway for test runs and set a UK land speed record at this location. • The Jet Car uses central heating burning oil as fuel rather than regular aviation fuel. Central heating oil is non volatile and the risk of fire is therefore low.
• Tracking Shots • Mini Cams	• The Jet Car is fitted with a number of built in safety features. Please see the attached risk assessment, prepared by Prime Time Landspeed Engineering, for a full breakdown. • A Ford Mondeo will be used for all tracking shots. This is a make and model that is regularly used for obtaining tracking shots by Top Gear. The camera and camera operator will be secured into the Mondeo prior to any shots being attempted. At no time will camera operators stand up to shoot through the sunroof while the vehicle is moving. • Remote mini cams will be fitted to the Jet Car all prior to

	filming. These mini cams will only be fitted by trained camera assistants who are experienced in this type of camera work. All cameras will be securely clamped to the vehicles using 'magic arms' specifically designed for this purpose. Additional tethers will be attached to all cameras to remove any risk of a camera coming loose and being sucked into the jet engine.

N.B. THIS MUST BE SIGNED BEFORE THE PRODUCTION CAN GO AHEAD

I have read the above and am satisfied that :

- it constitutes a proper and adequate risk assessment in respect of the programme activity and that the precautions identified above are sufficient to control the risks.

adequate arrangements are in place to communicate the risk assessment findings and to co-ordinate the safety arrangements of all those affected, e.g. site owners, engineers, contractors, freelances, resources, etc.

Signature of Producer ……**Pat Doyle (Series Producer)** **Date 14/09/2006**

Details of Safety Training received X Interactive ☐ Senior Managers' Course

☐ Other (give details below)

☐ Assignment ☐ Hostile Environments

Signature of person with designated responsibility for safety co-ordination

in Producer's absence …… **Scott Weintrob (Director)** **Date 14/09/2006**

Details of Safety Training received X Interactive ☐ Senior Managers' Course

X Other (give details below) Safe Management of Productions 1&2

☐ Assignment ☐ Hostile Environments

Producer *- the term "Producer" refers to the person in control of the production, and not only to those with a "Producer" job title or grade. On any programme the Producer is responsible for safety. This responsibility covers all staff, contributors, contractors or others who may be affected by the production activity. The Producer can delegate* ***duties*** *to others, e.g. EM, gaffer, 1st AD, but responsibilities cannot be delegated. The producer is responsible for ensuring that the person to whom he/she delegates a duty has sufficient experience, knowledge and status to perform it safely.*

FORMS/80NEWPRA6

Appendix 5. e-Mail from Jon Ling to Top Gear

From: Jon Ling
Sent: 18 September 2006 16:57
To: Pat Doyle; [redacted] s.40(2)
Cc: Andy Wilman
Subject: RE: Top Gear Jet Car Risk Assessment

Hi Pat

Looking through paperwork, seems like you have covered off everything you can plus the Prime time RA although brief, covers off everything - it is a risky shoot hence couple of important things….

- If shoot being cut to one day, ensure Hammonds training adequate and no corners cut
- Keep speed to a minimum where possible and only increase to significant level (the company will know when the risk increases significantly)
- Who has final say if shoot goes ahead eg, adverse weather etc
- Ensure no staff put at risk if vehicle goes out of control eg, positioning of cameramen
- Ensure Hammond not distracted by PTC's - need strict adherence to this
- Track checked over before each attempt as per RA
- Access to medical facilities - if it all goes tits up, can we get him out of there fast and to adequate facilities?
- Ensure no pressure on presenter if not happy

Best of luck
Cheers
Jon

Appendix 6. Top Gear Final Risk Assessment

BBC PROGRAMME RISK ASSESSMENT

		Distribution			
Series/Dept/Business Unit	DOCUMENTARIES & CONTEMPORARY FACTUAL – White City	**Name**	**Designation**	**Room No.**	**Bldg.**
Strand/Series	**Top Gear Series 9**	s.40(2) s.40(2)	Safety Services	3302	WC
News or Programme Item	Jet Car	Susie Cooper	Production Manager	4356	WC
Date or period this Risk Assessment covers	20th and 21st September 2006	Pat Doyle	Series Producer	4356	WC
Producer/Editor	Pat Doyle	Seonaid Murray	Production co-ord Docs	4356	White City
Location address and Contact No.	Main Runway Elvington Airfield Yorkshire				

Tick the hazards identified then refer to the BBC Safety Rules and Guidance (latest version on Gateway)

*(If you contract a company to provide a service in a high risk activity (those Identified with a * in the first column, then companies listed on the BBC Pre-vetted List of Contractors must be used. If the programme includes high risk, activities, work abroad or the use of Pre-vetted, contractors this form must be sent to Safety Services)*

HAZARD - Pre-vetted Contractors - attach specific assessment		HAZARD		HAZARD	
Aircraft / "special" flying *	☐	Access/egress	☒	Machinery	X
Armourers *	☐	Animals	☐	Manual handling (attach specific assessment)	☐
Costume/Make-Up Vehicle	☐	Audience/Public	☐	Mines/excavations/caves/tunnels/ quarries	☐
Diving Operations *	☐	Communication Failure	☐	Noise (attach specific assessment)	☒
Explosives/Pyrotechnics/ Fire effects *	☐	Compressed gas/cryogenics	☐	Person with special needs	☐
Flying Ballet *	☐	Confined spaces	☐	Physical exertion	X
Hydraulic Hoists (Cherry Pickers) *	X	Derelict Buildings/dangerous structures	☐	Radiation ionising/non ionising	☐
Lasers *	☐	Electricity or gas	☐	Speed	☒

Location Catering		Fire/Flammable material	X	Tropical Diseases (e.g. Malaria - attach details of medical arrangements e.g. prophylactics, local hospitals and evacuation plan)	☐
Location Lighting Services *	☐	Fight sequence	☐	Vehicles/off road driving	☒
Hire of Lighting Equipment	☐	Glass	☐	Violence/ Public disorder	☐
Scaffolds *	☐	Hazardous substances/ chemicals/ drugs micro-organisms (attach specific -assessment)	☐	Water	☐
Smoke Effects *	☐	Heat/cold	☐	Weather	X
Stunts *	☐	Hostile Environment: (attach confirmation of clearances from Senior Management)	☐	Working patterns/working hours	☐
Physical Effects	☐	Inexperienced performer or children **N.B.** for children, risk assessment must be provided to parents or guardian.	☐	Working at heights	X
		Lifting appliances/ machinery	☐	Other	☐

Experts Engaged

List experts used, including pre-vetted contractors. Each pre-vetted contractor should be required to provide the significant findings of their risk assessment in writing. This information should then be included in, or appended to this form and reviewed with other activities and arrangements to check effective co-ordination.

BBC Top Gear:

Scott Weintrob	Director	……	……..
Richard Hammond	Presenter		
Toby Wilkinson	Cameraman	……..	……
Paul Bamford	Cameraman	……..	……
Grant Wardrop	AP	……..	……
Andy Wilman	Exec		
Pat Doyle	Series Producer		……..
Susie Cooper	Production Manager	……..	
Seonaid Murray	Production Co-ordinator	……..	

BBC Transport

Electra
Electra Film & Television, Wharf House, Brentwaters Business Park, The Ham, Brentford, Middx, TW8 8HQ

Jet Car

Mark Newby	Prime Time Landspeed Engineering
Colin Fallows	Prime Time Landspeed Engineering

http://www.primetimelandspeed.co.uk

Basing Rescue Paramedics / Fire Crew

Details of Activity

Briefly Describe what is intended. For clarity, this may include sketches/story board/diagrams/checklists.

Over the course of two days presenter Richard Hammond will receive instruction in how to drive a jet powered dragster supplied by Prime Time Landspeed Engineering. Instruction and all driving will take place on the main runway at Elvington Airfield,Yorkshire. Instruction will be provided by Prime Time drivers, Mark Newby and Colin Fallows.

The jet car has a potential top speed of approximately 320 mph.

Hazards Identified and Risks Arising *Identify and list what could reasonably cause harm. Against each identify who is at risk, i.e. who could be harmed and how. Ignore the trivial, concentrate only on those hazards that could result in serious harm or affect several people.*	**Risk Assessment and Proposed Precautions** *For each of the above, evaluate the risks and decide whether existing precautions are adequate or more needs to be done. Take into account information from contractors, premises management, resource providers, and others about the risks and controls. List the proposed controls for each significant hazard and identify any contingency plans in place for emergencies or failures of safety critical arrangements, e.g. miss fire of explosive effect or stunt; car going off road; member of public being doorstepped, turning violent.* ***Include fire and first aid and welfare arrangements.***
• Track Access	• Top Gear will have exclusive use of the runway at Elvington for the duration of the shoot. Access to the runway and the observation positions will be strictly controlled by Elvington staff and BBC crew. At no time will Top Gear crew members position themselves on the track so as to put themselves or others at risk
• Noise	• It is anticipated that the Jet Car car will potentially generate a maximum volume of around 150Db. All talent and crew members will be required to wear ear plugs and ear defenders capable of withstanding this volume whilst working with the three race cars. Richard Hammond will be fitted with active noise reducing head phones. These will be equipped with a closed radio loop to allow communication with the race teams in the pits.
• Speed and Car Safety	• The Jet Car is designed for high stress, high speed use, and will be maintained by engineers from Prime Time Land Speed Engineering. The car will be checked after each run. If any of the mechanics believe the car to be unsafe the filming will be aborted until the fault is corrected. • For safety it is essential that the seats in the Jet Car cars fits Richard Hammond exactly. To this end Richard Hammond will attended a seat fitting prior to the shoot. • Whilst driving the Jet Car and Clio Richard Hammond will wear bespoke FIA approved race overalls and FIA approved flame retardant under wear. • Whist driving the Jet Car Richard Hammond will wear a bespoke FIA crash helmet. He will also be wearing a Hans device that prevents the head and shoulders from being wrenched around violently in the event of an accident.

	• Richard Hammond will perform PTCs whist driving the Jet Car. Whist doing so he should endeavour to keep his eyes on the road and look at the camera for no longer than it would normally take to inspect the car instruments. He should also endeavour to keep both hands on the wheel when recording PTCs. • Richard Hammond suffered a whiplash injury on 30th of June after performing a van rolling stunt during the making of a Top Gear film. After careful consideration and following discussions with his physician and the Top Gear producers he has decided to go ahead with this shoot. • A paramedic / fire team will be in attendance for the duration of the shoot • The maximum speed of the Jet Car will be governed by Prime Time engineers prior to each run. Only when they are happy that Richard has mastered control of the car at a particular top speed will they 'turn up the wick' on the jet car, allowing him to move up to the next level of top speed • The Prime Time engineers are confident that given two days training Richard Hammond should be able to reach a speed in excess of 300 mph. This speed is achieved by turning on the Jet Car's afterburners. Only when they are happy that Richard is capable of driving at such speeds will they activate the afterburners • The runway Elvington is surrounded by a large, grass covered run off area. There are no buildings or other obstructions within close proximity to the runway. Therefore the risk of the Jet Car colliding with any solid object is low. • The key Prime Time engineers have 25 years experience of working with Jet Cars. They regularly use the Elvington runway for test runs and set a UK land speed record at this location. • The Jet Car uses central heating burning oil as fuel rather than regular aviation fuel. Central heating oil is non volatile and the risk of fire is therefore low. • The Jet Car is fitted with a number of built in safety features. Please see the attached risk assessment, prepared by Prime Time Landspeed Engineering, for a full breakdown.
• Tracking Shots • Mini Cams	• A Ford Mondeo will be used for all tracking shots. This is a make and model that is regularly used for obtaining tracking shots by Top Gear. The camera and camera operator will be secured into the Mondeo prior to any shots being attempted. At no time will camera operators stand up to shoot through the sunroof while the vehicle is moving. • Remote mini cams will be fitted to the Jet Car all prior to

	filming. These mini cams will only be fitted by trained camera assistants who are experienced in this type of camera work. All cameras will be securely clamped to the vehicles using 'magic arms' specifically designed for this purpose. Additional tethers will be attached to all cameras to remove any risk of a camera coming loose and being sucked into the jet engine. **PLEASE NOTE THESE ADDITIONAL NOTES FROM JON LING** • If shoot being cut to one day, ensure Hammonds training adequate and no corners cut • Keep speed to a minimum where possible and only increase to significant level (the company will know when the risk increases significantly) • Who has final say if shoot goes ahead eg, adverse weather etc • Ensure no staff put at risk if vehicle goes out of control eg, positioning of cameramen • Ensure Hammond not distracted by PTC's - need strict adherence to this • Track checked over before each attempt as per RA • Access to medical facilities - if it all goes tits up, can we get him out of there fast and to adequate facilities? • Ensure no pressure on presenter if not happy

N.B. THIS MUST BE SIGNED BEFORE THE PRODUCTION CAN GO AHEAD

I have read the above and am satisfied that :

- it constitutes a proper and adequate risk assessment in respect of the programme activity and that the precautions identified above are sufficient to control the risks.

adequate arrangements are in place to communicate the risk assessment findings and to co-ordinate the safety arrangements of all those affected, e.g. site owners, engineers, contractors, freelances, resources, etc.

Signature of Producer ……**Pat Doyle (Series Producer)** **Date 14/09/2006**

Details of Safety Training received X Interactive ☐ Senior Managers' Course
☐ Other (give details below)
☐ Assignment ☐ Hostile Environments

Signature of person with designated responsibility for safety co-ordination

in Producer's absence …… **Scott Weintrob (Director)** **Date 14/09/2006**

Details of Safety Training received X Interactive ☐ Senior Managers' Course
X Other (give details below) Safe Management of Productions 1&2
☐ Assignment ☐ Hostile Environments

Producer *- the term "Producer" refers to the person in control of the production, and not only to those with a "Producer" job title or grade. On any programme the Producer is responsible for safety. This responsibility covers all staff, contributors, contractors or others who may be affected by the production activity. The Producer can delegate* ***duties*** *to others, e.g. EM, gaffer, 1st AD, but responsibilities cannot be delegated. The producer is responsible for ensuring that the person to whom he/she delegates a duty has sufficient experience, knowledge and status to perform it safely.*

FORMS/80NEWPRA6

Appendix 7. Primetime Landspeed Engineering Risk Assessment

FAO PAT DOYLE.

PrimeTime

Safety Submission Document - [redacted]

5.0 Health and Safety: Hazards and Risk Assessment

This section deals with any work activity involved following the delivery of the race vehicles and support equipment to the Fairford airbase. It identifies the hazards that people could encounter and the control measures that will be implemented to minimise risk. The table arrives at a Risk Level (R number) which if under a score of 12 can be tolerated or if the score is below 7 the risk is acceptable. [redacted]e.

Likelihood (L)	Severity (S)	Risk (R)	Consequence
5 = very likely	5 = Fatal	Level = L x S	13 to 25 = Unacceptable – significant risk, must be eliminated or moved to a lower level
4 = Likely	4 = Major harm		8 to 12 = Undesirable – must be avoided if reasonably practicable
3 = Possible	3 = Moderate harm		3 to 7 = Acceptable – can be accepted provided risk is managed
2 = Unlikely, but conceivable	2 = Minor harm		1 & 2 = Negligible – no further consideration necessary
1 = Highly unlikely	1 = delay only		

Item	Item or Activity	Hazard	Risk without controls			Control Measures	Risk with Controls		
			L	S	R		L	S	R
	Jet Cars								
1	Fuel – Jet A1 – pit station	Spillage on to the crew or ground around the car crew	3	3	9	Fuel is contained within drums and containers limiting volumes. All fuel is pump transferred to the vehicle tanks. Drip trays used.	2	1	2
		Fuel ignition & Fire affecting crew.	3	4	12	No ignition sources are close by. Fire extinguishers are available.	2	3	6
2	Tyres	Deflation	3	3	9	Tyres have been selected to be capable of meeting rotational speeds encountered. Wheels retain tyres in place.	2	2	4
		Punctured tyres could detach from wheel rim.	3	5	15	Track is FOD checked before each attempt to remove any items that could cause a puncture	2	3	6
		Failure	3	5	15	New high speed Land speed tyres are in use	2	3	6
3	Steering	Failure	3	5	15	Aircraft and racing car components used	1	2	2

[redacted]

Item	Item or Activity	Hazard	Risk without controls			Control Measures	Risk with Controls		
			L	S	R		L	S	R
	Jet Cars Continued								
4	Braking Primary Chute	Failure to deploy at end of timed distance	3	3	9	Chutes are selected to meet speeds and back up is available	2	2	4
5	Braking secondary chute	Failure to deploy when required	2	4	8	Chute is selected to provide the necessary safety back up.	1	4	4
6	Braking - wheel brakes	Failure of friction material to sustain high speed use.	3	4	12	Brakes are only needed as support to the chutes when coming to a complete halt.	5	1	5
7	Noise	Jet engines are inherently noisy when running	5	3	15	Personnel required to be close to the running engine wear ear protection	5	1	5
8	Explosion or internal failure	Engine ingesting FOD that causes damage to compressor sections	4	3	12	Track FODding takes place and the engine inlet is mesh protected	2	3	6
	Heat	Parts of the engine and tailpipe remain at high temperature after each run	5	3	15	Covers protect personnel from the hottest areas and the knowledge of the vehicle by those getting close to it prevent burns.	2	3	6
9	Loss of control / off course deviations	Wind buffeting & compromising vehicle aerodynamics	3	4	12	The team deploy a person to monitor cross wind conditions prior to running each vehicle. Cars do not run in high crosswinds or on a wet track.	2	3	6
		Bird Strike to car cockpit screen or engine	3	3	9	Wildlife scared from track vicinity.	1	3	3

Appendix 8. Race Logic Telemetry Information

From: julian@racelogic.co.uk [mailto:julian@racelogic.co.uk]
Sent: 25 September 2006 16:09
To: Grant Wardrop
Subject: Jet Car data

Hi Grant

Here is a summary of the data from the VBOX:

Test run
Driver : Colin Farrows
Time : 10:34am
Max speed : 266.8 MPH
Afterburner : Yes
File : VBOX0005.VBO
Shutoff Distance: 1183m (distance down the runway that the Engine was shut off)

Run 1
Driver : Richard Hammond
Time : 12:54pm
Max speed : 206.1 MPH
Afterburner : No
File : VBOX0008.VBO
Shutoff Distance: 1472m

Run 2
Driver : Richard Hammond
Time : 1:44pm
Max speed : 210.3 MPH
Afterburner : No
File : VBOX0009.VBO
Shutoff Distance: 1444m

Run 3
Driver : Richard Hammond
Time : 2:53pm
Max speed : 220.4 MPH
Afterburner : No
File : VBOX0010.VBO
Shutoff Distance: 1509m

Run 4
Driver : Richard Hammond
Time : 3:26pm
Max speed : 205.1 MPH
Afterburner : Yes, but only for 3.8s
Distance : 1411m
File : VBOX0011.VBO
Notes : Run aborted early
Shutoff Distance: 778m

Run 5
Driver : Richard Hammond
Time : 4:21pm
Max speed : 234.2 MPH

05/10/2006

Afterburner : Yes
Length : 1344m
File : VBOX0012.VBO
Notes : Run aborted early
Shutoff Distance: 576m

Run 6
Driver : Richard Hammond
Time : 4:56pm
Max speed : 314.4 MPH
Afterburner : Yes
Distance : 2320m
File : VBOX0014.VBO
Notes : Driver makes a 0.5G correction to direction at 301 MPH during acceleration due to the fact that the vehicle has deviated 5.49m from centreline of runway

Shutoff Distance: 1519m - note this is 336m later than Colin.

Run 7
Driver : Richard Hammond
Time : 5:25pm
Max speed : 288.3 MPH
Afterburner : Yes
Distance : not available
File : VBOX0015.VBO
Throttle off Distance : 1138m

Time (s)	Comments
0.00	1.71 G off the start line
	Up to 14.25s the vehicle tracks very staright down the runway, with very little correctional input from the driver. The maximum deviation from the centreline of the runway is only 2.91m
14.25	Significant -ve spike in vertical velocity, indicating ride height dropping by a small amount from previous runs, it can be seen that this is not a bump in the track, because these can be mapped out
14.64	Vehicle turns right at 2.1G
14.99	cornering force builds to 3.75G
15.31	cornering force peaks at 5.1G
15.50	some kind of large impact on the vehicle, this may have been when the vehicle left the runway
15.71	-6G deceleration 14.2m from the centreline of runway
16.17	@27.26m from centreline of runway, satellite reception is lost, possibly inverted at this point?

Note that I can produce some nice printouts or graphics if necessary, and also if you want a video overlay for any of the in-car shots showing a speedo and g-force meter, then I can do this as well.

Best regards

Appendix 9. Tyre Report Annex

25 April 2007

Mr Iain Moore
Beachcroft LLP
St Ann's House
St Ann Street
MANCHESTER
M2 7LP

Dear Iain

Re: Your Clients: Chubb Insurance Company of Europe
Insured: BBC

Thank you for your enquiry concerning the post run examination of the tyres. I apologise for the delay in responding, but in order to give a comprehensive answer, I would require some of the information that we have requested from Prime Time.

However, in simple terms a detailed examination of each tyre immediately following each run is likely to have revealed the area of weakness on the front offside tyre.

It is not possible to be pedantic about such a matter because it seems clear from the video recording that the bulge, clearly visible during the penultimate run, was not clearly visible on the recording at the start of the final run.

The sooner the tyre examination was carried out the more likely it would be that the area of weakness would be found.
The temperature of the tyre after each run, and at the start of each run, is, in my view, an important parameter, and it would assist to know if the temperatures of the tyres were recorded.

Clearly the type of examination carried out is important but my understanding, after the meeting with Health and Safety and Prime Time representatives, was that a "hands on"

examination of each tyre was carried out between each run, but, as I have said, the time interval between the end of the run and the examination is important.

One other point worthy of mention at this juncture is that it is a distinct possibility that examination of the tyres between earlier runs should/could have identified the presence of the penetrating object which I believe led to the failure of the tyre. Whilst one can understand that the weakened area of the tread may not have been visible at the time of an examination, the presence of a penetrating object, such as a nail, would not only be clearly visible and identifiable, but would be the sort of object that the tyre examiner would/should be looking for.

I trust this answer is of some assistance.

I am also attaching an interim note of our fees and expenses.

Yours sincerely

JOHN MANDERSON