# Sportini X11: The World's Most Advanced Sports Car

## *Braking Systems for the 21st Century*

**Drivers love the Sportini X11 for its eye-turning looks, its subtle responsiveness, and of course its immense power and acceleration. But it is reassuring to know that the Sportini X11 also has the world's most advanced computer controlled braking system, delivering precise, responsive braking at the touch of a button. High-tech brake-pads, made of a patented Aramid-Iron composite material, ensure that you are never put at risk, even in the most extreme situations.**

**Overheated brakes are a thing of the past, with our revolutionary new "Turbo-freeze" cooling system, which pumps a million Joules of heat per minute out of the four brake pads. It is so powerful that we need special sensors to ensure t hat the wheels do not freeze solid!**

**Indeed, we are so confident in the power of this computer controlled system that we have dispensed with a hand-brake! The weight saved means more of that powerful acceleration and responsive cornering that Sportini drivers have come to love.**

**Excerpt from the Encyclopedia of Automative Engineering.**

## Energy Dissipation during Braking

The purpose of brakes is to dissipate energy – convert it from kinetic or potential energy into thermal energy, and dump this thermal energy into the environment, so that the braking system does not overheat.

Calculating the amount of energy to be dissipated in a given braking event is straightforward. If slowing on a flat surface, the energy to be dissipated is the difference between the kinetic energy of the car before and after slowing down. If trying to keep a constant speed on a downhill slope, the energy dissipated is the difference between the gravitational potential energy at the top and bottom of the slope.

Where does this energy go? Friction in the brake pads converts this energy into heat. So where does the heat go? There are two answers: a short term one and a long term one.

In the short term (such as during an individual braking event, such as the descent of a particular hill, or slowing down from top speed to a halt), too much heat is deposited in the brake pads too quickly for any feasible cooling system to transport it away. So the brake pads will become hot. How hot depends on the heat capacity of the brake pads – a large heat capacity is desirable, as it minimises the temperature rise during a given braking event. Secondly, the brake pads must be designed to survive and function well at high temperatures. Advanced synthetic polymers such as Kevlar are typically used for this purpose.

In the longer term, this built-up heat must be removed from the car between braking events. This may be done passively, typically by as air circulation around the brake pads, or actively, typically by connecting the brake pads to the engine's cooling system).

**Sportini Internal Technical Memo: Commercial in Confidence**

**Aramid-Iron Composite Brake Pads (NOTE X11-B-001)**

The models X10 and X11 are equipped with brake pads made with an Aramid-Iron composite, produced and marketed by Surry Chemicals Plc.

These combine the strength and temperature resistance of Aramid (a synthetic polymer similar to those used in bullet-proof vests), with the high heat capacity of Iron. It can tolerate temperatures of 400° C before disintegrating, and has a heat capacity of 3 J/K per gram.

These properties have allowed us to reduce the weight of the brake pads by 30% compared to previous models, while still maintaining the ability to absorb $10^7$ J of heat before overheating. It thus fully meets specifications. In-between braking events, of course, the active cooling system will be needed (see note X11-C-002) to transport this heat away prior to the next braking event.

Note for maintenance documentation section. This heat absorption capacity is for new brake pads, of thickness 5cm. This thickness will decrease due to routine wear and tear, and as it does so, the heat absorption capacity will likewise decrease. Once the brake pads are thinner than 3cm, they no longer meet specifications, and there is some risk that the brakes would overheat (and hence cease to function) during strong braking events.

**Transcript of police interview with Angela, Proprietor of Braddon Mechanical Repair.**

**Officer:** So you serviced Ms. Balmoral's car the day before the accident.

**Angela:** Yes.

**Officer:** Repeat what yo told us on the phone about the intruder.

**Angela:** Well, all day there was a woman hanging around. She wandered down our driveway a couple of times, then ran back out whenever one of us approached her. She was dressed in high heels and a tight pink skirt, but was carrying what looked like a large camera case.

**Officer:** Did anything strike you as suspicious about her?

**Angela:** you're joking, right? People dressed like that don't hang around a garage. And running off whenever one of us approached her?

**Officer:** Do you think she could have done something to the car?

**Angela:** Not really – one us us was around pretty much all day.

**Officer:** Did you tell Ms. Balmoral about this?

**Angela:** No – to tell the truth, I didn't. She was so rude and superior I didn't feel like telling her anything.

**Officer:** What was she rude about?

**Angela:** She didn't want me replacing her brake pads. Said I was just trying to do them to make more money off her.

**Officer:** Were you?

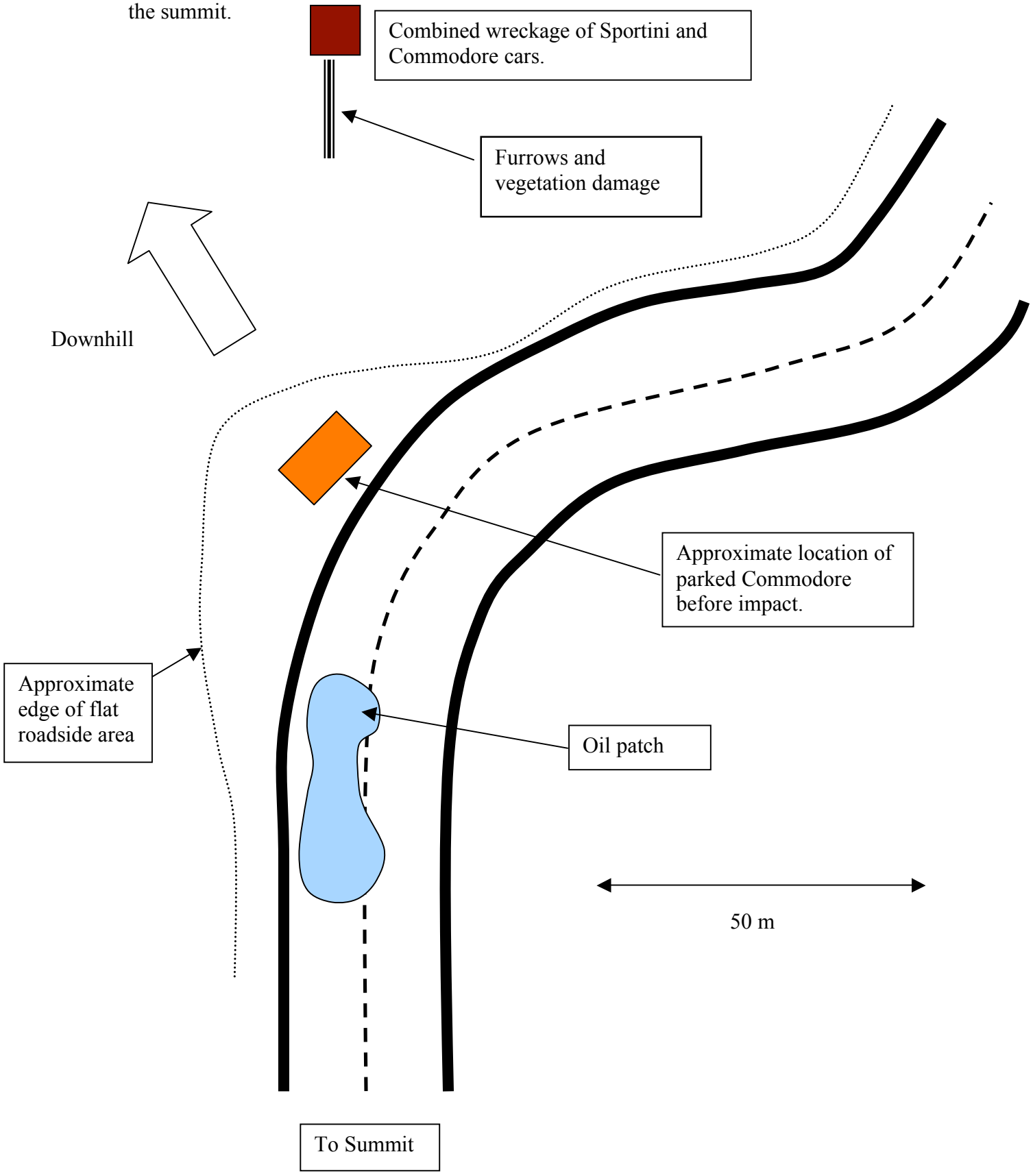
**Angela:** Of course not! What sort of person do you think I am! Her brake pads were worn down to only 5mm thickness and definitely needed urgent replacement.

**Officer:** So why do you think she objected?

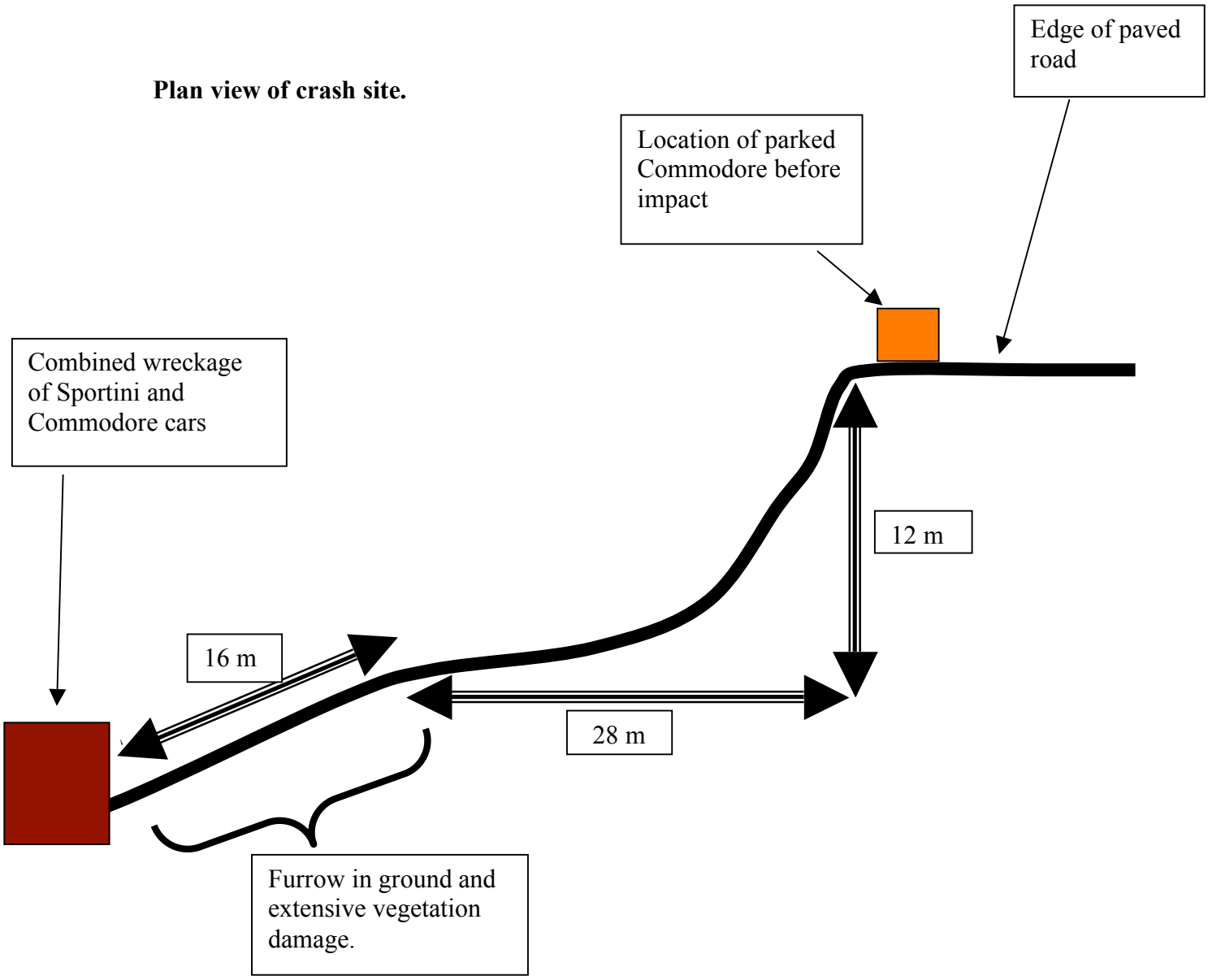
**Angela:** Probably because we'd have to order the replacement pads from Europe, so she'd be off the road for two weeks. That's the trouble with these fancy imported sports cars...

**Map of crash site**

Location: 1.7 km horizontally from the Summit of Mt Ainslie. Elevation 230m below the summit.



**Plan view of crash site.**



**Car Specifications: From carsguide.net**

**Sportini X11**

| | |
|---|---|
| **Weight** | **1570 kg** |
| **Length** | **5.1 m** |
| **Width** | **1.6 m** |
| **Height** | **0.9 m** |

**1984 Holden Commodore Calais**

| | |
|---|---|
| **Weight** | **1366 kg** |
| **Length** | **4.7 m** |
| **Width** | **1.7 m** |
| **Height** | **1.36 m** |

# Sportini X11: The World's Most Advanced Sports Car

## *Tires that embrace the road*

**A car to die for – that's how "Motorheads Magazine" described the Sportini X11. One of the many factors that gives this awe-inspiring performance car its incredible cornering performance are its tires.**

**Carefully designed in our Palermo research laboratories, these broad tyres hug the road like no others. Our revolutionary new tyres cling to the road 25% better than most sports cars, allowing you to take corners 12% faster than any other current production road-car.**

**And you can kiss goodby to punctures! The kevlar-reinfoced tires resist almost any impact, and even if there is a rupture, the automatic pressure compensation will keep you on the road for many hours.**

**Leave the competition behind – buy a Sportini X11. Yours for only US$560,000. Check our web page for a dealer near you today.**

**Sportini Internal Technical Memo: Commercial in Confidence**

**Tyre performance under different road conditions (NOTE X11-T-003)**

The model X11 is equipped with the new variable-pressure nitrogen-filled stiffened deformable tyres, which yield a significant improvement in the coefficient of friction between the car and the road.

Like all tyres, however, performance is significantly degraded if the road surface is wet, dirty or unstable. Laboratory testing has established the following values for the coefficient of friction under different conditions:

| Road Condition | Coefficient of Friction $\mu$ |
|---|---|
| Dry, sealed road | 1.7 |
| Wet, sealed road | 1.3 |
| Dry sealed road with oil spill | 1.1 |
| Wet sealed road with oil spill | 0.8 |

Coefficients of friction on unsealed roads are impossible to measure with any accuracy, due to the inherently variable nature of such surfaces, but are typically in the range 0.5-1.3.

To avoid potential litigation (particularly from US sales), we should make it clear in the manual that cornering speeds are reduced in wet or oily conditions.

**Excerpt from the Encyclopedia of Automative Engineering.**

## Safe speeds during cornering

A large fraction of single-car accidents happen during cornering, typically due to driver error.

As a car turns a corner, the road must apply a sideways (perpendicular) force to the tyres sufficient to change the direction of the car's momentum vector.

There are two ways in which a vehicle can get into trouble when cornering too fast. For high sided vehicles such as trucks, busses and SUVs, the sideways force exerted on the tyres is typically strong enough to rotate ("flip") the vehicle, causing it to roll off the road. For low-sided vehicles such as sports cars, however, such rolling is almost never seen, unless the car hits a bump or another car. Instead, the friction between tyre and road proves inadequate, and the car skids sideways.

The likelyhood of such a skid can be evaluated if you know the coefficient of friction between the car and the road. This will be a function of the tyres and of the road surface. The maximum sideways force that the tyres can exert will be the coefficient of friction multiplied by the normal force between car and road. This must exceed the necessary perpendicular force, or else a skid will result.

For road-cars, this normal force is simply the mass of the car multiplied by the gravitational constant g. Formula-1 race cars, however, use inverted wings to aerodynamically increase thie normal force. Some road-cars have fins or spoilers than are claimed to have the same effect, but such claims seldom stand up to serious scrutiny.

**Transcript of police interview with Craig, owner of parked car destroyed in the crash**

**Officer:** Are you the owner of the parked 1984 Holden Commodore Calais destroyed in the crash,

**Craig:** Former owner, you mean. The insurance company have it now.

**Officer:** Could you describe the events of that afternoon?

**Craig:** I suppose I could say it all over one more time.

**Officer:** Please do.

**Craig:** I was driving my five-year old daughter Elinor to a birthday party when she insisted that she had to go to the toilet right now. It was 3.02pm and we were already late for the party, so I was pretty annoyed, but of course you get no choice in situations like this. I parked the car on the gravel by the side or the road, got out, unbuckled Elinor's seatbelt, and we walked over to the trees and went behind a bush. A few seconds later, I heard what sounded like a particular brassy sports car approaching. Then I heard an immense crash from very nearby, followed by a second or two of silence, then a sort of metallic thud, and a second quieter crash. I stuck my head over the bush, but at first couldn't see anything. Then I noticed – our car had disappeared! There was this strong smell – something like burning plastic.

**Officer:** Did you hear the screaching of brakes before the crash.

**Craig:** Can't say that I did.

**Officer:** What did you do then?

**Craig:** Well, I helped my daughter pull up her pants, and then we ran over to where our car had been. The gravel was all disturbed, but apart from that there was no sign of our car. But when we walked over to the top of the slope, we saw a smoking pile of crushed metal perhaps ten or twenty metres down the slope.

**Officer:** Were there any other witnesses around?

**Craig:** Not really – there were no other cars in sight at the time of the crash, though a green Mini drove past as we came out from behind the bush. I remember commenting to Elinor about how fast it was going.

**Transcript of police interview with Paul, who was bushwalking on Mt Ainslie on the afternoon of the crash**

**Officer:** Please tell us where you were at the time of the incident.

**Paul:** Ah, yes, now, where was I exactly?

**Officer:** Yes?

**Paul:** It was Sunday afternoon, wasn't it?

**Officer:** Yes.

**Paul:** and I always go walking on Mt Ainslie on Sunday afternoons. But where was I? One of those paths, you know.

**Officer:** Could you be a little more specific?

**Paul:** Well, I saw him in the bushes, you know. Saw him plain as the noise on my face.

**Officer:** Who?

**Paul:** The man of course – the one I was telling you about. Honestly, don't they educate you copper these days?

**Officer:** Could you describe him?

**Paul:** Well, he was a man. Or I suppose he could have been a woman. Anyway, he was in the bushes. Or further down the path, or something.

**Officer:** What was it about this person that made you call us?

**Paul:** Well, it was the big thing he was carrying, like an oil can. After I heard about the crash and the oil on the road, I felt I had to do my duty as a citizen and report it.

**Officer:** Are you sure it was an oil can?

**Paul:** What do you think I am – blind? Young whipper-snapper, of course I'm certain. Wasn't at the time, mind you – thought it might have been a lunch box or a camera, or perhaps one of those binocular thingies, but my memories are always crystal clear, thank you very much.

**Transcript of police interview with Emma, who saw Ms Balmoral and Mr Chubb depart the summit**

**Officer:** you were enjoying the view from the summit of Mt Ainslie

**Emma:** That's right.

**Officer:** And when did you first notice Ms Balmoral?

**Emma:** Well, she and her toy boy were pretty hard to miss. We heard them coming a long time before they arrived – that blasted noisy growling car of theirs. Then they climbed out and sort of posed by the side of the car, as if they expected everyone to be admiring them.

**Officer:** What happened next?

**Emma:** Well, they walked over to the viewpoint. But I don't think they were paying any attention to the view – too busy running their hands over each other. Must have been frozen solid in those skimpy clothes. They were all over each other like a rash. Quite revolting to watch.

**Officer:** And how long did they stay at the summit?

**Emma:** Oh, not long – only a minute or two. Then they got back in that revolting excuse for a car and growled back off down the hill.

**Officer:** And what time was this?

**Emma:** Oh, it was just after 3pm.

**Officer:** And did you hear the crash.

**Emma:** We most certainly did. Can't have been more than a minute after the left; they must have driven down the hill like maniacs.

**Officer:** What about the green Mini?

**Emma:** Yes – that was very strange. There were these four men in dark suits, wearing mirror sunglasses. They were just standing around near their car until Cristina drove off, then they all suddenly jumped into the car and raced off after them.

**ACT Forestry: Routine Report.**

During our routine Sunday evening patrol of forestry trains at the base of Mt Ainslie, we found a small burnt-out car, probably a Mini. It was still smoking. Registration places and engine numbers had been removed, so we were unable to contact the owners.

Breaking News…

# European Princess hurt in Canberra crash

*From our Canberra correspondant*

Princess Cristina Balmoral and her male-model boyfriend Mr Bruce Chubb were involved in a car crash this afternoon in Canberra.

The celebrity couple were driving down from the viewpoint on noted beauty spot Mt Ainslie when her multi-million dollar sports car left the road, collided with a parked car and fell down a steep slope. Rescuers pulled  Cristina and Bruce from the wreckage, and they were transported to the Canberra Hospital by helicoper. A hospital spokesman said that both were in a stable condition.

Princess Cristina is second in line for the throne of Scotland. Her wild lifestyle and lavish celebrity parties have recently made her a staple of the gossip magazines. She had been romantically linked to a string of actors and wealthy businessmen.

She is in Australia to promote her autobiography “Bad Girl” and is travelling with her latest boyfriend, male-model and actor Bruce “The Rock” Chubb (real name Cecil Girdlestone).

Cristina first became famous for her driving, having been arrested for doing 230km/hr on the grounds of Buckingham Palace in London. She went on to place highly in a number of road racing competitions. She was driving one of the world’s most expensive cars, the Sportini X11, at the time of the accident.

Breaking News…

# Car Crash Cover-Up, Alleges King

*From our Edinburgh correspondant*

The king of Scotland total launched a blistering attack on the Australian government. He alleges that the recent road accident involving his daughter, Princess Cristina Balmoral, was in fact attempted murder.

“Its ridiculous to think that she would run her car off the road” he said. “She is a highly skilled racing driver, and road conditions were fine. There is no way she would crash in those circumstances”.

“I think it is clear that the CIA, KGB, Mossad, MI5 and ASIO were involved in an assassination attempt. Doubtless trying to destabilise the Scottish government. The Australian prime-minister has rung me up to deny any knowlegde, but the bastard is lying through his teeth. I demand a full public enquiry. Not that I have any faith in the results – there is clearly a major cover-up going on. I have instructed my ambassador to impound the wreckage of the car until such a time as the Secretary General of the United Nations personally organises the investigation.”

Conspiricy theorists have been going wild ever since the crash. All hotels in Canberra are packed with sightseers come to visit the crash site and pursue their own investigations.

Two main theories are currently doing the rounds. One involves a mysterious green Mini seen by several people close to the crash site, and later found abandoned and burnt out in the nearby bush. It is believed that gvernment agents in this car may have shot out the tires on Princess Cristina’s car. The second theory involves an unidentified person seen in the vicinity of the accident carrying an oil drum. It is speculated that oil was spread over the road to cause Princess Balmoral to lose control of her car and crash.

**Accident Scene Investigator's Report**

The overall outline of the accident seems clear.

The crash victims were driving a Sportini X11. This car was proceeding downhill from the summit when it came to the bend in the road. Rather than following the road, the car continued in a straight line, impacting a Holden Commodore that was parked by the side of the road.

It appears that the Sportini impaled itself on the Holden, and the two cars then flew, locked together, off the side of the road, down a small cliff. They hit the ground 28m away (see attached site plan and cross section), then slid a short distance further down the hill before colliding with a gum tree and coming to a halt.

Clearly the drivers are lucky to be alive. It appears that both were wearing racing harnesses, and in addition airbags deployed. These measures almost certainly saved their lives.

One puzzling feature is a large and recent oil spill on the road, at about the location where the Sportini X11 failed to make the turn (see site plan). It is unclear whether this was deliberately placed, or whether it dripped from some elderly car at this place. Regardless, it must have been formed since the last rain, three days previous to the accident.

**Memo to the Investigation Team.**

*Chief Minister's Office.*

It is crucial that the investigation into this accident be carried out swiftly and thoroughly. The prime minister has informed me that unless answers are found quickly, there is danger of a major international incident, and possibly a trade boycott. Daily, more and more sensational stories are appearing in the tabloid press, and my office is besieged by international paparazzi. Scarcely an hour goes past without some new and yet more lurid conspiracy theory hitting the headlines.

I regret to say that the wreckage of the car involved in the accident has been impounded by the Scottish embassy, and they are refusing us access to it.

I have, however, provided you with all the evidence we currently possess. I ask you, with all possible speed, to review this evidence and see whether there is anything in here to support or contradict the claims that this accident was actually attempted murder.

If it is attempted murder, two two main suspects are the drivers of a green Mini seen leaving the accident scene, and a mysterious person carrying an oil drum seen on Mt Ainslie later that afternoon. It would be helpful to the ongoing police investigation if you could tell us which, if either, of these suspects most merits investigation.