# Delayed Landing Gear Deployment Trial Report

# Document information

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## Glossary

| | |
|---|---|
| **aal** | above aerodrome level |
| **amsl** | above mean sea level |
| **ATC** | Air Traffic Control |
| **CAA** | Civil Aviation Authority |
| **CDA** | Continuous Descent Approach |
| **ICAO** | International Civil Aviation Organisation |
| **ILS** | Instrument Landing System |
| **LLACC** | London Luton Airport Consultative Committee |
| **LTCC** | London Terminal Control Centre |
| **NAPs** | Noise Abatement Procedures |
| **nm** | nautical miles |
| **NTSC** | Noise and Track Sub-Committee |
| **SOPs** | Standard Operating Practices |

# Introduction

Noise Reduction through more efficient operational procedures, forms one of the four elements of the International Civil Aviation Organisation (ICAO) Balanced Approach to aircraft noise management.

The way aircraft are operated in day-to-day operations present a direct noise impact for communities within close vicinity to the airport. By changing the way an aircraft approaches or departs the airport can significantly reduce the aircraft noise exposure for people on the ground.

## Arriving Aircraft

The most significant noise generation during arrival is generally upon final approach. As aircraft approach the airport, they are given a clearance by Air Traffic Control (ATC), in terms of headings, altitudes, and/or speeds to guide aircraft towards the final approach path for the runway. The final approach path is a straight line approximately 6-12 nautical miles (nm), extended from the runway. Once on final approach, aircraft intercept the Instrument Landing System (ILS).

The ILS is a ground-based radio guidance system which transmits two directional radio beams, the Localiser and the Glide Path. The Localiser ensures that the aircraft is lined up with the centreline of the runway, whereas the Glide Path provides vertical guidance. Once established on the ILS, Flight Crew receive indications in the cockpit advising if the aircraft needs to fly higher/lower or left/right to keep on the correct approach path to land safely. The standard vertical descent profile for an ILS is 3 degrees.

At some point during the descent on the final approach, aircraft have to deploy the landing gear. There is no established optimal point to deploy the landing gear, however airlines' Standard Operating Practices (SOPs) specify when aircraft should have the landing gear deployed and flap selected. Generally, it is associated with a specific altitude, e.g. no later than 1,500ft above aerodrome level (aal), however it varies across different airlines and aircraft types.

As the gear goes down, it increases aircraft drag and aircraft noise, and thus has a direct effect on the noise experienced by people on the ground. The longer the landing gear deployment is delayed, the longer period of time aircraft will travel without creating additional noise.

The Civil Aviation Authority (CAA) report CAP 1165 advises that early landing gear deployment can increase noise from arriving aircraft by 3-5dB.

## Delayed Landing Gear Deployment Trial

London Luton Airport have committed to determine whether there would be any noise benefit that might arise from delayed landing gear deployment whilst ensuring there would be no adverse impacts on safety or operational performance. The airport conducted a trial to understand the impact of a delayed landing gear deployment on aircraft noise disturbance, Continuous Descent Approach, speed adherence and occurrences of go-arounds.

A successful trial would be one which enabled sufficient data gathering, with no adverse impact on the daily operation.

## The Trial

The trial took place between 5th May and 31st July 2017; During these dates, the first six weeks or 'pre-trial phase' were aimed to establish a baseline by gathering the results for current standard arriving operations. During the second six weeks aircraft operators were encouraged to deploy the landing gear no earlier than 5NM before landing, subject to weather and safety requirements.

The trial did not require changes to the ILS, flight procedures and no specific/additional technology was required to start the trial.

**Limitations of the trial**
As weather plays a big part in aircraft stabilization criteria at the required distance for arrival, the trial was subject to weather conditions and was operational during CAT I conditions only. This means that during poorer weather conditions or visibility, aircraft operators were not required to carry out the trial procedures.

The trial was also subject to wind conditions and noise monitoring was carried out during westerly operations only.

**Stakeholder Engagement Prior to the Trial**
Prior to the beginning of the trial, LLA engaged and informed multiple stakeholders of its intended plans. These included:

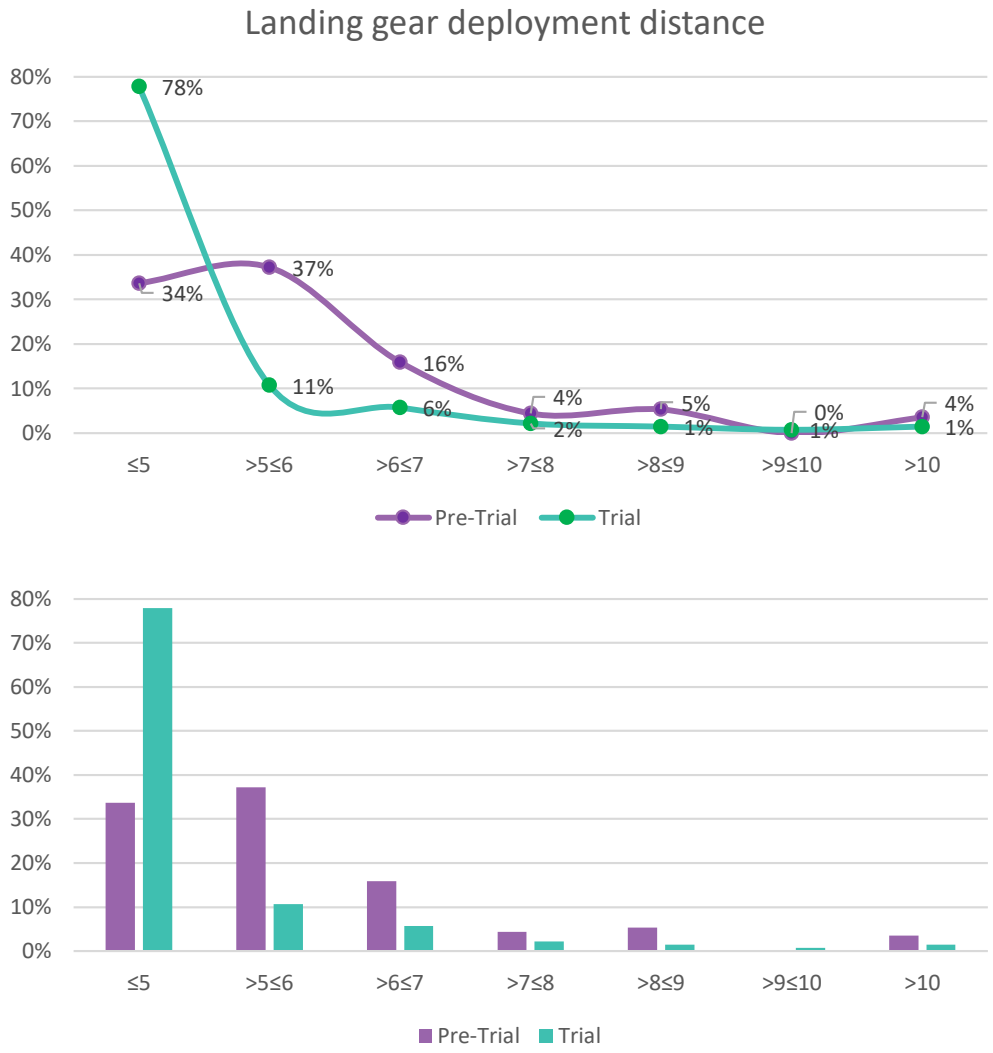
- NATS - Local and London Terminal Control Centre (LTCC) down at Swanwick
- LLA airlines and aircraft operators
- London Luton Airport Consultative Committee (LLACC) and Noise and Track Sub-Committee (NTSC)
- Local community groups and residents

**Trial Participation**
There were numerous airlines and a variety of aircraft types that participated in the trial, accounting for 66% of all arrivals during the trial. A NOTAM was issued informing operators of the trial so there may well have been more operators adopting the trial procedures but would not have been included in the comparison analysis.

## The Trial's Results

**Landing Gear Deployment**
During the trial 78% of arrivals that participated in the trial put the gear down at 5nm or closer to the Runway, compared to 34% during the baseline period.

The chart below compares the distances to threshold for deployment of landing gear during the pre-trial and trial periods, with results grouped into 1nm bands.




**Aircraft altitude on Final Approach**
Aircraft altitude data for all arriving aircraft was available in LLA's Noise and Track Monitoring system, Topsonic. The altitude data provided was above mean sea level (amsl).

There was no change in aircraft altitudes during the pre-trial and trial.

**Continuous Descent Approach (CDA) Performance**

Continuous Descent Approach is one the Airport's Noise Abatement Procedures that allows aircraft to stay higher off the ground for longer and perform a continuous steady descent without any level off segments. By avoiding extended low level segment, aircraft use less thrust and thus resulting in noise reductions at locations between 10-25 nautical miles from touchdown.

At London Luton Airport CDAs commence from 5000ft amsl and deem to be continuous if no section of level flight greater than 2.5nm has been flown. Aircraft CDA performance during the pre-trial and during the trial was calculated in LLA's Noise and Track Monitoring system.

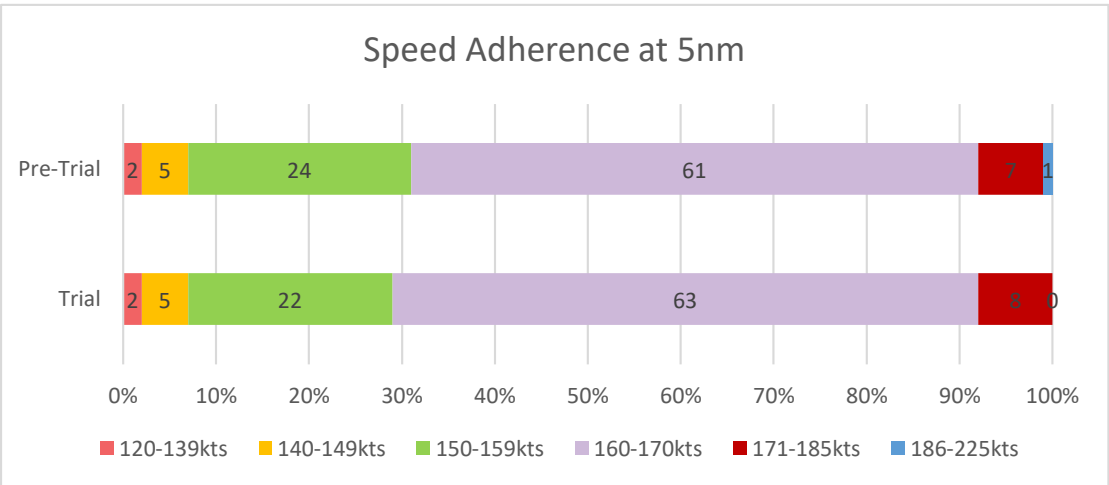
One objective of this trial was to measure the impact of the delayed landing gear deployment on the aircraft's ability to perform a CDA. The CDA performance during the trial was 96% compared to 94% during the pre-trial. Whilst CDA results suggest that there has been an improvement in CDA performance, it is important to note that there was an identical improvement for the same periods in 2016. Weather conditions on the day and runway usage variance during the pre-trial and trial could also have some impact on the results.

**Speed Adherence on Final Approach**

In order to achieve consistent aircraft movement rates on the runway and avoid any possible go-arounds, speed adherence on final approach is crucial. All arriving aircraft have to comply with 160-170kts at 5nm.

Prior to the trial it was raised that aircraft could be approaching the runway faster than normal. In addition to reducing speed and using flaps, deployment of the landing gear induces a greater amount of drag, and helps to slow aircraft down. Keeping the landing gear up for longer, could potentially make it harder to adhere to speed limits, thus resulting in aircraft catching-up and/or reducing the gap for departing aircraft, and increasing ATC workload. This could affect the movement rate.

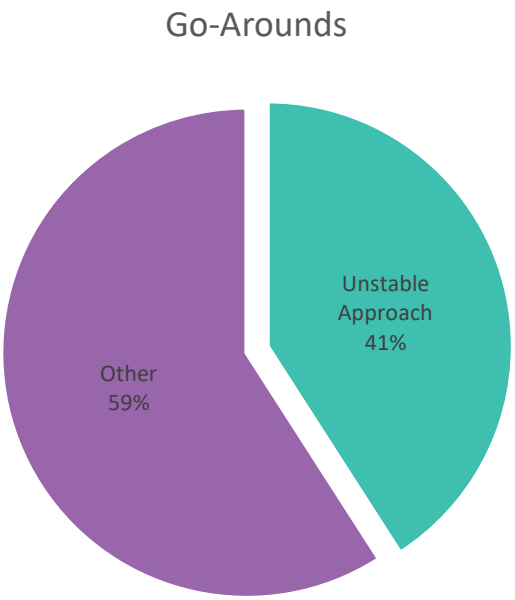
The aircraft speed at 5nm from touchdown was provided by NATS. During the trial speed adherence increased from 61% to 63% of aircraft flying 160-170kts at 5DME. LLA believes that the improvement in speed adherence could be explained by a greater Flight Crew awareness in the cockpit as a result of the trial. The diagram below compares the speed adherence at 5NM during the pre-trial and trial periods.



**Number of Go-Arounds**

A go-around, also known as a missed approach, is a standard procedure and is entirely safe. It can be initiated by the Pilot or instructed by ATC for a variety of reasons including:

- Wildlife in the vicinity of the runway
- Unstable approach (eg, too high, too low, too fast)
- Adverse weather conditions (e.g. storms or strong cross-winds);
- Higher priority traffic; could be Medical or Police Helicopter flights.

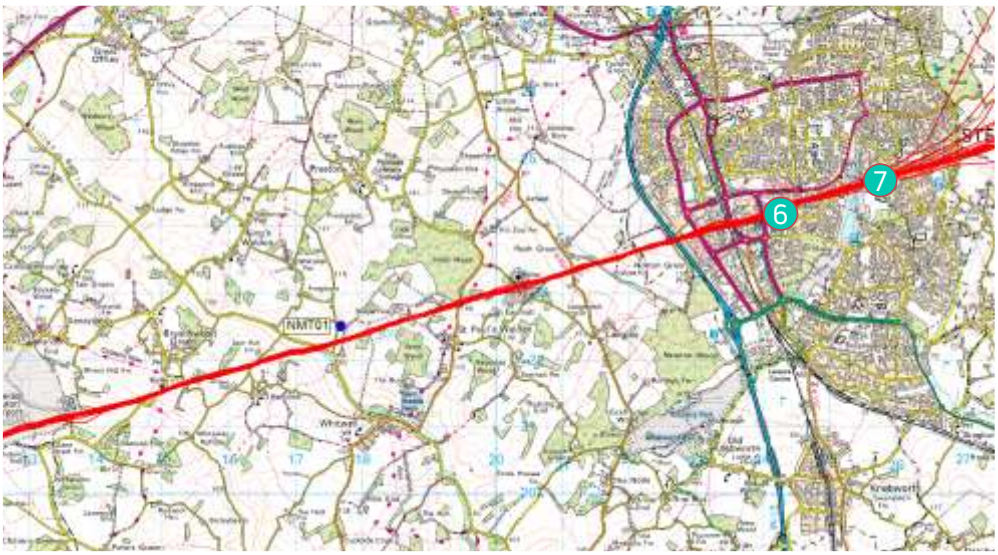



The reasons for go-arounds were supplied via the Luton ATC Watch log. Specific focus was on unstable approach as aircraft could be flying the final approach faster as a result of the trial. Overall, go-arounds accounted for 0.5% of all arrivals during the trial period with 0.2% linked to unstable approach, however there is no evidence or specific reports that the unstable approaches were linked to the trial.

**Noise Measurements**

In order to gather data of the impact of aircraft noise distribution, noise measurements were taken from the specific monitoring terminals along the arrival route on runway 26:

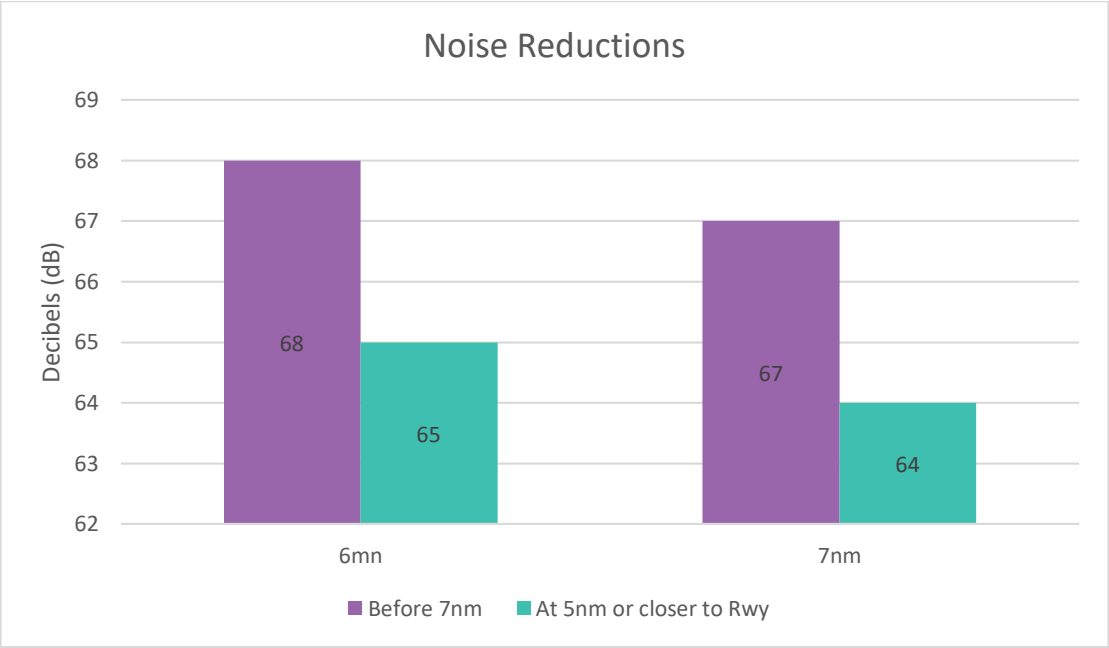
- **"No effect" 0-5nm region**. There was a permanent noise monitor to the east of the runway, NMT1, close to the approach path and 2.4NM from runway threshold.
- **"3 dB(A) Benefit" 5-10NM region**. Stevenage under the approach path stretches from the A1(M) (approx. 5NM) to Chells Manor (approx. 8.5NM). For this area where a benefit is expected, noise monitoring was taken place in west Stevenage at 6NM and 7NM, as nearly all aircraft are established on the final approach.



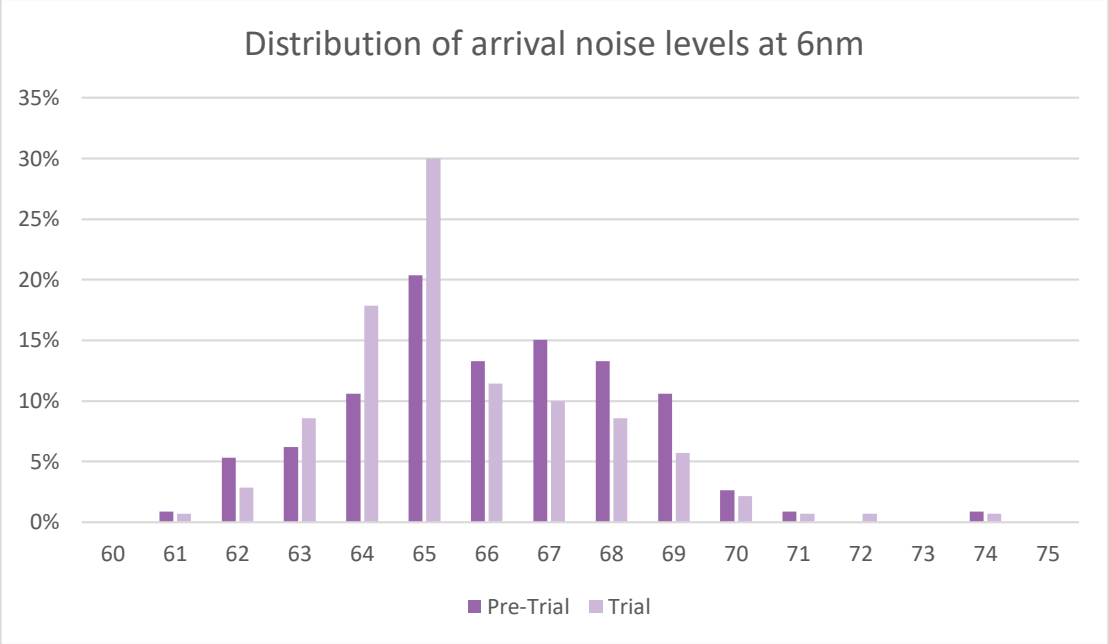
The metric used for analysis and comparison is the LasMax, the maximum noise level from a single aircraft passing over the noise monitor.

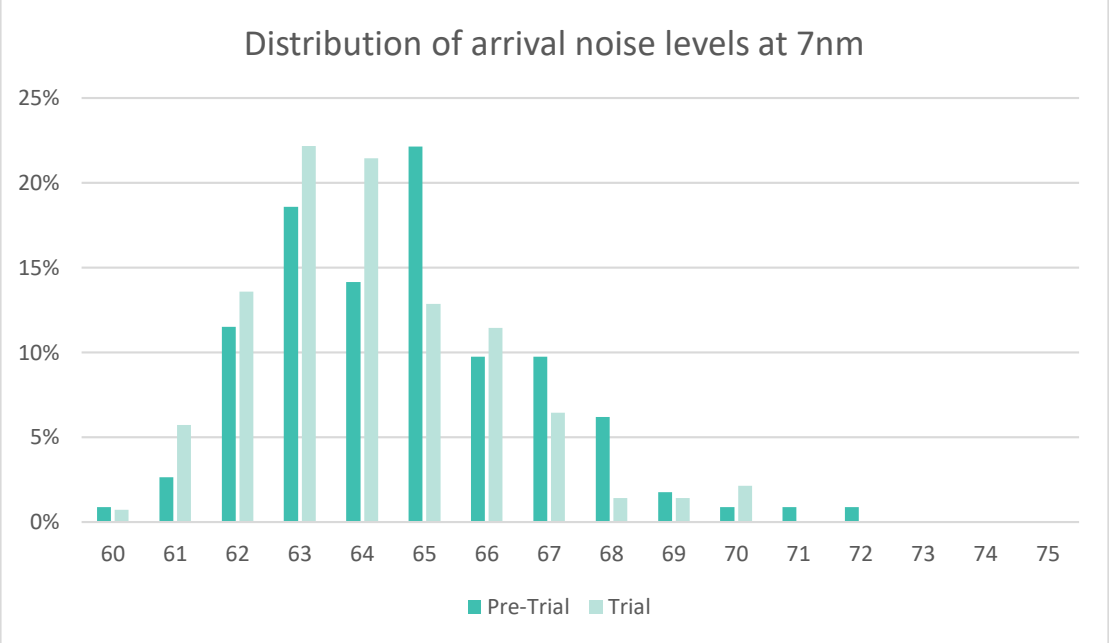
As weather conditions can affect noise measurements, noise results that were recorded at a time when wind speeds were greater than 10m/s were automatically identified invalid within Topsonic and therefore were discarded from the analysis.

Keeping the gear up for longer and deploying it at 5nm or less to the runway resulted in average noise reduction of 2.7dB at 6nm and 3.4dB at 7nm.




Two diagrams overleaf represent the distribution of noise measurements for all arrivals over the pre-trial and trial period.


Distribution of arrival noise levels at 6nm
35%
30%
25%
20%
15%
10%
5%
0%
60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75
Pre-Trial
Trial


Distribution of arrival noise levels at 7nm
25%
20%
15%
10%
5%
0%
60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75
Pre-Trial
Trial

## Trial conclusions and next steps

The trial would be considered successful if sufficient data was gathered and the use of delayed deployment of landing gear did in fact produce a noise reduction of at least 3dB(A) along the arrivals flight path with no adverse impact on the operation.

The trial met all objectives with no negative impact on the daily operations, but with a significant noise reduction for residents living directly under the arrivals flight path.

From ATC perspective there was no operational changes or additional workload when comparing pre-trial and trial.

LLA have not received any negative feedback from airline operators. In fact, some operators have amended their SOPs following the trial.

Post-trial LLA received positive correspondences from Stevenage, that is affected by westerly arrivals, and from Dagnall and Kensworth, both affected by easterly arrivals, asking to keep the trial running as it makes a noticeable difference for communities.

LLA stated that providing the trial meets all the objectives, the Arrival Code of Practice will be revised and recommendations to delay the landing gear deployment will be included. LLA is planning to work closely with the remaining airline and aircraft operators that did not participate in the trial, to explain the benefits of this procedure and to encourage them to delay the lowering of the gear where possible.