

REPORT ON CONFERENCE ODOUR DETECTION BY ANIMALS | RESEARCH AND PRACTICE

16–20 June 2008 | Os, NORWAY

During 16-20 June, around 100 people assembled at Ulven Military Camp in Os, Norway for a conference entitled *Odour detection by animals: Research and practice*. Attendees included a broad range of scientists, animal trainers, and end-users of detection animals, with representatives from demining organizations, police, customs, armed forces, and search and rescue organizations. The conference was jointly organized by the GICHD and Fjellanger Dog Training Academy, with support from the Norwegian Military Defense Research Establishment (FFI), the Norwegian Military Dog Training Centre (FHSK), and Norwegian People's Aid (NPA). The main sponsors of the event were the Swiss Government, the Swedish International Development Agency (SIDA), and the Norwegian Ministry of Foreign Affairs.



Reasons for the conference and the conference objectives

There were three main reasons why this conference was held:

- 1) The detection of illicit substances such as explosives, weapons (including landmines) and drugs is a matter that is currently of great concern to authorities charged with the responsibility of ensuring national security, reducing suffering among innocent victims of armed conflicts, and/or curtailing anti-social behaviour of citizens. Furthermore, in humanitarian demining, an ability to accurately detect the presence of mines can dramatically increase the efficiency of clearance operations. Expensive and time-consuming methods (such as the deployment of manual deminers and/or machinery) can then be applied selectively only to areas where mines actually exist.
- 2) Despite millions of dollars being spent on the development of “high-tech” devices for sensing chemical and/or physical markers of these substances/items, the olfactory systems of various animals continue to surpass the detection accuracy and operational efficiency of these man-made engineering efforts.
- 3) Advocates for using animals in detection roles must now compete with the scientific evidence that the physicists, chemists and biologists developing artificial sensing devices cite to promote their ventures. This latter reason for the conference was a guiding principle for the conference organizers.

We believe that the empirical validation of techniques used to prepare an animal for indicating a specific target odour, such as that emanating from landmines, is now of paramount importance to the acceptance, practical use, and future development of our industry. Gone are the days when we could claim that 25 years of experience working with dogs in the military was sufficient to learn all that was necessary for training a dog to indicate a landmine or a stash of cocaine. Such experience is also now insufficient to convince others of the accuracy, efficiency and potential of our animals.

Instead, we must cite rigorous scientific evidence that our animals are doing the job well, and to the best of their abilities. This requires application of our training regimes of scientifically proven facts about the chemical properties of our target odours and our animal's sensory and learning abilities. It also requires the application of scientific methods while we seek to identify how best to train and test our animals.

To this end, the conference assembled a group of speakers that had either scientific expertise relevant to preparing animals for odour-detection roles, or experience with the practical issues involved in this task. It was our hope that animal trainers would leave the conference with a better understanding of how to apply some findings from scientific research, and some scientific methods, in their preparation of animals. Similarly, we expected that the future work of some of the scientists might be influenced by what they learned from the reported experiences of animal trainers. Fortunately, the results of a formal questionnaire delivered on the final day of the conference suggested that we had succeeded in influencing the opinions of most attendees.

A summary of conference proceedings

The conference was formally opened by Ambassador Stephan Husy (Director of GICHD) and Ms Susan Eckey (Deputy Director General, Department of UN, Peace and Humanitarian Affairs, Norwegian Ministry of Foreign Affairs). The presentations that followed were organized into seven sets, with each set addressing a particular theme.

Chemical signatories: research conducted by chemists trying to define the chemical signatures of various classes of illicit drugs or various types of landmines

Although this work is extremely sophisticated and involves the measurement of minute differences in the chemical constituents of various compounds (or mine types), simple chemical profiles that distinguish one drug class, or one mine type, from another still elude the chemists. It was also apparent in these seminars that collaborations between chemists and physiologists studying the cellular properties of olfactory systems in animals might assist an application of the chemists' analyses to the production of effective training aids.

Put simply, if an animal's olfactory system cannot register specific quantities of specific chemicals, then those chemicals cannot be part of the odour signature defining the target item and so could be eliminated from the chemists' list of chemicals to measure.

Olfactory system: anatomical and physiological aspects of the olfactory systems of humans and dogs

These seminars were effectively tutorials aimed at describing some implications of scientific knowledge in this area for animal trainers. An issue highlighted in these presentations was the inherent difficulty in researching the olfactory systems and abilities of animals while no single system exists for measuring the quality and quantity of odours. The study of vision is aided by being able to measure the intensity (or brightness) and frequency (or wavelength) of light even below a human's sensory threshold. Similarly, the study of hearing is aided by measuring the tone (or frequency) and loudness (or volume) of sound.

Unfortunately, no measurement systems have yet been developed for odours. This makes it extremely difficult to compare an animal's behavioural response to a specific odour source with any other objective measures of the signal type and strength, and so hinders a trainer's ability to control and manipulate the odour presented to animals during training.

Dog Training Techniques: demonstrations of various training techniques currently in use by those preparing mine-detection dogs and remote-detection dogs

These demonstrations were an extremely useful way of communicating some key components of different training technologies. They also highlighted the fact that accurate detection of a target

odour requires that an animal readily and continuously engages in complex behaviour involving numerous pre-requisite component responses. Measuring and studying detection accuracy alone often blocks a view of just how complex the behaviour of successfully searching for a target odour actually is.

These presentations served as stimuli for later discussions of the directions that should be taken in future research.

Breeding and selection: research undertaken to improve the breeding and selection of animals for odour-detection roles

One of the key questions addressed in these presentations was how best to predict when a puppy will respond positively to odour-detection training and so mature into an accurate and reliable detector of landmines. Various behavioural indicators were considered, as were the methods that could be used to measure these behaviours, but it was clear that only rigorous longitudinal research can provide us with the answers we need. Fortunately, such research has recently begun.

Odour Detection: research into some behavioural principles of olfactory discrimination learning (odour detection) in animals

A full range of presentations were held on this issue. These included the following topics:

- 1) Equipment and methods necessary to conduct rigorous scientific research into behavioural measures of an animal's sensitivity for various odours.
- 2) Implementation of the research methods used in Applied Behaviour Analysis (a field of Clinical Psychology) while training animals to detect target odours. This process aims at optimizing and empirically validating the training methods.
- 3) Basic research into discrimination learning in laboratory rats and possible implications of that research for training methods.
- 4) Summary about the findings of an extensive programme of research into explosives detection by dogs. This presentation effectively drew together key points made in the previous related seminars and offered the audience applied examples of the concepts described in those seminars.

Training Practices

The managers of mine-detection dog (or mine-detection rat) units within various demining organizations described the key components of their organization's training and operational systems, and discussed some of the challenges they face in those systems. Although many of these challenges were unique to the political and physical environments in which they worked, others were faced by the majority of organizations (e.g., the need for standardized and rigorous testing protocols, issues involved with maintenance training) and so were discussed formally and informally at length.

Emerging Technologies: research and development efforts to use animals in less traditional odour-detection roles

Projects aimed at the remote detection of mined areas, or spaces containing explosives (i.e., REST), by dogs and rats were described. Similarly, research investigating the use of honey bees for the detection of minefields was described. Two of the more unusual applications involved training rats to indicate the presence of tuberculosis in human sputum samples, and training dogs to locate endangered tortoises in desert areas of North America.

The main point emerging from these presentations was that the nature of the target item (or substance) is probably less important than the details of training and testing, and that significant progress can be made if the trainers and researchers in the various detection domains were to formally collaborate more than they presently do.

Anyone wanting further information about the conference including the Schedule of Presentations, and names and contact details of attendees should contact Mr Havard Bach (h.bach@gichd.org), Dr Rune Fjellanger (rune@fjellanger.net) or Dr Max Jones (bm.jones@umassmed.edu).