

# Nano UAS - An Upcoming Reality

By Petter Muren

Nano Unmanned Aircraft Systems (UAS) are based on tiny remotely controlled aircraft weighing less than 10 grams, about the same as a 2 Euro coin. They will be equipped with cameras, sensors and navigation systems. These aircraft will be so small and silent that it will be very difficult to detect them, even at close range. Because of their extremely low mass they will be safe to operate.

In 2005 DARPA announced a program asking for innovative proposals for the research and development of Nano UAS. DARPA defined the systems as having airborne vehicles no larger than 7.5 cm, capable of performing a useful mission at an affordable cost and having a gross weight of less than 10 grams. Nano UAS should be functional, mission capable, and have a range greater than 1000 meters at up to 10 meters/sec forward speed. The aircraft were to be able to carry a 2 gram payload and hover in place for more than one minute. Endurance was to be more than 20 minutes.

With the introduction of Nano UAS, a whole new field of opportunities will be opened. For the first time ever it will be possible to operate in close quarters, inside buildings and even below the canopy of a dense forest. Especially in the USA interest is high, but also in Europe and elsewhere Nano UAS programs have started. Draper Laboratory is developing an innovative coaxial rotor aircraft, Lockheed Martin has a very ambitious project around an artificial Maple Seed and California based AeroVironment is working on a Hummingbird. Universities and science laboratories are involved in many of the projects and so far operational systems have been seen as a possibility well into the future, some predict after 2020. The Norwegian company Prox Dynamics, however, has set out to develop real working Nano UAS within 2 to 3 years.

This company builds on a 15 years long history of small unconventional electric aircraft designs and a long line of record breaking micro aircrafts from another Norwegian company, Proxflyer. One of them is the Picoflyer, the helicopter with the world's smallest rotor diameter of only 6 cm. In terms of mass this helicopter is only beaten by Proxflyer's current record holder, 7 cm long, weighing less than 1 gram. The company also has what is believed to be the lightest remotely controlled ornithopter, a 10 cm flapping wing aircraft weighing 1 gram. Proxflyer is the company behind the new rotor system that was used in the first inherently stable indoor toy helicopter, the Bladerunner. The success of the Bladerunner inspired other expert designers from the hobby world to come up with their own innovative flying toy designs. The smallest indoor toy helicopters available today are less than 10 cm long – close to the challenging goals set by DARPA, however, none of them are able to perform any useful mission.

The first product from Prox Dynamics, the PD-100, will have



a rotor diameter of 10 cm, a weight below 20 grams and it will have an onboard autopilot. The aircraft is supposed to operate outdoors under windy conditions as well as indoors. Typical payloads will be a video camera with data link for transmitting back pictures, microphones for recording sound or droppable sensors. The design is partly based on off the shelf components. Lithium polymer batteries and motors developed for the mobile handset industry will be used. Also from the phone industry and from handheld navigation systems, tiny video cameras, gyro sensors and other miniaturized electronic components are available.

The most characteristic feature of Nano UAS is their small size that enables them to be used in operations and under conditions not thought of before. Unique operational capabilities include:

- **Stealth Due Small Size and Low Noise** – close range surveillance with low risk of being detected, both video and sound recording from a hovering position will be possible.
- **Safe Operated Anywhere** – with a mass of 10 grams and moderate speed a Nano UAS is harmless and can be flown close to the general public, no special precautions or safety measures are necessary.
- **High Precision Payload Drop** – a small payload may be positioned and precisely dropped, practically anywhere.
- **Indoor and Outdoor Operations** – missions including flight at street level through urban areas, entering houses through windows and indoor surveillance will be possible.

The PD-100 is still a few years from its release, with planned deliveries of early production units to key customers in 2010. Already this year, however, proof-of-concept models are planned and demonstration flights will take place at the end of 2008 and early 2009.

Substantial interest has also been expressed by various security forces, as was highlighted in the USEP study (Conseil Général de l'Armement, France) published in 2007.

Operational Nano UAS seem to be only a few years away and we should start to think of ways to operate them and how to best utilize their unique potential.

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