

# The "Manicopter": an Unmanned Aerial Multicopter Vehicle with Robotic Manipulation Capability



NAVAL  
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*Concept of the Manicopter prototype which is under development at the NPS Spacecraft Robotics Lab*

- The objective of the proposed research effort is to investigate the dynamics and control issues and establish a possible concept of operations for an Unmanned Hexarotor Aerial Vehicle equipped with an On-board Robotic Manipulator.
- The ongoing first phase of the project (sponsored by FY15 CRUSER funding) has been focusing on the feasibility study and the development of a prototype demonstration hardware. An hexarotor UAV system was acquired (built by Kevin Jones, NPS) together with an off-the-shelf robotic manipulator.
- By december 2015 we plan to have a fully operation prototype of the Manicopter (see Figure 1), which we are going to extensively use during the here proposed second phase of the project

- The proposed work for FY16 includes three main tasks:
  - 1) to derive a complete analytical model of the Manicopter system.
  - 2) to implement a software model (flight simulator-like) based on the analytical model.
  - 3) to develop and test different possible concepts of operations for the Manicopter, including in particular a hybrid approach to autonomously control the flight of the hexacopter (e.g. during hovering with compensation of the manipulator motion) while teleoperating its on-board manipulator.
  - 4) to perform experimental testing of sample operations in the “flying-cube” of the Spacecraft Robotics Lab

- The availability of a remotely operated aerial manipulator gives the unique capability of physically interacting with the environment and/or with other vehicles.
- This capability, which is largely lacking in current unmanned aerial vehicles, could enable new critical missions (e.g. monitoring, searching and rescuing, disaster relief operation, and defensive countermeasure).
- The idea of an airborne robotic manipulator has been only very recently emerging within the robotics community and many research questions are still open and worth investigating from the point of view of possible future DoD applications