Scientific use of Remotely Piloted Aircraft Systems (RPAS) in Antarctica: a review

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Information Paper submitted by Portugal, Germany, United Kingdom

***Summary***

The use of Remotely Piloted Aircraft Systems (RPAS) for research within the Antarctic Treaty area has been noted since the mid-2000´s. Since then, there have been various policy developments to minimise the impacts of RPAS use (e.g. the adoption of the Environmental Guidelines for operation of Remotely Piloted Aircraft Systems (RPAS) in Antarctica (Resolution 4 (2018)). This paper presents a summary of a recent comprehensive review concerning the use of RPAS for scientific activities in Antarctica (Pina & Vieira 2022). A total of 190 scientific publications were identified, on a wide range of research topics, which shows the usefulness of RPAS for Antarctic research. With an increase in RPAS use for Antarctic research predicted in the future, we encourage (i) more collaborative UAVs research, (ii) continued efforts to minimize associated environmental impacts, (iii) the sharing of research data and (iv) regularly review and update existing policy documents and guidelines, as necessary.

### *Introduction*

Remote sensing is a powerful tool that has been used to identify, map and monitor Antarctic features and processes for nearly a century. Satellite remote sensing has played a main role for the last c. five decades, as it is the only way to provide multi-temporal views at continental scales. However, the emergence of small consumer-grade Remotely Piloted Aircraft Systems (RPAS) over the past two decades has resulted in the generation of spatial data at very high resolutions. The scientific benefits of RPAS is evident through their use in field research activities relevant to a diverse range of research topics (Mustafa et al. 2018).

In recent years, several guidelines and policy document have been generated relevant to RPAS:

* Parties have prepared practical manuals for RPAS use (e.g., Spain, New Zealand)(ATCM XXXIX/IP28; ATCM XL/IP27; ATCM XL/IP86);
* The Council of Managers of National Antarctic Programs (COMNAP) has produced guidelines on RPAS operational and safety issues (ATCM XXXIX/WP14; ATCM XLI/IP43);
* The International Association of Antarctica Tour Operators (IAATO) has produced policies for their members’ use of RPAS (ATCM XXXIX/IP120); and
* The Scientific Committee on Antarctic Research (SCAR) has produced advisory information on recommended precautionary overflight distances (ATCM XXXVIII/WP27)
* Environmental Guidelines for operation of Remotely Piloted Aircraft Systems (RPAS) in Antarctica (Resolution 4 (2018) and Harris et al. (2019))

Additionally, Germany recommend a substantive revision of the Environmental Guidelines for operation of Remotely Piloted Aircraft Systems (RPAS) in Antarctica (Resolution 4 (2018)), and encouraged Parties to carry out more research on the potential impacts of RPAS on Antarctic wildlife (ATCM XLII/IP10; ATCM XLIV/WP14). This Information Paper presents a summary of result generated by a recent comprehensive review of RPAS use for scientific activities in Antarctica (Pina & Vieira 2022).

***Recent developments on RPAS use in Antarctic science***

Analysis of 190 scientific publications (published in peer-reviewed journals and proceedings of conferences) was carried out, that included a detailed overview of the activities and identified advantages and difficulties. An evaluation of future opportunities and challenges for expanding the use of RPAS in Antarctic field activities was also carried out (Pina & Vieira 2022) (Table 1).

Table 1. Main topics of scientific papers using RPAS in Antarctica (Pina & Vieira 2022).

Table

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The importance of using RPAS to support numerous and diverse scientific activities in Antarctica becomes clear after analysing the scientific publications. To some degree, RPAS use has revolutionized the remote acquisition of data. RPAS use can deliver high resolution image or other date in a rapid and cost-effective manner. RPAS are particularly useful in locations that would otherwise be largely inaccessible or difficult to access. Indeed, many of the studies were only possible through the use of RPAS-derived data.

Many of the scientific advances undertaken across Antarctica resulted from overflight of:

* terrestrial areas (e.g., detailed 3D mapping; vegetation mapping, terrestrial community discrimination and health assessment; periglacial form characterization, etc.);
* ice and snow (e.g., detailed topography, depth and features of ice-sheets, glaciers and sea-ice);
* fauna (counts of penguins, seals and flying birds and detailed morphometrics); and
* areas relevant to atmosphere studies (more detailed meteorological measurements and air-surface couplings) (see Figure 1).

Chart, map, scatter chart

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Figure 1. (a) Location of RPAS surveys in Antarctica reported in published papers; (b) Insert shows data for northern Antarctic Peninsula.

Despite the likely low environmental impact of RPAS-based surveys, the increasing number of applications and increasing levels of use may lead to impacts in the most sensitive Antarctic ecosystems. We encourage (i) more international cooperation in RPAS research (ii) continued efforts to minimize associated environmental impacts, (iii) the sharing of research data and (iv) regularly review and update existing policy documents, and guidelines, as necessary.

**References**

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