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JUSTAS Requirements

Review of previous operational research support

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Abstract

This Reference Document is intended to summarize the requirements that would need to be met by a Remotely Piloted Aircraft (RPA) in order to fulfill the Joint Unmanned Surveillance and Target Acquisition System (JUSTAS[1]) scenarios. We have also surveyed previous work done by Defence Research and Development Canada (DRDC) in support of JUSTAS, or that could be leveraged by JUSTAS for requirements analysis. For each study that we reviewed, we have provided the context in which it could be used to support JUSTAS requirements analysis.

Significance to defence and security

JUSTAS has been a long term project and since its inception, both JUSTAS and the Directorate of Air Staff Operational Research (DASOR) have seen several staff turnovers. Therefore it is useful to gain an understanding of previous work that may be leveraged by the JUSTAS project. We wish to see how much of the previous work is still valid, as well as what can be directly applied to the creation of a software package that may be used to asses JUSTAS RPA bids.

[1] The JUSTAS project has been renamed the Remotely Piloted Aircraft Systems (RPAS) project. However since this report has a significant focus on work done under JUSTAS, we have kept the historical name for readability.

Résumé

Ce document de référence a pour but de décrire les exigences qui devraient être satisfaites par un aéronef télépiloté (RPA) afin de réaliser les scénarios du Système interarmées de surveillance et d'acquisition d'objectifs au moyen de véhicules aériens sans pilote (JUSTAS[2]). Nous avons également examiné les travaux déjà effectués par Recherche et développement pour la défense Canada (RDDC) à l'appui de JUSTAS, ou qui pourraient être exploités par JUSTAS pour l'analyse des critères. Pour chaque étude que nous avons examiné, nous avons fourni le contexte dans lequel il pourrait être utilisé pour supporter l'analyse des exigences de JUSTAS.

Importance pour la défense et la sécurité

JUSTAS est un projet à long terme et, depuis sa création, JUSTAS et le Directeur recherche opérationnelle (Force aérienne) (DROFA) ont vu plusieurs changements de personnel. Par conséquent, il est utile de comprendre les travaux complétées qui peuvent être exploités par JUSTAS. Nous souhaitons établir quelles études précédentes sont toujours valables, ainsi que celles qui peuvent être appliquées à la création d'un progiciel qui pourra être utilisé pour évaluer les RPA proposés pour JUSTAS.

[2] Le projet JUSTAS a été renommé le projet système d'aéronef télépiloté (RPAS). Cependant, vu que ce rapport a un focus sur le travail complété pour JUSTAS, nous avons maintenu le nom historique afin d'améliorer la lisibilité.

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Acknowledgements

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1 Introduction

The Joint Unmanned Surveillance and Target Acquisition System (JUSTAS[3]) is the Canadian Armed Forces (CAF) project aimed at procuring a Remotely Piloted Aircraft (RPA) capability. The goal of the project is to procure the right RPA, in the right quantity, for the needs of the CAF.

Director Air Staff Operational Research (DASOR) has been engaged to provide support in identifying and assessing requirements. For identification, JUSTAS has provided DASOR with the High Level Mandatory Requirements (HLMRs) and Statement of Operating Intent scenarios [1]. The scenarios illustrate what the RPA capabilities should be in order to complete relevant missions. These capabilities, in addition to the HLMRs form the JUSTAS requirements. For assessment, the intention is to develop a software tool or methodology that would aid in determining how well the identified requirements are met by competing RPA.

JUSTAS has been a long term project and since its inception, both JUSTAS and DASOR have seen several staff turnovers. Therefore it is useful to gain an understanding of previous work that may be leveraged by the JUSTAS project. We wish to see how much of the previous work is still valid, as well as what can be directly applied to the current tasking.

In this report, we will review the requirements that we have been able to extract from the HLMRs and scenarios provided as part of the tasking. We will then provide an overview of previous work, either completed in support of JUSTAS, or that may be applicable to requirements evaluation. We will then conclude with a summary of what we have learned, and what should be done next.

[3] The JUSTAS project has been renamed the Remotely Piloted Aircraft Systems (RPAS) project. However since this report has a significant focus on work done under JUSTAS, we have kept the historical name for readability.

2 Requirements drawn from HLMRs and scenarios

The JUSTAS project has provided us with the HLMRs and scenarios that illustrate how the RPA is intended to be used [1]. From these documents, we were able to extract requirements related to airfield conditions, mission weather, airspace considerations, and systems that the RPA will be expected to carry. In this section we will summarize these requirements, as well as other specific requirements that were not grouped into these categories. The values listed are based on the most stringent requirement across all scenarios.

2.1 Airfield conditions

The scenarios require that the RPA be able to take off and land on an airfield anywhere between 10 and 3300 feet above mean sea level. The takeoff density altitude[4] is between 300 and 6000 feet, however the maximum airfield density altitude specified in any scenario is 7500 feet. The shortest runway length in any scenario is specified as 6001 feet. The temperature range at the airfield may be anywhere between -32 and 39^{o}C, however the takeoff temperature range is less stringent, from -28 to 32^{o}C. The landing temperature is specified to be between -32 to 30^{o}C. It seems reasonable that the landing temperature is less controllable than the takeoff temperature, as takeoffs can be delayed longer than landings. So the fact that the low extreme temperature is lower for landings than takeoffs is intuitive. However, by the same logic, it would seem that the high extreme temperature should also be higher for landings than for takeoffs, which does not appear to be the case.

The following airfield conditions are not specified for any scenario: takeoff wind speed, takeoff visibility, landing density altitude, landing wind speed and landing visibility. Also the minimum airfield density altitude specified in any scenario is 1500 feet. However should we assume there is no real minimum, and that aircraft should only be limited by maximum density altitude?

2.2 Mission weather

The relative humidity during missions is indicated to be between 11% and 20%. The cloud ceiling varies from 5000 to 15,000 feet. The most precipitation anticipated is based on a monthly average of 97 mm for the scenario timeframe. Severe storms are listed as a potential flying condition.

There are several aspects of weather that have not been specified during the mission. Visibility and mission wind speed are not specified for any of the scenarios. Air temperature during missions is from 2 to 22^{o}C, however this is a less stringent requirement than the takeoff and landing extremes so it may not add any further restriction here.

2.3 Airspace

Altitudes are specified either in feet or flight level, as appropriate. Flight level indicates the altitude in hundreds of feet assuming that the pressure at sea-level is the standard 101.32 kPa. For example, Flight Level (FL) 200 would correspond to 20,000 feet if local variations in air pressure are ignored. Using

[4] "Density altitude is pressure altitude corrected for temperature. In layman's terms it directly affects the performance parameters of any aircraft, and in effect it is the equivalent altitude of where, performance-wise, the aircraft "thinks" its [sic] at. The higher the density altitude, the lower the aircraft performance, and vice versa." [2]

flight levels allows transiting aircraft to ensure they are at different altitudes even if their barometers are calibrated for different locations. In Canada (and the United States) flight level is used above the “transition altitude” of 18,000 feet. [3]

The minimum cruise altitude is specified as 10,000 feet. The maximum cruise altitude is given as FL 600 in the training scenario. However the maximum value in any of the operational scenarios is FL 300 so it may be more realistic to set FL 300 as the actual requirement. Imaging and attack are carried out at varying altitudes, with imaging between 4000 feet and FL 180, and attack between 10,000 feet and FL 200.

Various classes of airspace are specified in the scenarios (Class A, visual flight rules, etc.). However, unless the JUSTAS project can identify any exceptions, it may be best to assume that the RPA should be able to fly in any airspace class.

Terrain elevation is between 2600 feet and 5300 feet for the expeditionary Intelligence, Surveillance and Reconnaissance (ISR) scenario, but it seems unlikely that this reflects a requirement for the RPA, as the density altitude is what affects aircraft performance rather than terrain elevation.

2.4 RPA systems

The threat environment is described as small arms fire, up to light anti-aircraft artillery. The RPA will need defensive measures to survive in this environment.

The sensor requirement is comprehensive, including Electro-Optical / Infrared (EO/IR), Electronic Support Measures (ESM), Signals Intelligence (SIGINT), Automatic Identification System (AIS), and Radar. The radar systems should be capable of weather, Synthetic Aperture Radar (SAR), Inverse SAR (ISAR) and Ground Moving Target Indicator (GMTI). The scenarios tend to describe what information needs to be gathered, rather than specifying a resolution requirement. It may be possible to refine the aggregated scenario requirements into a National Imagery Interpretability Rating Scale (NIIRS) requirement. It should also be made clear whether the sensor package is expected to form part of the RPA bid, or if the sensor package is to be a separate purchase to augment the chosen RPA. Related to the sensors, the RPA should also carry a laser designator to provide a target for other close air support aircraft. The requirements given in the scenarios are as follows:

– Conduct pattern of life assessments (EO/IR, SAR, SIGINT)
– Detect muzzle flash
– Perform battle damage assessment
– Perform GMTI
– Zoom in to see disturbed earth / wires (for improvised explosive device detection)
– Detect with radar small pirate vessels at 50 nm
– Detect 90 ft fishing vessel at 90 nm
– Identify 90 ft fishing vessel (presumably the RPA is allowed to approach closer than the 90 nm required for detection, though this is not specified)
– Count men on board fast moving skiff
– Classify skiffs as probable/suspicious pirate or not

- Detect skiff crew retrieving weapons
- Detect low-flying Cessna flying at 90 kts
- Detect parked car out of sight of road
- Detect individuals crossing a field
- Visually ID any vessel between 150 and 300 feet
- Maintain necessary distance required for visual and aural covertness, and be able to collect the required data
- Perform earthquake damage assessment
- Detect all ships of medium size or larger, and determine their headings
- Identify 75 ft yacht between 8 & 22 kts speed from a distance as required for covertness

Depending on the scenario, various armament loads are preferred. The RPA should be able to carry any of the following options:

- 2 laser-guided weapons
- 2 Light-weight Survival Kit – Air Droppable (SKAD)
- 2 AGM-114 Hellfire Missiles
- 1 AGM-114 Hellfire Missiles and 2 GBU-48 250 lb Precision Guided Munitions (this is a point of confusion as the GBU-48 is a 1000 lb bomb [4])

Communications equipment should allow for connectivity to Wideband Global SATCOM (WGS), Polar Communication and Weather (PCW), Link16, VHF-FM and UHF. Full motion video will be transmitted through Tactical Common Data Link (TCDL). One scenario also specifies that the RPA should be able to act as a communications relay from local authorities to national agencies, though it doesn't specify what communications systems would be required for this task.

The RPA should be capable of Instrument Flight Rules (IFR) transit, and automatic takeoff and landing. It will be controlled by Joint Force Air Component Commander (JFACC) while in restricted airspace. The JFACC must be able to dynamically control the RPA and payload, in near-real time, under Line of Sight (LOS), Beyond Line of Sight (BLOS), and Remote Split Operations (RSO), and respond to situational changes and new taskings.

There are several requirements related to speed, however these requirements are not met simply through speed but a combination of speed and endurance, or speed and sensor capability. The arctic surveillance scenario requires the RPA to remain on station for 24 hours, so the endurance of the aircraft must be 24 hours in addition to the time required to transit to the surveillance area. The speed of the RPA, in combination with the sensor package, should be sufficient to detect and classify all vessels within an Area of Interest (AOI), and to locate and identify all vessels within the AOI that meet the parameters of a vessel of interest. The intent is to locate, using an all sensor search (EO/IR, ESM, SAR, SIGINT, AIS), and track a specific 75 ft yacht before it reaches its destination. In the scenario, the Vessel of Interest (VOI)'s point of departure is known and the AOI is defined by where the VOI might be when the RPA arrives. This means that the faster the RPA can reach the AOI, the smaller the AOI will be.

2.5 Other requirements

No number of RPA is given as a requirement, however there should be a sufficient number as to provide 24/7 coverage for a month. This number would depend on the endurance and the operational availability of the RPA. The RPA should be capable of being prepared and ready for launch within an hour's notice. The HLMRs specify that there must be "sufficient operational and training systems, infrastructure, and logistical support to sustain: a single line of operation for force generation / employment in Canada; and two separate 24/7 lines of operation from a single deployment location (in Canada or overseas)."

A secure ground control station must provide the following crew stations for the remote aircrew: Air Vehicle Operator, Payload Operator, Imagery and Signals Analysts. Crew located at forward operating locations include launch and recovery crew, including Air Weapons Systems Technicians for the SKAD and for weapons loading before flight.

2.6 Discussion on requirements gathered

In the previous sections, we have raised questions that relate to the requirements that were identified. There are other requirements in the scenarios that require further interpretation as well. Our concerns with these requirements are as follows.

The largest mission by surface area for any scenario is 90,000 square nm. However the Northwest Passage (NWP) scenario identifies a mission area of 1754 km length. Is the NWP narrow enough that only the length is a concern? The distance to the mission area is also not specified for all missions.

The most stringent requirement on endurance is a 24 hour flight, including 3 hours to transit to the area and presumably another 3 hours to return. This allows 18 hours for surveillance of the area. This means that instead of one RPA with 24 hours endurance, this mission could be completed by two RPA each with 15 hours endurance (6 hours in transit and 9 hours each on station). Three RPA with 12 hour endurance could achieve the mission, but would only spend half their time on station (6 hours in transit, 6 hours on station). This simply illustrates that the manner in which the endurance requirement for a mission is met can be flexible.

There remains the question of whether all of these represent real requirements. Are some of these requirements trivial for any aircraft that can meet the rest of the requirements? Or could some of the requirements, such as the endurance example given above, be mitigated by having a higher number of less expensive RPA?

Previous studies have focussed entirely on the surveillance capability. Once again, we see very little here in terms of measuring attack capability. The only measurable factors seem to be the number of hard points and the weight carrying capacity.

3 Previous work

In this section we will summarize work that has been done by Defence Research and Development Canada (DRDC) either in support of JUSTAS, or that may be leveraged for the evaluation of requirements. In either case, we will discuss how the work in question relates to the requirements identified in the previous section.

3.1 Previous evaluations of RPA

Two previous reports have attempted to evaluate RPA as ISR platforms. Neither of these reports considered any attack capability.

3.1.1 Gauthier & Bourdon: measures of performance and value-added benefits

Gauthier and Bourdon [5] decided on ten Measures of Performance (MOPs) that they believed were appropriate for evaluating maritime ISR aircraft. They then used these MOPs to compare the Global Hawk and Predator B RPA to the CP140 Aurora currently in service. The MOPs used are listed in Table 1. As the table illustrates, most MOPs are evaluated based on the speed and endurance of the aircraft. From a requirements perspective, minimum requirements for speed and endurance could be derived from the required thresholds in these MOPs. Note that a trade-off may be possible, where higher speed might make up for lower endurance, or vice versa, rather than setting the requirements as specific speed and endurance values.

Table 1: *MOPs evaluated in [5].*

Derived from Speed and Endurance	Other
Persistence	Identification capability
Response time	Target location accuracy
Coverage	Weather capability
Revisit rate	Mishap rate
Number of reports	
Report frequency	

To evaluate RPA in a manner tied to mission success, Gauthier and Bourdon [5] created five “Value-Added Benefits” (VAB) for each of four relevant Force Planning Scenarios (FPS). For example, the VAB chosen for the search and rescue scenario were:

- Reduce time needed to assist
- Increase the search effort (coverage)
- Increase positional accuracy
- Improve Situational Awareness (SA)
- Facilitate sustainment of operations

For each VAB, Medium-Altitude Long-Endurance (MALE) and High-Altitude Long-Endurance (HALE) RPA were assessed based on whether they provided a significant, moderate, or no improvement over current capabilities. This assessment was informed indirectly by the MOP analysis, with the Global Hawk representing a typical HALE RPA, and the Predator B representing a MALE RPA. The numbers of significant and moderate improvements were then tallied for both RPA types. The Aurora was not evaluated as it forms part of the current baseline.

The MOP analysis provides a link between scenario requirements and aircraft specifications, particularly speed and endurance, though ISR systems and weather capability are also addressed. Mishap rate is also considered here. Although it was not identified in the requirements drawn from the JUSTAS scenarios in the previous chapter, aircraft reliability may be an important consideration. While the VAB portion of the analysis is intended to specifically address the needs of the FPS, the qualitative nature of the analysis makes it impossible to reverse-engineer from scenario requirements to aircraft specifications. However, the methodology may still be useful for future JUSTAS analysis.

3.1.2 Arbour: JUSTAS speed and endurance requirements

Arbour [6] further investigated the trade-off between speed and endurance for RPA requirements in four ISR scenarios: point surveillance, tracking a vessel transiting the NWP, and vessel search and track operations on the East and West coasts. These scenarios are likely based on early versions of the JUSTAS scenarios. In fact, the NWP, East Coast, and West Coast scenarios are very similar to scenarios from which we drew requirements in Chapter 2. Rather than use the specifications of a specific RPA, Arbour used ranges of values for both speed and endurance, and determined how MOPs varied in response. For the first two scenarios, transit time and on-station time were evaluated across the range of speed and endurance values. In order to determine the distance to the mission area, assumptions needed to be made on where the RPA would be based. For the NWP scenario, the portion of the vessel transit that would be tracked was also evaluated. This MOP is largely equivalent to on-station time but more reflective of the mission requirement for a target transiting a long distance. For both vessel search and track scenarios, expected search time was also evaluated. The expected search time was estimated based on the notion that the less time the RPA takes to reach the vessel’s last known position, the smaller the search area will be. Also for these scenarios, results were only produced across a range of RPA speeds, rather than across speed and endurance. The reason for this is that these scenarios assumed the mission must be completed (including finding the vessel and tracking it for six hours) with a single RPA sortie, and so the mission duration sets the endurance requirement.

The simulation work by Arbour could be updated for the latest versions of the modelled scenarios, as well as extended to other scenarios in order to determine what speed and endurance combinations would allow for successful mission completion. This work illustrates that, as noted in the previous chapter, JUSTAS requirements for speed and endurance are linked as these capabilities may compensate for each other to some extent.

3.2 Groundwork for further evaluation of RPA

3.2.1 Wong and Jassemi-Zargani: General Image Quality Equation

NIIRS assigns a numerical value (0 to 9) to an image, with each step on the scale corresponding to a definition of details that could be distinguished within the image [7]. Wong and Jassemi-Zargani [8] examine the General Image Quality Equation (GIQE) [9] which is used to determine the NIIRS rating that can be expected based on a system's technical parameters. GIQE was developed for imaging systems with a Q factor of one (meaning the optical resolution and sampling resolution are equal) and there was concern that it may not be valid for other systems (the report cites the imaging systems on a Global Hawk RPA, for example). The report shows that for a system such as a Global Hawk, the GIQE does provide a reasonable NIIRS estimate.

The JUSTAS scenarios include requirements such as "conduct pattern of life assessments," "detect all ships of medium size or larger," or detecting "muzzle flash." While sensor specifications are not likely to include such descriptions, these qualitative requirements could be reframed as NIIRS requirements. This research suggests that it would then be possible to apply the GIQE to bidders' sensor specifications to determine whether the requirements are met.

3.2.2 Wind & Horn: Surveillance Analysis Workbook

The Surveillance Analysis Workbook (SAW) [10] is a macro-enabled Excel spreadsheet used for evaluating coastal surveillance plans. The spreadsheet considers the Joint Task Force Atlantic (JTFA) and Joint Task Force Pacific (JTFP) surveillance zones, and for each zone a user inputs data describing the extent of any surveillance patrols conducted in that zone. The SAW uses that information as well as the estimated time required for a surface vessel to transit through each zone to determine the probability of detecting and identifying such a vessel. This is referred to as the Probability of Identification (P_{ID}) and the metric is described in [11]. The SAW considers P_{ID} to be cumulative, meaning that if a ship route transits through an outer zone followed by an inner zone, any ship detected along that route in the outer zone is considered to be detected for the purposes of the inner zone as well. The SAW can be used for surveillance systems that provide detection but no identification (as in [12]), with the caveat that what the SAW will output as P_{ID} is actually probability of detection.

Once again, this work relates to the speed and endurance requirements discussed in the previous chapter. In this case speed, endurance, and sensor field of view combine to determine how much coverage is obtained in the surveillance zones that the RPA would patrol. While speed and endurance are not directly measures of military utility, P_{ID} is a measure of how well the surveillance mission is achieved. Because of this, the SAW may be a useful tool for evaluating candidate RPA.

3.2.3 Cazzolato and Sprague: system of systems simulation

Cazzolato and Sprague [13] created a preliminary model of current and potential future surveillance assets attempting to detect 28 different ships[5] in the Canadian north. Their initial result is that replacing a CP140 Aurora flying an 8 hour mission out of Yellowknife with a Global Hawk flying a 22 hour mission out of Winnipeg would not produce a statistically significant improvement in the number of targets detected or the average time that targets spend in the area of responsibility before being detected. While the simulated Global Hawk did outperform the Aurora on an individual basis, the difference was not significant in the context of the modelled surveillance system of systems (which included one National Aerial Surveillance Programme aircraft and one Royal Canadian Navy Frigate).

In terms of the requirements that we have drawn from the scenarios, this model (like the SAW) accounts for speed, endurance, and sensor field of view. It translates the RPA performance in these requirements

[5] Five adventurers, four trawlers, four drill ships, ten cargo ships, and five cruise ships. Each scenario was run five times, with each ship keeping the same route but a different schedule across each run.

into a degree of capability improvement in terms of the ability to achieve the surveillance mission. This is a preliminary model that could benefit from further refinement, after which it could become another tool to compare RPA options.

3.2.4 McCourt and Rempel: fleet size

McCourt and Rempel [14] created a Monte Carlo simulation to determine the number of RPA that would be required for the fleet in order to maintain four simultaneous, continuous missions, depending on aircraft reliability and required probability of success. They note that time restrictions prevented them from conducting a sensitivity analysis. Also the balance of their assumptions suggests that the results are likely optimistic. For these reasons, their analysis may be considered a starting point for fleet size requirements.

The JUSTAS scenarios do not consider reliability. Instead they describe the sorties of one or two RPA that are assumed to be ready. Given the single-flight nature of the scenarios, they are not suited to establishing a reliability requirement. However this is still a requirement that should be considered by the JUSTAS project.

4 Conclusion

We have examined the requirements that would need to be met by an RPA used to fulfill the JUSTAS scenarios. Further requirements, such as aircraft reliability or number of aircraft available, may also exist without necessarily being captured within the scenarios. These should be given consideration before requirements are finalized.

We have also surveyed previous work done by DRDC in support of JUSTAS, or that could be leveraged by JUSTAS for requirements analysis. Much of this previous work focuses on speed and endurance, particularly how they combine to create coverage. All of this previous work has been conducted from a surveillance perspective, and so there has been no consideration for a weapons carrying capability. For each study that we reviewed, we have provided the context in which it could be used to support JUSTAS requirements analysis.

Section 2.6 identifies some issues that need to be clarified in order to finalize the JUSTAS requirements. Once this is completed, the JUSTAS project has asked for DASOR's help in developing a software package that would be used to perform the bid evaluation to choose an RPA system. This software package would implement an analysis of the proposed RPA systems against the identified requirements (this may be similar in concept to the fixed-wing search and rescue bid evaluation tool described in [15]). In order to create this software package, all requirements would need to be framed in such a way as to be measurable in terms of system specifications (for example, coverage being derived from speed and endurance). The previous work that we have examined has shown that there may be trade-offs where an RPA may be weak in one metric if it is sufficiently strong in another. These trade-offs will be an important consideration when creating the scoring system for a bid evaluation software package. If weights are assigned to each metric, these weights may require subject matter expert input. The final product will also require validation before its final use.

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List of symbols/abbreviations/acronyms/initialisms

AIS	Automatic Identification System
CAF	Canadian Armed Forces
DASOR	Director Air Staff Operational Research
DRDC	Defence Research and Development Canada
EO/IR	Electro-Optical / Infrared
ESM	Electronic Support Measures
FL	Flight Level
FPS	Force Planning Scenario
ft	feet
GIQE	General Image Quality Equation
GMTI	Ground Moving Target Indicator
HALE	High-Altitude Long-Endurance
HLMR	High Level Mandatory Requirement
IFR	Instrument Flight Rules
ISAR	Inverse Synthetic Aperture Radar
ISR	Intelligence, Surveillance and Reconnaissance
JFACC	Joint Force Air Component Commander
JTFA	Joint Task Force Atlantic
JTFP	Joint Task Force Pacific
JUSTAS	Joint Unmanned Surveillance and Target Acquisition System
km	kilometer
kts	knots
MALE	Medium-Altitude Long-Endurance
MOP	Measure of Performance
NIIRS	National Imagery Interpretability Rating Scale
nm	nautical miles
NWP	Northwest Passage
PCW	Polar Communication and Weather
P_{ID}	Probability of Identification
RPA	Remotely Piloted Aircraft

SA	Situational Awareness
SAR	Synthetic Aperture Radar
SAW	Surveillance Analysis Workbook
SIGINT	Signals Intelligence
SKAD	Survival Kit – Air Droppable
TCDL	Tactical Common Data Link
VAB	Value-Added Benefit
VOI	Vessel of Interest
WGS	Wideband Global SATCOM

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This Reference Document is intended to summarize the requirements that would need to be met by a Remotely Piloted Aircraft (RPA) in order to fulfill the Joint Unmanned Surveillance and Target Acquisition System (JUSTAS) scenarios. We have also surveyed previous work done by Defence Research and Development Canada (DRDC) in support of JUSTAS, or that could be leveraged by JUSTAS for requirements analysis. For each study that we reviewed, we have provided the context in which it could be used to support JUSTAS requirements analysis.

Ce document de référence a pour but de décrire les exigences qui devraient être satisfaites par un aéronef télépiloté (RPA) afin de réaliser les scénarios du Système interarmées de surveillance et d'acquisition d'objectifs au moyen de véhicules aériens sans pilote (JUSTAS). Nous avons également examiné les travaux déjà effectués par Recherche et développement pour la défense Canada (RDDC) à l'appui de JUSTAS, ou qui pourraient être exploités par JUSTAS pour l'analyse des critères. Pour chaque étude que nous avons examiné, nous avons fourni le contexte dans lequel il pourrait être utilisé pour supporter l'analyse des exigences de JUSTAS.

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Joint Unmanned Surveillance and Target Acquisition System; JUSTAS; Remotely Piloted Aircraft; RPA; Remotely Piloted Aircraft System; RPAS; Unmanned Aircraft System; UAS; Unmanned Air Vehicle; UAV