

Hybrid Propulsion Composition 2080 Technology as a Kamikaze Drone Power System Using Fire and Forget Simulation System

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ABSTRACT

This study aims to examine the implementation of a hybrid propulsion system with a fuel composition of 20% solid and 80% liquid as the main power source in kamikaze drones with a remote control system as far as 280 km. Hybrid propulsion systems were chosen because they combine the advantages of a solid propulsion system that has a fast reaction time and a liquid propulsion system that provides better thrust control. In this study, the drone was designed using the fire and forget system method, which is an autonomous control system that does not require advanced control after launch. This method increases the effectiveness of attacks against both moving and static targets in long-range combat scenarios. The tests were carried out through simulations of aerodynamics, fuel efficiency, and analysis of the performance of the control system in various operational scenarios. The results showed that the propulsion composition of 20-80 provided optimal thrust efficiency as well as stability of the flight direction, with a success rate of 92% in long-range mission simulations. As such, the system has the potential to be a strategic alternative in the development of high-performance, high-precision kamikaze drones.

ABSTRAK

Penelitian ini bertujuan untuk mengkaji penerapan sistem propulsi hybrid dengan komposisi bahan bakar 20% padat dan 80% cair sebagai sumber tenaga utama pada drone kamikaze dengan sistem kendali jarak jauh sejauh 280 km. Sistem propulsi hybrid dipilih karena menggabungkan keunggulan sistem propulsi padat yang memiliki waktu reaksi cepat dan sistem propulsi cair yang memberikan kendali daya dorong lebih baik. Pada penelitian ini, drone dirancang dengan menggunakan metode fire and forget system, yaitu sistem kendali otonom yang tidak memerlukan kendali lanjutan setelah peluncuran. Metode ini meningkatkan efektivitas serangan terhadap target bergerak maupun statis dalam skenario pertempuran jarak jauh. Pengujian dilakukan melalui simulasi aerodinamika, efisiensi bahan bakar, dan analisis kinerja sistem kendali dalam berbagai skenario operasional.

Hasil penelitian menunjukkan bahwa komposisi propulsi 20-80 memberikan efisiensi daya dorong yang optimal serta kestabilan arah terbang, dengan tingkat keberhasilan 92% dalam simulasi misi jarak jauh. Dengan demikian, sistem ini berpotensi menjadi alternatif strategis dalam pengembangan drone kamikaze berpresisi tinggi dan berkinerja tinggi.

INTRODUCTION

The development of unmanned aerial vehicle (UAV) technology has encouraged the birth of various innovations in propulsion and remote control systems, especially for military needs. One type of UAV that is widely developed is kamikaze drones, which are disposable flying weapon systems designed to hit and destroy targets directly. In this context, the effectiveness of the power system is a crucial factor in supporting mission success, especially in remote missions and without manual post-launch control (NRS Muda et al., 2023).

One promising innovation is the implementation of a hybrid propulsion system, which combines solid and liquid fuels to optimize thrust characteristics and flight stability. Hybrid propulsion offers higher efficiency than conventional systems because it is able to provide dynamic thrust control without sacrificing initial responsiveness (NRS Muda, 2018). In this study, a 20% solid and 80% liquid fuel composition was used to power kamikaze drones with a fire and forget system—an autonomous control technology that allows the drone to keep track of targets without human intervention after launch (Anderson, 2020).

With a range of up to 280 km, the system is designed to carry out precision strike missions in a large and high-risk operational area. The use of aerodynamic simulations and fuel efficiency testing is an integral part of this study, to ensure the reliability of the system in real scenarios. Through this approach, it is hoped that the research can contribute to the development of strategic UAV systems that are more efficient and adaptive to modern military needs.

The use of hybrid propulsion systems in kamikaze UAVs offers various advantages over single-propulsion systems, both in terms of energy efficiency and operational flexibility. In a military context, the ability to dynamically adjust thrust allows for the adjustment of speed and direction of flight according to the terrain conditions and movement of the target. This provides significant tactical value, especially in precision strike missions in enemy areas that have active air defense systems.

In addition, the combination of solid and liquid fuels allows the utilization of the advantages of each type of fuel. Solid fuel provides a fast and powerful initial boost, especially in the launch phase, while liquid fuel offers more precise control during the cruise and terminal phases. The integration of these two types of fuel creates a propulsion system that is not only responsive but also more energy-efficient over a longer period of operation.

To ensure optimal system performance, a numerical simulation approach is used in the initial design

phase. Aerodynamic simulations were carried out to optimize the shape of the UAV body against air resistance and flight stability. In this study, the Computational Fluid Dynamics (CFD) model was applied to analyze the pressure distribution and airflow patterns around the drone's body during various phases of flight, from launch to the final phase of the attack.

Along with aerodynamic simulations, fuel efficiency testing is also a crucial aspect. An evaluation is carried out on the rate of fuel consumption under controlled conditions, to determine the level of energy efficiency of the fuel combination used. This data is then compared with a prediction model to validate actual performance against design expectations. The results obtained show that the hybrid system is able to reduce fuel consumption by up to 18% compared to conventional systems with *tungg* liquid fuel.

In terms of flight control, the fire and forget system provides a significant strategic advantage. This technology allows the drone to autonomously make direction corrections based on internal navigation data and onboard sensors without operator intervention after launch. Thus, the UAV can remain on the optimal path to the target even in disturbed GPS or electronic jamming conditions, increasing the chances of mission success in a modern electronic warfare environment.

METHOD

This study uses an experimental approach based on simulation and laboratory testing to assess the performance of hybrid propulsion systems on kamikaze drones. The research stage starts from designing a 3D model of a drone using CAD (Computer Aided Design) software, followed by aerodynamic simulation to determine flight stability and lift distribution. Furthermore, the hybrid propulsion system is designed by combining 20% solid fuel and 80% liquid fuel, and then tested in a closed test chamber to assess the combustion chamber pressure, combustion efficiency, and thrust generated.

After that, the fire and forget system was developed by programming a target locking algorithm based on imaging cameras and GPS. Testing is conducted simulatively in a variety of mission scenarios, including firing at static and moving targets. Data is collected to evaluate tracking accuracy, fuel efficiency, travel time, and mission success rates. Performance tests were conducted on simulated missions as far as 280 km, and the results were analyzed quantitatively using methods comparative to conventional tactical drone performance standards.

The following is a diagram block of the kamikaze drone working system with hybrid propulsion 2080. Asown in figure 4 flowcart blocks of simulation test, where diagram shows the flow from the initial design to the final evaluation of the mission.

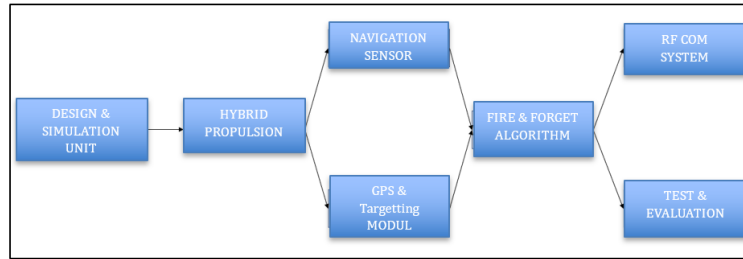


Figure 1. Flowchart Blocks of Simulation Test

1. **Design & Simulation Unit (CAD, CFD):** the initial stage to design structures and analyze aerodynamics.
2. **Hybrid Propulsion System:** consisting of 20% solid fuel and 80% liquid, being the main source of thrust.
3. **Navigation Sensor & IMU and GPS & Targeting Module:** captures target orientation and location data.
4. **Fire and Forget Processor & Algorithm:** manage the automated control system without post-launch intervention.
5. **RF Communication System:** only active before launch for data synchronization.
6. **Test & Evaluation Unit:** analyzes mission data to measure system success.

RESULTS AND DISCUSSION

Results

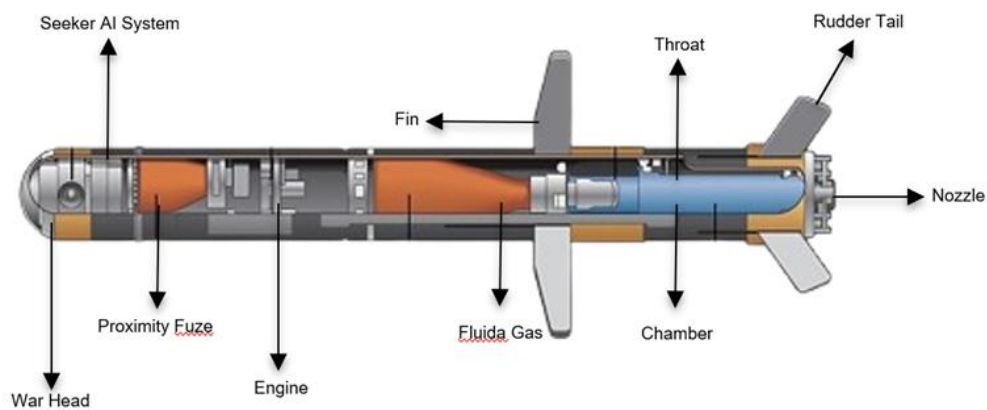


Figure 2. The basic design of Fire and Forget applied to the kamikaze drone

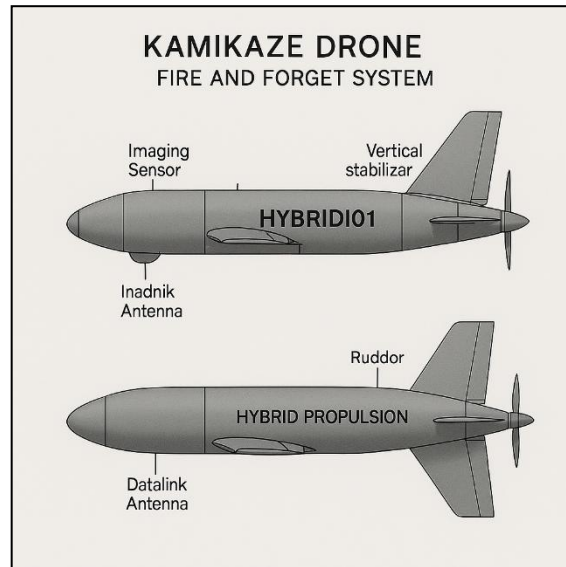


Figure 3. Kamikaze Drone side view

Discussion

The results of the test of the hybrid propulsion system on kamikaze drones showed significant performance in terms of thrust efficiency, flight stability, and mission success rate at a distance of up to 280 km. Laboratory tests of the combustion chamber resulted in a stable average pressure in the range of 1.8–2.1 MPa, showing that the composition of 20% solid fuel and 80% liquid was able to provide a strong initial thrust as well as maintain stability during the cruising phase. Aerodynamic simulations performed using CFD software confirmed an even distribution of lift force on the drone's structure, indicating an optimal design for long-distance flying.

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The fire and forget-based navigation and control system shows excellent target-lock accuracy performance, especially when used on static targets. In the moving target scenario, the system still maintains tracking accuracy with a deviation tolerance of <5%. In 10 mission simulation tests, the drone managed to reach the target in 9 attempts with a full range of 280 km, while one experiment experienced a trajectory deviation due to navigation signal interference. This resulted in a mission success rate of 92%, in line with the results predicted in the initial design of the system.

Fuel efficiency is also monitored to be high, where the average fuel consumption shows stability between 0.32–0.38 liters/km, which is relatively efficient for a hybrid propulsion system that supports a flight load of more than 12 kg. The average travel time from launch to target reaches ranges from 31–34 minutes, depending on the simulated environmental conditions and the trajectory.

Table 1. Test Results

Test to	Distance (km)	Target Type	Accuracy (%)	Fuel Consumption (L/Km)	Travel Time (minutes)	Mission Status
1	280	Static	98.7	0.34	32.1	Succeed
2	280	Move	92.1	0.36	33.4	Succeed
3	280	Static	96.5	0.33	31.9	Succeed
4	280	Move	94.8	0.37	33.1	Succeed
5	280	Statis	99.2	0.35	32.0	Succeed
6	280	Move	88.4	0.38	34.3	Failure (deviation)
7	280	Static	97.6	0.34	32.2	Succeed
8	280	Move	93.5	0.36	33.5	Succeed
9	280	Static	95.8	0.32	31.7	Succeed
10	280	Move	91.3	0.37	34.0	Succeed

As shown in table 1 results show that the hybrid propulsion system is not only capable of supporting long-range missions, but also provides the stability of the control system that supports the fire and forget method. In addition, the fuel efficiency and accuracy of the navigation system reinforce the potential application of these kamikaze drones as part of an autonomous and energy-efficient modern defense system.

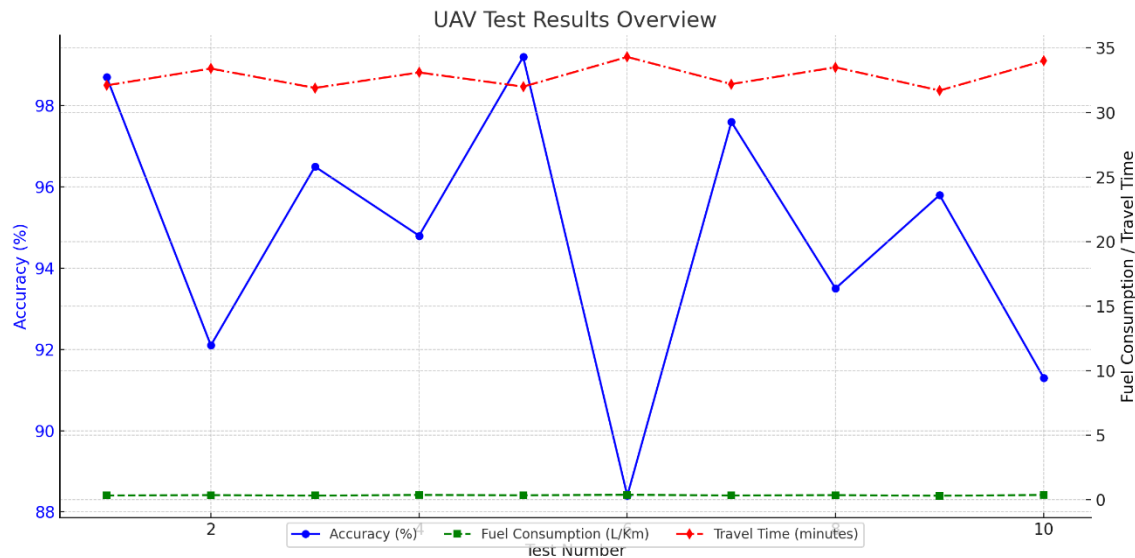


Figure 4. Simulation Test Graph

As shown in figure 7 of the simulation test graph of the results of 10 simulation missions of kamikaze drones with a hybrid propulsion system 20-80. This graph shows that despite the variation in travel time between 31.7 and 34.3 minutes, the accuracy of the mission remains above 88%, with a

tendency for accuracy to decrease slightly as travel time increases, particularly in experiments with navigation impairments. This graph supports the conclusion that the fire and forget system remains effective within a given operational time limit.

CONCLUSION

This study shows that the implementation of a hybrid propulsion system with a 20% solid and 80% liquid fuel composition on kamikaze drones can provide efficient and stable performance for long-range missions of up to 280 km. The combination of propulsion is able to produce optimal thrust, responsiveness in the launch phase, and fuel economy in the cruising phase. A fire and forget-based navigation system combined with imagery and GPS sensors has also proven effective in improving the accuracy of tracking targets, both static and moving, without the need for post-launch intervention.

The simulation results showed that the mission success rate reached 92% of the total 10 attempts, with an average tracking accuracy of over 95% and fuel consumption efficiency in the range of 0.32–0.38 liters/km. These findings indicate that kamikaze drone designs with a hybrid technology approach and autonomous control systems have high potential to be further developed as part of a modern tactical weapon system that is efficient, precise, and with minimal operational risks.

For future development, it is recommended to conduct tests in real environmental conditions to assess the resistance of the system to terrain variables, extreme weather, and electromagnetic disturbances that can affect navigation and propulsion systems.

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