



An MQ-1 Predator.

## Have Autonomous and Unmanned Systems Changed War Fundamentally?

by Mitchell Binding

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### Introduction

Technology is advancing at a pace that is changing how we visualize war. Have *autonomous* and *unmanned* systems changed war fundamentally? Remaining aware of the Clausewitzian distinction between the nature and character of war, I argue that war is undergoing a fundamental change in character. War is changing due to transformations in the technology on the battlefield, as well as in society and politics, and in relation to the warrior. This article begins with a background of unmanned and autonomous systems, before assessing current uses. I ask what we mean by war, and what defines fundamental change – specifically the much-discussed ‘Revolution in Military Affairs’ (RMA), societal and political change, and how the warrior has changed. Finally, I analyze what changes have been brought by autonomous and unmanned systems and how they constitute a fundamental change in war.

### First, Some Definitions

Unmanned systems are vehicles that do not ‘contain’ a human, but are directly or indirectly controlled by a human who has made all decisions, often remotely.<sup>1</sup> Importantly, automated systems deterministically ‘reason by a clear if-then-else, rule-based structure,’ meaning that, all other things being equal, output is always the same.<sup>2</sup> Autonomous systems are similar, but can navigate their own environment and make their own decisions. Based upon environmental inputs, these systems reason probabilistically to predict the best course of action to achieve the goal.<sup>3</sup> Autonomy is best understood on a scale and not as a binary, as there are varying levels of semi-autonomy.

### From Whence the Unmanned System?

Humans have been removing themselves from combat for centuries; as long ago as archers in the 14<sup>th</sup> Century, combatants have sent forth aerial weapons.<sup>4</sup> The unmanned leap can be traced to the 1940s, when Germany developed its V1, V2, and FX-1400 rockets.<sup>5</sup> These were pilotless bombs powered by ram-jet or rocket motor, the first glimpse of a remotely-controlled ‘aircraft,’ and they were the predecessors of the Intercontinental

Ballistic Missiles of the 1950s and then armed with nuclear weapons throughout the Cold War.<sup>6</sup> These systems became increasingly computerized, as they already required computational speed beyond human ability, and were superior at the repetitive and monotonous tasks required to monitor airspace for aerial or nuclear attacks.<sup>7</sup>

In the 1970s, these technologies grew still more capable. Observers of the industry discussed Remotely Piloted Vehicles (RPVs) being potentially utilized in combat, including ‘bombing, reconnaissance and even close air support,’ and as an air superiority fighter capable of maneuvers unlimited by human physiology.<sup>8</sup> Weapon autonomy increased with technologies such as the ship-born *Aegis*, a system designed to defend naval ships from missile attacks; B-52 computers, which calculated when to open the bomb doors and release weapon payloads in the 1991 Gulf War; and *Patriot* missile systems, able to lock on to threats at distances and speeds beyond the capabilities of humans, and with an ability to react autonomously.<sup>9</sup>

This brief background aims to demonstrate that early iterations of unmanned and autonomous systems have existed for some time. Today, their uses are enmeshed in warfare – being used by air forces, armies, and navies in every tactical environment. Unmanned and autonomous technologies have been especially appealing for jobs that are ‘dull, dirty, or dangerous.’<sup>10</sup> These are jobs that humans are either inherently not good at, or strongly dislike, or are likely to result in user death or serious injury. Not only are these technologies

seen as important for their contributions to national security and for saving human lives, their low price tag compared to manned systems makes them attractive.<sup>11</sup> For example, the *Reaper* Unmanned Aerial Vehicle (UAV) is designed to be ‘employed primarily against dynamic execution targets,’ fulfilling some of the same missions that manned fighters such as the F-35 does, but can do it cheaper.<sup>12</sup> The *Predator* UAV costs approximately one-thirtieth that of new manned fighter jets, and it can carry out many of the same functions.<sup>13</sup> And the cost-effectiveness of unmanned aircraft is expected to improve. Unmanned systems will continue to get better and cheaper as the ‘smart-phone revolution’ introduces and refines tiny sensors, gyroscopes, GPS, radio and controls – providing opportunities for the military, but also for non-state actors with access to basic technology.<sup>14</sup>

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This progress in unmanned vehicles is not limited to aircraft systems, but has become ubiquitous on land and at sea as well.<sup>15</sup> Bomb disposal and delivery systems in combat zones have been increasingly entrusted to unmanned vehicles such as the *PackBot* and *SUGV*.<sup>16</sup> Militaries are also developing autonomous transport vehicles that rival the leaps being made in the commercial sector.<sup>17</sup> Some militaries also continue to push ahead with autonomous weapon systems, such as South Korea’s SGR-A1 sentry robot that monitors the Demilitarized Zone.<sup>18</sup> The United States Navy also continues to utilize its advanced *Aegis* combat system with its ability for fully autonomous target engagement.<sup>19</sup> And the US is also developing new technologies like the Shipboard Autonomous Firefighting Robot.<sup>20</sup>



Uriel Sinat/Getty Images/68013960

Israeli soldiers get ready to launch a *SkyLark* drone during a drill on 16 January 2012 near Bat Shlomo, Israel.



These technologies will continue to become ‘more capable, intelligent, and autonomous.’<sup>21</sup> Current trends indicate these machines will soon ‘learn world models,’ not only mapping surroundings but segmenting and labelling objects as do humans. These possibilities exemplify the field of unmanned and autonomous technology today, and its trajectory in the future.

### What Is War?

Distinguished British historian Hew Strachan and Sibylle Scheipers of the School of International Relations, University of St. Andrews, provide five criteria in Oxford’s ‘Changing Character of War’ project: “First, war involves the use of force...Second, war rests on the contention [that]... possibly the most important feature of war is reciprocity... Third, war assumes a degree of intensity and duration to the fighting...Fourth, those who fight do not do so in a private capacity, and fifth, and consequently, war is fought for some aim beyond fighting itself.”<sup>22</sup> These five criteria, while raising some questions (largely regarding thresholds and metrics), are instructive in helping us discern what constitutes war. Unmanned and autonomous systems do fit the five criteria; an objection could be that reciprocity is unclear between a low-technology insurgency and a high-technology robotized force, but we must remember that “...the enemy has a vote and that his responses might be ‘asymmetrical.’”<sup>23</sup> Having said this, unmanned and autonomous war still fits this definition.

Clausewitz provides the most well-known conception of war. He says that “war is nothing but a duel on an extensive scale... *War therefore is an act of violence to compel our opponent to fulfil our will.*”<sup>24</sup> Clausewitz claims “war...always starts from a political condition, and is called forth by a political motive. It is therefore a political act.”<sup>25</sup> He sees war consisting of a “wonderful trinity,” embodied in the people, the general and his army, and the government.<sup>26</sup> This trinity is necessary to the nature of war, and will factor into our later analysis. Lastly, Clausewitz describes war as such:

“There is only one single means, it is the *fight*. However diversified this may be in form, however widely it may differ from a rough vent of hatred and animosity in a hand-to-hand encounter, whatever number of things may introduce themselves which are not actual fighting, still it is always implied in the conception of war, that all the effects manifested have their roots in the combat... All that takes place in war takes place through armed forces, but where the forces of war, i.e., armed men are applied, there the idea of fighting must of necessity be at the foundation.”<sup>27</sup>

Importantly, “fighting must be at the foundation,” and all war’s effects must have “roots in the combat.” Therefore, we could reasonably argue that belligerents of both sides must be present, “i.e., armed men are applied.” The question of thresholds arises... Would archers have counted as combatants? What about artillerymen and bomber pilots? Do UAV pilots count? And ‘supervisors’ of autonomous systems? Clausewitz might answer that as ‘the *fight*’ is in pursuit of a political end, the nature of war

has not changed, even if technologies ‘may introduce themselves which are not actual fighting.’

### What Is Fundamental Change?

The term ‘Revolution in Military Affairs’ has become prolific in military writing, but the meanings scholars attach to the term are diverse – with diverse arguments that there have been between two and eleven RMAs throughout history. Futurists Alvin and Heidi Toffler claim that the only true RMAs resulted from the Agrarian and Industrial revolutions, and all other “so-called ‘revolutions’ in warfare are greatly exaggerated.”<sup>28</sup> Less restrictively, historian Simon Adams argues there have been eleven revolutions, and career US Army officer and strategist Andrew F. Krepinevich submits that ten RMAs have occurred just since the 14<sup>th</sup> Century.<sup>29</sup> From a middle viewpoint, British Army officer and historian J.F.C Fuller has identified three, and Israeli military historian Martin Van Creveld argues for four.<sup>30</sup> Some have attempted to bridge the divide by describing a *spectrum*.<sup>31</sup> Others, such as American strategists Steven Metz and James

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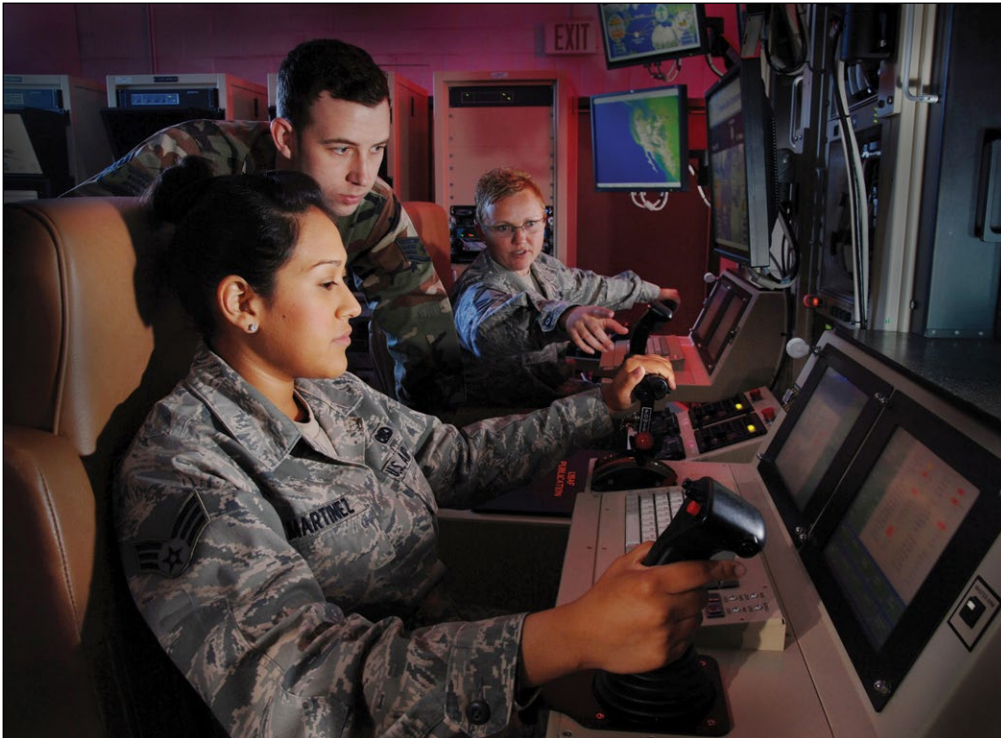
Kievit, separate “minor and major RMAs.”<sup>32</sup> While avoiding semantics, it is important to decide where warfare diverges from evolutionary progress and becomes “revolutionary.”<sup>33</sup> Most authors agree that a revolution entails “not mere reform but rather an overthrowing of an established order and its replacement with something fundamentally different.”<sup>34</sup> It must “fundamentally affect strategy,” and advance “broader economic and political changes.”<sup>35</sup> Importantly, most experts, including the “most restrictive in defining RMAs,” believe that a revolution is presently occurring.<sup>36</sup>

### The Social-Political Dimension

What makes a RMA truly revolutionary is that it *drives* or *is driven* by broader social and political change. There are two aspects of social and political changes currently being driven by the technological changes – casualty avoidance and lack of societal connection to the military.

Leaders endeavour to minimize war’s casualties to prevent domestic resistance to foreign policy.<sup>37</sup> This approach was seen in Bosnia and Croatia, where “No nation that sent forces to join UNPROFOR [United Nations Protection Force], or for that matter NATO in support of UNPROFOR, had any intention of committing those forces to battle or indeed of risking them at all.”<sup>38</sup> The distinguished British General Sir Rupert Smith, commanding the mission, said the UN’s rules of engagement made clear that “... the safety of the forces was more important than implementing the mandate.”<sup>39</sup> This demonstrates the disinclination governments have for casualties.

Citizens are also increasingly uninterested in war.<sup>40</sup> With the widespread end of conscription and the proliferation of technologies that separate soldiers from direct combat (neither of which are negative developments in themselves), the West has grown accustomed to watching “from a safe distance, empathizing but not experiencing, sympathizing but not suffering.”<sup>41</sup> This disconnect has serious implications, especially in democracies, where there



US Air Force photo by Val Gemples/Released

USAF technicians manning and explaining a UAV ground control station during training at March Air Reserve Base, California, 19 April 2010.



508 Collection/Alamy Stock Photo/CBKX14

AN RQ-4 *Global Hawk*, which has the capability to record vast amounts of intelligence, surveillance, and reconnaissance data and then relay it to war fighters on the ground.

is supposed to be an innate connection between the *demons* (populace) and the foreign policies of its government. As unmanned and autonomous systems spread in warfare, the last remaining human connections with the front-line may be severed.<sup>42</sup> War becomes more a sport to be watched and enjoyed than to contemplate with mortal seriousness.<sup>43</sup> This is apparent in viral ‘war porn’ videos from soldiers and UAVs uploaded to YouTube and shared by millions of people.<sup>44</sup> And this brings to mind General Robert E. Lee’s observation over a century ago, that “...it is good that we find war so horrible, or else we would become fond of it.”<sup>45</sup> The downside to the public, and its political representatives, becoming desensitized to the realities of war is that war begins to seem less awful as a tool of politics.

A related question is whether autonomous and unmanned systems have changed the *warrior* fundamentally. Again, technology has continuously increased distance between soldiers and their enemies—from archery, to artillery, to bomber aircraft.<sup>46</sup> Unmanned and autonomous technologies create a more profound distance in that it is not merely physical, but also a “psychological distance and disconnection.”<sup>47</sup> Pilots of some unmanned systems face the challenge of flying combat missions in a war zone, and then driving home to their families. A *Predator* pilot shared the following illustrative statement: “You see Americans killed in front of your eyes and then have to go to a PTA meeting.”<sup>48</sup> This situation has resulted in a high rate of Post-Traumatic Stress Disorder among UAV pilots as they struggle to reconcile the battlespace with their home life.<sup>49</sup>



Another aspect of warriors' disconnect from the battlespace is that they become entirely indifferent to killing. As the new warrior safely fights his battle from a control station, the emotion and fear that normally exist are absent, and the act of killing a designated enemy becomes routine.<sup>50</sup> Today's 'techno-warrior' heralds the arrival of a 'new' combatant – some have questioned whether they should be considered warriors at all.<sup>51</sup> However, in the end, "...warfare is quintessentially a human endeavor...technologically sophisticated weapons are only means to an end."<sup>52</sup>

### So, Have These Systems Changed War Fundamentally?

Unmanned and autonomous systems bring fundamental changes to warfare. The number of unmanned vehicles in Iraq skyrocketed from a few in 2003, to more than 5,300 in 2009, becoming utilized in practically every mission.<sup>53</sup> Unmanned Combat Aerial Systems (UCAS), such as the Boeing X-45 and Northrop-Grumman X-47, are being developed to replace human fighter pilots and are already capable of flying many air combat missions.<sup>54</sup> Unmanned systems are employed in a vast array of tasks: by 'combat commuters' in Nevada who fly *Global Hawks* and *Predators* from thousands of miles away, as well as troops operating mini-UAVs for tactical surveillance and reconnaissance.<sup>55</sup>

Autonomous systems also continue to improve, to the point that humans are being pushed further out of 'the loop.' Operators have maintained 'veto power' over computers, but as the battlespace grows faster, more confusing, and more complex,

hesitation to overrule autonomous systems increases.<sup>56</sup> This is becoming more relevant as autonomous systems are capable of decisions without humans, including to take life, but they have not yet been permitted to do so. In the coming decades, however, militaries will become more confident in autonomous systems' learning and decision-making, permitting them to override human decisions when necessary.<sup>57</sup> When this happens, humans could be pushed out of the loop at every plateau except the political-strategic level.<sup>58</sup> Some militaries have already accepted the need to "adapt its tactical authority delegation and eventually use artificial intelligence and automation to enhance and speed up decision-making."<sup>59</sup>

A final hurdle in granting autonomy to systems in warfare is permitting *ethical decisions*. Computers can follow ethical frameworks or rules of engagement. In fact, autonomous systems excel at Kantian 'categorical imperatives' and the demands of strict ethical guidelines, perhaps better than humans.<sup>60</sup> Autonomous systems are uninfluenced by anger, fear, vengeance, or even self-preservation in uncertain environments.<sup>61</sup> These possibilities constitute a further step in the fundamental change in war, so we must consider them now.

### Conclusion

After introducing the concept of war, we discussed fundamental changes, noting that a Revolution in Military Affairs should "fundamentally affect strategy."<sup>62</sup> The use of unmanned systems, particularly drone strikes and surveillance, have played a key role in the West's role in the Middle East



US Air Force by Staff Sgt. Eric Harris/Released

Ground shot of an RQ-4A *Global Hawk*. Note the relative size of this massive UAV.

over the last decade. President Obama made them “the centerpiece of his administration’s counterterrorism policy,” confirming a shift in strategy at the strategic and political level.<sup>63</sup> Recall also, that military revolutions must coincide with “broader economic and political changes.”<sup>64</sup> Economically, the unmanned and autonomous revolution has had a dramatic impact upon employment, as machines transform the economy and job landscape.<sup>65</sup> We also discussed the political and social changes underway due to unmanned and autonomous systems – including public and political disconnect from war, and the ‘spectator sport’ mentality, possibly undermining the very foundation of ‘peaceful democracies.’

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Finally, recall Clausewitz’s trinity, comprising the people, military, and government. The people are scarcely affected by war, the army does not even need to be physically present, and the government (resulting from the other two) experiences a lack of accountability.<sup>66</sup> If every aspect of the trinity is presently undergoing fundamental change, then it is reasonable to conclude that unmanned and autonomous systems have fundamentally changed the character of war. It is important that we address this change now because, in one manner or another, this issue will continue to require our deep attention.



## NOTES

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