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LEGAL JURISDICTION AND CRIMINAL LIABILITY FOR ACTS IN OUTER SPACE

Nehal Emam[1], Shadi Alshdaifat[2], Abdulellah Al Nawayseh[3*]

[1] PhD Student, Public Law Department, University of Sharjah, UAE. U21101891@sharjah.ac.ae, https://orcid.org/0000-0002-5192-3070)

[2] Associate Professor of Public International Law, University of Sharjah, UAE. https://orcid.org/0000-0001-6136-4295

[3] Professor of Criminal Law, Mu'tah University, Jordan. https://orcid.org/0000-0002-5016-2150

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Corresponding Author: Abdulellah Al Nawayseh

ABSTRACT

As human endeavours in outer space intensify—propelled by governmental initiatives and private sector enterprises the issue of criminal culpability in this alien realm has grown increasingly pressing. This article utilises a comparative legal examination of national frameworks from the United States, Canada, and Japan to investigate how current laws manage crimes perpetrated in outer space. It emphasises the fundamental components of criminal liability: the physical act (actus reus), the mental state (mens rea), and procedural enforcement. The research indicates considerable inequalities in legal protection and enforcement strategies, exacerbated by the lack of a cohesive international framework and the shortcomings of agreements like the Outer Space Treaty (1967) and the Intergovernmental Agreement on the International Space Station (1998). The paper's primary contribution is the proposal for a Space Criminal Code and the creation of a World Space Court to resolve jurisdictional uncertainties and guarantee accountability beyond Earth. These proposals seek to establish a cohesive and internationally recognised legal framework that can maintain justice in outer space.

KEYWORDS: Criminal Liability, Space Law, Outer Space Crimes, International Cooperation.

1. INTRODUCTION

Criminal liability for actions undertaken in outer space is a burgeoning and pressing issue in international law, propelled by the swift proliferation of human endeavours beyond Earth. As space exploration transitions from government-led initiatives to a collaborative arena involving private firms and space tourism, the legal frameworks for addressing criminal conduct encounter unparalleled obstacles. The lack of a cohesive legal framework, along with jurisdictional uncertainties, poses significant enquiries regarding the administration of justice in this distinct context (Chatzipanagiotis et al., 2015). This study examines the primary research question: How can criminal culpability be created and enforced in a legal void such as outer space? This study examines the primary research question: How can criminal culpability be created and enforced in a legal void such as outer space? This study utilises a comparative legal examination of national frameworks from countries with advanced space programs, including the United States, Canada, and Japan. The selected states were identified for their clear legal frameworks regarding space-based activities and their proactive involvement in international space governance. The examination investigates the interpretation and application of the fundamental elements of criminal liability—actus reus (the physical act), mens rea (the mental condition), and procedural enforcement—across various legal systems in the context of extraterrestrial matters. The report identifies legal deficiencies, jurisdictional discrepancies, and enforcement obstacles, establishing a foundation for recommending a more cohesive and integrated worldwide legal framework. Current legal frameworks, such as the Outer Space Treaty (1967) and the Intergovernmental Agreement on the International Space Station (1998), offer restricted jurisdictional direction, predominantly reliant on nationality and registration. Some states have implemented legislation to prosecute space crimes perpetrated by their citizens, while others depend only on international treaties, leading to inconsistent enforcement and legal deficiencies. (Chatzipanagiotis et al., 2015). Comparative legal analysis indicates that certain nations, including the United States, Canada, and Japan, have implemented national legislation that extends their criminal jurisdiction to operations in space, but others depend only on international treaties (Jakhu & Pelton, 2017; Sundahl, 2019). Canada's Criminal Code specifically permits the prosecution of Canadian astronauts for offences committed onboard the ISS, irrespective of the victim's nationality. This strategy is not widely implemented, resulting in possible deficiencies in enforcement and accountability (Jakhu & Pelton, 2017). Furthermore, academics contend that existing rules of extraterritorial jurisdiction are inadequate for the distinct circumstances of space, where offences may transpire among multinational crews, aboard commercial spacecraft, or in unclaimed areas of celestial bodies (Sundahl, 2019). Suggestions for a Space Criminal Code or a World Space Court have been made to rectify these deficiencies and provide uniform legal norms among nations (Jakhu & Pelton, 2017; Tronchetti, 2020). This paper addresses these difficulties by proposing the creation of a Space Criminal Code and the establishment of a World Space Court. These projects seek to establish a cohesive and generally recognised legal system that guarantees responsibility and justice in outer space, which is essential as mankind anticipates prolonged residence on the Moon, Mars, and beyond (Tronchetti, 2020).

2. THE ELEMENTS OF SPACE CRIMES

Criminal culpability, whether terrestrial or extraterrestrial, is basically based on the existence of particular legal elements that delineate and constitute a crime. The elements—typically classified as material, moral, and legal components—are crucial for determining criminal liability. Within the realm of space law, these aspects acquire extra significance due to the distinctive environment, jurisdictional intricacies, and the lack of a cohesive worldwide criminal code for space. In conventional criminal jurisprudence, as implemented by numerous national systems including the United Arab Emirates (UAE), these components are codified and methodically treated. The UAE's Federal Crimes and Penal Code delineates the material aspect in Articles 32–38 and the moral element in Articles 39–44. Nonetheless, when addressing space-related offences, these elements must be construed in accordance with international treaties, including the Outer Space Treaty (1967) and the Intergovernmental Agreement on the International Space Station (1998), which assign jurisdiction based on nationality and registration. In contrast, nations such as the United States, Canada, and Japan have broadened their criminal legislation to encompass offences perpetrated by its citizens in outer space. Canada's Criminal Code specifically permits the prosecution of Canadian astronauts for offences committed onboard the ISS, irrespective of the victim's nationality. The United States enforces its federal criminal law

extraterritorially concerning its astronauts and space assets, while Japan possesses analogous stipulations within its national space laws. Notwithstanding these national initiatives, there now exists no worldwide legal framework that thoroughly delineates space crimes or institutes a universal enforcement system. Academics have suggested the establishment of a Space Criminal Code or a World Space Court to rectify these deficiencies and guarantee consistency in the enforcement of criminal law in outer space. The United States, Canada, and Japan include explicit extraterritorial laws for pursuing space-related offences; however, the lack of standardised implementation methods and mutual recognition agreements considerably hinders collaborative enforcement. Each jurisdiction functions within its distinct legal parameters, resulting in fragmented accountability and possible conflicts in cases involving multinational crews or cross-border victims. Canada's specific regulations for prosecuting astronauts on the ISS differ from Japan's more generalised legislative framework, whereas the U.S. depends on extensive federal jurisdiction. These disparities underscore the absence of interoperability among national systems, which diminishes the efficacy of legal remedies to space crimes. In the absence of a cohesive framework or common enforcement mechanisms, the likelihood of jurisdictional gaps and legal ambiguity is significantly elevated underscoring the necessity for an international institution, such as a Space Criminal Code or World Space Court, to guarantee uniform and collaborative justice beyond Earth.

2.1. The Material Element of Space Crimes

The material element (actus reus) of a crime denotes the physical act or omission that defines the illegal behaviour. In the realm of space crimes, this aspect is notably intricate due to the innovative and frequently unparalleled nature of the offences committed. Legal scholars typically concur that the material element consists of three components: (1) conduct—the physical action considered unlawful (e.g., unauthorised launch, sabotage); (2) result—the detrimental outcome of the conduct (e.g., damage to a satellite); and (3) causal link—the relationship between the conduct and the result. In space, these elements must be analysed considering the distinct hazards and technology involved. Unauthorised launches may contravene national licensing statutes and international commitments established by the Outer Space Treaty. Tronchetti (2020) contends that these infractions undermine the efficacy of existing treaty enforcement procedures, particularly when private entities engage in cross-border activities. The intentional generation of space debris is increasingly regarded as criminally negligent; yet, as Soroka (2023) observes, the lack of enforceable international regulations complicates prosecution, even when the damage is predictable and avoidable. Interference with satellite operations, including hacking or jamming, introduces additional complexities. Ireland-Piper and Freeland (2023) assert that these actions obscure the distinction between cybercrime and space crime, necessitating a hybrid legal response that few nations are presently capable of offering. The militarisation of space, officially forbidden by Article IV of the Outer Space Treaty, continues to exist in a legal ambiguity about enforcement. Researchers Jakhu and Pelton (2017) contend that given the absence of a precise definition of "weapon" in space, nations may exploit ambiguities to enhance military capabilities while masquerading as civilian endeavours. Emerging concerns, such as illicit resource extraction and environmental degradation—e.g., asteroid mining or poisoning of celestial bodies—underscore the insufficiency of existing legal systems. The U.S. Commercial Space Launch Competitiveness Act (2015) confers rights to U.S. citizens for mined resources; nevertheless, Tronchetti (2020) argues that this may contravene the non-appropriation principle of the Outer Space Treaty. In contrast, the UAE has not yet established separate legislation for space crimes, instead depending on regular penal statutes. This method, however adaptable, fails to provide the clarity required to tackle the technical and jurisdictional intricacies of space-related crimes. In conclusion, although the material aspect of space crimes exhibits fundamental parallels with terrestrial offences, its implementation in outer space necessitates a more sophisticated and comparative legal framework. Ireland-Piper and Freeland (2023) assert that aligning legal norms across states is not only a theoretical objective but also a practical imperative to guarantee accountability and maintain the rule of law in a progressively commercialised and contentious space environment.

2.1.1. Criminal Behavior in Space Activities

Comprehending illegal conduct in space necessitates the modification of conventional legal terminology to accommodate the distinct legal void of outer space. In general jurisprudence, criminal behaviour is characterised as a voluntary act or omission that is likely to have a legally prohibited outcome, a premise upheld by legal systems such as those of the UAE and the U.S. In space law, this term encompasses actions or inactions by individuals, nations, or commercial companies that could contravene international treaties, national legislation, or multilateral agreements (Tronchetti, 2020; Soroka, 2023). Tronchetti (2020) contends that the lack of a cohesive legal framework complicates the consistent application of these concepts, particularly when commercial entities engage across many jurisdictions. Criminal behaviour in space can be classified into positive acts, such unauthorised satellite launches or the placement of weapons in orbit, and negative acts, such as neglecting to deorbit dead satellites or failing to report hazardous situations. Although both UAE and U.S. law acknowledge omissions as illegal when a legal duty is present, Ireland-Piper and Freeland (2023) highlight that enforcement is inconsistent due to ambiguity regarding the definition of a legal duty in space. Soroka (2023) attacks the dependence on terrestrial analogies, asserting that space-specific responsibilities must be formalised to prevent interpretation discrepancies (Ireland-Piper & Freeland, 2023; Soroka, 2023). A model of space crime entails limiting access to outer space, including activities such as contaminating orbital trajectories or monopolising orbital positions, which contravene the Outer Space Treaty's principle of non-appropriation. Jakhu and Pelton (2017) assert that these actions ought to be classified as environmental crimes; nevertheless, national systems differ in their readiness to prosecute. For example, although the U.S. enforces sabotage legislation, the UAE's dependence on broad criminal statutes may fail to include the complete extent of damage, particularly when international interests are involved (Jakhu & Pelton, 2017; Ireland-Piper & Freeland, 2023). A separate model addresses the transgression of allowable spatial use, including the monopolisation of resources or the militarisation of celestial bodies. These actions violate international standards, notably Article IV of the Outer Space Treaty. Academics such as Tronchetti (2020) and Jakhu & Pelton (2017) discuss whether national legislation—exemplified by the U.S. economic Space Launch Competitiveness Act—sufficiently reconciles economic autonomy with international responsibilities. The UAE's focus on peaceful use and collaboration demonstrates a more conservative stance, however it lacks enforcement measures for infractions by foreign businesses (Tronchetti, 2020; Jakhu & Pelton, 2017). A third paradigm pertains to sovereignty assertions over heavenly bodies, which are expressly forbidden by international law. Claims of ownership over the Moon or Mars contravene the notion of the common inheritance of mankind. Soroka (2023) cautions that in the absence of explicit criminalisation, such allegations may remain unaddressed, particularly without a binding international adjudicatory authority. Ireland-Piper and Freeland (2023) advocate for the establishment of a Convention on Criminal Liability for Space Crimes to tackle these rising risks (Soroka, 2023; Ireland-Piper & Freeland, 2023). In practice, positive criminal behaviour include unauthorised operations or the deployment of hazardous technologies, whereas negative behaviour pertains to the failure to remove debris or report collisions. Failing to deorbit expired satellites may amount to criminal negligence in accordance with environmental protection rules. Tronchetti (2020) observes that the U.S. orbital debris mitigation recommendations lack enforceability, and the UAE has not yet formalised these commitments into binding legislation, which raises issues over regulatory inertia (Tronchetti, 2020; Jakhu & Pelton, 2017). Although both the UAE and the U.S. acknowledge illegal omissions and acts in theory, their implementation of space-related activities varies considerably in breadth and enforceability. The United States has established specific regulatory instruments; however, as Jakhu and Pelton (2017) contend, these are frequently reactive and disjointed. Conversely, the UAE's dependence on broad laws may provide flexibility but lacks the specificity required for space governance. These disparities

highlight a significant challenge: in the absence of standardised definitions, enforcement criteria, or collaborative jurisdiction, criminal culpability in space remains disjointed and responsive. As space endeavours grow more international and commercial, the lack of common standards and enforcement mechanisms threatens to compromise legal certainty and the long-term viability of outer space.

2.1.2. Criminal Outcome in Space Activities

The criminal outcome is a fundamental aspect of the material component in criminal law, denoting the tangible or legal consequence of an unlawful act or omission. Traditionally, it is regarded as the inevitable consequence of actions that violate legally protected interests. In space law, this idea must be modified to account for the global and environmental ramifications of space activities, which may impact the space environment and humanity's collective rights (Soroka, 2023). In space-related offences, the criminal consequence arises from illicit actions during space missions that contravene international or state regulations. It establishes the legal categorisation of the offence, its stage of completion, and the severity of the penalties. In purposeful crimes, the result signifies the fulfilment of the offence, whereas in negligent acts, the outcome is crucial for the crime's existence. Legislators frequently utilise the severity of the consequence to inform punishment (Ireland-Piper & Freeland, 2023). When states or private entities impede access to space, the resultant criminal consequences may include physical obstructions, such as space debris or artificial obstacles, which disrupt spacecraft navigation and contravene the provisions of the Outer Space Treaty. In the United States, such actions may be tried under sabotage or environmental legislation, whereas the United Arab Emirates may invoke general criminal provisions due to the lack of particular space crime statutes (Ireland-Piper & Freeland, 2023). Exceeding allowed space utilisation may result in resource monopolisation, harm to celestial bodies, or the deployment of weaponry in orbit. These actions violate international conventions and present global security threats. The United States permits private resource extraction under to the 2015 Commercial Space Launch Competitiveness Act while refraining from asserting sovereignty claims, in contrast to the United Arab Emirates' 2019 Space Law, which underscores peaceful utilisation and collaboration (Soroka, 2023). Claims of sovereignty over celestial bodies lead to consequences such as unlawful appropriation or the exclusion of others from common orbits, contravening the premise that space belongs to all humanity. While not currently criminalised, these outcomes are inciting demands for new international frameworks, such as a Convention on Criminal Liability for Space Crimes (Soroka, 2023). Transgressions of the principle of peaceful utilisation may lead to consequences such as military operations or armament testing from space, thereby jeopardising terrestrial infrastructure or endangering human life. The mere presence of a threat, regardless of immediate damage, can result in a criminal consequence under U.S. and UAE law (Ireland-Piper & Freeland, 2023). Environmental damage in space encompasses the contamination of orbits with perilous inactive satellites, resulting in prolonged deterioration and threats to forthcoming missions. These results contravene the 1972 Liability Convention. The United States handles this via federal debris reduction regulations, whereas the United Arab Emirates is harmonising its legislation with international norms (Soroka, 2023). Although both the U.S. and UAE acknowledge the criminal outcome as a crucial factor in culpability and sentencing, their methodologies differ in clarity and enforcement concerning space-related offences. The United States has established specific regulations and regulatory frameworks—such as those pertaining to sabotage, environmental damage, and resource extraction—that facilitate the precise classification and prosecution of space-related offences. Conversely, the UAE depends on broad criminal statutes, which may be construed to encompass space-related consequences but lack specific enforcement measures. This mismatch illustrates wider disparities in state definitions and responses to the ramifications of illegal space activities. Lacking standardised criteria for assessing criminal outcomes especially those with global or environmental ramifications—legal accountability in outer space is inconsistent and reactive. These disparities highlight

the necessity for a global framework that explicitly delineates space-related criminal consequences and institutes uniform enforcement procedures across states.

2.1.3. Causal Relationship in Space Crimes

Causality constitutes the third fundamental element of the material aspect in criminal law and is vital for determining liability in space-related offences. It establishes the legal connection between the illicit act and the resultant injury, ensuring that the outcome is a direct consequence of the behaviour rather than a mere coincidence. In general jurisprudence, causation establishes that the action resulted in the outcome. In space law, it links unlawful space actions to detrimental consequences, demonstrating that the act was the direct cause of the harm. To substantiate a space crime, it is insufficient to demonstrate that an illicit act transpired and resulted in harm; the harm must be a foreseeable and direct consequence of the act. This notion is acknowledged in both the UAE and U.S. legal frameworks, albeit with differing methodologies. The UAE employs both the theory of proper causation and the principle of the strongest cause, providing a dual framework for ascertaining culpability in cases when numerous circumstances contribute to harm. Noir, 2019 In uncomplicated scenarios, causality is evident. If a private entity emits debris that hinders another spacecraft, and this can be attributed to an unauthorised launch, the causal relationship is direct. The resultant blockage or harm would not have transpired without the initial unlawful act, so establishing a legally sufficient nexus for culpability. Nonetheless, space operations frequently entail several participants and intricate systems. If a supply delay leads to astronaut fatalities in conjunction with internal mismanagement, causality must be evaluated using theories that consider simultaneous causes. Under UAE law, an actor is deemed accountable if their actions were foreseeable and substantially contributed to the result. Likewise, U.S. law evaluates whether the action was a significant element in producing the harm. The 1972 Liability Convention establishes that launching states are strictly accountable for damage on Earth and liable based on fault for damage in space. This framework necessitates a verifiable connection between the space object and the damage, while delegating the interpretation of intricate causality to national systems. Causality becomes very intricate in instances of delayed or latent harm, such as environmental degradation or militarisation. Positioning nuclear materials in orbit may not result in immediate harm, although it engenders a continual risk. Legal systems are progressively acknowledging this possibility for injury as adequate to prove culpability. Noir, 2019 if a satellite holding radioactive material is not deorbited and subsequently causes environmental harm, a causative relationship can be shown if the failure was both predictable and substantial. This corresponds with the UAE's relevant causation principle, which assigns liability to actors when their actions are likely to result in injury under ordinary circumstances. Although both the UAE and U.S. legal systems acknowledge causality as fundamental to criminal responsibility, their frameworks differ in evaluating intricate and multifaceted situations characteristic of space activities. The UAE's dual methodology—integrating suitable causation and strongest cause theories—provides adaptability in assigning liability in cases involving many actors or delayed damages. Conversely, the U.S. employs a substantial factor test, emphasising whether the action materially influenced the outcome. The discrepancies have tangible consequences: in multinational operations or situations involving potential environmental damage, the assessment of liability may differ based on the jurisdiction. Furthermore, although the 1972 Liability Convention establishes a fundamental international standard, its dependence on national interpretation permits variability. In the absence of a unified causation framework designed for the complexities of space activities, legal culpability may become disjointed and uncertain—highlighting the necessity for more explicit international standards and collaborative enforcement strategies.

2.2. The Moral Element of Space Crimes

The moral component, or mens rea, is a fundamental principle in criminal law, differentiating between intentional and unintentional crimes. In the realm of space crimes,

this factor has significant importance due to the intricacy and possible worldwide ramifications of actions conducted beyond Earth. Mens rea denotes the mental condition of the perpetrator at the moment of the crime and is crucial for determining responsibility. Stark (2013) contends that the varied application of mens rea terminology across legal systems diminishes legal clarity and institutional responsibility, highlighting the necessity for standardised definitions to regulate conduct and constrain discretion. Mens rea generally manifests as intention or negligence. Article 39 of the UAE Federal Penal Code delineates this as either intentional conduct or inadvertent mistake. Conversely, U.S. law differentiates among specific intent, general intent, recklessness, and negligence. These discrepancies profoundly affect both responsibility and punishment. For example, English and U.S. courts have deliberated whether foresight of consequences constitutes intent, as demonstrated in R. v. Woollin, where the House of Lords determined that intention might be inferred from foresight of virtual certainty (Stark, 2013). In space law, intent encompasses intentional activities such as sabotaging satellites, fabricating mission data, or positioning weapons in orbit—behaviors that demonstrate a blatant disdain for international standards and are regarded with the utmost severity. Negligence, in contrast, include failures such as disregarding debris mitigation methods or commencing operations without sufficient safety inspections. Even if inadvertent, such behaviour may nevertheless incur culpability if the injury was foreseeable and preventable. This corresponds with the notion of foreseeability highlighted in both UAE and international legal systems (Freeland & Gruttner, 2020). Comparative legal systems provide several methodologies for evaluating responsibility. U.S. courts frequently utilise the "reasonable person" criterion and depend on circumstantial evidence to deduce purpose. The UAE, conversely, prioritises foreseeability and awareness of repercussions, holding individuals accountable for both planned and expected outcomes. This comparative perspective is especially pertinent in space law, where jurisdictional ambiguities and international treaties hinder enforcement. Instances of morally culpable conduct in space encompass cyberattacks on satellites, neglecting to deorbit obsolete spacecraft, unauthorised resource extraction, and the submission of fraudulent orbital data. Covert military deployments in orbit constitute intentional violations of peaceful usage requirements and reveal culpable intent. Freeland and Gruttner (2020) emphasise that the escalating militarisation of space highlights the pressing necessity for legal clarity and enforcement measures to handle both deliberate and negligent actions in this developing field.

2.2.1. The Role of Intent in Space Crimes

Criminal intent, or mens rea, represents the highest degree of moral guilt, indicating a conscious choice to contravene legal standards. In both terrestrial and extraterrestrial situations, intentional crimes are deemed the most reprehensible due to the deliberate choice involved. This notion is fundamental in both the UAE and U.S. legal systems. Marchuk (2013) elucidates that the development of mens rea in international criminal law highlights the importance of purpose in determining culpability, especially in intricate or high-stakes contexts. Article 39 of the UAE Federal Penal Code defines intent as the deliberate execution or neglect of a criminal act with the objective of attaining a particular result. U.S. law also differentiates between particular and general intent, evaluating the actor's knowledge, intention, and understanding of outcomes. These distinctions are essential in assessing the extent of responsibility and the severity of punishment. In space law, intent holds particular importance because to the inherently high-risk nature of activities. A space crime is deliberate when the perpetrator consciously participates in actions that contravene legal standards. For example, intentionally contaminating orbital trajectories or positioning armaments in space signifies explicit intent, as does the deployment of nuclear weapons in orbit or the establishment of military installations on extraterrestrial entities. These practices demonstrate a deliberate neglect of international duties and norms of peaceful utilisation (Marchuk, 2013). Intent also pertains to threats or violence directed towards astronauts. Deliberately jeopardising their lives or undermining life-support systems demonstrates

intentional behaviour. Both the UAE and U.S. legal systems classify such acts as deliberate offences, subject to heavy punishments. The U.S. legal system assesses purpose by circumstantial evidence and foreseeability, whereas the UAE prioritises awareness and volition. Both systems ensure accountability for actors whose acts lead to criminal outcomes (Druart, 2024). A complex issue emerges when intent exists solely at the commencement or conclusion of the act. The law of the UAE categorises the offence as intentional if the initial act was deliberate, regardless of whether the intent continued. U.S. courts may also acknowledge initial purpose if the result was predictable. If an entity intentionally pollutes launch corridors to limit access, the subsequent blockage of another spacecraft still indicates the initial intent. The offence is deemed purposeful as the result was a predictable consequence of the actor's actions. Intent must align with the action, not merely the outcome. UAE and U.S. legislation necessitates the presence of intent during the execution of the act. If intent emerges solely post-act, it is typically inadequate unless it is part of an ongoing sequence of activity. Intent may be direct, wherein the actor seeks the outcome, or indirect, where the actor anticipates the conclusion and proceeds nonetheless. In space law, the monopolisation of celestial resources or the deliberate submission of erroneous orbital data demonstrates clear purpose (Druart, 2024).

3. THE PROCEDURAL ASPECTS OF SPACE CRIMES

Addressing criminal culpability in outer space necessitates not only the definition of the crime but also the establishment of legal procedures for investigation, prosecution, and adjudication. Procedural law regulates the administration of justice, encompassing the detection of offences and the enforcement of judgements, and must evolve to accommodate the extraterritorial and multinational characteristics of space activities. Sachdeva (2023) observes that the lack of a cohesive procedural framework for space crimes constitutes a substantial deficiency in international law, particularly as private and state entities increasingly engage in common orbital domains. Jurisdiction presents a fundamental difficulty. According to Article VIII of the Outer Space Treaty (1967), the state of registry maintains sovereignty over its space objects and persons. This approach is constrained when crimes involve numerous nationalities or transpire in unregistered or privately managed settings. The United States addresses this via its Special Maritime and Territorial Jurisdiction rules, which extend federal law to U.S.-registered or operated spacecraft. The UAE established a framework for space governance with its 2019 Federal Law on the Regulation of the Space Sector, however its procedural processes remain under development. Csabafi (1971) asserts that although the Outer Space Treaty establishes a jurisdictional foundation, it is deficient in the procedural intricacies required to address complicated criminal situations involving several participants. The Intergovernmental Agreement on the International Space Station (ISS) serves as a paradigm for global collaboration. It enables partner states to assert jurisdiction over their people on the ISS and establishes methods for conflict resolution. This multilateral strategy illustrates the functionality of shared legal frameworks in space, providing a potential model for extensive procedural harmonisation (Sachdeva, 2023). There is an increasing demand for a specialised international legal framework, such as a Space Criminal Code or a Convention on Criminal Liability for Space Crimes. The suggestions seek to standardise protocols for evidence collecting, extradition, and adjudication, possibly via a specialised tribunal or arbitration process. Deplano (2023) contends that changing interpretations of the Outer Space Treaty may facilitate such advancements, especially on equitable benefit-sharing and collaborative governance. Arbitration is progressively utilised for space-related commercial disputes in the UAE. The UAE Arbitration Law, derived from the UNCITRAL Model Law, provides a versatile and impartial framework. Although not commonly utilised in criminal contexts, its procedural flexibility may guide future hybrid frameworks for quasi-criminal or regulatory infractions in space (Sachdeva, 2023). Two procedural domains are particularly vital: investigation and jurisdiction. Investigating space crimes presents obstacles such as evidence

preservation in microgravity and the coordination of multinational teams. Clarity in jurisdiction is crucial when many states or private entities are engaged, necessitating explicit regulations about prosecutorial power and legal accountability. Csabafi (1971) and Sachdeva (2023) emphasise that the future of space law hinges on reconciling current accords with the practicalities of executing justice beyond Earth. International bodies, such as the United Nations Office for Outer Space Affairs (UNOOSA), could be essential in coordinating multinational efforts to overcome the procedural hurdles associated with investigating space crimes. UNOOSA, tasked with fostering international collaboration in the peaceful utilisation of outer space, is ideally situated to aid in the establishment of standardised investigative methods, enhance data sharing, and offer technical help to member nations. Deplano (2023) proposes the establishment of intergovernmental panels, modelled after the ISS structure, to supervise collaborative investigations, particularly in instances involving numerous states or private entities. These panels could serve as impartial entities to arbitrate conflicts, guarantee procedural consistency, and enhance transparency. A centralised registry of space incidents and forensic data, overseen by UNOOSA or a comparable organisation, might improve accountability and facilitate prompt responses to criminal activities. These procedures would enhance enforcement and cultivate confidence among spacefaring states, establishing a foundation for a more cohesive and collaborative legal framework in outer space.

3.1. Inquiry and Investigation into Space Crime

The investigative phase is a pivotal stage in criminal proceedings, focused on revealing facts and assessing the sufficiency of evidence to advance the case. The complexity of space crimes arises from the technical nature of the offences and their extraterritorial context. Sachdeva (2023) elucidates that the absence of a cohesive investigation framework for space crimes, coupled with the participation of multinational entities and sophisticated technologies, poses considerable legal and logistical obstacles. In the UAE, investigations are regulated by the Federal Criminal Procedure Law, with judicial police officers and the Public Prosecution overseeing the procedure. Specialised police with proficiency in space systems and cyber operations are crucial for addressing offences such as unauthorised satellite utilisation or orbital interference. Article 34 of the law delineates judicial police personnel and authorises the Minister of Justice to appoint space-specialized officers, in accordance with Article 15 of Federal Decree-Law No. 1 of 2014, which permits the UAE Space Agency to implement space regulations. In the United States, government entities like the FBI and NASA's Office of Inspector General (OIG) examine space-related offences pursuant to the Special Maritime and Territorial Jurisdiction statutes. These enquiries frequently necessitate inter-agency and international collaboration, particularly for events occurring on global platforms such as the ISS. Sachdeva (2023) asserts that such cooperation is vital for effective enforcement in the absence of a worldwide enforcement entity.

3.1.1. Preliminary Investigation and Evidence Gathering

The initial investigative phase encompasses the gathering and examination of evidence, conducting witness interviews, and evaluating the suspect's involvement. In the UAE, the Public Prosecution assesses the evidence prior to submitting the case to court. A grand jury in the U.S. may render an indictment based on the findings. Judicial police personnel in the UAE and federal agents in the U.S. are pivotal in the collection of evidence. Due to the intricacy of space crimes, these police necessitate specialised training and access to sophisticated forensic instruments and satellite information. Global collaboration is vital. The ISS Intergovernmental Agreement allocates jurisdiction according to nationality and spacecraft registration, enabling partner states to investigate and prosecute their people while promoting evidence sharing. Despite the absence of a cohesive international framework, initiatives for a Space Criminal Code and a Convention on Criminal Liability for Space Crimes seek to standardise investigative processes. These activities underscore the necessity for specialised training, international cooperation, and protocols

adapted to the distinct environment of outer space (Sachdeva, 2023). In the UAE, Article 31 authorises officers to investigate crimes and gather evidence; however, the use of these powers in space is complicated by the absence of general procedural regulations. Likewise, U.S. agencies function under standard criminal procedures that have not been specifically adapted for space conditions, depending instead on interagency collaboration and technical proficiency. Delegating investigative authority to specialised personnel is crucial. UAE officials must comprehend public and private space operations and possess access to real-time data and international collaboration. U.S. agents frequently collaborate with NASA, the Department of Defence, and private enterprises to guarantee precise investigations.

3.1.2. Reporting and Remote Procedures

Article 36 of UAE legislation mandates authorities to receive criminal reports and preserve evidence. In the United States, federal agents and prosecutors manage reports from individuals, corporations, or agencies that may initiate investigations. Both systems differentiate between a report—alerting authorities to a crime—and a complaint—a formal petition to commence legal action. This differentiation is enshrined in UAE Article 11 and manifested in U.S. procedural regulations. Judicial police officers addressing space crimes must be equipped to receive reports from many sources, including foreign space agencies, international organisations, commercial enterprises, and individuals impacted by unlawful space operations. The format of these reports is subordinate to their content, which must demonstrate a violation of national or international space law. Upon receipt of a report, officers are tasked with preserving evidence, including telemetry data, satellite photos, communications records, and physical wreckage. In the UAE, results are recorded in official reports, whereas in the U.S., stringent chain-of-custody rules guarantee the admission of evidence. Both approaches prioritise witness interviews, expert consultations, and adherence to legal documentation standards. In the UAE, the Public Prosecution supervises the preliminary investigation, encompassing site inspections, evidence collection, and interrogations. In the United States, federal prosecutors implement analogous methods in accordance with the Federal Rules of Criminal Procedure, thereby safeguarding due process and legal rights.

Under UAE law, on-site inspections are mandated in instances of flagrante delicto; however, this proves difficult in space. Legal academics regard this need as optional when physical access is unattainable. In the United States, analogous difficulties are tackled utilising remote sensing and telemetry data. Both Emirati and U.S. legal systems interpret procedural statutes according to intent rather than literal text. In practice, forensic teams are frequently assigned crime scene responsibilities. The UAE's Federal Law No. 5 of 2017, currently included into Decree-Law No. 38 of 2022, permits remote processes, encompassing evidence collecting and witness interviews, via secure digital platforms. Article 4 of the 2017 legislation enables the implementation of procedural procedures remotely at any phase of a case, and Article 2 authorises remote involvement by all parties involved. In the United States, such adaptations—expedited by the COVID-19 pandemic—facilitate virtual interviews, digital evidence submission, and remote court appearances in accordance with the Federal Rules of Criminal Procedure.

3.1.3. Role of Remote Technology in Space Investigations

Remote technology is very advantageous in space crime investigations, because physical access to the crime scene is frequently unattainable. Telemetry, satellite photos, and digital records enable investigators to reconstruct occurrences.

This corresponds with global trends that advocate for digital forensics and remote collaboration (Sachdeva, 2023). The UAE empowers judicial police personnel to gather and record remote evidence, encompassing data from space research centres and satellite systems. These materials are assembled into official reports for legal prosecution. In the United States, federal agents adhere to comparable rules, upholding rigorous evidentiary standards to guarantee legal integrity.

3.1.4. Comparative Implications

The UAE and the U.S. have developed distinct methods for criminal investigations, highlighting significant variations in their approaches to space-related offences regarding specialisation, adaptability, and international collaboration. The UAE's legal structure permits the appointment of space-specialized officers and remote processes; nonetheless, it lacks comprehensive protocols specifically designed for the distinct issues of space criminal investigations. Conversely, the U.S. utilises interagency collaboration and technical proficiency, bolstered by federal jurisdictional regulations, while remaining subject to terrestrial legal limitations. The disparities underscore a more significant concern: the lack of a cohesive international investigation framework results in disjointed enforcement and procedural irregularities. As space endeavours grow more global and technologically intricate, effective inquiry will rely on standardised standards, specialised training, and comprehensive digital forensics. The proposed Space Criminal Code and Convention on Criminal Liability for Space Crimes provide a framework for standardising investigation protocols, guaranteeing that space crimes are managed with uniformity, accuracy, and international collaboration.

3.2. Jurisdiction over Space Crimes

The jurisdiction over extraterrestrial offences is a fundamental concern in space law. The legal system in the UAE comprises federal, local, and military courts, each with specific jurisdictional boundaries. The federal judiciary, created under Article 95 of the Constitution and specified in Federal Law No. 32 of 2022, adjudicates offences within federal jurisdiction, including offences committed beyond UAE territory, as delineated in Article 144 of the Federal Criminal Procedures Law. This illustrates the overarching notion of extraterritorial jurisdiction, which is crucial for handling space-related offences (Cormier, 2020). The municipal judiciaries in Abu Dhabi, Dubai, and Ras Al Khaimah function autonomously and address crimes within their jurisdictions, encompassing space-related offences that are licensed or executed locally. Since 2006, the judiciary of Abu Dhabi has operated under municipal jurisdiction, adjudicating space-related offences unless federal legislation is applicable. The military judiciary, regulated by Federal Decree-Law No. 11 of 2009, possesses jurisdiction over offences involving military personnel or operations, encompassing defense-related space missions. This reflects the jurisdictional hierarchy observed in other federal systems, where military and civilian courts may intersect based on the nature of the offence (Csabafi, 1971).

3.2.1. U.S. Jurisdictional Framework

In the United States, jurisdiction over space-related offences is predominantly federal. According to 18 U.S. Code Section 7, the Special Maritime and Territorial Jurisdiction (SMTJ) applies U.S. law to spacecraft that are either registered in the U.S. or operated by U.S. nationals. Criminal activities on the ISS are regulated by the Intergovernmental Agreement (IGA), which allocates jurisdiction according to country and module registration. Federal courts in the United States, with the assistance of the Department of Justice (DOJ) and federal agencies, adjudicate such cases (Sachdeva, 2023). Both nations claim extraterritorial jurisdiction via explicit legal stipulations. In the UAE, Article 3/23 of the Penal Code permits the prosecution of offences committed outside if they are punished under UAE law. Such matters are generally adjudicated in the capital's criminal court. In the United States, extraterritorial jurisdiction pertains to offences involving U.S. nationals, assets, or interests elsewhere. Csabafi (1971) observes that these jurisdictional extensions are essential in space law, where conventional territorial limits do not exist.

3.2.2. Federal vs. Local Jurisdiction

Federal courts in both jurisdictions adjudicate high-priority or multinational offences. In the UAE, Federal Law No. 14 of 1995 and Decree-Law No. 12 of 2017 confer exclusive jurisdiction to federal courts for drug trafficking and international offences. Likewise, U.S. federal courts adjudicate terrorism, drug trafficking, and space-related offences pursuant to provisions such as the War Crimes Act and the Controlled Substances Act. In the event of a space crime occurring in a UAE emirate with a federal

judiciary, such as Sharjah or Fujairah, federal courts possess jurisdiction, except when the offence pertains to specific categories such as state security. In emirates with local judiciaries, such as Abu Dhabi or Dubai, local courts generally have jurisdiction unless the offence is federal or pertains to national security. Article 8/33 of UAE Federal Law No. 10 of 1973 confers original jurisdiction to the Federal Court of Appeal over state security offences, encompassing threats to national security, document forgery, and currency counterfeiting. Appeals are sent to the Federal Supreme Court. In the United States, analogous disputes are adjudicated by federal district courts, with appeals directed to the U.S. Courts of Appeals and, on occasion, the Supreme Court. The jurisdiction of local courts in the UAE is regulated by Article 104 of the Constitution, permitting emirates such as Abu Dhabi, Dubai, and Ras Al Khaimah to maintain control over civil and criminal issues unless federal law is applicable. State courts in the U.S. function in a comparable manner; however, crimes associated with space generally come under federal jurisdiction due to their transnational characteristics (Cormier, 2020). The military judiciary of the UAE, pursuant to Federal Decree-Law No. 11 of 2009, adjudicates offences involving military personnel or resources. Decree-Law No. 12 of 2017 expands this to encompass foreign crimes involving military personnel. The Uniform Code of Military Justice (UCMJ) regulates military jurisdiction in the U.S., encompassing space operations conducted by the U.S. Space Force. Military tribunals possess jurisdiction over space crimes in the UAE that involve military personnel or transpire within military-controlled zones. The Federal Court of Appeal may assume jurisdiction if national security is involved. This reflects the U.S. paradigm, wherein national security offences are adjudicated by federal courts (Sachdeva, 2023).

3.2.3. Jurisdictional Principles and Venue

The UAE employs personal, subject-matter, and territorial jurisdiction to establish judicial authority. Article 142 of the Criminal Procedure Law underscores territorial jurisdiction; but, federal and military courts may supersede this depending on the offense's nature. The United States adheres to analogous principles, establishing jurisdiction based on venue and national interest. In federal and local courts, jurisdiction for space crimes is determined by the location of the material element's occurrence. Continuing or multi-jurisdictional offences may be prosecuted in any court where a portion of the crime occurred. This corresponds with U.S. practice, wherein venue is adaptable in cyber or multinational cases (Cormier, 2020). The jurisdiction of military courts in both nations is determined by the status of the individuals concerned or the geographical location of the offence. Offences perpetrated by or against military personnel, or those happening in military jurisdictions such as launch sites or space stations, are adjudicated by military tribunals. In the event that a space-related offence jeopardises UAE national security, jurisdiction transfers to the Federal Court of Appeal. In the United States, such cases are adjudicated by federal courts possessing jurisdiction over espionage, terrorism, or infrastructure risks.

3.2.4. Comparative Implications

Although both the UAE and the U.S. claim extraterritorial jurisdiction over space crimes, their legal frameworks exhibit divergent methodologies influenced by federal systems, judicial hierarchies, and national security imperatives. The UAE's tripartite system—federal, municipal, and military—provides flexibility while also creating complication, particularly in establishing jurisdiction over space-related offences involving numerous parties or interests. Conversely, the U.S. consolidates jurisdiction under federal law, facilitating prosecution via agencies such as the DOJ and courts with extensive territorial authority. These disparities have substantial ramifications for global collaboration and legal clarity. In the absence of standardised jurisdictional regulations or mutual recognition agreements, enforcement may be erratic, especially in instances involving international crews, shared platforms, or private organisations. The stratification of jurisdiction—whether by geography, subject matter, or personal status—highlights the necessity for a cohesive global framework. Proposals for a Space Criminal Code or an international adjudicatory body may facilitate the resolution of jurisdictional problems and provide consistent legal

responses to offences perpetrated beyond Earth's boundaries.

4. CONCLUSION

This research enhances the area by presenting a legal framework matrix for assessing jurisdictional adequacy in space crimes and promoting an international adjudication system. This study does a comparative review of country legal systems, specifically those of the UAE and the U.S., to identify significant deficiencies in the definition, investigation, and punishment of criminal offences occurring in outer space. It illustrates that existing legal frameworks are disjointed, reactive, and not prepared to tackle the intricacies of international operations, commercial entities, and rising concerns like cyber intervention, orbital contamination, and illicit resource exploitation. The analysis indicates that although treaties such as the Outer Space Treaty and the ISS Intergovernmental Agreement provide jurisdictional frameworks, they are deficient in procedural rigour and enforcement mechanisms essential for effective accountability. National strategies differ significantly, and the lack of standardised legal frameworks diminishes deterrence, legal certainty, and international collaboration. This paper advocates for the formulation of a Space Criminal Code and the creation of a World Space Court or a comparable judicial entity to address these difficulties. These procedures would establish a cohesive legal framework, delineate prosecutable offences, and enhance cross-border investigative collaboration. International organisations like UNOOSA, in partnership with intergovernmental panels, ought to spearhead initiatives to standardise protocols for evidence collecting, jurisdictional coordination, and trial proceedings. The clash between burgeoning space endeavours and antiquated legal frameworks engenders a significant legal void. In the absence of reform, grave offences in space may remain unpunished or be misinterpreted, so diminishing deterrent and compromising international collaboration. Adequate global enforcement mechanisms are still absent, resulting in the prosecution of space crimes solely within national jurisdictions, which fosters selective accountability. There is an urgent necessity for legal innovation to reconcile terrestrial criminal justice with the realities of outer space. The essential inquiry persists: if a crime occurs on Mars tomorrow, who possesses the legal jurisdiction—and the technical capability—to investigate, prosecute, and adjudicate the offender? This is no longer a theoretical issue it is an urgent legal question that requires resolution.

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REFRENCES

Blount, P. J. (2017). Renovating Space: The Future of International Space Law. Denver Journal of International Law and Policy, 45(3), 447–470.

Csabafi, I. A. (1971) The Concept of State Jurisdiction in International Space Law. Springer. https://doi.org/10.1007/978-94-015-0921-3

Chatzipanagiotis, M., & Moro-Aguilar, R. (2015) Criminal jurisdiction in international space law: Future challenges in view of the ISS IGA. Criminal Code, RSC 1985, c C-46, s 7(2.1). Retrieved from https://laws-lois.justice.gc.ca/eng/acts/C-46/ (Accessed: April 16, 2025)

Deplano, R. (2023) Inclusive space law: The concept of benefit sharing in the Outer Space Treaty. International & Comparative Law Quarterly, Vol.72, No.3, 671–714. https://doi.org/10.1017/S0020589323000234

Druart, P. (2024) Mens rea in international criminal law: A look at Eichmann's responsibility in the light of Kant and Arendt. In Heritage in War and Peace, Springer, 227–238. https://doi.org/10.1007/978-3-031-47347-0_15

Flynn, B. (2005) Exploration of Maltese prehistoric temples through the application of multimedia technologies. Mediterrannean Archaeology and Archaeometry, Vol.5, No.2, 23–34.

Freeland, S., & Gruttner, J. (2020) The laws of war in outer space: Some legal implications of a broader definition of 'armed conflict'. In A. Abass (ed.), Protecting the Global Commons: The Future of International Law, Springer, 231–250.

Gabrynowicz, J. I. (2010). One Half Century and Counting: The Evolution of U.S. National Space Law and Three Long-Term Emerging Issues. Harvard Law & Policy Review, 4(2), 405–416.

Hobe, S. (2019). Developments in International Space Law. German Journal of Air and Space Law (ZLW), 68(3), 345–360.

Ireland-Piper, D., & Freeland, S. (2023) Star laws: Criminal jurisdiction in outer space. Journal of Air and Space Law, Vol.48, No.2, 44–75.

Ireland-Piper, D. (2019) Space Laws: Criminal Jurisdiction in Outer Space. ILA Reporter. (Accessed: April 21, 2025)

Jakhu, R. & Pelton, J. N. (2017) Global Space Governance: An International Study. Springer.

Jakhu, R. S., & Pelton, J. N. (2016). Global Space Governance: An International Study. Springer. https://doi.org/10.1007/978-3-319-34007-0

Lyall, F., & Larsen, P. B. (2018). Space Law: A Treatise. Routledge. https://doi.org/10.4324/9781315619943

Marchuk, I. (2013) Evolution of the mens rea doctrine in international criminal law. In The Fundamental Concept of Crime in International Criminal Law, Springer, 115–157. https://doi.org/10.1007/978-3-642-28246-1_5

Manfred, L. (2020). Space Traffic Management: The Challenge of Global Governance. Air and Space Law, 45(3), 321–342.

Masson-Zwaan, T., & Hofmann, M. (2019). The Regulation of Space Activities: Moving Towards a Global Legal Framework. Journal of Space Safety Engineering, 6(1), 1–7. https://doi.org/10.1016/j.jsse.2019.01.001

Sachdeva, G. S. (2023) Crimes in Outer Space: Perspectives from Law and Justice. Springer. https://doi.org/10.1007/978-981-99-3265-8

Soroka, L. (2023) Modern views on criminal liability for crimes in outer space. Philosophy and Cosmology, Vol.30, 67–75. https://doi.org/10.29202/phil-cosm/30/6

Stark, F. (2013) it's only words: On meaning and mens rea. The Cambridge Law Journal, Vol.72, No.1, 155–177. https://doi.org/10.1017/S0008197313000056

Sundahl, M. (2019) Criminal jurisdiction and law enforcement in outer space. In M. Sundahl & F. Tronchetti (eds.), Research Handbook on Space Law, Edward Elgar Publishing, 245–263.

Sundahl, M. (2018). Space Law and Arbitration: The Potential of International Arbitration for Disputes in Outer Space. Journal of Dispute Resolution, 2018(2), 135–160.

Tronchetti, F. (2020) Fundamentals of Space Law and Policy. Springer.

United Nations Office for Outer Space Affairs (UNOOSA). (2020). Report of the Committee on the Peaceful Uses of Outer Space. United Nations, A/75/20.

Von der Dunk, F. G. (2015). Private Enterprise and Public Interest in the European "Spacescape." Journal of Space Law, 40(1), 1–34.