DUE REGARD IN THE AGE OF AUTONOMY: RETHINKING MENS REA FOR AI-GENERATED SPACE DEBRIS

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I. ABSTRACT

With the militarization and commercialization of outer space, the proliferation of autonomous and AI-powered systems with minimal human intervention in real-time has become more widespread. The internal logic that drives these systems may not always be entirely clear, even for their designers. The creation of orbital debris by autonomous space systems in consequence of faulty algorithmic decision-making, or by omission of due-regard requirements by individuals in the design phase, poses a serious legal question – does such an action fulfil the requirement of mens rea in order to make someone criminally liable? This article investigates this question with regard to both Indian and international criminal law.

The article uses the notion of "algorithmic debris" to refer to any predictable harms resulting from autonomous decision-making in outer space. First, it discusses the due regard requirement found in Article IX of the Outer Space Treaty as a starting point for a normative basis for the duty of due algorithmic care. The article then attempts to map such duty on the BNS framework for mens rea concerning intention, knowledge, rashness, and negligence, including criminal negligence under Section 106 of the document. At the same time, the article analyses Article 30 of the Rome Statute as well as some relevant international humanitarian law provisions about damage to the environment to determine whether actions creating debris in times of war can constitute war crimes.

The major argument is that AI does not take away mens rea but shifts it from the accused to the designer, programmer, and operator of the autonomous system. Where there is a known risk of space debris, it will be an act of criminal negligence if due regard clauses are not included in the BNS and meet the threshold provided for by Rome Statute Article 30.

II. Keywords: Algorithmic Debris, Mens Rea, Outer Space Treaty, Bharatiya Nyaya Sanhita, Autonomous Systems.

III. INTRODUCTION AND RESEARCH PROBLEM

The environment in low Earth orbit is becoming increasingly crowded, with the result that the density of satellites and other orbiting objects is increasing, together with the number of anti-satellite weapon tests and decades of activity in space leading to a debris field that threatens the safety of all space-faring nations. More importantly, the systems currently operating in this environment, whether they be maneuvering satellites, autonomous targeting systems, or collision avoidance technology, operate independently of their operators, such that attributing culpability for any damage or destruction becomes extremely difficult.[1]

In 1978, Donald Kessler and Burton Cour-Palais noted that collisions between orbiting bodies could result in a chain reaction effect where one collision produces more debris, thereby increasing the probability of subsequent collisions—a scenario later dubbed the Kessler Syndrome.[2] The practicality of such a scenario was shown by the Chinese kinetic test against their Fengyun-1C weather satellite in 2007, which resulted in over 3,000 pieces of debris being cataloged, and many more not being trackable due to their small size. However, no nation has ever been found criminally responsible for the consequences of that act or the resulting space debris threat.

A legal gap is created as a result of such accidents, which is highlighted more when autonomous technology takes precedence over human decision-making at the moment of impact. If a human pilot launches a missile, then traditional legal reasoning can be used as follows: was it intentional, reckless, or negligent? In the case of a launch by an autonomous software program that produces a manoeuvre and creates debris, it is necessary for the law to trace back the mental state involved.[3]

The OST obligates States to undertake their activities in space 'with due regard to the corresponding interests of other States Parties.'[4] This paper contends that while the due regard requirement is an interstate diplomatic norm, it is more importantly a standard of care that if

[1] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, arts. I, VI, IX, Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205 [hereinafter Outer Space Treaty].
[2] Donald J. Kessler & Burton G. Cour-Palais, Collision Frequency of Artificial Satellites: The Creation of a Debris Belt, 83 J. Geophysical Res. 2637, 2637 (1978).
[3] Andrea J. Harrington, Due Regard as the Prime Directive for Responsible Behavior in Space, 20 Loy. U. Chi. Int'l L. Rev. 57, 58–60 (2024).
[4] Outer Space Treaty, supra note 1, art. IX.

intentionally left out of the algorithmic architecture of autonomous space systems would constitute the mental element of criminal liability as per Indian law. For the purpose of analysis in this context, the criminal-law provision is Bharatiya Nyaya Sanhita, 2023.[5] As far as international criminal law is concerned, Article 30 of the Rome Statute applies.[6]

The main question that this paper seeks to address is not whether AI systems have mens rea; they clearly don't. But, can those humans who design, program, and deploy AI space systems without due-regard measures be considered as fulfilling the mens rea requirement of criminal laws?[7]

A. Objectives of Research

There are four research objectives that this study intends to achieve. The first objective is to give substantive meaning to the due regard responsibility in Article IX of the OST through its application in current debris mitigation literature and practice in order to create a normative baseline for the design of algorithms in autonomous spacecraft. The second objective is to provide an analysis of the structure of mens rea in the BNS, including intention, knowledge, rashness, and negligence, with focus on Section 106 (death by negligence). Third, it examines the mental element criteria under Article 30 of the Rome Statute vis-a-vis the provisions of IHL concerning environmental damages, in terms of their relevance in applying to debris creation activities in times of conflict. Lastly, it offers recommendations for doctrinal changes that will address the accountability lacuna created by the intersecting legal regimes mentioned.

B. Research Questions

The research is framed within the following questions:

1. What is the due-regard duty as per Article IX of the OST, and what lessons are offered by recent literature on the applicability of the same to debris-producing and self-directed military space operations?

2. What is the conception of intention, knowledge, recklessness, and negligence as per the BNS,

[5] Bharatiya Nyaya Sanhita, No. 45 of 2023, §§ 13, 106 (India) [hereinafter BNS].
[6] Rome Statute of the International Criminal Court, art. 30, July 17, 1998, 2187 U.N.T.S. 90 [hereinafter Rome Statute].
[7] Harrington, supra note 3, at 57–58.

and can the exclusion of due-regard protections in AI-powered space systems meet such mental elements?

3. What is the assessment of mental elements in light of international criminal law standards, including the provisions of Article 30 of the Rome Statute and IHL principles of environmental destruction during hostilities?

4. What are the possible reform measures in order to reconcile the requirements of BNS and Rome Statute with regard to the mental element to avoid criminal immunity of the algorithmic debris in war?

C. Research Hypotheses

H1: In light of current research on debris mitigation and COPUOS guidance in relation to Article IX of the OST, there exists an obligation of due care that must guide the development and use of artificial intelligence technologies in outer space.

H2: In terms of the BNS, the intentional exclusion of due regard provisions in AI space systems where debris threats have been established and possible mitigating measures can be taken could constitute mental elements required for the commission of negligence under Section 106, and in some instances, might amount to knowledge-based culpability.

H3: The combination of Article 30 of the Rome Statute together with IHL principles relating to environmental protection and attacks on civilians creates a plausible framework for establishing mens rea with respect to human beings who conduct autonomous operations resulting in debris formation in armed conflict situations.

H4: In light of both BNS and Rome Statute mental elements requirements, taking into account the principle of due regard and artificial intelligence technology scholarship, there is reason to create a rebuttable presumption of knowledge for high-level officials authorizing the deployment of autonomous systems that create debris in crowded orbits.

D. Research Methodology

The current research employs doctrinal and comparative approaches. In particular, there is an analysis of the OST, and its interpretation by various scholars in relation to the obligation of

due regard.[8] The research conducts an analysis of BNS by studying statutes, Indian study material, and case law on criminal negligence.[9] It studies Rome Statue Article 30 via the Elements of Crime of the International Criminal Court and doctrinal literature.[10] Scenarios of AI-based ASAT attacks and failure of collision avoidance systems are used to see how the approaches apply to the issue at hand.

IV. LITERATURE REVIEW

A. Due Regard, Space Debris, and Space Law

The ninth article of the OST mandates that activities undertaken in outer space must take place "with due regard to the corresponding interests of other States Parties" while not causing "harmful contamination" of outer space.[11] For decades, this provision was considered a nebulous diplomatic phrase that held little operational meaning. However, the latest body of literature tends to emphasize its significance.

Andrea Harrington contends that due regard is capable of functioning as a "prime directive" of proper conduct in outer space through its consideration of environmental considerations and safety-of-navigation principles, thus creating an obligation for states to reduce space debris.[12]

In turn, the Lexicon on Outer Space Security of the United Nations Institute for Disarmament Research characterizes due regard as the necessity of taking into account the rights and interests of other states.[13]

As noted by Jonathan Lim, there are concrete procedural and technical ways to fulfill the Article IX due-regard obligation, such as adhering to COPUOS debris mitigation guidelines, performing conjunction assessment, and being transparent about space activity.[14] The COPUOS debris mitigation guidelines passed by the United Nations General Assembly suggest that space actors should adopt certain practices aimed at reducing debris production, which

[8] Outer Space Treaty, supra note 1, art. IX; Harrington, supra note 3, at 59.
[9] U.N. Inst. for Disarmament Research, A Lexicon for Outer Space Security 22–23 (2023), https://spacesecuritylexicon.org.
[10] Sarah Finnin, Mental Elements Under Article 30 of the Rome Statute of the International Criminal Court: A Comparative Analysis, 61 Int'l & Comp. L.Q. 325, 327–30 (2012).
[11] Outer Space Treaty, supra note 1, art. IX.
[12] Harrington, supra note 3, at 65–68.
[13] U.N. Inst. for Disarmament Research, supra note 13, at 22–23.
[14] Lim, supra note 14, at 8–10.

involve planning for proper disposal after missions and minimizing risk of fragmentation.[15]

In their study, Dale Stephens and Cassandra Steer establish that international humanitarian law covers outer space military missions and that destructive ASAT operations should abide by the rules of distinction, proportionality, and precautions in attack.[16] Based on this literature review, the idea that due regard now holds enough normative weight to justify an algorithmic due care principle in autonomous space systems design emerges clearly.

B. Mens Rea and Criminal Negligence Under the BNS

The BNS upholds the mens rea elements of intent, knowledge, rashness, and negligence.[17] The Indian law faculties' teaching resources classify these elements in a sliding scale wherein intent and knowledge constitute the most culpable forms of mens rea, and rashness and negligence deal with culpable risk-taking and failure of due diligence.[18]

Under Section 106 of the BNS, it is a crime to cause death through criminal negligence. In India, the courts uniformly hold that criminal negligence should entail proof of gross lack of due diligence in situations where there is an evident and imminent threat to life.[19] The landmark case of Jacob Mathew v. The state of Punjab held that the test for professionals must be whether the act was done recklessly, amounting to total disregard for the safety of others.[20]

The scholarly discourse around AI and Indian criminal law has started making the case for an interpretive approach that may take into account omissions related to design and implementation of technologies in high-risk contexts when it comes to a foreseeable risk of harm and the presence of expertise on the part of the individual whose conduct is at issue.[21] The key step in this analysis involves assessing, not the decision taken to execute the algorithm,

[15] COPUOS Debris Guidelines, supra note 8, at 1–3.
[16] Dale Stephens & Cassandra Steer, Conflicts in Space and the Law of Armed Conflict, 42 Annals Air & Space L. 243, 248–50 (2017).
[17] BNS, supra note 5, §§ 100–106 (defining intention, knowledge, rashness and negligence as the core mental elements of criminal liability).
[18] Law Faculty, University of Delhi, Law of Crimes-I: Bharatiya Nyaya Sanhita 2023 at 14–18 (2024 teaching materials), https://lawfaculty.du.ac.in.
[19] Empress of India v. Idu Beg, (1881) ILR 3 All 776, 780 (India).
[20] Jacob Mathew v. State of Punjab, (2005) 6 SCC 1, ¶ 21 (India) (holding that for criminal negligence, the degree of negligence must be gross and of a very high degree).
[21] Matthew Mittelsteadt, Negligence Liability for AI Developers, Lawfare (Sept. 25, 2024), https://www.lawfaremedia.org/article/negligence-liability-for-ai-developers.

but the prior steps leading to the decision, such as omissions made by the defendant.[22]

C. AI Liability and Negligence

Generally, discussions about the role of AI in criminal law tend to exclude criminal liability for AI itself and advocate anthropocentrism.[23] It is then more relevant to look into the identification of human actors liable for criminal behavior rather than considering AI as a possible subject of criminal prosecution.[24]

Matthew Mittelsteadt asserts that negligence liability of AI developers may be proven if the developers failed to meet industry standards and to carry out adequate tests or documentation regarding known shortcomings.[25] Moreover, Matthew Mittelsteadt suggests that, in case of liability, courts are going to "look through" the algorithm in order to find the human actor responsible for causing the damage.[26]

D.International Criminal Law, Environmental Damage, and Space Warfare

Within international criminal law, the general principle of mens rea for crimes is established by Article 30 of the Rome Statute, stating that criminal acts in the jurisdiction of the ICC require intent and knowledge, except where specifically provided otherwise.[27] Sarah Finnin's interpretation makes it clear that the intention involves the purposeful doing of something, while knowledge includes awareness that circumstances exist or an effect is likely to follow.[28]

Draft Principles on Protection of the Environment in Relation to Armed Conflicts have been prepared by the ILC and involve protecting the environment prior to, during, and following hostilities.[29] According to Stephens and Steer, such draft principles are applicable to the realm

[22] Jayati Upadhyay, Determining the Liability of Artificial Intelligence in Contemporary Times, iPleaders Blog (Aug. 30, 2021), https://blog.ipleaders.in/determining-the-liability-of-artificial-intelligence-in-contemporary-times.
[23] Gabriel Hallevy, The Criminal Liability of Artificial Intelligence Entities, 15 J. Internet L. 1, 3-5 (2012).
[24] Sadaf Fahim & G.S. Bajpai, AI and Criminal Liability, 1 Indian J. A.I. & L. 64, 72-80 (2020).
[25] Matthew Mittelsteadt, Negligence Liability for AI Developers, Lawfare (Sept. 25, 2024), https://www.lawfaremedia.org/article/negligence-liability-for-ai-developers.
[26] Mittelsteadt, supra note 25 (arguing that courts will 'look through' the algorithm to identify the human actors whose decisions led to harm).
[27] Rome Statute, supra note 6, art. 30(2).
[28] Finnin, supra note 11, at 330–32.
[29] Int'l Law Comm'n, Draft Principles on Protection of the Environment in Relation to Armed Conflicts, U.N. Doc. A/77/10, princ. 13 (2022) [hereinafter ILC Draft Principles].

of space operations and destructive kinetic actions resulting in hazardous debris.[30]

According to Massingham and Stephens, although the adoption of autonomous systems makes the assignment of blame difficult but not impossible, commanders who endorse ill-regulated algorithms are able to meet the mens rea stipulations of Article 30 since the consequences were foreseen.[31]

V. RESEARCH AND ANALYSIS

A. Algorithmic Debris and the 'Star Wars' Analogy

The term 'algorithmic debris' refers to the unintended negative consequences of the use of algorithms within autonomous decision-making in space, where such algorithmic debris is created as a result of specifying or training algorithms that are associated with satellite operations, ASATs, and collision avoidance systems without taking into account the presence of other space objects in the environment and its sustainability. The 'Star Wars' analogy alludes to the growing militarization of near-Earth space, where autonomous decision-making systems operate.[32]

Legally speaking, there are at least two closely related issues raised by the idea of algorithmic debris. The first one concerns whether the choice to pursue autonomous systems in outer space, while being aware of the associated risks, without embedding the necessary mitigations to those systems meets the mens rea standards of criminal liability under domestic and international law. The second issue deals with the possible existence of negligent behaviour or culpable ignorance of actors who fail to program their systems to account for the risk of creating debris.[33]

As the collective nature of harm demonstrates, the case for culpable negligence or knowledge becomes even stronger. Given the Kessler analyses and previous examples of ASAT tests, the fact that space debris poses not just local but civilizational problems, makes the foreseeability of those risks obvious for any actor deciding to act in a negligent way.[34]

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[30] Stephens & Steer, supra note 32, at 255–58.
[31] Massingham & Stephens, supra note 18, at 295–96.
[32] Kessler & Cour-Palais, supra note 2, at 2638–39.
[33] Int'l Comm. of the Red Cross, Annex to the ICRC Report on International Humanitarian Law and the Challenges of Contemporary Armed Conflicts: Autonomous Weapon Systems and the Use of Force 14–15 (2014).
[34] Steven A. Mirmina, Reducing the Proliferation of Orbital Debris: Alternatives to a Legally Binding

B. Due Regard and the Obligation of Algorithmic Due Care

Traditionally, the due-regard clause contained in Article IX of the OST has been understood to be an international duty obliging the conducting state to negotiate any potential harmful interference via diplomacy. Nevertheless, modern scientific literature persuades one to see in it additional technological and operational duties that should guide the creation of automated space technologies.[35]

Harrington's theory of the possibility of treating due regard as a 'prime directive' for responsible behavior in space indicates that such a duty extends beyond mere international policy. As a result, if states have to perform their activities in respect of the interests of others, then the architecture of software that guides the performance of such activities should necessarily comply with this obligation. Such embedding may consist of limiting targeting algorithms to certain orbits, designing avoidance maneuvers as highly conservative, or introducing restrictions on kinetic engagements leading to the formation of space debris.[36]

COPUOS guidelines on debris mitigation serve as the standard that determines whether the design of algorithms can be said to have been adequate.[37]Lack of compliance with COPUOS guidelines in an activity involving high risk cannot simply be viewed as a failure at the policy level. This can be seen as an omission at the design stage that potentially gives rise to criminal liability under domestic law. States are responsible internationally for activities carried out by their nationals in outer space under Article VI of the OST, regardless of whether these activities are undertaken by state or non-state actors.[38]

C. Mens Rea According to BNS and Omission to Program Due Regard

The BNS distinguishes among four different states of mind, all of which could be relevant for the criminal liability of the actor. First, intention refers to a state of mind where the actor either seeks to cause an outcome or performs certain acts in full awareness of their inevitability.[39]

Instrument, 99 Am. J. Int'l L. 649 (2005).

[35] Harrington, supra note 3, at 70 (arguing that due regard must inform the design of autonomous space systems, not merely post-hoc assessments of physical conduct).

[36] Harrington, *supra* note 35, at 70.

[37] COPUOS Debris Guidelines, supra note 8, at 4–5.

[38] Outer Space Treaty, supra note 1, art. VI (imposing international responsibility on States for national activities in outer space, whether carried on by governmental agencies or by non-governmental entities).

[39] BNS, supra note 5, § 13(1) (defining 'intention' as the desire to bring about a consequence that one's act is virtually certain to produce).

Next, knowledge means awareness of a situation or the inevitability of a consequence, although it may not necessarily be the principal goal of the actor.[40] Rashness is characterized by a conscious disregard of the danger while negligence represents a failure to perceive it.[41]

According to Section 106 of the BNS, the offence of causing death by negligence consists of an unintentional action that results in someone else's death. In line with case law starting from Empress of India v. Idu Beg[42] and reaching its peak with Jacob Mathew, the Indian courts have established that criminal negligence implies the existence of gross failure to show due care in a situation where there was obvious and significant danger of loss of human life.It must be stressed that negligence can also be an omission; that is, when a person neglects to do something he is legally obliged to do. Professional standards in dangerous activities may be useful in determining whether there is a gross deviation from the expected standard of care.[43]

When we speak about automated space systems, the reasoning is as follows. Designers of automated space systems operate in the field where all the perils of generating space debris have been well described and discussed among specialists; moreover, official recommendations to counter those hazards have been developed. When one installs an automated space system without implementing any measures to reduce its hazard potential, without making it comply with COPUOS debris guidelines and risk assessments, this constitutes gross deviation from professional standards.[44]

The causal sequence necessary for establishing liability under Section 106 is as follows: due-regard measures are omitted during the design phase, creating an autonomous system incapable of avoiding the formation of debris-generating events; the system is subsequently employed in an operational scenario; the system conducts maneuvers or attacks that result in debris creation; and finally, the debris kills people, either through direct impacts with crewed craft or by interfering with navigation equipment used by passenger aircraft, or even through the initiation of the Kessler syndrome.[45]

[40] BNS, supra note 5, § 13(2) (defining 'knowledge' as awareness that a circumstance exists or that a consequence will occur in the ordinary course of events).
[41] Law Faculty, University of Delhi, supra note 20, at 16.
[42] Empress of India v. Idu Beg, supra note 22, at 780.
[43] Jacob Mathew v. State of Punjab, supra note 23, ¶ 26
[44] BNS, supra note 5, § 106 cmt.; Mittelsteadt, supra note 25 (noting that for AI systems in high-risk domains, failure to implement recognized standards of care can constitute criminal negligence).
[45] BNS, supra note 5, § 106.

However, the line between negligence and intent based on knowledge is often blurred when individuals have concrete evidence pointing toward the inevitability of adverse effects. In cases where government officials or business leaders receive scientific reports suggesting that a particular anti-satellite test or autonomous maneuver will likely produce debris endangering civil satellites or missions involving crew members, the decision to proceed with the engagement without incorporating stringent mitigative limitations could well fit the knowledge component of the BNS mens rea criteria rather than the negligence threshold.[46]

4. The Mental Elements of ICL and Analysis of War Crimes in Space

According to Article 30 of the Rome Statute, crimes which come under the ICC jurisdiction need to be committed with intent and knowledge, unless there is any other specific provision to that effect.[47] In accordance with the analysis provided by Finnin, intention includes both the purpose of committing the crime and knowing that the consequence would take place in normal circumstances, whereas knowledge includes knowing the circumstances or the consequence itself.[48] The Elements of Crimes in the ICC show that intent and knowledge can be deduced from certain factual circumstances.[49]

Norms for environmental protection under international humanitarian law and international criminal law offer a particular doctrinal route for tackling the issue of space debris. The Draft Principles on the Protection of the Environment in Relation to Armed Conflicts, adopted by the International Law Commission, create duties not to cause widespread, long-term, and severe damage to the natural environment, and to safeguard objects necessary for the survival of the civilian population.[50] Destructive anti-satellite weapons testing and autonomous debris-producing activities during armed conflicts could fall within the scope of these rules, posing threats to satellite-based communications, navigation, and weather monitoring systems that civilians rely on.[51]

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[46] Upadhyay, supra note 26.
[47] Rome Statute of the International Criminal Court art. 30, July 17, 1998, 2187 U.N.T.S. 3.
[48] Sarah Jane Finnin, Mental Elements under Article 30 of the Rome Statute of the International Criminal Court: A Comparative Analysis, 61 Int'l & Comp. L.Q. 325 (2012).
[49] Int'l Crim. Court, Elements of Crimes, U.N. Doc. ICC-ASP/1/3 (Part II-B) (2011) [hereinafter Elements of Crimes].
[50] ILC Draft Principles, supra note 49, princ. 7 (obligating states to take measures to protect the environment in relation to armed conflict, including before a conflict begins).
[51] Thorne, supra note 33 (analyzing how the principle of proportionality under IHL applies to debris-creating military space operations).

Should the commanding officers authorize any operation causing space debris with an appreciation of such consequences, especially considering warnings from experts about systemic effects and available technical options for mitigating the problems, the mens rea element set out in Article 30 is met even if the exact pattern of debris collisions was only probable but not certain to happen.[52] This is precisely what Massingham and Stephens conclude when arguing that increased autonomy makes attribution more complex but does not eliminate it.[53]

E. Comparative Analysis of Mapping: BNS and Rome Statute

There exists a similar structure between the models used by BNS and Rome Statute in determining the required mental element for crimes committed. This similarity is important analytically because both models define intentional and knowing behavior as grounds for criminal liability, different from negligent behavior and risks that may arise from failure in taking reasonable care.[54] In both cases, knowledge is demonstrated if a person knows that an action's consequence will happen under normal circumstances despite his/her behavior to the contrary.[55]

Such a convergence means that the same scenario of events – general knowledge about debris hazards, technical possibility of taking preventive actions, lack of regard for internal advice, and reliance on autonomous technology in a negligent manner – can form the basis of liability under both the approaches at once. The national prosecutor who uses the BNS approach can press criminal negligence charges as defined by Section 106 or knowledge-based intent in certain instances. The international prosecutor can consider the identical set of actions under Article 30 of the Rome Statute in relation to various war crimes.[56]

The notion of dolus eventualis, wherein the actor is aware of the harmful effect that is likely to result from their action, and acts in spite of this knowledge, provides for the possibility of creating a bridging factor between the BNS rashness rule and the knowledge rule in the Rome

[52] Int'l Comm. of the Red Cross, supra note 17, at 16–17.
[53] Eve Massingham & Dale Stephens, *Autonomous Systems, Private Actors, Outer Space and War*, 23 Melb. J. Int'l L. 288 (2022).
[54] Sarah Finnin, *Mental Elements Under Article 30 of the Rome Statute of the International Criminal Court: A Comparative Analysis*, 61 Int'l & Comp. L.Q. 325 (2012).
[55] Mohamed Elewa Badar, *The Concept of Mens Rea in International Criminal Law: The Case for a Unified Approach* (2013).
[56] Elements of Crimes, supra note 47, intro. ¶ 2 (stating that mental elements may be inferred from relevant facts and circumstances).

Statute. Proper development of this doctrine within the Indian framework, drawing on comparative literature in criminal law and the unique aspects of AI-induced harms, may bridge the systems that give rise to negligence and intent liability.[57]

VI. RECOMMENDATIONS

A. Defining Specific Responsibilities of Care Relating to AI within Space Activities Domestically

Indian national space and defense policies must integrate specific responsibilities of care relating to the use of AI, with regard to the OST's responsibility to pay "due regard" for the consequences of activities and BNS criminal negligence. It could be in the nature of legislation requiring that space activities involving AI must observe COPUOS guidelines concerning debris mitigation, employ conjunction assessment tools, and provide a list of limitations of the system before its operation.[58] This lack of compliance may be considered an omission of statutory duties, which will facilitate the invocation of Section 106, et seq., of the BNS.[59]

The doctrine and legislative framework must set out clearly the line of accountability in autonomous military operations in space. The rules of engagement and military doctrines could provide that the targeting software is to take into account the “due regard” considerations by limiting engagements which would generate debris as well as taking other precautions to ensure civilian spacecraft safety.[60] The legislature could create a rebuttable presumption of the knowledge on part of senior decision makers who authorize such operations in congested and debris-filled orbits about a high probability of adverse outcomes.[61]

C. Developing Guidance for Mens Rea in Relation to Algorithmic Harms

Guidance should be developed regarding how to apply the different mens rea categories to cases involving algorithmic harm. Such considerations may involve the existence of alternative, less harmful technologies; the soundness of the risk assessment prior to

[57] Finnin, supra note 11, at 340–42 (arguing that virtual certainty as to a consequence satisfies the knowledge limb of Article 30 of the Rome Statute).
[58] Harrington, supra note 3, at 72–74.
[59] Lim, supra note 14, at 12–14 (explaining that the due regard obligation requires not only respecting the legal rights of other states but also adopting technical measures to reduce risks to the shared orbital environment).
[60] Massingham & Stephens, supra note 18, at 290–93.
[61] Massingham & Stephens, supra note 18, at 302–04.

deployment; the extent of agreement within the technical and legal community as to the nature of the danger posed by the particular technology; and whether there were any internal "red flag" signals that were disregarded due to economic expediency.[62]

If such factors coincide, it will be simpler to determine that the responsible individual(s) possessed actual knowledge, as opposed to merely exhibiting negligence. The dialogue between Indian criminal law and international criminal law scholarship, especially the former's use of dolus eventualis, can be used as a means of adopting the latter category of mens rea in a limited manner.[63]

VII. CONCLUSION

The issue of algorithmic debris in outer space illustrates the inherent conflict between the anthropocentric approach to criminal liability and the actualities of the increasing autonomy of space technologies. Autonomy does not negate human involvement; rather, it moves the locus of that involvement from the downstream phase of algorithm implementation to the upstream stages of design, programming, approval, and oversight. The legal challenge consists of tracing the chain of human involvement back to its origin, rather than focusing solely on the implementation stage.

In accordance with a close interpretation of the OST, the BNS, and Rome Statute Article 30, this study maintains that the absence of due regard measures in autonomous space technologies constitutes an adequate fulfilment of the mens rea requirements of both national and international criminal statutes. Article IX of the OST, when viewed through the lens of contemporary research into debris mitigation and the guidelines of COPUOS, creates a normative benchmark—the duty of algorithmic due care—that allows for the evaluation of the actions of technology designers, operators, and commanders.

As regards Section 106 of the BNS model, the inclusion of criminal negligence could readily extend to algorithmic omissions in relation to debris risks that have been thoroughly documented and for which technical solutions exist. Where the actors have relevant specific knowledge regarding the near-certainty of negative outcomes, then the analysis might move

[62] Mittelsteadt, supra note 25.
[63] 63 Finnin, supra note 11, at 340–42 (arguing that virtual certainty as to a consequence satisfies the knowledge limb of Article 30 of the Rome Statute).

away from negligence to one based on knowledge-based intentionality. With respect to international law, Article 30 of the Rome Statute, coupled with IHL environmental protection rules and the draft principles of the ILC, offer a clear basis for evaluating debris-producing autonomous missions during armed conflicts as war crimes.

To resolve the problem of accountability, there must be coordinated efforts to legislate AI-specific obligations of care in outer space activities; ensure better accountability mechanisms in autonomous military missions; and develop mens rea requirements that account for algorithmic harm. The failure to implement such changes would inevitably create an area of legal immunity within which significant harms would be classified as collateral damage caused by technology rather than the predictable outcome of morally blameworthy human decisions. As the age of autonomous space operations begins to dawn, it becomes necessary that law traces responsibility back to its source.

VIII. REFERENCES

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