

## EDUCATIONAL COMPONENT OF SCIENTIFIC SCHOOL OF THE ACADEMICIAN S. KONIUKHOV IN THE FIELD OF ROCKETRY

Olena Voitiuk<sup>1</sup>

<sup>1</sup>Postgraduate, SI G.M. Dobrov Institute for Scientific and Technological Potential and Science History Studies of the NAS of Ukraine, Kyiv, Ukraine, e-mail: helen\_zt24@ukr.net, <https://orcid.org/0000-0002-7670-6849>

**Abstract.** *The rocket and space sphere is one of the high-tech manufacturing industries in Ukraine. It provides competitive advantages, sustainable development and security of the state. Educational activity in the system of training professionals in the field of rocketry is the main segment of modern economic development of Ukraine. This determined the relevance of our study. This article systematizes and generalizes information about the characteristic features of the scientific and technical school of the academician of the National Academy of Sciences of Ukraine S. Koniukhov. He was the outstanding scientist-designer, professor, Hero of Ukraine. The structure of its components is highlighted, for example, the production and research component (Yuzhnoye SDO, SE «Yuzhmash») and the academic component (NAS of Ukraine, the National Space Agency of Ukraine and the International Academy of Astronautics). It is shown how these units contributed to the development of rocket and space science and technology. The scientific-organizational and pedagogical activity of the scientist is described, which are an integral part of the educational component of his scientific school. It has been clarified the role of the scientist in the organization of domestic educational institutions in the field of rocketry. This contributed to the formation of the sectorial system of secondary special and higher professional education in Ukraine, as well as its integration into the world educational space. Thus, the scientific and educational activities of S. Koniukhov contributed into ensuring the current level of training of highly qualified specialists, retraining and advanced training of scientific and engineering personnel of the space industry of Ukraine.*

**Keywords:** *history of science and technology, scientific and technical school, advanced training, professional education, academician, Yuzhnoye SDO, rocket and space sphere, Ukraine.*

**JEL Classification:** I00; I20

**Formulas:** 0; **fig.:** 0; **tabl.:** 0; **bibl.:** 18

**Introduction.** Recently, the history of science is reproduced through the prism of the achievements of scientific schools. In domestic historiography on the history of rocket and space science and technology, the term «school» is applied to the creative work of prominent scientists, including M. Yangel, V. Utkin, V. Budnik, V. Kovtunenکو, M. Gerasyuta and others. One of such prominent personalities was the General Designer-General Director of the Yuzhnoye SDO (1991 2000), academician S. Koniukhov. Under his the leadership were implemented large international commercial projects, in particular, «Sea Launch», «Land launch», «Dnepr», as well as four National Space Programs of independent Ukraine. S. Koniukhov is an author of 735 scientific works on the creation of rocket and space technology and the formation of the domestic space industry. This contributed to the preservation of Ukraine's international prestige as a state with developed space science and industry in the international community of the world's leading space powers. An urgent task is to highlight the creative contribution of S. Koniukhov in the development of pedagogical science and practice.

**Literature review.** The functioning, characteristics and structure of «scientific schools», in particular «scientific and technical» in the field of rocketry, are described

in the works of Yu. Khramov, S. Bakuta, V. Onoprienko, V. Savchuk, F. Sanin, O. Kopyl, I. Fedorenko, O. Gubky and others. Essays on the life of S. Koniukhov, his organizational and research activities, as well as interviews and memoirs about the scientist are described in works by A. Bulat, S. Koniukhov, O. Degtyarev, M. Mitrakhov, V. Gorbulin, A. Shevtsov, I. Oliynyk, G. Sokol, N. Andrusenko, I. Selifonov, P. Semenenko and others.

**Aims.** The purpose of this article is to highlight the personal contribution of the academician of the NAS of Ukraine S. Koniukhov and his scientific and technical school in the development of branch science and education.

**Methods.** The use of bibliographic and source methods contributed to the search and systematization of primary information. The method of generalization made it possible to determine the structure of the scientific and technical school of S. Koniukhov. Historical-chronological and subject-logical methods allowed to determine the features of organizational and pedagogical activity of the scientist and their influence on the development of branch education in Ukraine and the world.

**Results.** In 1991, S. Koniukhov headed the Yuzhnoye SDO as the General Designer-Chief of the enterprise in a historically crucial period for Ukraine and the most difficult for the enterprise. [3, p. 122]. In the early 1990s, after the collapse of the USSR, one of the priorities of Ukraine's industrial policy was the conversion and restructuring of the defense sector of the economy. In the new difficult conditions of political and economic reforms, the lack of state funding for the main activities of domestic industry enterprises of the defense industry has jeopardized the very existence of the rocket and space industry in Ukraine.

In December 1991, S. Koniukhov reorganized Yuzhnoye SDO, in order to commercialize its domestic and foreign economic activity, ensure the competitiveness of products, as well as increase its intensity of social and economic development. The scientist organized new divisions at the enterprise, in particular marketing and commercial activity and introduced the position of Deputy General Designer for Economics [3, p. 211, 212; 4, p. 394, 5, p. 90]. In 1992, the main directions of conversion work of the enterprise were determined and the divisions of the enterprise responsible for their implementation were appointed [3, p. 212; 4, p. 152; 4, p. 90;]. Since then, Yuzhnoye SDO has started working on a wide range of national economic issues, as well as finding potential customers in the global space services market. Learners, colleagues and followers knew S. Koniukhov as a true leader with the professional qualities of a leader, diplomat, enthusiast and patriot of missile technology. Unique knowledge and versatile professional training of the scientist contributed to the implementation of bold and risky projects of the transition of Yuzhnoye SDO to market relations and maintaining the Ukraine status of the «space state» [9, p. 386, 387].

According to F. Sanin, O. Kopyl and V. Savchuk, the scientific and technical school is a creative team formed based on the main Central Design Office. An outstanding scientist-designer heads it. This team develops an original scientific and technical direction for the implementation of a specific scientific and technical idea «in the form of a finished product - a complex scientific and technical system» [16. p.

36, 37]. Yu. Khramov singles out the characteristic features of the scientific school, for example: high qualification of researchers; significance of the obtained results in a certain field of science, high scientific authority in this field; recognition in the scientific community [8. p. 61]. I. Fedorenko proposes a typical structure of a scientific and technical school, which consists of production and research, academic and educational components, as well as a coordinating body. [6. pp. 258, 259]. The given characteristic features of the «scientific school» defined by previous researchers, the beginning of scientific and organizational activities of S. Koniukhov as the Chief of the Yuzhnoye SDO, we can consider the moment of founding the scientific school of S. Koniukhov, in addition, to define it as «scientific and technical» and the scientist - the founder (scientific leader). Let us consider in more detail features of functioning of the basic component of scientific and technical school of S. Koniukhov.

*Production and research component.* During the twenty-year period of S. Koniukhov's enterprise management (1991-2010), 116 were made launches (106 of them were successful) of rockets from four foreign spaceports, which were developed by CDO «Pivdenne» and manufactured by SE «Yuzhmash». More than 200 spacecrafts from around the world have been launched into Earth orbits [4, p. 247]. The company has implemented significant international projects as «Sea Launch», «Land launch», «Dnepr», «Cyclone-4», «Ocean-O», «Egypotsat-1» and much more. This contributed to the preservation of Ukraine's international prestige as a state with a developed space science and industry. Yuzhnoye SDO has become an important partner among the world's leading space powers [9. p. 387].

Currently, Yuzhnoye SDO continues to develop experimental production and experimental base. SDO develops commissioned and partially makes samples of high-tech, science-intensive, innovative, competitive in the world market of rocket and space technology [18]. O. Degtyarev, General Designer of Yuzhnoye SDO (2010-2020), noted that the company's production is developing in five strategic directions, formed by S. Koniukhov. First of all, it is:

- creation of rocket and space complexes, launch of various classes of rockets and provision of launch services in partnership with foreign customers;
- creation of spacecraft and satellite systems for various purposes to monitor the Earth's surface;
- development of an orbital spacecraft, a module for orbital services provision, a small platform for geostationary communication satellites;
- creation of advanced liquid rocket engines;
- creation of high-precision and missile and jet weapons etc. [4, p. 388].

The scientist noted, «A significant merit of S. Koniukhov is that Ukraine was one of the ten countries that have a full cycle of space production» [4, p. 389].

*Academic section.* On the initiative of S. Koniukhov was organized fruitful cooperation of Yuzhnoye SDO with many academic institutes of NAS of Ukraine, industry institutes, military science and higher education institutions of Ukraine in the development of rocket and space technologies. He was using modern principles of interaction and cooperation for the preservation and development of domestic

scientific and technical potential of the rocket and space industry. The former President of the NAS of Ukraine B. Paton believed that S. Koniukhov «deeply understands the need for close creative contacts of the Yuzhnoye SDO staff with basic science and with the NAS of Ukraine» [3, pp. 116, 130; 4, p. 273].

Due to the broad worldview of S. Koniukhov and his global approach to solving the problems of creating rocket and space technology in the formation of a modern market economy, there were established business relations with scientists from the United States, the EU, China, Japan, India, Russia and other countries. Yuzhnoye SDO was admitted to the International Astronautics Federation. Since 1994, S. Koniukhov was a corresponding member of the IAA and its Vice President (2005-2011). The result of his scientific and organizational work in the IAA was the participation in its activities of about 30 Ukrainian scientists and specialists of industry enterprises [3, pp. 215, 222, 227, 238, 245]. In 2017, S. Koniukhov as the first representative of the space industry of Ukraine was inducted into the IAF Hall of Fame, which reflects the figures of prominent personalities, who make a significant contribution to the development of space science and technology for the benefit of humanity [4, p. 284].

S. Koniukhov took an active part in the work of the collegial bodies of the NAS of Ukraine. The four National Space Programs of Ukraine were developed and implemented with the participation of the scientist, such as a member of the Scientific and Technical Council of the National Space Agency of Ukraine (NSAU), together with the central executive bodies, the NAS of Ukraine and some industry enterprises. As part of their implementation, Ukrainian spacecrafts «Sich-1», «Sich-1M», «MS-1-TC», «Sich-2» and others were launched [3, p. 213; 9. p. 470]. This helped the development of domestic space science, the establishment of international contacts, as well as the entry of industry enterprises into the world market of space services. In 2010 Yuzhnoye SDO received the status of scientific organization [4, p. 285]. O. Degtiarev noted that Yuzhnoye SDO «closely cooperates with the NAS of Ukraine and its institutes, with scientific organizations of the Ministry of Defense and leading technical universities of the country, strengthening the connection between science and industry, which were supported and developed by academician S. Koniukhov» [4, p. 388].

*Educational component.* Flexibility and predictability of thinking allowed S. Koniukhov to unite efforts of high school, higher educational institutions, research institutes and branch enterprises of Ukraine concerning early identification of the most talented learners and to start their training according to the scheme of continuous education: school – technical college and higher educational institution - enterprise [3, p. 52]. It should be noted that in 1987-1992th the scientist was the head (part-time) of the Mechanical Engineering Products System Design Department of the Institute of Advanced Training of the Ministry of General Mechanical Engineering of the USSR. In 1991, he was awarded the academic title of professor at this department [10, sh. 9]. During that period, S. Koniukhov prepared and published more than thirty «Professional Development Programs for specialists» (1989-1992),

as well as three textbooks on the design and development of power plants and pneumatic systems (1989), [10, sh. 21].

Also since 1988, S. Koniukhov was the Deputy Chairman of the Academic Council for awarding academic degrees of Technical Sciences Candidate in the Yuzhnoye SDO [9, p. 550]. Since 1988, he has been the head of the branch of the Institute of Physics and Technology (later - the Faculty of Physics and Technology (FPhT) of Dnipropetrovs'k State University (DSU), established at the Southern Machine-Building Plant [12, p. 199]). In 1991, S. Koniukhov was a member of the expert council of the High Attestation Commission of Ukraine [3, p. 213]. In 1996, he was elected a member of the Council for Science and Technology Policy of Ukraine; in 2000, he became a member of the Council for Science and Technology Policy under the patronage of the President of Ukraine.

Since 1988, the scientist was the chairman of the state examination commission for the presentations of diploma projects, as well as a member of the Specialized Academic Council for the presentation of candidate and doctoral dissertations of DSU (later – O. Gonchar Dnipro National University (DNU)) [3, p. 208; 4 p. 394]. According to the former rector of DNU M. Polyakov, S. Koniukhov's participation gave these meetings «an importance and opportunity to determine the value of dissertations not only in purely theoretical terms, but also in the sense of using the results in the practice of rocket and space sphere» [3, p. 150].

With the development of scientific and technological progress and increasing intensification of the domestic educational and scientific system development, the forms of cooperation between Yuzhnoye SDO and DSU have been continuously improved. The educational process of the FPhT of DSU was closely connected with the scientific, design and production activities of the Yuzhnoye SDO construction design office and the SE «Yuzhmash». In particular, managers and leading industry specialists taught special disciplines at the university; students in divisions and workshops of enterprises in modern equipment performed laboratory works and production practices; topics of term papers and diploma projects were selected from specific research developments of enterprises. Yuzhnoye SDO and SE «Yuzhmash» helped the university to create its own laboratory base [9, p. 538]. S. Koniukhov himself noted that their interaction «is a successful example of the implementation on practice of the ideas of integration of science, industry and education» [3, pp. 59, 60]. In 2008, at the meeting of the Academic Council of DNU, S. Koniukhov was solemnly awarded the title of «Honorable Doctor of sciences of DNU». And awarded the medal «For the faithful service of DNU» for many years of his conscientious and fruitful work, significant contribution to the training of highly qualified specialists, development of scientific research and material base of DNU.

In July 1995, in the Yuzhnoye SDO (at the initiative of the scientist) was created the «New Technology» department number 408 of the National Aerospace University «Kharkiv Aviation Institute» (NAU «KhAI»). S. Koniukhov (part-time) headed her [9, p. 540]. Fourth and fifth year students of NAU «KhAI» studied directly in the design and engineering departments of the enterprise. After graduating from university, they were assigned to work in various departments of Yuzhnoye SDO.

According to the graduates of «KhAI» (1963) and later on employees of Yuzhnoye SDO V. Khvatova (Zvyagina) and M. Khvatov, an active participation of S. Koniukhov and the personnel service of Yuzhnoye SDO facilitated the fastest organization of the department number 408. They noted that «the training received at the department in the conditions as close as possible to production, accelerated professional and social adaptation of young professionals, helped them join the production cycle easier and faster» [17, p. 40].

Thus, was established the cooperation of teachers, leading academics and industry specialists, as well as a number of specialized schools and industrial enterprises, including the College of space-rocket engineering of DNU [15, p. 221]. Currently, it is the only state higher educational institution of the 1st level of accreditation in Ukraine, which trains specialists in the rocket and space industry. S. Koniukhov made a significant contribution to the formation and development of the college, as well as its educational classrooms and facilities [11, p. 3].

S. Koniukhov tried to support close cooperation of Yuzhnoye SDO with many educational institutions of Ukraine on the issues of training highly qualified specialists for the rocket industry. Students and learners of more than 15 educational institutions underwent production, design and undergraduate practice at the «Pivdenne» construction design office. The company systematically provided them with methodological assistance in compiling and adjusting special training programs in disciplines related to the study of missile technology, as well as assistance in creating their own laboratory base [9, pp. 537, 538].

In September 1996, on the initiative of NSAU with the support of SE «Yuzhmash» and Yuzhnoye SDO was organized the National Aerospace Education Center of Youth. S. Koniukhov carried out the general management of works on its creation [15, p. 221].

In 1998, by the decision of S. Koniukhov was established the Rocket and Space Training and Research Center (RSTRC), based on the Yuzhnoye SDO. It included branches of the FPhT of DNU Department and NAU «KhAI» Department, the training department, the research sector, as well as graduate school. Under the leadership of S. Koniukhov, his students successfully defended six candidate and five doctoral dissertations there [3, pp. 53, 151; 4, p. 278; 4, p. 155; 9, p. 381; 10, sh. 27]. RSTRC ensured the participation of students, postgraduates, young professionals and teachers in research and design work. The center introduced advanced world learning technologies, conducted exchanges of students and teachers and joint international seminars, conducted internships and training of foreign specialists, etc. [9, p. 541]. Currently RSTRC continues educational, methodical and scientific work on the design and construction of rocket and space technology, etc. [3, p. 53; 4, p. 278].

In 1999, S. Koniukhov revived the activities of the Young Specialists Council of Yuzhnoye SDO. Among the main tasks of this organization were mobilization of creative activity of young professionals and scientists of the enterprise for the successful implementation of production tasks and training [1, p. 17]. At the initiative of the scientist, young specialists studied courses in algorithmic programming languages, modern computer technologies, patent science, English language courses,

as well as involved into scientific and technical creativity, scientific work etc. Those who worked at the company for more than two years had an opportunity to enter the postgraduate school of the Yuzhnoye SDO [9, p. 534].

In 1991-2010, the scientific potential of the enterprise significantly increased - more than ten doctors of sciences and more than a hundred candidates of sciences successfully presented scientific researches; more than 30 candidate and 7 doctoral dissertations were defended [2, p. 59].

An important experience of scientists and specialists in the field of rocketry is reflected in textbooks and manuals prepared under the general editorship of the scientist. First of all, it is «Rocket as an object of control» (2004), «Design and construction of launch vehicles» (2007), «Accuracy of launch vehicles» (2009) and others. The work «Design, construction of rockets and spacecraft» (2004) presents training programs for retraining of industry professionals. It should be noted that in 2010 the textbook of the scientist «Launch vehicles and space stages as objects of control» (2007) was nominated for the State Prize of Ukraine in science and technology as a national achievement in the field of training highly qualified specialists for the rocket and space sphere. It was nominated in the set of textbooks «Production, testing and operation of rocket and space technology» [14].

**Discussion.** It should be noted that the main scientific and historical research of the creative biography of S. Koniukhov was conducted only at the beginning of the XXI century. However, they contain the same type of repeated factual material, mostly for reference. Previous researchers have focused on the reconstruction of the life and creative path of the scientist. The role of the scientist in the organization and development of rocket and space science and education in Ukraine and the world is covered insufficiently. In historiography on the researched subject, there are no scientific works about features of creation and genesis of scientific and technical school of S. Koniukhov. Only a few of them state that S. Koniukhov have created a scientific school of modern methods for designing rocket and space systems. Comprehensive historical scientific investigations, which contain a thorough analysis of the intellectual heritage of the scientist was not carried out.

**Conclusions.** Thus, we can say that S. Koniukhov founded a scientific school of modern methods for design rocket and space systems. The complex of structural elements (production-research, academic and educational components) allows defining it as «scientific and technical». The scientist was a scientific leader who led the process of its formation. Systematization and generalization of information about the structure of the scientific school S.M. Koniukhov is held for the first time. It is proved that the scientific and educational activity of the scientist contributed to providing a modern level of training of highly qualified specialists, as well as retraining and advanced training of scientific and engineering personnel of the rocket and space sphere of Ukraine and the world. The teams, organized by S. Koniukhov, now continue to implement the strategic directions formed by scientists for the development of the rocket and space sphere and vocational education. The results of the study will help to popularize the history of pedagogy and its outstanding educators in Ukraine.



## References:

1. Andrusenko, R. V., Selifonov, I. P. and Semenenko P. V. (2013). Vozrozhdenie soveta molodyh specialistov KB «YUzhnoe» i put' ego stanovleniya v novom kachestve [Activity of restored Young Specialists Board has been presented. Reorganizations in Young Specialists Board have been displayed]. *Visnyk Dnipropetrovskoho universytetu. Seriya Istoriia i filosofiia nauky i tekhniki*. V. 21, № 21, S. 16-25 [in Russian].
2. Bulat, A. F. and Zadvornyi, O. Ye. ed. (2015). *Viddilennia mekhaniky NAN Ukrainy : Istoryko bihrafichnyi dovidnyk* [Department of mechanics of NAS of Ukraine : Historical and biographical guide]. Kyiv : Akademperiodyka, 343. [in Ukrainian].
3. Degtyarev, A. V. ed. (2012). *Koniukhov. K 75-letiyu so dnya rozhdeniya* [Stanislav Koniukhov. On the occasion of the 75th birthday]. Dnepropetrovsk : Art-Press, 256. [in Russian].
4. Degtyarev, A. V. ed. (2017). *Koniukhov: «Sud'ba moyo - KB «YUzhnoe». Fotoal'bom k 80 – letiyu so dnya rozhdeniya akademika NAN Ukrainy, General'nogo konstruktora S.N. Koniukhova*. [YUzhnoye SDO, the Lot of Mine: A Photobiography of Stanislav Koniukhov. The photo album on the 80th birthday of Stanislav Koniukhov, General Designer and Member of the National Academy of Sciences of Ukraine]. Kyiv : Spejs-Form, 352. [in Russian].
5. Degtyarev, A. V. ed. (2018). *Yuzhnoye, the Lot of Mine: A Photobiography of Stanislav Koniukhov*. Kyiv : Space-Form, 216. [in English].
6. Fedorenko, I. V. (2008). Otlichitelnye priznaki nauchno-tekhnicheskikh shkol [Distinctive features of scientific and technology schools]. *Yuzhnyi arkhiv. Istoricheskie nauki*. Vyp. 28-29. S. 256-265 [in Russian].
7. Informatsiino-analitychne ahentstvo Dniprovskoho natsionalnoho universytetu [Information and analytical agency of Dnipro National University]. URL : <http://www.dnu.dp.ua/newsprint/262> [in Ukrainian].
8. Khramov, Yu. A. (1982). Shkoly v nauke [Schools in Science]. *Voprosy istorii estestvoznaniya i tekhniki*. № 3. S. 54–67 [in Russian].
9. Koniukhov, S. N. ed. (2009). *Prizvany vremenem. Ot protivostoyaniya k mezhdunarodnomu sotrudnichestvu*. [Called Up by Time. From Confrontation to International Cooperation]. Dnepropetrovsk: Art-Press, 832. [in Russian].
10. Lichnoe delo. Koniukhov Stanislav Nikolaevich [Personal file. Stanislav Koniukhov]. *Tekushchii arkhiv Prezidiuma NAN Ukrainy*, f. 251, op. 655, d. 20, 40 l. [in Russian].
11. Mandryka, T. (2014). Tut navchali i vykhovuiut na vysokomu rivni [Here they teach and educate at a high level]. *Dnipropetrovskiy universitet*. № 9. S. 3 [in Ukrainian].
12. Poliakov, M. V. ed. (2001). *Sekretnyi» pidrozdil haluzi : Narysy istorii fizyko-tekhnichnoho instytutu Dnipropetrovskoho natsionalnoho universytetu* [The «secret» part of the industry : Essays on the history of the physical-technical institute of Dnipropetrovsk National University]. Dnepropetrovsk : DNU, 376. [in Ukrainian].
13. Poriadok vyznachennia kandydatur z chysla studentiv Dnipropetrovskoho natsionalnoho universytetu imeni Olesia Honchara dlia pryznachennia imennykh i personalnykh stypendii [Procedure for determining candidates from among students of Oles Honchar Dnipropetrovsk National University for nominal and personal scholarships]. URL : [http://www.dnu.dp.ua/view/normativnie\\_akti](http://www.dnu.dp.ua/view/normativnie_akti) [in Ukrainian].
14. Sait Komitetu z Derzhavnykh premii Ukrainy v haluzi nauky i tekhniki [Site of the Committee on the State Prizes of Ukraine in science and technology]. URL : <http://kdpu-nt.gov.ua/uk/works-cards/67.49> [in Ukrainian].
15. Sanin, F. P., Dzhur, YE. O., Kuchma, L. D. and Khutornyi, V V. (2002). *Rozvytok raketno-kosmichnoi tekhniki v Ukraini* [Development of rocket and space technology in Ukraine]. Dnepropetrovsk : Art-Press, 402. [in Ukrainian].
16. Sanin, F. P., Kopyl, O. O. and Savchuk, V. S. (2011). Naukovo-konstruktorska shkola M.K. Yanhelii ta yii rol u rozvytku raketobuduvannia v SRSR [Scientific and design school of M.Yangel and its role in the development of rocketry in the USSR]. *Nauka i naukoznavstvo*. № 4. S. 35–45 [in Ukrainian].
17. Tkachenko, N. M. ed. (2012). *Professor Nikolai Vasilevich Belan: biobibliograficheskii sbornik* [Professor Nikolai Belan: biobibliographic collection]. Kh.: Nats. aerokosm. un-t im. N. E. Zhukovskogo «Khark. aviats. in-t», 2012. 144 s. [in Russian].
18. Zvit pro upravlinnia za 2019 r. DP «KB «Pivdenne» im. M. K. Yanhelii» [report about management for 2019 of Yuzhnoye SDO]. URL : [https://www.yuzhnoye.com/compl/M\\_R\\_2019.pdf](https://www.yuzhnoye.com/compl/M_R_2019.pdf) [in Ukrainian].

*Received: January 12, 2020  
Approved: February 02, 2021*