



SFSA CASTEEL REPORTER

Steel Founders' Society of America

a publication serving
SFSA steel casting industry Members

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Casteel Commentary

The Casteel Commentary reviews SFSA efforts with the Department of Defense to develop a new set of tools for design of steel castings in a model-based environment. This is exciting stuff and we need your support, help and guidance.

Europe Foundry Tours and GIFA 2019 (Registration deadline is March 25th!!)

SFSA has arranged seven foundry tours for members in France, Belgium, and Germany in June, leading up to GIFA (<https://www.gifa.com>) in Dusseldorf, Germany. SFSA has arranged transportation and hotel accommodations for the tours, which will start in Paris, France on June 18 and conclude June 24 in Dusseldorf, Germany. The full agenda and registration information is now available on the [SFSA Member Hub](#). **Please note:** This tour will be limited to the first 30 registrants and the registration must be received no later than March 25th. In addition, the registration costs include transportation and hotel accommodations for the duration of the tour but does not include any cost associated with attending GIFA.

SFSA EHS/HR Meeting

There is still time to register for the SFSA EHS & HR Group Meeting on April 9-10, 2019 at McConway & Torley in Pittsburgh, PA. This meeting is a great opportunity to learn from your peers on many topics including how to improve EHS training and practices, communication, and the latest HR topics. In addition, a roundtable discussion is the perfect forum to share practices and get answers to your EHS and human resource questions. There is no registration cost for members for the meeting - travel, hotel, meals, etc. are the attendees' responsibility. **Additional meeting details and registration are available here:** <https://sfsa.site-ym.com/events/EventDetails.aspx?id=1209339>

Hotel Accommodations:

[Hotel Indigo Pittsburgh East Liberty](#)

Group Rate: \$129/night

Make reservation online at <https://bit.ly/2Hk5EuV>

Cutoff date for rate is **3/18/19**.

NextGenMfg and Future Leaders Meetings

Please join us for the inaugural NextGenMfg meeting on Thursday afternoon, 5/23 in Harrisburg, PA with a tour of Andritz on Friday morning, 5/24. The meeting will feature presentations by the National Manufacturing Centers on robotics and smart manufacturing, and SFSA research on applying scanning technology, automated grinding and machine learning. Attendees will learn how this manufacturing technology can be utilized in the job shop environment of a steel foundry. We'll also do a roundtable to discuss opportunities for IoT/AI/machine learning along with manufacturing capability touted in Industry 4.0 or Smart Manufacturing to optimize a sand casting surface or do arc-air. In conjunction with the NextGenMfg meeting, we will hold a Future Leaders meeting that will begin on Thursday morning, 5/23 (dutch treat dinner Wednesday evening, 5/22). Future Leaders will have a roundtable collaboration discussion and then participate in the advanced manufacturing technology discussion Thursday afternoon. Many members have recently hired new employees – Future Leaders offers an opportunity to grow these new hires to ensure the future of your foundry. Have you considered getting these individuals to participate in this opportunity? For questions, please contact David Poweleit at poweleit@sfsa.org.

Cast In Steel at AFS Cast Expo

SFSA has several activities planned in conjunction with the upcoming AFS Cast Expo, April 27-30 (<https://www.afsinc.org/tradeshows/castexpo-2019>) in Atlanta. First, SFSA is sponsoring a new student casting competition called Cast in Steel (<https://www.sfsa.org/castinsteel>). The challenge this year is to cast a Viking axe. There are 22 teams participating in this year's competition. The axes will be tested for durability and sharpness like the History Channel show Forged in Fire. We will hold the performance testing of the axes on April 26, 1PM at Treehouse Studios, 642 North Ave NW (1.3mi from the Georgia World Congress Center). The awarding ceremony will be on April 27, 4PM in GWCC Room A404.

In addition, we plan to host a luncheon for members on Monday, April 29th after the T&O Committee Meeting that morning. If you haven't yet let us know whether or not you plan to attend, please take a moment now to do so: <https://www.surveymonkey.com/r/SFSACastExpo19>

Spring Leadership Meeting

SFSA invites members to attend the SFSA Spring Leadership Meeting on May 21-22 at the Hilton Hotel in Harrisburg, PA. The Spring Leadership meeting will start on Tuesday after the SFSA Board meeting and include lunch and an industry roundtable. The marketing committee will meet in the afternoon and everyone is welcome to attend. On Wednesday, the group will tour three member foundries: Regal Cast, Ashland Foundry & Machine Works, and Effort Foundry. Breakfast, lunch, and transportation will be provided. You must register online at <https://sfsa.site-ym.com/events/EventDetails.aspx?id=1212147>, fees are: \$30 SLM only, \$145 Bus Tour only, if participating in both total will be \$175. Costs includes meals listed below. We hope to see you there!

Steel Performance Initiative (SPI)

Steel is a fundamental and critical material for the performance of all defense equipment. It provides affordable and reliable material needed both for protection and lethality. Steel has not been supported in the development or deployment of new technology recently as the focus has been on lighter weight metals or other new technologies. These new technologies oftentimes never transfer to the battlefield given their high cost and lack of Manufacturing Readiness Level. This failure to invest in steel technology for advanced weapon systems threatens US leadership in commercial steel technology and in defense equipment performance. The formation of the Steel Performance Initiative (SPI) will enable the US to develop innovative steel technology and retain global dominance through advanced steels both on and off the battlefield. The goal is to create a sustained program, with all the services participating, which will give steel producers the opportunity to be world leaders in technology and commercially successful so that they form a robust and reliable supply chain for DOD systems. SFSA has the support of government, steel producers, foundries, forge shops, and academia and is working to secure program funding in the GFY '20 budget.

Research Review

SFSA visited the University of Iowa (UI), Iowa State University (ISU), and University of Northern Iowa on March 5-8 for an R&D project review.

UI is modeling reoxidation and inclusions in steel castings. Air entrainment is the major source of oxide inclusions so knowing how much air is entrained would help quantify inclusions that form. UI performed water modeling trials mimicking the work done by UAB under the Clean Steel Program several years ago. Water is poured from a tank with a bottom nozzle through a sprue into another tank. The displaced and entrained air that exit the bottom of the sprue flow into a collection bag where its volume is measured. The air entrainment prediction model was refined using these water experiments. Trials using molten aluminum (poured in air and in argon) were done as part of a parallel effort with AFS. It was found that a temperature correction factor needs to be applied because when dealing with pouring molten metal, gases entrained are hot in the mold then they cool as they flow into the collection bag. This cooling reduces the volume of the gas collected. In the aluminum trials, the critical velocity (velocity above which air entrainment occurs) was found to be around 2.17 m/s which is different from what has been reported in the literature (0.5-1.0 m/s). First trial with molten steel has been done. Air entrained in WCB seems to be similar to air entrainment in water and aluminum poured in an argon atmosphere. Percent oxygen of the collected air was measured and it was about 0.3%.

The oxygen in the entrained air is assumed to be used up by oxide formation. More trials with molten steel will be done.

Iowa State University is continuing their work on developing a digital standard for surface quality inspection of steel castings. Proposed method uses variograms to measure surface roughness. Once the underlying geometry is defined, the height difference between points is calculated. The goal is to output a single surface roughness value from scanned data of the casting surface. Preliminary trials using comparator plates (GAR C-9 and SCRATA Plates) show that this method can differentiate between the different levels of the comparator plates. Gage Repeatability & Reproducibility study still needs to be done and method needs to be tested on actual castings.

University of Northern Iowa is investigating 2 types of ceramic sands as a non-silica alternative for green sand and no-bake molding systems. Both ceramic sands showed less fines when subjected to mechanical attrition. Their tensile strength was reduced after the 1st reclamation cycle but remained constant after 2-5 cycles. The sinter point decreased with the number of reclamation cycles which seemed to have caused the penetration defects observed on test castings. UNI is also taking the lead on assessing the readiness and capabilities of foundries in producing castings using Additive Manufacturing tooling. Survey will be circulated to SFSA members to acquire more industry information.

A complete list of on-going research projects can be found here: <https://www.sfsa.org/research.php>.

High Alloy Inclusion Class

Thanks to the support of Tom Stevens, the high alloy inclusion class in Guadalajara, Mexico was a success. The class had 27 participants from 11 different foundries. Special thanks to POK and Fimex for hosting the foundry tours and providing support in organizing the event.

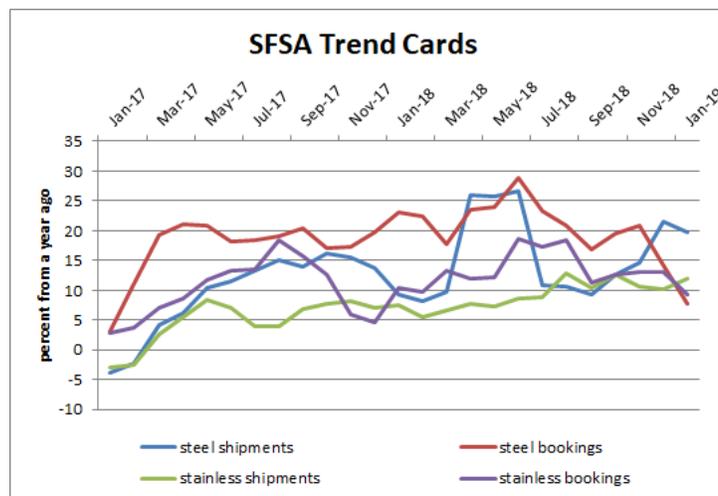
Market News

Steel and stainless steel casting demand softened in January. Bookings fell below shipments. Casting shipments remain strong but bookings suggest more stable levels of business.

The backlog is about 9 weeks for steel and stainless castings. The January trend report still anticipates expanding business and the need for more staff.

Census reports are behind because of the shutdown. The weekly production of steel is up while pricing for steel mill products has fallen since the middle of last year.

The demand for capital goods flattened out late last year. Oil prices feel but have bounced up a little in the past month and copper prices have had a similar fall and bounce.



Casteel Commentary

It is a strange and turbulent time. Business has improved and we are facing new challenges with regulatory pressures like silica levels, labor unavailability during low unemployment and a lack of interested new employees. Our industry both for a short time in 2009 and for a much more difficult period in 2016-2017 has gone through a severe contraction and now a strong rebound.

Globalization, cultural changes, uncertain economic policies and generational changes in our plants and in our customers' organizations make business a continuous challenge. The old understandings and practices are no longer acceptable and legacy practice appear to be questioned but not yet replaced. As our customer's staff changes even the existing products are questioned.

As a partial response to this challenge, SFSA Board identified new product development, customer education and workforce development as strategic challenges for our industry. We successfully gained financial support from the Defense Department to develop modern model-based tools for

casting design tied to NDT based on performance. This project is moving ahead rapidly with the goal of making it easy to buy a steel casting.

One approach for this program is to develop a design methodology like the ASME Boiler and Pressure Vessel Code. The Code makes designing fittings and other castings straightforward, it sets the strength levels for design and provides the required NDT levels. SFSA is using modern analysis tools to assess and validate that a similar set of embedded NDT requirements would allow us to provide allowable strength levels for design engineers. This would let them buy a steel casting like ordering a printed metal part. They design the part using the strength levels we provide. We then have a standard first article NDT to qualify the part but that is in the standard and would not require the customer to make any of those difficult quality decisions. We will demonstrate that this leads to reliable and robust designs. The design engineer then can just like a printed metal part, give us the solid model and we can make the part knowing the NDT requirements.

We are also developing standard grades that are like the normal mill products to eliminate the perception that cast grades are inferior in properties to mill products. The mills make a "carbon" steel grade that looks like ASTM A487 Grade 1A. This is a normalized and tempered grade with a pinch of vanadium. It has a yield strength requirement of 55 ksi with elongation of 22%. We want to have a grade like this so ordering and using the casting will require no special skills but will be as easy as ordering a machined or fabricated part.

In fact we are also working with AWS to include cast grades in AWS D1.1 so we can use that design standard and those pre-qualified WPS weld procedures when our customers use a casting in a fabricated structure.

The other approach we are pursuing is to develop a method of using the simulation of solidification to provide local properties based on the casting process to allow even more aggressive reliable designs. This method would specify NDT for critical features of the casting to ensure reliable performance. The local design properties would depend on the solidification and heat treatment and be provided as a design allowable for the customer. Larger OEMs with sophisticated staff will be able to optimize their performance in a model-based design environment to gain the best value from the casting.

This summer SFSA is planning to support a number of student interns to collect properties from castings with their solidification information for the support of this critical work.

This is exciting and important work and the foundation of growth and prosperity for our industry. We will need your support and advise to ensure we are successful in developing a platform that gives our future design customers the tools and confidence they need to fully utilize our products.

Raymond

**STEEL FOUNDERS' SOCIETY OF AMERICA
BUSINESS REPORT**

SFSA Trend Cards (%-12 mos. Ago)	12 Mo Avg	3 Mo Avg	January	December	November
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Carbon & Low Alloy

Shipments	17.3	19.7	14.2	29.3	15.5
Bookings	18.8	8.8	11.0	-1.2	16.5
Backlog (wks)	9.0	8.9	8.8	8.0	10.0

High Alloy

Shipments	10.3	11.9	20.1	5.5	10.0
Bookings	12.8	9.3	4.0	10.5	13.5
Backlog (wks)	9.6	10.2	10.0	10.5	10.0

**Department of Commerce
Census Data**

Iron & Steel Foundries (million \$)

Shipments	1,383.1	938.3	0	1,398	1,417
New Orders	1,410.5	950.7	0	1,415	1,437
Inventories	2,017.5	1,391.3	0	2,086	2,088

Nondefense Capital Goods (billion \$)

Shipments	77.3	53.1	0.0	79.6	79.6
New Orders	78.0	50.8	0.0	77.5	75.0
Inventories	178.1	120.9	0.0	181.7	181.0

**Nondefense Capital Goods
less Aircraft (billion \$)**

Shipments	68.1	45.9	0.0	68.9	68.9
New Orders	68.6	45.7	0.0	68.2	68.9
Inventories	124.3	84.6	0.0	127.2	126.6

American Iron and Steel Institute

Raw Steel Shipments (million net tons)	8.0	7.9	8.1	7.8	7.8
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